

Unlocking Shared Mobility

Investigating **Free-flow** parking for car-sharing in Australia

A guide to assist local authorities in understanding and planning for free-floating car sharing systems



ABOUT THIS REPORT

This report was developed as a component of the project “Unlocking Shared Mobility – Investigating free-flow parking for car-sharing in Australia”, made possible with funding from partners through the iMOVE CRC (Cooperative Research Centre) and supported by the Cooperative Research Centres program, an Australian Government initiative.

The main partners are: iMOVE Australia Limited, ITS Australia, RMIT (University), Insurance Australia Limited (IAG), Cubic Transportation Systems (Australia) Pty, Ltd ('Cubic' or 'CTSA'), and Royal Automobile Association of SA Inc.

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GLOSSARY

CS	Car sharing
FFCS	Free-floating car sharing
SBCS	Station-based car sharing
FFSB	Free-floating/station-based
FFAB	Free-floating/area-based
P2P	Peer-to-peer car sharing
CSO	Car sharing operator
TNCs	Transportation network companies
AVs	Autonomous vehicles
EV	Electric vehicle
EVCS	Electric vehicle car sharing
MaaS	Mobility as a service
OSFA	One-size-fits-all
ICE	Internal Combustion Engine
HEV	Hybrid Electric Vehicle

INTRODUCTION

This work was developed as a component of the project “Unlocking Shared Mobility – Investigating free-flow parking for car-sharing in Australia”, made possible with funding from partners through the iMOVE CRC (Cooperative Research Centre) and supported by the Cooperative Research Centres program, an Australian Government initiative.

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This Project is working in close collaboration with key stakeholders in academia, government, industry, and the community to better understand the current parking challenges and work towards a solution that enables the wider availability and usability of car-share services.

Project partners



The iMOVE CRC is a consortium of 44 industry, government, and research partners engaged in a concerted 10 year effort to improve Australia’s transport systems through collaborative R&D projects. It will help companies and Australia be more competitive, productive, and prosperous.

INTRODUCTION

Across Australia, there is increasingly intense competition for curbside space and parking. Roadside infrastructure management is a complex challenge in most jurisdictions so working to better understand and improve current parking arrangements will tackle a range of high priority issues for local and state governments, businesses, and our growing urban and regional centres.

The current, round trip, car-share services in Australia are proven to reduce the use of motor vehicles, and can also increase the use of public transport, cycling, and walking. Free-floating car sharing services (FFCS) have been introduced in a range of jurisdictions internationally as an additional option to round trip car-sharing. FFCS removes the need for the shared vehicle to have a specific parking spot, most commonly allocated by a Local Government Authority (LGA), negotiated with the car-share provider. FFCS allows users to pick up and return cars anywhere within specified areas of a city.

While a seemingly simple proposal, whereby a customer can collect a vehicle through their member app and pay-per-kilometer to a destination of their choice, and park it where another member of the car-share program can share it, this can be a surprisingly complicated process to enable, and can cause public backlash, as seen with the implementation of free-floating bike share.



Project goals

Assess the potential, opportunities and challenges facing national and international cities in regard to shared mobility:

- **free-floating car sharing (FFCS)**
- **related parking issues**

Provide an evidence base and guidance to government and industry that may enable them to work with car sharing services in a way that best suits the communities in the areas where they operate.

Identify key issues policy makers should consider to manage car sharing development in their cities and integrate it with public policy objectives and practices.

The topic of this project is timely and placed in a fast-changing field, that increasingly requires understanding and critical analysis, which generates vast opportunities for research, experimentation and further projects. In addition, this project is being developed in a particular period for the humanity, during the pandemic crisis of COVID-19 that hit the world in early 2020. The circumstances of dealing with this crisis have been impacting significantly all aspects of urban life. Urban mobility, an area already pervaded by constant changes and uncertainty, is especially facing fierce challenges during these strange times. And, overall, the real results of this situation still remain to be seen and understood.

Research report objectives

- Analyse national and international research and practice of car sharing, with a special focus on FFCS.
- Raise main issues related to FFCS facing cities around the world.
- Assess and build a foundational understanding of opportunities and challenges for the implementation of free-floating car sharing, contextualized to Australian urban areas, to inform and guide potential local developments of the mode.
- Inform the next steps of the project and help with the development of guidelines for future provision of policies and possible deployments of FFCS in Australia.
- Characterise and understand how FFCS has been deployed globally: a compendium of features, examples, and analyses of FFCS deployments and the market.
- Depict the profile of FFCS operations before the COVID-19 crisis.



Challenging times are impacting significantly in all aspects of urban life.

Methodology

Desktop research

Review and analysis of existing national and international knowledge, with a special focus on FFCS.

Stakeholder engagement inputs

Interviews, meetings and workshops conducted with relevant stakeholders from industry and government.

Workshops



The initial workshops happened in 2019, at the **City of Port Phillip**, the **City of Waverley**, and the **City of Sunshine Coast**; and the final workshop happened online in 2020, with participants from different parts of Australia.

Project coverage: cities that participated in workshops.

Adelaide	Hobsons bay	Parracity
Ballarat	Holdfast	Parramatta
Brimbank	Lakemac	Playford
Brisbane	Liverpool	Portphillip
Canadabay	Manningham	Randwick
Casey	Maribyrnong	Sunshinecoast
Cbcity	Marion	Waverley
Cumberland	Monash	Willoughby
Dubbo	Moreland	Wollondilly
Gawler	Moretonbay	Wollongong
Glen Eira	Mornington Peninsula	Wyndham
Hobartcity	Orange	Yarra

Key stakeholders

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here



CITY OF ADELAIDE



What Australian cities/local planners want to know about FFCS

A summary of issues, questions and concerns that were raised during three workshops developed at the initial phases of this project is presented below. The work performed for this report and project was also an effort to answer some of these questions and inform Australian cities/local planners of relevant issues related to FFCS.

- What is the relationship between FFCS and other existing transport modes – does it compete with public transport?
- What are the impacts of FFCS? Does it make people give up a private car in terms of ownership and use?
- How can we identify and assess local impacts of FFCS operations?
- How are the trips made in FFCS?
- Who are the potential users of FFCS?
- What are successful deployments of FFCS? Vehicles utilization seems to be the key for CSOs.
- Where has FFCS been operating?
- How do these cities allocate parking for it? And what are adequate approaches (and pricing schemes for the permits) to allocate parking spaces for this type of car sharing? Permits for FFCS seem to be a challenge, and processes need to be cross councils.
- Are existing deployments successful?
- Who are the providers of FFCS?
- What is the ideal density for the system to work?
- Which are the best approaches to address congestion/overcrowded PT/car ownership?
- Should cities support FFCS - from the beginning?
- How should the city authorities work to/what should the city do to regulate for FFCS? How should the regulations be?
- For FFCS to work in big Australian cities, which LGAs around the main one should be part of the operation area – considering cross council data and regulation?
- What about the clustering issues?
- What kind of pre consultation should be done before introducing FFCS to an area?
- How could a pilot for FFCS be designed, to be attractive and measurable?
- How much information can cities ask from FFCS providers and what kind of data is strategic?
- What is the best way to access these data?
- What is a good way to redesign curb space use and management?
- Do communities ask for FFCS?
- Can FFCS be used for first and last mile trips, to fill the gaps of public transport modes?
- How do we encourage the provision of shared transport services in regional/less densely populated areas?
- How about EVs and their related infrastructure, such as charging stations?
- How to increase community engagement in the process of regulating for FFCS?
- What about when AVs are around? What could be a strategic approach to this uncertain future?

NEW MOBILITIES IN AUSTRALIA

Cities across Australia have significantly different characteristics, ranging from few large and well-developed metropolitan centers, with suburban, sprawled and car dependent surroundings, to smaller (mostly in population) but sparse urban areas, similarly car dependent. Cars, roads and, especially, parking infrastructure are core parts of the Australian transport system and have been challenging sustainable urban planning practices. Processes to elaborate regulatory systems for transport in Australian cities would benefit from taking these differences into consideration and from creating tailored approaches and policies for each profile of city.

In fact, a more progressive approach to manage the Australian “system of automobility” (Urry, 2004) seems to be emerging in some cities. The content of current reviews in transport strategies and parking management schemes, followed by their challenging implementation (when accepted by the local community), suggest this shift on the way to deal with urban space. However, Australian cities still face challenges in regard to public understanding and acceptance of the measures.

Larger cities, like Melbourne and Sydney, have broad public transport networks, which are currently being improved with the implementation of significant, and somewhat politically challenging, projects. However, private car dependence and dominance are still among the main challenges that face Australian cities in their attempts to become more environmentally sustainable, especially the largest centers that are under pressure by the expected rapid increase in urban population.

Shared mobility modes have been implemented in Australian cities during the past years and keep evolving. These modes feature different stages of development across the country and are represented by car sharing, ride hailing and micromobility (docked and dockless bike sharing and scooter systems) schemes. Discontinued endeavors, in particular the dockless bike sharing ones, can teach valuable lessons about how these modes behave in Australian contexts and about the issues related to new mobilities that cities will likely need to deal with in future attempts and/or deployments.



Waverley 'PUDO' Bays case

Waverley Council is “running a twelve-month trial and enabling pick-up/drop-off (PUDO) bays in prime commercial locations across the LGA, Council has allocated kerb space for all modes of transport such as car and bike services, taxis and kiss and ride activities. These are supported by tailored Mobility-as-a-Service apps that will indicate the locations of these bays and other relevant information. The MaaS concept proposes a seamless travel experience for planning, booking and purchasing transport as it is required, while also reducing the need for individually owned assets such as cars” (Waverley Council 2020).



MaaS: What it is

Source: ITS Australia (2018 p.6)

Mobility as a service (MaaS) has also been incorporated into the agenda of discussion and implementations of transport initiatives in Australia. Some local governments, from state and municipal scale, have been exploring the possibilities and opportunities that this new technological environment can provide. New South Wales and Queensland seem to be more advanced in this regard, and the pioneering and most representative initiatives from NSW, in particular those related to data sharing and standards, inspire the development of initiatives in different states. In early 2019, following the development of a [report about MaaS in Australia](#) (ITS Australia, 2018), a [National MaaS Reference Committee](#) was created in the country, “to continue the collaboration that was fostered” during the work for this report (ITS Australia, 2019, 2018). The Inaugural meeting of National MaaS Reference Committee was held in Melbourne, in April 2019, and the second meeting happened in November 2019, in Adelaide. The Committee gathers relevant actors from the states (from different types of institutions, like government, industry and academia) to collaborate, explore and promote an “effective and equitable development of MaaS” (ITS Australia, 2018), enabling a [vision for MaaS in Australia](#). Finally, this committee was divided in sub-committees that are working to “better understand the key challenges and opportunities across the four focus areas previously identified” (ITS Australia, 2019).

Amid the emergence of new mobilities and the increasingly uncertain future, a great challenge for Australian cities, as it is for most of the cities around the world, is to achieve or improve the efficiency of their transport systems, exploring opportunities that technology and innovation can provide. Finding a suitable combination of modes for the different urban forms and needs means creating strategic networks, that keep public transport as the foundation, but wisely include other solutions available. Especially where the costs of implementing and maintaining fixed large-scale infrastructure cannot meet the needs for accessibility and connection faced by suburban or remote communities.

THE ROLE OF CAR PARKING AND PARKING POLICY

in cities and transport



Car parking is a significant use of urban land, comprising both public road space (or kerbside / curbside) and various types of private off-street space. Car parking supports car ownership and use for private vehicles – it is essential to car-based cities, and cities have been built or re-built around storage for cars. Car parking is essential to car-based travel and to car-based cities, with private cars stationary around 95 per cent of the time (Barter, 2019). Car parking occupies as much as half the ground space of some downtown North American cities (Ben-Joseph 2012; Shoup, 2005, p 131); and for example 14% of Los Angeles County as a whole (Chester et al 2015); or 12% of floorspace in the local government area of Melbourne (Taylor 2018). Ample free parking is associated with higher car ownership and car use (Haman et al 2018; Shoup et al 2018). Throughout the 20th century the management of street space was reconfigured largely around parking for privately owned vehicles. Marsden et al (2020) surmise that new types of mobility, including car sharing, are shifting and intensifying the demands for street and parking space, but that public streets remain “a highly contested space which the state finds hard to govern effectively”.

The availability and price of parking influences private car ownership and use: the provision of ample free car parking has a significant role in supporting and subsidising car ownership and car use. Public policy is closely involved in the provision and management of car parking for private vehicles. Governments typically require the provision of off-street private parking; as well as managing the use of public road space, including allocation for car parking space and the conditions placed on it. The availability and price of car parking is a key part of automobility and of supporting private car use and ownership. Just as private car ownership depends on car parking and parking policy, emerging mobilities, including car sharing, make claims on street space and are supported or constrained by car parking (Marsden et al 2020; Dowling et al 2018).

Car parking occupies

14%

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MELBOURNE
(Taylor 2018)

“public streets remain “a highly contested space which the state finds hard to govern effectively” Marsden et al (2020).

Approaches to parking policies

Barter (2015) characterizes three basic approaches to parking policies: two mainstream ('conventional', and 'parking management'), plus 'market-based' approaches.

CONVENTIONAL PARKING POLICIES

Conventional (supply-based, or 'predict and provide') parking policies use minimum off-street parking requirements and treat on-street parking as free infrastructure. On-street parking is usually free, and site-based minimum rates of off-street parking are required. Minimum off-street parking requirements emerged in response to rapidly rising car use in mid-20th century cities. They have been commonplace in most Australian cities since the 1950s. Conventional supply-based parking policies are increasingly criticised for subsidising car use and for over-supplying car parking at the expense of other transport modes and land uses. Critics argue that such approaches over-supply parking, subsidize car use at the expense of other land uses and transport modes, disguise the real demand for and costs of parking space, impact housing markets, and are an imperfect means of managing on-street parking (Manville 2017; McCahill & Garrick 2010; McDonnell et al 2011; Shoup 2005; Pierce and Shoup 2013; Shoup et al 2018).

PARKING MANAGEMENT POLICIES

By contrast, parking management policies use precinct-based, rather than site-based, parking strategies. They seek to manage traffic and land-use impacts and to balance competing parking demands, using tools such as timing and pricing (Litman 2018). Some parking management policies explicitly limit or reduce the amount of car parking (Kodransky & Mermann 2010).

MARKET-BASED PARKING POLICIES

Market-based parking policy approaches are comparatively rare but include Japanese cities with little or no public on-street parking, combined with extensive private off-street parking based on willingness to pay (Barter 2011). With his claims for dynamic parking (Shoup 1998; Pierce & Shoup 2013), Shoup argues that local authorities should set the 'right price' for public (curb) parking, based on occupancy targets by time and location, and on driver willingness to pay. This allows minimum off-street requirements to be reduced: off-street and on-street parking are integrated to minimise both under-priced and overpriced parking. The profits from demand-based pricing, in Shoup's model, should be returned to visible local improvements via parking improvement districts.

Approaches to parking policies

In recent decades, arguments for parking policy change have typically called for reducing or removing requirements for off-street parking; and for some version of street space reallocation or kerbside management for public parking space.



“... governments should develop clear hierarchies and principles for how street space is allocated, including for car sharing”.

(Centre for London, 2020)

Some arguments for alternatives to conventional parking are concerned with increasing the efficiency and availability of parking. Others are concerned with reducing subsidies to car ownership and use; or with reclaiming public space for purposes other than car parking (such as pedestrian space – e.g. Park(ing) Day). Car parking is often intensely politicized and asserted as a right rather than as a market good (Taylor 2014; 2018; Marusek 2011). This is particularly true where residential parking is concerned (Taylor 2014, 2018; Kent & Dowling 2016; Guo 2013b; Molenda and Sieg 2013; Van Ommeren 2011, 2014). In some contexts, residential on-street parking is completely free and unrestricted. In others, residential permits are used to manage non-resident parking by privileging existing residents over others (Marsden 2006; Van Ommeran et al 2014; Molenda & Sieg 2013).

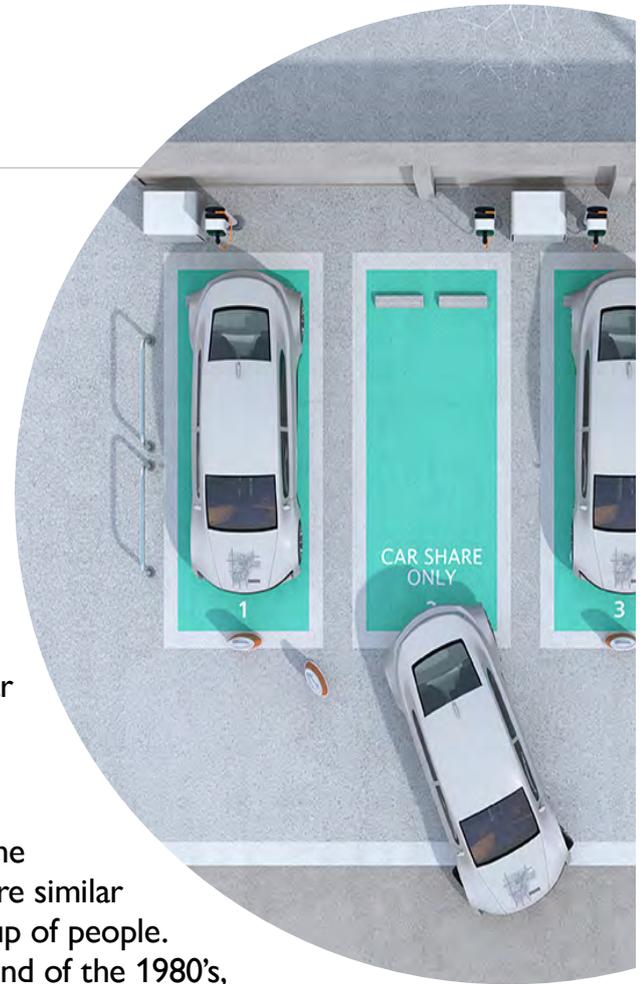
In the [market-based Japanese system](#) there are no rights to street parking, and the right to own a car is itself contingent on the purchaser arranging access to off-street parking space for it (Barter 2011). Alternative approaches to parking policy take the position that public parking space is not a right as it does not meet the criteria for a public good and should be monetized; or that public parking space should be re-imagined as alternative forms of public space. In recent decades, arguments for parking policy change have typically called for reducing or removing requirements for off-street parking; and for some version of street space reallocation or kerbside management for public parking space. Marsden et al (2020) argue for greater awareness of public streets (kerbsides) and the competing claims made for them; and call for clearer policies on how existing and emerging claims to public street space are managed in the public interest. Similarly a report by the Centre for London (2020) urged governments to develop clear hierarchies and principles for how street space is allocated, including for car sharing.

CAR SHARING

Car sharing is a transport system that allows members to use a car when they need one. “The principle of carsharing is simple: individuals gain the benefits of a private automobile without the responsibilities and costs” (Shaheen and Cohen, 2013, p. 6), or “burdens” (Alessandrini et al., 2015, p. 147), of car ownership.

Members of car sharing schemes also have access to diverse types of vehicles, which can be used for different types and lengths of trips (mostly shorter than regular car rental trips), depending on their needs.

The first initiatives of car sharing emerged in Europe in the late 1990’s. These initiatives had different natures but were similar in goal in regards to a more strategic use of within a group of people. The first commercial initiatives started operating in the end of the 1980’s, in Switzerland and Germany, and were followed by North American ones in the 1990’s, in Canada and USA. Car sharing then began spreading within Europe, North America, and around the world, also showing relevant development in Asia and Oceania. For more information about the history of car sharing and places where it operates, please see (Shaheen et al., 2006; Shaheen and Cohen, 2013). The graph below shows global car sharing market trends.



Global Car Sharing Market Trends – Global Trends
Source: Shaheen et al. (2018, p. 5)

Types of car sharing

The evolution of technologies has impacted significantly in the development of car sharing and, currently, the system has different types of operation, or business models. These types are described below, and the image illustrates their main concepts.

“station-based”

SBCS

vehicles have to be returned to the point of origin (pods in Australian context) to end the trip or booking, also called “round-trip” or “back-to-base”, “stationary”, “A to A”, depending on the location and context;

“free-floating/station-based”

FFSB

vehicles can be taken from and left at any station of the system (like a docked bike sharing), also called “on-demand/station-based”, “one-way/ station-based”, or “one-way/stationary”, depending on the location and context.

“free-floating”

FFCS

vehicles can be taken from and left at any available parking spot in the city, as long as they are inside a GPS delimited service area, defined by each provider. This type is also called “free-flow”, “flexible”, “on-demand”, “point-to-point”, “A to B”, depending on the location and context.

“free-floating/area-based”

FFAB

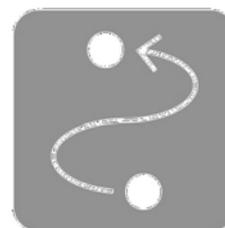
vehicles belong and can be taken from a delimited area of the system in the city and have to be returned to the same area to end the trip or booking.

Within these models of operation, there are alternatives that differ in terms of fleet ownership and management. One example of this is “peer-to-peer” (P2P) car sharing, in which members can rent vehicles that belong to other members, a process managed by companies that provide the operational system for these transactions. P2P car sharing happens in a “station-based” mode, because the vehicles have to return to the owners’ parking space at the end of the trip.

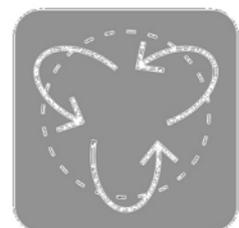
Additionally, there are some companies that offer **hybrid services, or “combined”** (Nehrke and Ziesak, 2020), in which their vehicles can be used either in a “station-based” or in a “free-floating” way by the registered users, but the conditions of these systems differ significantly from one location to the other.



SBCS
station-based
P2P



FFSB
free-floating
station-based



FFCS
free-floating
FFAB

Graphical representation - types of car sharing

Source: Paganelli (2013, p. 36)

Other characteristics of car sharing

CAR SHARING IMPACTS



Car sharing has proven to **reduce car ownership and use** in many cities where it operates, but results differ from one place to the other. In addition to that, evidences have also shown that **car sharing users tend to use transit, walk and cycle more**, “shifting from a car-oriented to a public transport-oriented lifestyle” (Becker et al., 2018, p. 60), which increases the benefits car sharing brings to cities (Shaheen and Cohen, 2013). It is important to reinforce that the vast majority of the studies were done considering users of SBCS. Also, it is well acknowledged among researchers and practitioners that car sharing will only bring these benefits if it is integrated with the wider transport system, and used as a complementary mode, just for the trips when a car is needed (Enoch and Taylor, 2006; Glotz-Richter, 2016; Kent and Dowling, 2016; Paganelli, 2019, 2013; Shaheen et al., 2010).

THE NATURE OF CAR SHARING OPERATORS (CSOs)

Car sharing operators (CSOs) can be private, cooperatives, public (launched or managed by local authorities), non-profit, and/or mixed. Also, automakers, manufacturers of parts of cars, and traditional car rental companies have a significant role in the development of car sharing, as they started launching or acquiring car sharing schemes and are responsible for some of the largest or more significant companies presently operating. In terms of fleets, vehicles usually belong to the providers, except in the P2P business models, and in some cases, vehicles can be leased for the operation of car sharing. For more information about the types of car sharing and their business models see (Ferrero et al., 2018; Remane et al., 2016; STARS H2020, 2018).

Location-based

Influenced by physical (urban form and land use) and socio-economic characteristics of a place, and the conditions of its transport system.

Car sharing is also known for its **potential as a testing ground for innovations**, like electric vehicles (EVs), which could also improve the environmental benefits of the mode (Firnorn and Müller, 2015; Ruhrort et al., 2014), and governments can take advantage of this condition. In fact, evidences suggest that EVCS can increase the will to use car sharing and give up a private car (Firnorn and Müller, 2015). Car sharing can also be potentially used to increase mobility options of disadvantaged communities (Rotaris and Danielis, 2018; Tyndall, 2017), but this field still requires significant exploration in terms of deployments and research.

CAR SHARING TYPICAL USERS

Studies done globally (academic and grey literature) tend to reach similar conclusions and show that car sharing typical users are **young** males (more men than women), usually with **higher education**, from **mid to high-income** classes, who live in **high-density areas**, and are **environmentally conscious** (Diana and Ceccato, 2018; Müller et al., 2017; Schmöller et al., 2015). Studies have also shown that smaller households (with or without children) tend to use car sharing as the second car and that millennials are an important segment of the users (Kopp et al., 2015; Lempert et al., 2019).

Interactions between car sharing and other new mobility modes

The interactions between car sharing and other new or shared mobilities, like ride-hailing, for example, may differ significantly, depending on the characteristics of the place where they operate. In some cases, they may compete with car sharing because ride hailing services do not require users to drive or park the car at the end of the trip, besides the fact that trips made on both are different. However, car sharing can also complement ride-hailing services and they may help each other, like in places where people use car sharing vehicles (short term rentals) to drive for ride hailing services. This practice happens in Singapore, for example, where the companies Smove and Whizzcar provide vehicles for drivers registered on Grab (Singapore's ride hailing scheme).

Another issue to observe regarding this relationship is the situation in Vancouver, for example, where ride-hailing services could not operate until Sep/2019 (Bliss, 2019), and free-floating car sharing seemed to be successful, at least until some service interruptions (William-Ross, 2019). Vancouver was considered the “car-sharing capital of North America” (late 2019), with more than 3000 car sharing vehicles - fleet that was larger than in Seattle, Portland and San Francisco (Vancity, 2018). However, the impacts that recent ride-hailing deployments will have in the city's transportation system, and its interaction with existing car sharing services, still remain to be understood.

Conclusions

The concept of car sharing is more complex than a transport mode that can be an alternative to the private car. Car sharing is also an ideological and political matter. How and if it will be used and developed depends significantly on a combination of cultural, economic, political, physical, (urban characteristics) and technological issues, topics frequently explored in research and reflections. Most of the research done about car sharing aims to understand travel behavior of users, the consequent impacts it brings, and/or to identify and improve commercial, operational and technological issues of the services.

Regarding urban characteristics, studies conclude that car sharing works better in places with good provision of alternative transport, particularly in high density and mixed-use urban areas, where the demand is concentrated (Celsor and Millard-Ball, 2007). However, as the characteristics of the field change rapidly, there is no “one-size-fits-all” (OSFA) solution for new mobilities, and ideas have to be adapted to the different places, additional research is constantly needed and could benefit the field of governance for this mode.

FURTHER READING

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FREE-FLOATING CAR SHARING (FFCS)

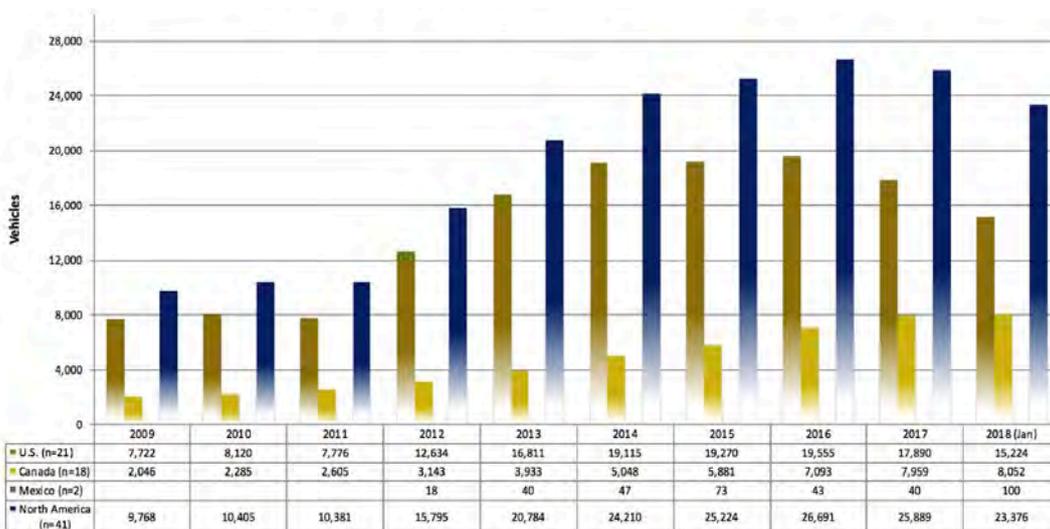


Source: Paganelli (2013, p. 36)

Free-floating car sharing is a more recent and relatively flexible type of car sharing that allows members to use vehicles for short periods, picking them up and returning them within a GPS delimited area of a city and/or its surrounding region.

Trips with FFCS can be one-way and bookings end (the payment stops) when the vehicle is parked in one of the authorized (concept that varies significantly from case to case) spaces within the service area.

The first free-floating car sharing operation was done in 2008, in Ulm, Germany, as an experiment of Daimler (Firnkorn and Müller, 2011; Remane et al., 2016). That was when the company Car2Go was created, although it does not operate there anymore. After that, Car2Go launched in Austin, USA (where it also has stopped operating), started spreading mostly around Europe and North America, and became the main global operator of this type of car sharing for some years (Kortum et al., 2016). Recently, in mid-2019, Car2Go has merged with DriveNow (another FFCS operator launched in 2011 by BMW, in Munich), to become a company called ShareNow, which, besides recent shut downs in North America and some European cities, might still be the main or most significant global FFCS provider.



* Data depict July of each year, unless otherwise noted. "n" reflects the number of operators as of January 2018. Numbers include roundtrip and one-way carsharing. Numbers do not include peer-to-peer carsharing.

Vehicle Growth in North America
Source: Shaheen and Cohen (2020, p. 3)

Main characteristics of FFCS systems

FFCS TYPICAL TRIPS

FFCS is used mostly for short and urban trips, and the purpose of these trips varies significantly, **from planned to circumstantial** ones, which becomes a challenge in trying to model or predict how this type of car sharing will be used. FFCS tends to be a convenient service to users (more than SBCS and P2P), because they get access to cars without the need to plan for their use in advance, like with SBCS. If they can drive and are willing to spend some time cruising for parking at the end of the trip, this mode can become more convenient than alternative transport. For example, it is faster and can be more convenient than a walk or a bike ride, if the weather is unpleasant. Or, it can also be faster and more convenient than a trip with public transport because it does not depend on timetables and possible distance from the last stop to the destination desired. FFCS users can also make stops within one trip, which means that they can keep the car while solving errands in the middle of the way, and most of the operators offer free parking for these stops (see Appendix 1).

The flexibility of FFCS also **allows trips to be multimodal**, for those who can use it, in which one of the legs is done with FFCS and the other(s) can either be done with public transport options available in the city, or become an active trip, if the person decides to walk or cycle (where bike sharing schemes allow). However, due to the **ad-hoc nature of FFCS trips**, it is difficult to predict how they will be, because they will depend on a mix of factors that influence the user's decision, like most of the decisions for options in transport behaviors, and these conditions can change rapidly.

FFCS USUAL PLACES

Research and some documents analysed for this work (Ceccato and Diana, 2018; Kortum, 2012; Kortum et al., 2016; Schiller et al., 2017; Tyndall, 2017) indicate that the characteristics of places and types of environments where FFCS will more likely work (and be more commercially viable) repeat among real deployments. In summary, FFCS tends to operate in:

- mid or high-density areas, like downtown areas, CBDs, historical centers, and their surroundings, as well as within and/or close to areas with higher density around major urban settlements,
- mid to high-income areas, characterized by significant economic development.
- areas with multimodal provision and relatively high mode share in public transport.

FFCS TYPICAL USERS

FFCS is more frequently used by (Ceccato and Diana 2018; Diana and Ceccato 2018; Müller et al., 2017; Schmöller et al., 2015):

- people with higher levels of education.
- people from higher income parts of the population
- relatively young people (between 20-40 years old) and some millennials, who usually belong to small/low-size households.
- people with multimodal transport behaviors.

FFCS technologies and providers

Regarding technological systems for the operation (registration, locations, booking, usage, payment, etc.) of car sharing schemes, various companies are developing IT platforms with apps, cards, car kits and GPS systems, i.e. Vulog, Invers, Wunder Mobility, among others, providers that offer services to different CSOs around the world.

FFCS operators tend to offer fleets with different characteristics globally. Vehicles vary significantly from micro two-seater, normally electric, vehicles (offered by Enuu, in Switzerland; Re.volt, in Czech Republic; and Innova Dash, in the USA, for example – images below), compact city cars (i.e. Smart cars, Toyota Coms, Renault Zoe, Fiat 500, or Smarts, Citroen C-Zero, Nissan Micra, Hyundai i10, etc.), and sport hybrid vehicles (i.e. the ones offered by Evo, in Canada, and Gig Car Share, in the USA), to compact cars, sedans, station wagons, SUVs, pickups & cargo vans, with some hybrid and electric options among them, offered by most of the operators. However, the sizes and diversity of fleets also vary significantly among operators, as some offer one or few models of vehicles, while others offer a mix of possibilities in the same city or region. Some research is focused on fleets for FFCS, and studies also suggest optimal sizes for the system to work (Terrien et al., 2016). However, this number should be adapted, depending on the provider and, especially, the characteristics of the location.

Finally, following current trends in transport, some of these CSOs are also offering a mix of services with micromobility options, i.e. motorcycles, scooters (electric or not), and/or bicycles. Examples of these operators are Aimo, in Sweden, Citybee, in Lithuania, Free2move, Playcar in Italy (Sardegna), GoTo, in Malta, Poppy, in Belgium, Re.volt, in Czech Republic, Vozilla, in Poland, Carusel, in Russia, among others (see Table 5).



<https://www.behance.net/gallery/62610381/revolt-carsharing>



Snapped from the video: <https://www.blick.ch/news/wirtschaft/enuu-soll-die-staedte-erobern-dieser-elftroflitzer-darf-auf-den-veloweg-id15007167.html>



<https://www.enuu.ch/>



<https://www.innovaevcarshare.com/simplicity/>

Examples of free-floating car sharing fleets with micro/two-seater electric vehicles

Sources: indicated below each image

Where FFCS operates

Like Daimler and BMW, many additional companies, from other automobile industry players, existing car sharing operators, and traditional car rentals to oil and energy industry players, technology providers, and startups or smaller organizations, followed the free-floating trend and developed operators for this type of service (FFCS) in diverse cities around the world. These operators apply different business and/or operational models (that vary from exclusively free-floating to hybrid services) in some cases, but with a similar approach to the way cars are accessed (free-floating) and used (one-way trips). Regarding FFCS operational models, perhaps the most challenging for companies and for local authorities are the hybrid systems in terms of defining strategic regulatory and management measures because of their complexity.

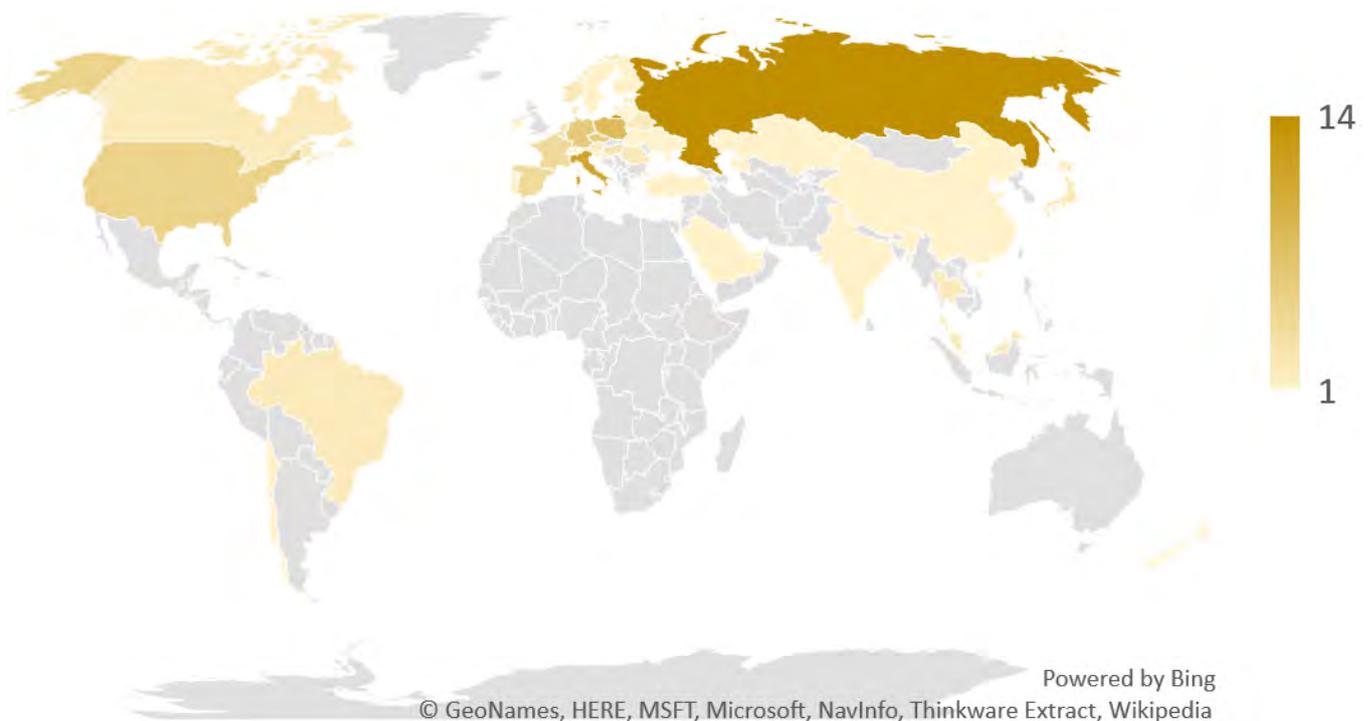
A list of global FFCS operators is provided in Appendix 1. The method applied to create this content followed three main phases.

First, data were collected from and verified in different sources, between January and April (2020), in the sequence explained below. The information was then organized on a database and summarized in the table presented in the appendix.

- * Review of the literature and other sources (Kortum et al., 2016; Movmi, n.d.; Remane et al., 2016) that presented information about FFCS operators from different parts of the world to make an initial list.
- * Survey of the interactive map provided by the global Carsharing Association (CSA) (<https://carsharing.org/carsharing-world-map/>), performed in early March/2020, to look for all the FFCS providers recorded in the association's database, updating and complementing the initial list, and arranging them by country.
- * Analysis of the websites (and LinkedIn pages available) of all listed FFCS operators, to confirm if they were still active, collect relevant information about their business models, operations and locations, and generate images of their service areas or maps (screenshots), using google translator when needed.
- * Review of local mainstream media in each country to confirm and collect additional relevant information about the CSOs and their situations in the cities or regions.

The map on the following page shows the countries where the identified FFCS providers operate, and the intensity of their colors represent the quantity of operators found in each country during this data collection - darker colors mean more operators identified. The images of the service areas and maps collected for this work were also organized in categories and the relevant cases are presented in the following sections of this document.

Where FFCS operates



Countries with FFCS operations

Source: desktop research elaborated for this work (Jan-Apr/2020) - appendix

Disclaimer

The intention of this work was to depict the most comprehensive scene as possible, for the moment and purpose of this project, mainly to inform its next steps. However, considering usual limitations of desktop research, the challenging moment in which this work was developed, and because this is a naturally fast-moving field, this list may not be complete. It is difficult to keep pace with the evolution of the market and the providers' situation may change constantly. Therefore, if this content is used for other purposes, information about the providers should be confirmed first, and the date of this investigation should be emphasized in possible mentions or citations.

FFCS impacts

Car sharing tends to impact positively in mobility behaviors, reducing car ownership and use. Therefore, when it comes to FFCS, some central and recurrent questions raised and asked in research and practice are:

- * Can impacts of station-based car sharing (SBCS) be replicated to free-floating (FFCS) services?
- * What are the impacts of FFCS in car ownership and use, and in making people shift from the private cars to alternative transport?
- * Does FFCS compete with sustainable modes of transport?

Wistfully, the answers to these questions are more complex than straightforward “yes” or “no” statements. Besides being a field that still requires significant exploration, especially in academic research, most of the works done so far have aimed to explore the terrains of FFCS in an attempt to establish a debate, by answering these and other relevant questions while navigating the complexity.

Overall, the field of FFCS is permeated by some controversies, assumptions and uncertainty, that emerge from different factors, especially in terms of its interactions with other transport modes (public and active), and the impacts it generates. Research has an important role in answering these questions, evaluating the impacts that FFCS generates in cities and studies done in different cities try to hamper the wave of assumptions by giving more clarity and accuracy to the terrain.

In summary, what studies have been able to answer so far is that:

“Research from SBCS is not ‘transferable’ to FFCS”.

(Becker et al., 2018, p. 52, 2017)



CAR SHARING UPTAKE

FFCS may also help with the uptake of car sharing as a transport mode. In general, influencing changes in the travel behavior of users (Becker et al., 2018, p. 60).

TRAVEL BEHAVIOR

In some cases, FFCS can impact positively in travel behavior (Martin and Shaheen, 2016), reducing “the level of car ownership and triggering a modal shift towards public transportation” (Becker et al., 2018, p. 60).

possible competition with

ALT TRANSPORT + SBCS

FFCS may compete with alternative transport and/or with other forms of car sharing (SBCS) for being a relatively convenient option - more flexible in some cases (Firnkor, 2012; Le Vine et al., 2014).

PUBLIC TRANSPORT

FFCS tends to compete with public transport in places where the transport system is less efficient - “not an adequate and attractive alternative” (Steiner et al., 2014, p. 8) - encouraging car use; when the purpose of the trip favours the choice of FFCS.

Evidence in the public domain regarding the impacts of FFCS is embryonic
(Ampudia-Renuncio et al 2018).

Net environmental impacts of FFCS are still unexplored in research.
(Becker et al., 2018; Guirao et al., 2018).

FFCS impacts

Conclusions from some studies reviewed for this work also suggest that, due to the “complementarity of round-trip and one-way carsharing” (6-t, 2014) FFCS may generate more positive impacts in cities if combined services operate in the same area. For example, with the deployment of hybrid systems, as mentioned previously. To illustrate this idea, a recent study done by the German Carsharing Association – BCS (Nehrke and Ziesak, 2020) to evaluate car sharing (SBCS, FFCS and “combined”, or hybrid) impacts from the user’s perspective in Frankfurt, Cologne and Stuttgart, concluded that:

Combined/hybrid services tend to impact more positively in cities

(Nehrke and Ziesak, 2020)

- * A system needs SBCS services to replace private cars.
- * Free floating can attract new users to the mode - as also concluded by (Steiner et al., 2014) - and can be used in parallel to car ownership.
- * Combined systems seem to be the best options – “the best of both worlds”.

The fact that car sharing impacts, in special FFCS ones, are location-related and influenced by the mix of characteristics of the place of operation - conditions of the transport system, combined with the physical characteristics (urban form and land use, in particular) of the city - seems to explain most of the controversy described above. FFCS, like other mobility schemes, works differently in each location, issue illustrated by most of the research done so far, with studies done in different cities that have found some contrasting results, and by practical examples, considering the variety of existing service areas analyzed here. This situation also reinforces the fact that there is no OSFA solution in terms of operations, regulations and usage of FFCS. Another point to consider is that research about FFCS usually faces methodological constraints, in terms of sizes of the samples, access to relevant information, methods to collect and analyse data (modelling, forecasting), subjectivities, etc. Additionally, because most of the studies available use different samples and/or follow different methods, it is difficult to generalize the conclusions. Hence, more academic research is constantly needed to make more accurate conclusions about the potentials, challenges and appropriate governance systems (Paganelli, 2019) for a beneficial FFCS implementation (Ampudia-Renuncio et al., 2018; Guirao et al., 2018; Terrien et al., 2016). In general, literature and practice indicate that attempts to get positive impacts from FFCS, or from any type of car sharing, should be aligned with strategic goals, be integrated and work as part of the wider transport system (Paganelli, 2013; Steiner et al., 2014; Terrien et al., 2016).

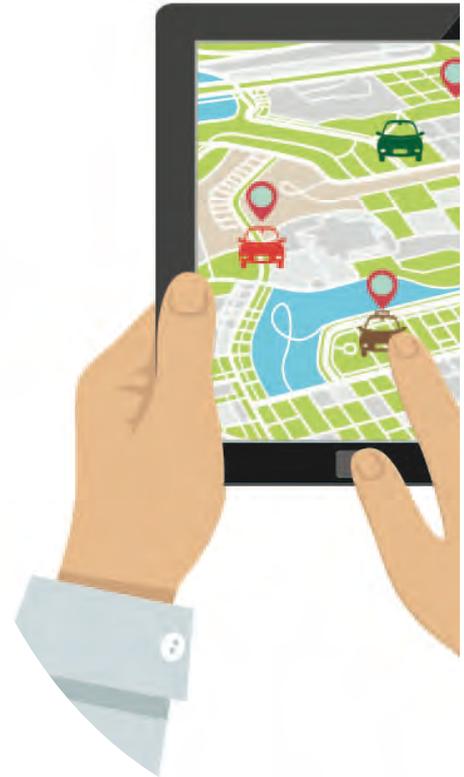
The role of parking in and for car sharing

Just as private car ownership depends on car parking and parking policy, car sharing models likewise are supported or constrained by car parking (Dowling et al 2018). Kent & Dowling (2016) argue car sharing relies on car parking space, and that policy gatekeepers for parking “exert substantial influence over car sharing’s success”. Marsden et al (2020) characterise public street space as “a highly contested space which the state finds hard to govern effectively”. They note multiple existing and emerging stakeholders in kerb space, including car share companies seeking exclusive or cheaper access to public parking space and the formalisation of car sharing through regulation.

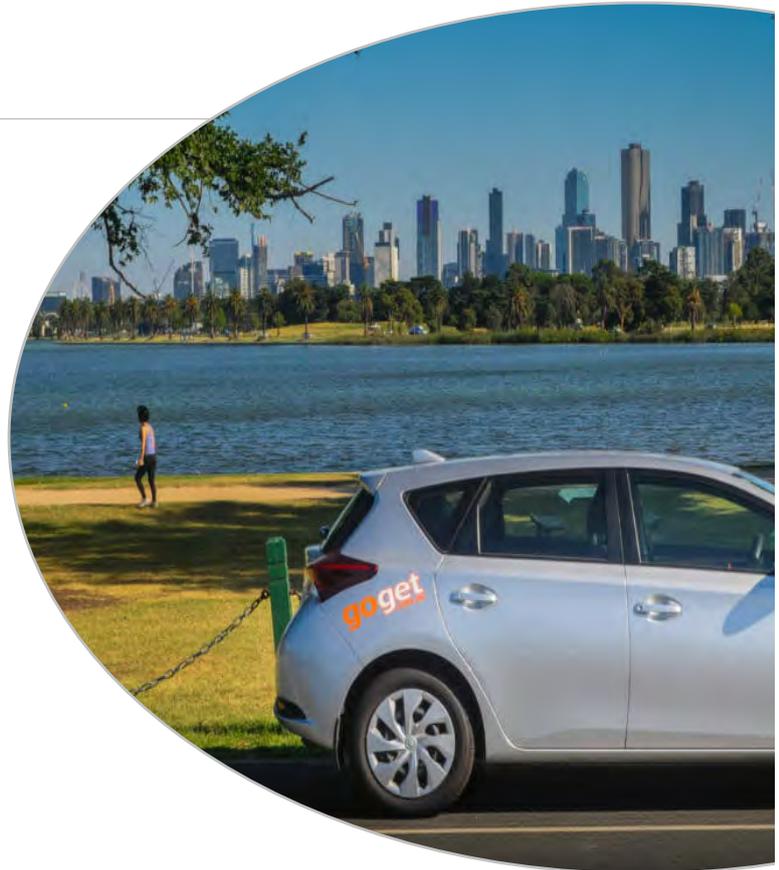
Kent & Dowling (2016) argue that car sharing relies on car parking space, and that policy gatekeepers for parking “exert substantial influence over car sharing’s success”. Marsden et al (2020) characterise public street space as “a highly contested space which the state finds hard to govern effectively”.

Car sharing relies on the infrastructure of private car ownership, and sharing works both for and against prevailing systems of automobility (Dowling et al 2018). The politics of (private vehicle) parking, and typical policy approaches to parking, have implications for car sharing and for other forms of Mobility As A Service or emerging transport technologies. Marsden et al (2020) are concerned there is a level of ad-hoc pressure on how streets are managed in response to new forms of mobility. They highlight inequities and inconsistencies with the current situation, but also that there are risks with responding to pressures from new forms of mobility without clear principles. Carrese et al (2020) also highlight parking policy as critical to car sharing.

In a meta-analysis of taxonomies of car sharing by Remane et al (2016), parking infrastructure is a key aspect of the ‘service platform’ of car sharing. Car parking is critical to the geography of car sharing as well as to the attraction of car sharing for users. Key physical types of car parking for car sharing are dedicated ‘stations’; or stations attached to other locations (airports, or train stations); or (common in Australia) share cars parked on-street; or off-street in public or private parking areas or developments; or at private homes (for peer to peer).



Dowling and Kent (2018) note that car sharing works where other transport modes are available, especially for commuting to work; and that car sharing areas are characterised by density and land use mix that typically results in pressures on on-street parking space.



Parking policies of different types have implications for car sharing. Considering station-based and peer-to-peer car sharing (see table), broadly, conventional parking policies lend themselves more to peer-to-peer operations where there are few parking restrictions but also no special privileges to car share vehicles. Station-based car sharing relies on allocated car parking. This model occurs and is successful in areas of parking management policies. Dowling and Kent (2018) note that car sharing works where other transport modes are available, especially for commuting to work; and that car sharing areas are characterised by density and land use mix that typically results in pressures on on-street parking space. Thus, “the streets where car sharing is likely to be successful are therefore also those where car parking is scarce, and the reservation of parking space specifically for car sharing vehicles makes it an attractive alternative” (p470).

The timing, meters and other exclusions used to manage comparatively scarce parking space in these areas mean there is value in exemptions to these rules (Marsden et al 2020); and in the corresponding greater likelihood of having parking space for a car sharing vehicle. Often the exemptions valued and sought for car sharing vehicles are similar to those afforded through residential parking permits. Ampudia-Renuncio et al (2018) note that planners “play a decisive role” in shared-mobility: car sharing services “depend on privileged access to street space (uncongested streets, free or cheap parking space) which can only be granted by the public sector”. While allocated parking appeals to users, Kent & Dowling (2018) reported “cultural distrust and/or ignorance of a new system” as an issue with non-users of car sharing, who resent (in Australia) the allocated spaces for car sharing. Local car sharing policies for reserved spaces sometimes set targets for the proportion of public parking spaces to be reserved for car sharing (e.g. 3.5% in Sydney, 3% in Calgary in Canada).

Parking policy typologies

Parking policy typologies combine with car sharing typologies to facilitate or constrain different outcomes. Each typology combination has its own barriers and risks. Parking and regulatory arrangements vary from place to place and should be tailored to local characteristics.

In a high-demand, managed parking situation, exemptions given to car sharing vehicles (subject to certain conditions) are typically through reserved spaces. Shaheen (2010) found that in North America over 70 municipalities had specific policies to favour parking of car sharing vehicles, typically through reserved spaces.

Options for parking policy for car sharing:

- allocated (reserved) spaces on and off-street (pods, areas, stations, hubs, EV stations) in public or private spaces.
- off-street reserved spaces or 'stations' (including at transit stations).
- permits (exemptions from normal timing and pricing) of different types (digital, cost per period/vehicle), parking fees.
- allocated/designated areas (with differing timing and pricing).
- access to and/or free or discounted parking in designated areas (low emission/central zones).
- technology-based data collection and pricing.
- hierarchical permits (e.g. free disabled parking, favourable pricing for shared cars, deliveries);
- time-based pricing."

Table: Car parking policy typologies and station-based or peer-to-peer car sharing

	<i>Conventional supply-based parking policies</i>	<i>Parking management policies</i>	<i>Market-based parking policies</i>
Off-street parking policy for car sharing	Can be used to lower site-based-off-street requirements	Can be used to reduce site-based parking provision, or to transition to parking maximums Parking 'stations' can support 'precinct parking' / unbundling	Allows more use of parking supply in an area Can be peer-to-peer or based on commercial rents
On-street parking policy for car sharing	Limited: few parking controls means no special provisions for car sharing Suits peer-to-peer (unrestricted use of street parking)	Timing, pricing exemptions – reserved street spaces or permits High appeal for operators of docked parking spaces in dense areas For users: exemptions = 'rock star park'	No on-street parking: car parking and car sharing is off-street.
Risks	Limited appeal or viability of car sharing to users or operators Private cars are dominant/required	Resentment / negative social norms around reserved car share spaces Unclear hierarchy of public good for allocation of space Enforcement issues: others parking in reserved spaces	May have limited appeal given the dominance of other transport modes Higher costs reserve cars and car sharing for higher income groups in high demand areas

KEY ISSUES TO CONSIDER WHEN IMPLEMENTING FFCS

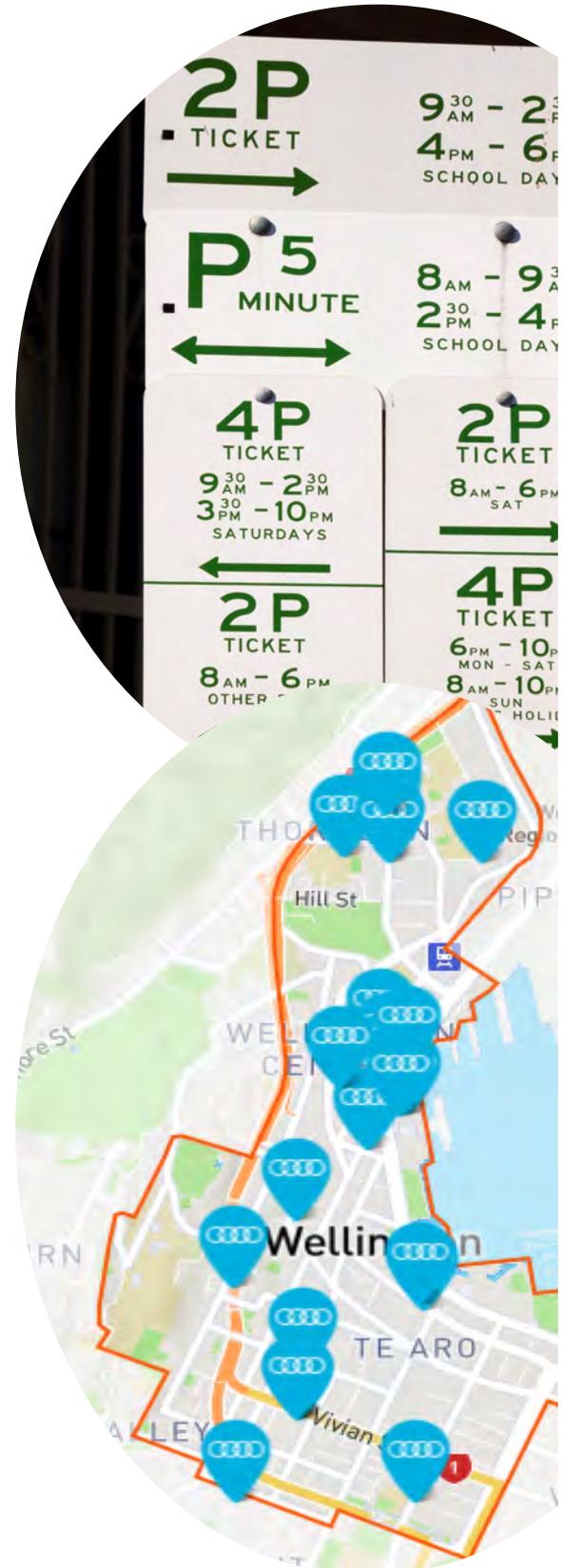
FFCS needs **urban space** to operate

Besides the difference in how the vehicles can be used, there are also significant differences between FFCS and SBCS in the background arrangements for the operations.

The first one, crucial for FFCS (Kortum, 2012), is that a **service area** must be defined before the FFCS operation starts in any city or region. This information will then be fed into the system and will guide the utilization of vehicles on their locations, as well as where trips can start and finish.

Another difference from SCBS is in the **allocation of space for parking**. Actually, parking spaces for FFCS can also be on-street, which requires negotiations with local authorities, or off-street, which requires negotiations with private parking owners or managers. However, the main difference from SBCS is in the terms of the negotiations for each. For on-street parking spaces, local governments need to decide how the available spaces will be allocated and used, how much they will cost, normally per vehicle, and how the companies will pay for them (permits and their lengths, conditions, payment cycles, etc.). In addition, similarly to SBCS, the service seems to work better from operational and marketing points of view if parking spaces are provided on-street.

These tasks of defining the service area and the measures for parking allocation and management are normally discussed together during initial phases in the places where operation is planned to start, but their characteristics vary significantly from one city to the other, and there is no “one-size-fits-all” (OSFA) solution. Nevertheless, some general concepts and lessons learned can (and should) be adapted to and replicated in different contexts.



ALLOCATION OF SPACE - SERVICE AREAS

Defining the service area for FFCS operations is a crucial step of the setting up process. Besides having some general principles in common, the final physical characteristics of service areas, and the way members can use vehicles within or in between these spaces, differ significantly from operator to operator, and from city to city.

Service areas receive different names in existing operations of FFCS, for example: operation/operating, business, coverage, use, handover, or defined core areas; home, lease completion, travel or CSO, zones.

Also, some FFCS operations allow users to travel in between cities (intercity trips), regions, service areas, campi, bases. The conditions for these operational modes depend on the providers and may imply in some extra payment.

Issues to consider when defining service areas for FFCS operations:



- * Commercially viable areas/locations are the usual goal of providers when defining the area.
- * An equity approach from the regulators could ensure a wider coverage of the system, as CSOs rarely want to offer the service in low density or low-income areas due to commercial and operational issues.
- * The process requires cooperation across borders and crucial negotiations with local authorities, in particular to solve operational and regulatory parking issues, who may (and should) have a say on where they understand the service should work, particularly to require equity.

One of the purposes of this work was to identify the **similarities and differences** in service areas of real deployments (desktop review explained previously) and organize them into categories. The classification resulted in 11 categories presented on the right:

1. Concentrated service areas
2. Fragmented service areas
3. FFSSB service areas
4. Service areas with drop off zones
5. Service areas with parking “hot spots”
6. FFAB service areas
7. Service areas with special sections
8. Mixed service areas (FF + FFSSB)
9. Regional service areas integrated with transit
10. Regional or extra-urban service areas
11. Service areas of hybrid services (SBSS + FFCS)

Types of service areas

The descriptions and examples of each type of service area found during this work are presented in the following pages.

1. CONCENTRATED SERVICE AREAS

Service areas with uniform shapes, that consider a part of the city as a whole for the FFCS operation.

MADRID - EMOV



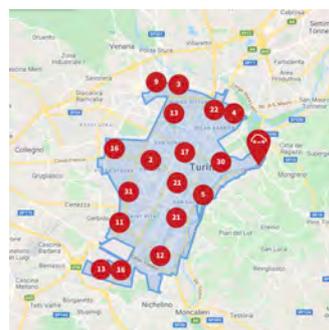
<https://www.emov.eco/madrid/>

MADRID - SHARENOW



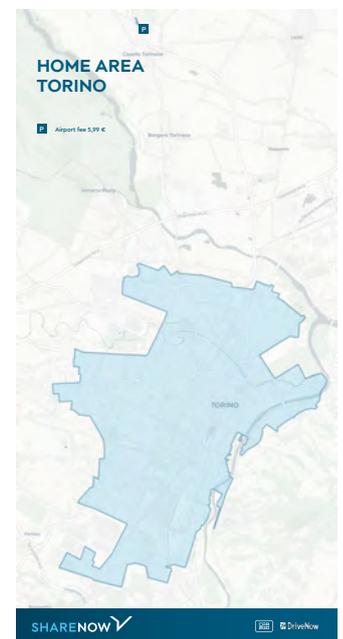
<https://assets.ctfassets.net/ro7z507xvlp4/6DvVwxDct3rTWHNIPaV3/e3234df2261c639c13570bf479801d34/share-now-es-home-area-madrid.pdf>

TURIN — ENJOY



<https://enjoy.eni.com/it/torino/map/>

TURIN — SHARENOW



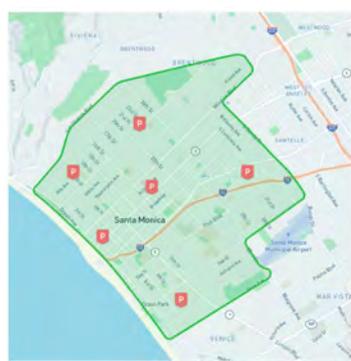
<https://assets.ctfassets.net/ro7z507xvlp4/6P6PkLLbkMqUdzEv6TiiM6IL/608e14aa6ed3c372ca758d856ad33d1b/share-now-it-torino-home-area.pdf>

LYON — YEA! (CITIZ)



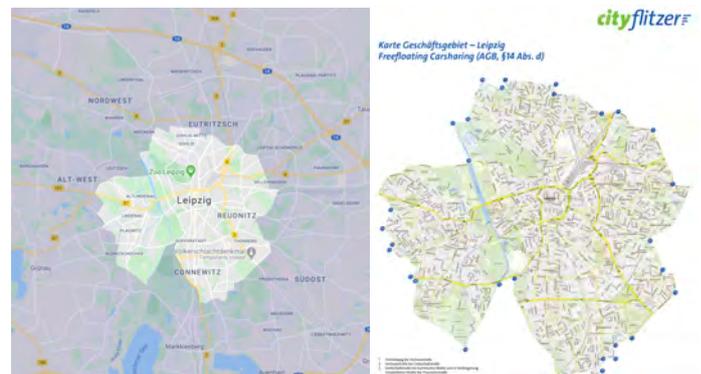
<https://yea.citiz.coop/>

LA (SANTA MONICA) — WAIVECAR



https://www.brightsign.biz/application/files/4415/2285/8633/WaveCar_case_study_FINAL.pdf

LEIPZIG - CITYFLITZER



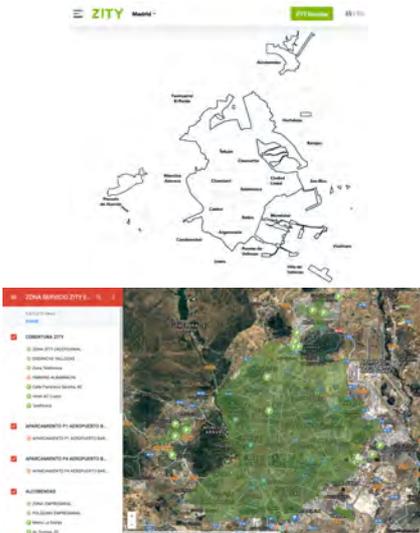
<https://www.cityflitzer.de/carsharing/geschaeftsgebiet/>

<https://www.cityflitzer.de/downloads/geschaeftsgebiet-cityflitzer-leipzig>

2. FRAGMENTED SERVICE AREAS

Service areas that consider one city or region but are divided into sections where trips can start and finish, which cover specific parts of this city, creating “islands” of operation. The shapes of these coverage “islands” vary significantly from one city to the other and, interestingly, vary substantially in comparison with the areas of other local CSOs.

Madrid – Zity



<https://zity.eco/en/madrid/>
https://www.google.com/maps/d/viewer?mid=1f7-mdCzjQNLgaaaAmRMbAUSlIuyoXgK_&ll=40.457661943807736%2C-3.667511135276186&z=12

Moscow - Delimobil



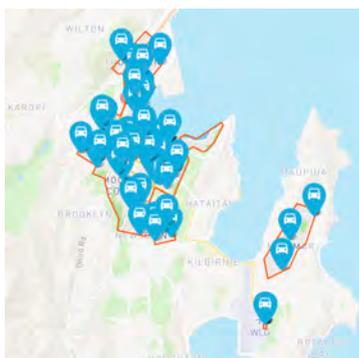
<https://delimobil.ru/map>

Frankfurt Area – Free2move



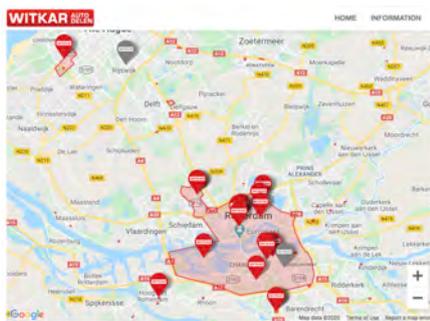
<https://carsharing.free2move.com/frankfurt/homepage-en/>

Wellington – Mevo



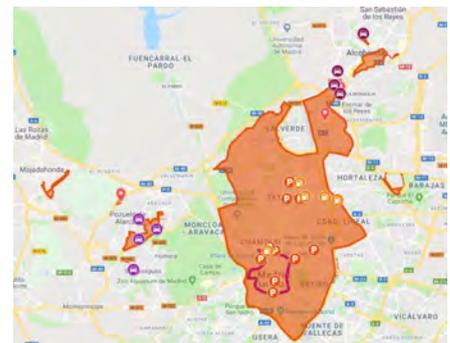
<https://mevo.co.nz/wellington/home-zone>

Rotterdam – Witkar



<https://www.witkar.nl/witkar-locaties/>

Madrid – Wible



<https://www.autonocion.com/guia-completa-carsharing-madrid-car2go-wible-zity-emov/> - 23/11/2018

Berlin – Sharenow



<https://assets.ctfassets.net/ro7z507xvlp4/7dzphCWtk8rr46IEYqO19C/891eaa7089c4196db930c24ad42b5bb/share-now-de-berlin-home-area.pdf>

Toronto – Communauto



<https://www.communauto.com/>

Vancouver – Evo



<https://www.evo.ca/>

3. FFSB SERVICE AREAS

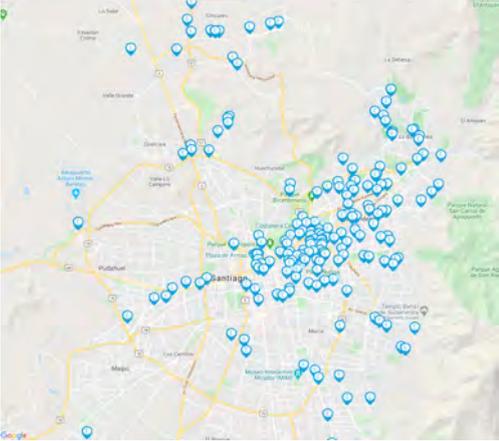
Service areas for the operation of FFSB systems (explained previously), which are usually the case in systems that offer shared electric vehicles, because they need to be connected to charging stations.

Tokyo — Times Car Share X Ha:mo



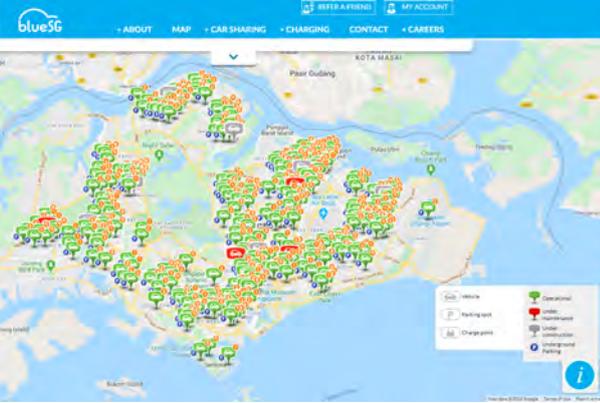
<https://share.timescar.jp/tcph/index.html#station>

Santiago (Chile) — Awto



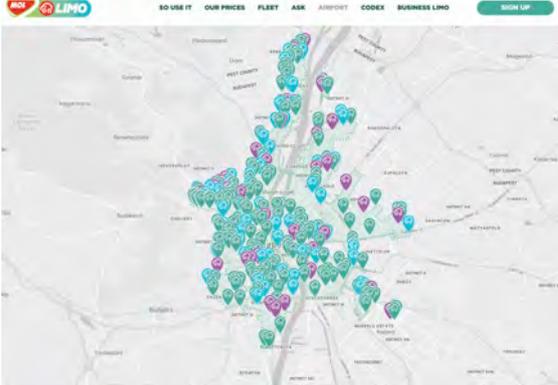
<https://awto.cl/estacionamientos>

Singapore — Bluesg



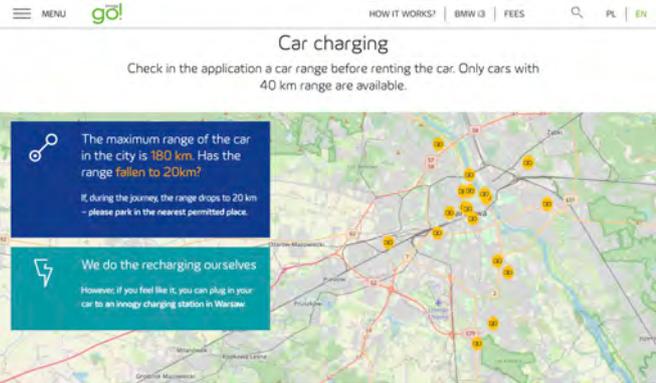
<https://www.bluesg.com.sg/car-sharing#map>

Budapest — Mol Limo



<https://www.mollimo.hu/hu>

Warsaw — Innogy Go!



<https://innogygo.pl/en/how-it-s-work>

Malta — Goto Malta



<https://www.goto.com.mt/car-sharing-locations/>

6. FFAB SERVICE AREAS

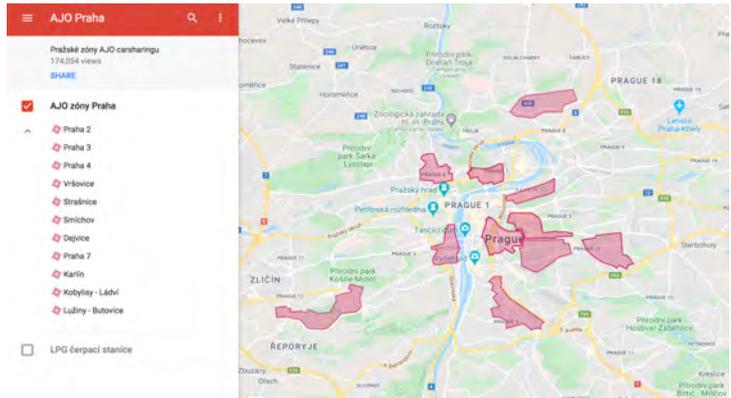
Service areas for the operation of FFAB (free-floating area based) systems.

Prague – Autonapul



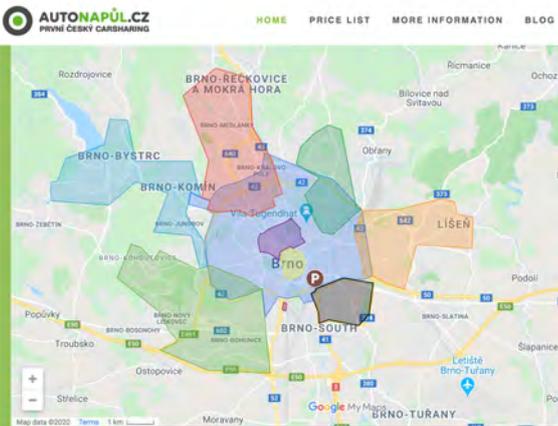
<https://www.autonapul.cz/en/carsharing-prague/>

Prague – Ajo Carsharing



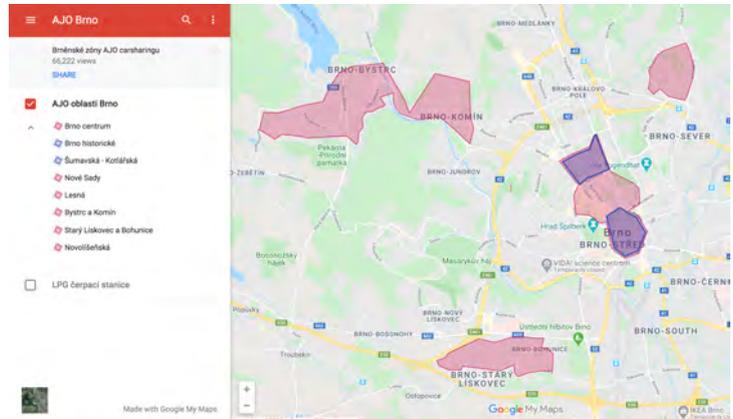
<https://www.google.com/maps/d/viewer?mid=1meSA-YrPKp1Rj80I-WRQeJCRg4&ll=50.082118433853836%2C14.465760270017881&z=12>

Brno – Autonapul



<https://www.autonapul.cz/en/carsharing-brno/>

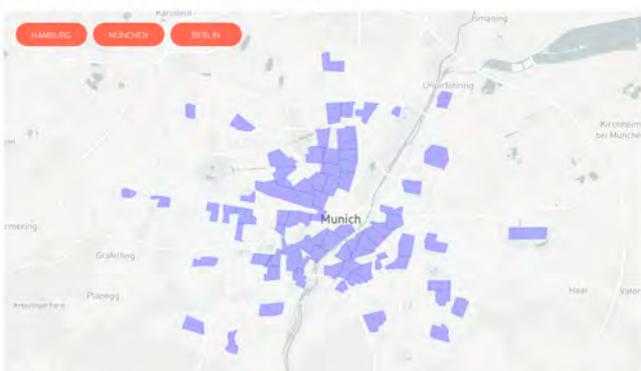
Brno – Ajo Carsharing



<https://www.google.com/maps/d/viewer?mid=18n19v-beXhrF8PpAFI287eZbPhI3Ufok&ll=49.19861133458017%2C16.578085605812248&z=13>

Munich – Oply (shut down in Feb/2020)

Here is Oply at home
More than 400 cars in the largest three cities



<https://www.oply.com/?lang=en>

Antwerp – Partago



<https://www.partago.be/waar-vind-je-partago-elektrisch-autodelen-communities.html>

7. SERVICE AREAS WITH SPECIAL SECTIONS

Service areas divided by the CSOs in sections with special characteristics, where different conditions for the use of their vehicles apply. The main differences in the conditions of these sections are in terms booking tariffs, parking fees, and accessibility.

Madrid – Wible



TWITTER – 23 Mar 2019
https://twitter.com/wible_esp/status/1109175548826263553/photo/1

Madrid – Wible



23 NOVIEMBRE, 2018
<https://www.autonocion.com/guia-completa-carsharing-madrid-car2go-wible-zity-emov/>

Wroclaw (Poland) – Vozilla



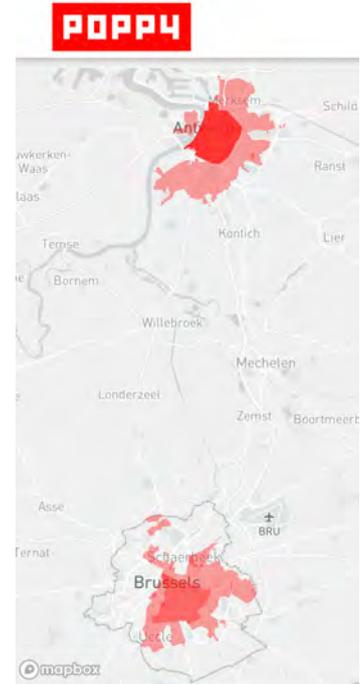
<https://www.vozilla.pl/>

Milan – Sharenow



<https://assets.ctfassets.net/ro7z507xvlp4/1j7q0ZidNLf6QGEjWGLVPO/192b02bbeed854f313deb450f4efb70e/share-now-it-home-area-milano.pdf>

Brussels - Antwerp – Poppy



<https://poppy.be/>

Frankfurt Service Areas – Cityflitzer/Book-n-drive



<https://web.book-n-drive.de/options/@50.143917,8.6332726,12z/data=lm0e0lm1e1>

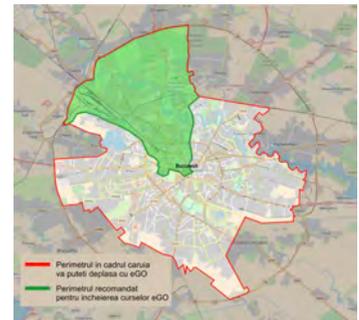
Toulouse - Iodines



You can circulate outside these zones but must take and return the car in these zones.

<https://www.iodines.fr/>

Bucharest – BCR eGO



<http://www.bcr-ego.ro/>

CASES

BCR eGO's service area, in Bucharest, has a perimeter within their full coverage area where the drop-off of vehicles is recommended (green surface in the image). Similarly, Sharenow has defined a drop off area in Milan, the "Milano Donut" (darker blue inner area delimited on the map), where parking fees are different. For instance, in some European cities, especially in Italian ones, CSOs also create special sections where access and/or parking are not allowed (or are, under special conditions) for their vehicles, which usually encompass or include parts of central historic areas where traffic is limited - ZTL ("Zona Traffico Limitato").

8. MIXED SERVICE AREAS (FF + FFSB)

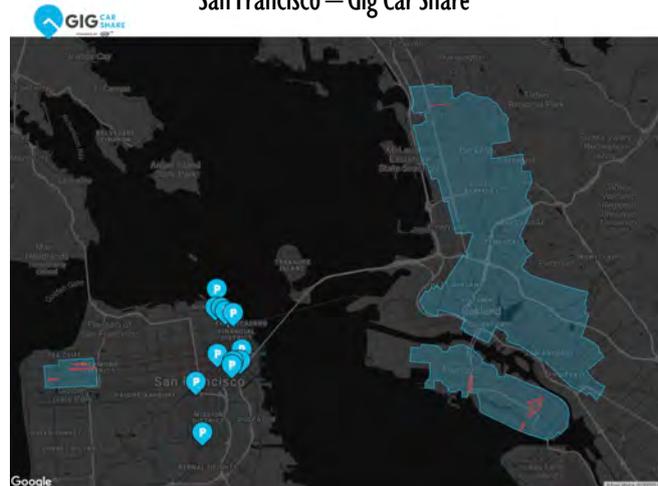
Service areas of systems that combine standard free-floating (FF) operations with station-based ones (FFSB - special parking spots or electric vehicles charging stations), within the same coverage area. These mixed zones are usually region-based, encompassing regional territories of major cities, and can also be divided into sections.

Arezzo — Car Sharing Arezzo (public car sharing)



<https://carsharing.targatelematics.com/CarSharing/site/arezzo>

San Francisco — Gig Car Share

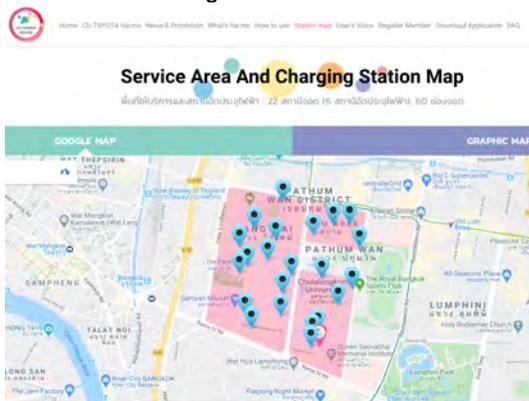


<https://gigcarshare.com/homezone/>

9. REGIONAL SERVICE AREAS INTEGRATED WITH TRANSIT

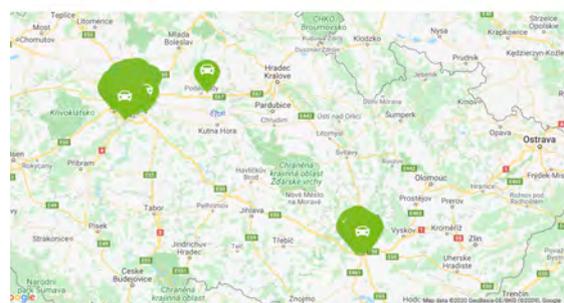
Service areas that allow connections between different cities within the covered perimeter and relevant regional transport hubs (i.e. rail or bus stations and airports).

Bangkok — Cu Ha:mo



<https://www.cutoyotahamo.com/station-map/>

Czech Republic — Car4way + Regiojet



<https://www.car4way.cz/web/rj/en>

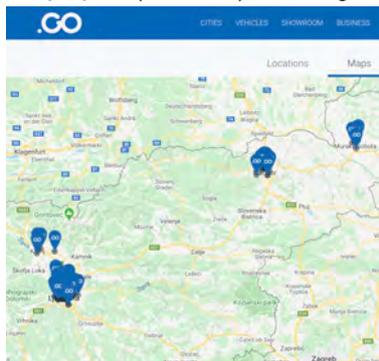
CASES

CSO Car4way, in Czech Republic has partnered with the regional rail provider to operate FFCS in an integrated approach between Prague and Brno. Similarly, car sharing systems can be designed to be part of a broader mobility platform to complement mass transit networks, embracing the opportunity offered by this mode, in particular for first and last mile trips, like Toyota's Ha:Mo Ride intra-campus car sharing - "Harmonious Mobility Network" Cite Ha:Mo, in Bangkok, Thailand, that was developed in partnership with Chulalongkorn University.

10. REGIONAL OR EXTRA-URBAN SERVICE AREAS

Service areas with regional coverage that include different cities and important transport hubs (i.e. airports or rail stations) from the same country, and, in most of the cases, allow extra-urban or intercity one-way trips between these places. Intercity one-way trips are journeys in which vehicles can be taken from one city's coverage area and returned at another city's service area or station from the same operator. Conditions for these trips (physical and financial) vary significantly from one operator to the other.

Ljubljana (and others) – Avant2go



<https://www.avant2go.si/en/cities/ljubljana-btc>

Madrid – Wible



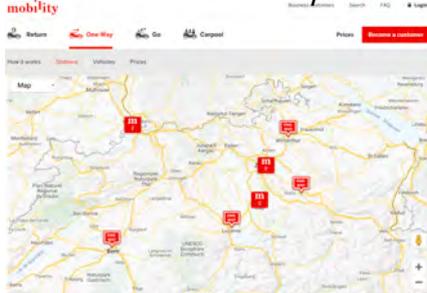
official map is not available due to COVID-19 interruption
Map from 2018 – from this article:
https://www.cadenaser.com/emisora/2018/05/23/ser_madrid_sur/1527067998_244407.html

Poland – Traficar



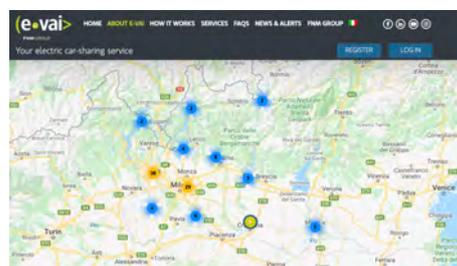
<https://www.traficar.pl/booking>

Switzerland – Mobility



<https://www.mobility.ch/en/one-way/stations/>

Lombardy (Italy) – E-Vai Car Sharing



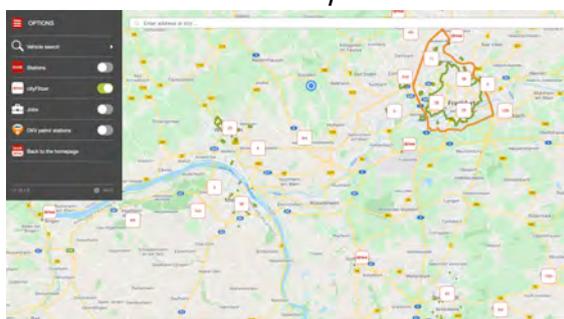
<https://www.e-vai.com/en/whats-e-vai/points>

Bologna - Ferrara – Corrente



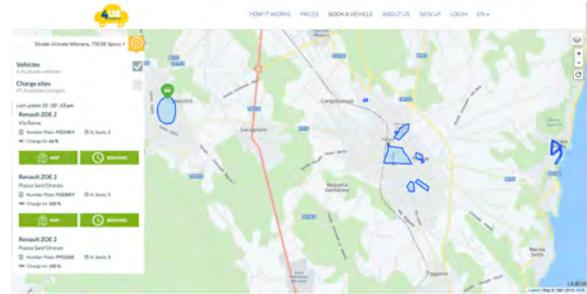
<https://corrente.app/#home>

Frankfurt + Rhine Areas – Cityflitzer/Book-n-drive



<https://web.book-n-drive.de/options/@50.0331533.8.3877539.11z/data=!m0e!m1e1>

Basso Salento – 4usmobile



<https://carsharing.ubiect.com/CarSharing/b2c/m4us.php?m=map>

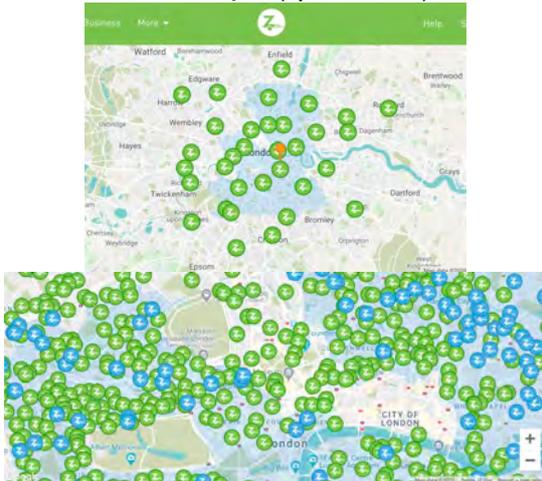
CASES

Mobility vehicles, in Switzerland, can be taken from and returned to stations from major cities spread around the country. CSOs Cityflitzer/Book-n-drive, in Frankfurt and Rhine areas, and 4USMobile, in Puglia's Basso Salento area, allow vehicles to be moved in between their coverage areas located in different cities from their regions. Also, CSO E-Vai allows members to move in between regional charging stations and Avant2go vehicles can be moved in between the operator's stops located in different cities countrywide. In other cases, intercity trips may only be allowed using specific vehicles and between specific cities covered by the CSO, i.e. Traficar, in Poland.

11. SERVICE AREAS OF HYBRID SERVICES (SBSCS + FFCS)

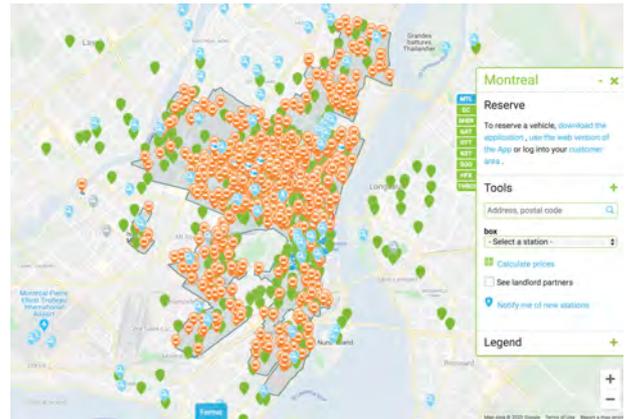
Service areas that accommodate hybrid services (SBSCS + FFCS) offered by the same operator, usually displayed on the websites and apps to guide their vehicles' utilization.

London – Zipcar (Hybrid Services)



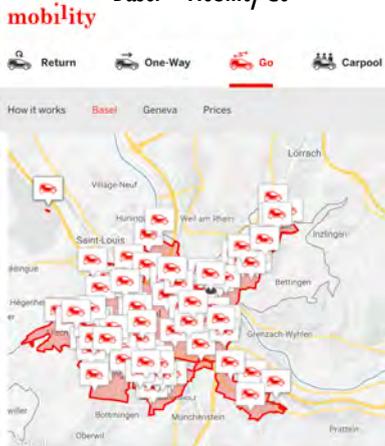
<https://www.zipcar.com/en-gb/car-hire-london>

Montreal – Communauto



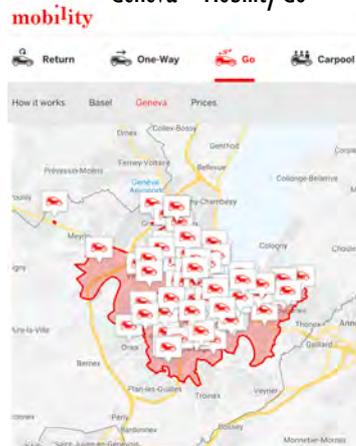
<https://www.communauto.com/>

Basel – Mobility Go



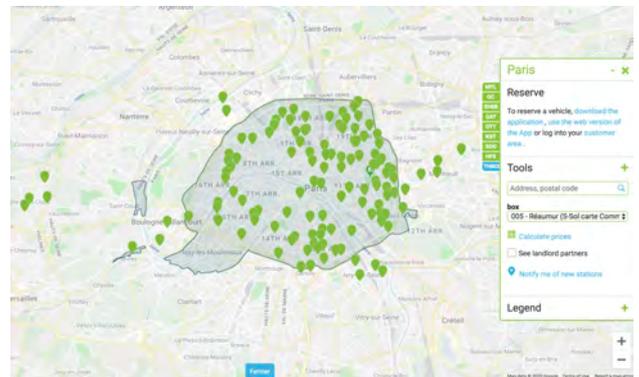
<https://www.mobility.ch/en/go/basel/>

Geneva – Mobility Go



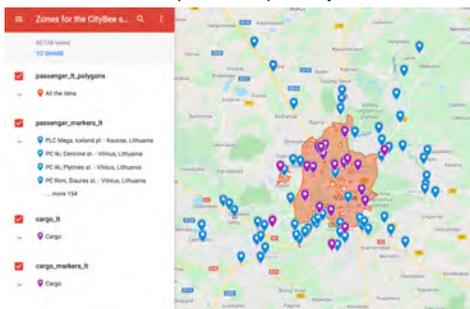
<https://www.mobility.ch/en/go/geneva/>

Paris – Communauto



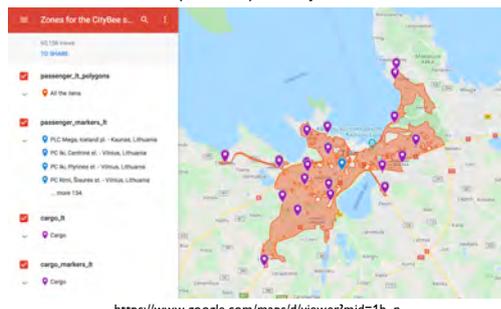
<https://www.communauto.com/>

Vilnius (Lithuania) – Citybee



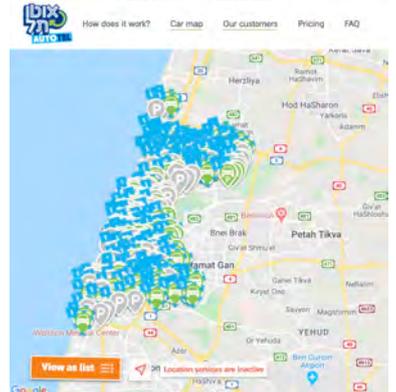
https://www.google.com/maps/d/viewer?mid=1b_n-GsPreMU737_F_2tjr2k2fniSuKNB&ll=55.99278977939822%2C32.9439281254854&z=6

Tallin (Estonia) – Citybee



https://www.google.com/maps/d/viewer?mid=1b_n-GsPreMU737_F_2tjr2k2fniSuKNB&ll=55.99278977939822%2C32.9439281254854&z=6

Tel Aviv – Autotel



https://www.autotel.co.il/en/#car_map

SPATIAL EQUITY

Spatial equity is an issue. Service areas themselves as with car share operators tend to be more likely in areas with good public transport access and mixed land use, which are often higher income.

Researchers tend to question the fact that FFCS operations do not usually cover regions that require better access to mobility, like low income, low density or suburban areas of cities, highlighting the need for local governments to explore services like FFCS to improve the transport provision in places with these characteristics (Kortum et al., 2016; Tyndall, 2017). Indeed, there is an opportunity for cities to explore FFCS services in disadvantaged or underserved areas, but it comes with the great challenge of enabling the establishment of financially sustainable systems for operators (with projects that incentivize them to provide services in these places), while also increasing the accessibility of the vulnerable areas.



An equity approach from the regulators could ensure a wider coverage of the system, as CSOs rarely want to offer the service in low density or low-income areas due to commercial and operational issues.

Tyndall (2017) finds in a study of 10 US cities with FFCS, that vehicles tend to be dropped off in clusters, disproportionately in areas with residents “who are educated, young, employed and white”. Whereas car share is less likely to provide a basic level of service in other areas. Cars tend to cluster within their ‘service areas’. LeVine & Polak (2019) find that the greater impact on car ownership and use from FFCS would come from targeting moderate income households (Los Angeles does have policies focused on moderate income groups). Social equity and spatial equity issues are considered by Zhang & Guhathakurta (2017), who also find that with the presence of parking fees (charged-parking), and shared autonomous vehicles, vehicles would likely move to areas adjacent to the downtown/CBD, which in Atlanta means low income neighbourhoods. Thus, they argue that parking pricing combined with other regulations should be used to reduce car travel (and potential social equity problems) resulting from autonomous vehicle parking.

Los Angeles case

Some places are working with this opportunity and approaching FFCS with a complementary perspective, and one example of this kind of service is the operation of BlueLA Carsharing, in Los Angeles (California - USA). In 2015, the service in LA “was awarded a grant from the California Air Resources Board through California Climate Investments (CCI) to pilot electric vehicle car sharing in low-income communities of Los Angeles. BlueLA Carsharing was selected to operate the service and has partnered with the Los Angeles Department of Transportation (LADOT) to deliver a system of 100 electric vehicles and 200 chargers to central Los Angeles” (“BlueLA,” n.d.).

ALLOCATION OF SPACE - PARKING

The role of the allocation of road space and parking in FFCS operation, regulation and control is critical. Parking is an essential element of the system for all types of car sharing, particularly FFCS. It is the most important form of support from governments to car sharing (Dowling and Kent, 2015a; Shaheen et al., 2010) but also a significant challenge. Knowing that there will be a guaranteed car on the spot when needed increases the reliability of car sharing and has a great impact on the decision to give up owning a car (Dowling and Kent, 2015a). Difficulty to offer this reliability is a challenge that FFCS services face in general.

The arrangements to allocate space for the vehicles and the management of parking spaces for FFCS work differently among the cities where this type of system operates. In general, parking spaces can be on-street, off-street, with or without permits, and, if there are permits, their conditions and prices also vary significantly.

FFCS operators bring “additional operational challenges” (Kortum 2012). In the typology of car sharing by Remane (2016), cluster 4 is entirely street parking; clusters 1, 2, and 3 are dedicated stations; cluster 4: one-way, free-floating. The fourth cluster is fundamentally different from the previous three in many aspects, based on its parking differences. Typically, these are limited to certain areas or ‘zones’ of a city.

Knowing that there will be a guaranteed car on the spot when needed increases the reliability of car sharing and has a great impact on the decision to give up owning a car (Dowling and Kent, 2015a).

Some cities have released **special permits for FFCS**, like Brussels, Westminster, Wellington, Brisbane (recently), among others. And also, in most of the cities the companies offer free parking for stops made during one booking, as long as it's done within the service area. These conditions change according to the city, which require negotiation and arrangements with local authorities, a complex and challenging, but necessary process, that must involve all the councils or cities affected by the boundaries of the service area.

Station-based operations for one-way trips (FFSB) tend to increase the reliability of this type of car sharing because they provide dedicated spots to park the vehicles at the destination. However, **ensuring parking availability** at the final stations is a challenge faced by operators and users, similar to what docked bike sharing systems experience. This lack of available spaces may prevent the completion of the trips at desired destinations, compromising the convenience of both modes (Dowling and Kent, 2015a). A way some companies found to deal with parking availability issues is to offer **vehicle delivery and/or pick up (valet) services**, within or outside their coverage areas. Normally, these services require booking and extra payment, like the ones provided by ShareNow, GreenMobility, in Denmark, Share'n go, in Italy, Car sharing Bi-bi.car, in Russia, Awto, in Chile, Hayr Carshare, in India, and Yoyo, in Istanbul, for example. See Appendix (1 – 2) for more details on parking issues for FFCS.

Parking policies for FFCS

The policies and risks associated with FFCS models have key differences. FFCS (as with other MaaS technologies) necessitates alternatives or arrangements, which should be negotiated with local authorities.

In practice, FFCS is implemented in similar ways to residential parking permits, and often in combination with a central low emission zone or other policies favouring electric vehicles. Cecato & Diana (2018) characterize car sharing operators as private but as having privileged parking access either through dedicated spaces (stations), or through access to free parking areas or to low emission zones in European cities.

Typical alternatives and arrangements are summarized below (see also Appendix 1 – 2):

- designated (reserved or valid) parking areas or spaces – per operator or class of vehicles.
- authorized / permitted public parking spaces.
- car sharing ‘points’, ‘drop-off zones’, ‘hot spots’, ‘bases’, or stations, particularly for EVCS – some allow reservation of spots.
- placard permits / exemptions for car share and similar vehicles (through mechanisms similar to residential parking permits) to park in public, permit only, metered or residential areas.
- (in theory) fully integrated timing and pricing systems.
- mobility ‘hubs’ or ‘stations’, that can also be located in relevant transport hubs (i.e. public transport and rail stations or airports and require partnerships with the transport agencies), inside or outside the service area.
- vehicle delivery / pick up and drop off – valet services.

Table: Parking policy typologies and parking issues particular to FFCS

	Conventional supply-based parking policies	Parking management policies	Market-based parking policies
Issues particular to FFCS	<p>High possibility of clustering and commuting</p> <p>Difficult to address spatial and other equity issues: still likely to be unviable</p>	<p>Relies on exemptions and permits similar to residential permits: difficulty with justifying and with negotiating price</p> <p>Without special parking access, reduced appeal to users</p> <p>Higher possibility of illegal parking issues</p> <p>Possible increase in car use and congestion</p> <p>Requires defined service areas</p> <p>Competition with residential or turnover parking</p> <p>Greater demand for consistent data on parking controls and use</p>	<p>Difficult to address spatial and other equity issues: likely to be viable but expensive</p>

Features used in parking policies for FFCS

Typical features used in parking policies for FFCS (without commenting on their success) include:

- * Residential parking permit style exemptions: these grant similar privileges to existing residential permits but usually apply over a wider area, and are charged a higher fee. In cities with a wide coverage of these 'digital permits' the permits are a major selling point of the schemes.
- * These permits are used in central or inner urban neighbourhoods that have or have recently introduced hierarchical parking including residential parking permits.
- * Free parking in designated low emission central zones; or free or discounted parking specifically for electric or low emission vehicles.
- * Reliance on electric vehicle priorities: parking can be free at any electric charging station, which incentivises operators to start or convert fleets to electric. Examples include Madrid, Los Angeles, Amsterdam, San Diego, Singapore, Turin, Wellington.
- * Cities usually negotiate annual per-vehicle fees for operators to gain access to central zones or to parking permits. The amounts can be ad-hoc or general, and may reflect differences in the levels to which different operators use on-street space.
- * Cities may also make requirements for accountability and reporting about travel behaviour and emissions impacts.
- * Free access to paid parking zones, access to limited traffic zones.
- * Access to areas normally restricted to residential parking or restricted by time. Some cities allow free access to metered spaces, others exclude metered spaces.
- * All FFCS schemes are anchored to some kind of defined service area – some are specially designed; others reflect existing administration boundaries like municipalities or (in Europe) congestion and low emission zones. Can be a composite of districts; or a low emissions zone; or a customised area (sometimes through compromise). Some home zones exclude major downtown areas, others exclude high-pressure residential areas.
- * Some cities use off-street stations/hubs as well, or allow access to docked station-based parking spaces. Others specifically exclude parking in private spaces or on docked spaces.
- * Cities where emissions and other policies specifically support and enable electric vehicle infrastructure are sometimes used to incentivise FFCS operators.
- * Some cities have differential parking fees for certain areas (e.g. Frankfurt), but this is uncommon. Differential parking prices are more the territory of proposals for future mobility parking models. Ciari et al (2015) model the potential of using differential parking pricing for managing demand pressures and clustering issues with FFCS.
- * LeVine & Polak (2017) find that the greater impact on car ownership and use from FFCS would come from targeting moderate income households (Los Angeles does have policies focused on moderate income groups).
- * It is common to use similar permits as to residential permits: termed 'digital permits', but really they are just exemptions tied to vehicle registration. The 'digital permits' typically have the same privileges and exemptions as to residential parking permits – permitting parking in areas with time limits, or marked for residential permits only. They extend over larger areas.
- * The digital permits for car sharing are priced higher than residential permits (which are often free). For example, Washington D.C. negotiates for 'zone 9' permits, between \$300-\$3,000 per car per year depending on the operator.

ALLOCATION OF SPACE - PARKING

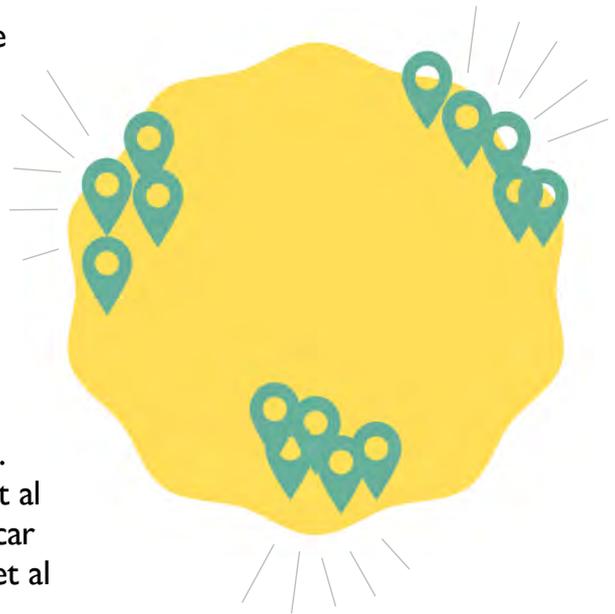
Attempts to **mediate between residential parking demands (and politics) and car sharing** are thorny and can be intractable. A Vancouver report (Vancity 2018) suggested that restrictive parking regulations forced BMW's DriveNow service out of San Francisco, and Toronto's "mediocre" car-sharing scene reflected drawn-out battles over parking rights. Chicago's service area was "gerrymandered" to avoid high demand residential areas. FFCS as with other parking rights afforded to car sharing pushes against norms and values around private car parking, reflected in conflict with residential parking and residential permits. Or, affordance of similar privileges as to residential parking permits which are themselves problematic rights to public space. Ostemeijer et al (2019) argue that, given residential parking is usually free or very low priced, that residential on-street parking policy tends to subsidise or increase car ownership. Ostemeijer et al (2019) connect this observed effect of street parking pricing to the possible implications for autonomous vehicles.

Parking fines and illegal parking can be an issue – parking fines still accumulate, as the onus is now on the user to park the car legally. Some MaaS modes and delivery vehicles are key issues in illegal / improper parking – Brown et al (2020) find that ride-hail and food delivery drivers disproportionately park illegally. These are some of the other pressures to formalise road space reallocation.

Parking is both the incentive and the potential barrier to FFCS: there is a **need to balance fair access to parking** with the appeal of the 'golden ticket' type of exemption for FFCS. In Berlin, while any public parking spot may be used, there are no special rights to it and the availability of parking on-street in many Berlin neighbourhoods is unlikely and in some, "the possibilities of curb parking do not exist" (Muller et al 2017). In most cities with FFCS some more explicit privileges of access to parking is involved. In Berlin enforcement and illegal parking issues are prevalent with free flow car share vehicles. Even with privileges, in Vancouver finding a free-floating vehicle, especially at peak times in certain neighborhoods, can be "impossible". One response is to provide more vehicles at transportation hubs. However, parking is "a deal-maker but also a deal-breaker": the possibility of easier free parking in a constrained city is an attractor, but where this is not attained the value of the car share use is undermined. Membership may be impacted as well as city goals, or parking enforcement. Dowling and Kent (2018) report users who initially accessed a car share without an allocated space ("it was just generally in a certain vicinity") and finding this more difficult. Trips ending while illegally parked – in front of fire hydrants, in other car company's spots, in no parking zones. Illegal parking was not a huge number in proportion to the number of trips but are still an issue. If FFCS is not given privileged access then enforcement is a more likely issue (as in Berlin). However other kinds of emerging mobility are more problematic for illegal parking (Brown et al 2020).

CLUSTERING

On a theoretical level – particularly when examining the potential for shared autonomous vehicles – a key issue identified with FFCS is **relocation and clustering**, and the asymmetry of demand for where cars are collected and dropped. Illgen and Hock (2019) note that the availability and special allocation of parking influences asymmetry – studies of demand however rarely take detailed account of differences in parking. Morency (2008 - cited in Kortum 2012) noted challenges with “variability in attractiveness” of vehicle locations – meaning difficulty with allocating and relocating vehicles. Vehicle relocation problems are identified by Bruglieri et al (2014); Millard-Ball (2019); Hao et al (2018). Increased car use is a risk identified by Ostemeijer et al (2019); Tian et al (2019); Wang et al (2018).



COOPERATION AND INTEGRATION ACROSS BORDERS

Cooperation and integration across borders can be a challenge for FFCS where there are multiple municipalities in a metropolitan area.

LeVine & Polak (2019) noted that in London “coordinating 32 separate authorities across different boroughs proved to be more difficult than anticipated”.

London is an example of inconsistent policies as a barrier to car sharing and particularly to FFCS. While the Centre for London (2020) urges London boroughs to develop hierarchies of street space including for car sharing; and to support car sharing as part of overall street and transport strategies (“kerbside strategies”) that move away from privileging private vehicles; London’s boroughs do not have consistent car share policies at this stage. Proposals are to develop a “fair price” for on-street parking for car sharing as a city-wide approach “to support harmonisation across boroughs”. The lack of consistent parking policies and permit privileges across Boroughs has been a deterrent in London and is cited by some operators as a reason for exiting London. Drive Now and Blue City both cited “high costs of operation and the different circumstances in the single boroughs”. Schiller et al (2017) surmised that FFCS stopped operations because they were “not able to secure parking permits”.

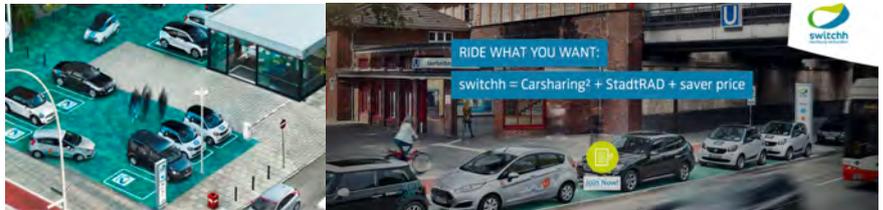
INTEGRATION WITH OTHER TRANSPORT MODES

A practical way to integrate car sharing with other modes of transport is to make vehicles available near or at public transport stops, stations or multimodal hubs.

“**Mobility hubs**” are examples of this integration, a concept that the city of Bremen, in Germany, put in practice decades ago with their “Mobilpunkts”, and has been inspiring other cities since then (like Bergen, in Norway). This concept has been adjusted and applied by other cities around the world, and incorporated into valuable guides for decision makers developed by organizations that work on the field (Bremen, n.d.; Shared-Use Mobility Center, 2018a; Taxistop, n.d.). Germany has been teaching good lessons about this topic, and a relevant example of this concept was developed by the city of Hamburg, the hubs called “Switchh”.

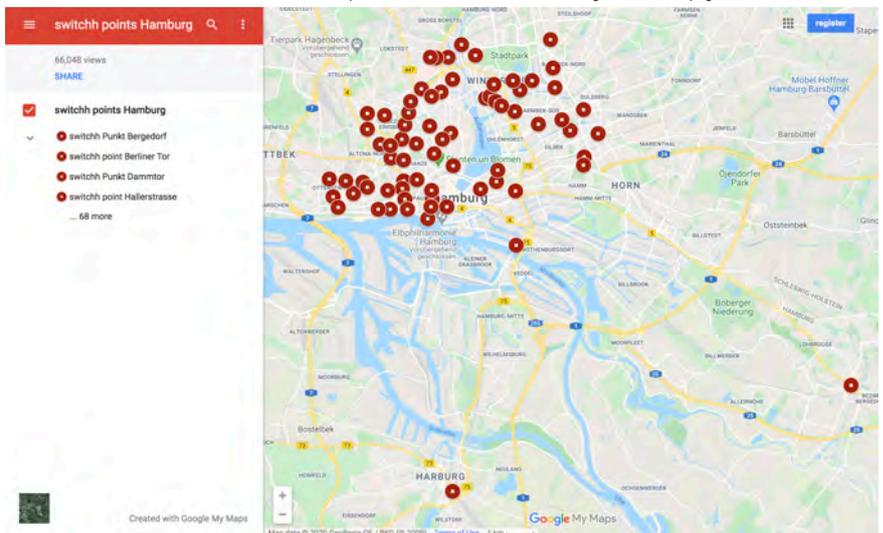
These multimodal mobility hubs, or “Switchh points”, were created by the city’s transit agency (HVV – Hamburger Verkehrsverbund) and include public transport, car sharing and bike sharing. They are usually built around public transport stations for trains (U or S Bahn), trams, buses, depending on the case, and there are 72 of them spread around the city. Different modes of transport are also concentrated within these hubs: car sharing (SBCS and FFCS), bike sharing, parking facilities, and charging stations for electric vehicles (HVV, n.d.; Shared-Use Mobility Center, 2018b, p. 16). Customers can find real-time information about the modes available in the HVV app –(Shared-Use Mobility Center, 2018b, p. 16).

HAMBURG - SWITCHH



<https://www.switchh.de/hochbahn/hamburg/switchh/homepage>

The image shows screenshots from the Switchh website with an image of the Berliner Tor station hub, a picture of another on-street hub, and the map of points located in the region. This example is relevant to this project because the hubs include both types of car sharing in the mix of transport options, with spaces for FFCS vehicles, and represent, at the same time, ways to support and integrate FFCS with the city’s transport infrastructure.



https://www.google.com/maps/d/viewer?mid=1Rt6CBV9QVnIEfd5Mts8-hW6_6U&hl=de&ll=53.526960968551336%2C10.054941733789065&z=12

Switchh points in Hamburg, Germany
Source: Switchh (n.d.)

PILOTS AND EXPERIMENTS

Research and literature widely acknowledge that there is no OSFA solution for FFCS implementation, which means that successful measures adopted in some places should not be transferred to other cities or regions without tailoring. The different ways how FFCS is implemented (types of services areas presented previously) globally emphasize that. And, to reinforce previously mentioned issues, the impacts of an FFCS system depend significantly on the mix of characteristics of a city and on how members use the vehicles.

With respect to that, **pilots and trials can be valuable tools** for cities that need, or are willing to, enable and manage FFCS operations, provided there is a proper structure and team behind them to plan, implement, manage and analyze their results (Terrien et al., 2016). In fact, experimentation is recommended by different relevant actors, and “local governments should trial or promote car sharing based on the success of current schemes” (NRMA, 2017, p. 4).

The **experimental and temporary approach** of these initiatives gives a chance for cities to understand how car sharing behaves locally, as well as to measure and evaluate its local impacts, without the pressure of definitive implementations. In particular, it allows an understanding of what happens to car use and parking after the deployment of these pilots (Strömberg et al., 2016). Furthermore, results from Terrien et al.’s (2016, p. 30) analysis of different FFCS deployments in Europe and in the USA indicate that “pilot projects are critical to driving change” because they “allow local governments and private companies to adapt regulation frameworks, improve service operations, and foster a culture of change across organizations” (Terrien et al., 2016, p. 30).

It is common to see cities organizing pilot projects for the deployment of FFCS. First, to understand the characteristics, and then to be able to regulate for it in a way that is compatible with the local usage, profile and impacts.

Examples of these cities, where pilots are in different stages of development, or already over, are:

- **San Francisco**
- **Portland**
- **Seattle** (recent with Lime, discontinued in 2019)
- **Chicago** (recent with Car2go, impacted by the operator’s decision to stop operating in the city from Dec/19 on)
- **Montreal**
- **Toronto** (trial with Communauto that started after Car2Go left and was recently approved)
- **Munich**
- **Grenoble** (Cité Lib by Ha:Mo - concluded)

See Appendix (1 and 2) for more information.

DATA SHARING AND TECHNOLOGY

It is widely recognized in literature and practice that data from different sources about how transport modes are used in a city are constantly needed, and that this information is strategic to **enable informed and appropriate decisions** in terms of planning, regulations, support and investments. This is especially the case for FFCS, as local planners need to understand how the vehicles are being used in the areas of their cities. FFCS operators can provide valuable information to local governments on the characteristics of the trips made with their vehicles, like origin, destination, distance and duration, as well as on the profile of the users (demographics) and their behavior or approach toward cars.

Moreover, acquiring and analyzing these data are crucial steps in the process of understanding the impacts FFCS generates in a city (Namazu et al., 2018; Schreier et al., 2015). However, getting access to strategic data can also be one of the most challenging parts of FFCS management, hindered by difficulties of dealing with sensitive information, about users (personal details) and providers (particularly those related to commercial issues and the usage of the vehicles), and their implications (Namazu et al., 2018; Schreier et al., 2015).

On one hand, it would be beneficial to have a standard or an ideal way to require data from providers about the new mobilities, particularly for the topic of this work - FFCS. However, this critical issue from the field of emerging transportation still requires significant exploration.

Data and technology limitations

Together with parking matters, data sharing is, usually, a controversial topic in negotiations related to FFCS. And, amid this complexity, cities tend to deal with issues of data in an ad-hoc or case by case basis.

Firnkorn and Muller (2015) proposed that the better model for FFCS is for “large car sharing-fleets parked in integrated vertical parking and charging facilities”. To Firnkorn and Muller (2011) the advantages of car sharing are both reducing emissions through requirements for electric vehicles, and through reduction in land consumption for parking. Cities generally lack the data and infrastructure for this model and rely on existing mechanisms instead.

Some research (e.g. Ciari et al 2015) proposes differential parking rates for FFCS, however this is relatively uncommon again largely due to a comparative lack of real-time or accurate parking data across cities: there is a lack of homogenous parking policy data in many cities. In the absence of these, FFCS schemes rely on other parking policies: low emissions zones, residential permits, electric vehicles parking. Where these parking situations are absent, FFCS can be limited. For example, London has a significant amount of private vehicles parked on-street, at low or little cost. The use of FFCS is limited where there is a lack of on-street parking management overall; or of policies supporting electric vehicles parking.

HIERARCHY OF ROAD SPACE ALLOCATION

Ampudia-Renuncio et al (2018) argue that “the positive impacts of FFCS on public transportation are not sufficiently clear, and policymakers’ role in ensuring privileged access by FFCS to on-street parking is a key issue for their future development”. Others emphasize the need to explain to the public why car-sharing should be granted privileged parking access, and the value gained by allocating public parking space. While some FFCS agreements are ad-hoc and some are more general, policy makers still need to make active policy decisions. However, “the challenge is that the evidence in the public domain regarding the impacts of FFCS is embryonic, rendering it difficult to make informed policy decisions”.

A clear hierarchy of road space allocation is needed to support car sharing including FFCS – in the absence of an articulated public good, the privileging or sale of public parking space risks being ad-hoc or privatised response to demands for codification (as argued by Marsden et al 2020). Parking is a critical and dominant function of public space, supporting driving. Marsden et al (2020) characterise two broad situations – one of unfettered chaos, and one with cars given priority. They list a **multitude of curbside stakeholders** in the exiting situation – with car share companies whose use comprises “exclusive access for pick up and drop off”, with a goal of “cheap parking”, to which “lobbying and some formal status in planning regulation” is pointed.

INTERACTION OF FFCS AND OTHER NEW MOBILITY MODES

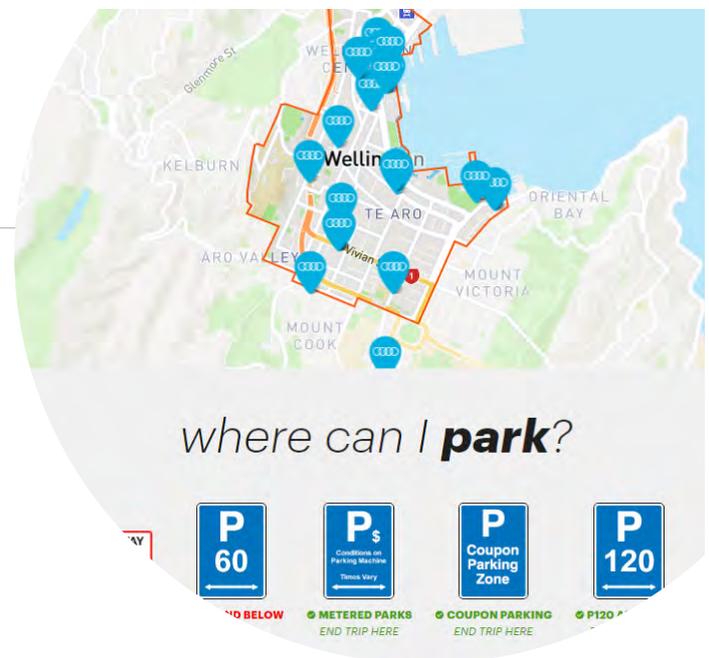
It is important to consider how other shared mobility modes are used in the cities and the interactions they may have with FFCS. Conversely, managing these interactions, to ensure they will be beneficial for cities, challenges the already complex role of local governments. Varying from case to case, they can interact differently with each other. In comparison with taxis or ride-hailing, modes that are more flexible and allow a certain freedom (everyone can use them, non-drivers and disabled, as long as they can afford the trips), FFCS may not be so convenient, because members are required to drive and look for parking at the end of the trip.

However, in comparison with SBCS, one conclusion from research is that, besides the potential, and identified competition between both types (Becker et al., 2018), FFCS can also help to consolidate car sharing as a transport mode in cities. This role is explained by the fact that even if or when FFCS brings negative impacts in terms of car use, it can help “advertise” car sharing as a mode, perhaps encouraging people to consider other options for transport that are not their own cars.

For instance, results from Becker et al.’s (2018) study suggest that:

“...a free-floating car-sharing scheme not only complements, but partially competes with existing station-based car-sharing schemes”... However, “despite a slightly weaker impact than for station-based car-sharing”, it can also “trigger a shift away from private vehicle ownership”, and “it seems to complement a public-transportation oriented lifestyle.” (Becker et al., 2018, p. 60).

“Governments need to develop a clear multi-use and multi-user framework for thinking about streets which ensures that regulatory recodification is properly thought through and allocates rights to maximise wider public goals” (Marsden et al 2020) .



Car sharing (and MaaS) relies on conventional infrastructure for private cars, like car parking spaces, and can itself encourage car use - ‘hell’ (Chase, 2014). Alternatively, car sharing can help to reduce car ownership, and potentially use, reducing sunk costs, and unbundling the ownership from the usage. With fewer sunk costs and less personal ownership (hybridisation), cars may be treated as more utilitarian or instrumental forms of transport. For example, the more efficient use of space and vehicles, and the reliance on data, allows for a demand rather than a supply-based approach to parking policy and potentially for the reduction of space allocated to car storage. Best case - ‘heaven’ (Chase, 2014) - predictions of the impacts of MaaS and autonomous cars tend to hinge on the idea that less car parking will be required.

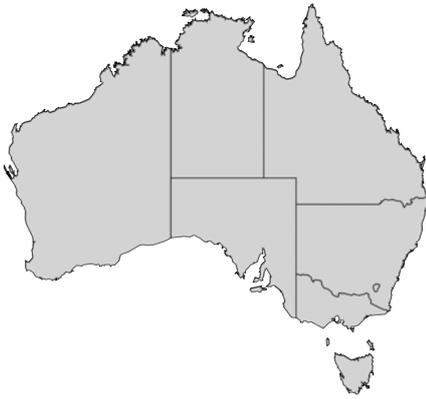
Marsden et al (2020) argue that “governments need to develop a clear multi-use and multi-user framework for thinking about streets which ensures that regulatory recodification is properly thought through and allocates rights to maximise wider public goals”. A recent Centre for London (2020) report considered the “value of alternative uses of kerb space”, beyond a tendency to prioritise private residential car parking, and recommended developing “kerbside strategies that allocate road and kerb space in accordance with clear use hierarchies”. FFCS and the parking policies that can be used to support or manage it are an example of the need for such policies. In the short term, technology and sharing platforms mean that existing car parks are already being used in new ways and putting pressure on existing ways of allocating space that tend to privilege private car ownership (Marsden et al 2020). MaaS and other technologies push up against existing approaches to car parking. Various authors urge that policy needs to clarify if and why a hierarchy of permits applies and on what basis.

Success factors of FFCS

According to Schiller et al. (2017, p. 3), “...in order to be successful, free-floating providers need to consider the following success factors:

- *Location: high population density to attract sufficient customers per car*
- *Pricing: based on time (mostly per minute), not distance*
- *Cooperation: local authorities have to grant parking spaces / permits*
- *Convenience: constant availability of (small) cars that fit needs in city areas”.*

CAR SHARING IN AUSTRALIA



The first car sharing operations in Australia emerged in the region of Sydney, in 2003, as an experiment that later became CarShare Australia, the organization responsible for launching GoGet, “Australia’s first national car sharing network” (GoGet, n.d.). The market started developing and expanding after that, with the emergence of more providers that now operate station-based (SBCS) and peer-to-peer (P2P) car sharing schemes in the main urban areas around the country. Examples of these providers are: Flexicar, RACV Car Share (shut down permanently), GreenShareCar, Popcar, Oyo Car Share, and CarNextDoor.



Australian car sharing operators (Mar/2020)

Source: websites of the providers

Car sharing uptake depends mostly on the urban form, cultural aspects, and the characteristics of the population, which explains why it has achieved different stages of development around Australia (Kent, 2018). The development of car sharing in Australia has an ad-hoc nature. Cities have enabled the system to operate in different ways, depending on the jurisdiction. Furthermore, operations are heavily reliant on fragmented local policies, in particular policies for the allocation and enforcement of parking, which are highly contested by local residents (Dowling and Kent, 2015a).

Station-based car sharing (SBCS) operations in Australia have already shown positive impacts on reducing car ownership and increasing the use of alternative transport (Jain et al., 2018; Philip Boyle & Associates, 2016; Phillip Boyle & Associates, 2016). The local impacts of car sharing still need further exploration in academic research, however, consultancy analyses and government reports represent an important part of the literature about car sharing in Australia (Cooper and Mifsud, 2016; Fishman, 2016; Philip Boyle & Associates, 2016; Phillip Boyle & Associates, 2016; SGS Economics and Planning Pty Ltd, 2012).

*“Car sharing emerged quietly onto the transport landscape in Australia, and has been accommodated and facilitated by local government parking policies. In this case, the tools for governing smart mobility already existed, and became adaptable to new imperatives”
(Dowling, 2018, p. 51).*

So far, most of the information and analyses have focused on the regions of Sydney and Melbourne, and the work developed by Kent and Dowling has a special focus on the regulation environment for car sharing in Sydney (Dowling and Kent, 2015b; Kent and Dowling, 2016, 2014). Sydney is often mentioned as a good example due its approach to car sharing and consequent policy, which has inspired the development of policies in other Australian cities.

The image on the right shows Oceanian trends for car sharing that consider the evolution of the market in Australia and New Zealand.



Oceanian Trends

Source: Shaheen et al. (2018, p. 4)

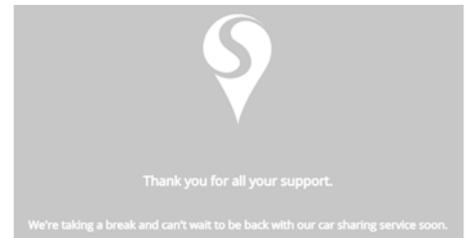
The need to tackle congestion with measures that make alternative transport more attractive is constantly emphasized by professionals involved with urban mobility. A report released recently by a local car sharing operator claims for more action from governments towards this goal (OpenCities and GoGet, 2019). This initiative from the operator, and a reaction to it (Malo, 2019), reinforce the role car sharing could have in the effort to improve transport systems and the relevance of including this mode in attempts aimed at achieving it (Malo, 2019).

FURTHER READING

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FFCS in Australia

To the knowledge of the authors, car sharing operations in Australia do not include FFCS services yet. Due to the instability of this field, this information applies to the moment when this report was being prepared and written (Oct/2019 to Apr/2020).



<https://smove.com.au/>

However, from what is publicly known, two companies have approached Australian cities (from 2018 to the present) in an attempt to launch their FFCS services. The first one was Car2Go (current ShareNow). The company started negotiating with relevant local stakeholders but left before officially starting operations. The second one was Smove, a Singapore based company that started operating in Sydney in mid-2019 and was planning to launch in Melbourne and in other Australian cities in the near future. Nevertheless, the company suddenly decided to put the operation on a “break” (Smove, n.d.), not only on Sydney, but in the country, and there are no previews for when or if the service will return to the city. These circumstances raise a significant need to understand the reasons behind the decisions to retrench from Australia and create an opportunity to gain insights on an actual FFCS operation in Australia.

Car2Go is currently working on implementing its services into the Australian market by mid-2019. Compared to the current market leaders, GoGet and Car Next Door, Car2Go allows users to take vehicles on one-way journeys without needing to return cars to their pick-up point. However, in order to execute this scheme correctly, the company will have to overcome widespread city parking permissions. According to CEO Thomas Beermann:

“In order for us to launch, it is essential that we get a parking regulation that covers the entire business area, the parking regulation needs to include access to all parking – paid parking, metered parking and also residential parking”

The initial vehicle offerings from Car2go will be internal-combustion-engined Mercedes-Benz vehicles, with plans to expand to EVs in the future. If successful, this scheme will be one giant step forward in changing the future infrastructure of Shared Mobility throughout Australia.

<https://movmi.net/shared-mobility-australia-new-zealand/>

“Introducing a new concept into the cities and States of Australia is a tough path, when this process cuts across multiple levels of Government, regulation and pre-conceived perceptions the challenge grows exponentially. This pathway is substantially different throughout the regions of Australia and requires some very interesting and challenging management to ensure that as many people as possible are kept happy and “on message” at all times. This is about managing the pathway and the flexibility needed on an ongoing basis to take different turns as needed, to be able to maintain a core strategy in an ever changing series of landscapes. How this has been done is an exploration of flexibility, durability and sheer determination”.

(Noyle, 2019 - <https://business.sydney.edu.au/events/research/2019/future-transport/car-sharing-australia-the-art-of-the-impossible>)

Australia is yet to see the arrival of a free-floating car-sharing venture, which allows vehicles to be picked up and dropped off anywhere, without the limitation of assigned parking spots located in potentially inconvenient places. The format is something Car2Go pioneered almost a decade ago, and now provides to 3.2 million users in 28 cities globally.

Sydney, Melbourne and Brisbane hold the most potential here according to Car2Go Europe CEO Thomas Beermann, whose team first explored the possibility of an Australian launch back in 2013. This time around there's greater engagement from state governments. The next hurdle is coordinating local municipalities.

<https://www.whichcar.com.au/news/worlds-leading-car-share-service-sizing-up-australian-market>

FFCS in Australia:

“No FFCS operations, but a policy...”

Brisbane City Council has recently released a type of permit to allow car sharing, or “short-term hire” operations in the city (not eligible to P2P, though) that enables the operation of FFCS, differently from what happens in Australia so far (Brisbane City Council, 2019). When released, these permits will be connected to the vehicles and will be “valid for use in any regulated parking permit scheme area” (Brisbane City Council, 2019). The geographic characteristics of Brisbane City Council suggest that an FFCS operation would be less challenging than in other Australian main cities to design and manage for the actors involved. The reason for this assumption is that the shape and size of the boundaries of the Council seem more suitable for a service area, and thus would reduce the need to negotiate with several LGAs to come up with a final arrangement. Nevertheless, this assumption needs to be validated with an actual trial or deployment of the service.



Car-Share Permits Information Guide

This information is to assist prospective car-share businesses to understand the assessment framework for Car-Share Permits in Brisbane. For full details regarding the Regulated Parking Permit Local Law 1906, or to find out about parking rules and regulations in Brisbane, please visit www.brisbane.qld.gov.au and search parking permits. A map displaying where regulated parking permit scheme areas (including traffic areas) in Brisbane is available here. For information about where to park refer to www.brisbane.qld.gov.au/where-to-park.

Brisbane City Council Regulated Parking Permit Scheme

Regulated parking permits are used to allow vehicles to park in regulated parking permit scheme areas contrary to area-wide or signed time limits, subject to specific conditions and eligibility requirements.

Council regulates parking in built up areas to protect neighbourhoods from becoming congested with commuter vehicles. It discourages the use of private vehicles and encourages the use of public and active transport, in high density areas. Regulated parking permits can help residents in regulated parking permit scheme areas to legally access kerbside parking near their homes without being subject to parking fees or the same parking time-limits as other motorists.

While a regulated parking permit scheme can improve opportunities to obtain parking, it does not guarantee parking availability.

Council recently introduced a new [digital parking permit system](#) that allows instant application and accommodates a wider range of parking permits. One of the new permit types is a car-share permit.

What are Car-Share Permits?

Council recognises that car-sharing is becoming increasingly popular, and car-share businesses are an important emerging industry that assists in reducing private vehicle use. The introduction of car-share permits will allow eligible car-share operators to provide their customers with greater access to on-street parking.

When will Car-Share Permits be available?

Car-Share Permits will be available from 1 August 2019.

Who is responsible for parking car-share vehicles legally?

Under Queensland law, the registered owner of a vehicle is responsible for making sure the vehicle is always parked legally. For example, car-share operators must ensure their customers do not park vehicles in locations that operate as clearways at different times of the day. If necessary, Council will take action to ensure the vehicle is removed. This may involve directing the car-share operator to remove the vehicle immediately, issuing a warning notice or infringement notice, authorising the towing of the vehicle, or a combination of these actions.

How much do Car-Share Permits cost?

The current car-share application fee as published in Council's Annual Plan and Budget 2019-20 is \$400 per registered vehicle for a permit that is valid for 12 months.

(Fees may change without notice. Please refer to Council's website for the up to date, published fees and charges.)

Refunds: Council will not refund a permit application fee, in full or in part, where the permit has been revoked or refused on the basis the permit holder has used a permit contrary to the conditions of use.

Obtained via a letter: Brisbane.

Predicting the impacts that FFCS services would have in Australian cities is still a difficult exercise. Evaluating local operations would make this task more feasible, but the current lack of official FFCS deployments in the local context pushes this task to future opportunities. In addition, there is not sufficient academic research on the topic yet, in general and in Australia, to help with these conclusions - particularly amidst recent and still ongoing transformations in the terrain of new mobilities and FFCS.

However, the experiences from other cities with FFCS operations, and the rapid Australian episode, can teach valuable lessons about common and mostly appointed issues related to the implementation of this type of car sharing. These issues may represent challenges that Australian local authorities would have to face when deciding if or how to support and deal with FFCS in the policy making process (Paganelli, 2019). Therefore, it is crucial that cities already start to consider them, or prepare to address them when needed, and this project seems like a favorable opportunity to explore and enable that.

RECOMMENDATIONS

Considering the role of local governments in a proper (beneficial to the city or region) implementation of new mobilities and in the creation of more sustainable urban environments, it is paramount to explore the relationship between FFCS and policies, or why governments need to deal with this transport mode (London Councils, 2020; Paganelli, 2019, 2013; Terrien et al., 2016).

Based on research and analyses of global deployments performed for this study, some recommendations for Australian cities to deal with possibly challenging local implementations of FFCS are:



INFORMATION

Knowledge about the concept of car sharing in general, especially how FFCS works, among policy makers and citizens.

LOCAL CHARACTERISTICS

Crucial understanding of local characteristics and potentials before regulating for FFCS, i.e. knowledge about the travel behaviour of local residents.

SPACE ALLOCATION

Definition of a service area for the FFCS operation taking into consideration that it is more likely that the vehicles will be used in-between LGAs in any deployment around Australia. Therefore, cross-council negotiation, collaboration and data sharing are paramount to define regulatory systems.

EXPERIMENTATION

Experiments and the development of pilots or trials to test how a local deployment of FFCS would be and understand its potential impacts.

CURB SPACE MANAGEMENT

Creation or adaptation of strategic parking and curbspace management systems, considering how parking spaces will be allocated for FFCS vehicles and what legal instruments are required for that: on or off-street, with or without permits, and, if there are permits, define their conditions and pricing schemes. A preliminary conclusion is that the better managed public parking is, the better FFCS risks are mitigated.

DATA SHARING

Development of a data sharing and evaluation system to measure the impacts of FFCS in the city and check if the results are achieving the goals, adjusting the implementation if these impacts are not positive for the city (urban sustainability).

LIMITATIONS OF THIS PROJECT AND REPORT

The elaboration of this project and report has experienced some limitations. As mentioned previously, this investigation is being developed during challenging times. Besides the recent and ongoing COVID-19 outbreak, the FFCS global market has been especially unstable and, in less than one year of this project, the scene has changed significantly. Some companies have entered the market, but, on the other hand, many have been shutting down abruptly, including some of the recent entrants. Similarly, the FFCS operations that were expected to happen in Australia did not eventuate and there are no current deployments in the country (to the knowledge of the authors), jeopardizing the initial intention to analyze them during the development of this project. These situations have impacted the scope of this investigation and required frequent adjustments in an attempt to keep pace with the changes.

Therefore, the purpose of this work became to characterize and understand how FFCS was deployed globally and to depict the profile of FFCS operations before the COVID-19 related crisis, creating content to be, subsequently, explored and shaped to an Australian context. This endeavor also aimed at counterbalancing the shortage of local FFCS developments to be analyzed by this project.

Finally, it is important to emphasize that this report is more suitable as a compendium of features, examples, and analyses of FFCS than as a source of information for the latest deployments of the market, because the information presented here may have changed between the finalization of this content and the publication of the results.



CONCLUSIONS

This report offers a collection of material about urban mobility, governance and car sharing (FFCS), focused on an Australian context, that may support government and industry in enabling best practice applications of car sharing in their jurisdictions.

As demonstrated here, FFCS works differently in cities around the world and success depends on a mix of characteristics, but the common challenge is to ensure it will be beneficial to these urban environments. For local governments, before implementing or creating support systems for FFCS to operate, it is crucial to understand the impacts of this mode in their cities, to assure that it will bring benefits instead of competing with existing public and active transport system. And that is why pilots and experiments are powerful tools. This process usually requires rethinking how urban space (kerb space) will be used, and the way parking will be allocated, procedure that makes local authorities, at least, consider the changes and discuss about how to implement them. And, in some ways, this exercise may trigger positive transformations in the planning and evaluation processes.



The findings presented in this report reinforce the value of initiatives like this project to build awareness, engage relevant actors, and provide an evidence base to help local governments and industry to create appropriate environments for FFCS in their cities, if that is the goal or if companies launch locally. The results may enable local planners to make more informed decisions about what role FFCS could realistically play in their urban environments and provide them with levers to define mechanisms for strategic FFCS deployments.

To conclude, recent global shutdowns and the continued volatility of FFCS operations help to illustrate the uncertainties over future demand for urban space and how best to manage it. Moreover, the current (Apr/2020) unpredicted COVID-19 crisis, followed by its devastating and forthcoming, but still unclear, consequences is exacerbating the complexity, pressure (especially over CSOs, local authorities and decision makers), and, perhaps, anxiety, that has permeated terrains like transport and urban planning in cities worldwide for several years.

It remains to be seen how the already vulnerable and uncertain future of car sharing, and transportation more generally will be after the prevailing changes. Yet, crises and societal shocks can enable positive change, and may instead offer opportunities to positively reinvent urban mobility.

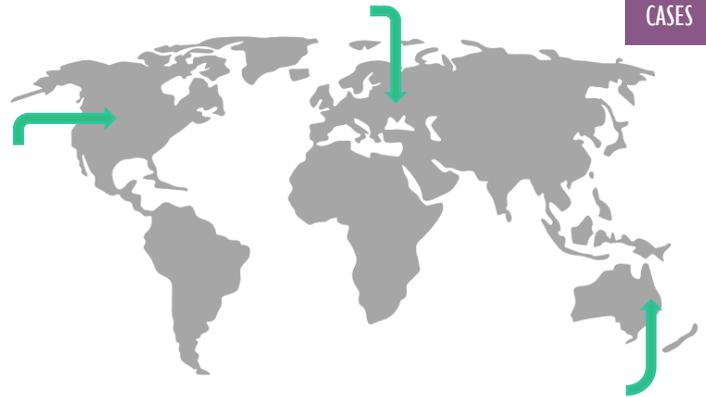
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Parking policies supporting examples of cities that have, or have had, free floating car sharing operators are summarised below.



Amsterdam issues citywide parking permits for electric car share vehicles. All FFCS vehicles are electric and may be parked at public charging stations.

In **Basel, Switzerland**, parking moved from free on-street parking toward pricing or to “making it exclusive for residents in the respective neighbourhoods” (Becker et al 2018). Into this context, FFCS operators have been issued permits with conditions relating to travel behaviour and impacts.

In **Berlin**, while any public parking spot may be used by FFCS vehicles, there are no special rights to it and the availability of parking on-street in many Berlin neighbourhoods is unlikely and, in some, “the possibilities of curb parking do not exist” (Muller et al 2017). This is in some contrast to most cities with FFCS: in which some more explicit privileges of access to parking is involved.

Brisbane’s new (2019) car share permit system affords similar privileges as to residential parking permits. While described as ‘digital permits’ the system does not collect information but rather means registration is linked to permits. The permits apply to 21 ‘parking control areas’ in Brisbane. Car share permits cost \$400 per vehicle per year (as compared to \$10 for residential permits) and are not available for peer-to-peer programs. A car-share permit applies to “any regulated parking permit scheme area”, where “parking restrictions indicate ‘resident permits excepted’” and allow “the vehicle to be parked for longer than the time limits indicated”. In Brisbane, most but not all metered (paid) public parking spaces do not have exemptions for residential permits or, by association, car share vehicles. Effectively the home zone of any FFCS scheme in Brisbane would be the 21 parking control areas, but with exclusions for the CBD and some key locations. The permit scheme exists, but, until the moment, no FFCS has taken them up in Brisbane. Permits (like residential permits) also generally do not extend to paid parking areas, only to timed and restricted parking areas.

In **Madrid**, Ampudia-Renuncio et al (2018) examine how FFCS operators rely on free parking for electric vehicles within the orbital ring road of the city (Ampudia-Renuncio et al, 2018). Sprei et al (2019) note for Amsterdam and Madrid, “free parking for BEV have been a major reason for operators to have a BEV only fleet.”

In **Milan**, regulations in 2013 allowed car sharing vehicles to park for free in central restricted traffic zones, and also to park in spaces restricted to residents. FFCS vehicles thus attach to two existing parking policies: low emission central zones, and residential parking exemptions. Milan operates a “requests for proposal” system, requiring “shared mobility companies to operate in the city as well as incentivize operational models that best serve the public interest” (Shared Use Mobility Centre 2018). Milan offers free parking in the Low Emission Zone and permits for other restricted parking areas. A per-vehicle fee (around \$1,200 per year) is charged, with discounts for electric vehicles and for vehicles operating in more than 15 municipalities. The Low Emission Zone applies congestion charges for all vehicles and incentivizes access for low or no emissions vehicles including electric FFCS.

Montreal previously had an electric-only policy for downtown areas: however, with limited take-up of electric vehicles, this eliminated 95% of car share vehicles in the city. FFCS companies now purchase residential-style parking permits (\$1,300 per year) that allows parking in 10 of 19 city boroughs.

Similarly, in **Turin** FFCS vehicles have free parking in central restricted traffic zones. The Turin policy is focused on air pollution control – car sharing vehicles have to be low-emission or electric, and to supply public access to electric charging stations. The full service area covers 40 square kilometres and FFCS operators in addition have free access to paid parking zones and to high occupancy vehicle lanes in Turin. Rome also allowed free parking in the central low emissions area.

In **Toronto**, parking restrictions on FFCS were considered “intolerable” – the conditions excluded permits in residential areas with high demand (over 95% capacity or with waiting lists). The Toronto permit fee was \$1,500 – considered high (although it isn’t that much higher than other cities. “The pilot (project) passed by city council is so restrictive, costly and unwieldy it seems purpose-built to make free-float car share for Torontonians impossible,” Paul DeLong, CEO of Car2Go North America, said in a statement.” They also stated that residential-style permits were critical to the success of FFCS: “The company said its membership increased by 51 per cent when it made vehicles more accessible in 2016 with an on-street parking option, which it uses in every other city where it operates.”

In **Vancouver** the granting of “golden ticket” equivalents to residential parking permits which can be used across the city is a major motivator and marketing point (Vancity 2018).

In Singapore (‘Blue’) and Los Angeles FFCS (previously ‘Blue’, now ‘Blink Charging Company’) schemes are based on electric vehicle charging spaces (on-street). The spaces are free flow but are reserved in advance. Vancouver’s FFCS permits are apparently supported by parking limitations and by the absence of ride-hailing services in the city until late-2019. Vancouver issues permits described as “super permits” or “golden tickets” to FFCS operators which effectively grant the right to park across the city – these are the equivalent of residential parking permits, but are not limited by area (Hermiston, 2017). Vancouver does not allow FFCS at metered spaces, due to concerns with low turnover in retail areas.

Washington D.C.'s FFCS operators also have a 'home area' within which cars may be parked for free at any public non-metered parking spot, as well as dedicated car sharing spots. This includes residential, metered, and non-metered area but not areas with time limits. These permits are advertised as "the ultimate parking freedom": "the most coveted parking permit in the nation's capital". Washington D.C.'s permits are negotiated with multiple operators, paying between \$300-\$3,000 per car per year but this varies based on the operator and the amount of time cars are likely to be parked on street. Operators with mostly off-street spaces pay less, and fully on-street operators pay more.

Ulm in Germany was studied by Firnkorn & Muller (2011, 2015) as an early model of free flow car sharing. The researchers proposed that the better model is for "large carsharing-fleets parked in integrated vertical parking and charging facilities". To Firnkorn & Muller (2011) the advantages of car sharing are both reducing emissions through requirements for electric vehicles, and through reduction in land consumption for parking. In practice in Ulm the scheme lacked data or special infrastructure, and instead used free parking in a defined central zone.

In **Austin**, Texas FFCS vehicles were initially only available to City of Austin employees – this was in exchange for free on-street parking at any metered space in the central operating area. Designated on-street spaces were also included.

In **San Diego**, FFCS relies on electric vehicles having access to any on-street parking space or to electric charging stations (1,500 spaces). (Kortum 2012).

FFCS generally required agreements with governments over access to on-street public parking space – either ad-hoc or more generally applicable, as in Washington D.C. The alternative (or complement) to on-street parking privileges are off-street parking mobility 'hubs' for FFCS vehicles. For example, German operator Flinkster, owned by the national rail Company, allows cars to be parked at train stations and other 'hubs'. This is partly a reflection of the car parking law in Germany which, until 2018, under federal law prevented the reservation ('exceptionalism') of street space for special users.

Summary table: Example cities with (or which had) free floating car sharing: supporting parking context and policies

City	Free Flow Car Sharing: Parking Context and Policies	Studies
Amsterdam	Operators need to be electric in order to qualify for parking permits. Vehicles may park at any public charging station.	Shared-Use Mobility Center (2018); Sprei et al (2019)
Austin, Texas	Designated car share parking as well as with free on-street parking at any meter in the 32 square mile operating area	Kortum (2012)
Basel, Switzerland	FFCS in defined inner areas, 'mobility go zones'. Afforded similar permits to residential parking permits – allowed free parking in paid or timed parking areas.	Becker et al 2018
Berlin	"Parking lots within the cooperating area": refers to public on-street parking. No special privileges, so availability of parking in some areas is an issue as are parking violations.	Muller et al (2017)
Brisbane	Recent (2019) parking changes introduced: digital car share permits. Car-share permits extend to any locations with residential permit exemptions, in parking control areas Similar privileges and exemptions from time limits as to residential permits. Mainly in timed, not metered, streets. Excludes some key CBD locations.	
Brussels	Digital permits for electric vehicles. Free parking in any public parking space in the home zone. The regional government sets parking limits for municipalities – 'super permits for FFCS'.	Shared-Use Mobility Center, 2018.
Chicago, USA	The cars had a 'home zone': the design of which was apparently "heavily gerrymandered" to avoid competing with residential parking.	
Hamburg, Germany	Arrangements with multiple local governments to allow free legal street parking for FFCS. FFCS vehicles can park in mobility hubs: 'Switchh'.	Shared-Use Mobility Centre 2018
Los Angeles, USA	Vehicles are electric and parking is based on electric vehicles in the home zone. The scheme has discount rates for lower income groups.	
Madrid, Spain	Free parking for electric vehicles in regulated streets inside the orbital motorway. FFCS relies on free car parking for all electric vehicles. Vehicles have to be dropped in publicly accessible areas.	Ampudia-Renuncio, M., Guirao, B., & Molina-Sanchez, R. (2018).
Milan, Italy	FFCS agreements allow free parking in the low emissions zone, and access to residential-style parking permits for other areas. A fee is charged per vehicle, reduced for electric vehicles.	Carrese et al (2020); Shared Use Mobility Centre (2018)
Montreal, Canada	FFCS cars can be parked in 10 of 19 boroughs. Previously electric only: but 95% not electric. Around \$1,300 per car per year for residential-style parking permits for each car: allows parking in any legal or residential area.	
San Diego, USA	Electric vehicles can park at any on-street space or at electric vehicle charging stations.	Kortum (2012)
Singapore	Based on 'blue' on-street and (more so) off-street electric parking / charging stations.	Barter (2019)
Ulm, Germany	Free parking in defined zone.	Firnborn & Muller (2011, 2015)
Turin, Italy	FFCS have free parking in central restricted zones, with an air pollution focus – vehicles are low-emission or electric.	Carrese et al (2020) Cecato & Diana (2018)
Toronto, Canada	Residential-style parking permits, but with more limits (considered difficult). Key to uptake but excluded parking in residential areas with a lot of residential demand.	
Vancouver, Canada	FFCS allowed at resident permit spaces – described as "golden tickets". Not at metered spaces - concerns about low turnover in retail areas.	
Washington, D.C.	Free parking in the 'Home Area' – "leave it in any public, non-metered street parking space or dedicated car-sharing only spots". Advertised as "The ultimate Parking Freedom". Can be parked in metered, residential, and non-metered areas. All must be 'unrestricted' as in, no time limits. Deals are considered 'pre-paid' parking – the permits are called 'zone 9 permits' and are negotiated for each operator based on the likely amount of time parked on-street.	
Wellington, NZ	Pilot of electric hybrid vehicles have free parking within 'home zone' (CBD) in council car parks, as well as at docked electric charging stations.	
Westminster	Digital permits via tender contracts, allowed parking in the 'zip zone'. Parking in public areas with residential permit exemptions or in paid parking bays. Not allowed in resident only bays. Unusual because FFCS operators pulled out of London due to difficulty negotiating with all 23 boroughs.	

data collected between Jan-Apr/2020

Global providers – organized by the names of operators (A-Z) – data collected between Jan-Apr/2020				
LEGEND	Hybrid services	Inter-area trips allowed (between cities, states, and/or service areas)	Offers micromobility services	Public CS
Global FFCS operator(s)	Countries (cities)	Observations (mainly service area and parking conditions) and/or especial characteristics of the service	Dates and places where the services were suspended or shut down + reason	Link(s)
Blue Carsharing	Singapore (BlueSG), USA (Los Angeles – BlueLA and Indianapolis – BlueIndy), Italy (Turin – BlueTorino), England (London – BlueCity), France (Bordeaux – Blueclub and Lyon – Bluey)	Electric FFCS services offered by the Bolloré Group in different cities globally. Vehicles can be picked up from and returned at any “Blue” charging station spread around the city. Members can reserve vehicles and parking spaces in the charging stations to guarantee a spot for the vehicle return – conditions vary according to each location (advantages of the service). BlueLA works in partnership with LADOT (City of Los Angeles Department of Transportation) and targets low-income households. BlueSG works in partnership with the Land Transport Authority of Singapore (LTA).	2020 - Service currently suspended due to the COVID-19 crisis in LA, Turin, Bordeaux and Lyon. Service permanently shut down in London (since Feb 10, 2020) and in Indianapolis (from May 21, 2020)	https://www.bluesg.com.sg/ https://www.blueia.com/ https://www.blue-indy.com/ https://www.bluetorino.eu/ https://www.blue-city.co.uk/ https://www.blueclub.eu/en https://www.bluely.eu/en
Communauto - Flex	Canada (Montreal, Québec, Halifax - Carshare Atlantic, Toronto - pilot, Edmonton - POGO, Calgary? - post Car2go) and in France (Paris)	Hybrid services – SBCS and FFCS flex – One-Way (“from point A to B”). Operational and regulatory issues vary from city to city, but, in general, FFCS vehicles can be picked up and returned within the “Communauto FLEX Zone” and must be parked according to the local rules.		https://www.communauto.com/
Carshare Atlantic - Communauto	Canada (Halifax)	Hybrid services – SBCS and FFCS flex – One-Way (“from point A to B”). FFCS vehicles can be picked up and returned within the “FLEX Zone”. Vehicles must be parked in permitted public spaces, according to the local rules, in designated areas, like waterfront lots, or in “FLEX drop-off points”.		https://www.carshareatlantic.ca/
Communauto POGO (former Pogo Carshare)	Canada (Edmonton)	Hybrid services – SBCS and FFCS Flex – One-Way (“from point A to B”). FFCS vehicles can be picked up and returned within the “Communauto FLEX Zone” and must be parked according to the local rules. Parking fees in permitted spaces within the service area are included in the booking fee, for both operational systems, SBCS and FFCS.		https://pogocarshare.com/
Free2Move – FFCS	USA (Washington D.C.), France (Paris), Spain (Madrid), Portugal (Lisbon), China (Wuhan - Yiweixiang), and, in Germany (Frankfurt).	Platform to provide CS services in one App. Specific FFCS services in some places. Operational and regulatory issues vary from city to city, as shown below.		https://us.free2move.com/
Free2Move Paris	France (Paris and the inner suburb of Issy-les-Moulineaux)	Users can park for free in authorized public on-street spaces and designated electric vehicle stations indicated in the Free2Move Paris App (former Autolib infrastructure). Trips must be started and completed within the service area.	2020 – Service temporarily suspended due to COVID-19	https://www.free2move.paris/
Free2Move Frankfurt	Germany (Frankfurt)	Vehicles can be used within the home area. Users can park the vehicles in any of the designated Free2Move parking spaces available in the city, in parking spots at Am Gericht, in Rüsselsheim and in the carsharing parking spots at Frankfurt Airport.		https://carsharing.free2move.com/frankfurt/homepage-en/
Free2Move Carsharing	USA (Washington DC)	Vehicles can be pick up and must be returned “in any meter or residential zone parking spot” within the home area. Users can park the vehicles for free while using the service, always following the local parking rules.		https://www.free2move-carsharing.com/
GreenMobility	Operating: Denmark (Copenhagen Aarhus), Norway (Oslo), Planned: Sweden (Gothenburg and Malmo - Feb/2020?), Belgium (Antwerp spring/2020?), Austria (Vienna 2020?), Ireland (Dublin??)	Copenhagen: Vehicles can be parked in public spots within the service area or in “GreenMobility Hotspots” (outside of the service area) upon the payment of a to finish the trip. “Smaller operation zones = Satellite Zones”. Vehicle “delivery” available upon booking, within the service area. Oslo: Vehicles can be parked in public spots within the service area or in “GreenMobility Hotspots”. Service delivered in cooperation with VY (Nordic transport provider).		http://greenmobility.com/dk/en
ShareNow (Car2Go + DriveNow)	Austria (Vienna) Denmark (Copenhagen), France (Paris 100% EV) Germany (Berlin, Hamburg, Munich, Frankfurt, Cologne, Dusseldorf, Stuttgart), Hungary (Budapest - 2019) Italy (Rome, Milan, Turin) Netherlands (Amsterdam - 100% EV) Spain (Madrid - 100% EV),	Operational and regulatory issues vary from city to city, but, in general, vehicles can be picked up and returned within the “home area” or in drop-off zones (upon payment of a fee). Some cities have these “Drop off zones”, which are part of the Home Area but are usually located outside the city – marked as “Zone A” or “Zone B” on the Home Area maps”. The drop off fee does not apply if the trips starts and ends within the same drop off zone. Some airports are included in the areas. Vehicle delivery services are available in some places. Cars “can park for free on any legal public street parking space within the Home Areas” – result of collaboration with local governments. Parking rules in each city: https://www.share-now.com/at/en/faq/parking/#where-can-i-park .	2019 - 2020 – permanently shut down in North America and some European cities - Finland (Feb/29/2020), Portugal (Lisbon), Sweden, Belgium, UK, U.S., and China. 2019 - European cities, Florence, London and Brussels; Canada (Vancouver, Calgary, Toronto, Montreal).	https://www.share-now.com/
Zipcar FLEX	England (London), and Belgium (Brussels)	Hybrid services – SBCS and FFCS (flex trips: one-way – blue vehicles on the map). Operational and regulatory issues vary from city to city, but, in general, Flex Trips must be ended within the “Zipzone” and vehicles must be parked in accordance with the different rules, specific to the borough where they are parked (Flex Parking): https://support.zipcar.co.uk/hc/en-gb/articles/115008239708-Approved-Flex-Parking . “Super permit” for FFCS in Brussels. Flex cars can only be found via the app.	2019 – Brussels (acquired by Poppy).	https://www.zipcar.com/en-gb/flex www.zipcar.be

Regional providers – organized by country (A-Z) – data collected between Jan-Apr/2020				
LEGEND	Hybrid services	Inter-area trips allowed (between cities, states, and/or service areas)	Offers micromobility services	Public CS
Regional FFCS operator(s)	Countries (cities)	Observations (mainly service area and parking conditions) and/or especial characteristics of the service	Dates and places where the services were suspended or shut down + reason	Link(s)
Smove	Australia (Sydney)	Very short operation period...	2019 - Sydney (on a break)	https://smove.com.au/
Vezuha	Belarus (Minsk)			https://vezuha.club/
Anytime	Belarus (Minsk)			https://any-time.by/
Poppy	Belgium (Antwerp or Brussels)	Started as a pilot, now it's official. Vehicles can be used within the 'homezones' of Antwerp or Brussels and parked anywhere in these zones. Offers connection service between Brussels airport ("Car Sharing Zone" in Parking P1 - Fast Zone) and Brussels or Antwerp. Offers cars, motorcycles and scooters sharing.		https://poppy.be/
Partago CVBA	Belgium (Flanders)	FFAB services - Cities from the region have designated service areas with different sizes, called "neighborhoods". The vehicles belong to these areas, instead of pods. Vehicles can be picked up and returned (at charging stations or on-street spots, if the car is at least 70% charged) within their specific service areas - the "neighborhoods". The app shows the exact location of the vehicles.		https://www.partago.be/
Beepbeep	Brazil (São Paulo and São José dos Campos)	In São Paulo: FFSB - cars can be parked in different "Beepbeep stations" around the city, normally in private spaces. In São José dos Campos: there is a service area, cars can be parked inside it or in "Beepbeep stations"		https://www.beepbeep.com.br/home
Urbano Carsharing	Brazil (São Paulo)	Intercity trips are allowed. Vehicles could be used within the 'Home Zones'. Had 35 designated "Home Zones" in the city.	2020? - Became Ucoop.app	https://www.urbano.eco.br https://www.ucoop.app/
Evo	Canada (Vancouver)	Vehicles can be picked up and returned in any approved parking space within the 'Home Zone'. Users can park for free in any on-street "Evo designated, residential or permit only spots (as well as all non-time restricted meter spots, excluding some areas) within the Home Zone" and should follow local parking rules. "Members can park on street in 2-hour zones, but other time-restricted areas are not permitted"; and they have "unrestricted parking in residential exempt and permit parking".		https://www.evo.ca/
Awto	Chile (Santiago and region, Viña del Mar / Valparaíso and Concepción)	Hybrid services - SBCS and FFSB - vehicles should be returned in any specific parking spots/stations of the network, which must be reserved in advance. Vehicles can be left in other locations (more convenient than the Awto designated spots) if needed "for an additional surcharge", except in "parking meter areas, yellow sidewalk, or places where parking is not allowed", but users must call the Call Center to finish the trip. Vehicles delivery services available upon booking and extra payment. Intercity trips are only allowed between Santiago and Viña del Mar / Valparaíso upon parking reservation and a surcharge payment when the destination is Santiago.		https://awto.cl/
Spincity	Croatia (Zagreb)	Vehicles can be picked up and returned within the "Spin City Zone".		http://www.spincity.hr
Autonapůl	Czech Republic (Brno, Prague, and other cities country-wide)	FFAB - Vehicles have to return to the "designated parking area" of origin. Members can also use cars from/in different cities of the network.		https://www.autonapul.cz/en/
Ajo	Czech Republic (Prague and Brno)	Prague: Vehicles can be used within the coverage areas. FFAB - Vehicles have to be returned to the same "handover area" from where they were picked up. Vehicles can be parked for free in blue and purple zones from some of the service areas of Prague (1 to 8). Parking in blue and purple zones from other parts of the city, done while the booking is in course, incurs in fees that must be paid by the users. Brno: Vehicles that belong to the "handover areas" located in the central part of the city (Brno center, Brno historical and Šumavská - Kotlářská) can access and park (as residents) at the historical center of Brno. Users can pick up and return vehicles in designated carsharing zones in Prague and most of Brno.		https://www.ajo.cz/
CAR4WAY	Czech Republic (Prague and Brno)	Free parking for CAR4WAY vehicles in blue and purple zones, and free charging for the EVs. Partnership with Regiojet, a national railway operator: vehicles can be used between regional Regiojet rail stations and "designated carsharing zones" in Prague and most of Brno - vehicles should be parked in in blue and purple zones.		https://www.car4way.cz/web/tj/en https://www.car4way.cz/carsharing
Re.volt	Czech Republic (Prague)	Vehicles can be picked up and returned within the "re.volt zone". Vehicles can be parked within the "car sharing zone" or at car sharing points - charging stations spread around the service area. Offers cars, motorbikes and scooter sharing.		https://revolt.city/
Anytime Carsharing	Czech Republic (Prague)	Vehicles can be used in the "Permitted Area (territory of the Czech Republic)" and can be parked in public permitted spaces (blue and purple zones) within the service area for free.		
Gonow!	Finland (Helsinki, Tampere, Lahti & Oulu)	Operational and regulatory issues vary from city to city, but, in general, vehicles can be parked during and at the end of the booking in public permitted or reserved spaces (spaces shown in app) within the service areas. Intercity trips are allowed upon booking.		https://www.gonow.fi/en/
Yea! - Citiz	France (Bordeaux, Grenoble, Lyon, Rennes, Strasbourg et Toulouse).	Citiz FFCS service. Citiz members can use Yea! vehicles	2020 - Temporarily shut down due to COVID-19	https://yea.citiz.coop/
Moov'in.Paris	France (Paris)	Became Ada.Paris - future ZITY?		https://www.moovin.paris/index.php?lang=en
Cité Lib by Ha:Mo	France (Grenoble)	FFSB 3-year trial from Sep/2014.	2017 - Trial ended	https://blog.toyota.eu/green/cite-lib-by-hamo/
Autolib	France	Electric FFSB services that were offered by the Bolloré Group in Paris.	2018 - Shut down permanently	https://www.autolib.eu/le-service-autolib-est-

	(Paris)	Vehicles could be picked up from and returned at any "Blue" charging station spread around the city.		definitivement-ferme-depuis-le-31-juliet-2018
Iodines	France (Toulouse)	3 different service areas: "Green zone, Zone 1 (red), and Zone 2 (gray)" for flexible return of the vehicles – Green zone, upon extra payment in more distant areas – Zones 1 and 2. Valet services available to deliver and/or pick up vehicles upon request and payment.		https://www.iodines.fr/
Oply	Germany (Berlin, Hamburg and Munich)	FFAB - Vehicles need to "get home" and be returned to the same "neighborhoods" where they were picked up from.	2020 – Shut down permanently	https://www.oply.com/?lang=en
MILES Mobility GmbH	Germany (Berlin, Hamburg, Cologne / Düsseldorf, and Munich)	Serviced is charged by the distance traveled, not by the time of use: #milesnotminutes, in which users don't pay more for congested conditions - "time pressure-free approach". Users can finish the trips anywhere within the service area – no stations. Parking is not allowed in Hamburg's Switchh stations.		https://miles-mobility.com/en/
MultiCity car-sharing	Germany (Berlin)		2017 – Shut down permanently	https://europe.autonews.com/article/20171120/COPY/311209992/p-sa-closes-fairing-berlin-car-sharing
Weshare	Germany (Berlin), Planned to expand in 2020 to Hamburg, Prague, Paris Madrid, Budapest, Munich, and Milan.	Vehicles can be picked up and must be returned in any permitted parking space within the operating area.		https://www.weshare.io/en/#price
Yourcar	Germany (Göttingen, Rostock and Stralsund)	Hybrid services: FFCS [FREE] and SBCS [STATION]. YourCar [FREE] vehicles can be picked up and must be returned "within the 'defined core areas/business areas but are not tied to fixed parking spaces". Vehicles can be parked in any public permitted parking spaces (including residential), which are free within the "YourCar [FREE] core areas" of the cities. "CityFlitzer is the station-flexible offer from Book-n-drive". Vehicles can be picked up and returned in permitted parking spaces within the different CityFlitzer areas. Leipzig: Vehicles can be parked in available public parking spaces within the "business area".		https://yourcar-carsharing.de/
Cityflitzer/Book-n-drive	Germany (Leipzig, Frankfurt + Rhine - Main area)	Frankfurt + Rhine area (via Book-n-drive): 2 different service areas, with special parking stations, the "Green cityFlitzer areas" that include inner city districts, where the return of the vehicles is flexible and free, and the "Smaller cityFlitzer areas", that connect "outer districts to the cityFlitzer network", where return parking is charged and values vary according to the distance from the green cityFlitzer areas. Intercity trips are allowed - cars can be moved between "Green cityFlitzer areas" located in the cities of the region.		https://www.cityflitzer.de/ https://www.book-n-drive.de/go/cityflitzer/ https://www.book-n-drive.de/go/frankfurt/ https://www.book-n-drive.de/en/gute-gruende/
Mol Limo	Hungary (Budapest)	Vehicles can be picked up and returned within the "Limo zone".		https://www.mollimo.hu/hu
GreenGo	Hungary (Budapest) and Czech Republic (Prague?)	PPP with BKK Budapest Transport Centre to manage the system? Vehicles can be picked up and returned within the service area.		https://greengo.com/hu/?lang=EN / https://greengo.com/cz/?lang=EN
Hayr Carshare	India (Tricity - Chandigarh, Panchkula and Mohali)	Vehicles can be picked up and returned within the "Designated/Valid Parking Areas as shown in the Mobile Application". Vehicles can be parked for free in designated slots spread around the cities. Vehicles can be used in between cities, as long as Hayr service is offered in the city. Vehicle delivery available upon extra payment.		https://hayr.in/
Autotel	Israel (Tel Aviv)	Hybrid? FFCS program supported and launched by the local government.		https://www.autotel.co.il/en/
CAR2GO	Israel (Haifa / Netanya)	Hybrid services = SBCS + FFSB + FFCS + P2P.		https://www.car2go.co.il/en/
Enjoy	Italy (Florence, Milan, Rome, Turin, Bologna)	Vehicles can park in public spaces or "Enjoy reserved spaces" within the service area. Vehicles can access ZTLs ("Zona Traffico Limitato" – Limited Traffic Zones) in the cities without extra payment.		https://enjoy.eni.com/it
Corrente	Italy (Bologna and Ferrara)	Vehicles can be picked up and returned within the service area. Vehicles can be parked in permitted public spaces within the service area. Vehicles can access and park in ZTLs ("Zona Traffico Limitato" – Limited Traffic Zones) in the cities without extra payment, with exceptions indicated on the map. Hybrid services and FFSB.	2020 – Temporarily shut down due to COVID-19	https://corrente.app/
Eppy	Italy (Latina - Lazio - close to Rome)	Vehicles can be picked up and returned within the service area, or "blue perimeter". Vehicles can access ZTLs ("Zona Traffico Limitato" – Limited Traffic Zones) in the city without extra payment.		https://eppynewdrive.it/vehicle-sharing/ https://carsharing.ubiect.com/CarSharing/site/eppy
Carsharing Arezzo	Italy (Arezzo)	Public CSO.		https://carsharing.targatelematics.com/CarSharing/site/arezzo
Move ECOsharing	Italy (Sardegna – Sassari and the north region)	Hybrid services. The FFCS service allows vehicles to be picked up and returned within the service area. Vehicles can be parked in "Move" permitted spaces.		https://app.direntsardinia.com/
4Usmobile	Italy (Basso Salento - region of Puglia)	Regional car sharing: service area that covers different urban areas – "urban and extra-urban areas". Electric vehicles can be picked up and returned within the cities of the delimited area.		https://4usmobile.it/4usmobile/
AmiGO Car e Bike Sharing by AMAT	Italy (Sicily –Palermo and other cities)	Public CSO Hybrid services in Sicily. FFCS in Palermo. The FFCS service allows vehicles to be picked up and returned within the service area indicated in the app. Vehicles can be parked in any "suitable parking space" within the service area. Offers bike sharing services too.		https://www.amigosharing.it/site/amigo.php
E-Vai	Italy (Lombardy)	FFSB service with electric vehicles and charging stations ("E-Vai Points") spread on a regional scale, located in strategic locations (E-Vai Easy Station, located next to railway stations) and integrated with the railway service/main airports in Lombardy. Allows intercity trips: Members can move vehicles in between cities of the region, as long as they are picked up and returned at any charging stations/hubs, or "E-Vai Points".		https://www.2e-vai.com/en

Share'n go	Italy (Milan, Modena, Firenze, Roma – shut down)	Vehicles can enter ZTLs ("Zona Traffico Limitato" – Limited Traffic Zones) in the cities without extra payment and can park in blue and yellow lines. E-Vai Public – car sharing vehicles available to municipal authorities during working hours and to other members during remaining hours. Pick-up and delivery of vehicles at the 'Sharengo Points'. Vehicles can access ZTLs ("Zona Traffico Limitato" – Limited Traffic Zones) in the cities without extra payment. Shut down due to vandalism and financial difficulties.	2020 – shut down in Milan. Previously shut down in Modena, Firenze, Roma	http://www.sharengo.it/
Playcar Car Sharing	Italy (Sardegna / Cagliari)	Hybrid services. The FFCS service allows vehicles to be picked up and returned within the service area indicated in the app. Vehicles can access central/historic areas and can be parked for free in permitted public spaces. Offers cars, motorbikes, scooters and bike sharing.		https://www.playcar.net/
Ha:Mo	Japan (Toyota City, Tokyo and Okinawa)	First-and-last-mile "mobility sharing system" with compact vehicles.		http://www.toyota-global.com/innovation/intelligent_transport_systems/hamo/index.html
Times CAR SHARE x Ha:mo	Japan (Tokyo)	Toyota's Ha-Mo		https://share.timescar.jp/teph/
Anytime	Kazakhstan (Almaty)	Vehicles can be picked up and returned within the service area. Users can park for free in permitted public spaces within the service area. Vehicles can be picked up and returned in permitted parking spaces within the "CityBee parking zone". Parking must follow local rules.		https://anytime.kz/
CityBee	Lithuania, Latvia, Estonia, and Poland	Intercity trips are allowed with some vehicles – returning them in another zone. Parking is free in some cities or in some specific CityBee zones. Offers car, bike and scooter sharing services.		https://www.citybee.lt/en https://www.citybee.lv/en
Socar	Malaysia (FF available in Penang) and South Korea	A "Free-floating Zone" is available in Penang, where specific vehicles (identified in the app and physically) can be picked up and "anywhere within the Majlis Bandaraya Pulau Pinang (MBPP) parking spots". One-way trips (between the "Zone" and airports - KLIA/KLIA2 and intercity - to/from KL/JB/Penang) are available upon extra payment in some cases. Vehicles can be delivered upon extra payment.		https://socar.my
Gocar Mobility	Malaysia	Hybrid services - SBOne-Way = "GoCar Hub". Allows interstate and intercity one-way trips in between "hubs" (PU + DO hubs).		https://hi.gocar.my/services/one-way-trip/
GoTo Malta	Malta	Hybrid services, with FFCS in between pods/parking stations around the island / able to park in a designated GoTo spot – incentivized by the lack of parking spaces in the island.		https://www.goto.com.mt/
Mobee	Monaco	New service to launch in May/2020... Free parking around the service area. Vehicles must be parked in "Mobee parking zones" in partner parking lots and distribution points. Offers members a rechargeable "prepaid card" scheme in addition to the IT platform. Vehicles available for tourists.	(On a break)	http://www.mobee.mc/
Witkar	Norway (Rotterdam, Edam-Volendam, and Groningen)	Hybrid services – SBSCS + FFCS. Users can park within the "Witkar zone" "Witkar zones" include KAV Car Rental and IKEA locations New "Witkar zones" soon Users will be able to take cars from one city to another, as long as they park inside a "Witkar zone".		https://www.witkar.nl/wat-is-een-witkar-zone-en-wat-is-free-floating/
Share'n go	Netherlands (Rotterdam, planned: The Hague, Amsterdam, and Utrecht)	Vehicles can be picked up and returned within the "coverage area".		https://site.sharengo.nl/
Mevo	New Zealand (Wellington and Auckland – planned)	"Mevo trips" - FFCS vehicles can be picked up and returned within the "Home Zone" that includes the airport. Users can end the trip parking in "dedicated and/or approved parking spaces" within the zone.	2020 - service currently suspended due to the COVID-19 crisis, "except for essential services personnel"	https://mevo.co.nz/
Panek	Poland (Warsaw and many other cities around the country)	Vehicles can be picked up and returned within the "PANEK CarSharing zone", in "urban paid parking areas or special car parks – with signs". Parking should follow traffic regulations.		https://www.panekcs.pl/
Innogy go!	Poland (Warsaw)	Vehicles can be picked up and returned within the "Innogy go! Zone". Parking is included in paid and free parking zones while using the service and should follow traffic regulations. Electric FFCS vehicles can use bus lanes (Act of 11 January 2018 on electromobility and alternative fuels).	2020 – Temporarily in "maintenance"	https://innogygo.pl/pl
Tauron	Poland (Katowice)	Vehicles can be picked up and returned in any publicly available and permitted parking place within the designated zone. Vehicles can be picked up and returned in any publicly available and permitted parking place within the service area.		https://www.tauron.pl/tauron/tauron-innowacje/emobility
Traficar	Poland (Warsaw, Krakow, Katowice, Wrocław, and Poznan)	Allows intercity one-way trips with a Renault Clio car and only between the Traficar service zones: Kraków, Warsaw, Tricity, Wrocław, Poznań and Silesia. Hybrid services – FFCS and SBSCS		https://www.traficar.pl/carsharing
4Mobility Carsharing	Poland (Warsaw, Poznan, Siedlce, Tri-City, Rzeszow)	Vehicles can be picked up and returned in any publicly available and permitted parking spaces within the designated 4Mobility zone, following parking regulations. Vehicles can park for free within the Paid Parking Zone.		https://4mobility.pl/
Easyshare	Poland (Łódź and Poznań)	Vehicles can be picked up and returned in any publicly available and permitted parking spaces within the free service area, in accordance with the road rules. Vehicles can park for free within the Paid Parking Zone. Partnership between MiiMove and Easyshare.		https://easyshare.pl/carsharingaminuty/
MiiMove	Poland (Tri-City, Rumia and Kosakow, Łódź and Poznań)	Vehicles can be picked up and returned in any publicly available and permitted parking spaces within the MiiMove service area, following parking regulations. Option of rental with parking - upon payment of a parking fee. Partnership between MiiMove and Easyshare Municipal electric car sharing program.		http://miiMOVE.pl/
Vozilla	Poland (Wrocław)	"Vozilla Municipal Electric Car Rental payment system - based on 3 zones" – amount to pay depends on the ending location. Free parking in most of the areas during use. Vehicles can drive in bus lanes.	2020 – permanently shut down due to financial complications and changes in the market	https://www.vozilla.pl/

		Offers scooters via Vozilla scooters/blinkee.city!		
Pony Car Sharing SRL	Romania (Bucharest, Cluj-Napoca and Alba Iulia)	Vehicles can be picked up and returned within the service area.		https://getpony.ro/en/
BCR eGO	Romania (Bucharest, Constanta and Timisoara)	Semi FFAB - Vehicles can be legally parked in public spaces. Vehicles can be picked up and returned within the service area (spread around Bucharest), but the provider recommends their use/return in the central – north area, a pre-defined space within the area of coverage. Users are rewarded (with gamification measures) for returning vehicles in charging stations.		http://www.bcr-ego.ro/
Artcars	Russia (Moscow and region)	Allows intercity trips that can end in Podolsk, Domodedovo and Scherbink, and in settlements nearby. Regularly opens new parking areas.		http://artcars.club/
Delimobil	Russia (Moscow, St. Petersburg, Ufa, Nizhny Novgorod, Yekaterinburg, Samara, Grozny, Novosibirsk, Krasnoyarsk, Krasnodar, Rostov-on-don and Tula)	Vehicles can be picked up and returned in publicly available and permitted parking spaces within the service area, following parking regulations – areas indicated in green on the map. Different tariffs – “morning and evening tariff”.	2020 - St. Petersburg authorities suspended car sharing operations during COVID-19 crisis	www.delimobil.ru
Car5	Russia (St. Petersburg, Moscow)	Hybrid services?	2019? - activity suspended due to problems with operations	https://truesharing.ru/b/23361/
Carenda	Russia (St. Petersburg)	Operating under YouDrive.	2019 - Moscow 2020 - St. Petersburg authorities suspended car sharing operations during COVID-19 crisis	https://carenda.ru/
Car Sharing UrentCar	Russia (Sochi)	Vehicles can be picked up and returned in publicly available and permitted parking spaces within the “Use Area”, following parking regulations – in areas “marked on the map with a blue line”: Krasnodar Territory in Sochi (Adler). Users can complete a car rental in the pink / purple zones. No intercity trips allowed. Offers bike sharing services.	2019 – “winter vacations” (on a break)	https://carsharing.urentcar.ru/index.html
Anytime	Russia	Operating under Delimobil.	2019	http://anytimecar.ru/
TimCar	Russia (Moscow – MKAD, and Kazan)	Service area changed constantly – around MKAD (Moscow Automobile Ring Road)	2019?	https://timcar.ru/en/
BelkaCar	Russia (Moscow and Sochi)	Vehicles can be picked up and returned in publicly available and permitted parking spaces within the “Travel Zone”, following parking regulations – in areas highlighted in blue. Special BelkaCar parking lots at airports. Closed Areas for Rental Completion in 2020 Moscow: “Lease can be completed within the MKAD, in some from MKAD’s outskirts, and in many large residential complexes outside the MKAD.” “Payment for city open paid parking lots and special parking lots for BelkaCar at airports”. Sochi: Vehicles can travel “along the mountain resort area and along the entire coastline up to Tuapse” and can only be returned in the permitted zone and in special parking lots within “Lease Completion Zone”. Zones of movement and parking in Sochi	2020 - Closed some vehicle return areas	https://belkacar.ru/
Colesa	Russia (St. Petersburg)	Vehicles can be picked up and returned within the service area - “Home zone”. Free parking in permitted public spaces within the “Home zone”. “Park in any free parking lot and in a public place within the Home Zone”.	2020? - Suspended operations temporarily? - St. Petersburg authorities suspended car sharing operations during COVID-19 crisis	https://colesa.com/
Carsmile	Russia (St Petersburg, Tula, Voronezh and Lipetsk)	Vehicles can be parked in any allowed space, following parking regulations.	2020 – suspended in St. Petersburg and Tula	https://carsmile.com/
Rentmee	Russia (Moscow and St. Petersburg)	Allows intercity trips within the “completion zone” - between Moscow and St. Petersburg. Rental can be completed “within the boundaries of the Territory of the completion of the lease”. Hybrid services.	2020 - St. Petersburg authorities suspended car sharing operations during COVID-19 crisis	https://rentmee.club/index.cfm?q=ru/rossia/#blokshagov
Youdrive	Russia (Moscow, Sochi and Saint Petersburg.)	Vehicles can be picked up and returned in permitted public spaces within the service area – “Green Zone”, following the different rules for each operation area. Free parking during use within the service area. Flexible vehicles charging. Regularly opens new parking areas in shopping and business centers. Free night parking (8pm – 8am) outside the Green Zone.	2020 - St. Petersburg authorities suspended car sharing operations during COVID-19 crisis	http://youdrive.today/
Matreshcar Carsharing	Russia (Moscow, St. Petersburg and Leningrad region)	Vehicles can be picked up and returned in permitted public spaces within the “business area”, following the different rules for each operation zones.	2020 - St. Petersburg authorities suspended car sharing operations during COVID-19 crisis	https://matreshcar.ru/
Yandex.drive	Russia (Moscow, St. Petersburg, Leningrad region, and Kazan)	Vehicles can be picked up and returned in permitted public spaces within the service areas, following local parking regulations. Allows intercity trips upon payment of the “Mezhorod” tariff.	2020 - St. Petersburg authorities suspended car sharing operations during COVID-19 crisis	https://yandex.ru/drive/
Car4you	Russia (Moscow)		2019	https://truesharing.ru/carsharing/car4you/
Carlion	Russia (Moscow)		2019	https://truesharing.ru/carsharing/carlion/
Carusel (Carousel)	Russia (Moscow)	Hybrid services? Vehicles can be picked up and returned within the service area. Users can park for free in permitted public spaces within the service area. Offers electric scooters and cars sharing services.	2020 – temporarily stopped due “to the difficult situation in the capital and the restart of the service”	https://karysel.webflow.io/ https://carusel.club/
Lifcar	Russia (Moscow and region)	Hybrid services. Vehicles can be picked up and returned in permitted public spaces within the service area - “MKAD” (Moscow Automobile Ring Road), following local parking regulations. Free parking “in city parking lots in Moscow in compliance with the traffic rules”.		https://lifcar.ru/en
EasyRide Car Sharing	Russia (Moscow)	Formerly integrated into the YouDrive car sharing application.	2019	http://easyride.ru/cgi-sys/suspendedpage.cgi

Cherrydrive	Russia (Moscow)	Operated under the YouDrive platform.	2019?	http://youdrive.today
Car sharing Bi-bi.car	Russia (Volgograd and Krasnoslobods)	Vehicles can be picked up and returned in permitted public spaces within the service areas, following the different rules for each operation zone. Free parking in any "convenient place within the area, subject to traffic rules". Vehicles delivery available.		http://bi-bi-car.ru/
URAmobile	Russia (Yekaterinburg and Chelyabinsk)	Vehicles can be picked up and returned in permitted public spaces within the service area – including airports, following local parking regulations. Free parking in permitted public spaces within the service area. Allows intercity trips between Yekaterinburg and Chelyabinsk upon payment of the "Mezhgorod" tariff - "Intercity" and "Daily" tariffs.		https://uramobil.ru/
iDrive KSA	Saudi Arabia (Riyadh)	Hybrid? SBCS and FFCS services.		https://idrive-ksa.com/en/
Smove	Singapore	A to B (station-based?). Members can use vehicles to "drive for Grab". Station-based FFCS: vehicles have to be returned in "Avant2Go spots". Allows intercity trips: vehicles can be used in between urban areas/cities, as long as they are returned in Avant2Go stops located in different cities country wide.		https://www.smove.sg/ https://www.linkedin.com/company/smove-systems
Avant2go	Slovenia (Ljubljana and other cities) and Croatia (Dubrovnik)	Slovenia: City fleet with e-FFCS. Vehicles can be picked up and returned within the "coverage area". Free parking in public spaces and in pay-as-you-go parking lots. Users can end trips parking within the service area (Locoparks), or by paying parking fees to stop at another location.		https://avant2go.si/ https://avant2go.hr/
Share'n go	Slovenia (Ljubljana)	Vehicles can be picked up and returned within the "coverage area". Free parking in public spaces and in pay-as-you-go parking lots. Users can end trips parking within the service area (Locoparks), or by paying parking fees to stop at another location.	2017?	https://site.sharengo.si/ sharengo.com – doesn't go through
Locomute	South Africa (Joburg + Cape Town)	Rental starts and ends within the "ZITY Service Zone". Allows "standby mode" to make stops out of the service area.		https://zity.eco/en/madrid/ https://zity.eco/en/bonjour/
Zity	Spain (Madrid), France (Paris – ex Moovi'n – March 2020?)	Free2Move carsharing operations. Vehicles can be picked up, returned and parked in public spots within the service areas.	2020 - temporarily out of service in both cities due to COVID-19	https://www.emov.eco/madrid/ https://www.emov.eco/lisboa/?lang=pt-pt
Emov	Spain (Madrid) Portugal (Lisbon)	Vehicles can be picked up, returned and parked in public spots, special zones/hubs in Repsol stations, in parking areas in streets of Madrid, or in "bases WiBLE" within the service areas. Offers vehicles in parking "bases" located in neighbor cities. Allows "inter-bases" trips or to the service area in central Madrid. Replacing Car2Go since 2018.	2020 - temporarily suspended due to COVID-19	https://www.wible.es/
Wible	Spain (Madrid)	On-street parking within the service area and parking "hotspots" – "differences between parking in Stockholm, Solna and Sundbyberg area". Offers car and scooter sharing services.		https://www.wible.es/
Aimo	Sweden (Stockholm)	"Super" Hybrid - offers all types of CS and services country-wide. Allows "one-way bookings" to move a vehicle from "Mobility station A to Mobility station B". Vehicles can be taken from and returned to stations spread around the country, in Zurich (and airport), Basel, Bern, Lucerne, Zug, Rapperswil-Jona, Winterthur. Started as a pilot in Basel (2014).		https://www.mobility.ch/en/one-way/how-it-works/ https://www.mobility.ch/en/one-way/stations/
Mobility One-way	Switzerland (country-wide coverage)	FFCS service – coverage area: "Mobility Go zone". Basel. Special parking spots within the "Blue Zone" – downtown, at relevant transport hubs (train station and airport), and in special areas (Aeschenplatz).		https://www.mobility.ch/en/go/how-it-works/ https://www.mobility.ch/en/news/mobility-journal/mobility-journal-01-2019/mobility-snatches-up-catch-a-car/
Mobility Go (Catch-a-car)	Switzerland (Basel and Geneva)	Supported by local authorities. Light electric vehicles for short urban trips. Vehicles do not require a car driving license to be used. Can be driven freely for 10 minutes within a zone. The first three journeys of the day are free. Users can ride them in bicycle lanes. Vehicles should be parked on bicycle or motorbike parking spots. Choose return station upon booking.		https://www.enuu.ch/
Enuu	Switzerland (Biel, Zurich)	Toyota's Ha:Mo Ride - "Harmonious Mobility Network" In partnership with Chulalongkorn University aimed at "integrating personal mobility with mass transit such as trains and bus networks". Car sharing system to be used "intra-campus", designed to complement public transport, in particular for first and last mile trips, as part of a broader mobility platform.		https://www.haupcar.com/ https://www.chula.ac.th/en/about/green-university/cu-toyota-hamo/ https://www.cutoyotahamo.com/en/home-2/
Hauptcar	Thailand	Hybrid? SBCS and OWSB services = return to the pod or leave one-way designated vehicles "at any "teleport point". Valet (delivery and pick up) of vehicles available upon payment.		http://driveyoyo.com/
Yoyo	Turkey (Istanbul)	Hybrid? SBCS and OWSB services = return to the pod or leave vehicle "at any RTA A, B, C, D parking zones". Vehicles can be picked up and returned in permitted parking spaces within the vehicle's usage area.		https://www.udrive.ae/
UDrive	UAE (Dubai)	Free parking within the service area during vehicle use and at the airport. Intercity trips allowed as long as the final city has a zone to complete trips. Different tariffs for the services.		https://www.getmancar.com.ua/
Getmancar Carsharing	Ukraine (Kiev)	1-year Pilot project for FFCS in Seattle that was discontinued upon its completion.	2019 after the end of the pilot	https://www.lime/lime-pod-car-sharing
Limepod	USA (Seattle)	"Flexible "first and last mile" electric car sharing program with compact cars and solar charging stations. Piloting in university campuses": Colorado State University, the University of Pittsburgh, the University of Washington and the University of Wisconsin–Madison. Mainly SBCS, but with one-way services offered in Ann Arbor, at the University of Michigan, and between Detroit and the Detroit Metro airport. Members can end one-way trips by leaving vehicles at the station selected upon booking.		https://www.innovaevcarshare.com/
Innova EV / Dash	USA (Ohio + other states in the future)	Valet services available in NY. Service is free for the first two hours, made possible by advertisement in the vehicles – conflicts with transport and advertising regulations. Vehicles can be picked up and returned in "valid spots" or at charging stations within the service area.	2020 - shut down permanently, situation aggravated by due to the COVID-19 crisis	https://www.mavendrive.com/#/faq
Maven	USA (Ann Arbor and Detroit)	Electric cars park for free in Santa Monica - at SaMo meters (though they have to comply with time limits and other parking rules) and are generally returned to a central lot near Seventh Street and Colorado Avenue. Users can drive "up to 20 miles outside our HQ in Santa Monica" – most of LA. An alert message is sent to inform if the vehicle passes the boundaries.		https://www.wavecar.com/
WaiveCar	USA (LA – Santa Monica and Venice)	Two distinct areas of operations: Sacramento - EVs – "Hybrid Gigs".		https://gigcarshare.com/
Gig Car Share	USA			

APPENDIX 2

Global FFCS providers and their space allocation/parking initiatives

<p>(San Francisco, Sacramento and Seattle - planned)</p>	<p>Hybrid services – San Francisco Bay Area. Free parking in permitted public spaces in within the “HomeZones”.</p> <p>SF Bay Area: Vehicles can be picked up and returned in permitted parking spaces within the “Bay Area HomeZone” – in San Francisco parking lots, in parts to the Richmond District, and in some BART stations – PT - “Bay Area HomeZone”.</p> <p>Sacramento: Hybrid Gigs can travel “between the two major HomeZones” and end trips in any of them. Electric vehicles need to be returned to their “own separate HomeZone”.</p>	<p>https://gigcarshare.com/sacramento/</p>
<p>Penske Dash</p> <p>USA (Washington D.C. and Arlington County)</p>	<p>Vehicles can be picked up and returned within “The Dash Zone”, but in public and unrestricted on-street parking spaces identified by Penske Dash (Arlington), or in designated parking locations – “approved garage or lot” (around Washington DC) - shown on the app, following different operation rules in each place. Members must follow private, local or state parking rules.</p>	<p>2020 – Ceased operations permanently amid the COVID-19 situation</p> <p>https://www.penskedash.com/</p>