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# Mobility on Demand (MOD) Sandbox Demonstration: Pierce Transit Limited Access Connections

*Evaluation Report*


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NOVEMBER
2022

U.S. Department of Transportation
Federal Transit Administration

## COVER PHOTO

*Image courtesy of Pierce Transit*

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# Metric Conversion Table

| SYMBOL | WHEN YOU KNOW | MULTIPLY BY | TO FIND | SYMBOL |
|---|---|---|---|---|
| **LENGTH** | | | | |
| **in** | inches | 25.4 | millimeters | mm |
| **ft** | feet | 0.305 | meters | m |
| **yd** | yards | 0.914 | meters | m |
| **mi** | miles | 1.61 | kilometers | km |
| **VOLUME** | | | | |
| **fl oz** | fluid ounces | 29.57 | milliliters | mL |
| **gal** | gallons | 3.785 | liters | L |
| **$ft^3$** | cubic feet | 0.028 | cubic meters | $m^3$ |
| **$yd^3$** | cubic yards | 0.765 | cubic meters | $m^3$ |
| NOTE: volumes greater than 1000 L shall be shown in $m^3$ | | | | |
| **MASS** | | | | |
| **oz** | ounces | 28.35 | grams | g |
| **lb** | pounds | 0.454 | kilograms | kg |
| **T** | short tons (2000 lb) | 0.907 | megagrams<br>(or "metric ton") | Mg (or "t") |
| **TEMPERATURE (exact degrees)** | | | | |
| **$^oF$** | Fahrenheit | 5 (F-32)/9<br>or (F-32)/1.8 | Celsius | $^oC$ |

| **REPORT DOCUMENTATION PAGE** | *Form Approved*<br>*OMB No. 0704-0188* |
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14. ABSTRACT
This report presents the results of an independent evaluation of the Pierce Transit Limited Access Connections Demonstration project, part of the Federal Transit Administration (FTA) Mobility on Demand (MOD) Sandbox program. In this MOD Sandbox project, Pierce County Public Transportation Benefit Area Corporation (Pierce Transit), in partnership with Sound Transit and Lyft, implemented a first/last-mile system to provide access to rail stations and other destinations of interest within the Tacoma, Washington, metropolitan region. The one-year demonstration period began May 2018 and was extended seven months to the end of 2019, delivering 10,825 trips to 330 different users. The project increased transit use among users and reduced net vehicle miles traveled (VMT); however, it did not result in increased transit ridership overall. The service reduced parking lot use and travel and wait times for users. In addition, the project provided service to a local college, Pierce College Puyallup, which improved the perception of transit service quality and enabled greater mobility security through a guaranteed ride home. It also produced a number of lessons learned related to deployment regarding approaches to marketing, contracting, and cost management and operator negotiations.

15. SUBJECT TERMS
Mobility on Demand, MOD, sandbox, transportation network company, TNC, Lyft, evaluation, Pierce Transit, Sound Transit, public transportation, first/last mile, public private partnership, guaranteed ride home

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## Abstract

This report presents the results of an independent evaluation of the Pierce Transit Limited Access Connections Demonstration project, part of the Federal Transit Administration (FTA) Mobility on Demand (MOD) Sandbox program. In this MOD Sandbox project, Pierce County Public Transportation Benefit Area Corporation (Pierce Transit), in partnership with Sound Transit and Lyft, implemented a first/last-mile system to provide access to rail stations and other destinations of interest within the Tacoma, Washington, metropolitan region. The one-year demonstration period began May 2018 and was extended seven months to the end of 2019, delivering 10,825 trips to 330 different users. The project increased transit use among users and reduced net vehicle miles traveled (VMT); however, it did not result in increased transit ridership overall. The service reduced parking lot use and travel and wait times for users. In addition, the project provided service to a local college, Pierce College Puyallup, which improved the perception of transit service quality and enabled greater mobility security through a guaranteed ride home. It also produced a number of lessons learned related to deployment regarding approaches to marketing, contracting, and cost management and operator negotiations.

# Executive Summary

The Federal Transit Administration (FTA) led an initiative, the Mobility on Demand (MOD) Sandbox Program, to explore how public transportation agencies could incorporate emerging technologies that complement and support the traditional functions of public transportation. One of the projects in this program was the Pierce Transit Limited Access Connections (LAC) Demonstration. Pierce County Public Transportation Benefit Area Corporation (Pierce Transit), in partnership with Sound Transit and Lyft, implemented a first/last-mile system using subsidized Lyft rides to provide access to rail stations and other destinations of interest within the Tacoma metropolitan region. Users were able to request rides within specified zones to travel to locations of interest within those zones. Rides that qualified were subsidized by the project and free to the user up to $30 per trip. The one-year demonstration period began May 2018 and was extended seven months to the end of 2019, delivering 10,825 trips to 330 different users.

This report presents the results of the independent evaluation of the Pierce Transit LAC Demonstration project as implemented in the Tacoma, Washington, metropolitan region. The project was one of 11 MOD Sandbox Demonstrations partially funded by FTA. The independent evaluation (IE) was sponsored by the USDOT Intelligent Transportation Systems Joint Program Office (ITS JPO) and FTA. The evaluation explored 17 hypotheses that reviewed a number of potential impacts and outcomes from the project, including impacts on mobility, accessibility, public transit ridership, vehicle miles traveled (VMT), safety, costs, and lessons learned. The results of the evaluation are summarized below and in Table ES-1.

**Hypothesis 1: The perception of transit service quality (including the Pierce Transit brand) will improve among riders.**

Hypothesis 1 evaluated whether the LAC pilot improved the perception of public transit service quality by Pierce Transit riders. Survey respondents were asked about the quality of Pierce Transit service as well as the perceived increase or decrease in mobility and access to and from transit locations as a result of the project. All respondents indicated that the project either improved the quality of Pierce Transit or that it had caused no change in the quality of transit. Overall, the results of the Hypothesis 1 analysis suggested a positive improvement in the perception of service quality among riders. Although the sample size was small, the results suggest that Hypothesis 1 was supported.

**Hypothesis 2: The overall ridership on Pierce Transit increases.**

Hypothesis 2 sought to explore whether overall ridership on Pierce Transit bus lines increased during the project period. To evaluate this question, ridership data were collected from Pierce Transit. Seasonal fluctuation in monthly ridership on Pierce Transit bus lines was around 700,000 unlinked trips per month. The average ridership during the entire time series was 676,655. Overall, the trends of the ridership data did not show significant departure from the trends preceding the project. Given that the project had 330 users and 8,827 trips, this result is not surprising for a system that produce hundreds of thousands of trips per month. As such, Hypothesis 2 was not supported.

**Hypothesis 3: Users of the new service ride transit more because of the new service.**

Hypothesis 3 explored whether the LAC project had an impact on the ridership of Pierce Transit by users of the service. That is, the evaluation sought to ascertain whether the presence of the system helped users of the service to increase their public transit ridership through providing better connections to existing transit infrastructure. A survey was used to evaluate how users of the system changed their transit use behavior in response to the system, including questions evaluating whether users were riding transit more as a result of the system. Respondents were further asked a variety of questions pertaining to whether they started using certain modes more or less, how they would connect to public transit (if at all), and why they chose to switch modes when traveling. Survey respondents were asked how they would have connected to public transit; 28% said they would not have connected at all, and 17% reported that they would have driven all the way to their destination instead. This suggests about 45% of respondents connected to their destinations using public transit because of the LAC project. The project, which specifically focused on facilitating access to and from public transit, enabled Lyft to complement public transit for specific trips sponsored by the project and showed an increase in transit use among users as a result of the project. The results suggest that Hypothesis 3 was supported.

**Hypothesis 4: The number of people accessing the Sound Transit stations increases.**

Hypothesis 4 sought to take a closer look at the number of people accessing Sound Transit stations. This evaluation was similar to that conducted on ridership data with Pierce Transit but for the Seattle Sounder commuter rail line. The Seattle Sounder runs from the southern end of the Tacoma region to downtown Seattle. Ridership on the Seattle Sounder exhibited a steady increase during the years leading up to the end of the project performance period. The final month of the project had a significant decline in ridership, but this could have been the result of the early onset of the COVID-19 pandemic. Data for the stations within the Tacoma region as served by the project, including the downtown Tacoma station and the Puyallup station, were examined but showed similar findings. The trend in boarding patterns for the local stations was found to be highly correlated (0.93) with the trends in total boardings. Taken together, the results suggest that Hypothesis 4 was not supported.

**Hypothesis 5: The cost-effectiveness of the TNC/ridesourcing provision will be better than previously demonstrated fixed-route services.**

Hypothesis 5 explored whether the cost-effectiveness of Transportation Network Company (TNC)/ridesourcing service provision was better than that of previously-demonstrated and existing fixed-route services. This hypothesis was evaluated using monthly cost data from Lyft and 2019 agency profile data from FTA's National Transit Database (NTD). In addition to trip cost, data from Lyft recorded various attributes for each trip, including request time, distance, duration, and origin and destination census tracts. The agency profile data provided cost-effectiveness metrics for Pierce Transit, against which researchers compared similar metrics derived from Lyft data. The project was found to be cost-effective relative to the demonstration of two fixed-route services that operated in 2014 and 2015. The two services had a total ridership of 8,823 unlinked trips over 573 days of service. The net cost per passenger served was $139.83 for Route 503 and $107.44 for Route 504. Further data analysis of Lyft cost data along with agency profile data from the NTD revealed that the Lyft provision was not as cost-effective as the system-wide average fixed-route bus service that Pierce Transit delivered at $8.46 per trip. The project was found to deliver a cost per trip of $11.70. However, achieving cost-effectiveness superior to that of overall Pierce Transit fixed-route bus service was not the goal of the project. Overall, Hypothesis 5 was found to be supported.

**Hypothesis 6: The cost-effectiveness of the TNC/ridesourcing service will be better than previously-demonstrated paratransit services.**

Hypothesis 6 explored whether the cost-effectiveness of the TNC/ridesourcing service provision was better than that of previously-demonstrated paratransit services. This hypothesis was evaluated using monthly cost data from Lyft and past paratransit ridership data. Agency profile data from 2019 from the NTD was also used. With regard to the comparison of the Lyft service cost-effectiveness to currently existing paratransit services, service effectiveness metrics considered included cost per unlinked passenger trip, cost per passenger mile, and cost per passenger hour.

Based on broad cost-effectiveness metrics alone, the results found that Lyft service might prove economical to paratransit users in situations in which wheelchair-accessible vehicles (WAVs) were not needed. It is noted that paratransit had to serve a wider region that was not restricted by the zones of the project. It is also important to note that the project did not test the provision of WAVs, because they were never requested. As a result, the cost analysis is not fully comparative and not completely fair. It is possible the system would still have been found to be cost-effective had it implemented WAV trips, but such direct comparison was not achievable. As a result, Hypothesis 6 was found to be partially supported.

**Hypothesis 7: The project will reduce parking lot use.**

Hypothesis 7 explored whether the use of park-and-ride lots were reduced because of the LAC project. The project classified Lyft rides with special codes to indicate that the ride was covered by the project and met the criteria for the cost subsidy. Certain LAC codes were associated with trips to commuter rail stations to reduce the use of overcrowded park-and-ride lots at those stations. Therefore, survey respondents were asked how much their use of park-and-ride lots changed as a result of the LAC project. Combining the results of the survey showing respondents' decrease in usage, as well as some dips in usage in the parking lot data, there could be some connection between the LAC program and lower parking lot usage. However, these drops were either very small or did not deviate much from overall parking use. It is possible that parking lot use fell among some users but that those spaces were filled by others not part of the project. Although the survey suggested some people used park-and-ride lots less, the overall impact may have been limited. The findings suggest that Hypothesis 7 was partially supported.

**Hypothesis 8: The overall travel times of users decrease.**

Hypothesis 8 evaluated travel times among the users of the LAC project. As public transit service schedules were not affected during the pilot, the evaluation explored whether riders were able to get to and from their public transit destination more quickly as a result of the pilot services. The survey asked users how their overall travel times using public transit changed. Half of respondents reported a decrease in travel time vs. 28% who saw an increase in overall travel time. It is worth noting that those who found that their travel time greatly decreased are more numerous than those who experienced an increase, suggesting that there could be several factors contributing to whether a user will experience an increase or decrease in travel time. Overall, it appears the LAC program decreased travel times overall for a majority of users. Overall, Hypothesis 8 was found to be partially supported.

**Hypothesis 9: The overall wait times of users decrease.**

Hypothesis 9 evaluated how user wait times changed as a result of the project. The survey asked users of the service to categorize how their overall wait times changed. The distribution of responses showed that 24% of respondents reported their waiting time "greatly decreased." Those who said their wait times "somewhat decreased" was also 24% of respondents. Hence, a substantial share of respondents experienced some kind of a wait time decrease. In contrast, 18%

of respondents noted somewhat of an increase in wait time; no respondents experienced wait times that “significantly increased,” and the remaining users did not know or saw very little change. These results were more favorable than the overall travel times. Close to a majority of users overall experienced a decrease in wait times compared to a small portion who saw them increase. Thus, the evidence suggested Hypothesis 9 was supported.

**Hypothesis 10: Passengers using wheelchairs will (on average) report improved mobility.**

Hypothesis 10 of the evaluation sought to ascertain whether passengers with transportation-related disabilities reported improved mobility as a result of the project. The survey included questions to evaluate mobility concerning users with disabilities. No respondent reported using a wheelchair. One respondent within the sample reported “true” that they had a disability that prevented them from driving an automobile. This individual offered a number of responses suggesting that, at least in this particular case, the system was improving mobility of a passenger with a reported disability. The results of the single respondent who indicated they had a disability that prevented them from driving an automobile suggest that improvements in mobility were experienced as a result of the system. However, the person was not a passenger using a wheelchair and, due to the limited sample size of 1, the results are inherently anecdotal. Hypothesis 10 is considered to be inconclusive, suggesting further research is needed.

**Hypothesis 11: By increasing transit ridership, trip substitution and mode shift will result in a net VMT reduction.**

The evaluation sought to determine whether VMT had any net decline as a result of trip substitution, mode shift, and public transit ridership. The assessment of net VMT change requires an assessment of several components of system activity. One key component is behavioral change, where the users change behavior in response to the new mobility options provided by the system. Another key component is system activity, where the system delivering new mobility options produces its own VMT. In a complete evaluation, this additional VMT must be set against the VMT that is reduced as a result of behavioral change among users.

The 20,216 net VMT produced by the system was far less than the estimated 232,000 miles reduced by personal vehicle shedding and personal vehicle suppression reported by the sample. The 20,216 net system VMT is considered a lower bound, because it does not include the fetch distance, the distance a vehicle travels empty (no riders) to get to the passenger. Considering an estimate of additional distance could be equal to the full system VMT (40,432), which this would raise the true system VMT to be a value close to 61,000.

Reductions from personal vehicle ownership could still be 30% of their present value, and the project would still have been found to reduce VMT under these estimates. There is uncertainty as to the exact magnitude of the shedding and suppression impact within the population, but the strong magnitude of both within the relatively small sample suggests that it was large enough to offset the system VMT even with aggressive assumptions on fetch distance. The results suggest that Hypothesis 11 was supported.

**Hypothesis 12: The perception of transit service quality will increase for Pierce College Puyallup students.**

Hypothesis 12 evaluated whether the perception of public transit service quality increased among Pierce College Puyallup students. To gauge the preception of Pierce College Puyallup students, repondents were asked if they had attended that school in during 2017–2019. All respondents indicated their preception of Pierce Transit, mobility, and access to and from public transit "greatly improved." In the survey, 22% of respondents (n=4) indicated they had attended Pierce College Puyallup during 2017–2019. Of the four respondents who indicated being students, all noted that the public transit service had improved. The sample size was limited but the responses received universally supported Hypothesis 12.

**Hypothesis 13: Riders who use the guaranteed ride home service will report improved mobility and accessibility.**

Hypothesis 13 explored the degree to which riders reported improved mobility and accessibility with respect to the guaranteed ride home service component of the LAC project. Ridership data indicated which of the rides used the guaranteed ride home promo code, and these data were analyzed for the hypothesis. There was no public transit service during the use of the guaranteed ride home service because it was after operating hours; thus, it is reasonable to assume that most users of the guaranteed ride home service used this code because it was their only option for traveling to their destination. There also were several people who used the promo code many times, suggesting that at least some users valued the service enough to use it often over the course of the project (i.e., July 2018 – December 2019). Overall, sustained use of the guaranteed ride suggests that mobility benefits were provided by this project. Overall, Hypothesis 13 was supported.

**Hypothesis 14: The guaranteed ride home enables increased transit use.**

Hypothesis 14 sought to establish whether the guaranteed ride home service increased public transit use. The size of this initiative was not large enough to influence ridership at the system level. The evaluation sought to determine whether evidence within the survey data supported that users were influenced by this service to use public transit more. The survey asked two questions about the guaranteed ride home service—researchers asked respondents about the impact of the Pierce Transit LAC project and the guaranteed ride home service had on access to and from public transit and the respondents' mobility using public transit. The distribution of responses suggested that the guaranteed ride service greatly improved access to and from public transit and mobility using public transit. About two-thirds of the sample (n=12) indicated that the service had greatly improved both. Only 6% (one respondent) reported that the project had not changed their interaction with public transit, and no one in the sample reported that their transit use declined. Respondents broadly reported using public transit modes more due to the first/last mile Lyft rides supported by the project. For example, the six respondents that reported using Seattle Sounder commuter rail service also reported using that mode more often due to the project. Similarly, seven of the nine individuals who used the bus reported riding it more as result of the project. Collectively, the results of the analysis suggest that Hypothesis 14 was supported.

**Hypothesis 15: Student enrollment may increase, especially those enrolled in night classes.**

One of the motivations for the project was to provide better access to the campus of Pierce College Puyallup. This improvement in access was motivated for the purposes of increasing student enrollment. The evaluation sought to explore whether there were notable changes in student enrollment in response to the improvement of access that was provided by the project. The overall trends in enrollment did not show significant departures in patterns or levels during the project period (July 2018–December 2019). It is possible that some individuals used the service and benefited from improved access to the campus, but the trends do not suggest that enrollment was significantly influenced by the LAC project. As such, the findings suggest that Hypothesis 15 was not supported.

**Hypothesis 16: The spatial spread of people using Pierce Transit and Sound Transit increases.**

Hypothesis 16 sought to explore whether the spatial spread of people using Pierce Transit and Sound Transit increased as a result of the project. The underlying theory behind this hypothesis was that improved and lower cost access of dynamic first/last mile travel to public transit infrastructure would enable users from more geographically spread-out locations within the region to access transit. The data planned for analysis of this hypothesis ultimately were not available. This included data on the approximate distribution of home locations of users accessing public transit compared with approximate home locations of system users from the survey. With no baseline data to compare user home locations and a limited survey sample size, Hypothesis 16 was found to be inconclusive due to insufficient data.

**Hypothesis 17: The process of deploying the project will produce lessons learned and recommendations for future research and deployment.**

Project stakeholders were interviewed to better understand the process of project implementation as well as challenges that were faced. The interviews offered context for the strategic thinking behind the project development. Pierce Transit proposed a three-pronged approach to address the issues facing its community—1) park-and-ride lots filling to capacity, 2) fixed-route service ending before night classes finished, and 3) a notable population living outside a walkable distance from fixed-route bus services. Despite the varying stakeholder roles of the experts interviewed, lessons learned were generally consistent and included the following:

- Public communication and branding
  - Signage placed at public transit stations was a very effective marketing tool.
  - Some travel zones included in the project were confusing for people to understand initially (e.g., where they were located, what they meant, etc.).
  - Branding of the project and its collaboration with a TNC partner could have been stronger. Developing a strong brand was not a major goal of the project, but it was felt that a stronger brand connection between public transit and the TNC partner could have increased user understanding about the service. As TNCs also operated in the region independent of the project, the branding link of the TNC to specific types of trips should be emphasized. For example, potential users could see "pink" branding, giving them instructions on how to participate in the pilot through the Lyft app. Although perceptions of transit quality were explored in the evaluation, the impact of marketing efforts was not.
  - Marketing efforts must be careful to emphasize the partnership as centered around the mobility service rather than implying a preference for a particular brand.
  - Much outreach was done to market WAV service; however, there were no WAV requests.
  - Stakeholders reported that communication between Pierce Transit and Pierce College was great and should be a model for future relationships.
  - Marketing efforts targeted at the commuter college campus could have been improved. A campus with a high number of transient students (i.e., students that may take off a term or never complete a degree) requires ongoing marketing and outreach each term.

- Users and user interfaces
  - Students will use mobility options if provided.
  - App-only options can create numerous barriers for particular populations (e.g., lack of universal design for people with disabilities, etc.).
- Data and performance metrics
  - Public transit agencies should adjust their metrics for measuring success and remember to not only look at a project from a research perspective but also from the agency and customer perspective (e.g., using customer ratings such as a net promoter score to measure customer experience).
  - Data are necessary for evaluating pilots and service and for improving operations. For example, better data on rider activity would be useful to verify if someone is boarding or riding the bus, as a user may just be going to a transit hub to access the Internet, for instance. More information on rider origins and destinations would support better planning and evaluation of metrics.
  - A transit agency may be more comfortable engaging in public-private partnerships long-term given that there were no known incidents or legal claims during the pilot.
  - The level of data provided by the TNC partner may be sufficient to determine if a partnership should be continued, but it was generally insufficient to leverage for transit planning decision making due to the level of aggregation and lack of data fields available. However, a challenge faced with respect to structuring the data to greater specificity was a reported position of the agency that could not protect such data from public records requests. This dynamic led to an agreement of a more limited dataset that all parties agreed would be more unobjectionable to private and public sector interests should a disclosure of it be required. Better legal protections of industry data might enable improved sharing between the public sector and private industry.
  - More specific data are needed to determine if TNC service is the optimal partnership model (vs. microtransit such as shuttles with greater passenger pooling, etc.).
- Agency operations and contracting
  - Pierce Transit learned that it could operate the partnership at a lower cost than replacing the service with new fixed-route transit; however, it needed to dedicate more resources to ongoing marketing.
  - A transit agency should not expect to receive a response for a WAV provider and should be prepared to step in and provide this service, either by the transit agency or through an existing paratransit provider.

– Issuing a formal Request for Proposals (RFP) could have set out clear expectations and reduced the time needed for contract negotiations.

In general, several people interviewed indicated that they did not think the project would have been initiated had it not been for FTA and may not continue due to limited state funding. Additionally, Pierce Transit noted that imposing the standard drug and alcohol testing policy on Lyft drivers, which was waived during the demonstration period, could become cost-prohibitive and would prevent this partnership from continuing in the future if there was not an ongoing waiver or a change in FTA policy. Lyft noted that it has its own internal processes for driver regulation, including a zero-tolerance policy. However, it also noted that a broader dialogue on approaches to driver testing and regulation for transportation systems operated under public-private partnerships may be useful. Some people at the agency advocated potentially replacing the direct subsidy with a voucher project, where the customer is provided with a coupon for any mode (bus, taxi, TNC, etc.) as a solution to drug and alcohol testing requirements because it allows the customer to choose and places the assumption of risk with the customer. The agency was concerned that designating a selected partner and subsidizing the rider could be viewed as a “continuation of service,” increasing agency exposure to potential liability.

**Table ES-1** *Summary of Findings*

| | Hypothesis | Status | Key Finding |
|---|---|---|---|
| 1 | The perception of transit service quality (including the Pierce Transit brand) will improve among riders. | Supported | The LAC project improved the perception of Pierce Transit quality among over 70% of survey respondents. |
| 2 | The overall ridership on Pierce Transit increases. | Not Supported | The overall levels of ridership of Pierce Transit do not appear to have been impacted by the project. |
| 3 | Users of the new service ride transit more because of the new service. | Supported | Survey respondents generally reported that they used public transit more because of the rides provided by the new service. |
| 4 | The number of people accessing the Sounder Transit stations increases. | Not Supported | The overall levels of ridership of Sound Transit do not appear to have been impacted by the project. |
| 5 | The cost-effectiveness of the TNC/ridesourcing provision will be better than previously-demonstrated fixed-route services. | Supported | The analysis found that the project delivered mobility at costs per trip that were significantly lower than those of previously-demonstrated fixed-route services designed to achieve the same objectives during 2014 and 2015. |
| 6 | The cost-effectiveness of the TNC/ridesourcing will be better than previously-demonstrated paratransit services. | Partially Supported | The costs of delivering mobility through the project were found to be lower than the costs of delivering paratransit trips. Paratransit services faced disadvantages in this comparison given that they had to serve a larger region and included WAV trips. |
| 7 | The project will reduce parking lot use. | Partially Supported | Overall, park-and-ride lot use appears to have somewhat decreased but was not significantly affected overall. |

**Table ES-1 (cont.)** *Summary of Findings*

| | Hypothesis | Status | Key Finding |
|---|---|---|---|
| 8 | The overall travel times of users decrease. | Partially Supported | Travel times appear to have increased for some and decreased for others. More respondents (50%) reported a decrease than an increase (28%) in travel times. |
| 9 | The overall wait times of users decrease. | Supported | As with the travel times discussed above, the data do not reflect universal consensus. Nevertheless, the data lean toward decreased wait times overall. |
| 10 | Passengers using wheelchairs will (on average) report improved mobility. | Inconclusive | A single survey respondent reported having a disability but was not a wheelchair user. This individual noted in a number of questions that the system improved their mobility. |
| 11 | By increasing transit ridership, trip substitution and mode shift will result in a net VMT reduction. | Supported | The reduction in VMT estimated as a result of personal vehicle shedding and personal vehicle suppression was found to be relatively large compared to the estimated system VMT. The project was found to reduce net VMT. |
| 12 | The perception of transit service quality will increase for Pierce College Puyallup students. | Supported | There was unanimous consensus among Pierce College Puyallup students surveyed of an improved perception of Pierce Transit services. |
| 13 | Riders who use the guaranteed ride home service will report improved mobility and accessibility. | Supported | There is supportive evidence that users of the guaranteed ride home service initiative experienced improved mobility and accessibility. |
| 14 | The guaranteed ride home enables increased transit use. | Supported | The guaranteed ride home appeared to support access to and from public transit infrastructure. |
| 15 | Student enrollment may increase, especially those enrolled in night classes. | Not Supported | Student enrollment was not found to be influenced by the project. |
| 16 | The spatial spread of people using Pierce Transit and Sound Transit increases. | Inconclusive | The evaluation did not have sufficient data to evaluate this hypothesis, leading to an inconclusive finding. |
| 17 | The process of deploying the project will produce lessons learned and recommendations for future research and deployment. | Supported | The project produced key lessons learned from the deployment of the project that can inform future pilot projects. |

Section 1

# Introduction

## Overview of MOD Sandbox Demonstrations

The Federal Transit Administration (FTA)'s Mobility on Demand (MOD) Sandbox effort was developed around a vision of a multimodal, integrated, automated, accessible, and connected transportation system in which personalized mobility is a key feature. FTA selected 11 MOD Sandbox Demonstration projects that tested strategies that advance the MOD vision. In partnership with public transportation agencies, the MOD Sandbox projects demonstrated the potential for new innovations to support and enhance public transportation services by allowing agencies to explore partnerships, develop new business models, integrate public transit and MOD strategies, and investigate new, enabling technical capabilities.

Ultimately, the evaluation of each project's benefits and impacts will guide future implementation of innovations throughout the U.S. Broadly, MOD Sandbox projects took several approaches, including development of new or improved trip planners, integration of innovative mobility services with traditional public transportation functions, and implementation of new integrated payment and incentive structures for travel using public transportation. Several Sandbox projects focused on improving first/last mile access to public transportation through collaboration with private sector operators, including bikesharing, carsharing, Transportation Network Company (TNC)/ridesourcing, and other shared mobility operators.

More information about the MOD Sandbox Program can be found at https://www.transit.dot.gov/research-innovation/mobility-demand-mod-sandbox-program. In addition, Table 1-1 provides a summary of all the projects in the MOD Sandbox Program.

**Table 1-1** *Overview of MOD Sandbox Projects*

| Region | Project | Description |
|---|---|---|
| Chicago | Incorporation of Bikesharing Company Divvy | Releases updated version of Chicago Transit Authority's (CTA) existing trip planning app. New version incorporates Divvy, a bikesharing service, and allows users to reserve and pay for bikes within the app. |
| Dallas | Integration of Shared-Ride Services into GoPass Ticketing Application | Releases updated version of Dallas Area Rapid Transit's (DART) existing trip planning app. Updated version incorporates shared-ride services to provide first/last-mile connections to public transportation stations and allows users to pay for services within the app. |
| Los Angeles and Puget Sound | Two-Region Mobility on Demand | Establishes partnership between Via and LA Metro. Via provides first/last-mile connections for passengers going to or leaving from transit stations. There is a companion project in Seattle, WA. |
| Phoenix | Smart Phone Mobility Platform | Releases updated version of Valley Metro's existing trip planning app. New version updates trip planning features and enables payments. |
| Pinellas County (Florida) | Paratransit Mobility on Demand | Improves paratransit service by combining services from taxi, ridesourcing/TNCs, and traditional paratransit companies. |
| Portland | Open Trip Planner Share Use Mobility | Releases updated version of TriMet's existing multimodal app. New version provides more sophisticated functionality and features, including options for shared mobility. |
| San Francisco Bay Area | Bay Area Fair Value Commuting (Palo Alto) | Reduces SOV use within Bay Area through commuter trip reduction software, a multimodal app, workplace parking rebates, and first/last mile connections in areas with poor access to public transportation. |
| | Integrated Carpool to Transit (BART System) | Establishes partnership between Scoop and Bay Area Rapid Transit (BART). Scoop matches carpoolers and facilitates carpooling trips for passengers going to or leaving from BART stations with guaranteed parking. |
| Tacoma | Limited Access Connections | Establishes partnerships between local ridesourcing companies/TNCs and Pierce Transit. Ridesourcing companies provide first/last mile connections to public transportation stations and park-and-ride lots with guaranteed rides home. |
| Tucson | Adaptive Mobility with Reliability and Efficiency | Builds integrated data platform that incorporates ridesourcing/TNC and carpooling services to support first/last mile connections and reduce congestion. |
| Vermont | Statewide Transit Trip Planner | Releases new multimodal app for VTrans that employs fixed and flexible (non-fixed) transportation modes to route trips in cities and rural areas. |

An independent evaluation (IE) is required by Federal public transportation law (49 U.S.C. § 5312I(4)) for demonstration projects receiving FTA Public Transportation Innovation funding. The IE for the MOD Sandbox Demonstration projects was sponsored by the USDOT Intelligent Transportation Systems Joint Program Office (ITS JPO) and FTA.

This report focuses on the independent evaluation of the Pierce Transit Limited Access Connections (LAC) MOD Sandbox project. Pierce County Public Transportation Benefit Area Corporation (Pierce Transit) partnered with Sound Transit and Lyft to provide additional transportation options to local areas that had limited access to public transit services within Tacoma and surrounding areas within Pierce County. The implementation of these services was delivered through the TNC, Lyft, in coordination with Pierce Transit and Sound Transit. The project entailed zone-based first-mile last-mile (FMLM) services, a provision of a guaranteed ride home after transit operating hours, and trips to and from park-and-ride lots. Taken together, the project aimed to deploy a more dynamic mobility system to complement existing fixed route and paratransit services. The evaluation of this project involved exploring a number of hypotheses surrounding the project's impact on the mobility and accessibility of users, vehicle miles traveled (VMT) and greenhouse gas (GHG) emissions, public transit ridership, congestion, safety, cost effectiveness of mobility, and lessons learned from deployment. Following a more detailed overview of the project, these hypotheses are explored in the sections that follow.

## Evaluation Framework

For each of the 11 MOD Sandbox projects, the IE team developed an evaluation framework in coordination with the project team. The framework is a project-specific logic model that contains the following entries:

- **MOD Sandbox Project** – Denotes the specific MOD Sandbox project.
- **Project Goals** – Denotes each project goal for the specific MOD Sandbox project and captures what each MOD Sandbox project is trying to achieve.
- **Evaluation Hypothesis** – Denotes each evaluation hypothesis for the specific MOD Sandbox project. The evaluation hypotheses flow from the project-specific goals.
- **Performance Metric** – Denotes the performance metrics used to measure impact in line with the evaluation hypotheses for the specific MOD Sandbox project.
- **Data Types and Sources** – Denotes each data source used for the identified performance metrics.
- **Method of Evaluation** – Denotes the quantitative and qualitative evaluation methods used.

# Section 2 Pierce Transit LAC Project Summary

The Pierce Transit LAC MOD Sandbox Demonstration project implemented a system that pursued a dynamic travel strategy to enhance accessibility for people within the Tacoma, Washington, region. The project had goals of increasing passenger throughput at stations served by parking-constrained park-and-ride lots, providing connections to existing bus routes, and providing rides home outside of regular public transit service hours. These goals were pursued through subsidized rides for a number of use cases including: 1) first/last mile travel to and from local fixed-route public transit routes, 2) offering Pierce College Puyallup students and employees guaranteed rides home after public transit operating hours, and 3) trips to and from park-and-ride lots around the Puyallup Sounder Transit stations. This final use case was intended to reduce crowding at lots during commute hours on weekdays. The subsidized rides were delivered through a TNC partner, Lyft, which implemented the subsidy through zone specific coupon codes that could be entered by users while paying for their trip.

Another objective of the project was cost-effectiveness of travel. Fixed-route public transit is cost- effective to move people at high levels of ridership. Pierce Transit was aiming to deliver mobility at a cost-effectiveness that was better than previously-executed fixed-route demonstration projects to meet many of the same needs. Additionally, the pilot project sought to test the use cases as a means of serving underserved communities. The region had seven zones serviced by Lyft, as shown in Figure 2-1. The zones enabled travel to occur within zones as well as to specific locations outside the zone and to make connections with transit connection points adjacent to or outside the zones. The project did not allow trips to start and end within the zone boundaries unless a transit connection point was either the starting or ending point of the trip. By the end of the project, the service had provided 10,825 trips to 330 different users.

## Project Timeline

The service began in May 2018, with a one-year service period through May 2019. This was extended an additional seven months to the end of 2019, at which point the demonstration ended. The following timeline presents the main project milestones:

- **February 10, 2017** – Agreement Execution Date with USDOT
- **May 2018** – Field demonstration starts
- **December 2019** – Field demonstration ends
- **December 2021** – Data analysis/ independent evaluation

Project partners Pierce Transit, Sound Transit, and Lyft collected data relevant to the demonstration between May 2018 and December 2019 and shared the data with the IE team for conducting the evaluation.

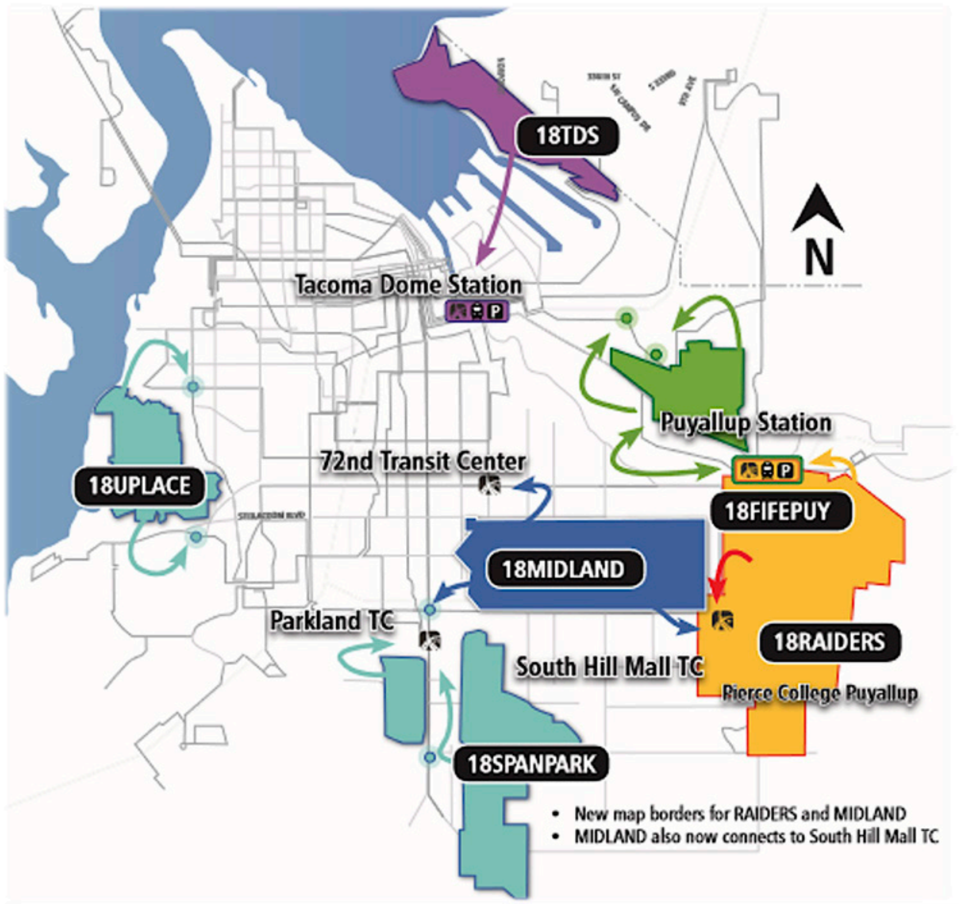


**Figure 2-1** *Map of LAC Zones*

Section 3

# Evaluation Approach, Planning, and Execution

The evaluation of each MOD Sandbox project was guided by an evaluation plan developed at the outset of the project. The evaluation plan was primarily built upon a logic model constructed by the IE team that had five basic components:

1. **Project Goal** – The stated goals of the project were defined from the proposal, project summary, and discussion with project team members.
2. **Evaluation Hypothesis** – Each project goal had a corresponding hypothesis. The hypothesis was a stated question that could be answered with a "Yes" or a "No" that was related to measuring the achievement of the associated project goal.
3. **Performance Metric** – This described the measurement proposed to be used to evaluate the hypothesis.
4. **Data Sources** – Data sources that followed from the performance metric and described the data type and source necessary to compute or evaluate the performance metric.
5. **Method of Evaluation** – This defined how the hypothesis would be evaluated; with the logic model, this was very general, declaring if the evaluation would be completed via survey analysis, activity data analysis, time series analysis, or other methods.

The logic model was a table, with one row containing five cells each populated with the components described above. The content of the logic model was also populated in advance of project implementation, where knowledge of the project trajectory and exact data collected were uncertain. The components of the logic model constructed for the evaluation of the Pierce Transit LAC project are presented in Table 3-1. The general methods of evaluation are listed following the table.

**Table 3-1** *Project Goals, Evaluation Hypotheses, Performance Metrics, and Data Sources for Pierce Transit LAC MOD Sandbox Project*

| Number | Project Goals | Evaluation Hypothesis | Performance Metric | Data Types/ Elements | Data Sources |
|---|---|---|---|---|---|
| 1 | Increase the quality of public transit service | The perception of transit service quality (including the Pierce Transit brand) will improve among riders. | Reported perception of transit service quality by Pierce Transit riders | Quantitative perception indicators from the survey on transit service quality and mobility | Survey of project participants (those who used the project services) |
| 2 | Increase ridership on Pierce Transit | The overall ridership on Pierce Transit increases. | Unlinked trips on bus lines | Ridership data from Pierce Transit (daily counts, by route) | Pierce Transit |
| 3 | Increase ridership on Pierce Transit due to the new service | Users of the new service ride transit more because of the new service. | Reported impact on personal ridership by users of the service | Survey responses on changes in ridership | Survey of project participants (those who used the project services) |
| 4 | Increase access to Pierce Transit bus routes and Sounder Transit stations | The number of people accessing the Sound Transit stations increases. | Number of riders accessing rail transit stations before and during the project | Ridership data at transit stations | Sound Transit ridership data |
| 5 | Provide access services more cost effectively | The cost-effectiveness of the TNC/ ridesourcing service provision will be better than previously-demonstrated fixed-route services. | Dollars spent per rider accessing Sounder stations and Pierce Transit bus routes, broken out by connections at Sounder stations | TNC ridership data during project, spending on TNC trips in conjunction with Pierce Transit, cost and ridership of previous demonstrations | Pierce Transit, Lyft |
| 6 | Provide paratransit services more cost effectively | The cost-effectiveness of the TNC/ ridesourcing service will be better than previously-demonstrated paratransit services. | Dollars spent per rider relative to dollars spent per paratransit rider | TNC ridership data during project, spending on TNC trips in conjunction with Pierce Transit, paratransit ridership and cost | Pierce Transit, Lyft |
| 7 | Reduce parking lot use | The project will reduce parking lot use. | Park-and-ride use | Parking at transit stations and park & ride lots | Pierce Transit ridership and activity data |

**Table 3-1 (cont.)** *Project Goals, Evaluation Hypotheses, Performance Metrics, and Data Sources for Pierce Transit LAC MOD Sandbox Project*

| Number | Project Goals | Evaluation Hypothesis | Performance Metric | Data Types/ Elements | Data Sources |
|---|---|---|---|---|---|
| 8 | Lower travel times | The overall travel times of users decrease | Survey respondents gauged how much their use of park-and-ride lots changed because of the project as well as commuter parking lot usage data provided by Pierce Transit | Survey responses on changes in travel times | Survey of project participants (those who used the project services) |
| 9 | Lower wait times | The overall wait times of users decrease. | Survey respondents gauged how much their wait times decreased or increased due to the project | Survey responses on changes in wait times | Survey of project participants (those who used the project services) |
| 10 | Users of wheelchairs report improved mobility | Passengers using wheelchairs will (on average) report improved mobility. | Reported travel times, wait times, mobility, and accessibility by passengers using wheelchairs | Survey responses of persons with disabilities who used the project services | Survey of project participants (those who used the project services) |
| 11 | Reduce net vehicle miles traveled. | By increasing transit ridership, trip substitution and mode shift will result in a net VMT reduction. | Estimated before and after VMT of service users | Survey responses, TNC trip activity data of project trips | Survey of project participants (those who used the project services), Pierce Transit, Lyft |
| 12 | Increase the quality of public transit service for Pierce College Puyallup | The perception of transit service quality will increase for Pierce College Puyallup students. | Reported perception of transit service quality by Pierce Transit riders who attend Pierce College Puyallup | Survey responses of perceived quality of transit indicators | Survey of users who are Pierce College Puyallup students |
| 13 | Improve transit use through the guaranteed ride home | Riders who use the guaranteed ride home service will report improved mobility and accessibility. | Use of the Lyft promo codes for the guaranteed ride home service within the context of how the project was conducted | TNC trip activity data of project trips, data on use of guaranteed ride home | Pierce Transit, Lyft |
| 14 | Improve transit use through the guaranteed ride home | The guaranteed ride home enables increased transit use. | Survey responses on the utility of the guaranteed ride home | Survey responses about the guaranteed ride home | Survey of project participants (those who used the project services) |

**Table 3-1 (cont.)** *Project Goals, Evaluation Hypotheses, Performance Metrics, and Data Sources for Pierce Transit LAC MOD Sandbox Project*

| Number | Project Goals | Evaluation Hypothesis | Performance Metric | Data Types/ Elements | Data Sources |
|---|---|---|---|---|---|
| 15 | Increase student enrollment | Student enrollment may increase, especially those enrolled in night classes. | Student enrollment | Student enrollment | Pierce College Puyallup |
| 16 | Increase transit use and rider satisfaction among those beyond the walk shed of the service corridor | The spatial spread of people using Pierce Transit and Sound Transit increases. | Spatial distribution of riders | Ridership and activity data | Survey of Pierce Transit riders and Lyft users (of subsidized trips), Pierce Transit, Lyft |
| 17 | Produce lessons learned through stakeholder interviews | The process of deploying the project will produce lessons learned and recommendations for future research and deployment. | Synthesis of stakeholder interviews | N/A | Stakeholder interviews |

The quantitative and qualitative evaluation methods used in the IE included the following:

- Survey analysis
- Activity data analysis
- Ridership data
- Summary of expert (stakeholder/project partner) interviews

The content of the logic model was translated into a data collection plan, which, in turn, was incorporated into a broader evaluation plan. The evaluation plan contains further details on the proposed data structures and analytical approaches to address each hypothesis. The evaluation plan was reviewed by project stakeholders and finalized towards the inception of the project. The project team then executed the project, working with the evaluation team to collect and transfer data at key junctures of the project. In the section that follows, the report presents background on the data collected in support of the evaluation, followed by a presentation and discussion of the results from the evaluation.

## Data Collected

A variety of datasets was used to conduct the evaluation. These datasets were collected in collaboration with Pierce Transit, Sound Transit, and Lyft and came in the form of survey data, activity data, ridership data, and stakeholder interview data. General descriptions of the available datasets are as follows:

- *Survey data* – A retrospective survey was launched with users of the system. The survey was designed and implemented by the independent evaluation team and deployed by Lyft to system users. The survey asked questions about user demographics, travel activities, and impacts of the LAC system on travel behavior. The survey captured 18 respondents, which was a small sample but represented about a 5% response rate. Data from the survey were used to evaluate questions and hypotheses related to behavior change to the extent possible given the sample size.
- *Lyft activity data* – Data for each Lyft trip taken within the region that used one of the trip codes were collected. The activity detailed a number of attributes including, de-identified passenger ID, transaction ID, date of travel, month/year, trip request time, day of travel, dispatch method, code name, origin (Census Tract), destination (Census Tract), origin (Census Block Group), destination (Census Block Group), trip time period, trip length, trip duration, trip cost, trip subsidy, actual trip duration, origin latitude, origin longitude, destination latitude, and destination longitude.
- *Paratransit data* – Activity data from the region's paratransit system included booking time and date, appointment time and date, departure time and date, start location, end location, trip miles, and number of passengers.
- *Ridership Data* – Pierce Transit provided bus ridership data and Sound Transit provided data for the Seattle Sounder for 2015–2019.
- *Stakeholder interview data* – The evaluation team conducted expert interviews with several people who were directly connected to the project team and had deep knowledge of the project. This included people at Pierce Transit and Sound Transit.

These datasets were applied to evaluate the hypotheses defined within the evaluation plan. In the sections that follow, these hypotheses are explored and evaluated using the data available. The methods applied for the different analyses depended on the hypothesis being addressed.

Section 4

# Section 4 Evaluation Results

**Hypothesis 1: The perception of transit service quality (including the Pierce Transit brand) will improve among riders.**

| Performance Metric | Key Finding |
|---|---|
| Reported perception of transit service quality by Pierce Transit riders. | The LAC project improved the perception of Pierce Transit quality among over 70% or survey respondents. |

Hypothesis 1 explored whether the LAC pilot improved the perception of transit service quality by Pierce Transit riders. Survey respondents were asked about the quality of Pierce Transit after the LAC project as well as the perceived increase or decrease in mobility and access to and from public transit. The distribution of the responses is shown in Figure 4-1.

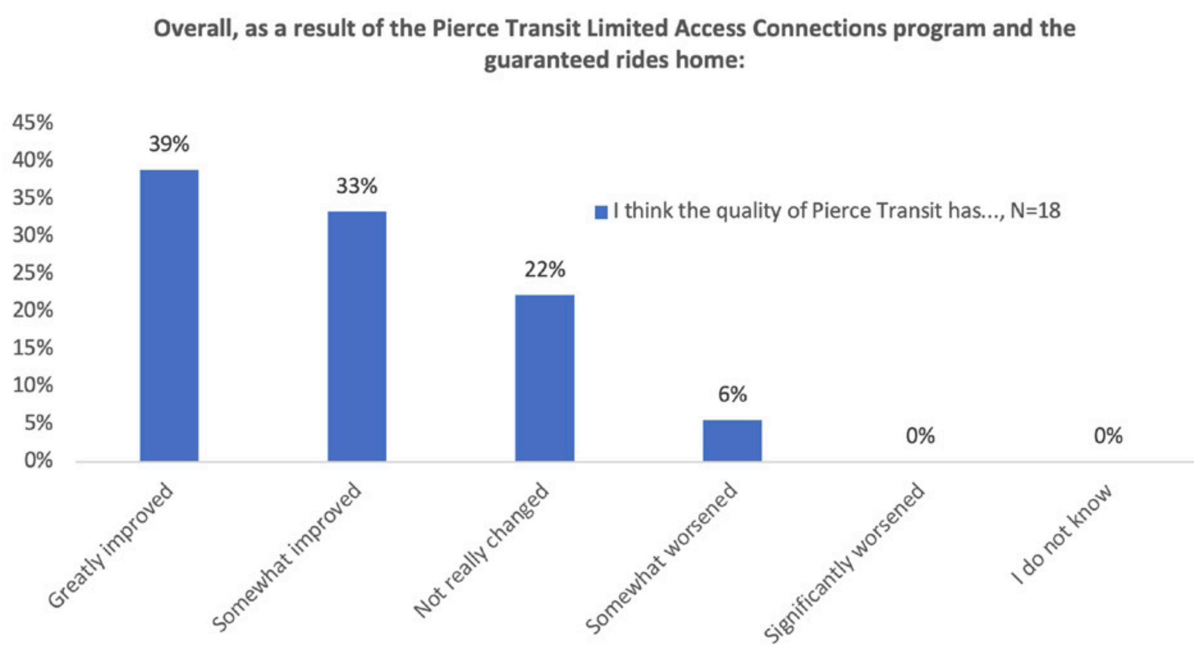


**Figure 4-1** *Perception of Pierce Transit After LAC Project*

Figure 4-1 shows that 39% of respondents reported that the quality of Pierce Transit had “greatly improved,” and 33% responded said it had “somewhat improved” because of the LAC project. Only 1 of the 18 respondents reported a “somewhat worsened” quality of Pierce Transit. The other questions asked about changes in mobility and access to and from public transit as a result of the project of respondents. These responses indicated that all respondents felt that the project either improved mobility and access or caused no change;

only one respondent reported that the project had imposed no change in both cases. Overall, the results of the Hypothesis 1 analysis suggested a rather unidirectional improvement in the perception of service quality among riders. Although the sample size was small, the balance of results suggests that Hypothesis 1 was supported.

**Hypothesis 2: The overall ridership on Pierce Transit increases**

| Performance Metric | Key Finding |
|---|---|
| Unlinked trips on bus lines | The overall levels of ridership of Pierce Transit do not appear to have been impacted by the project. |

With Hypothesis 2, the evaluation sought to explore whether overall ridership on Pierce Transit bus lines increased during the project period. To evaluate this question, ridership data were collected from Pierce Transit. Figure 4-2 shows a plot of total monthly ridership for Pierce Transit bus lines across all routes for 2015–2019. The plot shows seasonal fluctuation in monthly ridership around 700,000 unlinked trips per month. The average ridership during the entire time series was 676,655. The data shown with Figure 4-2 does not reveal significant changes in the overall level of ridership before and during the project, suggesting that, whereas survey data within the project show increases in public transit use by individuals, these impacts were not large enough to substantively change ridership of Pierce Transit during the project operating period in 2019.

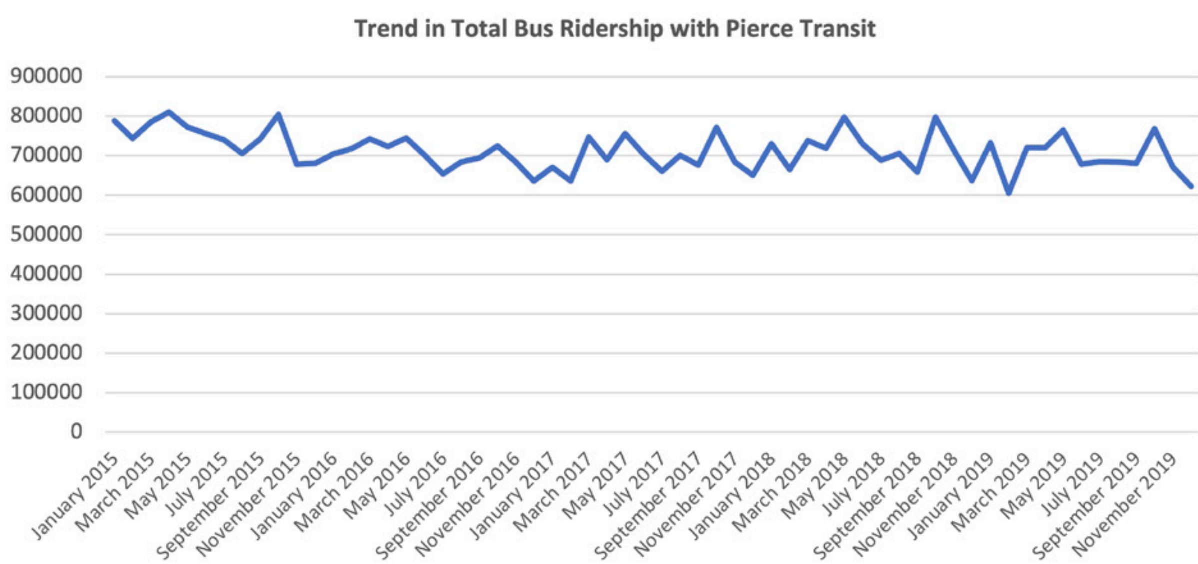


**Figure 4-2** *Pierce Transit Ridership, 2015–2019*

Figure 4-3 shows the year-over-year percentage change in Pierce Transit ridership for each month—for example, the total ridership of January 2016 divided by the total ridership of January 2015. The series shows this successive calculation for 2016–2019. The results from Figure 4-3 show a highly stable level of ridership year-over-year. The average year-over-year percentage for 2019 was 97% of ridership in 2018. The results suggest that ridership on Pierce Transit did not increase during the period of the project.

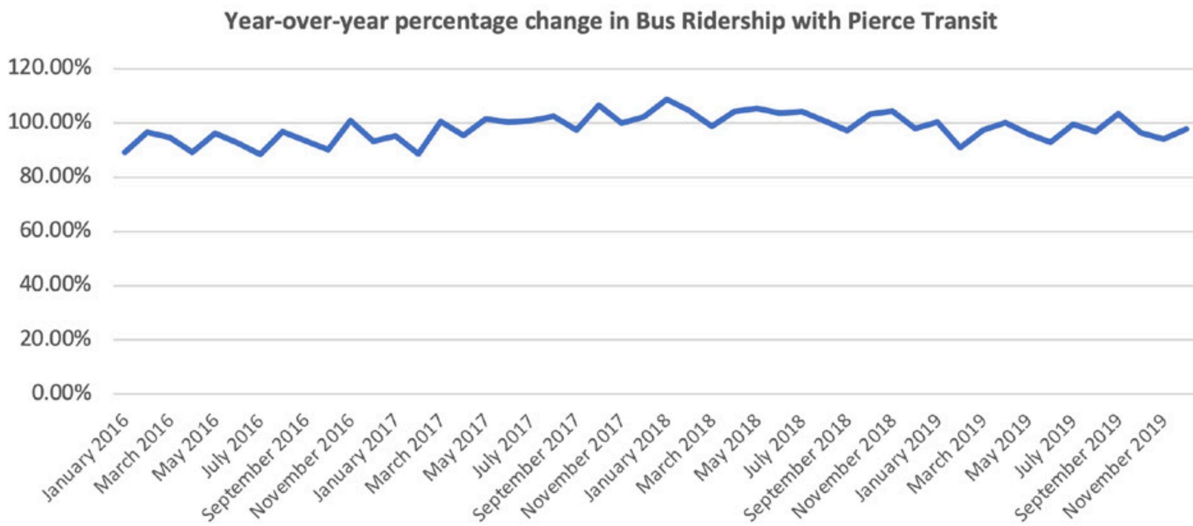


**Figure 4-3** *Year-Over-Year Percentage Change in Pierce Transit Ridership*

Overall, the trends of the ridership data did not show significant departure from the trends preceding the project. The finding does not mean that the project failed to increase public transit ridership among users, which is better indicated through survey data; rather, the findings suggest that any impact of the project on ridership was small relative to the overall volume of the system and therefore not visible within the broader levels of ridership. Given that the project had 330 users and 8,827 trips, this result is not surprising for a system that produces hundreds of thousands of trips per month. As such, Hypothesis 2 was found to be not supported.

**Hypothesis 3: Users of the new service ride transit more because of the new service.**

| Performance Metric | Key Finding |
|---|---|
| Reported impact on personal ridership by users of the service | Survey respondents generally reported that they used public transit more because of the rides provided by the system. |

Hypothesis 3 evaluated whether users of the new service rode public transit more because of the project. The evaluation sought to ascertain whether the presence of the system increased the public transit use through providing better connections to existing transit infrastructure. The survey was used to evaluate how users of the system changed their public transit use behavior in response to the system. This included questions evaluating whether users were riding public transit more as a result of the system. Respondents were further asked a variety of questions pertaining to whether they started using certain modes more or less, how they would connect to public transit (if at all), and why they chose to switch modes when traveling.

Figure 4-4 shows how survey respondents changed their usage of each mode as result of the system. Two-thirds of those who drove alone reported doing so much less often because of the Lyft rides. Users of the Seattle Sounder reported increase usage, including two-thirds who reported using it "much more often." The most used mode, public bus, saw 78% of its users ride it more (44% much more often) because of Lyft rides. The remaining 22% who reported less usage likely did so because the Lyft rides took them to a place or station where they normally took the bus.

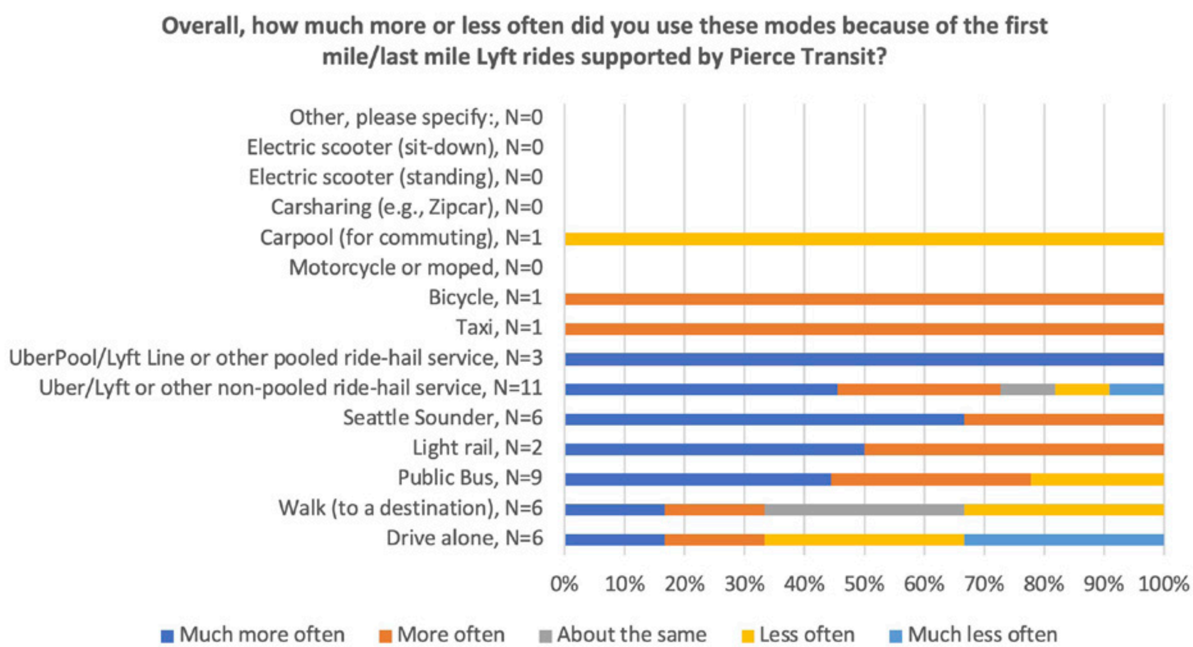


**Figure 4-4** *How First/Last Mile Influenced Mode Choice*

Figure 4-5 shows a slightly different perspective on the Lyft rides. When survey respondents were asked how they would have connected to public transit, 28% said they would not have connected at all. In addition, 17% reported that they would have driven all the way to their destination instead. This suggests that about 45% of respondents connected to their destinations using public transit because of the LAC project. The results are notable, in that TNCs such as Lyft are often serving as substitutes for public transit.[1] However, the nature of the project, which specifically focused on facilitating access to and from public transit, better enabled Lyft to complement public transit for specific trips sponsored by the project.

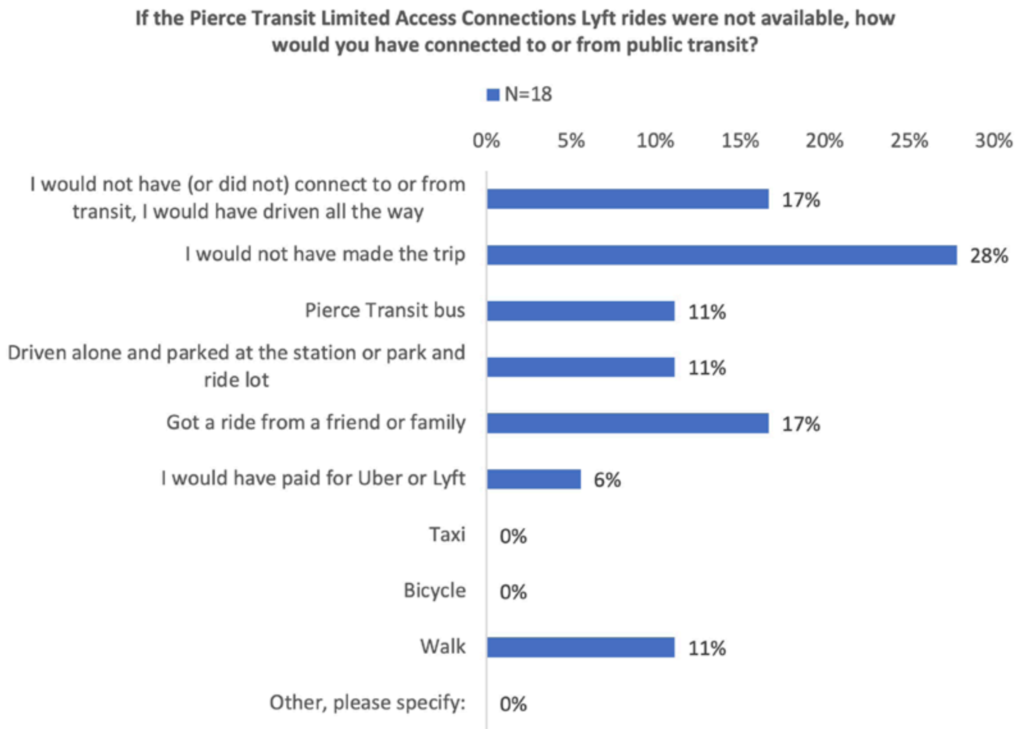


**Figure 4-5** *Impact of LAC Lyft Rides on Public Transit Connections*

The statistics in Figure 4-5 suggest that the majority of respondents would have either not made the trip or would have made the trip with some type of personal vehicle. Only 11% would have used public transit, and another 11% would have walked; another 6% of respondents indicated they would use Lyft or Uber if the LAC project was not available. Although the sample size was limited, the balance of responses broadly suggest that the project was supporting public transit ridership through connections to it.

Survey data shown in Figure 4-6 show the distribution of survey responses that evaluated the change in public transit use as a result of using rides with promotional code. The distribution shows that two-thirds of respondents rode public transit more as a result of using the promo codes, 28% reported no change, and 6% reported riding transit less.

[1] Martin, E., Shaheen, S., and Stocker, A. (2021), "Impacts of Transportation Network Companies on Vehicle Miles Traveled, Greenhouse Gas Emissions, and Travel Behavior Analysis from the Washington D.C., Los Angeles, and San Francisco Markets" University of California, Berkeley eScholarship, https://doi.org/10.7922/G2BC3WV9.

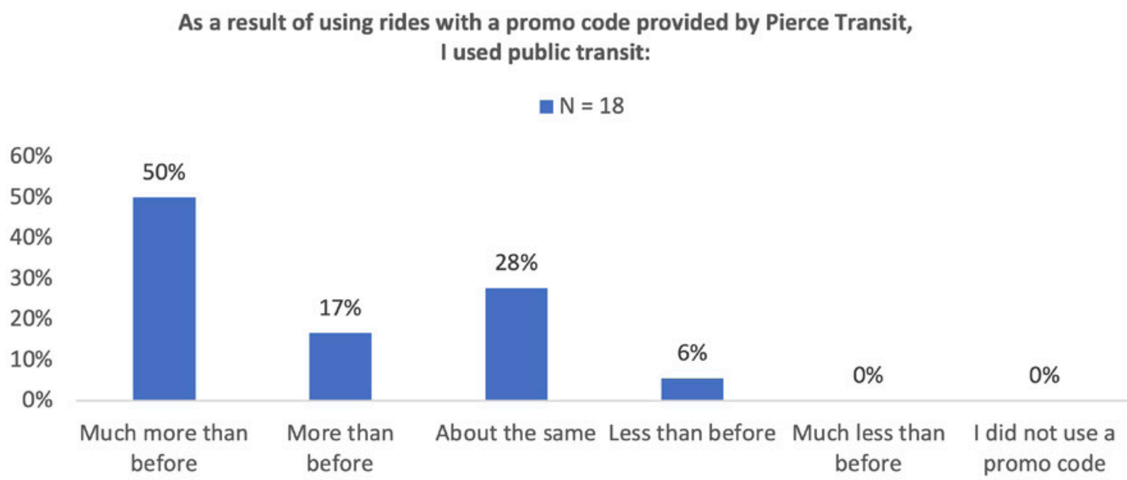


**Figure 4-6** *Change in Public Transit Use as Result of Promo Code*

Although the sample size was small, the distribution predominantly shows an increase in public transit use as a result of the project. This result, in combination with the previous results from similar questions, suggest that Hypothesis 3 is supported.

**Hypothesis 4: The number of people accessing the Sound Transit stations increases.**

| Performance Metric | Key Finding |
| --- | --- |
| Number of riders accessing rail transit stations before and during the project | Overall levels of ridership of Sound Transit do not appear to have been impacted by the project. |

Hypothesis 4 sought to take a closer look at the number of people accessing Sound Transit stations. This evaluation was similar to that conducted on ridership data with Pierce Transit but for the Seattle Sounder commuter rail line. The Seattle Sounder runs from the southern end of the Tacoma region to downtown Seattle. Figure 4-7 shows the total boardings for all Sound Transit stations and the total boardings of the two Sounder stations in the Tacoma region. Data for these individual stations contained few monthly anomalies that had to be corrected by interpolation (October–December 2015 and December 2018), whereas anomalies within the aggregate series were corrected using public ridership reports that readily contained total boardings for the whole system. The total boardings are plotted on the left axis, and the two Tacoma region stations are plotted on the right axis.

Figure 4-7 shows that ridership on the Seattle Sounder exhibited a steady increase during the years leading up to the end of the project performance period. The final month of the project had a significant decline in ridership, but this could have been an anomaly with the data. Although the COVID-19 pandemic was soon to hit the U.S., it was not severely affecting the country in December 2019. Nonetheless, both series exhibit a precipitous drop at this time.

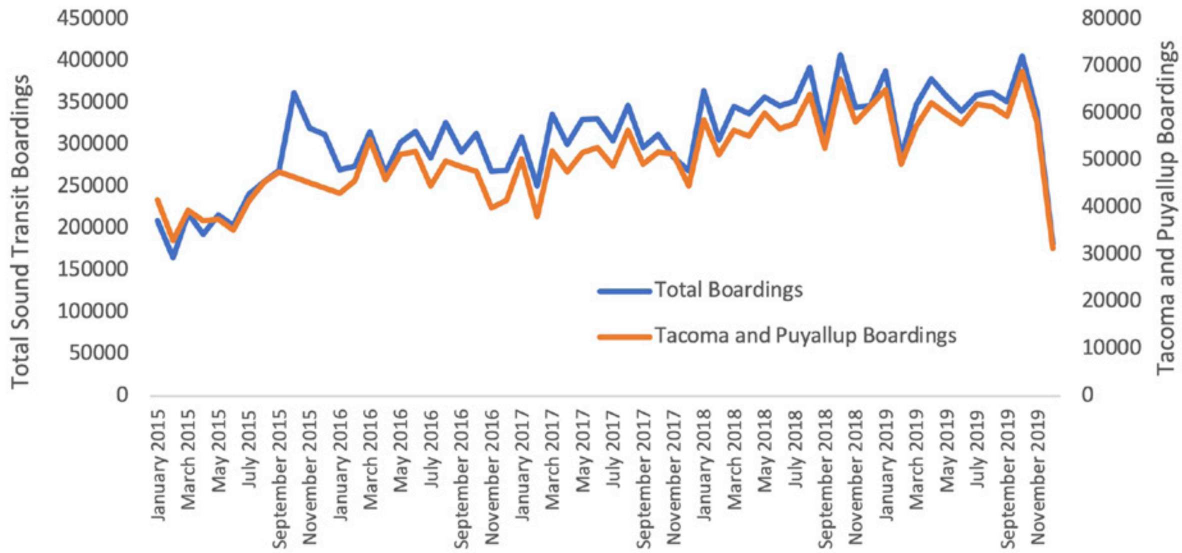


**Figure 4-7** *Total Boardings for Sound Transit Seattle Sounder, 2015–2019*

The correlation between total boardings and stations in the Pierce Transit region was 0.93, suggesting that the patterns of the local stations and the system showed similar findings to Hypothesis 2. Collectively, the examination of ridership did not show significant increases in ridership during the project period. Hypothesis 4 was not supported.

**Hypothesis 5: The cost-effectiveness of the TNC/ridesourcing service provision will be better than previously-demonstrated fixed-route services.**

| Performance Metric | Key Finding |
|---|---|
| Dollars spent per rider accessing Sounder stations and Pierce Transit bus routes, broken out by connections at Sounder stations. | The analysis found that the project delivered mobility at costs per trip that were significantly lower than those of previously demonstrated fixed route services designed to achieve the same objectives during 2014 and 2015. |

The fifth hypothesis explored whether the cost-effectiveness of the TNC/ridesourcing service provision was better than that of previously-demonstrated and existing fixed-route services. This hypothesis was evaluated using monthly cost data from Lyft, 2019 agency profile data from FTA's National Transit Database (NTD), and summary information from a fixed-route demonstration that was previously implemented by Pierce Transit. In addition to trip cost, data from Lyft recorded various attributes for each trip, including request time, distance, duration, and origin and destination census tract. The agency profile data provided cost-effectiveness metrics for Pierce Transit, against which similar metrics devised from the Lyft data were compared.

In 2014 and 2015, Pierce Transit implemented two fixed routes, 503 and 504, with demonstrations called the Fife-Milton-Edgewood (FME) Community Connectors. The objective of these services was to fill the same mobility and accessibility gaps as the Pierce LAC project. Route 503 was the Fife-to-Puyallup Sounder Station Community Connector and operated on weekdays, providing peak commuter service with trips synchronized to Sounder train connections. Route 504, the Milton and Edgewood Community Connector, was tailored for local community destinations.

The two services had a total ridership of 8,823 unlinked trips over 573 days of service. The net cost per passenger served was $139.83 for Route 503 and $107.44 for Route 504. A major goal of the LAC project was to deliver similar mobility costs at a lower cost per passenger.

Not all transit services operating in the Fife and Milton regions operated at such efficiencies (which were relatively inefficient in this case). During 2015, Pierce Transit operated Route 500 from Federal Way to Downtown Tacoma, with 355,084 boardings at a cost per passenger of $5.85. Route 501 ran from Milton to Federal Way, delivering 143,289 boardings and operated at a cost per passenger of $11.50.

The analysis of this hypothesis explored the cost per passenger of the project and compared those costs with the costs of the two fixed-route connector services, routes 503 and 504, and against those of more highly-used routes such as routes 500 and 501. The analysis also evaluated the costs of the project against the average costs of transit operations within Pierce Transit.

With the application of Lyft cost data, metrics evaluated were trip cost, cost per vehicle mile, and cost per vehicle minute. The project fully subsidized the user cost for concierge trips and subsidized up to $30 for conventional trips. For the vast majority of trips, the fare paid by the user was the same as the subsidy paid by the agency. These metrics were grouped by hour of day and day of week to reveal changes in cost-effectiveness related to when a trip was hailed and to better understand the utilization of the Lyft provision. Summary statistics for the ungrouped data are shown in Table 4-1. The evaluated metrics remained mostly stable over time, with some deviations, as described below.

**Table 4-1** *LAC Trip Summary Statistics*

| | Weighted Mean | Unweighted Mean | Median | Std. Dev. |
|---|---|---|---|---|
| Cost per unlinked passenger trip | | $11.70 | $11.61 | $4.30 |
| Trip length, mi | | 4 | 3 | 2 |
| Trip duration, min | | 10.7 | 10 | 4.9 |
| Cost per vehicle mile | $3.30 | $4.20 | $3.57 | $2.09 |
| Cost per vehicle minute | $1.10 | $1.21 | $1.14 | $0.43 |
| Trip count, total | 8,842 | | | |

*The weighted means represent the true averages (e.g., total cost divided by total vehicle miles was $3.30), and the unweighted means, medians, and standard deviations are calculated by giving all trips equal weight to the measure regardless of length or duration.*

First, total trip count increased steadily throughout the period of data collection, resulting in a similar upward trend in total trip expenses, as shown in Figure 4-8. This is likely due to demand increasing as awareness of the LAC pilot expanded.

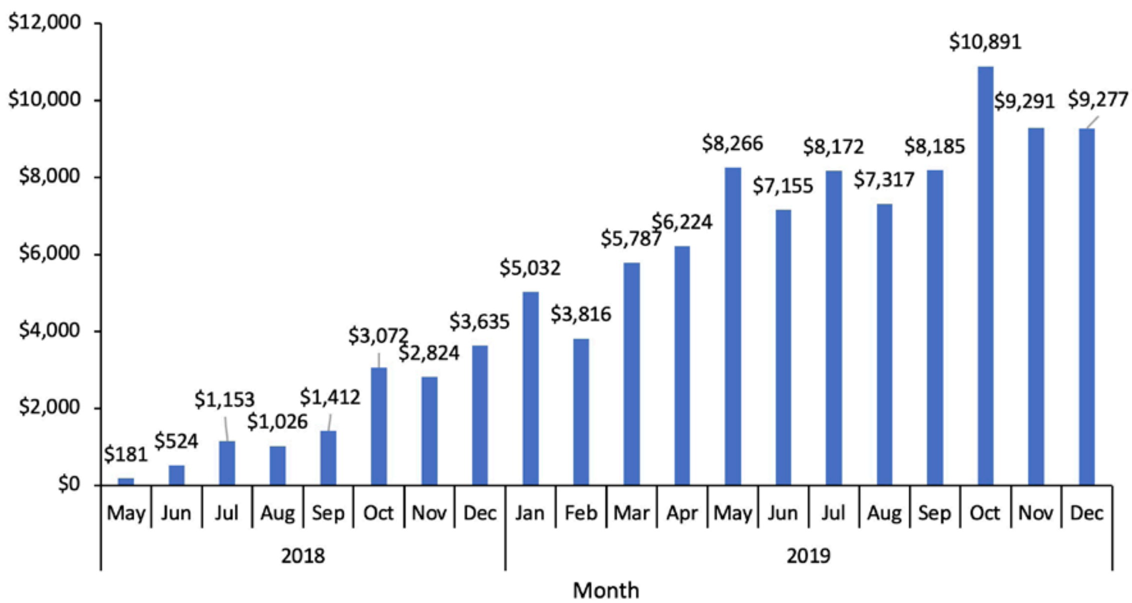


**Figure 4-8** *Total Trip Cost to Agency by Month*

Total trip expenses were also much lower on non-weekdays and outside of AM and PM peak hours, as shown in Figures 4-9 and 4-10, respectively. This is due to the majority of demand for Lyft trips occurring on the commute between home and work.

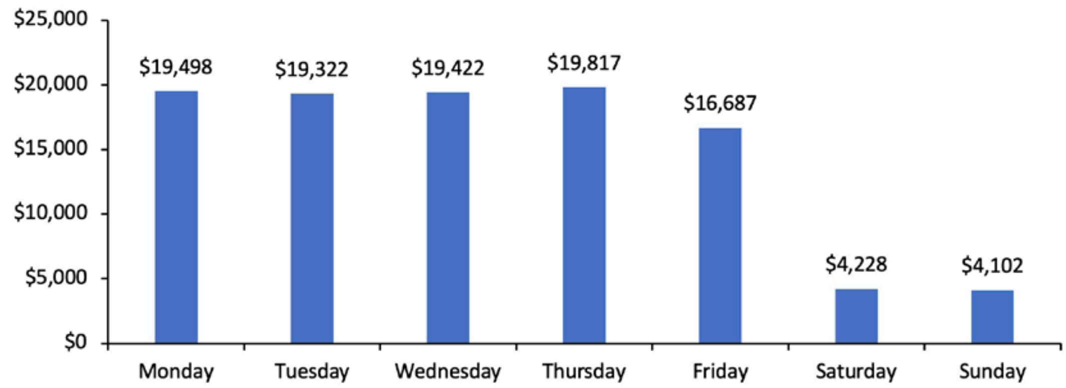


**Figure 4-9** *Total Trip Cost to Agency by Weekday*

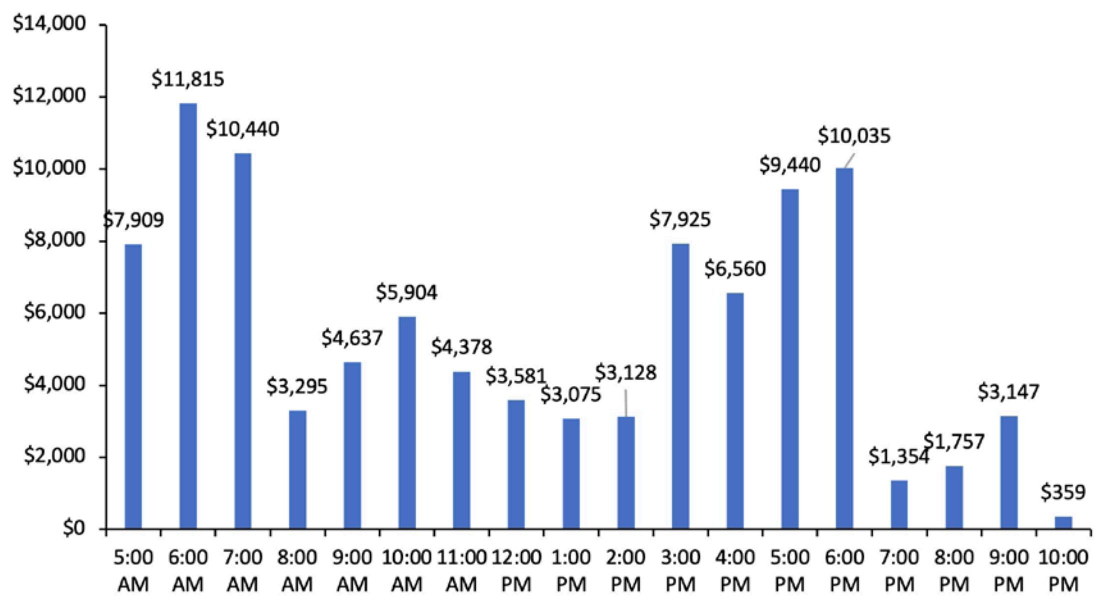


**Figure 4-10** *Total Trip Expenses by Hour of Day*

The average cost per minute was slightly higher on Saturdays and Sundays, as shown in Figure 4-11. This could be explained by the lower trip duration on these days as seen in Figure 4-12, causing whatever fixed price of the Lyft ride that may exist to comprise a greater proportion of the ride's total cost.

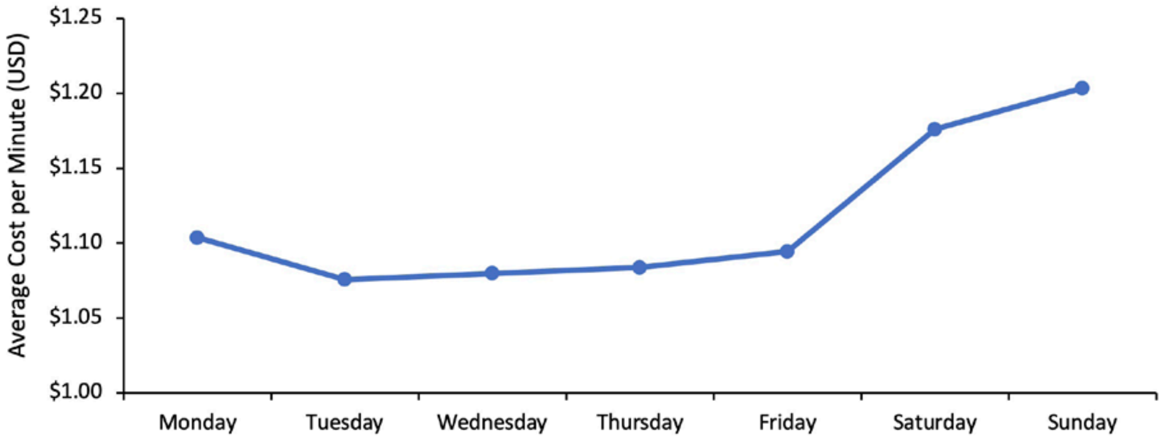


**Figure 4-11** *Average Agency Cost per Minute by Weekday*

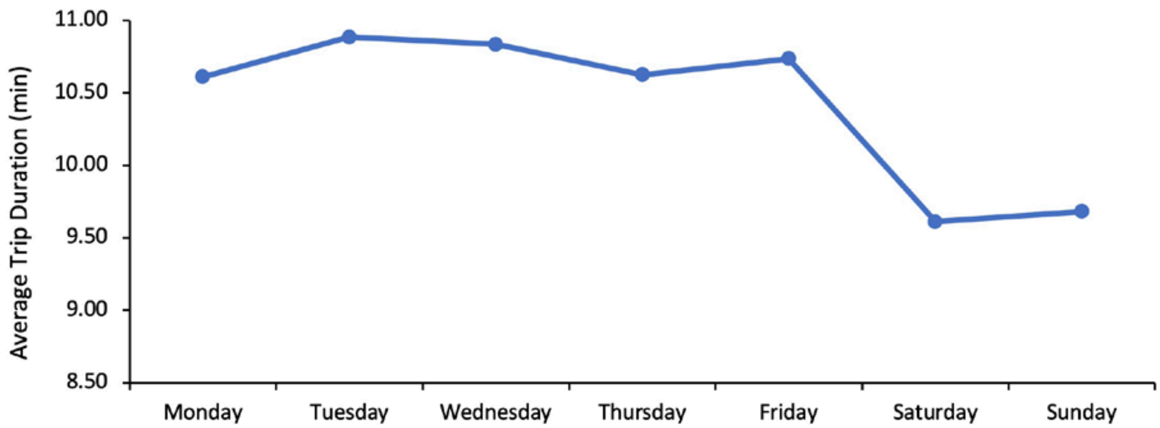


**Figure 4-12** *Average Trip Duration by Weekday*

The final deviation observed was that the average cost per mile appeared to increase in the final few months of the period of data collection, as shown in Figure 4-13. The drop in average trip length seen in Figure 4-14 in the same time period could explain this change, as the fixed price of the Lyft ride would then be a greater proportion of the total cost. The reduction in average trip length could be due to a change in population demographics, with more Pierce College Puyallup students hailing shorter rides between campus and home in the fall season than during the summer months.

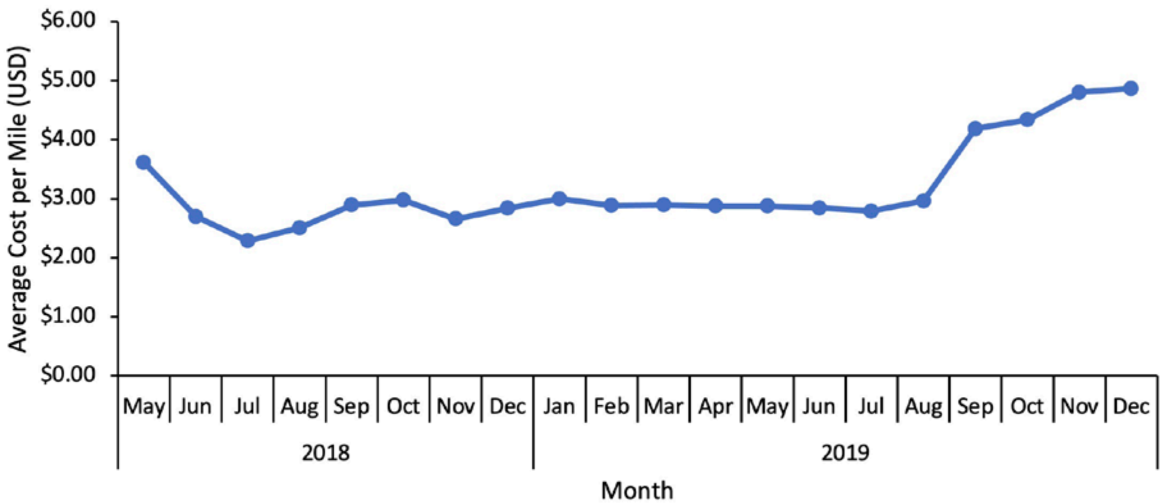


**Figure 4-13** *Average Cost per Mile by Month*

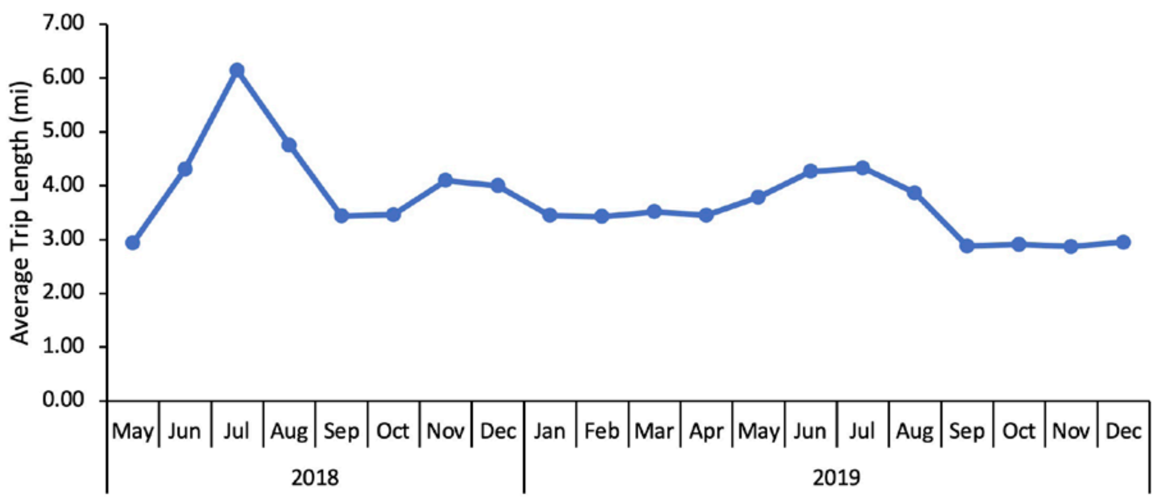


**Figure 4-14** *Average Trip Length by Month*

With regard to comparison of the Lyft provision's cost-effectiveness to currently-existing fixed-route services, the service effectiveness metrics considered were cost per unlinked passenger trip, cost per passenger mile, and cost per passenger hour. Table 4-2 summarizes these.

**Table 4-2** *Service Effectiveness Metrics for LAC (Lyft) vs. Fixed-Route Service*

| Service | Agency Cost per Unlinked Passenger Trip | Cost per Passenger Mile | Cost per Passenger Hour | Unlinked Trips per Vehicle Hour |
|---|---|---|---|---|
| Route 503 | $117.17 | NA | NA | 1.22 |
| Route 504 | $105.13 | NA | NA | 1.36 |
| LAC (Lyft) | $11.70 | $3.30 | $65.69 | 5.62 |
| Average Pierce Transit fixed-route service | $8.46 | $1.93 | $21.87 | 18.9 |

The service efficiency metrics in Table 4-3 can be used equivalently to understand the efficiency of the fixed-route service and construct cost-effectiveness metrics based on cost per vehicle mile and cost per vehicle hour. Note that for the Lyft services, vehicles miles equals passenger miles and vehicle hours equals passenger hours. This is due to two attributes of the service. First, Lyft vehicles are in service for the project only when they are taking a passenger who is using a coupon code or booked the trip through the concierge service. Outside of this time, the Lyft vehicles are simply operating as regular Lyft vehicles. In that sense, the design project enabled Pierce Transit to use the vehicle stock only when it was needed. This is a considerable advantage with respect to managing costs, in that idle time of the vehicle or labor are not covered by Pierce Transit (at least not directly). For the purpose of cost comparison, Lyft passenger miles are also equal to Lyft vehicle miles within these data and project design. It is possible that a coupon or concierge passenger traveled with a companion during a given trip, but this information is not regularly collected by TNCs, and was not available in the data.

**Table 4-3** *Service Efficiency Metrics for LAC (Lyft) vs. Fixed-Route Service*

| | Cost per Vehicle Mile | Cost per Vehicle Hour |
|---|---|---|
| Route 503 | NA | $143.52 |
| Route 504 | NA | $143.35 |
| LAC (Lyft) | $3.30 | $65.73 |
| Average Pierce Transit fixed-route service | $14.11 | $159.49 |

Overall, the analysis results demonstrated that the provision of the LAC project was more cost effective than previously demonstrated fixed route services that were established to achieve the same objective. While separate from the hypothesis, the services were not found to be more efficient that fixed-route transit in general, where higher levels of ridership exhibited greater cost efficiency on the provision of mobility via public transit. The results of the analysis support Hypothesis 5.

**Hypothesis 6: The cost-effectiveness of the TNC/ridesourcing provision will be better than previously demonstrated by paratransit services**

| Performance Metric | Key Finding |
|---|---|
| Dollars spent per rider relative to dollars spent per paratransit rider | The costs of delivering mobility through the project was found to be lower than the costs of delivering paratransit trips. Paratransit services faced disadvantages in this comparison given that it serves a larger region and operates WAV vehicles. |

The sixth hypothesis explored whether the cost-effectiveness of the service provision was better than that of previously-demonstrated paratransit services. This hypothesis was evaluated using monthly cost data from Lyft and past paratransit ridership data. Agency profile data from 2019 from FTA's NTD was also used.

Paratransit ridership for 2013–2019 is presented in Figure 4-15 and shows the scale of the paratransit service and its trend over time. The results show that paratransit ridership declined by 80,000 in 2013–2019. Figure 4-16 shows the operating expenses of the paratransit system over the same annual period. The trend of Figure 4-16 shows that yearly operating expenses gradually increased until 2017 before dropping the following year. There is a weak correlation ($R^2$=0.322) between annual operating expenses and annual unlinked trips. Paratransit trips were dropping consistently during the same period, which possibly spurred efforts to cut operating costs in 2018.

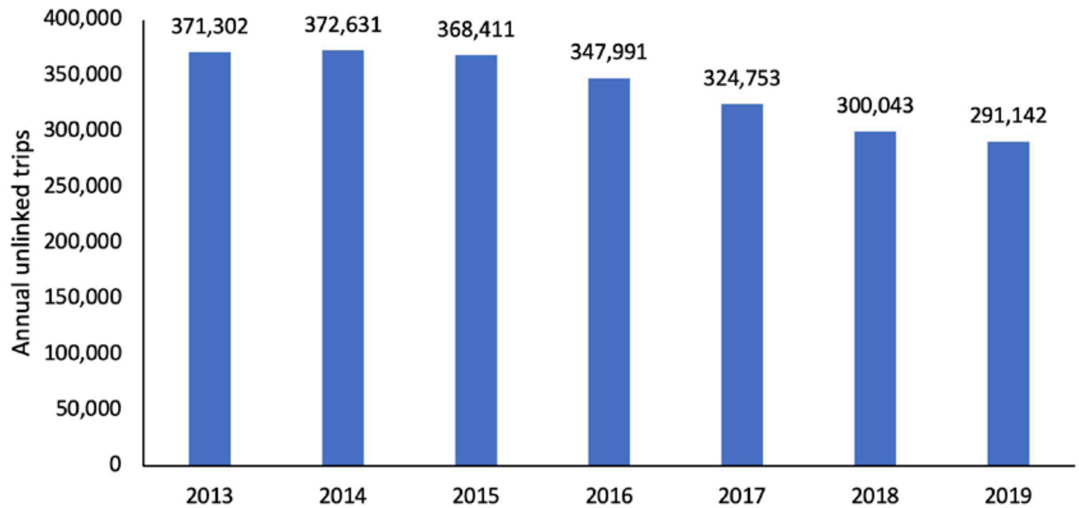


**Figure 4-15** *Annual Unlinked Paratransit Trips per Year*

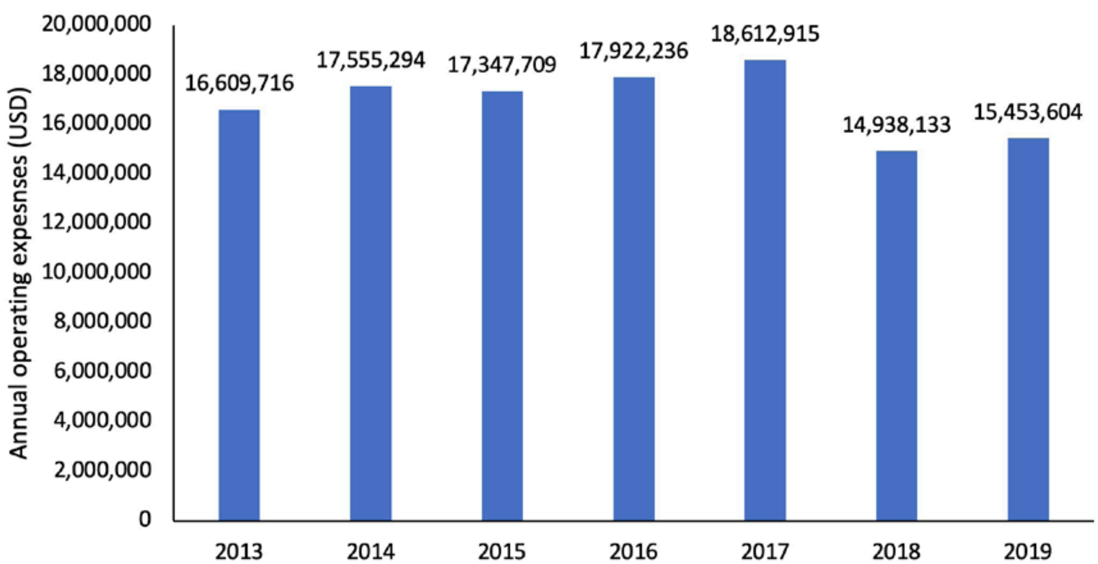


**Figure 4-16** *Annual Paratransit Operating Expenses per Year*

Figure 4-17 shows the distribution of trip lengths for both the Lyft trips and paratransit services during the evaluation, with blue showing that of paratransit trip lengths and orange showing that of Lyft trip lengths. The brown areas show where the distributions overlap. The distributions show that the Lyft trips were generally shorter than the trips served by paratransit. This difference was driven by the difference in service regions. Lyft was required to serve trips only within the zones of the LAC project, whereas the paratransit system was required to service the broader Tacoma region.

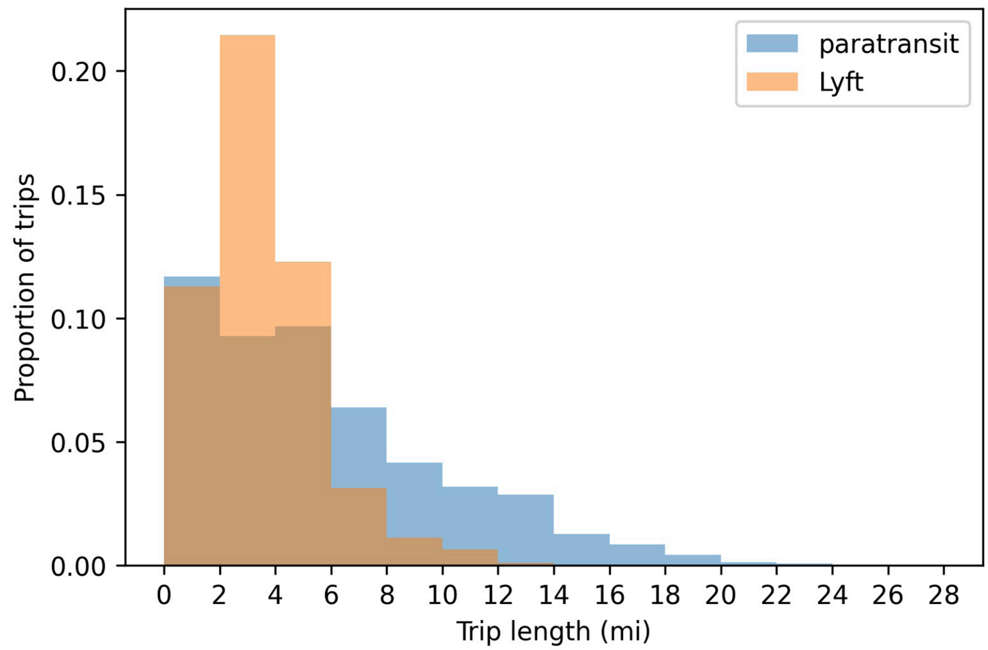


**Figure 4-17** *Trip Lengths, Paratransit and Lyft*

Figure 4-18 shows the spatial distribution of Lyft vs. paratransit trips. Darker blues indicate higher totals; data for Lyft span May 2018–December 2019, and data for paratransit span January 2018–August 2020.

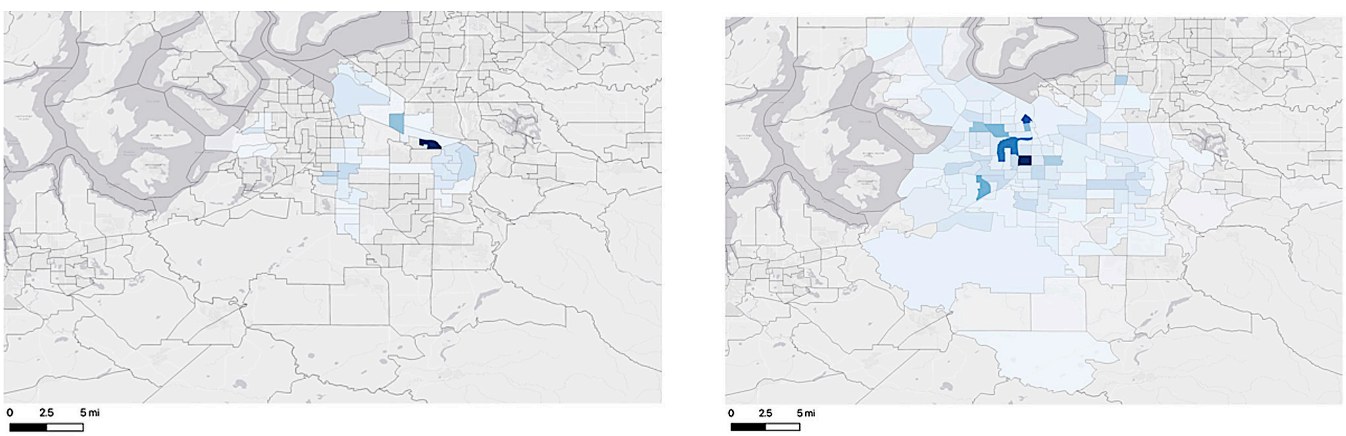


**Figure 4-18** *Spatial Distribution of Lyft Pick-ups (left) vs. Paratransit Pick-ups (right) by Census Tract*

Comparing in Figure 4-18 the origins of the Lyft trips (left) to paratransit trips (right), it is clear that the utilization differed greatly, with the census tract with the most Lyft pickups containing Pierce College Puyallup and the tracts with most pickups for paratransit representing more suburban areas. These and other factors contributed to the differences in cost per trip experienced by the two systems.

To evaluate the comparison of the Lyft provision's cost-effectiveness to currently-existing paratransit services, service effectiveness metrics considered were cost per unlinked passenger trip, cost per passenger mile, and cost per passenger hour. These statistics are presented in Table 4-4.

**Table 4-4** *Cost-Effectiveness Metrics for LAC (Lyft) vs. Paratransit Service*

| | Agency Cost per Unlinked Passenger Trip | Agency Cost per Passenger Mile | Cost per Passenger Hour |
|---|---|---|---|
| LAC (Lyft) | $11.70 | $3.30 | $65.69 |
| Paratransit service | $53.08 | $6.98 | $106.91 |

The results in Table 4-4 show that provision of demand-responsive travel through Lyft is more cost-effective than the paratransit operations on a per-trip, per-mile, and per-passenger-hour basis. One very important caveat within this result is that Lyft did not provide any WAV service within the project, although it was a goal of the project to include WAVs for Lyft first/last mile service. WAVs could be requested within the project by another means, but none were. As WAV vehicles are larger and more specialized, the lack of WAV provision by Lyft improved the cost-competitiveness of its services in this analysis when compared to traditional paratransit.

Given these caveats, the results suggest that paratransit service in Pierce County was less cost-effective per unlinked passenger trip. This result would hold unless it had supplied at least 183% of its average number of trips in 2019 at the same cost; this would correspond to serving 3.7 unlinked trips per vehicle revenue hour. This increase in ridership would have to have been achieved through additional occupancy only to hold under these results.

The evidence suggests that the provision of services through Lyft was cost-effective relative to Pierce Transit paratransit (on-demand) services. However, this conclusion comes with some important caveats. The paratransit system serviced a larger area than the LAC zones. Further, the paratransit system operated with WAVs. However, whereas WAVs are versatile in the diversity of users they service, they are not the most cost-effective vehicles. Many riders that use paratransit do not necessarily need the full WAV vehicle infrastructure. The analysis presented here suggests that TNC vehicles can service trips at agency costs that are lower than full paratransit service through a variety of cost metrics; however, the project did not test the provision of WAV vehicles. Hence, the comparison executed here is not a completely fair one. It is possible that, were WAV vehicles provided only for trips in which they were needed, as opposed to for all trips, the cost-effective conclusions found here would likely still hold. But this conclusion remains speculative, as the WAV provision was not executed. Collectively, the results of the analysis suggested that Hypothesis 6 is partially supported.

**Hypothesis 7: The project will reduce parking lot use.**

| Performance Metric | Key Finding |
|---|---|
| Survey respondents gauged how much their use of park-and-ride lots changed because of the project as well as commuter parking lot usage data provided by Pierce Transit | Overall park-and-ride lot use does appear to have somewhat decreased but not significantly affected overall. |

Hypothesis 7 explored whether the use of park-and-ride lots was reduced among users of the LAC project. According to Pierce Transit's report, the main purpose of some of LAC codes was to reduce the use of overcrowded park-and-ride lots at commuter stations. Therefore, survey respondents were asked how much their use of park-and-ride lots changed as a result the LAC project. Results from the survey, shown in Figure 4-19, were used to evaluate this hypothesis.

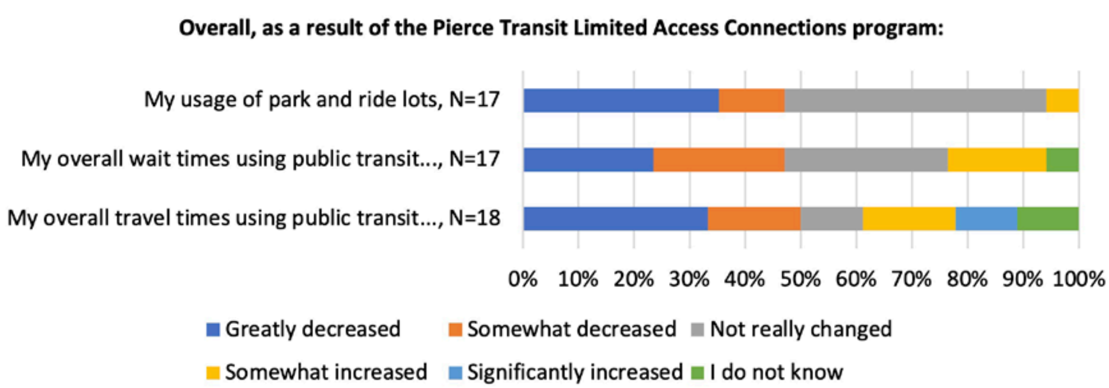


**Figure 4-19** *Change in Travel Times Resulting from LAC*

In addition, the use of those lots over time, gathered from Pierce Transit, was also used. The data set contains the number of spaces used and the total number of spaces available going back several decades for all stations. Occupancy of the Tacoma Dome and Puyallup stations, the only two stations within the range of the project, was used for this analysis. A measurement of the overall occupancy of all stations was used as a benchmark to explain any trends. For practical purposes, the time period was limited to 2017–2019, which partially overlapped with the LAC project, which ran May 2018–December 2019. These combined results are shown in Figure 4-20.

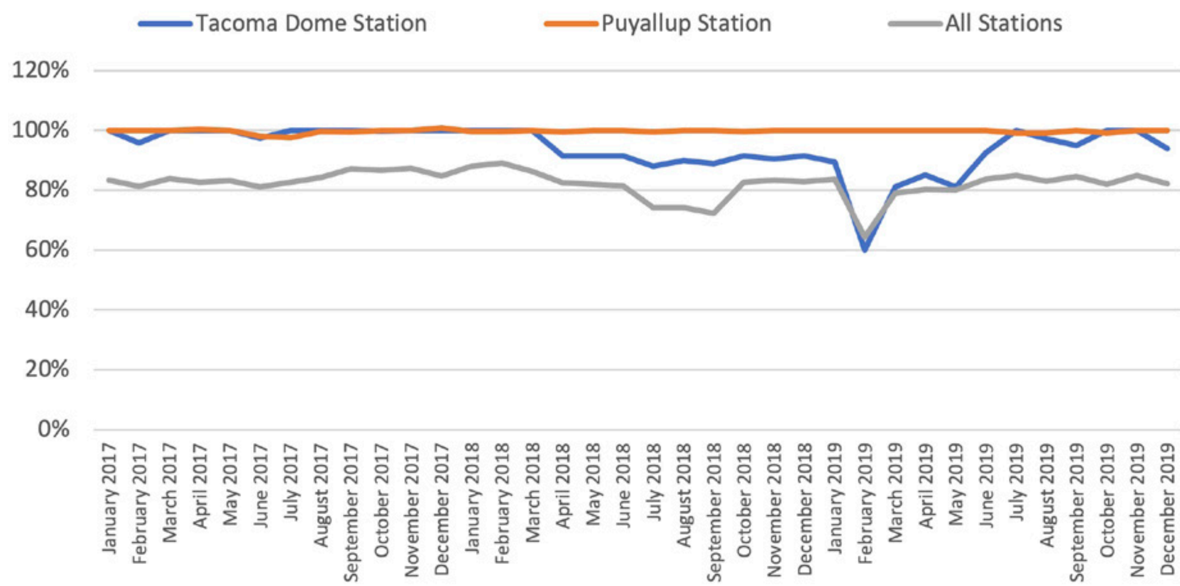


**Figure 4-20** *Park-and-Ride Lot Usage Over Time*

Finally, the differences between the occupancy of those stations and the overall occupancy in 2017 vs. 2019 were directly compared. As it took time to advertise the LAC project, it would be unfair to compare May 2017 to May 2018; therefore, Figure 4-21 shows the difference in percent occupancy from 2017 (no project) to 2019 (project already in place for several months).

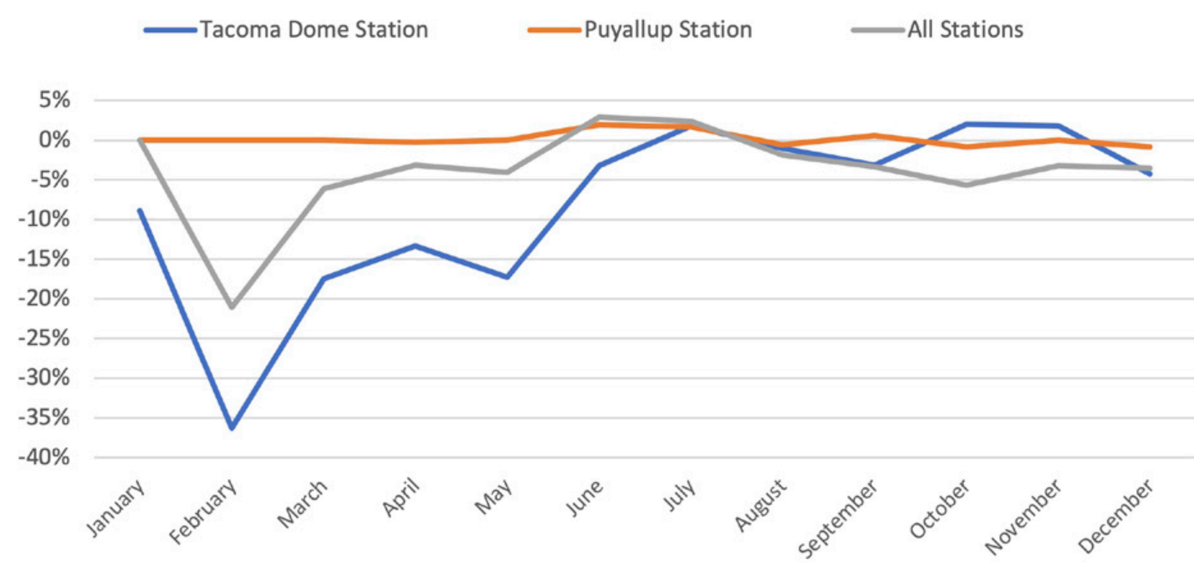


**Figure 4-21** *Percentage Difference in Park-and-Ride Occupancy, 2017 vs. 2019*

Figure 4-21 also shows how much respondents' use of park-and-ride lots increased or decreased due to the LAC project. The survey found 35% of respondents reporting they saw their use of the lots "greatly decrease."' That is in addition to the 12% who indicated their use "somewhat decreased." Only one respondent (6%) saw their use of park-and-ride lots "somewhat increase." Park-and-ride lot occupancy data were used to evaluate trends in occupancy. Figure 4-21 shows the overall level of occupancy of the 20 lots in the Pierce Transit jurisdiction and the Tacoma Dome and Puyallup stations specifically for 2017–2019.

Across all lots within Pierce Transit's jurisdiction, occupancy generally remained at steady rate at or around 80%. One exception occurred during February 2019, where a drop in occupancy at the Tacoma Dome station reduced occupancy of the system lots to about 60%. The Tacoma Dome station, which had a capacity of 2,337 at the beginning of the project and 2,380 at the end of the project, represents about 35% of total capacity of Pierce Transit park-and-ride lots; events at this station will move the total occupancy of the system.

The Puyallup Station occupancy shows a park-and-ride lot that was at capacity the entire term of the project and during the preceding year. The occupancy trend at the Tacoma Dome station shows that there was a drop from 100% to about 90% when the project began. This reduction stayed present until the middle of 2019, when occupancy returned to full utilization. It is possible that the drop in utilization of this park-and-ride lot had some association with the project. Based on the codes submitted by users, a sizable number of trips went to the Tacoma Dome station. Of the 10,457 trips for which codes were recorded, 1,123 trips (~11%) were to the Tacoma Dome station. This traffic level would have been enough to influence the capacity utilization of the Tacoma Dome station lot. The 10% drop in lot utilization at the start of the project suggests that about 230 spots were freed up. This is larger than what the trips would have caused, suggesting that other factors were possibly at play, but changes in parking lot utilization and size of the trip activity suggest that the project was influential enough to impact the lot occupancy.

Figure 4-21 shows the difference, per month, in occupancy before (2017) and during (2019) the LAC project. Negative values indicated a decrease in occupancy in that month and positive indicates an increase.

Although there were significant drops in occupancy for the Tacoma Dome Station in the first several months of 2019, these trends are once again mirrored in the overall occupancy. There were, however, multiple small drops towards the middle and end of the year that could be due to the Lyft rides. The Puyallup Station, on the other hand, saw very little variation between 2017 and 2019. There were, however, dips in the percentage towards the end of 2019 of around

1%. It is possible that parking lot use fell among some users but that those spaces were filled by others not part of the project.

Combining the results of the survey showing respondents' decrease in lot usage, as well as some dips in usage in the parking lot data, there could be some connection between the LAC project and lower parking lot usage. However, these drops were either relatively small or deviated only slightly from the overall parking usage. Overall, the findings suggest that Hypothesis 7 was partially supported.

**Hypothesis 8: The overall travel times of users decrease.**

| Performance Metric | Key Finding |
|---|---|
| Survey respondents gauged how much their travel times decreased or increased due to the project | Travel times appear to have increased for some and decreased for others. More respondents (50%) reported a decrease than increase (28%) in travel times. |

Hypothesis 8 evaluated travel times among users of the LAC project. As public transit service schedules were not affected, the evaluation explored whether riders were able to get to and from their destination or transit connection. Survey respondents were asked how their overall travel times using public transit have changed.

As noted in Hypothesis 7, Figure 4-19 above shows the results of the survey relating to this hypothesis; 33% of respondents said their travel times "greatly decreased" and 17% said their travel times "somewhat decreased." There were, however, 17% and 11% who indicated their travel times "somewhat increased" and "significantly increased"; another 11% said their travel time had "not really changed."

Grouping them, 50% of respondents reported a decrease in travel time vs. 28% who saw an increase in overall travel time. It is also worth noting that those who saw their travel time greatly decrease outnumbered all who saw any type of increase. This suggests that there could be several factors contributing to whether a user experienced an increase or decrease in travel time. Whereas the survey did not ask for those factors, it is safe to say the LAC project somewhat decreased travel times overall for a majority of users. Overall, Hypothesis 8 was found to be partially supported.

**Hypothesis 9: The overall wait times of users decrease.**

| Performance Metric | Key Finding |
|---|---|
| Survey respondents gauged how much their wait times decreased or increased due to the project | As with the travel times, the respondents did not have a universal consensus. However, the results trend towards decreased wait times overall. |

Hypothesis 9 evaluated how the LAC project impacted the ability of public transit riders to get to transit stops at times that require minimal waiting. As with the previous hypothesis, survey respondents were asked to categorize how their overall wait times changed.

As shown, Figure 4-19 above summarizes the results from this survey question. Compared to overall travel time, fewer respondents reported their waiting time “greatly decreased” (24% wait time vs. 33% travel time). Those who said their wait times “somewhat decreased” was also 24%. This means that just under a majority of respondents (48%) saw any kind of wait time decrease. This is compared to 18% of those who report a “somewhat increased: wait time. No respondents saw wait times “significantly increase”; the remaining users did not know or saw very little change.

These results were more favorable than the overall travel times. Nearly a majority of users saw overall wait times decrease compared to small portion who saw them increase (no respondents reported that their overall wait time “significantly increased”). The evidence suggested Hypothesis 9 was supported.

**Hypothesis 10: Passengers using wheelchairs will (on average) report improved mobility.**

| Performance Metric | Key Finding |
|---|---|
| Reported travel times, wait times, mobility, and accessibility by passengers using wheelchairs | A single respondent took the survey who reported a disability that impacted their ability to drive an automobile. This individual reported in a number of questions that the system improved his or her mobility. |

Hypothesis 10 of the evaluation sought to ascertain whether passengers using wheelchairs reported improved mobility as a result of the project. The survey asked respondents three questions to evaluate disabilities using “true” or “false” responses, as follows:

- I use a wheelchair.
- I have disabilities that prevent me from driving an automobile.
- I require special accommodation, such as vehicles that can accommodate wheelchairs, in order to get around.

A limitation of this survey was the small sample size of 18. A further limitation is that persons with disabilities are a subset of most user populations. No respondent reported using a wheelchair. One respondent with the sample reported “true” that they had a disability that prevented them from driving an automobile. This individual offered a number of responses suggesting that, at least in this case, the system improved the mobility of a passenger with a reported disability. A collection of the survey questions and responses from this individual are shown in Table 4-5.

**Table 4-5** *Mobility-Related Responses of Individual with Disability*

| Question | Response |
|---|---|
| How have the Pierce Transit Lyft rides impacted the locations to which you travel? | I now travel to locations that I could not reach before |
| As a result of using rides with a promo code provided by Pierce Transit, I used public transit ... | Much more than before |
| Overall, as a result of the Pierce Transit Limited Access Connections program, my usage of park-and-ride lots ... | Greatly decreased |
| Overall, as a result of the Pierce Transit Limited Access Connections program, my overall wait times using public transit ... | Somewhat decreased |
| Overall, as a result of the Pierce Transit Limited Access Connections program, my overall travel times using public transit ... | I do not know |
| Overall, as a result of the Pierce Transit Limited Access Connections program and the guaranteed rides home, my mobility using public transit ... | Greatly improved |

Results of the single respondent with a reported transportation-related disability suggest that improvements in mobility were experienced as a result of the system. However, the person was not a passenger using a wheelchair and, due to the limited sample size of 1, the results are inherently anecdotal. Hypothesis 10 is considered to be inconclusive.

**Hypothesis 11: By increasing transit ridership, trip substitution and mode shift will result in a net VMT reduction.**

| Performance Metric | Key Finding |
|---|---|
| Estimated before and after VMT of service users | The reduction in VMT estimated as a result of personal vehicle shedding and personal vehicle suppression was found to be relatively large as compared to the estimated system VMT. The project was found to reduce net VMT. |

The evaluation sought to determine whether VMT had any net decline as a result of trip substitution, mode shift, and public transit ridership. Assessment of net VMT change requires an assessment of several components of system activity. One key component is behavioral change, in which users change behavior in response to the new mobility options provided by the system. Another key component is system activity, in which the system delivering new mobility options produces its own VMT. In a complete evaluation, this additional VMT must be set against the VMT that is reduced as a result of behavioral change among users.

The first input to this analysis was derived from Figure 4-5, which reports on the mode substitution that occurs when an individual used the LAC system; as shown, overall, 34% of respondents said they would have traveled in a personal vehicle of some kind to the public transit station, and 17% would have not connected to public transit at all but would have driven to their destination. Collectively, 51% of respondents would have engaged in some personal vehicle travel if the system was not available; the remaining respondents would not have made the trip, would have walked, or would have taken public transit.

The survey also asked questions about changes in vehicle ownership. Respondents were asked if they had gotten rid of a car as a result of using the LAC system (i.e., personal vehicle shedding); results are shown in Figure 4-22. One respondent reported getting rid of a vehicle as a result of using the LAC system and also indicated in a follow-up question that they would still have the vehicle if not for the project. That respondent was also asked how many miles they drove annually using that vehicle; the indicated 3,000 miles per year, which suggests that the car had been lightly used but was shed as a result of the project. The vast majority (89%) did not get rid of a vehicle during the project.

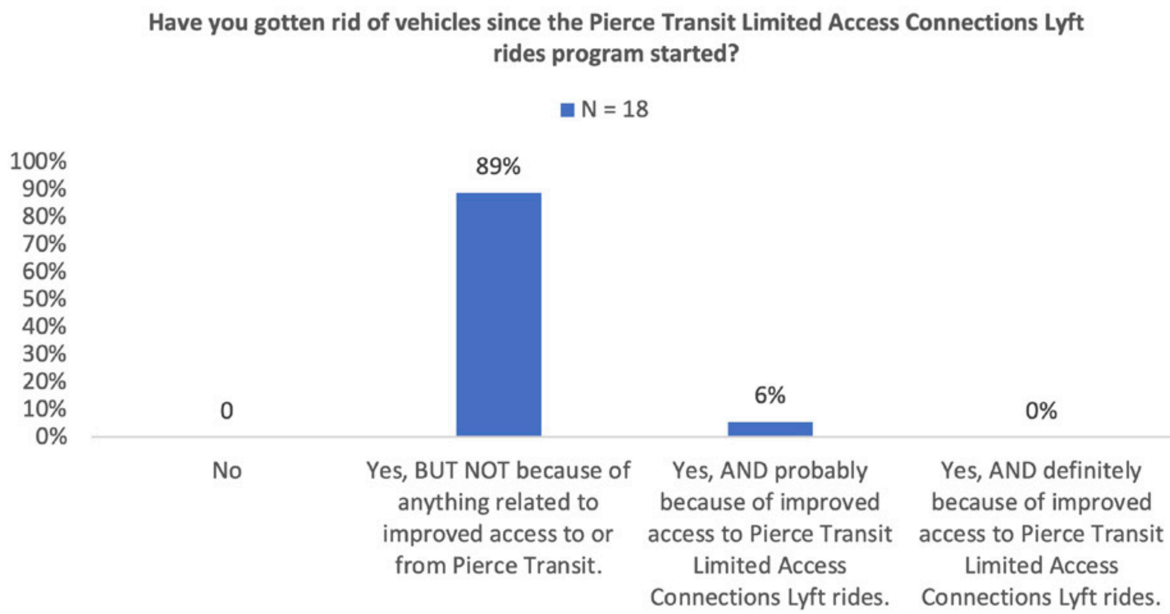


**Figure 4-22** *Vehicle Shedding Due to LAC Use*

In addition to exploring the impact of the project on vehicle shedding, the survey evaluated whether users acquired a vehicle after the project was over. The results are shown in Figure 4-23, showing that 72% of respondents had not sought to acquire a vehicle, 11% had acquired a vehicle, and others (12%) were looking to acquire one or had thought about it. Although the sample was small, this suggests that the project served as a substitute for the mobility provided by a personal vehicle.

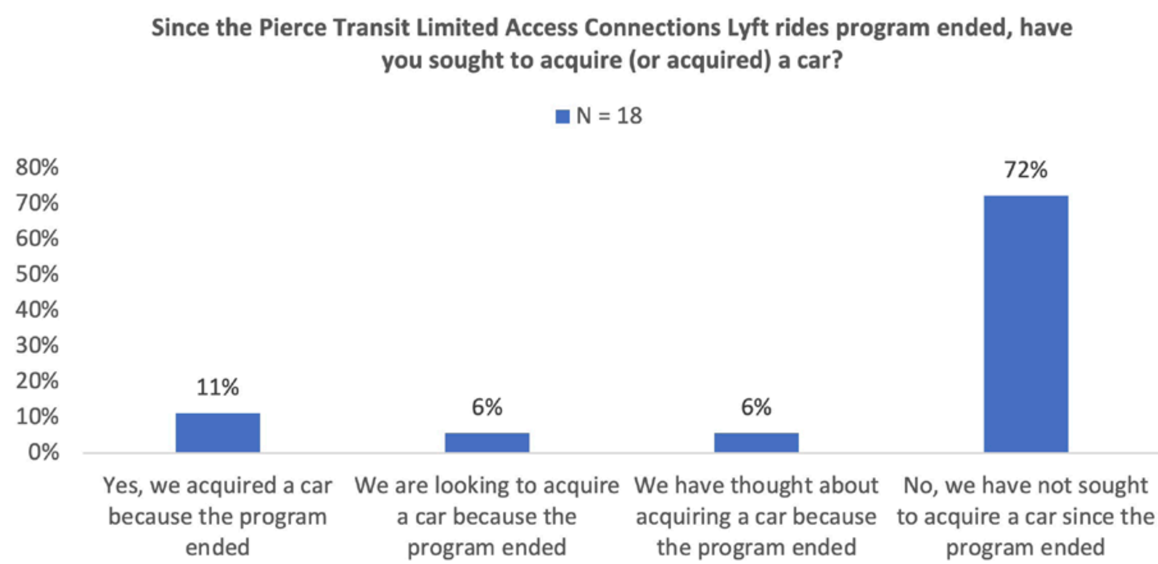


**Figure 4-23** *Vehicle Acquisition Following LAC Project*

In addition to the VMT associated with personal car shedding impacts, there was VMT associated with personal vehicle suppression impacts. Respondents who said they acquired a car, were looking to acquire a car, and thought about acquiring one were asked in a follow-up question to estimate how many miles per year they would drive those vehicles. Only the two responses from those who acquired a vehicle were considered—one said 2,000 miles per year, and the other said 9,000 miles per year.

To assess how this displacement of miles traveled by personal vehicles would apply to the user population, the analysis evaluated the degree to which the sample reflected the population in terms of frequency of use. Respondents with a higher frequency of use of the service may have been more likely to respond to the survey; thus, the sample could be biased towards respondents with higher VMT impacts.

Activity data and survey responses allowed a comparative analysis of the frequency of LAC use associated with the sample and the population. User IDs (which were de-identified) in the activity data allowed for a calculation of trips per user, which can be aligned with the frequency of use response categories in the survey, as shown in Figure 4-24.

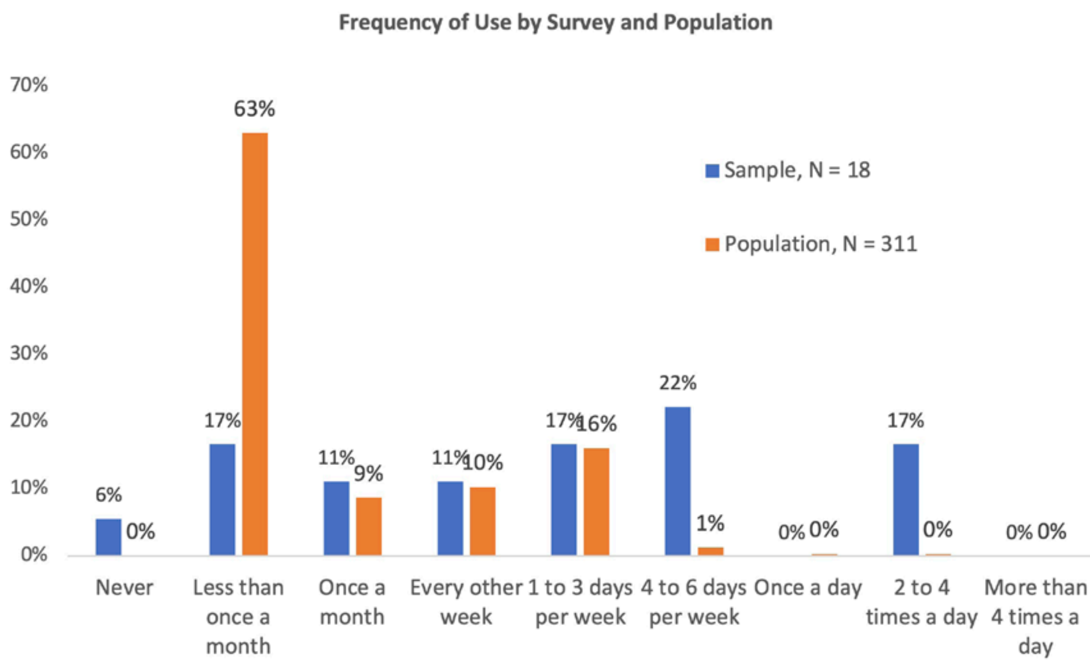


**Figure 4-24** *Frequency of LAC Use Across Sample and Population*

As expected, the share of the population using the LAC service less than once per month far exceeded the share represented in the sample. The sample appears to be more evenly distributed across the frequency of use categories. The within-category quotient of the population share divided by sample share creates the weight, which expands or contracts the impact of a single member of the sample. The weights of individuals who reported suppressing or shedding a vehicle were all close to 1, as they used the service 1–3 days per week or every other week. The weighted miles shed or suppressed were then divided across the sample, yielding the personal vehicles miles shed or suppressed per person. This rate was then applied to the total population size to estimate the miles reduced from personal vehicle shedding or personal vehicle suppression across the population.

Results from this analysis suggest that across the user population the project may have decreased about 50,000 miles per year due to personal vehicle shedding and 182,000 miles per year due to the personal vehicle suppression. In total, these impacts are estimated to have amounted to a reduction of 232,000 miles driven in personal vehicles.

This reduction in personal vehicle driving was set against the other component of VMT, miles traveled by system vehicles to deliver project services. Lyft provided basic activity data on trip miles traveled over the course of the project that included estimates of miles traveled during individual trips. Figure 4-25 shows the distribution of trip miles from the LAC trips completed with Lyft.

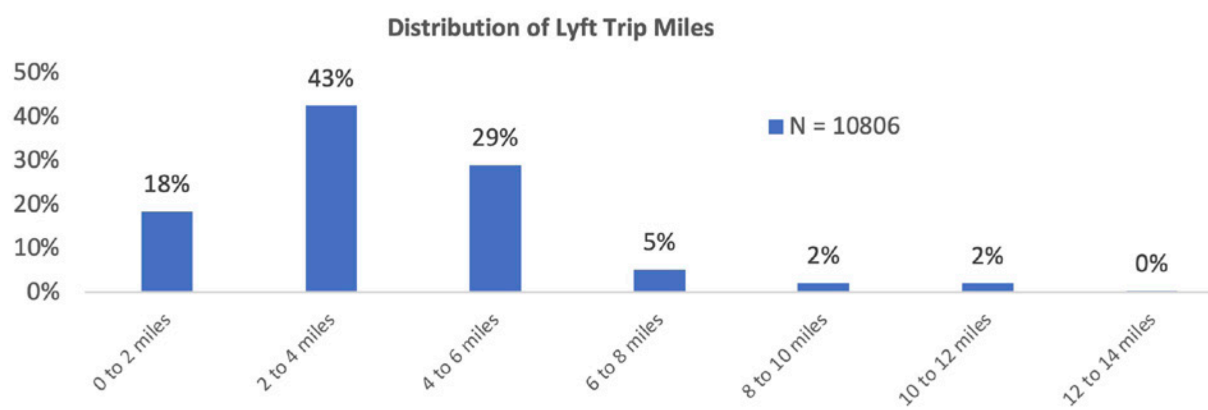


**Figure 4-25** *Distribution of Trip Miles Driven by Lyft within LAC Project*

The distribution shows that 43% of trips were 2–4 miles, and 61% of trips were 4 mile or less. The entire project implemented 10,806 trips. The data presented trip mileage as an interval. By approximating trip mileage as the midpoint of each interval (e.g., 0–2 = 1 miles), the total trip mileage can be estimated. Across all trips, this estimate suggests that Lyft trips amounted to 40,432 miles traveled. This mileage is an underestimate of the true VMT caused by project travel, as it does not include the additional mileage associated with traveling to the passenger or other “deadheading” mileage. Lyft vehicles were not used exclusively for the project, so deadheading was not exclusively a result of the LAC project. However, the estimated mileage traveled for the trips provides an order of magnitude of the VMT of the project.

If 51% of LAC trips were substituted for a trip that would have been made in a personal vehicle (see Figure 4-5), then about half of the VMT would have been driven anyway had the system not been operating. Applying a raw percentage from the sample would suggest that approximately 20,216 miles would have been traveled even in the absence of the system. This implies that the other half would not have occurred and, thus, is additional VMT produced by the system. If the impacts offsetting VMT from this system were derived solely from mode substitution, the result would clearly indicate that the system increased VMT.

The 20,216 net VMT produced by the system was far less than the estimated 232,000 miles reduced by personal vehicle shedding and personal vehicle suppression reported by the sample. The 20,216 net system VMT is a lower bound, because it does not include the fetch distance, the distance a vehicle travels to get to the passenger. This additional distance could be equal to the full system VMT (40,432) and would raise the true system VMT to be a value close to 61,000. Reductions from personal vehicle ownership could still be 30% of their present value, and the project would still have been found to reduce VMT under these estimates. This would amount to a reduction of about 222 miles per project participant. There is uncertainty as to the exact magnitude of the shedding and suppression impacts within the population, but the strong magnitude of both within the relatively small sample suggests that it was large enough to offset the system VMT even with aggressive assumptions on fetch distance. The results suggest that Hypothesis 11 was supported.

**Hypothesis 12: The perception of transit service quality will increase for Pierce College Puyallup students.**

| Performance Metric | Key Finding |
| --- | --- |
| Reported perception of transit service quality by Pierce Transit riders who attend Pierce College Puyallup. | The consensus among Pierce College Puyallup students surveyed is unanimous. All respondents report an improved perception of Pierce Transit services. |

Hypothesis 12 evaluated whether the perception of public transit service quality increased for Pierce College Puyallup students. To gauge this perception, repondents were asked if they had attended the school during 2017–2019; results are shown in Figure 4-26. In total, 22% of respondents indicated they had attended the school.

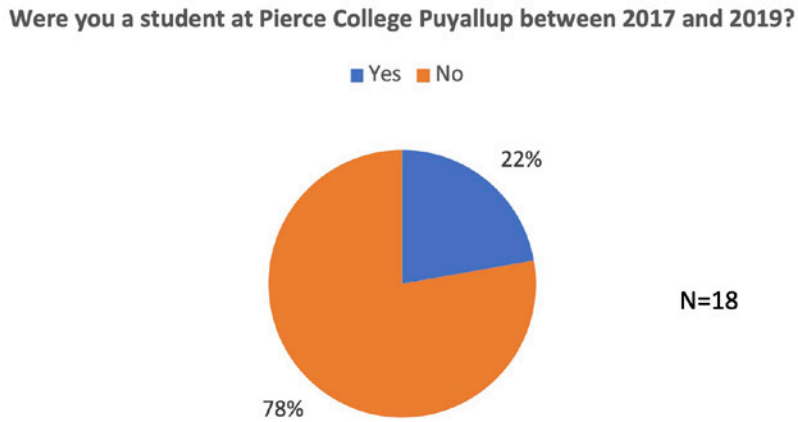


**Figure 4-26** *Survey Respondents who Attended Pierce College Puyallup, 2017–2019*

Figure 4-27 shows responses for those who indicated being students at Pierce College Puyallup during the specified time period; all indicated that their perception of Pierce Transit, mobility, and access to and from public transit had "greatly improved."

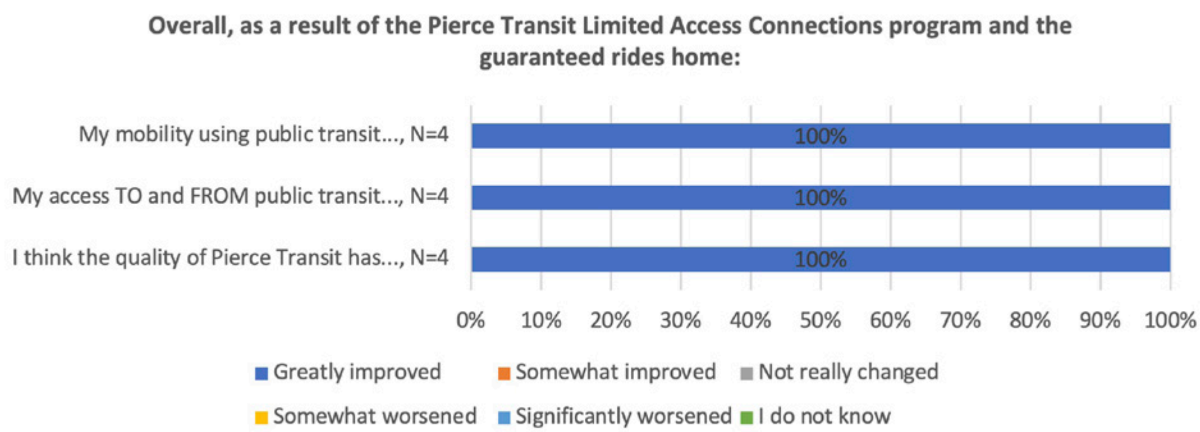


**Figure 4-27** *Perception of Pierce Transit Among Pierce College Puyallup Students*

Of the four respondents who indicated they were students, all indicated that public transit service had improved. The sample size was limited, but the responses received universally support Hypothesis 12.

**Hypothesis 13: Riders that use the guaranteed ride home service will report improved mobility and accessibility.**

| Performance Metric | Key Finding |
|---|---|
| Use of the Lyft promo codes for the guaranteed ride home service within the context of how the project was conducted. | There is reasonable evidence to indicate at least some users of the guaranteed ride home initiative did experience improved mobility and accessibility, despite the evidence not being obvious. |

Hypothesis 13 explored the degree to which riders reported improved mobility and accessibility as a result of using the LAC guaranteed ride home service. Ridership data were used to evaluate use of the promo code during the LAC pilot, from which the code used, month, and year were recorded. Each code had a specific purpose; use of each code during the LAC project is shown in Figure 4-28.

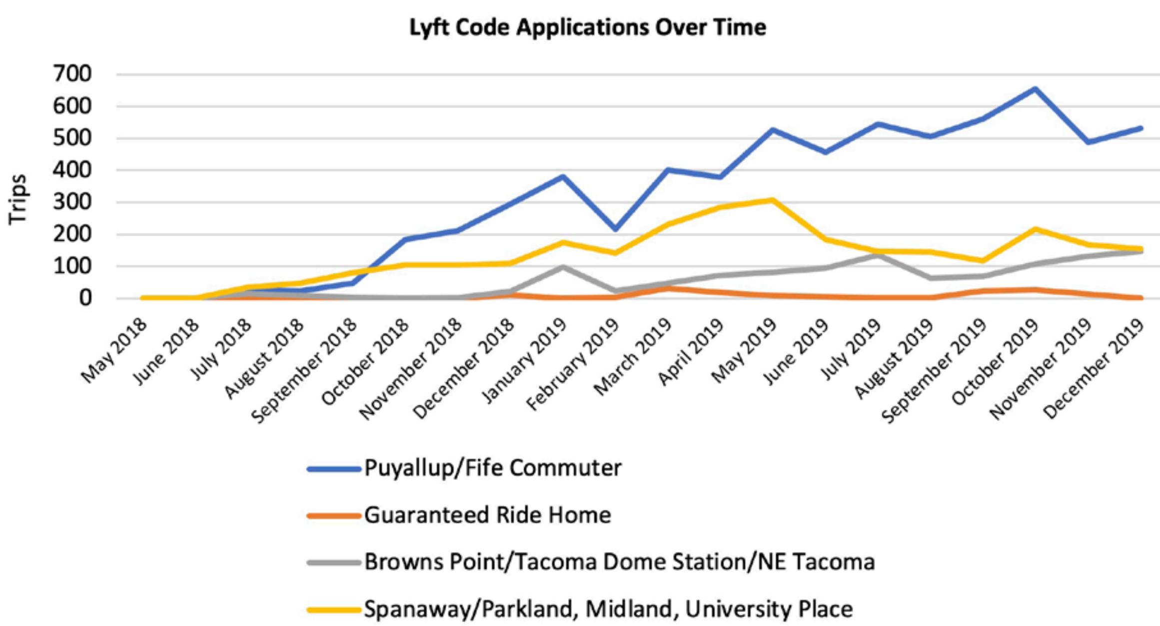


**Figure 4-28** *Use of Lyft Promo Codes, May 2018–December 2019*

As shown in Figure 4-28, use of the guaranteed ride home code was low compared to use of other LAC promo codes. There were two minor peaks around March and October 2019, with a large valley in between, but this could be attributed to how the project was run.

The main purpose of the guaranteed ride home was to provide a free ride for students who took late classes at Pierce County Puyallup. Students without a car had no options to get home, as public transit serving the college no longer was provided from 8:30–10:00 PM (the times the guaranteed ride home code was offered). Figure 4-29 shows frequency of use of guaranteed ride home codes among users. Although a large portion of users used the service only once or twice, a considerable number used it many more times, including two users who used it more than 40 times during the project. Use of the guaranteed ride home code remained flat over the course of the project. As the project went on and more people became aware of it, use of most codes trended upwards; however, use of the guaranteed ride home remained mostly stagnant and was used sparsely throughout the project. The largest number of rides was recorded in March 2019, at 32.

Figure 4-29 also shows how much use of the promo code depended on the time of year. The spring quarter of the Pierce College Puyallup ends in June and the fall quarter begins in September; as students were the primary target of this promo code, these trends favored the hypothesis.

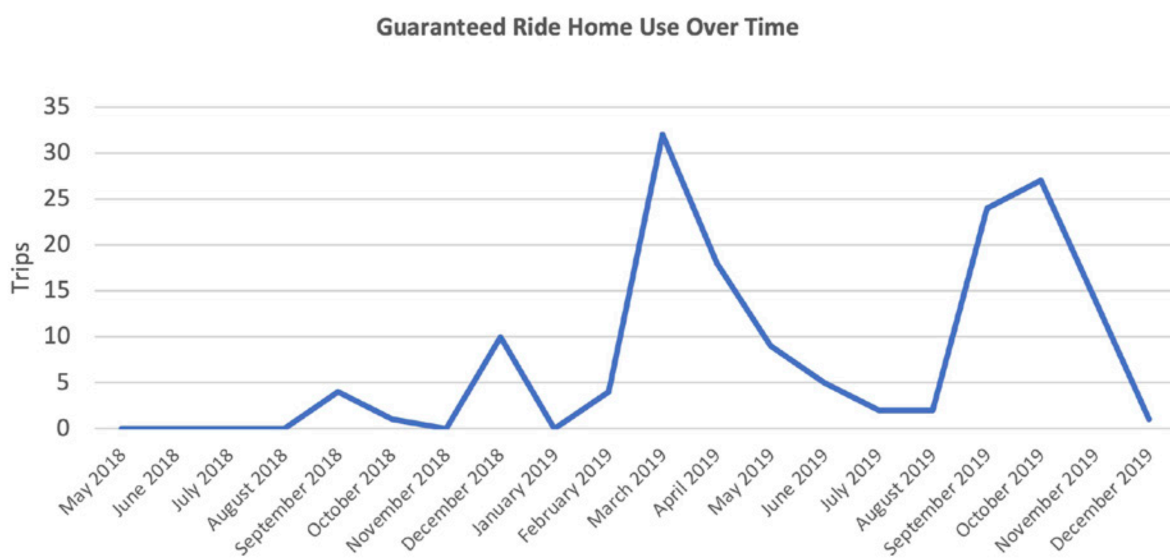


**Figure 4-29** *Guaranteed Ride Home Use*

Figure 4-30 shows the frequency of use for the guaranteed ride home. Note that the distribution applies only to those who used the code at least once (discarding observations of zero). It is important to note that there was no public transit service during the hours of use of the guaranteed ride home service. Thus, it is reasonable to assume that most users of the guaranteed ride home used this code because it was the most desirable and possibly only option for traveling to their destination. It is also observed that some users used the promo code several times, indicating that at least some users valued the code enough to use it often over the course of the project.

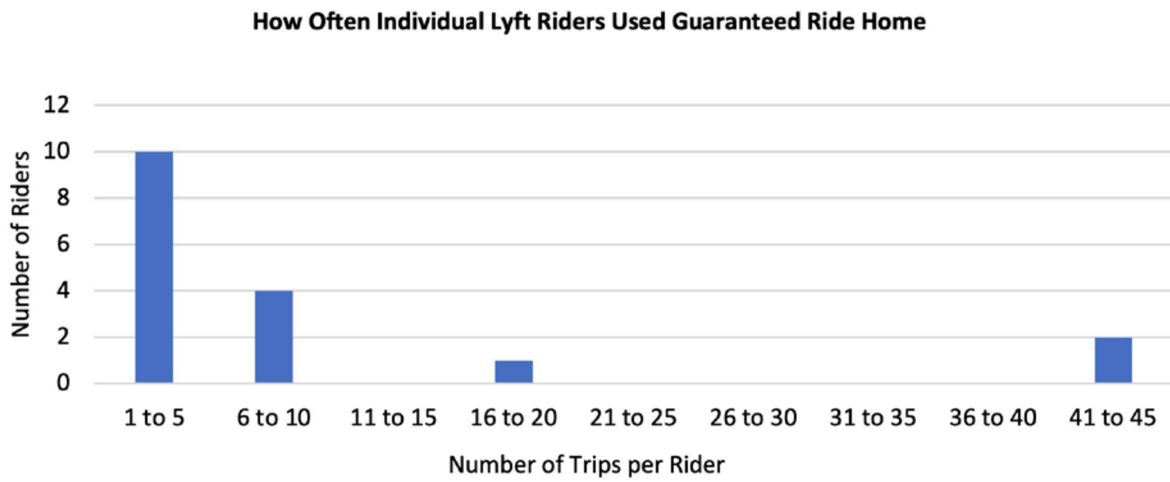


**Figure 4-30** *Frequency Use of Guaranteed Ride Home Codes Among Users*

The hypothesis asked if users of the guaranteed ride home saw an increase in accessibility and mobility. How the project was structured for users with little to no mobility or accessibility combined with relatively frequent use among a large portion of users, however, provides strong evidence in favor of the hypothesis. Overall, Hypothesis 13 was supported.

**Hypothesis 14: The guaranteed ride home enables increased transit use.**

| Performance Metric | Key Finding |
|---|---|
| Survey responses on the utility of the guaranteed ride home | The guaranteed ride home appeared to support access to and from public transit infrastructure. |

Hypothesis 14 sought to establish whether the project impacted increased public transit use. The size of the project (8,827 trips and 330 users) was not large enough to influence ridership at the system level and was not visible within the trends in ridership data. The evaluation sought to determine if evidence in the survey data supported the concept that users were influenced by the project to use public transit more. Two questions were asked about the impact of the Pierce Transit LAC project and the guaranteed ride home service on access to and from public transit and mobility using transit; responses are shown in Figure 4-31.

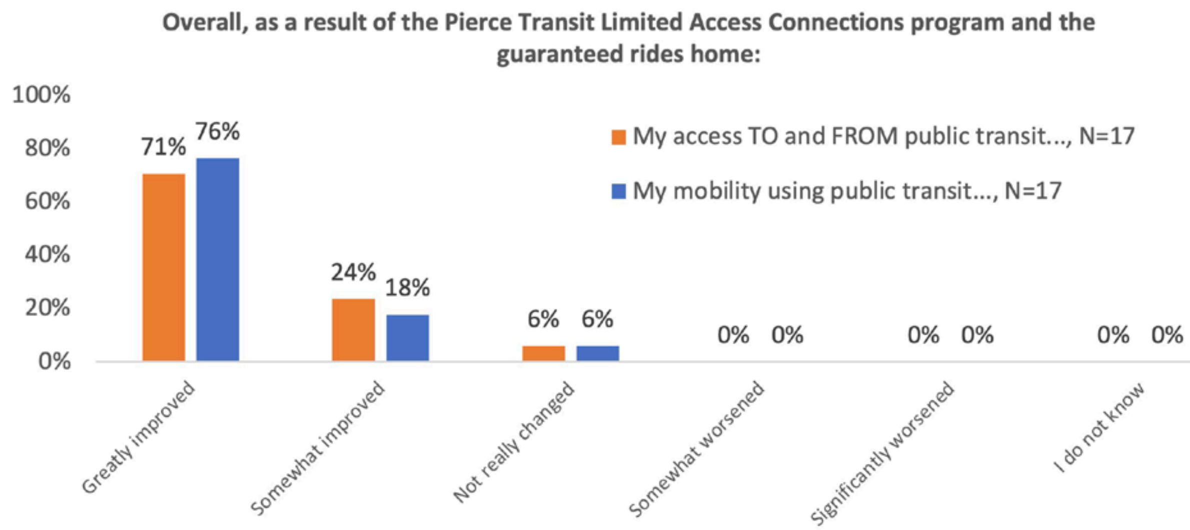


**Figure 4-31** *Guaranteed Ride Home Impacts*

The distribution of responses suggests that the guaranteed ride greatly improved access to and from public transit and mobility using public transit. About two-thirds of the sample indicated that the service had greatly improved both; only one respondent reported that the project had not changed their interaction with public transit, and no one reported that their transit use declined. This distribution of response also lends further support to the previously-discussed Hypothesis 13. As noted in earlier analyses, the sample size was small by most standards, but the responses indicate that the project was directly responsible for improvements that enhanced the utility of public transit and increased its use. This result is further supported by the data in Figure 4-4 in the analysis of Hypothesis 3, which showed that respondents broadly reported using public transit modes more due to the first/last mile Lyft rides supported by Pierce Transit. The six respondents who reported using the Seattle Sounder commuter rail reported using it more often as a result of the project. Similarly, nine respondents reported using public buses in the survey, and 7 of those 9 reported using buses more as result of the project. This latter result is notable, as public buses are often substituted with TNCs. Collectively, the results of the analysis suggest that Hypothesis 14 is supported.

**Hypothesis 15: Student enrollment may increase, especially those enrolled in night classes.**

| Performance Metric | Key Finding |
|---|---|
| Student enrollment | Student enrollment was not found to be impacted by the project. |

One of the motivations for the project was to provide better access to the campus of Pierce College Puyallup to increase student enrollment. The evaluation sought to explore whether there were notable changes in student enrollment in response to improvement of access provided by the project. Figure 4-32 shows the trends in enrollment by curriculum category.

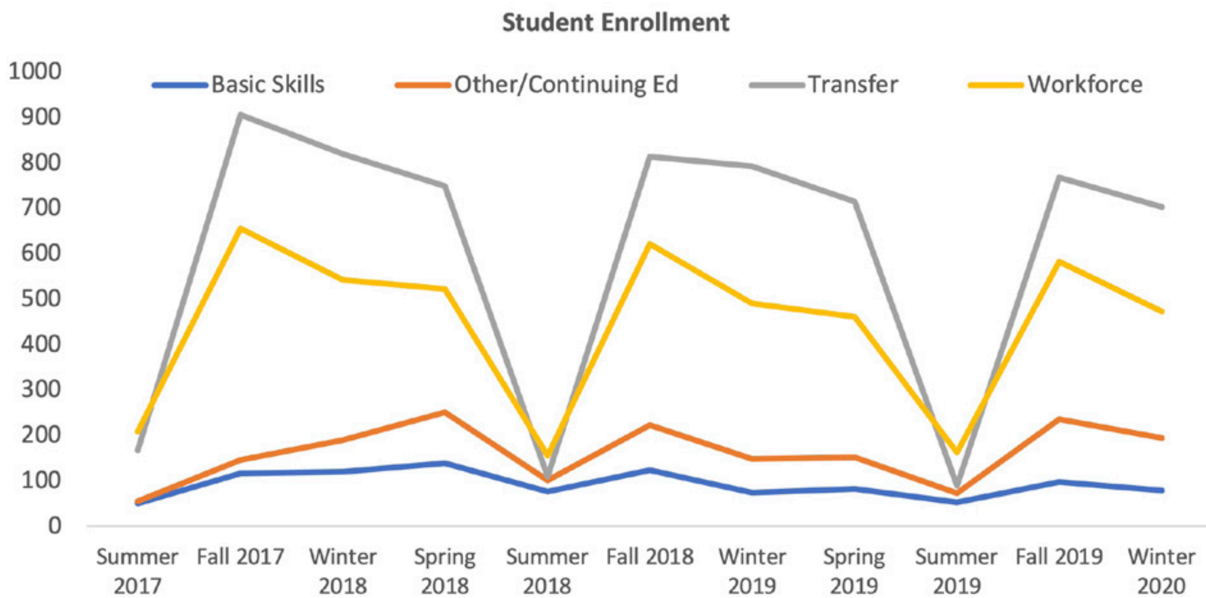


**Figure 4-32** *Trends in Student Enrollment at Puyallup College, Mid-2017 to Early 2020*

Trends in student enrollment show relatively little change over the time of the LAC project. Transfer student enrollment showed a slight downward trend, as did enrollment within the workforce curriculum. The other two curriculum categories fluctuated during the data period but stayed mostly level. Overall trends in enrollment did not show significant departures in pattern or magnitude during the period of the project. It is possible that some individuals used the service and benefited from improved access to the campus that influenced their enrollment status, but the nature of the trends does not suggest that enrollment was significantly influenced by the LAC project. As such, the findings suggest that Hypothesis 15 was not supported.

**Hypothesis 16: The spatial spread of people using Pierce Transit and Sound Transit increases.**

| Performance Metric | Key Finding |
| --- | --- |
| Spatial distribution of riders | The evaluation did not have sufficient data to evaluate this hypothesis, leading to an inconclusive finding. |

Hypothesis 16 sought to explore whether the spatial spread of people able to use Pierce and Sound Transit increased as a result of the project. The underlying theory was that improved and lower cost access of dynamic first/last mile travel to public transit infrastructure would enable users from more low-density areas within the region to access transit. However, data planned for analysis of this hypothesis were not available, including data on the approximate distribution of home locations of users accessing public transit for comparison with approximate home locations of system users in the survey. With no baseline data to compare user home locations and a limited survey sample size, Hypothesis 16 was found to be inconclusive.

**Hypothesis 17: The process of deploying the project will produce lessons learned and recommendations for future research and deployment.**

| Performance Metric | Key Finding |
|---|---|
| Synthesis of stakeholder interviews | The project produced key lessons learned from the deployment of the project that will inform future pilot projects. |

Members of the Pierce Transit LAC project team were interviewed to better understand challenges, barriers, successes, and broader lessons learned from the implementation of the project. Interviews were conducted with representatives of Pierce Transit, Sound Transit, and Pierce College District. Section 5 provides a synthesis of those interviews and the findings related to Hypothesis 17.

## Wait and Travel Time Comparisons of WAV and Non-WAV Trips

Although users in the LAC project had the option of hailing WAVs for travel, no WAVs were requested. Had there been requests for WAVs, the vehicles would have been supplied by a non-Lyft vehicle through a dispatch system, likely a paratransit operator, and an analysis would have been conducted to compare the wait and travel times of WAV trips and non-WAV trips. The evaluation team did conduct an analysis of wait times and travel times of Lyft first/last mile trips from available data, all of which were for standard vehicles.

Wait times were not readily computable from the project data provided by Lyft. However, the survey asked users about wait times they experienced, and results are presented in Figure 4-33. The distribution shows that almost three quarters (72%) of respondents reported that their wait times were less than 10 minutes, and all respondents who could recall their wait times reported wait times of 15 minutes or less. The findings are naturally limited by the small sample size of the survey. However, distribution of responses suggest that the wait times were generally in line with expectations of typical wait times for TNCs and public transit.

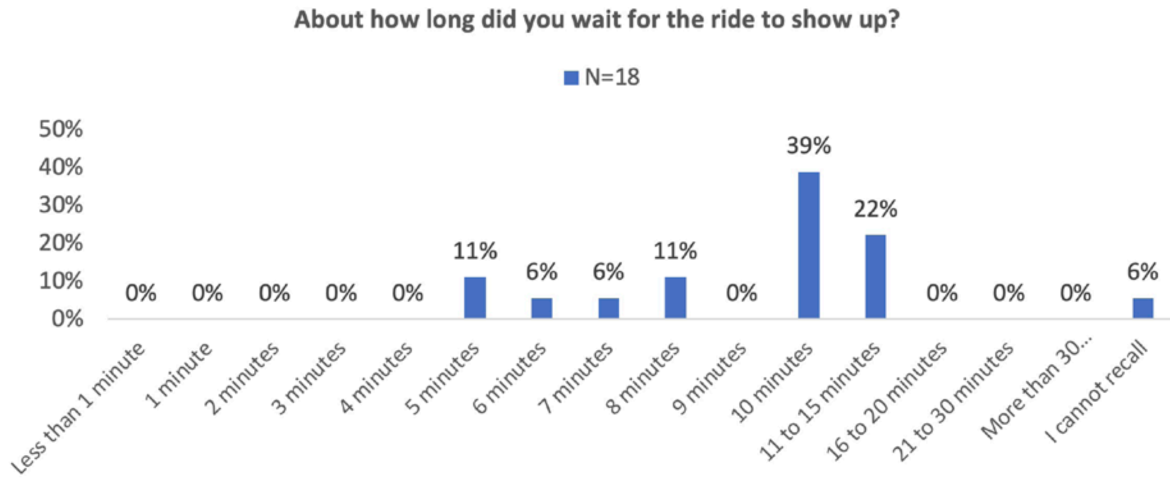


**Figure 4-33** *Distribution of Wait Times for Rides*

The distribution of travel duration for the non-WAV trips executed by the project are presented in Figure 4-34, which shows that 80% of the trips delivered by the project were 15 minutes or less. Nearly 100% of trips were completed within 30 minutes, and only 2 trips took more than 45 minutes. The distribution of travel times shows that the system could provide mobility within travel times that were competitive with traditional expectations of travel time for many public transit trips.

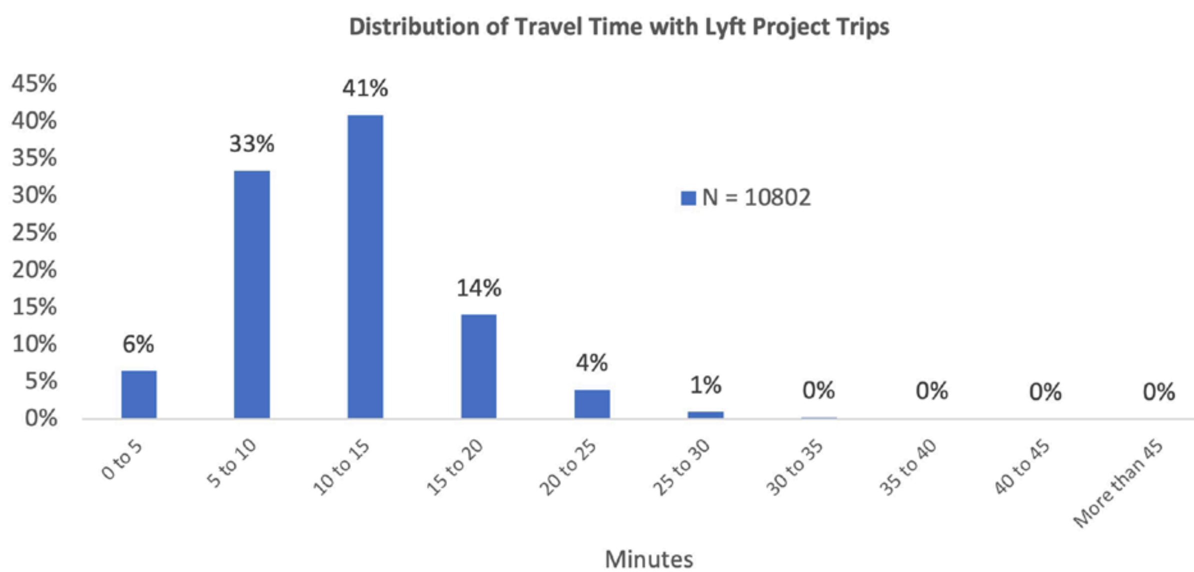


**Figure 4-34** *Distribution of Travel Time with All Lyft Project Trips*

Trips that were executed by Lyft in the project were broken out into the "Codes" category and the "Concierge" category. Codes trips were those that were registered by the user entering a code into the app to indicate the zone to which the trip applied; Concierge trips were those that were scheduled by a phone call. Distribution of travel times for trips within these categories is shown in Figure 4-35.

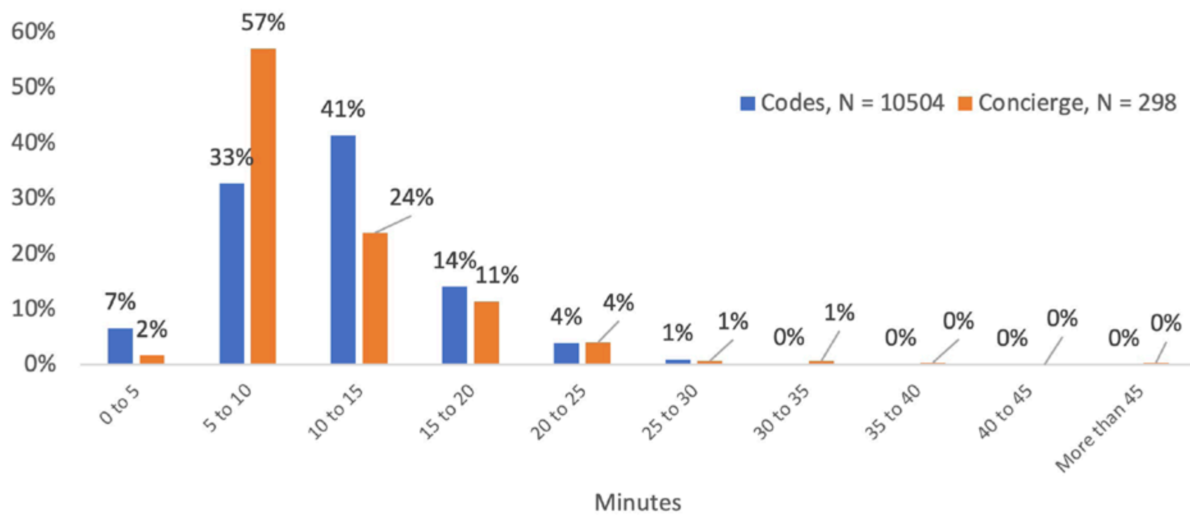


**Figure 4-35** *Distribution of Travel Time with Codes and Concierge Trips*

Distribution of travel times for these trips shows differences and similarities. Concierge trips show that a majority had travel times of 10 minutes or less, which was better than the travel times of Codes trips. However, both distributions showed that about 80% of trips were 15 minutes or less. For Codes trips, 81% took 15 minutes or less, whereas 83% of the Concierge trips took 15 minutes or less. In general, the results showed a similar performance in travel time across the two services. Overall, the observed wait and travel time performance information for the project suggest that it delivered reasonable and consistent wait and travel times for users within the region.

# Section 5 Lessons Learned from Project Partners

## Introduction

To better understand the experiences of agencies and operators during the project, the IE team conducted several interviews with project stakeholders who discussed the development of the project, its motivations, challenges faced, and successes identified. This section details highlights of those collective insights.

Pierce Transit proposed a three-pronged approach to address travel issues facing its community—park-and-ride lot congestion, fixed-route public transit service ending before Pierce College Puyallup night classes ended, and concentrated populations living outside a walkable distance from fixed-route bus service. Based on an average Lyft trip cost using various zones and times of day, Pierce Transit calculated an average trip cost of $11 for its TNC/ridesourcing partners. All trips were subsidized and offered in the following ways:

- The first approach was a first/last mile strategy and sought to serve riders needing transportation to or from public transportation because their start or end point was beyond a half-mile from nearest transit access. Pierce Transit collaborated with its TNC partner to provide first/last mile service in and between selected zones, and these trips were subsidized.
- The second approach was a guaranteed ride home for riders traveling home after transit service had stopped for the night. These rides were subsidized and covered by grant funds.
- The third approach was to provide trips to and from park-and-ride lots and Sound Transit Sounder commuter rail stations to reduce congestion. These services were designed to increase ridership at stations served by parking constrained park-and-ride lots, provide connections to existing bus routes, and provide rides home outside of regular service hours. These trips also were subsidized.

Key goals of the project included increasing ridership at stations served by parking-constrained park-and-ride lots that reached capacity, providing connections to existing bus routes, and providing rides home outside of regular service hours. Based on an average cost of $11 per Lyft trip, Pierce Transit believed these rides were more cost-effective than fixed-route demonstration projects previously executed to meet many of the same needs. Additional goals of the pilot included testing another transportation mode (TNC on-demand service) for underserved communities.

# Findings

To better understand stakeholder perspectives on various aspects of the public-private MOD partnership, the IE team conducted four stakeholder interviews with various project staff and partners. These interviews included representatives from Pierce Transit, Sound Transit, and Pierce College District.

## General Perceptions of Forming and Managing the MOD Partnership

Leveraging MOD for a first/last connection to fixed-route public transit was envisioned before this grant was available. At that time, the Pierce Transit Planning Manager asked the Business Development Office about developing a way to work with TNCs. There was much interest by the agency to explore partnerships with TNCs, and at the time very few agencies were collaborating with TNCs. The partnership was originally conceived as a way to serve underserved areas.

When the MOD Sandbox opportunity arose, it was an attractive option for a variety of reasons. It elevated the profile of public-private partnerships and made it easier for public agencies, particularly smaller public transit agencies, to reach out to TNCs and discuss partnership opportunities. Additionally, typical public transit partnerships can cost upwards of $1M and are unaffordable for many smaller agencies. What was particularly attractive about the MOD Sandbox project was that it enabled a pilot model with per-trip subsidies, forgoing the need for large capital expenditures and labor contracts.

Pierce Transit connected with a TNC partner, and initial discussions evolved around paratransit opportunities. However, the TNC legal department expressed concerns about a paratransit pilot, and the discussion evolved into a pilot serving the Pierce College District market.

Sound Transit and the Pierce College District were approached about a potential partnership with the TNC and Pierce Transit. The college had a close working relationship with Pierce Transit for several years, including frequent fixed-route bus service at one of the district's two campuses. At the other campus, Pierce College Puyallup, the campus had much less frequent bus service, and approximately 95% of the campus commuted by car. Although there was local service between the campus and Puyallup's South Hill Mall transit center (with connections into the city center), the college wanted to explore the potential of a stop along the route, possibly with a parking lot to act as a park-and-ride facility. Although that did not work out, the discussions laid the groundwork for two projects, including what would eventually evolve into the first/last mile partnership with Lyft as part of the MOD Sandbox. Pierce College's initial concern with bus service to the campus was that it did not work well for evening course schedules—students could take the bus to campus but had no way to return home. Pierce College reported that the MOD pilot helped increase evening transit ridership to the campus by guaranteeing a ride home.

## Forming and Managing the Partnership from the Legal Perspective

The partnership with Lyft evolved out of failed negotiations with Uber. Pierce Transit reported that negotiations with Lyft were easier, primarily because general TNC boundaries around data-sharing had already been tested with Uber. Based on the failed negotiations with Uber, it was clear to Pierce Transit that individualized user data-sharing was unacceptable, and the agency knew that a concierge service (telephone dispatch) would be difficult at that time.

In many ways, Pierce Transit attributes some of the contract negotiation success to lessons learned from prior attempts. The agency also noted the contract negotiations were a learning process in understanding what was important and then working internally together to narrowly tailor the requested data from the TNC partner. In the end, Pierce Transit decided that the data that were critical to the project were those that could be employed for future decision-making and allow it to make a more informed decision about whether to continue the partnership with agency funds and whether to engage in these types of partnerships after FTA funding was expended.

Pierce Transit noted that negotiations with Uber did not fail exclusively as a result of data issues, as the agency had accepted a limited data-sharing scope. The primary reasons were that Uber did not offer a service that would allow Pierce Transit to book rides for customers without smartphones and for paratransit customers, and the agency had concerns about public records requests under State or federal law. UberCentral used a tool similar to Lyft's Concierge but the version available at the time of negotiations was not ready for use by a public agency and also had data privacy concerns. Ultimately, Pierce Transit offered its own telephone dispatch using customer service employees to book paratransit rides, and Lyft's concierge desktop-based service was used to supplement the normal app-based approach to engage with the system. The employee union was not satisfied with this arrangement because it was outside its negotiated scope; after further negotiations, they were paid more per hour to take those calls.

Although Concierge service was used for about 300 trips, it was never used to request a WAV. WAV trips were active in the region through paratransit operations, so reasons for the lack of demand were unclear and could possibly be related to marketing and awareness. It is worth noting that calls made to the Concierge service were handled by Pierce Transit's paratransit customer service representatives. Those answering the calls were knowledgeable about

WAV needs and familiar with paratransit customer needs, and referrals for first/last mile services were encouraged where appropriate. Paratransit staff reached out to customers who were deemed conditionally-eligible (had some ability use fixed-route service in certain circumstances) to advise them of the first/last mile service. Another explanation could be that paratransit service in the region was already functioning and the population did not seek to experiment with the new service. It is likely that paratransit customers felt more comfortable using their existing resources as opposed to requesting a WAV for the first/last mile portion of their trip. As no WAV trips were requested, it is likely that awareness or marketing were not sufficient to encourage WAV passengers to try the service.

With respect to public records requests, Pierce Transit did not want any sensitive data that were not releasable. The agency does not hold back any records (with the exception of specific information designated as confidential); for the project, it would provide 15-day notice to the TNC partner who, if desired, could challenge the request. This provision took some time to negotiate through Lyft sales staff; it may have been easier to negotiate directly with a designated attorney at the TNC instead. However, the process that Pierce Transit pursued in the project was not uncommon for Lyft. Sales staff of mobility companies are more familiar and engaged with the transportation service delivery aspects of the business, and legal staff are more engaged with aspects that relate to assessing risks to the company. During the project, although Pierce Transit received public records requests and provided notice to the TNC partner, the TNC partner did not oppose any request.

In addition to the contract with Lyft, Pierce Transit has a partnership agreement with Sound Transit that enables the use of curb space for pick-off and drop-off zones and allows for the installation of signage that did not exist previously. As part of the agreement, Pierce Transit designed and installed loading zone and station wayfinding signage, and Sound Transit helped promote the LAC service through marketing and promotion signage (e.g., a banner) in the adjacent parking garage.

## Potential Next Steps

FTA granted approval to extend the MOD Sandbox LAC project through December 2019, when project ended. In general, many people interviewed indicated that they did not think the project would have been initiated had it not been for FTA and would not continue due to limited State funding. Additionally, Pierce Transit noted that imposing its standard drug and alcohol testing policy on Lyft drivers, which was waived during the demonstration period, could become cost-prohibitive and would prevent the partnership from continuing in the future without an ongoing waiver or a change in FTA policy. Lyft noted that it had its own internal processes for driver regulation, including a zero-tolerance policy; however, it also noted that a broader dialogue on approaches to driver testing and regulation for transportation systems operated under public-private partnerships may be useful. Some people at the agency advocate replacing the direct subsidy with a voucher project, where customers are provided with coupons for any mode (e.g., bus, taxi, TNC, etc.) as a solution to the drug and alcohol testing requirement because it allows the customer to choose the service provider and places the assumption of risk on the customer. The agency was concerned that designating a selected partner and subsidizing riders could be viewed as a "continuation of service," increasing agency exposure to potential liability.

## Lessons Learned

Despite the varying roles of the stakeholders interviewed, lessons learned were generally consistent and were identified as follows:

- Public communication and branding
  - Signage placed at public transit stations was a very effective marketing technique.
  - Some travel zones included in the project were confusing for people to understand initially (e.g., where they were located, what they meant, etc.).
  - Branding of the project and its collaboration with a TNC partner could have been stronger. Developing a strong brand was not a major goal of the project, but it was felt that a stronger brand connection between public transit and the TNC partner could have increased user understanding of the service. As TNCs also operated in the region independent of the project, the branding link of the TNC to specific types of trips should have been emphasized. For example, potential users could see "pink" branding, giving them instructions on how to participate in the pilot through the Lyft app. Although perceptions of transit quality were explored in the evaluation, the impact of marketing efforts were not.
  - Marketing efforts must be careful to emphasize the partnership as centered around the mobility service rather than implying a preference for a particular brand.
  - Much outreach was done to market WAV service; however, there were not any WAV requests.
  - Stakeholders reported that communication between Pierce Transit and Pierce College was great and should be a model for future relationships.
  - Marketing efforts targeted at the commuter college campus could have been improved. A campus with a high number of transient students (who may take off a term or never complete a degree) requires ongoing marketing and outreach each term.

- Users and user interfaces
  - Students will use mobility options if provided.
  - App-only options can create numerous barriers for particular populations (e.g., lack of universal design for people with disabilities, etc.).
- Data and performance metrics
  - Public transit agencies should adjust their metrics for measuring success and remember to look at a project not only from a research perspective but also from the agency and customer perspectives (e.g., using customer ratings such as a net promoter score to measure customer experience).
  - Data are necessary for evaluating pilots and service and for improving operations. For example, better data on rider activity would be useful to verify if a person is boarding or riding the bus; a user may be going to a transit hub only to access the Internet, for instance. Information on more rider origins and destinations would support better planning and evaluation of metrics.
  - A transit agency may be more comfortable engaging in public-private partnerships long-term given that there were no known incidents or legal claims during the pilot.
  - The level of data provided by the TNC partner may be sufficient to determine if a partnership should be continued, but it was generally insufficient to leverage for transit planning decision making due to the level of aggregation and lack of data fields available.
  - More specific data are needed to determine if the TNC service is the optimal partnership model vs. microtransit—shuttles with greater passenger pooling, etc..
- Agency operations and contracting
  - Pierce Transit learned that it could operate the partnership at a lower cost than replacing the service with new fixed-route transit; however, it needed to dedicate more resources to ongoing marketing.
  - A transit agency should not expect to receive a response for a WAV provider and should be prepared to step in and provide this service, either by the transit agency or through an existing paratransit provider.
  - Issuing a formal Request for Proposals (RFP) could have set out clear expectations and reduced the time needed for contract negotiations.

# Section 6 Conclusions

Evaluation of the Pierce Transit LAC project found that it completed most objectives that it set out to achieve. At a high level, the evaluation explored whether the project 1) improved the perception of transit service, 2) increased ridership overall, 3) increased public transit use among users, 4) was cost-effective, 5) reduced parking lot use, 6) decreased travel and wait times, 7) improved perceived accessibility to public transit stations, 8) reduced VMT, 9) offered a guaranteed ride home that improved mobility, accessibility, and increased public transit use, 10) influenced student enrollment, and 11) produced lessons learned from the implementation.

Results showed that the project was generally successful in improving mobility and access to the local public transit infrastructure, and survey data showed that the project generally increased the use of public transit among system users. The scale of the project, at about 330 users, was not large enough to influence public transit system ridership to magnitudes detectable within ridership data.

Pierce Transit had previously aimed to address first/last mile issues in the region with the provision of specialized fixed-route services. The evaluation explored the degree to which the project was cost-effective when compared to previously-demonstrated fixed-route services. Results of the analysis found that the project delivered mobility at per-trip costs that were lower than those of two fixed-routes, 503 and 504. Subsidizing Lyft trips cost $11.70 per unlinked passenger trip, whereas routes 503 and 504 cost $117.17 and $105.13 per trip, respectively. The analysis also generated a comparison of costs against the average fixed-route service for Pierce Transit and found that Pierce Transit incurred costs of $8.46 per trip. Hence, the LAC subsidy for Lyft trips was more cost-effective than a low ridership fixed-route connector service but not more efficient than the broader fixed-route transit system.

A similar analysis was conducted to evaluate the cost-effectiveness of the LAC service compared to the costs of paratransit. Results showed that the project delivered mobility at costs that were lower than paratransit on a cost-per-trip basis. The findings were driven, in part, by the relative agency cost efficiency of the Lyft services. It was noted that paratransit had to service a wider region that was not restricted by the zones of the project and that paratransit systems generally operate WAVs, unlike the cars traditionally driven by TNCs. The larger size and lower fuel economy of WAVs and specialized operators generally lead to higher operating cost, giving TNCs a cost advantage for trips that do not require WAVs.

The analysis evaluated whether the project impacted parking lot use. Survey data showed that LAC users decreased their use of park-and-ride lots in response to the project. Parking lot use data were also analyzed, but the scale of the project may not have been large enough to produce changes in parking lot use that were definitively attributable to the project and observable through system-level data.

The analysis further found that the project likely reduced overall wait times as well as travel times to some extent. Half of respondents reported a decline in travel times, and 28% reported an increase. With respect to wait times, a majority of respondents reported that their wait times had at least somewhat decreased as a result of the project.

The evaluation also explored whether passengers who use wheelchairs reported improved mobility as a result of the project. The survey had only one respondent who identified as a person with disability that prevented them from driving an automobile. They reported that the project did improve their mobility but they were not a wheelchair user. Additionally, the singular sample size was not large enough to be conclusive on the hypothesis.

The evaluation found that the project reduced VMT. This finding was supported by the fact that the sample reported a relatively strong impact of the LAC project on vehicle ownership. In addition, mode substitution with a personal vehicle was relatively high (50%). This substitution, in conjunction with a vehicle impact, appropriately weighted by frequency of use, suggested that the project was effective in reducing VMT.

The project further explored whether there were any changes in the perception of public transit service quality among Pierce College Puyallup students. A survey of respondents, although in a very limited sample size, suggested that the project had improved the perception of service quality. The evaluation also analyzed whether the project increased student enrollment at the college; results of the analysis did not find that student enrollment was substantively impacted by the project. The project offered a guaranteed ride home that could be used after public transit operating hours. Results of the analysis found that the guaranteed ride home improved mobility and accessibility as well as increased public transit use.

Finally, the project produced a number of lessons learned through its implementation. The agency learned that it could operate the project partnership at a lower cost than conventional fixed-route services meant to achieve the same objectives. However, it was also noted that additional resources for marketing were needed to achieve effective utilization. The success of marketing efforts and the degree to which customers were satisfied with the service should be included as key metrics. Other lessons learned related to technology and data. The agency found that app-only solutions created a number of barriers for special populations that may not be able to interact with technology and that data obtained from the TNC operator were useful in assessing system performance but did not offer as much value in support of transit planning.

Overall, the LAC project was able to achieve a large number of its objectives. The evaluation found that 12 of the 17 hypotheses were fully or partially supported. Those supported confirmed a positive impact from the project on transit perception, users, cost effectiveness, impacts on VMT, travel and wait times, and others. The successes derived from the Pierce Transit LAC project provide foundational knowledge for other transit agencies on which to build similar projects.

# Appendix

The appendix shows the distribution of responses from the retrospective survey for selected questions that were not otherwise discussed in the analysis but may offer additional information that can be useful for understanding the project.

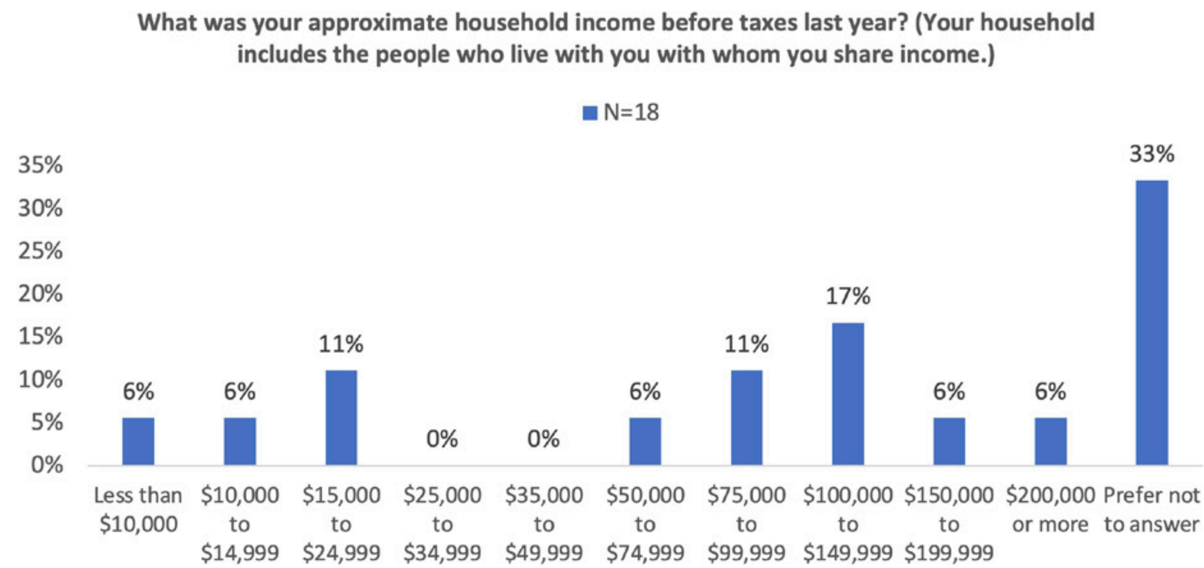


**Figure A-1** *Survey Respondent Household Income*

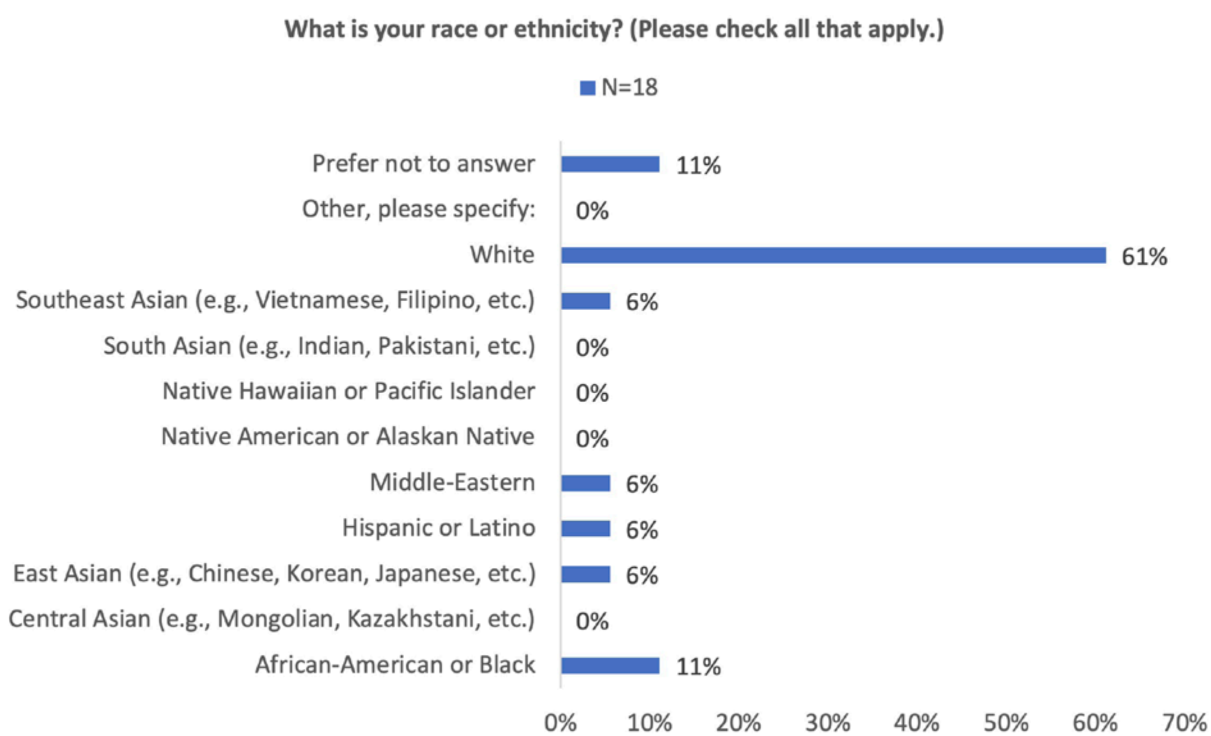


**Figure A-2** *Survey Respondent Race/Ethnicity*

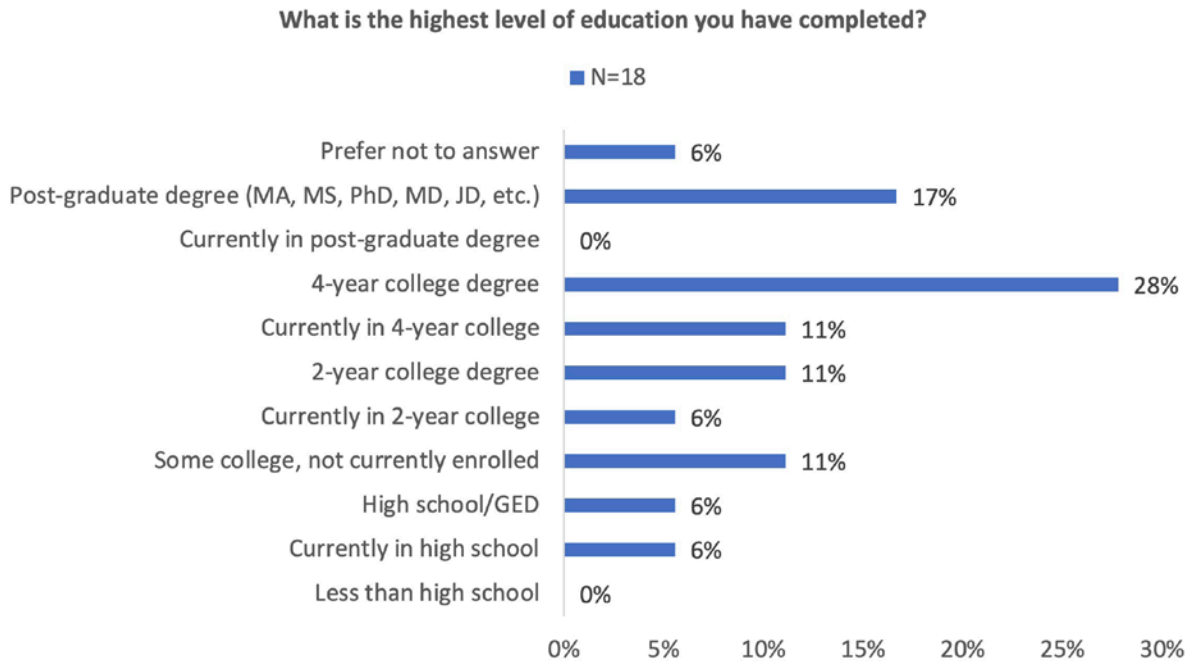


**Figure A-3** *Survey Respondent Education*

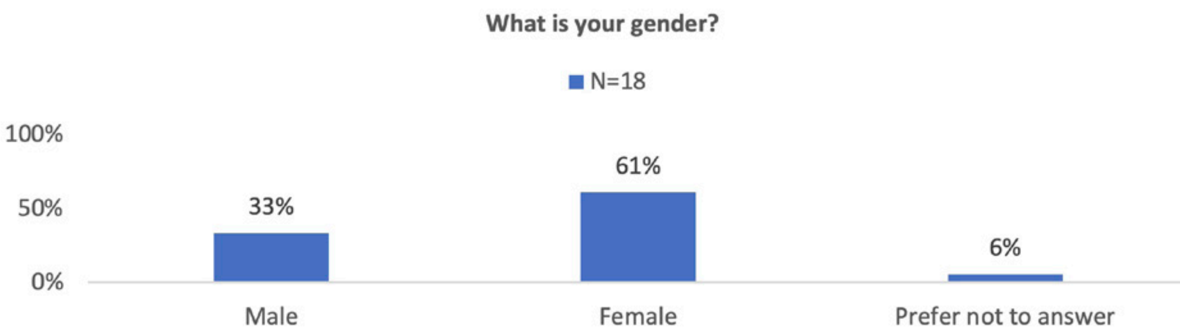


**Figure A-4** *Survey Respondent Gender*

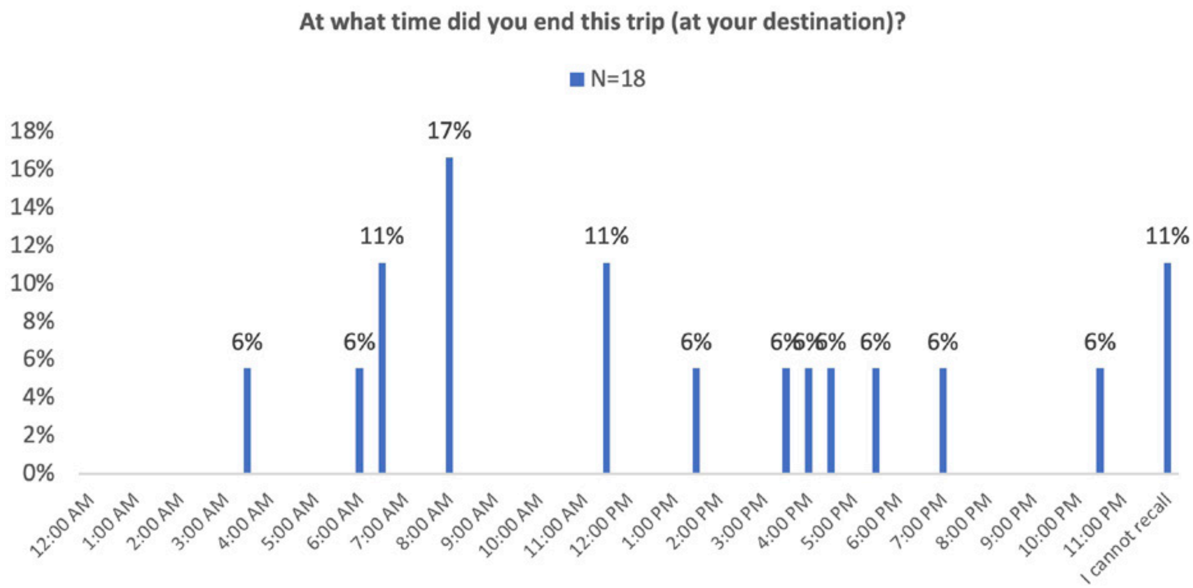


**Figure A-5** *Survey Respondent Trip End Time*

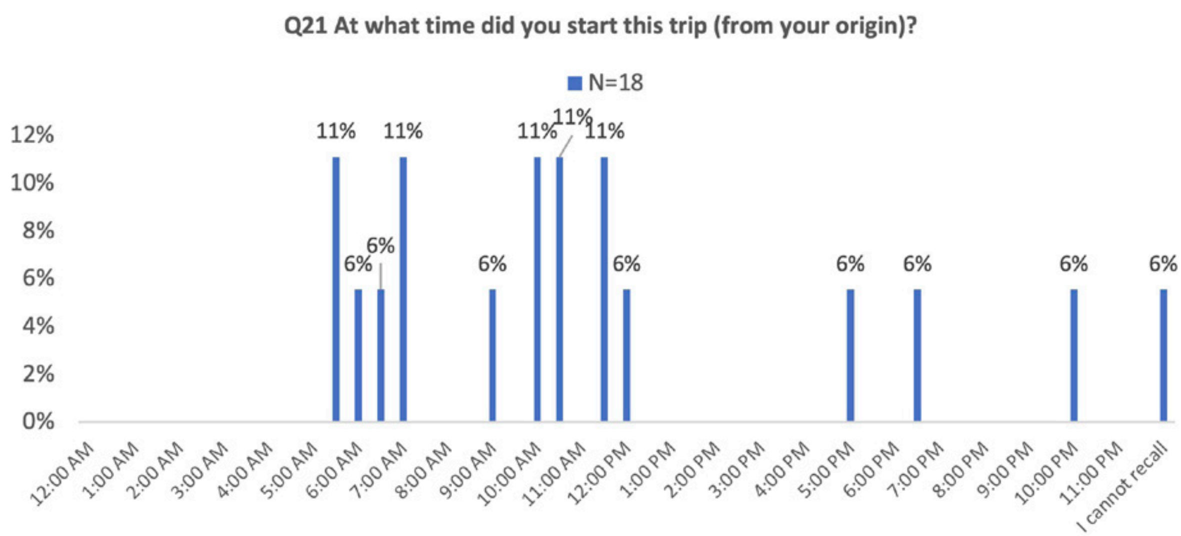


**Figure A-6** *Survey Respondent Trip Start Time*

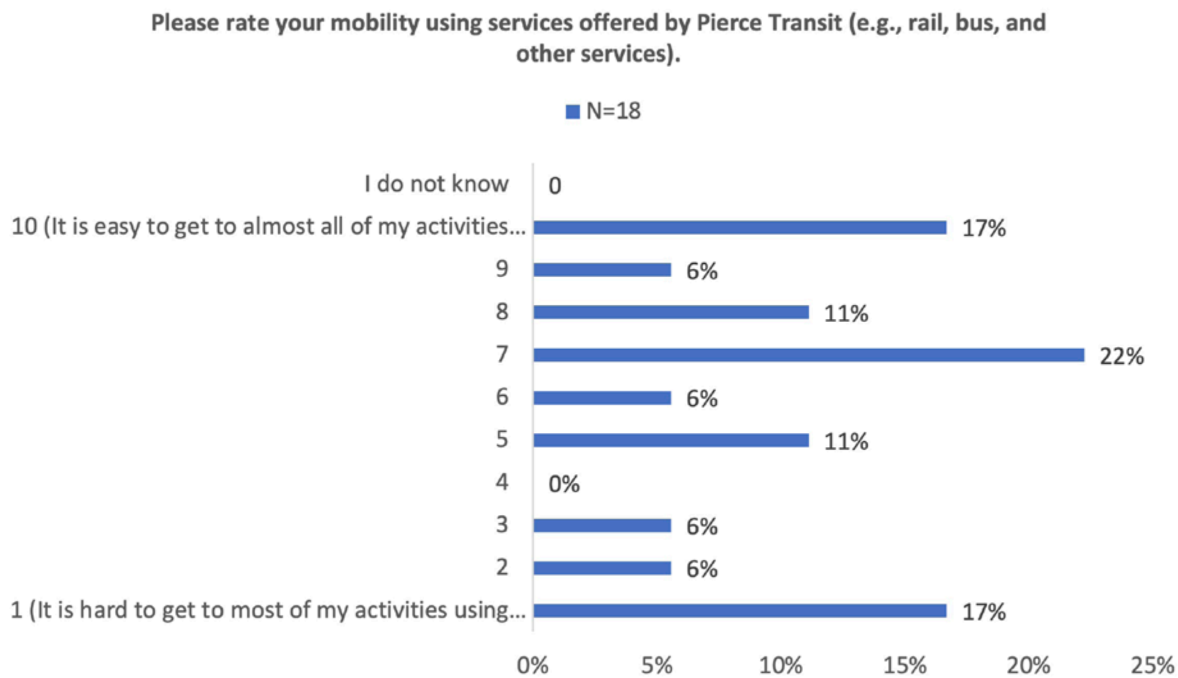


**Figure A-7** *Survey Respondent Rating of Mobility with Pierce Transit*

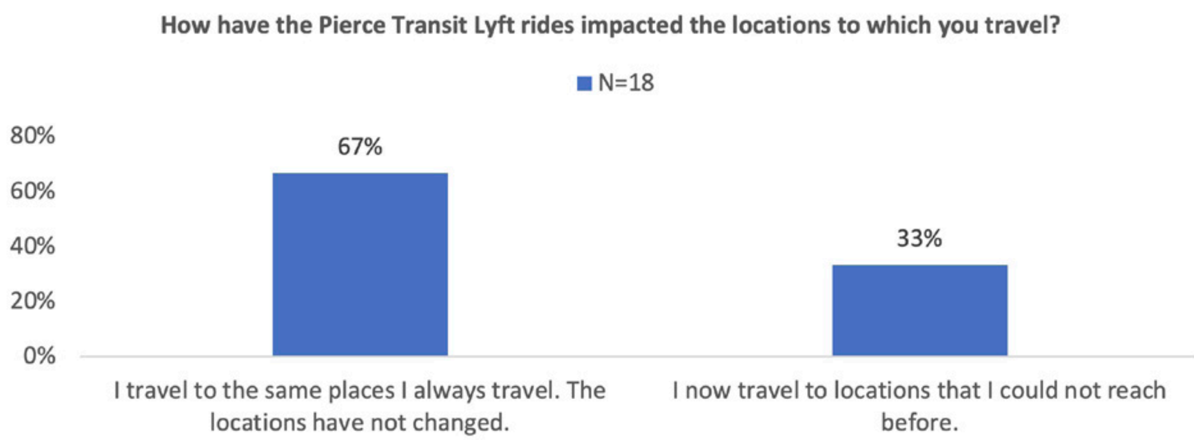


**Figure A-8** *Impact on Locations of Travel*

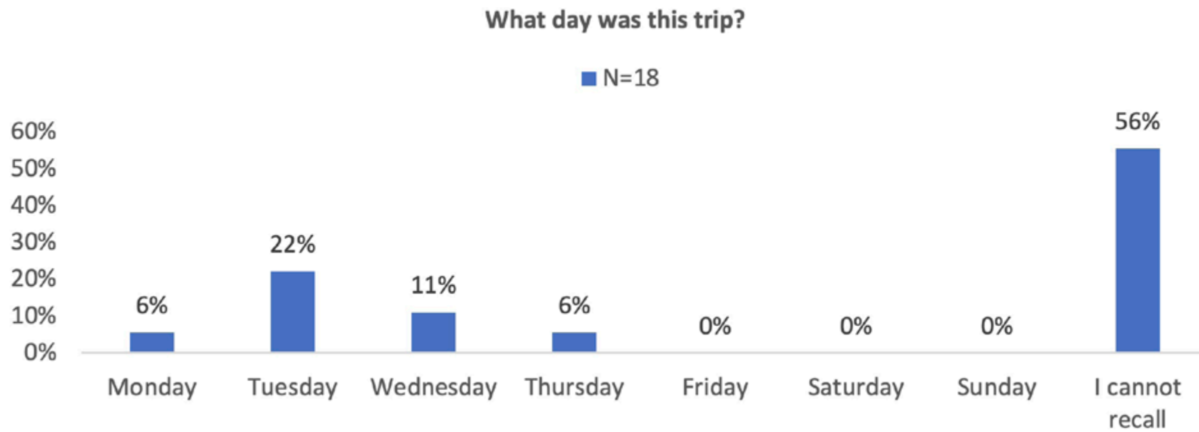


**Figure A-9** *Survey Respondent Day of Trip*

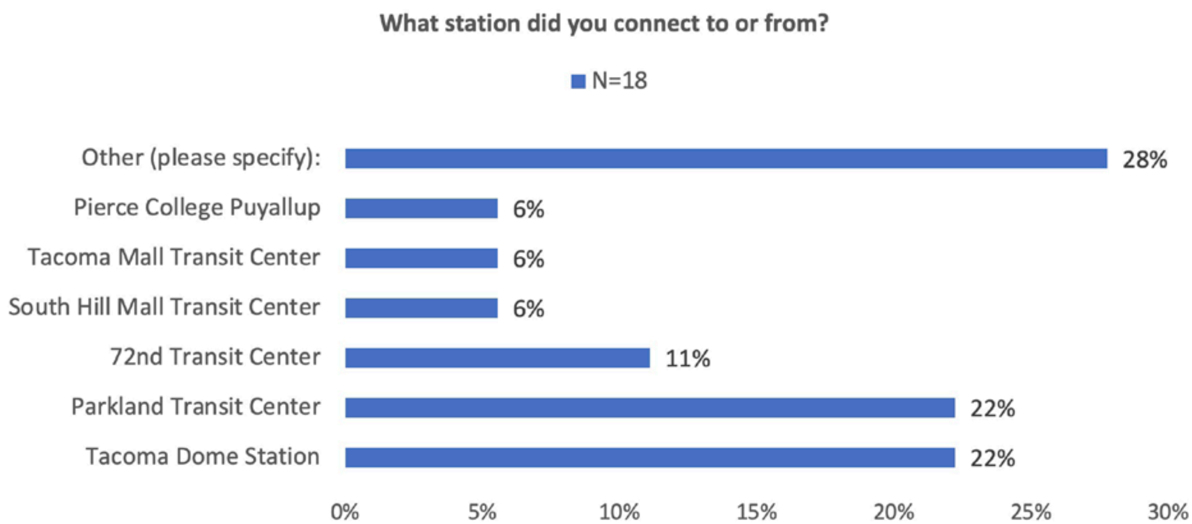


**Figure A-10** *Survey Respondent Station or Location of Connection*

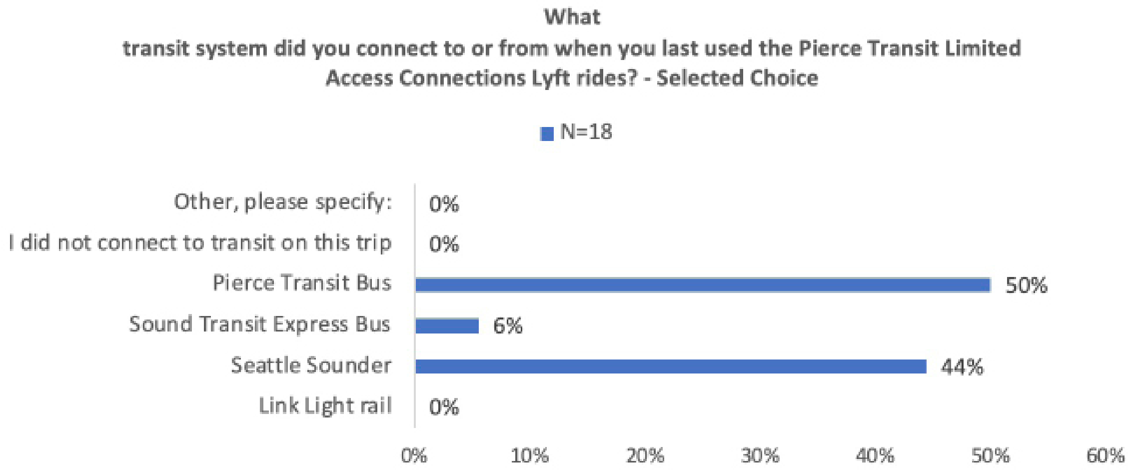


**Figure A-11** *Survey Respondent Transit Mode Connection*

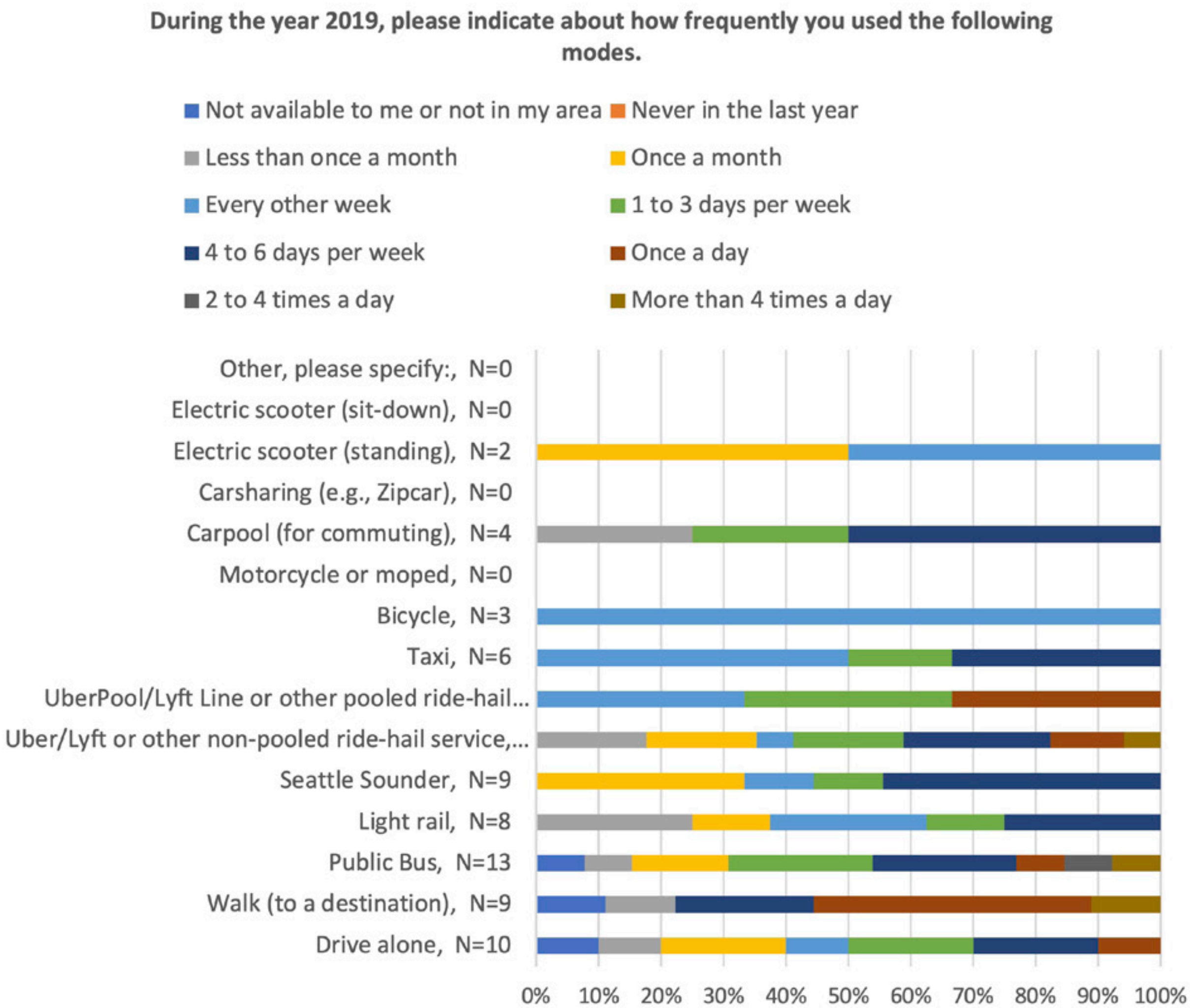


**Figure A-12** *Survey Respondent Frequency of Mode Use*

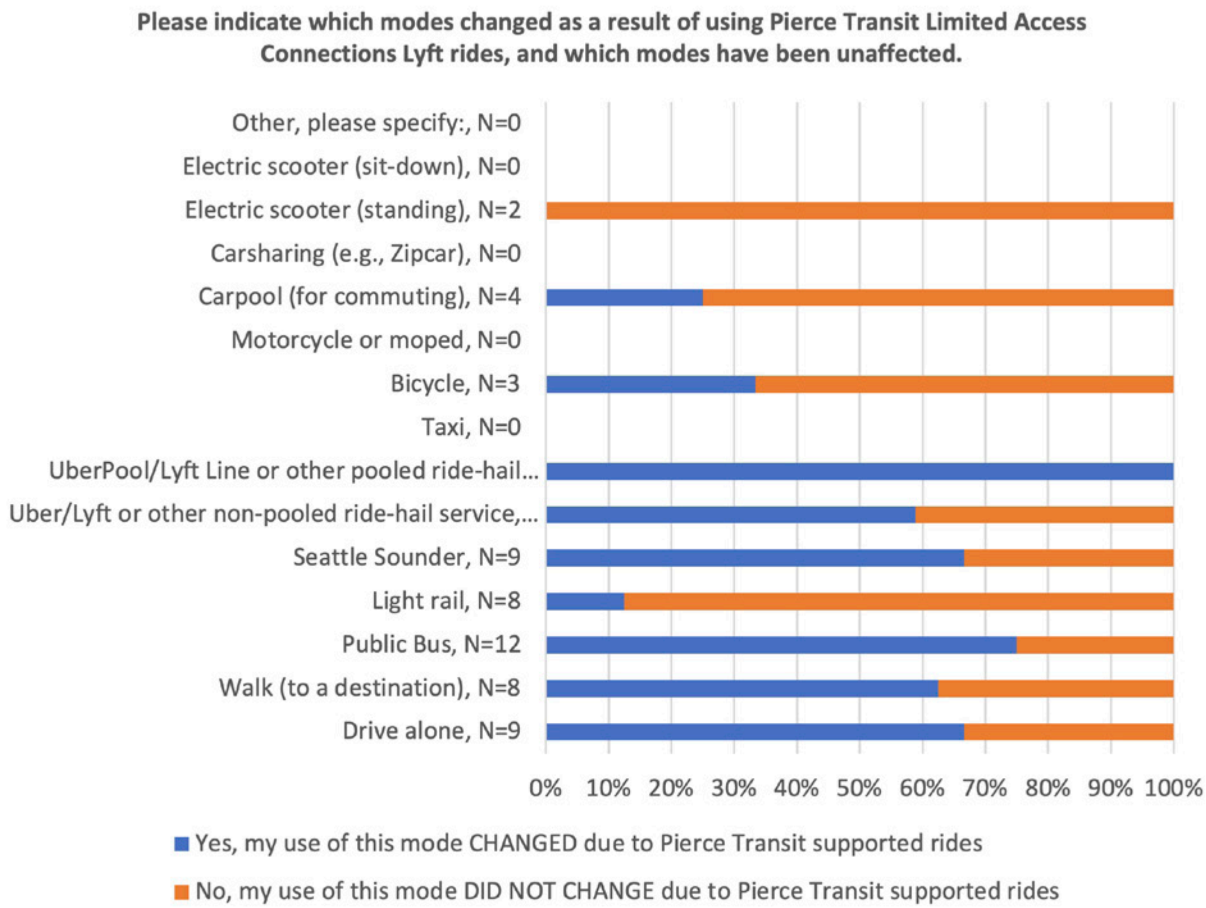


**Figure A-13** *Survey Respondent Change in Mode Use*

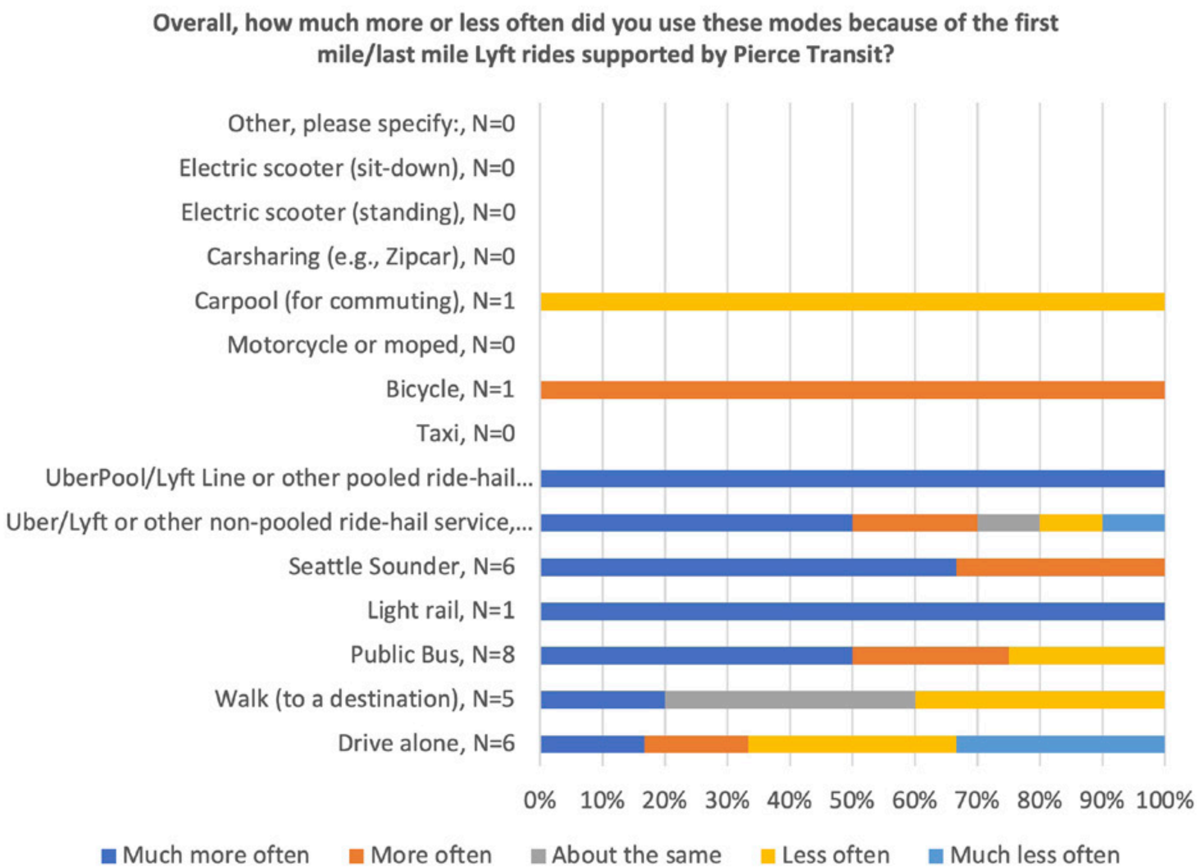


**Figure A-14** *Survey Respondent Directional Change in Mode Use*

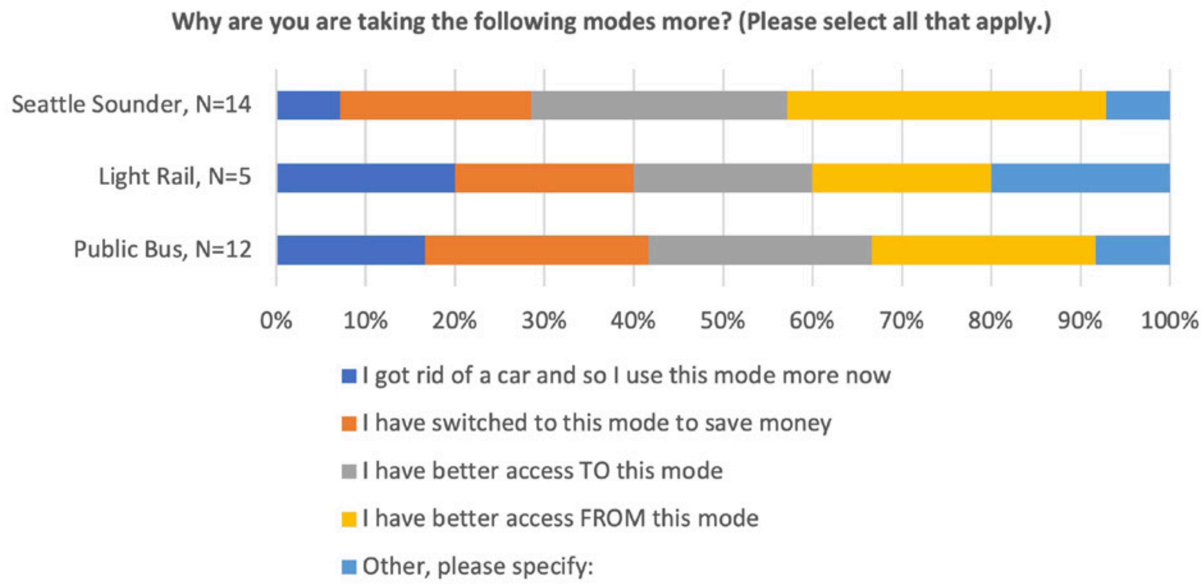


**Figure A-15** *Reasons for Increased Use of Transit Mode*

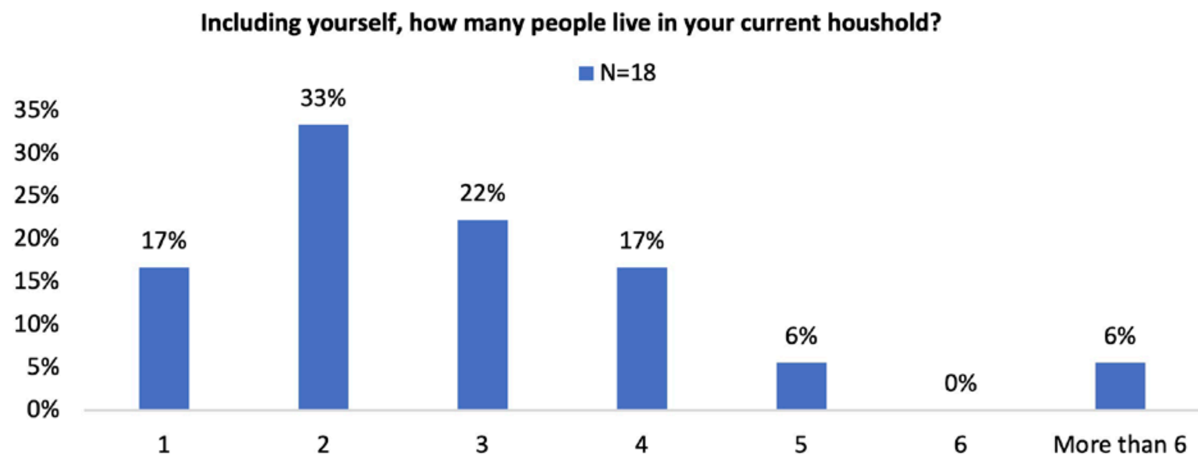


**Figure A-16** *Survey Respondent Household Size*

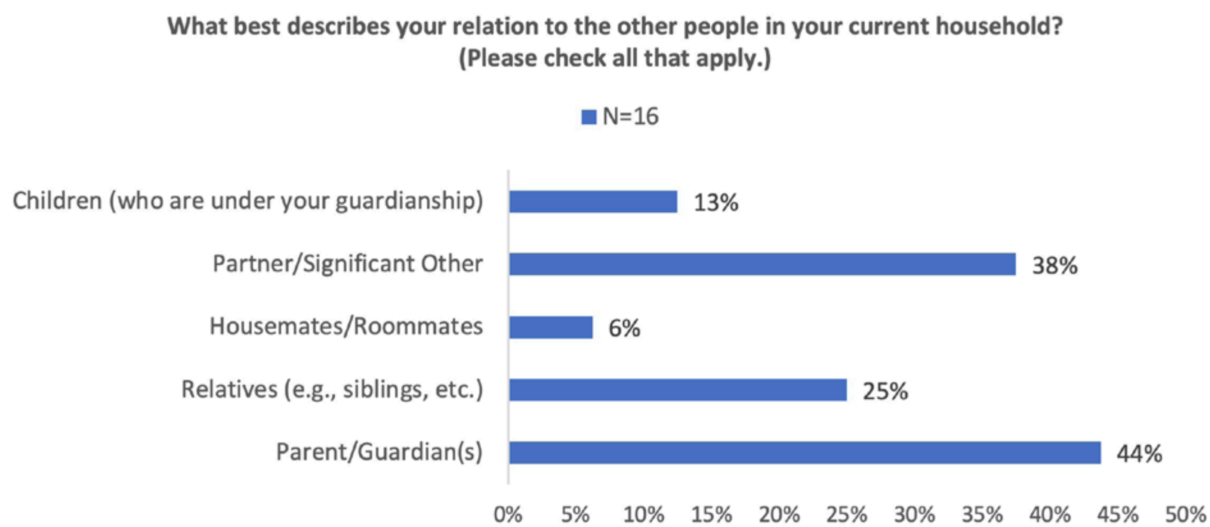


**Figure A-17** *Survey Respondent Household Composition*

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