

# Free-Floating Car Sharing As First/ Last Mile Access Solution: A Seattle Case Study

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## ABSTRACT

This report, compiled by King County Metro's Innovative Mobility program, explores the use of free-floating car share services as a first/last mile access mode to fixed route transit at park and ride facilities. Based on data collected by King County Metro during an ongoing car share parking pilot at Northgate park and ride in Seattle, this paper showcases the demand for free-floating car share as a mode of access to transit, its potential for increasing parking turnover, and the resulting usage patterns. Data sources include reports submitted by the participating car share companies for all trips beginning or ending at the selected park and ride, and a survey to participating users, among others. Early results indicate that, while this new type of access mode to transit can have a significant impact in complementing transit to facilitate car-free lifestyles, key policy questions need to be addressed in order to reassess the role of park and rides in this moment of change and innovation in the mobility landscape. King County Metro's car share parking pilot is also discussed in the context of the mobility hub concept that different transit agencies across the country are considering.

## INTRODUCTION

For decades, park and rides have served as a critical connection for residents in peripheral areas of lower density to access fixed-route transit services to key destinations within their metropolitan areas. Evidently, since this type of suburban environment is not supportive of efficient transit services, and the distances between residences and transit hubs can be too great to walk, driving is often the only practical option for accessing the transit hub. Park and rides enable travelers to limit the distance they travel in their personal vehicle by facilitating the connection with longer haul transit services, as opposed to driving the entire distance to their destination. Not only does this decrease the personal expense for the individual traveler, but also supports societal goals of reduced single-occupant vehicle (SOV) travel and greenhouse gas emissions.

Recently, the growth of metropolitan populations has led to increasing demand and overcrowding at park and rides. The classic policy solution to this challenge has been to build additional parking capacity; however, many transit agencies now find this type of long-term capital investment ineffective, given its prohibitive costs, and the knowledge that the expected induced demand would still deliver a new moment of saturation in a not too distant future. A new approach to this challenge growing in popularity among transit agencies is the management of their parking facilities, incorporating a wide range of policy tools, such as the issuing of special parking permits for high occupancy vehicles (HOV), or charging for parking, among others. The concept of creating a special HOV permit, for instance, gives priority access to the park and ride to those vehicles bringing two or more transit riders to the park and ride – this way each permitted parking stall increases its productivity of transit riders when compared to the common SOV use case. Similarly, the concept of charging for parking at park and rides is seen as a tool to optimize the use of the available parking stalls and limit abusive uses, thus also rendering a higher productivity of transit riders per stall.

In addition to improved parking management, increasingly agencies see the mobility hub concept as a more viable and broader reaching approach to park and rides and other types of transit hubs (SANDAG and Imperial County Transportation Commission 2017). Considering the growth of numerous private mobility services in the last decade, mobility hubs are called to become the point for integration between private and public mobility options in one transportation center, a place for numerous possibilities for seamless multi-modal transfers. Mobility hubs are also considered to be a great way to maximize the impact of robust fixed-route transit centers, through the deployment of improved options for first/last mile connections.

Car sharing, particularly free-floating car sharing, is one of the new privately-operated modes that could yield significant benefits through its integration with transit at a mobility hub. Free-floating car sharing services allow members to reserve and drive a car anywhere within a specified service area. For the most part, free-floating car share vehicles are parked on-street through agreements with the corresponding local jurisdiction, but dedicated parking can be arranged in off-street parking lots, particularly in areas where on-street parking is either unavailable or highly utilized. By offering free-floating car share services at a mobility hub, transit customers could, for instance, alight a fixed route service coming from downtown, and take a free-floating car share vehicle directly to their final destination in a lower density area without the need to wait for local buses, taxis or transportation network company services.

King County Metro (Metro), the public transportation agency for King County, Washington, which includes the city of Seattle, is working to leverage emerging mobility options to give people more ways to get around King County. Part of Metro's long-term vision is to transform park and rides from private car-to-bus facilities into mobility hubs that offer a wide variety of mobility services to customers. One of Metro's first pilots in this space is the dedication of parking stalls for the exclusive use of free-floating car share vehicles, plus the

additional authorization to park free-floating car share vehicles in regular stalls if the designated stalls are occupied. The pilot was launched in January 2018 at the Northgate Transit Center in the city of Seattle, with two free-floating car share providers – car2go and ReachNow. Through this pilot, Metro aimed to: i) facilitate a new mode of first/last mile access to Northgate; ii) assess how supporting free-floating car share vehicles through the provision of dedicated parking could increase parking turnover and increase access for customers; and iii) test partnering with private mobility providers.

## RELATED RESEARCH

Free-floating car share services are still relatively new, operating only in select cities in the United States and the world. The available literature on the topic is relatively limited, with most research focusing mainly on transportation mode shift after the introduction of free-floating car share in a city.

Among the studies conducted on free-floating car sharing, a common trend is that users have reduced personal vehicle usage. In a 2015 study on five car2go cities in the United States, between two and five percent of the members indicated that they had sold a car after joining the program, and another seven to ten percent of members forgo the purchase of a new vehicle. In Seattle in particular, the study showed that among active members, three percent sold their vehicles, while nine percent suppressed purchase of a vehicle. This translates into an upward estimate of 6,315 vehicles removed due to car2go's free-floating car sharing service in Seattle (Martin and Shaheen, 2016).

Studies on car sharing, and shared mobility modes in general, have shown that these services enable households to not only reduce private vehicle ownership but often times turn towards a transit-oriented lifestyle. For instance, in Buffalo, New York, Buffalo CarShare, a stationed car sharing service, reported that 59 percent of its members used public transit to get to a vehicle, and 17 percent used transit every time they made a trip using a car share vehicle (Randall 2011). Similarly, a study conducted for the American Public Transportation Association in seven American cities– Austin, Boston, Chicago, Los Angeles, San Francisco, Seattle and Washington, DC – found that common users of shared mobility modes, including car share, are more likely to use public transit, own fewer cars, and spend less money on transportation overall (Murphy, 2016).

The available research on the direct interplay between *free-floating* car share and public transit is not as clear. A number of studies have reported that the introduction of free-floating car share services has had a negative impact on transit and active mode choices among its users (Firkorn, 2012; Le Vine et al., 2014). In Seattle, a 2016 study painted a more diverse picture: 64 percent of car2go users reported no change in their usage of buses, 28 percent reported a decrease in usage frequency, and eight percent reported an increase (Martin and Shaheen, 2016). Experiences from Western Europe with free-floating car share suggest that a decrease in transit usage when the car sharing services are introduced should be interpreted as that the service “helps to make the whole transportation system more efficient” accommodating for trips for which transit may have been an inefficient solution (Becker 2017).

Research has also shown that the mobility benefit of car sharing services disproportionately accrues to advantaged populations. In a six-month study conducted among ten car2go cities in the United States, Tyndall (2017) found that access to the free-floating car sharing service is unequally distributed within the service area. Racial demographics, education, employments, and age are all strong predictors for vehicle availability. However, according to this study, median household income does not have a significant effect on whether a vehicle is available in a given area.

We believe that King County Metro's free-floating car share pilot is one of the first pilots of its kind in the United States, aiming to formalize the use of free-floating car share as a first/last mile access mode to fixed route transit services at park and rides. The closest application of this type of service that we have identified is in Munich's mobility hub (*Mobilitätsstationen*). Miramontes et al (2017) found that more than 80 percent of free-floating car share users rated the availability of parking and the connection to public transportation services as important elements of their overall transportation experience. With this paper, we aim to share first hand data on the implementation of this type of service in United States. This type of data and literature will be key to better understand how private mobility providers can complement transit, and in time, to support the setting of guidelines for the design of the mobility hubs that many transit agencies aspire to create.

## BACKGROUND AND METHODOLOGY

### Study Area and Agreements with Car Share Companies

King County Metro's free-floating car share parking pilot program launched in January 2018. The pilot comprised the designation of four parking stalls in the southwest corner of the East Park & Ride Lot of Northgate Transit Center for the exclusive use of free-floating car share vehicles, plus the additional authorization to park free-floating car share vehicles in regular stalls if the designated stalls are occupied. The Northgate Transit Center is located in North Seattle adjacent to Interstate-5, the Northgate Mall, a large movie theater, a public library, community center, and multi-family residences. The neighborhood is transitioning from a suburban mall community (one of the first in the country) to a designated urban village. Limited walking and biking infrastructure contribute to a significant percentage of people who drive to the area. There are approximately 1,000 parking stalls that serve Northgate Transit Center, and this parking fills early in the morning indicating latent demand for transit access. The Northgate Transit Center provides access to many high-frequency, all-day bus routes with direct service to major job, education, and commercial centers such as downtown Seattle, the University of Washington, and other city centers in North King County.

Northgate Transit Center was selected because of its access problems. Additionally, it is the only Metro-owned park and ride in the city of Seattle; within King County, free-floating car sharing is only available in the city of Seattle. Through this pilot, Metro partnered with the only two free-floating car share companies operating in the area: ReachNow and car2go. Through these partnerships, Metro awarded access to the park and ride to both car share companies, posted signs at the car share stalls noting that they are reserved for ReachNow and car2go vehicles, and agreed to conduct regular enforcement. In exchange, the two car share companies, ReachNow and car2go, agreed to provide Metro with detailed monthly reports for the duration of the pilot program. Each monthly report describes the location and times of trips that start and end at the park and ride as well as the parking duration for trips ending at the park and ride. Only one of the car share companies is also able to differentiate between trips that start and end at the designated stalls and trips that do so at the regular use stalls (the other company was unable to provide that detailed level of data). In addition to monthly reports, the car share companies agreed to send a quarterly Metro-drafted survey to users who started or ended trips in the park and ride. At the car share companies' request, this study will not compare differences between the two operators. The partnership agreements were initially slated to end on June 30, 2018, but have since been extended for another year to June 30, 2019.

All three organizations – Metro, ReachNow, and car2go – promoted the pilot program. Metro promoted the pilot through rider email alerts, in-person street teaming, a press release, social media, on-platform signage,

as well as directional signage entering the lot; ReachNow through a press release, customer email, social media, and in-car messaging; and car2go through a customer email, social media, and in-app messaging.

## DATA AND RESULTS

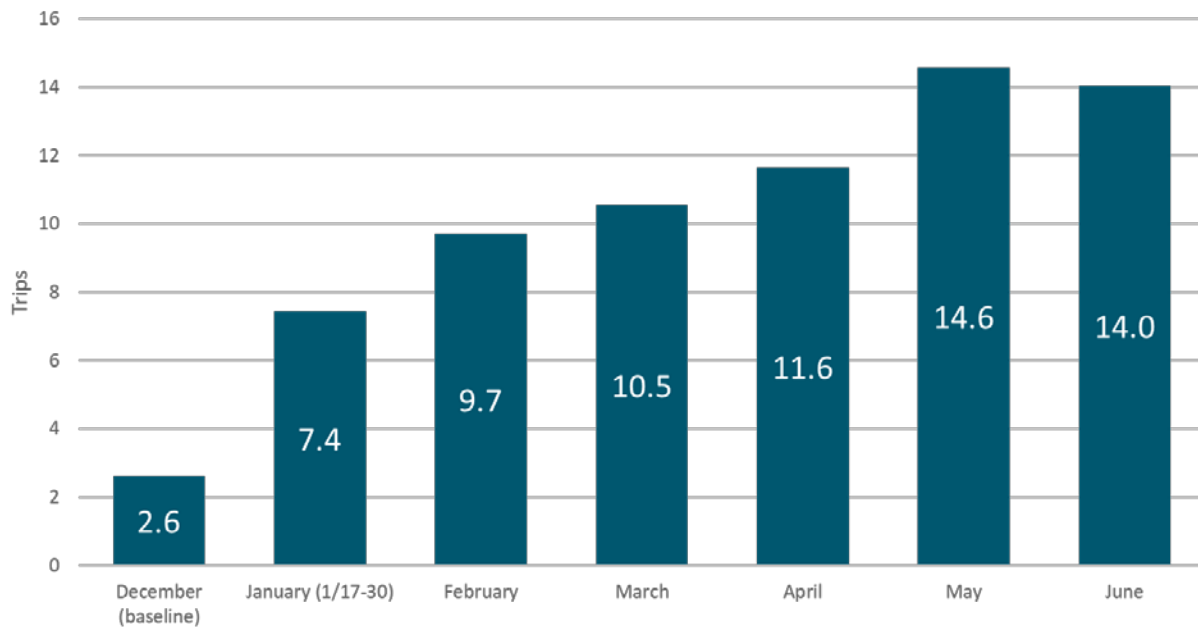
### Monthly Reports

This study utilizes data from the first five and a half months of the car share parking pilot program. Monthly utilization reports have been provided by car2go and ReachNow from January 17 to June 30, 2018. Additionally, data from December 1, 2017 to January 16, 2018 was provided as the baseline for comparison.

**Usage:** The definition of a trip for this study is one either starting or ending at the Northgate Transit Center East Lot. Prior to the start of the pilot program, some car share users were already utilizing the park and ride lot, albeit this use was against the rule that car share vehicles should only be parked on-street. The December 1 to January 16 baseline figure shows a usage of 2.6 trips per day. Since the pilot's launch, the average number of trips per day has shown steady month to month growth from 7.4 in January (1/17 to 1/30) to 14.0 in June, with the peak usage in May at 14.6 trips per day. This steady growth was predicted by the car share companies' representatives, who believed that it takes time for users to learn that this parking option is available, and change travel behavior.

**Day of use:** While the usage of the service is steadily increasing, it is not evenly distributed during the week. Car share is more highly used on the weekends, with Saturday topping the chart at 13.7 trips per day. The usage is at the lowest on Mondays, with an average of 9.9 trips. The weekend increase is possibly due to decreased local transit service as well as increased likelihood of non-routine trips, or users accessing the nearby Northgate Mall, movie theaters, or other destinations.

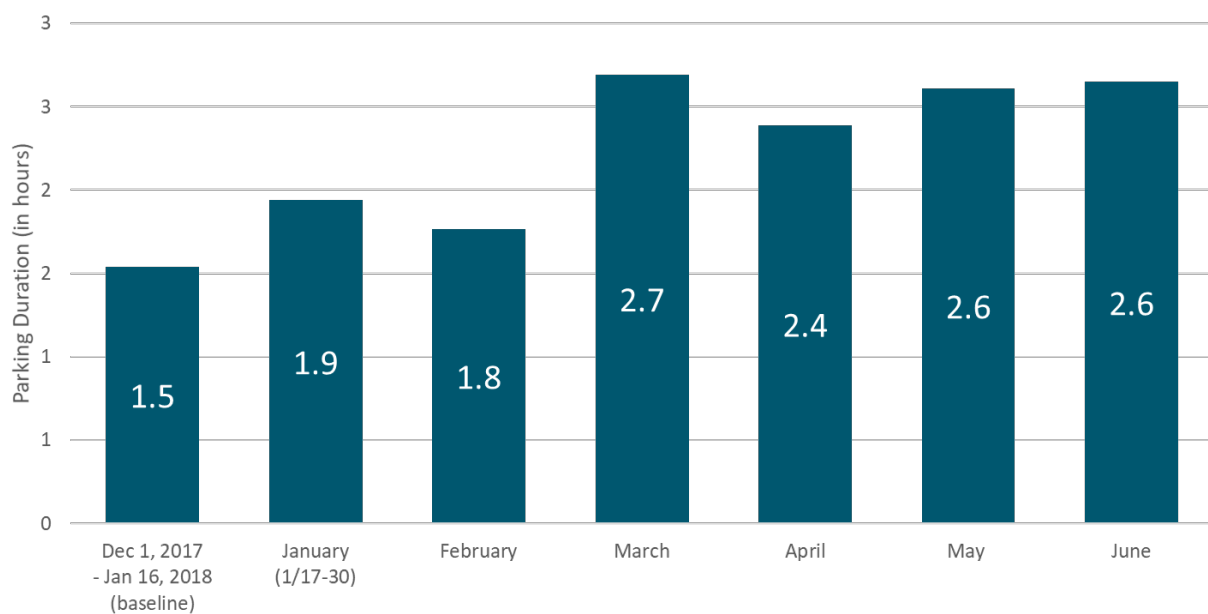
[Figure 1: Car Share Trips Per Day by Month]



**Parking duration:** During the study period, the monthly reports revealed that car share vehicles are parked at the Northgate East Lot for a median length of 2.42 hours. A median instead of an average is chosen for this

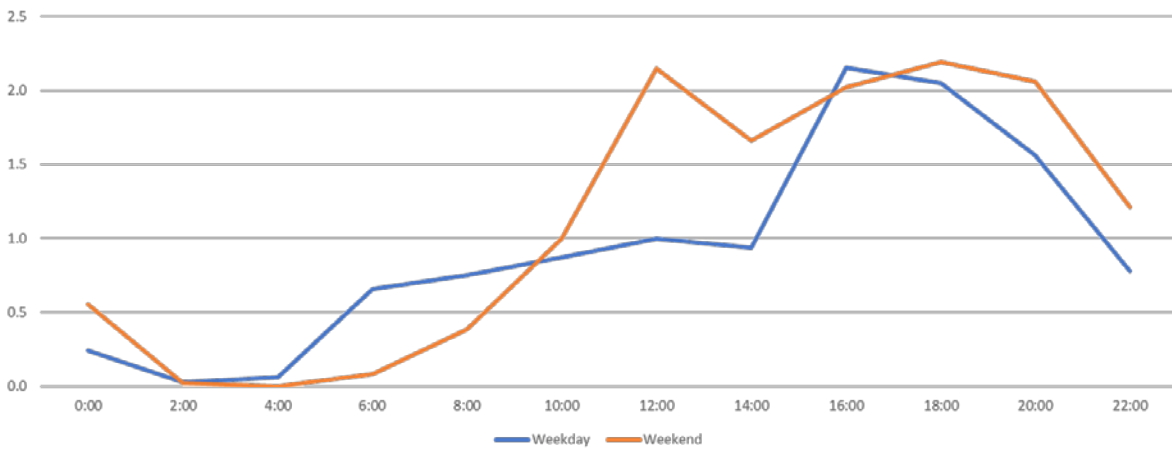
analysis as it mitigates the impact of outlier data points, typically due to vehicles left overnight or vehicles that were unavailable for reservation for extended periods of time due to malfunction. While Metro does not have the capability to collect data for how long each personal vehicle parks at any of its park and ride facilities, Metro does track general use patterns of its high capacity park and ride facilities. An internal Metro report on parking management at the Shoreline Park and Ride (located 5 miles north of the Northgate Transit Center) shows that between the hours of 8:00 a.m. to 3:00 p.m., the lot is occupied at above 90 percent capacity, with very few trips starting or ending during this time period (King County Metro, 2018). Similar reports for other facilities and general internal agency experience indicate that this pattern is replicated at Northgate – about 90 percent of the personal vehicles that utilize the facility park for at least seven hours. Accordingly, the estimated duration of a parking event by a private vehicle at Northgate is almost three times (2.92) that of a free-floating car share vehicle.

[Figure 2: Median Duration of Individual Car Share Parking Events by Month]



**Time of use:** In addition to the finding that car share vehicles are parked for about one third of the time of personal vehicles, the hours of high utilization of car share vehicles (both arriving and leaving the park and ride) do not coincide with the hours of high utilization for general purpose vehicles. The highest utilization for car share vehicles on weekdays was observed between 4:00 pm and 8:00 p.m., which are later than the typical hours of high utilization of general purpose vehicles during the week which are between 8:00 a.m. and 3:00 p.m. (King County Metro 2018). Weekend days exhibit a lengthier continuous period of high utilization of car share vehicles from 12:00 pm to 8:00 p.m. This usage pattern correlates to the need of more flexible travel options for evening and weekend travel. This pattern is consistent with car share companies’ experiences, wherein users typically rent car share vehicles for non-routine trips and are less likely to car share for morning commutes, which are generally more predictable.

[Figure 3: Average Daily Utilization of Car Share by Time of Day: Weekday vs. Weekend]



**Distance:** In terms of distance traveled, the median travel distance for car share users to or from Northgate Transit Center is 4.45 miles, which is 1.6 times greater than the median distance traveled to or from Northgate Transit Center by general users (2.72 miles) (King County Metro 2017). It is worth noting that the mileage reported per car share trip is for the entire car booking, which may include multi-stop multi-purpose trips during the reservation period, suboptimal routing choices, and even days-long out of town trips. The inclusion of outlier trips was mitigated by using the median instead of the mean. Conversely, the median distance of private vehicles driven to the park and ride is measured as the geodesic (“as the crow flies”) distance between the point of origin or destination and the lot as opposed to actual distance traveled. We suspect that the actual average distances traveled between the last origin/first destination point and the park and ride do not vary as considerably between car share trips and general users.

### Parking at Designated Stalls

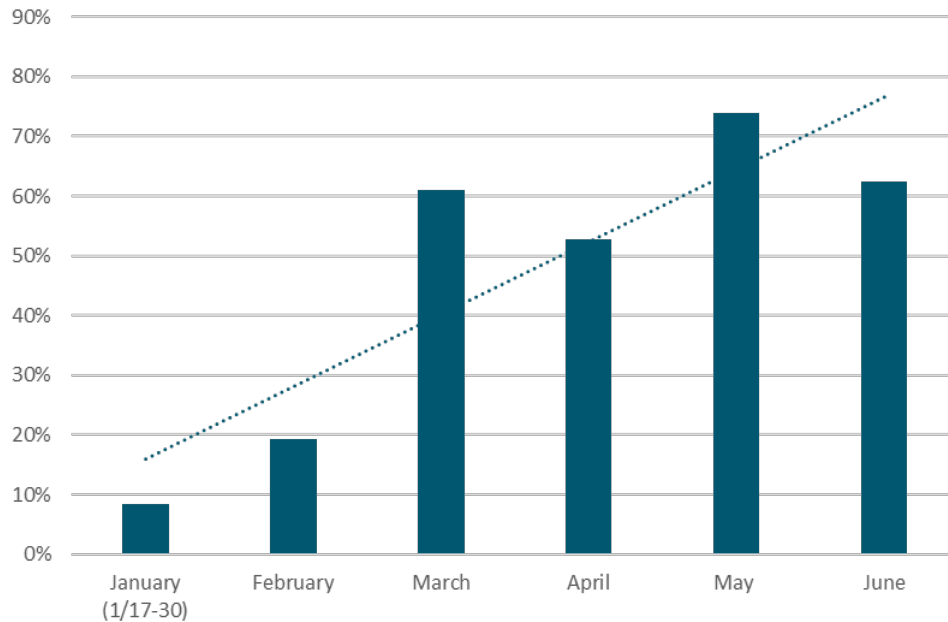
As part of the monthly report, one of the two car share companies provided data on whether their vehicles were parked in the four designated stalls (as opposed to other general purpose stalls). The utilization rate of the designated stalls has been low, although it is steadily increasing from month to month. As the one company that has provided Metro the data on designated stall usage shares a lower proportion of the overall car share utilization of the park and ride lot, this portion of the analysis is more limited.

For the car share company that provided designated parking stall occupancy data, the percentage of car share trips to the park and ride lot that ended in the designated stalls has increased from less than 10 percent in January to more than 60 percent in June. The stalls are used throughout the day, though roughly follow the morning and evening peak hours, with hours of high utilization at 7:00 and 11:00 in the mornings, and between 5:00 to 9:00 in the evenings.

[Figure 4: Percentage of Trips Ending in Designated Stalls]

## Percentage of Trips\* Ending in Designated Stalls

\*Data only available from one car share company



Additionally, daily morning counts on the utilization of the four designated stalls are conducted every weekday at 8:30 and document how many of the stalls are occupied by car share vehicles from either company at that time. In January-February, no car share vehicles were found parked at the designated stalls at 8:30 am. In June, at least one stall was occupied 23 percent of the time. No more than two designated stalls have been occupied at the same time during the morning count. This observation matches the finding reported above that the hours of high car share utilization are later in the day. Metro is considering the use of electronic parking sensors to develop a more complete dataset of utilization throughout the day/week.

### User Surveys

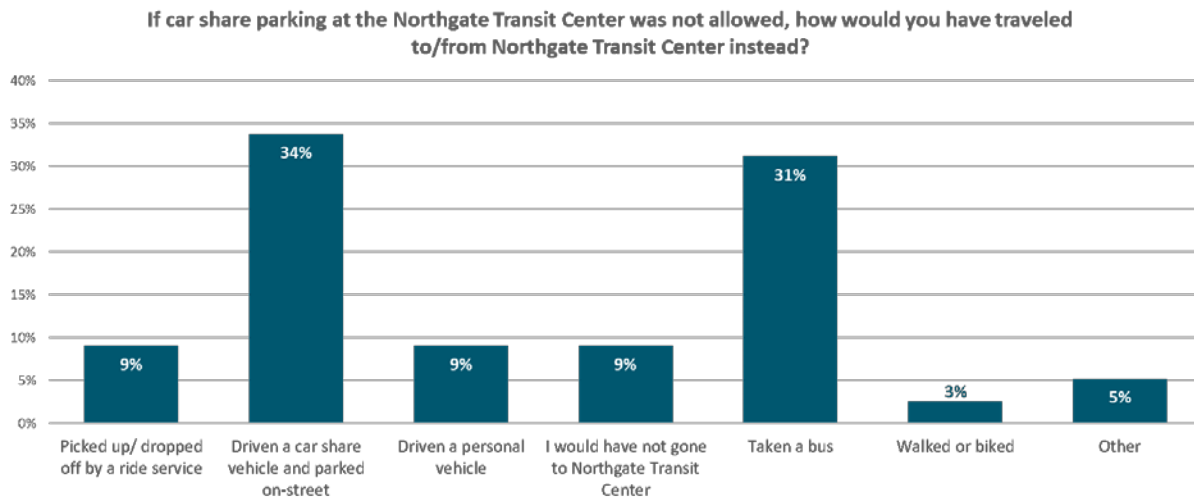
Metro-drafted user surveys were sent out in May 2018 from the two car share companies to all 488 users that started or ended a car share trip at the Northgate Transit Center lot between January 17 and April 30. The anonymous surveys consisted of three questions regarding the user experiences and opinion on the car share pilot program. There were five optional questions that inquire about the users' demographic background in terms of age group, disability, racial/ethnic identities, primary language spoken, and household income. Of the 488 surveys sent out, there were 77 valid responses from the users, a 15 percent response rate.

The first question asked "Did designated car share parking spaces at Northgate Transit Center improve your travel experience?" Three-quarters of respondents answered "Yes," while 11 percent answered "No." A further 14 percent was not aware of the designated car share parking. This shows that, while most car share users believe that this new option to access the park and ride offered by Metro has been beneficial, more marketing is needed to educate users on the availability of the designated stalls and the complementary features of the program.



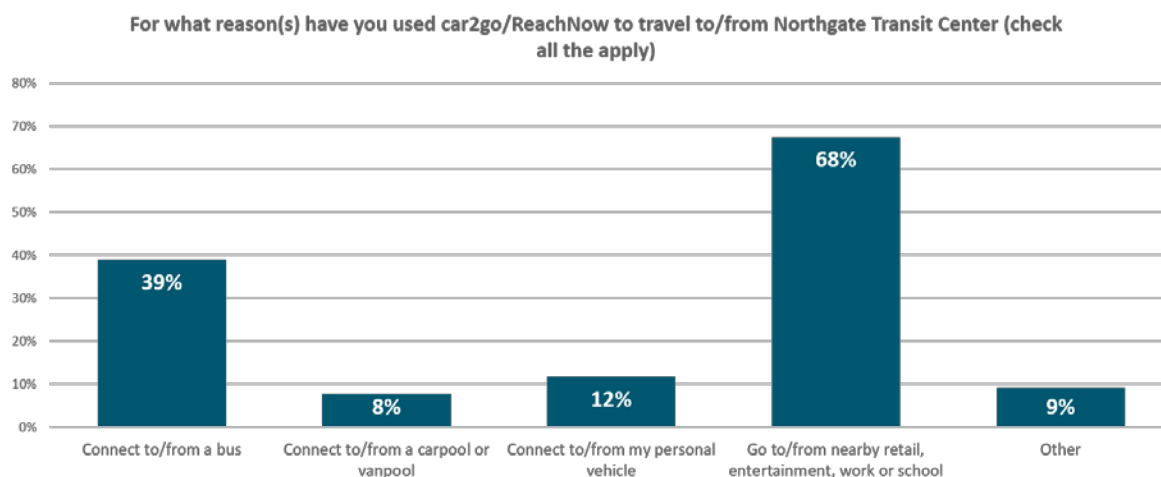
The second question touched on mode shift as a result of car share parking, “If car share parking at the Northgate Transit Center was not allowed, how would you have traveled to/from Northgate Transit Center instead?” Two-thirds of respondents reported that they would not have driven a car share vehicle, suggesting that the offering of car share parking at Northgate yielded an improvement in the mobility options available for the majority of users. The remaining one-third of the respondents would have driven a car share vehicle anyway and parked on-street.

[Figure 5: Survey Results: Mode Shift]



The third question regarded the purpose of travel to/from the study area, “For what reason(s) have you used car2go/ReachNow to travel to/from Northgate Transit Center (check all that apply)?” Approximately half of the respondents reported that they used the available car share parking to connect to transit (buses, carpool, vanpool) at Northgate Transit Center. However, the most popular trip purpose, reported by over two-thirds of the respondents, was using car share parking to access the nearby retail, entertainment, school or work destinations, which likely include the Northgate Mall just north of the transit center. The data also suggest that there could have been instances in which users completed multimodal multi-purpose trips, using car share to connect to/from transit and access some of the adjacent services near Northgate.

[Figure 6: Survey Results: Trip Reason]



Based on the answers from the demographic questions, users are generally white, English-speaking, young, and able-bodied. However, there seems to be a more diverse user profile in terms of income, with respondents coming from all income levels. This result matches Tyndall's analysis that demographics predict free-floating car sharing vehicle availability with the exception of income (2017).

## CONCLUSION

Metro's pilot aims to assess whether facilitating access for free-floating car share vehicles at an over-crowded park and ride could i) facilitate a new mode of first/last mile access to Northgate; ii) assess how supporting free-floating car share vehicles through the provision of dedicated parking could increase parking turnover and increase access for customers; and iii) test partnering with private mobility providers. Three sources of data were used to assess the first two goals: i) detailed utilization reports from the car share companies, ii) daily morning counts of the stall utilization, and iii) user surveys. The data analysis found that car share vehicles had a shorter parking duration than privately owned vehicles (with car share vehicles parked for approximately two and a half hours and privately-owned vehicles parked for approximately seven hours). This early data suggests that car share vehicles may lead to a more efficient use of the parking stalls. Additionally, car share parking activity was found to complement general purpose parking activity at the park and ride in terms of the times and days that car share vehicles utilize the facility, with car share parking being most highly utilized during evenings and weekends. This use patterns suggest that providing car share parking at the park and ride helps support 24/7 mobility, particularly for those that do not have access to a private car.

The provision of car share parking at Northgate provided a new mode of access to transit and improved travel experiences. The steady growth of daily car share trips is the first indication that there is demand for providing access to car share services at facilities like the Northgate Transit Center. From the user survey, we also learned that the majority of users reported that the designated parking spaces improved their travel experience and that they would not have otherwise used a car share vehicle to make that trip (which reinforces the notion that allowing for car share parking increased mobility options). This is further proof that fostering the use of car sharing supports a car-light lifestyle, as indicated in the literature review.

While car sharing increased mobility options and improved user experiences, more data is needed to understand the intersection between car share parking and transit ridership. Two-thirds of users reported

that they used car sharing at the park and ride to go to/from nearby retail, entertainment, work or school. This does not in and of itself suggest that users' travel was unrelated to transit or ridesharing. For example, a user could have taken transit to the area, gone shopping, and then driven a car share vehicle home (possibly at night when transit was less available or because they had purchased items they couldn't easily bring on the bus). That said, it is likely that at least some users of car sharing at the park and ride did not have any connection to transit for that trip. The existing data limits interpretation and analysis and would be supported by additional data collection, such as through improved survey design, intercept surveys, observations, or focus groups.

Acknowledging that at least some park and ride users are likely not directly connecting to transit raises an important policy question regarding the role of park and rides and similar facilities moving forward. Does allocating public park and ride spaces for private car share companies offer a return on investment in transit ridership? In addition, as transit agencies transition their park and rides to mobility hubs that consolidate a variety of public and private transportation options into one geographic area, how critical is it that users connect to fixed-route transit, carpools, or vanpools (the currently allowable uses of Metro park and rides)? This question can be made even broader by asking the value of using limited space at mobility hubs for uses not immediately pertaining to mobility, such as rider amenities like parcel delivery lockers, coffee stands, or restrooms. Similarly, as transit agencies evolve into mobility agencies, what is the value associated with supporting car-light and car-free lifestyles and overall mobility as opposed to solely facilitating access to transit? As the transportation system shifts into a new mobility paradigm, transit agencies and other key stakeholders involved in the funding and regulation of these types of facilities – including cities, state governments, and federal agencies – will need to challenge previous assumptions about how to best use these land assets to achieve their goals. If agencies seek to support seamless, multi-modal connections, they will need to find opportunities to leverage and engage with emerging mobility services.

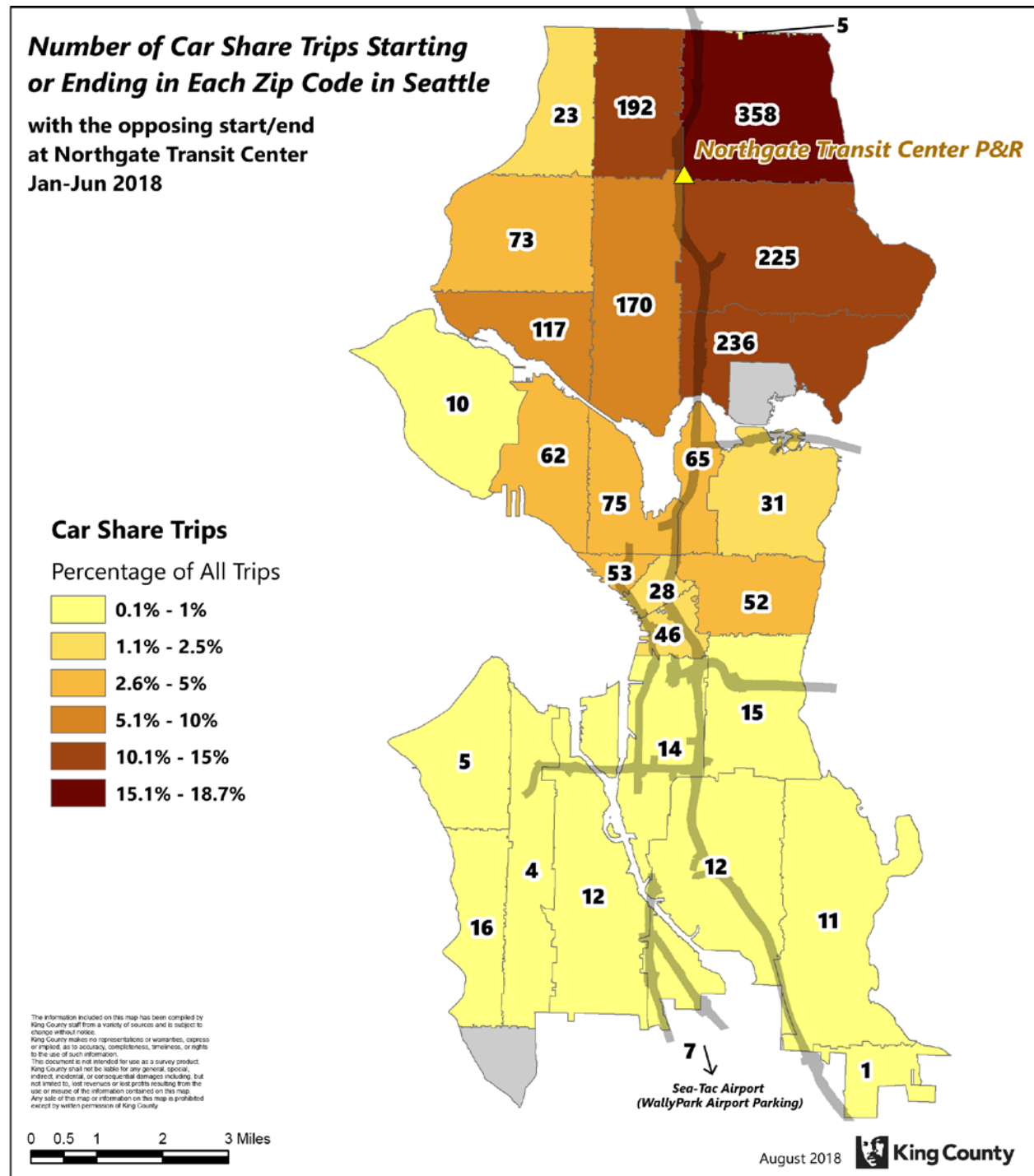
The third goal of the pilot – to test partnerships with private mobility providers – was deemed successful. Metro and car2go and ReachNow maintained positive relationships throughout the pilot, and all parties have agreed to continue the pilot for another year to gain additional insights. Through this public-private partnership, a public resource (parking) is exchanged for data to assess the viability of dedicated free-floating car share parking at a park and ride. All parties participated in the marketing of the program and users benefited from a better travel experience.

Finally, while not a specific goal to increase mobility options for traditionally disadvantaged communities, we did assess user demographics for this pilot. Though we did find that users were predominantly white, English-speaking, able-bodied Millennials, we also found that users come from all income levels. This supports previous research on user access to free-floating car sharing (Tyndall 2017). As such, we can say that supporting car sharing helps improve mobility options for people of all income levels, though not all disadvantaged populations.

## **NEXT STEPS**

Continuing the pilot for an additional year will allow Metro to continue to assess the impacts of car share parking on improving parking turnover and increasing access to transit. Metro plans to supplement the existing data sources with the installation of parking sensors to provide additional insights into parking utilization. Additionally, Metro plans to revise survey questions, particularly to better understand travel patterns and the relationship between car share parking and transit utilization.

APPENDIX 1:



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