

Supporting Carshare Vehicles in the City of Vancouver: North American Parking Policies

Prepared by: Rainer Lempert, UBC Greenest City Scholar, 2018

Prepared for: Billy Dong, Parking Engineer, City of Vancouver Parking Management Branch

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About the Author

Rainer Lempert is an MSc candidate at the UBC Institute for Resources, Environment, and Sustainability.

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- 1. Executive Summary _____ 1
- 2. Introduction _____ 6
 - 2.1 Carsharing Background _____ 6
 - 2.2 Carsharing in Vancouver _____ 7
 - 2.3 Project Definition and Methods _____ 8
- 3. Preliminary Research _____ 9
- 4. Review of Carshare Policies from North American Municipalities _____ 12
 - 4.1 Boston _____ 12
 - 4.2 Calgary _____ 13
 - 4.3 Denver _____ 17
 - 4.4 New York City _____ 19
 - 4.5 Portland _____ 21
 - 4.6 Salt Lake City _____ 23
 - 4.7 San Francisco _____ 23
 - 4.8 Seattle _____ 25
 - 4.9 Toronto _____ 27
 - 4.10 Vancouver _____ 30
 - 4.11 Washington D.C. _____ 31
- 5. Discussion of Emerging Best Practices _____ 33
- 6. References _____ 36

1. Executive Summary

Carsharing Context

Carsharing is a service where members have access to a fleet of shared vehicles distributed across a city. Members can book a vehicle when needed, allowing for the convenience of vehicle ownership while reducing the need to own private vehicles. The popularity of carsharing in North America has expanded rapidly over the last decade, growing from only 30,000 members in 2003 to over 1 million members in 2013. The two primary forms of carsharing are a one-way or free floating model, where users can pick up and drop off vehicles anywhere inside a service area, and a two-way or round trip model, where members pick up the vehicle at a specific location and later return it to that starting location. “Peer-to-peer” carsharing services, such as Getaround, also exist, where private vehicle owners can make their vehicles available to rent.

Carsharing has existed in the City of Vancouver since 1996, when the Cooperative Auto Network (which later changed its name to Modo), a two-way carshare operator, was founded. Since then three other carshare operators (CSOs), one-way services Car2go andEvo, and two-way service Zipcar, operate within the city.

Project Objectives and Methods

The objectives of this project are to undertake a review of emerging best practice examples from cities around North America on carshare parking policies. Policies such as ending trips at on-street meters, off-street parking requirements, and parking relaxations and incentives for publically-available car share vehicles are reviewed.

Information was gathered both by reviewing pertinent municipal carshare literature and contacting and interviewing city officials knowledgeable on carshare policy. Only North American cities were considered for the study because transportation systems and options in cities in Europe, Asia and North America differ significantly. Ultimately, eleven cities were included in the study: Boston, Calgary, Denver, New York City, Portland, Salt Lake City, San Francisco, Seattle, Toronto, Vancouver, and Washington D.C.

Summary of Carshare Policies by City

Boston

- Boston has two active two-way CSOs (Zipcar and Maven) and one active peer-to-peer CSO (Getaround).
- Boston offers city-ordained on-street and municipal lot designated carshare spaces through its DriveBoston pilot program. Participating CSOs pay an annual fee of \$2,700 for spaces in lower-density urban areas and \$3,200 for spaces in higher-density areas. 80 spaces are currently active around the city, but due to high utilization rates this will likely be increased to 200 spaces once the pilot ends.

Calgary

- Calgary is served by one CSO, the one-way service Car2go.
- One-way carshare vehicles in Calgary may end their trip in any on-street parking space, including metered space, open to the general public except locations with posted time restrictions of less than two hours. CSOs are assessed a \$450 annual fee per one-way carshare vehicle with an all-zone RPP permit. Hourly public parking rates for privately owned vehicles, including any special rates (e.g. small car discounts), also apply to carshare vehicles parked in metered spaces.

- CSOs may request designated carshare spaces. Full-sized vehicles are assessed an annual fee of \$1000 while small vehicles (e.g. smart cars) are assessed a fee \$500 per year, plus a \$50 administrative fee.
- Calgary has codified policies to manage clustering of one-way vehicles. In business areas, carshare vehicles are not allowed to occupy more than 25% of any parking zone, averaged monthly. In residential areas, vehicles cannot occupy more than 20% of any block, again averaged monthly. If CSOs do not comply with these policies, fees and restrictions may be applied.

Denver

- Denver has three two-way CSOs (Maven, eGo Carshare, and Zipcar) and one one-way service (Car2go).
- Denver offers a Vehicle Area Permit for one-way carsharing vehicles, which exempt vehicles from meter payment and residential permit restrictions at locations with time limits of 2 hours or greater. An annual fee of \$850 is applied to each carshare vehicle.
- Dedicated Space Permits are also offered to any locally active CSO for on-street parking. A maximum of 30 parking spaces is allowed. Fees are applied based on parking space location. Spaces in the dense downtown area cost \$750 annually, non-downtown neighborhood spaces cost \$500 annually, and “opportunity areas,” or lowest density locations, cost \$250 annually.

New York City

- New York is served by both one-way (Car2go) and two-way (Zipcar and Enterprise Carshare) CSOs.
- One-way vehicles are not allowed to end trips in metered or residential zones.
- Late May, 2018, the City Carshare Pilot Program (CPP) was announced. This program enables any CSO, one-way or two-way, to enroll and receive designated on-street and municipal lot parking spaces. Up to 300 on-street spaces and 10% of municipal lot spaces will be made available. On-street spaces are free, while cars parked in lots must pay whatever relevant fee is charged at that particular facility.
- The CPP was drafted in part to provide equitable access to carsharing. In order to participate, CSOs are required to place at least 20% of its on-street spaces in low-income neighborhoods currently underserved by carsharing. CSOs that voluntarily give discounts to low-income members or provide at least one hand control adapted vehicles will be given additional parking spaces.
- The CPP is still in its initial stages, and its viability has yet to be assessed.

Portland

- Portland has two one-way CSOs, Car2go and ReachNow, and one two-way CSO, Zipcar.
- One-way carshare vehicles may end their trip in any on-street parking space open to the general public. One-way vehicles are allowed to stay at a meter indefinitely, longer than the time restriction for private vehicles. CSOs are responsible for paying all of their time associated with metered parking, as tracked by their API.
- The City is currently developing an auditing process to ensure that CSOs are accurately paying metered fees. City interns will be given access to the CSO API and will spot check metered locations.
- An annual \$100 fee is applied on all one-way vehicles for residential parking permits.
- Clustering is managed on an ad hoc basis, with one-way CSOs quickly responding to situations of clustered vehicles. This is partly due to a strong working relationship between the City and one-way CSOs.
- There is an annual auction between CSOs for designated spots. Despite particular spots being designated for individual CSOs, signage does not advertise CSO names, adhering to Portland’s strict no advertising in rideaway zone policy

Salt Lake City

- Salt Lake City currently has no active CSOs, with Enterprise Carshare leaving the city in 2017. However, they were included in this study because of the municipal initiative to designate carshare locations for free in eighteen high-density locations across the city.
- Despite municipal support and initial interest from Salt Lake City residents, Enterprise Carshare failed to attract high utilization, and eventually left the city.
- According to Dan Bergenthal, Transportation Engineer at Salt Lake City Transportation Division, the program ended primarily because Enterprise failed to effectively advertise.

San Francisco

- San Francisco is served by two two-way CSOs (Zipcar and Maven) and one peer-to-peer CSO (Getaround).
- The City of San Francisco offers designated on-street spaces to carshare vehicles. The City offers up to 1,000 designated spots for CSOs.
- Spaces are priced monthly by a three tiered system. Spaces in the dense downtown core cost \$285 per month, spaces in areas of medium density cost \$180 per month, and spaces in the lowest density cost \$50 per month. This pricing scheme incentivizes CSOs to place their vehicles in outer areas where the population is less dense and where transit coverage is thinner.

Seattle

- Seattle currently has four CSOs, including two free floating services, Car2go and ReachNow, a round-trip service, Zipcar, and a peer-to-peer service, Getaround.
- CSOs annually pay \$930 per vehicle towards a metered parking permit for one-way vehicles. This allows vehicles to park in any metered area that offers more than one hour of parking time. If a vehicle spends more than \$930 worth of metered time, the CSO is required to pay the difference.
- CSOs annually pay \$800 per vehicle towards a residential parking permit for one-way vehicles.
- Zipcar (the sole two-way provider in Seattle) annually pays \$3,000 for a designated space paid parking zone (metered spot) and \$300 for a designated space in a non-paid parking area.
- Seattle is in its initial stages of its low-income carshare program. The City will purchase minutes of travel time from CSOs providing one-way services and distribute them freely to members of the Salem Housing Authority, a public housing mission. For this pilot, low-income residents pay nothing for access to one-way vehicles. In the future they may pay a subsidized fee.

Toronto

- Toronto currently has two two-way CSOs, Zipcar and Enterprise Carshare. Car2go, which used to be the largest CSO operating in Toronto, left the city at the end of May, 2018.
- Car2go left the city in large part due to the 18-month pilot initially approved by Toronto City Council April, 2018. In particular, Car2go took issue with the stipulation that the City would not allow free-floating carshare vehicles to park on residential streets that are at 95% of capacity for parking permits, claiming that this new policy would impact 50 percent of trips taken daily by Toronto residents who were members of their service.
- The pilot also required one-way vehicles to pay an annual fee of \$1,500 for residential parking permits, the largest fee found in this study. Carshare vehicles are not allowed to end trips in metered locations.
- The pilot included an anti-clustering policy, requiring that no more than one car-share vehicle from the same company be allowed to park on a street block with residential permit parking for any length of time. This policy is far more stringent than other municipal clustering policies, such as Calgary, which enforces its policy by monthly average.

- Due primarily to Car2go's response, Toronto City Council reopened talks to discuss the policies of the carshare pilot. Responding to Car2go's biggest complaint, City Council proposed to not allow one-way vehicles to park on residential streets that are 100% capacity for parking permits, not 95%.
- The final status of the carshare pilot, and Car2go's Toronto operations, remains uncertain.

Vancouver

- Vancouver does not currently allow one-way vehicles to end trips at parking meters.
- One-way and two-way vehicles may purchase a permit authorizing parking in all residential permit zone and resident parking only zones for an annual fee of \$75.67. This permit also exempts vehicles from the three-hour parking bylaw, which stipulates that vehicles may not park outside of another residence between 8am-6am for more than three hours.
- Both one-way and two-way CSOs in Vancouver are allowed to purchase designated parking spaces throughout the city. In non-metered areas, permitting fees are assigned based on a three-tiered geographic zone system, ranging from \$306 per parking space (for lower density areas) to \$1,346.40 per parking space (for highest density areas).
- To designate an on-street parking space in a metered parking zone, CSOs must pay the maximum revenue the parking space would have generated if metered. This ranges from approximately \$3,000 to \$25,000, depending on the meter rate.
- The City allows developers to substitute the number of required parking spaces at new developments at a ratio of 1 designated carshare vehicle space for 5 private auto parking spaces. This enables developers to minimize the amount of space required for parking lots, and gives residents greater access to carsharing, decreasing the necessity of car ownership.

Washington D.C.

- Washington D.C. currently has five operating CSOs, one-way service Car2go, two-way services Zipcar, Enterprise Carshare, and Maven, and peer-to-peer service Getaround.
- The District's Point-to-Point Carsharing Program allows one-way vehicles to park in any unrestricted residential parking permit zones and metered zones without the CSO paying an associated permitting fee.
- To qualify for this program, participating CSOs must have seven one-way vehicles located in low-income neighborhoods. One-way CSOs also must maintain at least one percent of its fleet in each Ward of the city at any point in time.
- Participating one-way CSOs are also required to provide the District with quarterly information, including carshare membership growth, geographical distribution of members, and vehicle utilization. This information is used by the DC Department of Transportation to assess the viability of the parking program. One-way CSOs are also responsible for disseminating an annual survey to all members, with questions regarding car ownership before and after joining the CSO, estimations of VKT before and after joining the CSO, and other modal transportation choices.
- CSOs are allowed to purchase designated on-street spaces for two-way carshare vehicles for an annual fee of \$2,890.

Emerging Best Practices

It is difficult to rigorously analyze all different carshare policies to ascertain the most viable options. Policies that are successful in some cities may be unsuccessful in others, due to differing city layouts, transit systems, and population needs. Carsharing is also a new, rapidly growing and changing industry, and carshare policy has

followed suit. Many policies are too new to be judged viable or not. Due to these considerations, what follows is the scholar's subjectively chosen emerging best practices for carshare policy.

Well constructed municipal carshare policy should achieve the following five goals (adapted from Calgary Parking Policies):

1. Equitably facilitate access to carshare services for all residents;
2. Allow ease of parking for CSO members, to facilitate the use of carsharing and more fully render the environmental and social benefits that entails;
3. Treat CSOs equitably, while acknowledging the differences between one-way and two-way carshare services;
4. Effectively manage low turn-over and clustering of carshare vehicles in congested parking areas;
5. Allow portions of existing or new parking spaces to be dedicated to carshare parking in commercial and residential areas.

There are multiple solutions towards achieving these five goals. These following practices, adapted from successful policies across the studied North American municipalities, should be investigated when creating future carsharing policy:

- Allow one-way carshare vehicles to end trips at parking meters. CSOs should either be responsible for paying all of their time associated with metered parking, as tracked by their API. Developing an auditing process to ensure the veracity of metered fees charged may be advisable. In some cases, subsidizing metered carshare parking should be considered.
- Charge a reasonable annual fee that enables carshare vehicles to park in residential parking zones, with the understanding that introducing carshare vehicles to a neighborhood may allow some residents to dispose of their private vehicles, which in turn opens up more neighborhood parking spots.
- Allow CSOs to apply for designated on-street parking spaces through a tiered geographic payment system, with higher density zones requiring higher annual fees. This incentivizes CSOs to place vehicles in areas less likely served by public transportation. One-way and two-way CSOs should be treated differently when applying for designated spaces, given differences inherent in the transportation systems.
- Clustering of one-way vehicles should be managed either by on an ad hoc basis (if the municipality feels comfortable with its relationship with the CSO) or through enforcement averaged on a weekly or monthly time frame.
- Work with CSOs toward creating equitable carshare policy that allows underserved or low-income community members access to carshare. While this is a best practice, it is worth acknowledging that different cities have different needs and requirements. For example, access to carshare may be less important for low-income members of cities that have reliable and equitably distributed public transit systems.

2. Introduction

2.1 Carsharing Background

Carsharing is defined as “a membership program intended to offer an alternative to car ownership under which persons or entities that become members are permitted to use vehicles from a fleet on an hourly basis.” (Millard-Ball, Murray et al., 2005). The first reported car sharing service arose in Switzerland in the late 1940s. However, it wasn’t until the late 1980s that more successful car sharing organizations began to arise in Europe. In the late 1990s and early 2000s carsharing began to spread to North America and Asia (Shaheen et al., 1999). Throughout the 2000s carsharing membership grew rapidly, aided by advances in Information Communication Technologies (ICTs). Smartphones lowered transactional costs associated with carsharing, making the service more convenient and affordable (Namazu, 2017).

The original form of carsharing is a “round-trip” or “two-way” model where members pick up the car at a specific location and later return it to that starting location. That model still exists, used by companies such as Zipcar. The improvements in ICTs led to another model, “one-way” or “free-floating” carsharing, where users can pick up and drop off vehicles anywhere inside a service area. Today Car2go is the most popular “free-floating” carsharing service with over 2.5 million members, while Zipcar is the most popular “round-trip” service with 750,000 members. There are currently 45 carsharing membership programs currently available across North America (Martin and Shaheen 2016). “Peer-to-peer” carsharing services, such as Getaround, also exist, where car owners can make their vehicles available to rent.

Carsharing can lead to potential environment benefits by reducing emitted greenhouse gases and vehicle dependence. Carsharing vehicles are generally efficient. The average vehicle in a carsharing fleet is 10 miles per gallon, or 27 liters per 100 kilometers, more efficient than the average vehicle sold by members after joining the carsharing organization. A study by Dowlatabadi and Namazu (2016) analyzed greenhouse gas emissions reductions associated with two-way carsharing adoption. They found that access to a newer, more optimized fleet of vehicles results in a 1/3 reduction in household greenhouse gases. A study by Martin and Shaheen (2016) found a similar result.

Carsharing also has been shown to reduce the number of cars on the road, improving traffic patterns and making cities more livable. According to a study done by Martin and Shaheen (2016), one carsharing vehicle removed 1-3 private cars from the road and deferred the purchase of 4-9 cars. This removes cars from traffic patterns and, perhaps more importantly, decreases parking demand. Many studies have estimated that, on average, privately owned vehicles are parked at least 95% of the time. With fewer cars to account for cities can redesign spaces currently occupied by parking lots and garages to better serve street life and improve cities.

Different types of carsharing lead to different reductions of privately owned vehicles. A study of reductions in personal car ownership (Namazu and Dowlatabadi, 2018) suggests that two-way members reduce their ownership by 50%, while one-way members only reduce their ownership by 10%. This study also showed that two-way members had an average of 0.68 cars per household, compared to 1.08 for one-way members.

There are several factors that could negate these environmental and social benefits. Carsharing makes driving accessible to some people who do not own a vehicle. If the increased number of trips by former non-car owners is greater than the decreased number of trips by former car owners, there could be an increase in net traffic congestion and emissions. There is, however, a worry that for these non-owners carsharing “may act as a stepping-stone towards car ownership,” which would add to the numbers of cars on the road. People with access to carsharing may migrate away from local businesses, perhaps shopping at larger chains located in suburban strips. This could contribute to a form of suburbanization, where people live in areas of high population density but commute frequently outside of that zone, increasing congestion and emissions and negatively impacting street life. (Bonsall, Jopson et al., 2002) One-way carshare vehicles also have the tendency to “cluster” around popular drop-off destinations, such as major employment, educational, or recreational centers. In extreme cases, carshare vehicles can occupy the majorities of entire streets for extended periods of time, blocking other vehicles, including local residents, from parking.

CS’s high prevalence has prompted many cities’ planning, transportation, and sustainability departments to examine its emerging role and utility as a transportation demand management (TDM) tool (Filosa 2006; Millard-Ball, 2005) to decrease individual car ownership and its associated negative impacts such as subsequent parking demand (Metro Vancouver 2014). Well-crafted municipal carshare parking policy should both account for and aid in the proliferation of the service and its associated positive social and environmental effects while simultaneously limiting its potential negative effects, such as clustering.

2.2 Carsharing in Vancouver

Vancouver is heralded as one of the most progressive carsharing cities in North America (Namazu & Dowlatabadi, 2018). Metro Vancouver is currently served by four different car share operators (CSOs), providing two-way (Modo and Zipcar) and one-way (Car2go and Evo) carsharing options to their members.

Improved carsharing accessibility can and should originate in supportive municipal policy. These policies can be complemented by private sector initiatives to achieve optimal carsharing outcomes. The City of Vancouver is in the process of realizing its *Metro Vancouver 2040: Shaping our Future* regional growth plan, a region-wide effort to improve urban planning and sustainability through a number of improved planning venues including transportation and associated sustainability metrics such as decreased GHGs, overall VKT, and traffic congestion. This plan specifically prioritizes city efforts to encourage increased carsharing prevalence as an

alternative to personal automobile use (City of Vancouver 2011). Because carsharing can help cities achieve sustainable transportation goals, municipal governments can curate this type of public-private cooperative partnership to improve urban planning and land management.

2.3 Project Definition and Methods

The goal of this project was to conduct research comparing car share parking policies used in different cities around the world. From this study recommendations of policies that the City should adopt to support car sharing could be gleaned. Cities chosen for research were limited to Canada and the US because transportation systems in cities in Europe, Asia and North America differ significantly.

Research for this report was done in stages. First a literature review was undertaken to find carshare policies supported by the academic community. To gain an understanding of differences in actual carshare parking policies in North America, internet research was conducted towards determining which municipalities have active CSOs and/or City-led programs supporting carsharing. Published municipal documents detailing carshare policy practices were searched for and, if existing, summarized. Otherwise knowledgeable city officials were sought out and contacted for interview. Certain cities were more protective of their information and were difficult to study. Ultimately, carsharing policies from eleven cities, Boston, Calgary, Denver, New York City, Portland, Salt Lake City, San Francisco, Seattle, Toronto, Vancouver, and Washington D.C., were compared.

3. Preliminary Research

Table 1 details municipal carsharing policy levels. The table lists five varieties of carshare policies; limits to carshare parking, fee/permit allocation, parking enforcement, carshare parking maintenance, and clustering enforcement, across three level of municipal support. The fifteen policies described in this matrix do not attempt to constitute all possible carsharing policies. Instead Table 1 serves as the beginnings of a framework from which municipalities can determine their carshare policies. When applicable, examples of policies are referred to Section 4.

Municipal Carsharing Policy Levers			
	Carsharing Treated as an Environmental Benefit: Maximum Policy Support	Carsharing Treated as a Sustainable Business: Moderate Policy Support:	Carsharing Treated as a Business: Minimum Policy Support
Limits to Carshare Parking	No limit to carshare parking variances (e.g. Vancouver, Section 4.10)	High caps on amount of designated carshare parking city-wide (e.g. San Francisco, Section 4.7)	Low cap on citywide carshare parking (e.g. Boston, Section 4.1, although that is subject to change)
Fee/Permit Allocation	Free or low-cost carshare parking provided to CSOs (e.g. New York City, Section 4.4)	Carshare operating fees determined by cost recovery needs, or reduced to achieve environmental goals (e.g. Calgary, Section 4.2)	CSO fees based on profit or cost-recovery methodology (admin fees, program fees, meter revenue differences) (e.g. Seattle, Section 4.8)
Parking Enforcement	Enforcement by local police; private cars parked at designated carshare locations towed or ticketed; carshare parking violations given leeway	Enforcement by local police	Enforcement by local police; carshare parking violations equal to other parking violations
Carshare Parking Maintenance	City funds signage, installation, demarcating costs, and associated maintenance (e.g. Salt Lake City, Section 4.6)	City funds installation/parking indicators; CSO pays for actual signs/maintenance (e.g. San Francisco, Section 4.7)	CSO pays for all - signs, installation, parking demarcation, maintenance (e.g. Boston, Section 4.1)
Clustering Enforcement	Managed on situational basis, with municipality trusting CSO to decluster impacted areas (e.g. Portland, Section 4.5)	Enforced by applying fees and restrictions to CSOs with regularly clustered vehicles, measured on a weekly or monthly time frame (e.g. Calgary, Section 4.2)	Enforced by applying fees and restrictions to CSOs with any evidence of clustering (e.g. Toronto, Section 4.9)

Table 1. Toolkit of potential city parking policies supportive of CS. Distinctions among policy actions are identified along a spectrum of support and involvement (adapted from Shaheen et al. 2010, Swett 2018).

Table 2 lists the one-way carsharing parking policies of all North American cities currently served by a one-way CSO. Toronto is not included in this list, since Car2go, its only one-way CSO, recently disbanded local operations. In all municipalities one-way vehicles are allowed to park in non-metered on-street parking, with varying restrictions. Except for New York City, all vehicles in all municipalities are allowed to park in residential spaces. Vehicles in all municipalities except Chicago, Montreal, New York, and Vancouver are allowed to park in metered spaces, with some restrictions. Seven of these ten listed cities are included in the Section 4 comparison.

City	Metered Spaces	Non-Metered On-Street Spaces	Residential Spaces	Other Allowances
Austin	Allowed if space offers >2 hrs of parking	Allowed if space offers >2 hrs of parking	Allowed	Designated on-street parking spots
Calgary	Allowed if space offers >2 hrs of parking	Allowed if space offers >2 hrs of parking	Allowed	Unrestricted on-street spaces within the Home Area
Chicago	Not allowed	Allowed unless there are posted parking restrictions	Allowed	Designated on-street parking spots
Denver	Allowed if space offers >2 hrs of parking	Allowed if space offers >2 hrs of parking	Allowed	
Montreal	Not allowed	Allowed unless there are posted parking restrictions	Allowed	Designated on-street parking spots outside of CSO home area
New York	Not allowed	Allowed	Not allowed	
Portland	Allowed if space offers >1 hr of parking	Allowed if space offers >1 hr of parking	Allowed if space offers >1 hr of parking	
Seattle	Allowed if space offers >1 hr of parking	Allowed if space offers >1 hr of parking	Allowed	Allowed in rush hour and bus zones along Avenues 1-6 in the Downtown core from 9 AM - 2 PM.
Vancouver	Not allowed	Allowed unless otherwise posted	Allowed	
Washington	Allowed if unrestricted	Allowed if unrestricted	Allowed if unrestricted	

Table 2. One-way on-street carshare parking policies in North American municipalities (information from Car2go website and consultation with municipal employees).

To provide context for the comparison of carshare policies in different municipalities found in Section 4, Table 3 lists information on seventeen North American cities with a carsharing presence. Eleven of these seventeen cities are included in Section 4.

Country	City	Population	Land Area (km ²)	Pop. Density (people/km ²)	Vehicles per household	Carshare Operators	Number of CS Cars	CS cars per 10,000 people
US	New York	8,175,133	784	10,430	0.6	Car2go, Zipcar, Enterprise Carshare	3,757	4.4
US	Los Angeles	3,792,621	1,214	3,124	1.6	Zipcar, PitCarz	357	0.9
US	Chicago	2,695,598	588	4,582	1.1	Zipcar, Enterprise Carshare, Gataround, Maven	807	3.0
Canada	Toronto	2,615,060	630	4,150	1.1	Zipcar, Enterprise Carshare	1,356	5.2
Canada	Montreal	1,649,519	365	4,518	1.0	Car2go, Commuauto	1,867	11.3
US	Philadelphia	1,526,006	347	4,394	1.0	Zipcar, Enterprise Carshare	724	4.6
Canada	Calgary	1,239,220	825.3	1502	<i>Not found</i>	Car2go	<i>Not found</i>	<i>Not found</i>
US	San Jose	945,942	457	2,069	2.0	Zipcar	31	0.3
US	San Francisco	805,235	121	6,633	1.1	Zipcar, Getaround, Maven	1,222	14.3
US	Denver	696,060	401.4	1,734	2.0	eGo Car Share, Car2go, Zipcar, Maven	<i>Not found</i>	<i>Not found</i>
US	Portland	639,863	375.5	1,704	1.5	Car2go, ReachNow, Zipcar	<i>Not found</i>	<i>Not found</i>
US	Baltimore	620,961	239	2,598	1.1	Zipcar	234	3.8
US	Boston	617,594	232	2,661	0.9	Zipcar, Getaround, Maven	923	14.1
US	Seattle	608,660	217	2,802	1.4	Car2go, Getaround, Zipcar, ReachNow	1,391	20.8
Canada	Vancouver	603,502	115	5,248	1.2	Car2go, Zipcar, Modo, Evo	2,373	39.3
US	Washington	601,723	177	3,400	0.9	Car2go, Zipcar, Enterprise Carshare, Getaround, Maven	1,506	22.9
US	Milwaukee	594,833	249	2,391	1.3	Zipcar	35	0.6

Table 3. North American cities with carshare presence (adopted from Namazu, 2017) .

4. Review of Carshare Policies from North American Municipalities

4.1 Boston

(information obtained from Kris Carter, Co-Chair of Boston Mayor's Office of Urban Mechanics)

Boston currently has three active CSOs, two round-trip services, Zipcar and Maven, and the peer-to-peer service Getaround. Zipcar Boston is in the beginning stage of what they are calling a “one way” program, although it is not one-way carsharing in the traditional, free-floating sense. Vehicles can be picked up at a designated Zipcar location and then dropped off at any other open Zipcar “one way” designated location.

Two Way Carsharing: DriveBoston Program

DriveBoston is the City's program to provide on-street and municipal lot parking spaces for carshare vehicles. Currently DriveBoston is in a pilot phase, with 49 spaces in municipal lots and 31 spaces reserved curbside. All locations are chosen collaboratively by the CSO and the City, to ensure the viability of the locations to both meet localized carshare demand and adhere to other city rules, regulations, and considerations. The City is responsible for installing signage with the CSO's logo in all DriveBoston locations. Carshare vehicles are subject to all standard parking rules and regulations when parked anywhere other than a DriveBoston parking space.

The program used to be run with both Zipcar and Enterprise Carshare vehicles, but since Enterprise left the City, DriveBoston exclusively partners with Zipcar. None of the curbside or municipal lot spaces are associated with the Zipcar “one way” program.

Annual fees associated with spaces in the program vary depending on proximity to the City core. The annual fee is \$2,700 for spaces beyond the Boston Common and \$3,200 for spaces within downtown Boston. While not a direct subsidy, Kris Carter, Co-Chair of Boston Mayor's Office of Urban Mechanics, notes that the city pays approximately \$4,500 annually to maintain each city parking space, including street cleaning, snowplowing, parking enforcement, and security. While he and other members of the Office of Urban Mechanics see the benefits of carsharing and would like to make the spaces cheaper, this is currently politically unfeasible.

The program has been successful, with all locations currently posting greater than 20 percent utilization rates. Previously, underperforming spaces were relocated to other neighborhoods with higher estimated utilization potential. Fifteen spaces, primarily located in areas of low population density, routinely have utilization rates greater than 50 percent. Over the course of the program, Zipcar user growth has been steady and consistent.

This is the last year of the pilot, but due to its success DriveBoston will continue to grow. Due to high utilization rates at each of the 80 spaces, the City is planning to expand the program to at least 200 carshare

parking spaces throughout the city. Zipcar hopes to add spots nearby to areas with the highest utilization rates to ensure that vehicles are available for members.

While Boston does not have any other programs directly geared towards increasing carshare infiltration, commercial developers hoping to get projects approved by the City must comply with stated TDM measures. In certain situations, these measures include assigning designated carshare spaces as part of their parking facilities. However these regulations are not codified and are executed on an ad hoc basis.

4.2 Calgary

(information obtained from section 5.1.6 of Calgary Parking Policies)

Carsharing currently represents a small percentage of travel in the city of Calgary, accounting for less than one percent of all trips. Despite this, Calgary has among the most thorough list of parking policies of all municipalities included in this study. Carsharing is generally supported by Calgary parking policies, with carshare vehicles distinguished as “preferred parkers,” (Section 3.9 of Calgary Transportation Plan) enabling them access to more high-quality parking options relative to private vehicles. This distinction, and the policies that follow, was given to carsharing because its associated environmental and social benefits contribute directly to achieving the goals of the Municipal Development Plan and the Calgary Transportation plan.

The stated purpose of the carshare parking policies is to allow citizens of Calgary to receive the benefits of carsharing, while managing challenging parking behaviours when and where they occur. Carshare parking policies focus on on-street parking, since off-street parking can be addressed ad hoc through individual contractual arrangements. Carshare parking policies are consistent with the following five principles:

- Facilitate access to carshare services for citizens of Calgary.
- Treat all CSOs equitably, while acknowledging the differences between roundtrip and one-way carshare services.
- Treat carshare users like all other drivers in Calgary, while interacting with CSOs like other businesses that operate in Calgary.
- Effectively manage low turn-over and clustering of carshare vehicles in congested parking areas, when and where this activity occurs.
- Allow portions of existing or new parking space to be dedicated to carshare parking in commercial and residential areas.

One-Way Carshare Parking Policies and Fees

- One-way carshare vehicles are allowed to stop-over in any on-street parking space open to the general public, and may end their trip in any on-street parking space open to the general public except locations

with posted time restrictions of less than two hours. Posted time restrictions apply to one-way carshare vehicles, except in Reserved One-Way Spaces.

- The City of Calgary may, at its discretion, allocate portions of on-street curb space in public right-of-way as Reserved One-Way Spaces. These spaces can be used equally by all CSOs offering one-way carshare services. No time restrictions apply, and the Calgary Parking Authority (CPA) will provide enforcement to ensure that only eligible CSO vehicles use the spaces. Hourly public parking rates for the nearest parking zone shall apply when using the spaces.
- Hourly public parking rates for privately owned vehicles, including any special rates (e.g. small car discounts), also apply to one-way carshare vehicles parked in on-street parking spaces open to the general public. The City and CPA may, on an ad hoc basis, implement reduced parking rates for one-way carshare vehicles in specific locations to encourage the use of underutilized street space or Reserved One-Way Spaces.
- In order to maximize the efficiency of on-street parking supply, CSOs will be required to redistribute one-way carshare vehicles when numerous vehicles are repeatedly parked within the same ParkPlus zone or residential block with posted RPP restrictions.
- CSOs may purchase an all-zone RPP permit from The City. This permit allows one-way carshare vehicles to park on blocks with posted RPP restrictions. CSOs are assessed a \$450 annual fee per one-way carshare vehicle with an all-zone RPP permit.
- CSOs may request Reserved One-Way Spaces in CPA lots using the same application process in place for individual private applicants. Calgary Transit may create, at its discretion, Reserved One-Way Spaces in park and ride lots.
- For on-street Home Spaces, Calgary assesses the following charges to the CSO:
 - A non-refundable application \$50 administrative fee to review each space request from the CSO for the forthcoming application period.
 - Costs for changes to signage and markings for each allocated space.
 - Cost for the rental of the street space when the Home Space is located in a commercial area or in front of a single family dwelling on a block with posted RPP restrictions.
 - Rental cost for full-sized vehicles of \$1000 per year, or the value of lost revenue, whichever is greater.
 - Rental cost for small vehicles (e.g. smart cars) of \$500 per year, or the value of lost revenue, whichever is greater.

Two-Way Carshare Parking Policies

- Round-trip carshare vehicles will be treated like general public vehicles when not parked in a Home Space.
- At the City's discretion, on-street Home Spaces may be provided for the exclusive use of a single CSO, for a period of one year before the space must be renewed, transferred or relinquished. Both round-trip and one-way carshare providers may request Home Spaces.
- The City may allocate up to three percent of available on-street parking space to Home Spaces in commercial areas, including the downtown core. The amount of space that may be allocated to Home Spaces in residential areas shall be at the discretion of the City, with due regard to local context.
- The City will establish a process for periodically allocating and reviewing on-street Home Spaces to one or more CSOs, with the aim of ensuring equitable distribution between CSOs. The City reserves the right to deny location requests.
- Home Spaces should not be located on blocks with time-of-day parking restrictions, or immediately in front of single family dwellings.
- The City may temporarily close an on-street Home Space at its discretion. The City will make best efforts to provide reasonable notice of closures.
- The City may permanently revoke a permit for an on-street Home Space at any time in the event of public need, lack of use by the CSO, or failure of the CSO to comply with City policy or bylaws. In the event a space is permanently revoked for public need, and more than six months remains in the current allocation period, the impacted CSO may apply to The City for an alternate location or for a prorated rebate of the rental value.
- CSOs may request off-street Home Spaces in CPA lots or Calgary Transit park and ride lots using the same application process in place for individual private applicants.

Carshare Parking Enforcement

- Carshare vehicles must adhere to maximum time restrictions in managed on-street space (e.g. 2 hour parking zones). Enforcement and ticketing procedures applied to privately-owned vehicles will be applied to carshare vehicles.
- Carshare vehicles parked on a designated snow control route, including in Home Spaces or Reserved One-Way Spaces, must be moved when a snow event is declared. Carshare vehicles must also be removed when street sweeping bans are in place.
- CSOs are responsible for paying all fines and towing fees.

- On-street Home Spaces can be temporarily closed by The City at its discretion (e.g. for construction, street fairs, emergency repairs, etc). The City will make best efforts to provide reasonable notice of closures.
- The City shall enforce parking restrictions for on-street Home Spaces or Reserved One-Way Spaces, including ticketing and towing of unauthorized vehicles, when infractions are identified by The City, CPA, or CSOs and their members.

Carshare Contracts

- Each CSO operating in Calgary must have a contract with The City and the CPA in order to allow trips to be ended on-street in public right-of-way. The contract must align with the carshare parking policies, and include the following:
 - An agreed-upon arrangement for paying parking fees.
 - Mechanisms to redistribute carshare vehicles when repeated vehicle clustering occurs.
 - CSOs are required to be proactive and reduce or prevent vehicle clustering where it is reasonably possible.
 - The City and/or CPA will notify the CSO, in writing, when vehicle clustering has been repeatedly observed.
 - Provision of the following documentation from the CSO:
 - Annual proof to The City of the necessary insurance;
 - Monthly reports to the CPA on parking activity in managed street space and RPP blocks, as well as the size of the CSO fleet; and
 - Annual data to The City on membership levels, as well as survey data to The City regarding:
 - changes in member's private automobile ownership;
 - changes in member's use of walking, cycling, transit, carshare and private automobiles;
 - aggregate membership demographics;
 - membership location using the first three digits of the postal code (to be kept confidential by The City);
 - major origin and destination areas (to be kept confidential by The City); and
 - dynamic maps showing 24 hour movement of vehicles for a typical weekday and weekend day (to be kept confidential by The City), if available.

Combatting Clustering

- The City will focus enforcement of clustering in the following areas:
 - In commercial pricing areas where the previous year's average occupancy exceeded 80 per cent during a given parking management period:
 - CSO vehicles shall not exceed 25 percent of available space in an individual ParkPlus zone, averaged over a month (excluding Reserved One-Way Spaces, Home Spaces or other permit-restricted spaces).
 - CSOs will be assessed a surcharge to hourly parking rates for the CSO's vehicles parked within the ParkPlus zone, as averaged over a month. The surcharge will be determined by the CPA, based on the extent to which the threshold has been exceeded, to a maximum of a 25 per cent increase over normal hourly rates.
 - On residential blocks with posted RPP restrictions where complaints are repeatedly received and total occupancy exceeds 60 per cent.
 - CSO vehicles shall not exceed 20 percent of available space on a block with posted RPP restrictions, averaged over a month (excluding Reserved One-Way Spaces, Home Spaces or other permit-restricted spaces).
 - Should the 20 per cent threshold continue to be exceeded for a period of six consecutive months after notification of the issue, The City may revoke access to the individual RPP zone for all of the CSOs vehicles, until such time as The City, CPA and CSO arrive at a mutually acceptable solution to the issue.

4.3 Denver

(information obtained from Denver Car Share Program 2017 Summary, Denver Public Works, and Robin Ferrin, Parking and Planning Program Administrator, Denver Public Works)

In May of 2013, the City of Denver adopted rules and regulations pertaining to private operators providing car sharing to Denver residents, employees, and visitors. Under the arrangement, CSOs provide a fleet of vehicles that individuals may use for personal or business trips, provided they are registered members with the car share provider. Four CSOs currently are active in Denver, eGo Car Share, Car2go, Zipcar, and Maven.

One-Way Carshare Parking Policies and Fees

Denver offers Vehicle Area Permits for one-way carshare vehicles. These permits exempt vehicles from meter payment and residential permit restrictions at locations with time limits of 2 hours or greater. Each Vehicle Area Permit costs \$850 annually. This fee was established based on the estimated idle time vehicles spend at the

parking meter. Enforcement agents have mobile access to a permit database, allowing them to accurately enforce parking restrictions on carshare vehicles.

Dedicated Space Permits

Denver’s permit program also allows CSOs that carry both one-way and two-way vehicles to purchase Dedicated Space Permits. These permits include signage provided by the City that contains the CSO’s logo. The City allocates at most 30 spaces to the downtown region. Currently, Zipcar has ten spaces, Car2go has seven spaces, eGo Car Share has three spaces, and Maven has nine spaces (Figure 1). Spaces are assigned to a three-tiered geographic price zone. Downtown spaces cost \$750 annually, non-downtown neighborhood spaces cost \$500 annually, and “opportunity areas,” lower density locations, cost \$250 annually. Operators must pay a higher fee if they choose to remove a meter, which is negotiated ad hoc.



Figure 1. Denver Designated Spaces

Operators are required to maintain 75 percent of their total car share fleet off-street. This requirement ensures balance in the parking lane with other uses and provides car share opportunities in areas where on-street dedicated spaces are not feasible.

4.4 New York City

(information obtained from Carshare Permit Application, and Section 4-08(o)(6) of Traffic Rules, New York City Department of Transportation)

New York City currently has three active CSOs, two two-way CSOs (Zipcar and Enterprise Carshare) and one one-way CSO (Car2go). Despite having a heavy ridehailing and taxi presence, carsharing has carved out a reliable niche in New York City, perhaps due to the city's low cars per household ratio of 0.6, among the lowest in North American municipalities.

Carshare Pilot Program

New York City recently launched its new Carshare Pilot Program (CPP) at the end of May, 2018. The CPP is scaffolded by two bills signed by Mayor Bill de Blasio on March 21, 2017 that requires the New York City Department of Transportation (NYC DOT) to create a carshare program that enables CSOs to apply for parking spaces on street and at designated municipal parking facilities. The stated goals of the program are to expand equitable access to carshare. Neighborhoods that are currently underserved by carshare services or have populations of primarily low-income New Yorkers in particular stand to benefit from the CPP. The pilot will also analyze the impact of carshare on car ownership, total vehicle miles travelled (VMT), and on-street parking availability. Results of the pilot will determine how the city decides to proceed with carshare parking policy in the future. This program is open equally to CSOs offering both one-way and two-way services. In order to participate in the CPP, interested CSOs must first pay a \$765 application fee.

The CPP will make approximately 300 on-street carshare designated parking spaces freely available. Fourteen neighborhoods, spread over all boroughs except Staten Island, will each be allotted ten to thirty spaces (Figure 1). Spaces will be located on street corners, in residential and unmetered areas. Wherever possible, spaces will be assigned to CSOs in pairs. On-street carshare parking spaces will be regulated by curb signage only authorizing a CSO's vehicle assigned to that carshare parking space to park in that location. The regulatory sign will feature the logo of the CSO holding the permit for that space. While NYC police will monitor carshare spaces and tow or ticket impermissibly parked vehicles, the CSO also has the authority to tow these vehicles at their own expense.

The CPP will make available 10% or 10 spaces (whichever is less) of parking spaces in all NYC DOT municipal parking facilities to eligible CSOs. The NYC DOT will assign spaces in pairs within each facility to eligible

CSOs. NYC DOT operates two types of facilities: 29 parking fields, which are outdoor, unattended, metered lots; and 7 parking garages, which are multi-story structures with controlled entry and payment options that range from pay-by-the-hour to monthly permits. If a CSO secures a designated spot through the CPP, they must pay whatever relevant fee is charged at that particular municipal parking facility. At least seven parking spaces with level two electric vehicle chargers—one in each of seven garages—will be made available to interested and eligible CSOs. While some parking garages provide 24-hour access to parked vehicles, many municipal parking facilities have operating hours that carshare companies will have to accommodate.

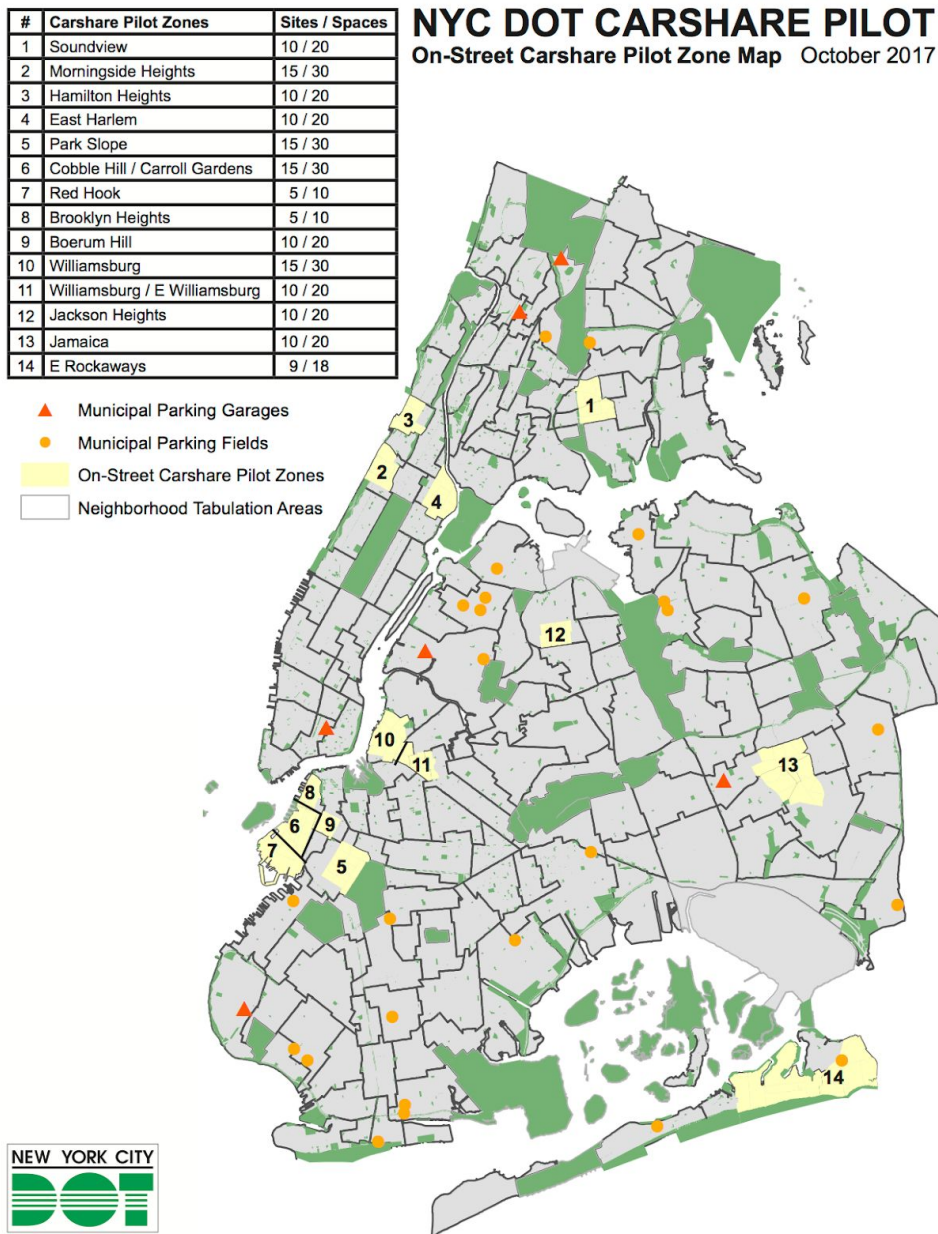


Figure 2. NYC Carshare Pilot Program On-Street Parking Zones

To assign on-street and lot/garage spaces, CSOs need to submit to the City a ranked list of all potential carshare locations (Figure 1). To meet the equity requirements of the CPP, at least 20% of spaces selected by CSOs must be designated as equity parking spaces, located in areas currently underserved by carsharing or areas that have a median income below the citywide average. Spaces will then be distributed to CSOs draft style, with CSOs receiving their location of highest available preference in a rotating order.

Providing equitable and accessible carshare service to all New York residents is a large component of the CPP. In addition to locating at least 20% of spaces in low-income neighborhoods, CSOs that provide discounted services to residents of the low-income New York City Housing Authority, or other residents that meet similar financial criteria, will also have the opportunity to secure additional on-street parking spaces. CSOs also have the opportunity to secure more spaces by providing one or more hand control adapted carshare vehicles, in order to make their fleet more accessible to the handicapped population. One-way CSOs participating in the pilot also must expand their home area to include the entire carshare parking zone (Figure 1) in which an equity space is located.

Other Carshare Policies

Other than the pilot program, carshare vehicles have limited rights in New York City. One-way vehicles cannot park in metered or residential areas for any amount of time, and one-way users need to be especially wary of parking on streets with scheduled street sweeping.

4.5 Portland

(information obtained from Colleen Mossor, Management Analyst, Portland Bureau of Transportation)

Portland has two active one-way CSOs, Car2go and ReachNow, and one active two-way CSO, Zipcar. The City of Portland recognizes that carsharing provides benefits to the City and its residents. In order to support carsharing in Portland, the Bureau of Transportation allows carshare organizations to obtain parking permits for carshare vehicles to park in the public right-of-way. Permits are relatively cheap compared to other municipalities, especially for residential parking.

One-Way Carshare Parking Policies and Fees

One-way carshare vehicles may stop-over in any on-street parking space open to the general public, and may end their trip in any on-street parking space open to the general public. Carshare vehicles are allowed to stay at a meter indefinitely, longer than the time restriction for private vehicles. CSOs are responsible for paying all of their time associated with metered parking, as tracked by their API. Quarterly payments generally approach \$90,000 for ReachNow (which has 350 operating vehicles) and \$120,000 for Car2go (which has 450 operating

vehicles). The City is currently developing an auditing process to ensure that CSOs are accurately paying metered fees. City interns will be given access to the CSO API and will spot check metered locations.

Until recently, residential parking permit fees included, per vehicle, a \$50 annual administrative fee in addition to the most expensive area parking permit offered by the City. However this policy was changed recently to a flat \$100 annual fee per vehicle, a rate that is far more affordable for the CSO than many other studied municipalities.

There are no official City policies to combat clustering. If the City receives word of sustained clustering from local residents, they offer a courtesy call to the CSO. Due to this system, and Car2go and ReachNow's compliance and willingness to move vehicles, there have been very few instances of sustained complaints from business owners or homeowners. According to Colleen Mossor, Management Analyst at the Portland Bureau of Transportation, this is due in large part to the good working relationship between the City and its CSOs.

The City recently launched a new initiative to streamline the citation paying process for CSOs. Every month, each CSO receives a list of citations, which they go through and determine on a case by case basis if the customer was at fault. If so, the City reissues the citation in the customer's name, enabling them to directly pay the citation.

Two-Way Carshare Parking Policies and Fees

Until recently, three two-way CSOs operated in Portland, Zipcar, Getaround, and UHaul Carshare. When this was the case there was an annual auction for designated parking spaces, with the highest bidder getting preferred access. In addition to the auctioned annual fee, the winning CSO also pays an annual \$50 administrative fee plus a one-time \$300 signage fee.

Despite CSOs winning designated spots that could only be used for their vehicles, the City would not put up signs advertising the names of CSOs, opting instead to use signage that simply said "Carshare Vehicle." This is due to the City's strict no advertising in roadway zone policy, which applies to all corporations.

This policy will soon be updated. With Getaround and UHaul's recent departure from Portland, Zipcar currently bids against itself for new parking spaces.

4.6 Salt Lake City

(information obtained from Dan Bergenthal, Transportation Engineer at Salt Lake City Transportation Division)

Salt Lake City does not currently have any active CSOs, but were included in this study because of an interesting initiative that ultimately failed. In 2009, the City decided to offer free parking at eighteen spots for a two-way CSO. Thirteen spots would be located across the City and the remaining five would be at the University of Utah. Locations were picked as areas of high population density and were mostly found within the downtown core. Most of the spots were previously paid, metered parking areas. The transportation department provided signage for the CSO at every location free of charge. The City decided to go forward with this initiative, which included losing income that would otherwise be provided by metered parking, because of the belief in the social, environmental, and transportation benefits of carsharing. The City first came to an agreement with UHaul Carshare, which operated out of the subsidized parking spots until 2012, when the City resigned its deal with Enterprise Carshare. This program was associated with the Salt Lake City Green Vehicle Parking Program, which gives free metered parking to all vehicles that meet certain mileage standards (currently greater than 41 mpg city) or an EPA Smog Rating (currently greater than 8). Vehicles in the carshare program were requested to pass these environmental efficiency standards.

Unfortunately, by 2017 Enterprise decided to cease operations in Salt Lake City, and the program officially ended. According to Dan Bergenthal, Transportation Engineer at Salt Lake City Transportation Division, the program ended primarily because the CSOs did not advertise enough for the technological diffusion to reach an inflection point where Salt Lake City residents would be familiar with carsharing.

4.7 San Francisco

(information obtained from Vehicle Sharing Parking Permit Policy, San Francisco Municipal Transportation Agency)

The San Francisco Municipal Transportation Agency (SFMTA) 2013-2018 Strategic Plan states as a goal: “Make transit, walking, bicycling, taxi, ride sharing, and car sharing the preferred means of travel.” To this end, the SFMTA has adopted policies to encourage and facilitate carsharing because of its social, environmental, and transportation benefits. The goal of the of the policy is fourfold:

- Make it easy for vehicle sharing organizations to place vehicles in San Francisco.
- Minimize requirements and limitations on CSO operations to enhance their ability to grow.
- Make the program as simple and efficient to administer as possible.
- Make carsharing as equitable and available to as many people as possible.

SFMTA has two carsharing programs, one for off-street spaces and another for on-street spaces. To participate in the on-street program, a CSO must providing access to at least ten vehicles to the city of San Francisco that

are for shared use 100% of the time. These vehicles must be available for pick up twenty-four hours, seven days a week, and they must have the CSO logo prominently displayed. Under these requirements, only two CSOs in San Francisco qualify for the on-street program, Maven and Zipcar (Getaround is a peer to peer service, while Enterprise Carshare recently left). Both these CSOs are round-trip services, and as such are subject to all parking rules and regulations when parked anywhere other than a permitted on-street carshare parking space.

The SFMTA acts accordingly when approving an on-street carshare vehicle parking space:

- SFMTA accepts requests for on-street parking space permits on a rolling basis from certified CSOs.
- SFMTA staff will review each space based on technical merit and the stated goal of advancing car sharing citywide.
- If a CSO abandons a parking space, the SFMTA will then offer that space to other CSO (on a first come, first serve basis). If another CSO does not want to place a shared vehicle in that parking space, the SFMTA will consider what other use of the curb would provide the most benefit (e.g., taxi stand, commercial loading zone, bicycle parking, intersection daylighting, etc.).
- SFMTA will grant a maximum of 1,000 dedicated on-street carshare parking permits.
- SFMTA will not consider applications for shared vehicle parking permits at metered parking spaces in most cases, given the need for business-serving metered parking on neighborhood commercial corridors.
- Once a permit application for a carshare on-street parking space has received preliminary SFMTA staff approval, the permit application undergoes the following approval steps:
 - Review by SFMTA transportation engineering staff to avoid conflict with other projects and initiatives or other regulations (e.g., locating a space in a tow away zone).
 - Review by the Transportation Advisory Staff Committee (TASC) to notify relevant SFMTA divisions and other City departments (e.g., Planning Department, DPW, SFPD).
 - An SFMTA Transportation Engineering Public Hearing.
 - Approval of the designated parking space by the SFMTA Board of Directors

Once approved, the SFMTA installs curb painting and signage for the permitted space. The CSO pays a monthly fee per space. SFMTA uses a three-tiered geographic “Pricing Zone” system to incentivize equal distribution of spaces across the city (see Figure 1). Permits for Zone 1, the urban core of San Francisco, are most expensive, with Zone 2 permits second most expensive and Zone 3 permits least expensive. This pricing scheme incentivizes CSOs to place their vehicles in outer areas where the population is less dense and where transit coverage is thinner. Zone 1 spaces cost \$285 per month, Zone 2 spaces cost \$180 per month, and Zone 3 spaces cost \$50 per month.

CSO vehicles belonging to the on-street program have other benefits and parking protections. The SFMTA issues an On-Street Shared Vehicle Parking Permit that restricts the use of a permitted parking space to a member-available vehicle of the permitted CSO. CSO vehicles parked at a permitted on-street parking space will be exempt from street sweeping, residential parking permits, and other time limit restrictions. Other vehicles parked in a carshare reserved parking space are subject to a \$110 fine and may be towed. If construction projects threaten to close a CSO permitted space for a significant period of time, SFMTA staff have the authority to create temporary on-street parking spaces to ensure that the permit is upheld.

The off-street carshare parking program is smaller than its counterpart, and entails the following:

- The SFMTA will accept requests from qualified CSOs for parking permits in SFMTA-administered parking lots and garages on a rolling basis.
- In SFMTA controlled parking lots, no more than 30 percent of the spaces may be allocated for shared vehicles.
- In SFMTA controlled parking garages, no more than 20 percent of the spaces may be allocated for shared vehicles.
- No one CSO may occupy more than 66 percent of spaces available for shared vehicles in any lot or garage.
- For garage and parking lot permit requests, the SFMTA will grant permits depending on space availability and other constraints, at the SFMTA's discretion; not all requests may be granted, and a waiting list may be maintained.

4.8 Seattle

(information obtained from Becky Edmonds, Senior Transportation Planner, Seattle Department of Transportation)

Seattle currently has four CSOs, including two one-way services, Car2go and ReachNow, a two-way service, Zipcar, and a peer-to-peer service, Getaround. Currently there are no parking policies that apply to Getaround, whose members generally prefer to park either off-street or in private lots. Seattle does not have many governmental incentives or subsidies for carsharing, although building developers can negotiate on an ad hoc basis for a designated carshare spot. The City also does not have any policies to combat clustering of one-way vehicles, despite this regularly being an issue at some locations, including Starbucks HQ. The City is, however, in the pilot process of its Low-Income CarShare program, an initiative within the City's Transportation Equity Program

One-Way Carshare Parking Policies and Fees

- CSOs annually pay a permit of \$930 per vehicle towards metered parking. This allows vehicles to park in any metered area that offers more than one hour of parking time.
- If a vehicle spends more than \$930 worth of metered time, the CSO is required to pay the difference. To enforce this, CSOs are required to provide The City access to their API. Spot checks on particular cars ensure that the city is being reimbursed for any metered time spent over the initial \$930.
- In addition, CSOs annually pay \$800 per vehicle towards a residential parking permit. This is further broken down into a \$100 administrative fee, \$200 parking zone fee, and a \$500 fee towards other TDM programs.
- One-way vehicles are not allowed to park in:
 - Temporary No Parking Zones (due to an event, construction, etc.)
 - Less than 5 feet from a driveway/alley entrance or crosswalk
 - Areas with specified time restrictions (e.g. Bus Only 3-6PM) except for downtown areas along Avenues 1-6 between 9 AM - 2 PM.
 - Bus stops, Taxi/Motorcycle Parking
 - Disabled spaces (unless you have a valid permit displayed in the car)

Two-Way Carshare Parking Policies and Fees

- Zipcar (the sole two-way provider in Seattle) annually pays \$3,000 for a designated space paid parking zone (metered spot) and \$300 for a designated space in a non-paid parking area.
- Two-way cars are subject to all parking rules and regulations when parked anywhere other than a permitted on-street carshare parking space.

Low-Income Carshare Program

Seattle is in the pilot stages of its low-income carshare program, an initiative within the Transportation Equity Program. The City has partnered with Car2go and ReachNow to offer free rides to residents of the Salem Housing Authority, a public housing mission. This program is targeted to areas of the population that are currently underserved by other transportation options. The City purchases minutes of travel time from Car2go and ReachNow and distributes them freely to members of the Housing Authority. For the pilot low-income residents do not pay for carshare rides, in the future they may pay a subsidized fee. This program guarantees revenue for Car2go and ReachNow. If successful, future iterations of this pilot may include a fleet solutions model where residents are guaranteed access to vehicles that are specific only to their building.

4.9 Toronto

(information obtained from Update on Free-Floating Car-Share Pilot and Interim Policy, Toronto Transportation Services)

Carsharing in Toronto is currently undergoing a period of flux. Car2go, the largest CSO in the City, officially ceased operations in Toronto May 31, 2018, after operating in the city since 2012. Car2go blamed the Toronto City Council and their new, heavily amended 18-month pilot program. “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,” said Paul DeLong, the CEO of Car2go North America. The primary complaint Car2go had with the pilot is its stipulation that the City would not allow free-floating carshare vehicles to park on residential streets that are at 95% of capacity for parking permits, or where there are wait lists for permits. Car2go also stated issue with the high parking permit fee of \$1,487.85.

Due primarily to Car2go’s withdrawal from the City, Toronto Transportation Services has been in consultation with free floating CSOs. The City is currently considering changes to its pilot that would enable Car2go to resume operations. On July 17, 2018, Toronto published an update to its pilot program. This update includes a summary of key policies found in the pilot as well as responses and criticisms from seven free-floating CSOs. The primary worries CSOs have about the pilot are its relatively short 18-month time frame, high residential permit fee, new areas restricted from parking, and more stringent policies to combat clustering.

One-Way Carshare Parking Policies and Fees (Latest Update)

- Pilot Policies
 - Up to 500 overnight on-street permits can be issued per carshare company for customers to park on permitted streets (for a maximum of 2,000 total permits).
 - The Free-Floating Car-Share pilot permit fee is \$1487.85 plus HST.
 - Car-share companies must pay outstanding fines or penalties before permits can be issued.
 - Excluded Areas
 - Streets and areas that are at 95 percent capacity or more for residential permit parking must be excluded from the car-share company/organization’s car-share service area via geo-fencing within the respective car-share company/organization’s trip reservation system. A list of excluded streets/areas that are at 95 percent capacity or more for residential permit parking will be provided by the City at the beginning of the permit period and updated every six months.
 - Six months after the commencement of the pilot, Community Council has the authority to add/remove and/or exclude a street and/or area from the pilot, after providing public notice.
 - Clustering of Car-Share Vehicles

- No more than one car-share vehicle from the same company is allowed to park on a street block with residential permit parking for any length of time. The car-share company must move its vehicle within two hours of a complaint.
- Feedback on the pilot
 - Timing of the Pilot Project
 - At least two companies indicated that establishing a free-floating car-share service requires a large capital investment (in the range of \$5 million or more), and can take several years to establish a customer base.
 - Companies fear that more restrictive carshare regulations might be adopted after the pilot program's 18 month timeframe. Some companies suggested that the pilot project have a longer timeframe than 18 months in order to mitigate the risk involved in participating in carsharing in Toronto.
 - Several companies expressed concern that the start and end dates of the pilot project should be revised, given that Council has directed staff to consider potential changes to the terms of the pilot.
 - Permit Fee
 - The pilot permit fee was established based on a review of other jurisdictions and is consistent with the City of Toronto's fee structure for the existing Car-Share Vehicle Parking Area (CVPA) program for areas where there is an impact to residential permit parking.
 - Some companies expressed concern that the pilot permit fee (approximately \$1,500) is the highest fee of all North American jurisdictions. It was acknowledged that the permit fee in Montreal is approximately \$1,300 (plus GST/QST).
 - Other companies supported the pilot permit fee, indicating that it was fair in comparison to the existing permit fee for the CVPA program. If the fee for the FreeFloating Car-Share pilot were to be reduced, it should be through a comprehensive review of established permit fees for the CVPA.
 - Permit-Parking Areas Excluded From the Pilot
 - Most companies expressed concern that streets and areas at 95 percent capacity or more for residential permit parking are excluded from the pilot. Car2go indicated that this was their most significant concern about the pilot as it would impact 50 percent of trips taken daily by Toronto residents who were members of their service. This would make operating in Toronto unviable, and was the primary reason for their decision to leave the City.

- Other companies felt that their systems could manage excluded areas through geo-fencing and in-vehicle communication messages to their members and that Council could decide to change the restrictions in the future, following the pilot project, once the impacts and benefits were more fully understood.
 - Major concern was expressed from several companies regarding the potential increase of restrictions during the pilot project, through the delegated authority granted to Community Council to further exclude streets and areas. The high degree of uncertainty this creates about the base area within which free-floating car-share services can operate is a significant risk to the sizable amount of capital investment required by these companies to launch free-floating car-share services in Toronto.
- Restrictions on Clustering of Car-Share Vehicles
 - Concern was expressed by several companies regarding the restrictions against clustering of more than one car-share vehicle from the same company parked on a street block and that the car-share company must move its vehicle(s) within two hours of a complaint. One company raised concerns about the additional operating cost of relocating vehicles and requested that the threshold for the number of vehicles considered to be clustering be increased, along with a lengthening of the two-hour time limit.
 - It was acknowledged that while such clustering can be a concern for residents in some areas, it tends to happen as a result of a higher number of local resident neighbours who use car-share services living on that street. In other cases, it can happen as a result of proximity to a key destination such as a transit station, where car-share vehicles are used for the "first-mile" as part of a multi-modal trip.
 - Several companies indicated that clustering was an issue that can be managed and mitigated, as they have done in other jurisdictions, but would not be possible to prevent entirely. It was noted that most other cities with free-floating car-share services don't have restrictions against clustering.
 - It was suggested that the exclusion of streets and areas at 95 percent capacity or more for residential permit parking may reduce the impacts that clustering might have on local residents, as it relates to the availability of on-street parking.

Talks are still ongoing, and the ultimate fate of the pilot program is currently uncertain. The day the update was released, City Council indicated that Car2go could be open to returning to Toronto. A week later, on July 23, 2018, Toronto City Council voted to amend its permit-Parking areas excluded stipulation, the primary factor that led to Car2go's departure. Carshare vehicles will now be excluded from locations with a 100 percent permit

subscription rate, instead of 95 percent. Despite this Car2go has yet to announce any plans to return to the City.

4.10 Vancouver

(information obtained from Billy Dong and Chris Darwent, Parking Engineers, Vancouver Parking Management Branch)

Vancouver is currently served by four CSOs. Modo and Zipcar are two-way services, while Car2go and Evo are one-way services. Of all studied cities, Vancouver has the highest overall carsharing utilization, with 39.3 carshare vehicles per 10,000 residents. This can be partly explained by the current lack of ride-hailing services, such as Uber and Lyft. Vancouver has a carsharing bylaw crafted to manage the city's high carshare utilization.

On-Street Carshare Parking Policies and Fees

Unlike most other North American municipalities with high carshare utilization, Vancouver does not currently allow one-way vehicles to end trips at parking meters. One-way and two-way vehicles may purchase a permit authorizing parking in all residential permit zone and resident parking only zones for an annual fee of \$75.67. This permit also exempts vehicles from the three-hour parking bylaw, which stipulates that vehicles may not park outside of another residence between 8am-6am for more than three hours.

Designated On-Street Parking Policies and Fees

Both one-way and two-way CSOs in Vancouver are allowed to purchase designated parking spaces throughout the city. In non-metered areas, permitting fees are assigned based on a three-tiered geographic zone system. In the Downtown area and other high-density locations, CSOs must annually pay a fee of \$1,346.40 per designated space. In zones of medium density, such as the Metro Core, CSOs must annually pay a fee of \$673.20 per designated space. In the remainder of the city outside the Metro Core, CSOs must annually pay a fee of \$306 per designated space. To designate a space in a metered parking zone, CSOs must pay the maximum revenue the parking space would have generated if metered. This ranges from approximately \$3,000 to \$25,000, depending on the meter rate.

To date, 151 on-street parking spaces have been issued to CSOs operating in Vancouver. Car2go has 59 spaces, Modo has 30, Zipcar has 28, and Evo has 34.

Other Programs

Vancouver supports carshare through another incentive. The City allows developers to substitute the number of required parking spaces at new developments at a ratio of 1 designated carshare vehicle space for 5 private

auto parking spaces. This enables developers to minimize the amount of space required for parking lots, and gives residents greater access to carsharing, decreasing the necessity of car ownership.

4.11 Washington D.C.

(information obtained from Reserved On-Street Carsharing Rulemaking and Point-to-point Carsharing Rulemaking, Washington D.C. Department of Transportation)

Washington D.C. currently has five operating CSOs, Car2go, Zipcar, Enterprise Carshare, Getaround and Maven. The District Department of Transportation (DDOT) has crafted policy to manage and help with the growth of both one-way and two-way carsharing services.

One-Way Carshare Parking Policies and Fees

The D.C. Point-to-Point Carsharing Program allows one-way vehicles to be parked in any unrestricted residential parking permit zones and metered zones without the CSO paying an associated permitting fee. The DDOT gives one-way CSOs this subsidy with the hope that the Program will expand transportation options for the residents, visitors and commuters of the District of Columbia, maintain and enhance mobility and access to jobs, housing, education, shopping and recreation, and improve access to carsharing vehicles. The DDOT also believes that this program will help reduce dependence on private vehicles and therefore increase the total number of parking spaces open to the general public.

This program applies to all active one-way CSOs in the District, provided that the CSO:

- Indemnifies the District against legal liabilities associated with the use of public space with point-to-point car-sharing operations
- Has all vehicles registered in the District of Columbia and display District license plates
- Has at least seven one-way vehicles located in low-income neighborhoods as identified by the Department of Transportation

The Point-to-Point Carshare Program was crafted to ensure equal access to carsharing for all district residents. In addition to maintaining at least seven vehicles in low-income neighborhoods at all times, one-way CSOs must maintain at least one percent of its fleet in each Ward of the city at any point in time and must maintain an area of operation that includes the entire District of Columbia. To account for time required to move cars, car-sharing companies shall be allowed a maximum of two hours with zero vehicles in a Ward.

At any point, the DDOT reserves the right to change its policy and begin charging a parking fee to one-way CSOs, if they determine that this is in the public interest. In order to assess the continued viability of the

program, registered CSOs are required to shall provide the DDOT with data on a quarterly basis to help evaluate the program impact. The DDOT will base its assessment on these performance measures:

- D.C. carshare membership and rate of growth
- Geographical distribution of membership
- Utilization per vehicle per month for each month
- An annual membership survey, with questions regarding car ownership before and after joining the CSO, estimations of VKT before and after joining the CSO, and other modal transportation choices.

Two-Way Carshare Parking Policies and Fees

The DDOT also has a program authorizing the permitting of public, on-street spaces, for use as designated two-way carshare vehicle parking. All on-street parking spaces authorized to two-way CSOs cost an annual fee of \$2,890. The DDOT reserves the right to annually increase this fee by the lesser of the Consumer Price Index or five percent. Other than having the ability to park in designated spaces, two-way vehicles are treated like any other vehicle and are privy to the same parking fees and restrictions.

5. Discussion of Emerging Best Practices

It is difficult to rigorously analyze all different carshare policies to ascertain the most viable options. Policies that are successful in some cities may be unsuccessful in others, due to differing city layouts, transit systems, and population needs. Carsharing is also a new, rapidly growing and changing industry, and carshare policy has followed suit. Many policies are too new to be judged viable or not. For example, the New York City Carshare Pilot Program is currently in trial stages while the Toronto carsharing pilot is currently in a state of flux. Due to these considerations, what follows is the scholar's subjectively chosen emerging best practices for carshare policy.

With the desired outcome of taking advantage of the environment and social benefits of carsharing, CSOs should be supported through municipal practices more than other business that do not have public health benefits. Well constructed municipal carshare policy should achieve the following five goals, adapted from Calgary Parking Policies: (1) Equitably facilitate access to carshare services for all residents; (2) Allow ease of parking for CSO members, to facilitate the use of carsharing and more fully render the environmental and social benefits that entails; (3) Treat CSOs equitably, while acknowledging the differences between one-way and two-way carshare services; (4) Effectively manage low turn-over and clustering of carshare vehicles in congested parking areas; (5) Allow portions of existing or new parking spaces to be dedicated to carshare parking in commercial and residential areas.

All five policies are more easily attainable if good relations exist between the municipal governments and local CSOs. For example, in Portland clustering can be handled informally, without codified policy charging fees and restrictions for clustering infractions, because Portland and local one-way CSOs have a strong working relationship.

Adhering to goal (3) and consistently differentiating between one-way and two-way carsharing is a particularly important principle in carshare policy construction. There are discrepancies between the services in regards to how they affect personal vehicle ownership and trends in member travel patterns. In both cases, two-way services have shown to be a better TDM option, with members treating it as a substitute for vehicle ownership and preferentially choosing modes of green transportation, such as walking and biking, more than members of one-way services. This could be due to motivations behind using each of these two services, with one-way members primarily seeking life convenience while two-way members primarily seeking life efficiency from carsharing (Namazu and Dowlatabadi, 2018).

Many policies included in this study offer the same restrictions or subsidies for one-way and two-way vehicles. Both the NYC Carshare Pilot Program and the Denver Dedicated Space Permits Program, offer dedicated

spaces for CSOs at either free or discounted prices due to the benefits inherent in carsharing services, such as reducing vehicle ownership, VKT, and GHG emissions. Treating carsharing as a monolith, as New York City and Denver have done, could result in policy that would be less publicly advantageous than if the two types of carsharing services were treated separately. New York City's CPP has a strong equity-g geared component, with participating CSOs required to have at least 20% of their designated on-street spaces located in low-income neighborhoods. However, applying this policy to both one-way and two-way CSOs may be a mistake. One-way vehicles don't need to park in designated spaces, meaning that their one-way spaces located in low-income neighborhoods may go uninhabited. Similarly, Washington's equity policy is geared exclusively towards one-way vehicles and may be difficult to enforce. It requires one-way CSOs to have at least seven vehicles located in low-income neighborhoods at any given time. Again, given the free-floating nature of one-way carsharing, this policy may be difficult to enforce without the Washington D.C. DOT spending resources on careful monitoring of the one-way CSOs API.

There are multiple solutions towards achieving the five outlined goals. These following practices should be taken into consideration when creating future carsharing policy:

- Allow one-way carshare vehicles to end trips at parking meters. CSOs should either be responsible for paying all of their time associated with metered parking, as tracked by their API. Developing an auditing process to ensure the veracity of metered fees charged may be advisable. In some cases, subsidizing metered carshare parking should be considered.
- Charge a reasonable annual fee that enables carshare vehicles to park in residential parking zones, with the understanding that introducing carshare vehicles to a neighborhood may allow some residents to dispose of their private vehicles, which in turn opens up more neighborhood parking spaces.
- Allow CSOs to apply for designated on-street parking spaces through a tiered geographic payment system, with higher density zones requiring higher annual fees. This incentivizes CSOs to place vehicles in areas less likely to be served by public transportation. One-way and two-way CSOs should be treated differently when applying for designated spaces, given differences inherent in the transportation systems.
- Clustering of one-way vehicles should be managed either by on an ad hoc basis (if the municipality feels comfortable with its relationship with the CSO) or through enforcement averaged on a weekly or monthly time frame.
 - Municipalities should take care to make sure anti-clustering policy is enforceable and not overly stringent. For example Toronto's new anti-clustering policy requires that no more than one car-share vehicle from the same company be allowed to park on a street block with residential permit parking for any given time or be subject to fees and restrictions. This may

both be difficult to enforce real-time and may make it difficult for members to find parking spaces.

- Work with CSOs toward creating equitable carshare policy that allows underserved or low-income community members access to carshare. While this is a best practice, it is worth acknowledging that different cities have different needs and requirements. For example, access to carshare may be less important for low-income members of cities that have reliable and equitably distributed public transit systems.
 - Seattle’s policy enables The City to purchase minutes from CSOs and distribute them to qualifying low-income community members.
 - New York City’s policy requires CSOs to have at least 20% of its designated on-street parking spots in neighborhoods identified as low-income or currently without access to carsharing, and provides extra spots for CSOs that voluntarily give discounts to low-income community members.
 - Both Seattle’s and New York City’s programs are in pilot stages and have not yet been subject to analysis determining their viability.

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