Eno
Center for Transportation

Mobility on Demand in the Puget Sound Region:

EVALUATION OF THE USE AND PERFORMANCE OF THE MOD PILOT

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Contact: publicaffairs@enotrans.org
www.enotrans.org | 202.879.4700

Authors

Mark Hallenbeck, *Director, Washington State Transportation Center (TRAC) at the University of Washington*
Alex Van Roijen, *Data Scientist, Washington State Transportation Center (TRAC) at the University of Washington*
Ryan Avery, *Senior Research Engineer, Washington State Transportation Center (TRAC) at the University of Washington*
Dmitri Zyuzin, *Systems Analyst Programmer, Washington State Transportation Center (TRAC) at the University of Washington*

About the Eno Center for Transportation

The Eno Center for Transportation is an independent, nonpartisan think tank whose vision is for an American transportation system that fosters economic vitality, advances social equity, and improves the quality of life for all. The mission of Eno is to shape public debate on critical multimodal transportation issues and build a network of innovative transportation professionals. As an organization, Eno values independence, collaboration, relevance, excellence, and entrepreneurialism. These core values are reflected in everything we do.

Table of Contents

About the Federal Mobility on Demand Program

Mobility on demand (MOD) refers to transportation services that can be hailed in real-time for an impending trip. MOD integrates data such as location tracking and traffic conditions, with user-entered destination and payment information. Though most MOD services are designed for users to interface using a smartphone, MOD can be requested through a web browser or call center, which can increase accessibility and equity of the service for people without access to a smartphone, people vision impairments, people who require non-English communication, and others. While MOD is not a new concept, recent technological advancements facilitate its deployment in a new way. Its role in the future of transit systems is yet to be determined.

In May 2016, the Federal Transit Administration (FTA) announced $8 million in funding for its Mobility on Demand Sandbox Demonstration Program. The program is part of FTA's support of transit agencies, government entities, educational institutions, and communities as they experiment with on-demand mobility tools such as smart phone applications and shared mobility services to augment and enhance existing transit agency services. MOD Sandbox was developed to test new ways to encourage multimodal, integrated, automated, accessible, and connected transportation. Among the key features of the program is its focus on local partnerships and demonstrated solutions in real-world settings.

Some of the eligible activities applicants could propose to advance MOD and transit integration were new business models for planning and development, the acquisition of new equipment, services, software and hardware, and operation of the project in a real-world setting. Eligible partners included public transportation providers, state and local departments of transportation, federally recognized Indian tribes, private for- and not-for-profit organizations, transportation service operators, state or local government entities, consultants, research institutions and consortia, and not-for-profit industry organizations. In October 2016, 11 projects were selected for funding (see the Appendix.)

The largest project awarded was a two-region partnership between Los Angeles and the Puget Sound Region. The Los Angeles County Metropolitan Transportation Authority (LA Metro) collaborated with King County, Washington Metro Transit (King County Metro) and the Central Puget Sound Regional Transit Authority (Sound Transit) on a project to contract with a transportation network company (TNC) to provide first/last mile service to select transit stations near disadvantaged communities. This proposal included evaluation and reporting by the Eno Center for Transportation and local research universities. The FTA awarded the team a grant of $1.35 million for the pilot and corresponding research.

The stated overall goal of the Los Angeles/Puget Sound project is to: 1) define how TNC services can be aligned with existing transit service to serve an effective first-mile/last-mile solution; 2) define how key partners can cost-effectively ensure equal access for individuals with disabilities and low incomes; 3) demonstrate payment integration across transit operator and TNC platforms, specifically to enable service to lower income and unbanked populations.

1.0 Executive Summary

Sound Transit and King County Metro teamed as sub-recipients on a project led by Los Angeles Metro (LA Metro) to demonstrate the viability of a partnership with a private sector transportation network company to increase access to transit through the provision of on-demand, first-mile/last-mile transit access services.

The Via to Transit pilot project was designed to achieve four goals:

- improve mobility by expanding access to transit
- test how to develop a partnership with a private sector mobility company
- broaden transportation network company (TNC) access to a wider audience, including populations without smartphones, those who need wheelchair accessible vehicles, unbanked populations, low-income populations, people of color, and populations with limited English proficiency
- inform best practices and Federal Transit Administration (FTA) guidance for public-private partnerships.

This independent evaluation report concentrates on the actual ridership impacts of Via service; that is, how many people chose to use Via, whether those individuals represented all segments of the population living in the study area, and whether the availability of the Via service for first-mile/last-mile trip making changed their use of Link light rail.

The Via to Transit service carried a considerable number of riders. Over 950 riders used the service each weekday at the end of February 2020, suggesting that just under five percent of all Link users in the service areas used Via as their first-mile/last-mile choice for accessing the station. While the greatest use of Via occurred during the peak commute periods, Via was frequently used during all times of the day, although late night use (after midnight) was marginal.

Because of changes in ridership season to season and because winter 2020 ridership was significantly affected by construction activity associated with the Sound Transit Connect 2020 project[1], it is unclear whether the Via service actually produced an increase in Link use. Total Link ridership dropped 23 percent between winter 2019 and winter 2020, primarily because of Connect 2020. However, Link ridership

[1] Connect 2020 was a construction project that took place at the International District Station from January 6, 2020 to mid-March of that year. It involved reconfiguring the Link light rail tracks to connect the East Link line to the downtown Seattle tunnel. The Connect 2020 construction activity resulted in a substantial increase in the headway of Link trains from roughly 7 minutes in the peak to between 12 and 14 minutes. Transfers were also required at the International District Station for all trips with origin and destination stations on either side of the station.

declined only ten percent at the Rainier Beach station, where Via had the largest ridership, and Link ridership at Othello, the second most heavily used Via service area, declined only 16 percent during Connect 2020.

A comparison of daily ridership on Link light rail and buses in the pilot service areas between winter 2019 and summer 2019 showed that Link ridership declined modestly; however, much of the observed difference in Link travel can be directly attributed to the loss of Youth riders making school trips, as school was out of session. Rainier Beach, the Link Station with the highest Via ridership, actually saw an increase in Link ridership during the summer, despite the decrease in student riders.

Some ORCA cards observed using Via in the summer of 2019—1,329 (26.4 percent)—were not observed in the winter ORCA data set. This group was considered to be new riders to bus, Link, or other transit services. They made up almost one-quarter of the Via riders observed in the ORCA bus and train usage data. This strongly suggests that the Via service either increased the number of transit customers or at least converted cash paying customers into ORCA card users.

Combining all of these ridership measurements, the evaluation team concludes that the Via service appears to have had a positive effect on Link ridership. However, the available data did not prove that Via actually increased Link ridership, as other factors appear to have had a larger impact on Link ridership than the improved access to Link stations provided by the Via service.

In terms of whether use of Via changed individual behavior, individuals who used Via showed a very bimodal distribution of Link ridership behavior changes. 34 percent of individuals who used Via at some point during the pilot test decreased their Link trip making by more than ten trips during the summer 2019 test period when compared to winter 2019. Conversely, 21 percent increased their trip making by more than ten trips. It is clear that the more individuals used Via, the more likely their transit trip making increased; however, infrequent users of Via were more likely to decrease their trip making from winter to summer.

Roughly one-quarter of Via users reported having previously used transit to access and egress Link stations. The shift of those individuals to Via appears to have resulted in a decrease in bus transit use at the bus stops nearest the Link stations, as well as a decrease in transfer activity at those locations. However, King County Metro transit routes serving the four Seattle Link stations did not show ridership

changes that were significantly different than those on routes operated by King County Metro in areas not served by the Via pilot service.

In terms of equity, low-income riders took about seven percent of Via trips. This usage rate was lower than that observed for bus service in the pilot study area (10.5 percent), but it was higher than Link ridership across the entire Link system (5.6 percent) and close to the low-income use of Link at the five stations in the pilot study (8.8 percent). The conclusion is that Via service was accessible to the lower income population, but that the low-income population generally did not increase its transit usage as a result of the Via pilot.

One group that did use Via extensively was the Youth population. Youth riders were highly visible in the Via ridership data, taking roughly 20 percent of all Via trips. Youth trips generally make up about 17 percent of all conventional transit trips in the Via service area during months when school is in session, but only 11 percent in the summer. Roughly 11 percent of Youth riders came from low-income families in comparison to roughly seven percent of the adult rider population. If low-income Youth riders were included in the "Low-Income" category and not just the "Youth" category, this would increase Low-Income use of Via by a modest amount.

In terms of ethnicity, the two surveys conducted for this project suggested that the Via service and Link light rail were used less frequently by individuals of color than by white individuals. Both surveys also suggested that people of color used Via less frequently than their percentage within the residential population in the Via service areas and less frequently than the percentage of Link riders at the stations. Individuals who identified as white made up 47 percent of Intercept Survey respondents and 58 percent of the Via Rider Survey respondents but were only 32 percent of the population in the combined population of the five service areas.

2. Introduction

2.1 Project Introduction

This report presents the local independent evaluation of the Via to Transit (Via) project in the central Puget Sound region. The project was funded in part by the Federal Transit Administration's (FTA's) Mobility on Demand (MOD) Sandbox demonstration program. The MOD Sandbox program provides a venue through which integrated MOD concepts and solutions—supported through local partnerships—are demonstrated in real-world settings. The remaining funding was supplied by Sound Transit, King County Metro, and the City of Seattle.

For this project, Sound Transit and King County Metro teamed as sub-recipients on a project led by Los Angeles Metro (LA Metro) to demonstrate the viability of a partnership with a private sector transportation network company to increase access to transit through the provision of on-demand, first-mile/last-mile transit access services. The pilot being evaluated introduced a new service to a market where the branding was entirely new to the communities it connected, and the service both complemented and competed with the existing local feeder transit service.

The Via to Transit pilot project was designed to achieve four goals:

- improve mobility by expanding access to transit
- test how to develop a partnership with a private sector mobility company
- broaden transportation network company (TNC) access to a wider audience, including populations without smartphones, those who need wheelchair accessible vehicles, unbanked populations, low-income populations, people of color, and populations with limited English proficiency
- inform best practices and FTA guidance for public-private partnerships.

This evaluation was conducted by the Washington State Transportation Center (TRAC) at the University of Washington, working with the Eno Foundation.

2.2 Report Introduction

This evaluation report is divided into four sections and an appendix. This first section provides an introduction to the project, a description of the first-mile/last-mile services provided, including the geographic areas covered, the payment methods used, and the types of accessible services provided.

The second section describes the overall goals of this evaluation effort. It also describes the data that were available to the project team for use in the evaluation.

The third section presents all of the evaluation results. It describes the use of the system, the characteristics of the individuals who used the Via to Transit service (e.g., age, gender, income, disability status, ethnicity, frequency of use). It also discusses trip characteristics (e.g., trip purpose, previous mode used for access to/from the station). A section on the performance of the Via system includes topics such as average travel time, trip length, wait times, and the number of wheelchair accessible vehicle (WAV) rides that were requested. The chapter discusses the impact of the Via to Transit service on the use of bus and Link light rail service within the pilot service area. Finally, the chapter discusses the impacts the Via service had on trip making behavior (e.g., whether the presence of Via increased or decreased transit use).

The fourth section provides the conclusions drawn from the measured evaluation outcomes described in section 3.

Finally, an Appendix presents development of a model for describing the relative importance of factors that affect the number of Via to Transit trips taken. This model can also be used as one method for predicting use of similar first-mile/last-mile services if they are offered elsewhere in the region.

2.3 Description of the Via to Transit Service

The service in the Puget Sound region, called Via to Transit, was a pilot implementation of an on-demand, accessible transit service that connected riders going to or from five transit hubs in southeast Seattle and Tukwila and their trip origin/destination within five service areas in the ridership sheds of those transit hubs. The service launched April 16, 2019 and operated through March 23, 2020. The service was suspended just before the planned end of the 12-month pilot period at the same time a series of other public transit service restrictions were implemented because of the COVID-19 pandemic.

Service was provided in the five geographic service areas shown in figures 1 and 2. Users could use a smartphone application or call a concierge service (a staffed call center) to arrange for on-demand travel to or from one of the five Sound Transit Link light rail stations in these five service areas. The Link stations were Mount Baker, Columbia City, Othello, Rainier Beach, and Tukwila International Boulevard. At those station areas, it was possible for riders to connect with light rail or one of 14 King County Metro bus routes. Table 1 shows which bus routes could be accessed at each of the five Link stations.

Table 1: Bus Routes Serving Pilot Link Stations

Link Light Rail Station	Available Bus Routes
Mt. Baker	7, 8, 9, 14, 48, 106, 987
Columbia City	50, 106
Othello	36, 50, 106
Rainier Beach	106, 107
Tukwila	124, 128, A-Line BRT, F-Line BRT

Figure 1: Seattle Service Areas

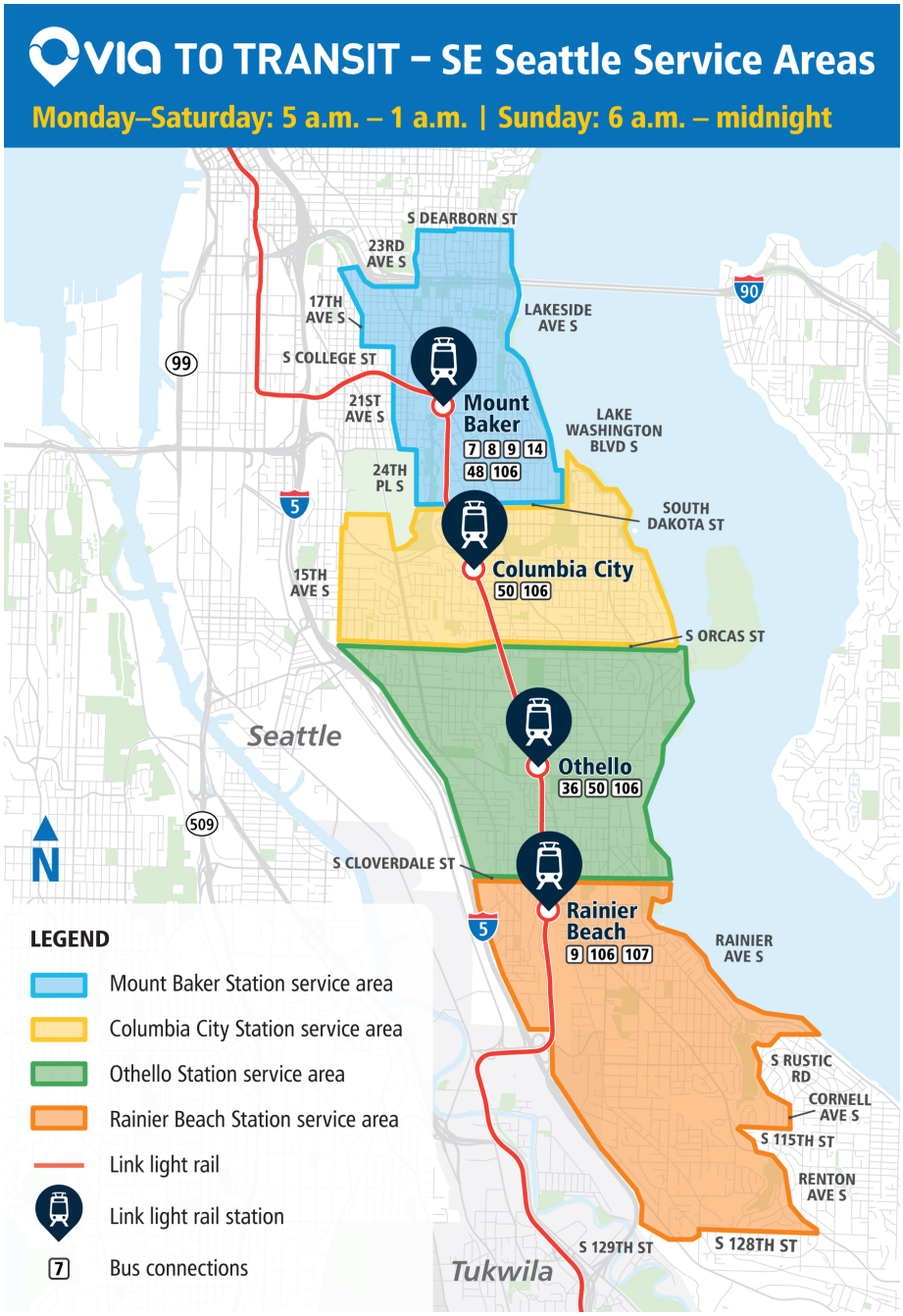
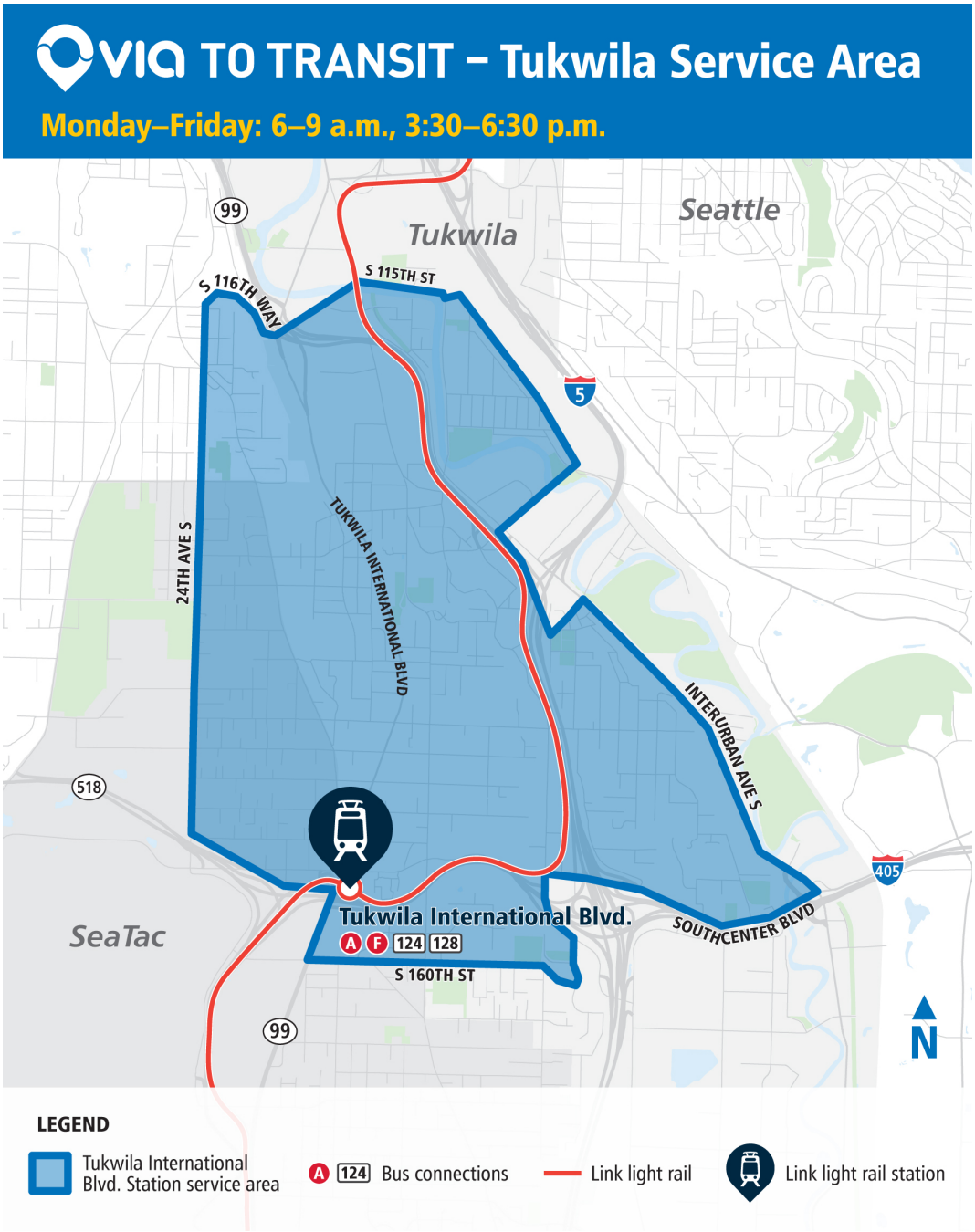


Figure 2: Tukwila Service Area



The Via service was available for use Monday through Saturday from 5:00 AM through 1:00 AM within the four Seattle service areas (Mount Baker, Columbia City, Othello, and Rainier Beach). On Sundays, the service was available from 6:00 AM through midnight. These service hours mirrored the Link light rail service hours.

In the Tukwila International Boulevard station service area, Via was available only during the peak periods on weekdays (6:00 AM until 9:00 AM and 3:30 PM to 6:30 PM). The Seattle service area hours were longer than those in Tukwila because the City of Seattle added funding to the project to extend those service hours.

Through community feedback, the project team heard that late-night safety concerns were an issue for some riders. The project team implemented a late-night pick-up option that provided door-to-door pick-up or drop-off with either trip origin or destination as the transit hub (i.e., riders did not have to walk a short distance to/from the vehicle). This option was enabled for all rides requesting a trip after 10:00 PM and before 6:00 AM.

To use the service, most users downloaded the Via app to their smartphone and used the app to request a ride from Via between one of the five transit Link stations and an end point within the service area surrounding that station.

If users did not have access to a smartphone, they could call the Via call center at 206-258-7739 and request a ride. When requesting a ride on the smartphone app, users could see the service areas available. Maps of the service areas were also available on the project website and on informational materials presented at each Link station.

2.4 Paying for a Via to Transit Trip

Passengers were able to pay for their Via to Transit trip using one of five mechanisms:

- Their electronic transit farecard (ORCA[2])
- A Transit Go Ticket
- A credit card
- A debit card
- Ride credits.

The cost of the Via to Transit trip mirrored King County Metro bus fares. These are shown in Table 2.

[2] ORCA – One Regional Card for All

Table 2. King County Metro Bus Fares and Via to Transit Fares

Fare category	Fare
Adults (19 and older)	$2.75
Youth (6-18 yrs)	$1.50
ORCA LIFT Cardholders (Income qualified)	$1.50
Regional Reduced Fare Pass (RRFP) Cardholders (registered seniors, Medicare, disabled)	$1.00

Transfers between Via and both King County Metro buses and Sound Transit Link light rail followed the same rules as all other transfers. If payment was made with an ORCA card, the full value of that payment was applied to transfer boardings between Sound Transit and King County Metro services. If the payment was made with a Transit Go ticket, the value of that payment could be applied to a transfer to or from a King County Metro bus but not to or from a Sound Transit service. Payment via credit cards, debit cards, and ride credits were limited to adult fare and did not provide transfers to buses or light rail. Cash fare payment and paper transfers were not accepted.

The vast majority of rides were paid for with ORCA. A modest number of rides were paid for with Transit Go tickets, and only a very small number of trips were paid for with credit/debit cards or ride credits. (See Table 3.)

Table 3. Payment Mechanisms Used by Riders

Type of Payment	Number of Payments[3]	Percentage of Payments
ORCA card	237,324	96.01%
Transit Go	7,977	3.23%
Debit Card	1,016	0.41%
Credit Card	729	0.29%
Ride Credit	145	0.06%
Grand Total	247,629	100%

2.5 Accessibility

Customers using wheelchairs or with other mobility needs could indicate that they required mobility assistance within their Via app profile by tapping "mobility assistance" within Account Settings. They could also request this assistance through the call center. With this option attached to the user's profile, or when requested by phone, Via would dispatch a wheelchair accessible vehicle directly to the rider's starting point rather than setting a pick-up location that might be a short walk away from the point where the traveler made the ride request. The wheelchair ramp of the Via vehicles was located in the rear of the vehicles and was 36 inches wide.

3. Evaluation Overview

3.1 Evaluation Goals

The primary goals of the local independent evaluation were to understand both the use of Via and how that use resulted in changes in use of Link light rail and bus services in the five pilot test service areas. In meeting this goal, a number of specific evaluation questions were of interest. These included the following:

[3] The data supplied to the evaluation team described the method used to pay by the individual who reserved the ride, but not how payments were made by any additional individuals included in that reservation request. The figures in this table assume that all riders included in the reservation paid with the same mechanism as the individual who reserved the ride. Ridership is summarized through February 29, 2020. Additional rides were provided in March 2020.

- The amount of Via usage occurring
- How that use varied over time and by geographic area
- Whether the availability of Via increased the use of Link light rail
- Whether the users of Via previously had used transit to reach the light rail stations, had used other modes for access, or had not previously used light rail or bus service
- Whether Via was used as a substitute for bus transit within the Via service areas or the majority of Via trips would not have occurred on transit had Via not been available
- Whether access to Link light rail improved for persons with disabilities and whether the use of Link increased by persons with disabilities, and
- Whether Via improved the equity of available transit options in the region, including
  - The degree to which the call center was used to provide access to the service for individuals without access to smartphones,
  - The degree to which the service was used by, and increased access to, low-income populations,
  - The degree to which the service was used by, and increased access to, people of color,
  - The degree to which the service was used by, and increased access to, people without a bank account, and
  - The degree to which the service was used by, and increased access to, people with limited English proficiency.

A secondary goal of the evaluation was to provide insight to the participating transit agencies and the City of Seattle in determining the value of continuing the program, as well as to provide support in making decisions about extending the program, including both extending the program in its current location or providing similar services in other geographic areas.

3.2 Data Used in the Evaluation

To understand both the use of Via and how that use produced changes in the use of both Link light rail and conventional bus and paratransit bus services in the five

pilot test service areas, the evaluation team used six major data sets. These data sets were as follows:

- An Intercept Survey of riders conducted before the start of the Via service. The survey was available in multiple languages, although few were taken in a language other than English. This survey was administered at four of the five Link stations (Rainier Beach was not included).
- ORCA transit farecard data describing when and where riders who paid with an ORCA card boarded a transit vehicle, as well as when and where those riders transferred between transit services. (Data were available for three periods: January 7 to March 22, 2019 (before the Via service started), July 1 to August 30, 2019 (after the Via service had been operating), and Jan 7, 2020, through March 24, 2020 (the last three months of Via service).
- An online Via Rider Survey taken by Via users. The Via Rider Survey was conducted in December 2019, eight months after the start of the Via pilot. A survey link was emailed to users of the Via app. The survey was available only in English.
- Via system use data describing the trips taken on the Via system (origin, destination, time of day, etc.), as well as trips that were requested but not taken.
- The 2018 American Community Survey (ACS).
- Built environment and transit service data (e.g., street networks and estimated transit and walking trip travel times and distances).

Data from these sources were used to describe the use of conventional transit and Via within the five service areas that were the subject of this pilot project, as well as many attributes of the individuals making those trips, the locations to/from which trips were taken, and the attributes of the services used.

The survey data sets provided demographic information about the individuals taking those surveys, including information on rider age, ethnicity, household income, whether they had a disability, and what those disabilities were. The surveys also provided trip details such as trip purpose; method of payment (e.g., cash, ORCA, Transit Go); the mode respondents typically used to access or egress the station; the method they used for a specific trip; and some attributes about respondents, including whether they had a smartphone, access to a car, and a bank account.

The primary limitation of both survey data sets was their size. For the before (Pre-Via) Intercept Survey, 1,182 riders responded about their trip leading to the station before boarding a Link train. An additional 354 riders filled out the same basic survey about their trip after arriving by rail. Most of these surveys were filled out before the rider left the station, although some were entered online later in the day.

For the second survey, the Via Rider Survey, 1,272 usable surveys were returned by Via users. Of those survey responses, 262 were about trips *to* the stations and 429 were about trips *from* the stations. Another 581 respondents said that they took Via both *to* and *from* Link stations, although those surveys did not always include responses to all questions about both trips *to* and *from* the stations. The Via Rider Survey was intended to be taken between December 3 and December 23, 2019, but was left open by accident until January 20, 2020, although the vast majority of survey responses were submitted in December.

The ORCA farecard and Via system usage data did not contain the descriptive rider information available from the two surveys. However, those data sources covered a much larger proportion of the transit-using public. Roughly 80 percent of all Sound Transit fares are generally paid with ORCA. The ORCA data covered all transit trips made with ORCA payments for the three data collection periods, January 7 to March 22, 2019, July 1 to August 30, 2019, and January 7, 2020, to March 24, 2020. Unless specifically indicated otherwise, snow days from the winter 2019 data set (February 3 to 12, 2019) and all data from March 2020 (because of the impacts of the COVID-19 pandemic) were removed from the analyses presented in this report.

ORCA must be used to obtain a transfer between King County and Sound Transit services. Therefore, the vast majority of transfers involved an ORCA payment. Consequently, ORCA data accurately described the number of transit vehicle-to-transit vehicle transfers that occurred to and from Link. Therefore, ORCA could be used to directly measure how many Link users arrived at a station by bus, and how many departed from a station by bus after arriving on Link.

Because ORCA is used for a very large portion of total boarding payments, its use also allowed for a very robust analysis of the overall usage patterns of both Link and King County Metro buses over the course of the Via pilot project. By using transit usage patterns outside of the five service areas as controls for the study, the research team was also able to examine the effects of Via on overall transit use within the five service areas. While ORCA data lacked detailed demographic information about users, they did indicate whether each transit rider was in one of five categories of riders—Adult, Senior, Low-Income, Youth, or Disability—as those categories are used to apply discounts to the transit fare charged.

Via system usage data described all trips made with the Via service, as well as the number of trip requests that could not be met because of a lack of system capacity. These data were uniquely suited for describing the actual utilization of Via, including the general location of the start and end of each trip. In addition, for Via users who paid with ORCA, it was possible to assign the same five basic ORCA rider attributes to those Via users. This allowed the research team to examine the use of Via by Low-Income, Disabled, Senior, and Youth riders.

4. Evaluation Results

4.1 Use of Via

This section of the evaluation describes the use of Via. Data were provided from the start of Via service on April 16, 2019, until February 29, 2020. While the system operated into March 2020, impacts from the COVID-19 pandemic affected use of the service, so March 2020 data were not included in this analysis.

From April 16, 2019, through February 29, 2020, a total of 247,629 passengers were carried, with 220,939 Via trip reservations having been made. Of the 220,939 completed trip reservations, 90.5 percent were made for one person, 7.7 percent were made for two people, and the remaining 1.8 percent were made for three or more people.

4.2 Basic Ridership Trends

Figure 3 shows the growth in completed Via trips from the start of the pilot demonstration through the end of February 2020. The "dips" observed in Figure 3 are weekends and holidays. Figure 4 shows the ridership trend by station, using the average number of completed weekday rides for each month. While the Via to Transit service continued to operate in March 2020, ridership was significantly affected by the COVID-19 pandemic, with ridership dropping significantly. Because these ridership reductions were caused entirely by the pandemic response and were not the result of actions taken by Via, they were removed from this evaluation, which is oriented toward "normal" service outcomes.

Both Figures 3 and 4 show that Via ridership grew steadily from the implementation of the service in mid-April through early fall 2019. This was followed by a modest decline in use during the holiday season. Use then remained fairly steady through the first two months of 2020, with total weekday ridership across all stations averaging 950 riders per day in February. (Note that Figure 4

includes travel occurring on holiday weekdays such as Thanksgiving as part of the average weekday ridership statistics.)

Rainier Beach experienced the largest amount of Via usage. Othello and Columbia City had the second and third greatest use. While these two stations initially had fairly similar Via ridership levels, Othello showed more growth than Columbia City, whose use flattened by mid-summer. All stations showed a modest Via ridership decline during December 2019. Othello and Rainier Beach experienced a modest rebound in ridership during January and February 2020. Tukwila had the lowest ridership, but it also had considerably fewer hours of Via service. Tukwila is also served by a large park and ride lot, which would have been expected to lower Via ridership.

Figure 3: Daily Via Ridership

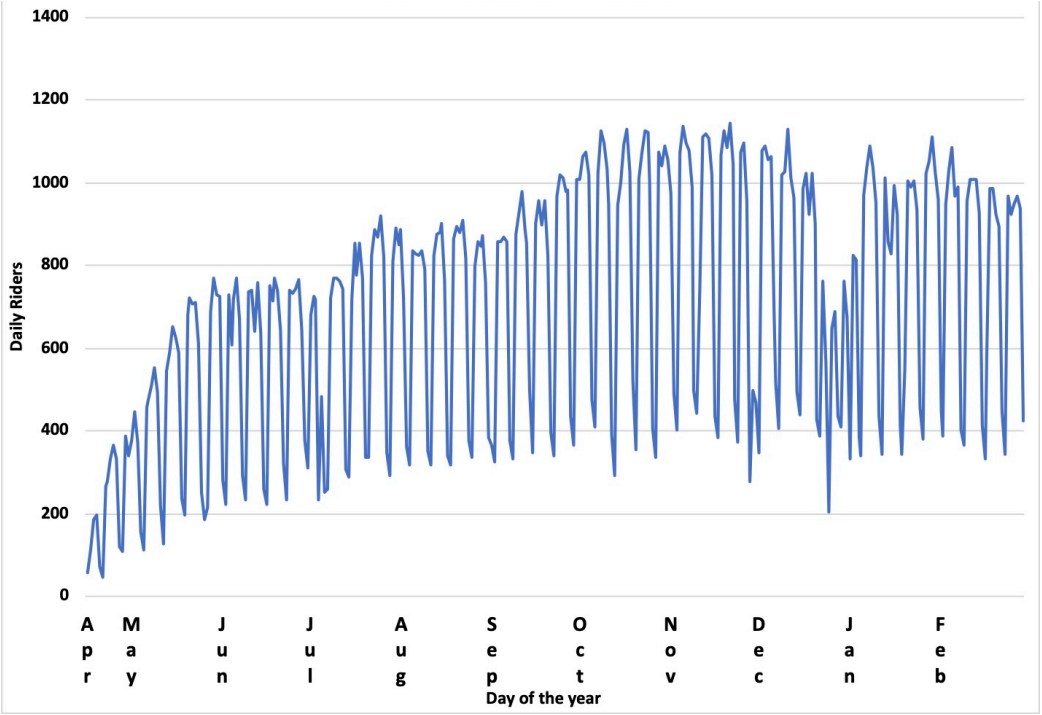


Figure 4. Average Number of Via Rides per Weekday by Station and Month

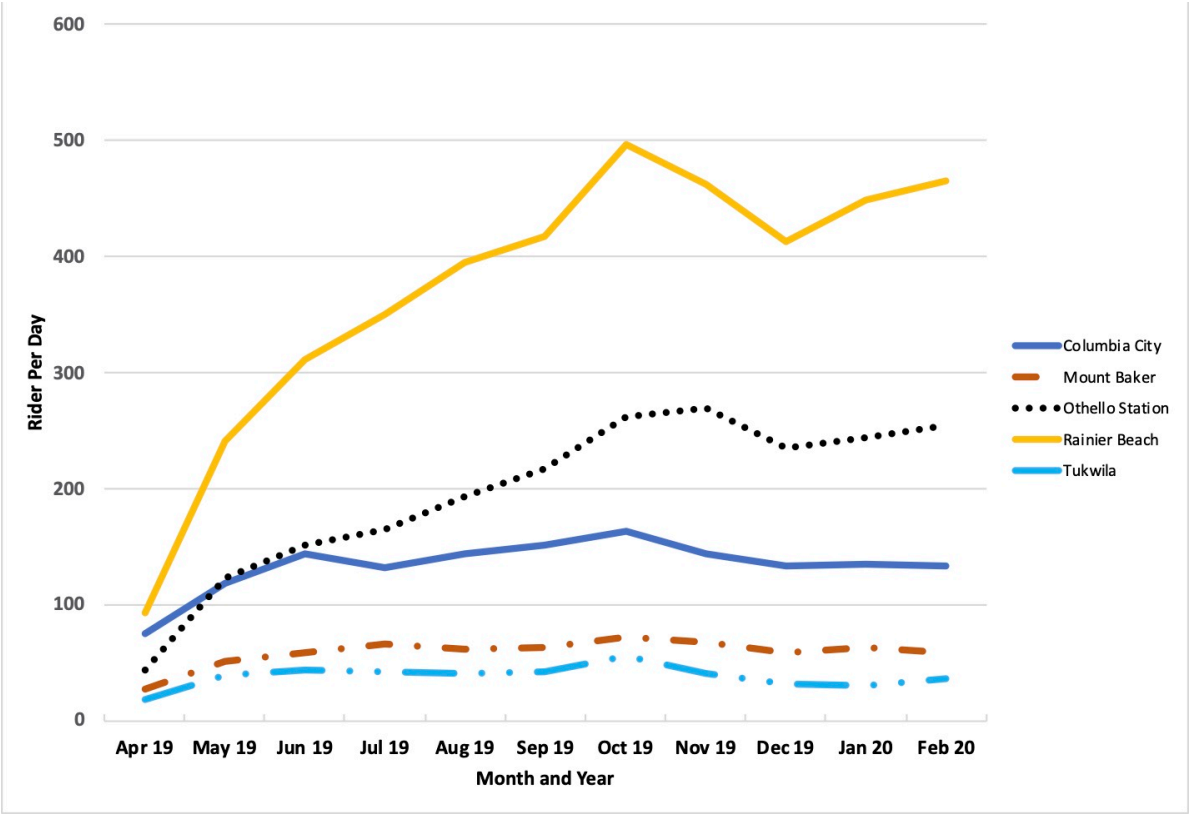


Table 4 provides average daily Via ridership per month at all five stations. The table includes both average day of month and average weekday ridership.

Table 4. Average Daily[4] and Average Weekday Via Ridership by Station by Month

	Columbia City	Mount Baker	Othello Station	Rainier Beach	Tukwila	Grand Total
April 2019	67 / 76	26 / 28	40 / 45	81 / 93	15 / 19	229 / 260
May	98 / 119	44 / 52	106 / 124	198 / 242	29 / 39	475 / 576
June	113 / 144	49 / 59	130 / 152	244 / 3112	30 / 44	567 / 713
July	112 / 132	57 / 66	145 / 166	293 / 350	32 / 43	641 / 758
August	119 / 144	54 / 63	166 / 194	325 / 395	30 / 42	696 /840
September	124 / 151	56 / 64	190 / 218	341 / 418	30 / 43	742 / 895
October	137 / 164	63 / 72	228 / 262	412 / 497	41 / 55	883 /1051
November	119 / 145	59 /68	232 / 270	384 / 463	29 / 42	826 /990
December	112 / 135	52 / 59	207 / 235	350 / 413	23 / 33	746 /876
January '20	114 / 136	57 / 64	212 / 245	380 / 449	23 / 31	788 /927
February '20	107 / 133	50 / 60	215 / 255	380 / 466	25 / 36	780 /953

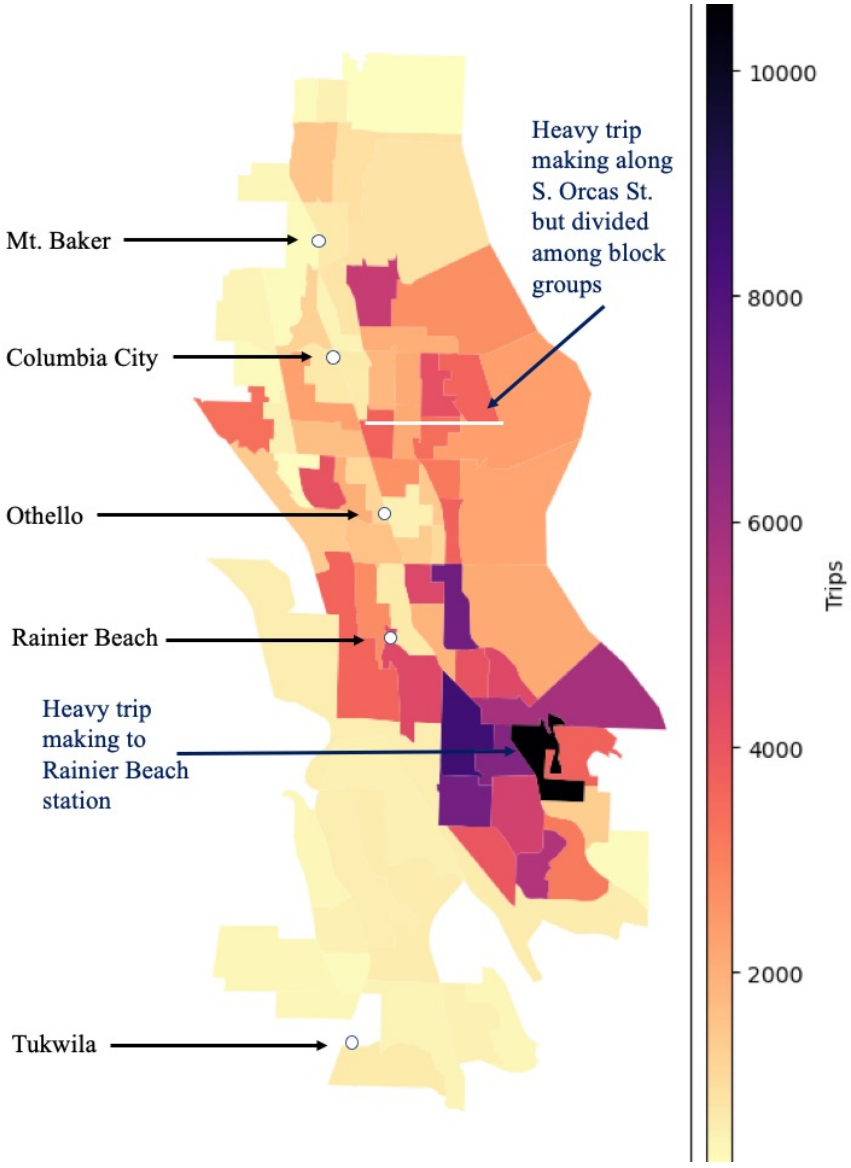
Figure 5 shows the geographic distribution of Via trips. Trips were aggregated by census block group, where the block group was assigned on the basis of the non-Link station end of the trip. Thus, the trip statistics include both trips to and from the Link stations. The geographic area with the largest overall use of Via was the southeast portion of the city (e.g., the neighborhoods of Rainier View, Skyway, and Lakeridge). Trips from those neighborhoods to Rainier Beach station were typically 1.5 to 2 miles long. There is decent bus service (10-minute headways in the peak period on the Route 106) on Renton Avenue, which cuts through those neighborhoods, but hilly terrain in the area may make walking to or from the bus problematic for some individuals.

One geographic pattern that was not apparent in the block group data, but that is called out in Figure 5, was a high volume of trips occurring along S. Orcas St. This east/west road experienced a high concentration of Via trips, but those trips were distributed among a number of block groups. S. Orcas St. has no east/west bus service and is nearly equidistant to the Columbia City and Othello stations. Depending on where on S. Orcas the trip starts/ends, it is a 1-to-2-mile walk to either station. The lack of good access to light rail in this general area caused the

[4] Includes weekend and weekday trips.

neighborhood to push very hard for development of the Graham Street station that was funded in ST3. It is a part of the pilot area where riders frequently chose Via over their alternatives.

Figure 5: Geographic Distribution of Via Trips: Total Trips by Census Block Group



If ridership is examined in terms of the number of trips per resident by block group, a slightly different picture of Via ridership is shown (see Figure 6), although much of the same overall ridership pattern is retained.

Figure 6: Geographic Distribution of Via Trips: Total Trips per Resident by Census Block Group

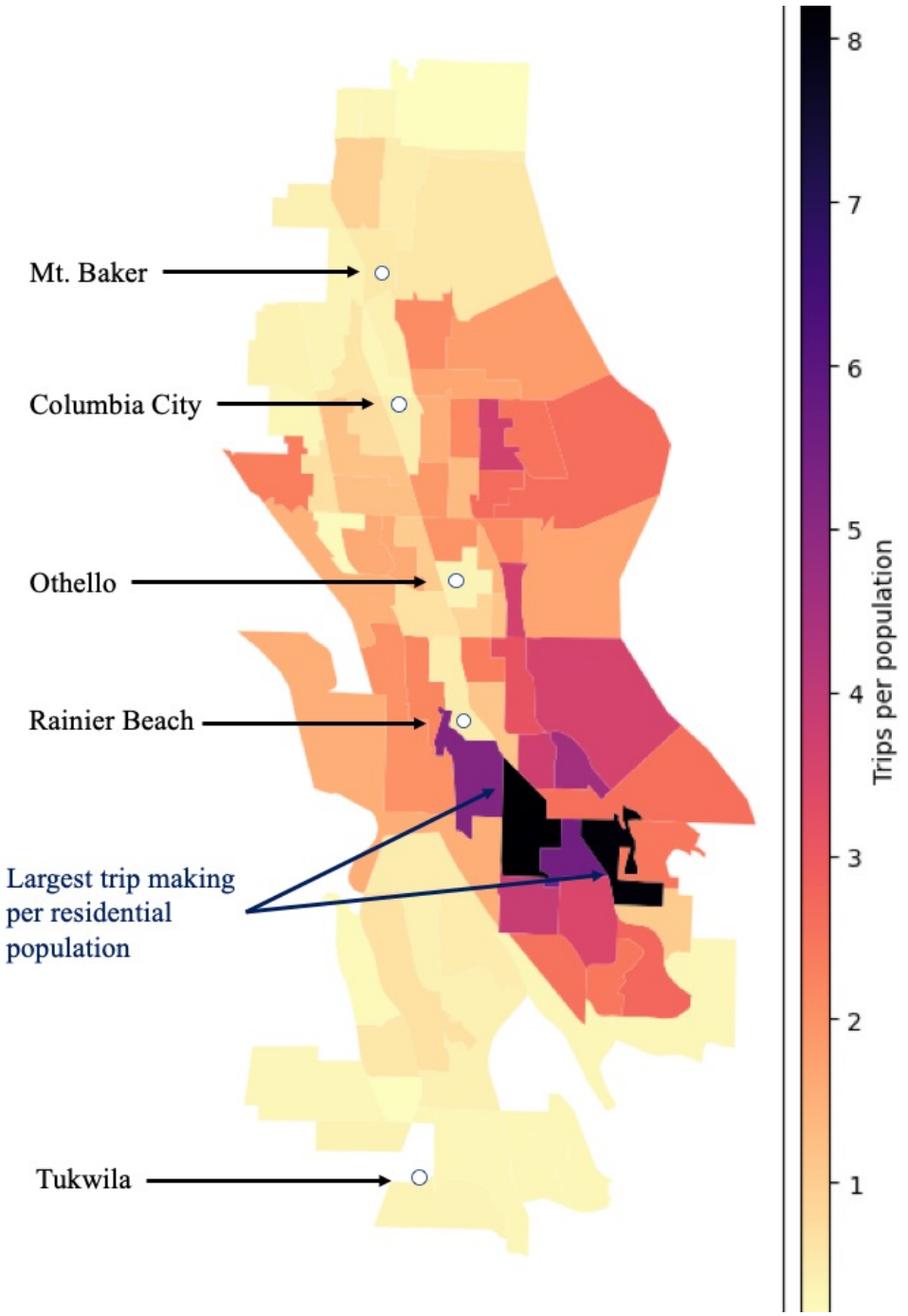


Figure 6, like Figure 5, shows that the highest use areas were in the southeast, centered on Renton Avenue, with riders traveling to and from the Rainer Beach Station. One area where trips may have occurred, even though residential density

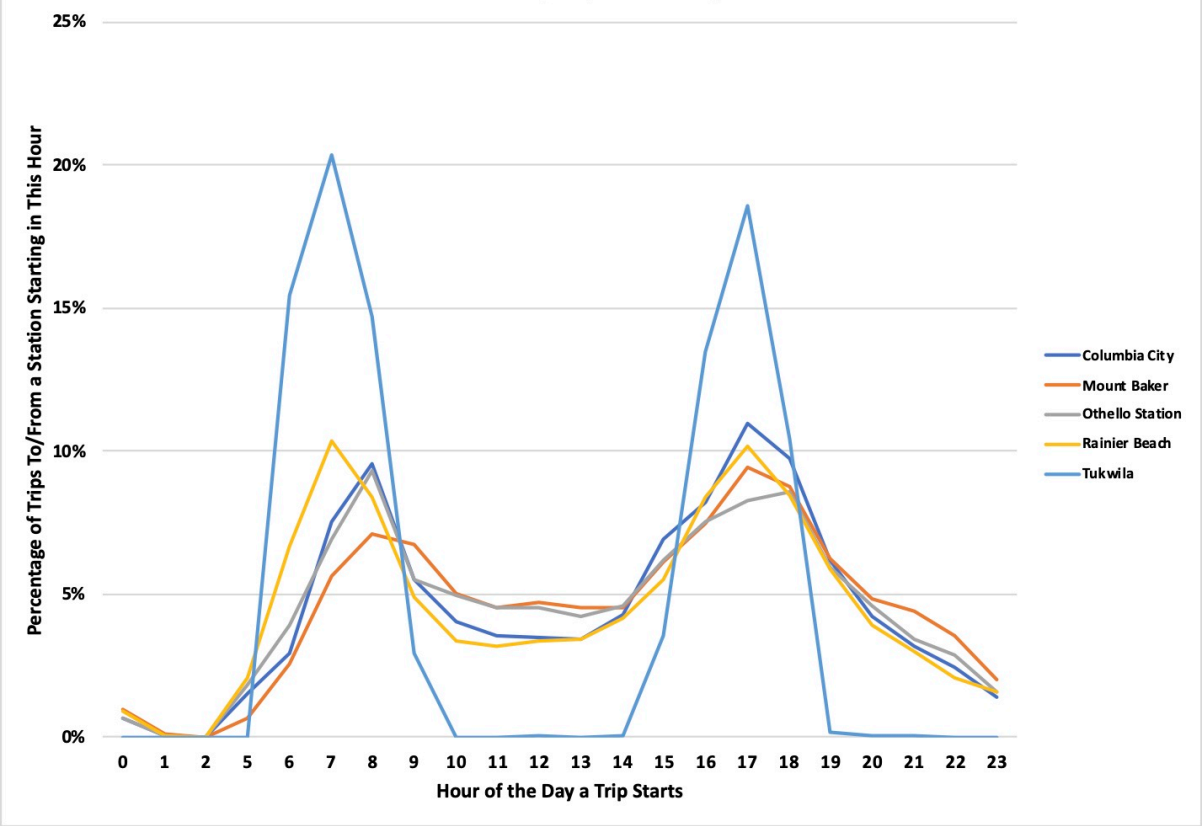
was moderate, was to a pair of churches (St. Paul's Catholic and Pentecostal Covenant) and a private school (St. Paul School).

Both maps show the relatively modest use of Via in the Mt. Baker and Tukwila service areas. For Othello and Columbia City, most of the ridership is came from east of the stations, with more modest use of Via from the top of the hill to the west of the stations.

4.3 Via Use by Time of Day

Figure 7 shows the time-of-day distribution of Via trips by Link station service area. As with figures 5 and 6, the data shown in these graphs do not differentiate between trips in which the rider was dropped off at the Link station and trips in which the rider was picked up at the station. The most obvious difference between the five stations was the effect of the shorter hours of service at the Tukwila station, where only peak period service was provided. All four Seattle stations showed fairly typical commute-oriented travel peaks in the AM and PM periods. The Rainier Beach station did have a morning peak period that was about an hour earlier than the other three Seattle stations. In addition, the Mt. Baker station had a lower morning peak than the other three Seattle stations. Mt. Baker and Othello both had a somewhat higher percentage of trips in the middle of the day than Rainier Beach and Columbia City.

Figure 7: Time of Day Distribution of Trips Using Via



24 percent of trips occurred in the AM peak, defined as between 5:00 AM and 9:00 AM. 33 percent of trips occurred in the afternoon peak (between 4:00 and 8:00 PM). Midday (9:00 AM to 4:00 PM) captured 31 percent of trips, with the nighttime period experiencing the remaining 12 percent.

Figure 8 shows the difference between weekdays and weekends at the time of day when travel occurred. (Note, that there was no Tukwila service on the weekends.) The lack of a morning peak period on the weekends was very clear. In contrast, a much larger fraction of trips took place in the middle of the day and in the evening.

Figure 8. Time of Day Distribution of Trips Using Via for Weekdays versus Weekends

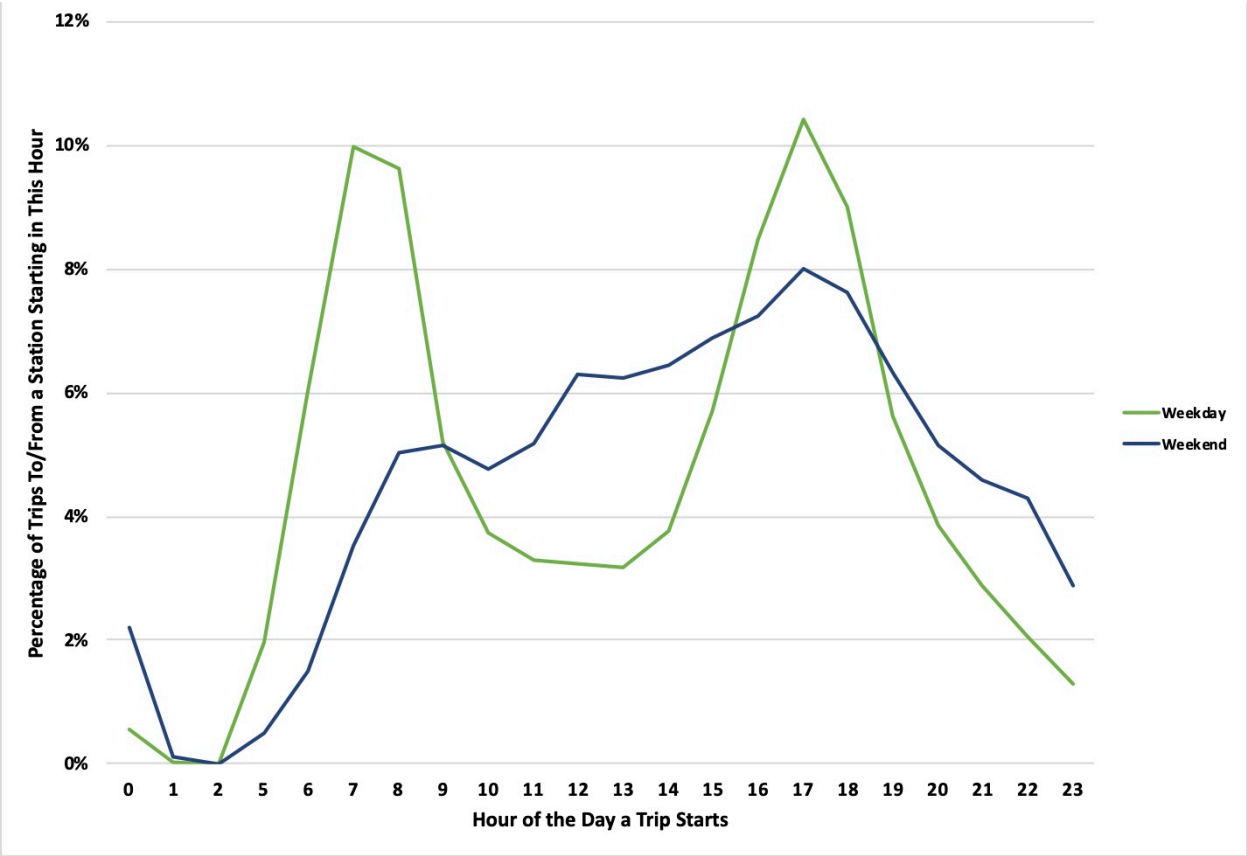
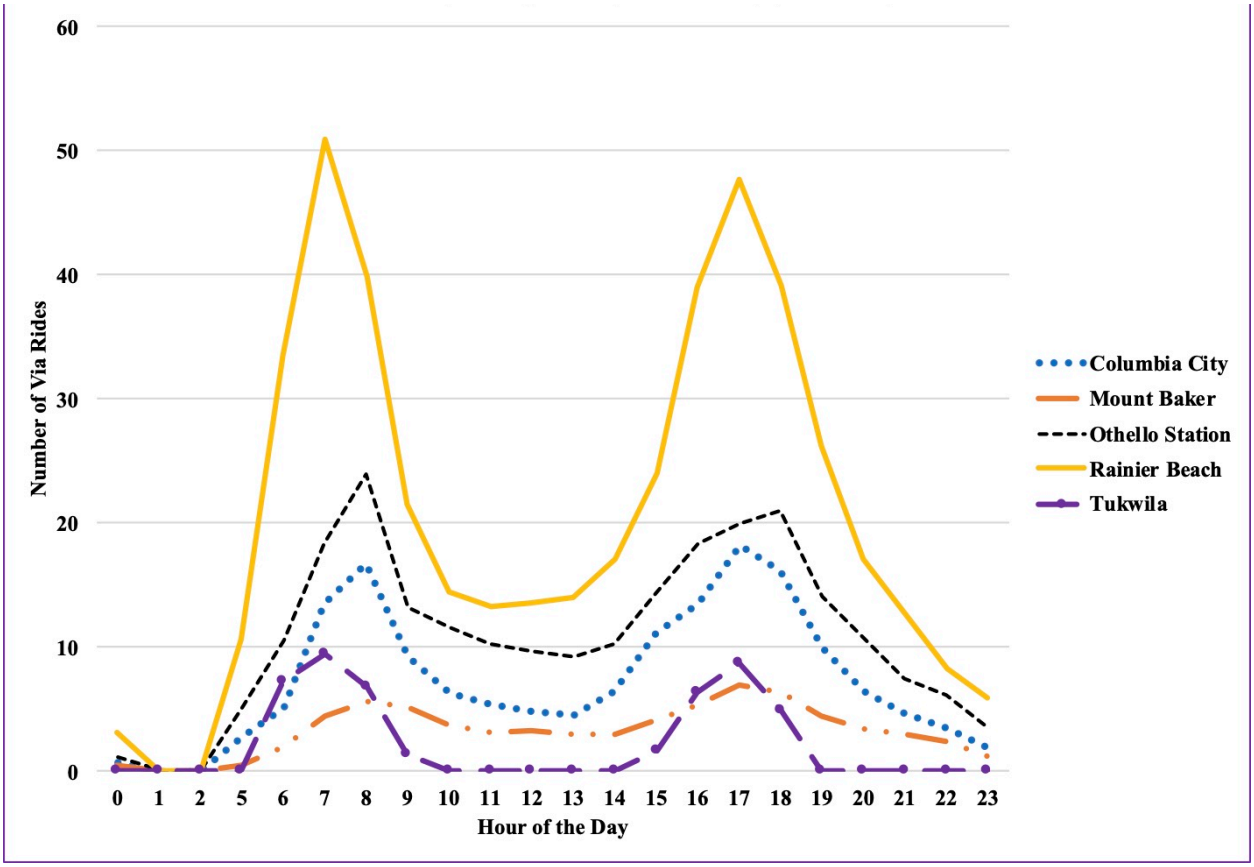


Figure 9 shows the average weekday Via ridership (number of passengers) for the nine-month period, June 2019 through February 2020. It shows that the Rainer Beach Station averaged 50 rides each weekday morning at 7:00 AM, with over 30 rides per hour at 6:00 and 8:00 AM, and between 4:00 and 6:00 PM. Othello averaged more than 20 trips per hour at 8:00 AM, as well as at 5:00 and 6:00 PM.

Figure 9: Weekday Average Hourly Via Ridership (June - Feb)



4.4 Wheelchair Travel

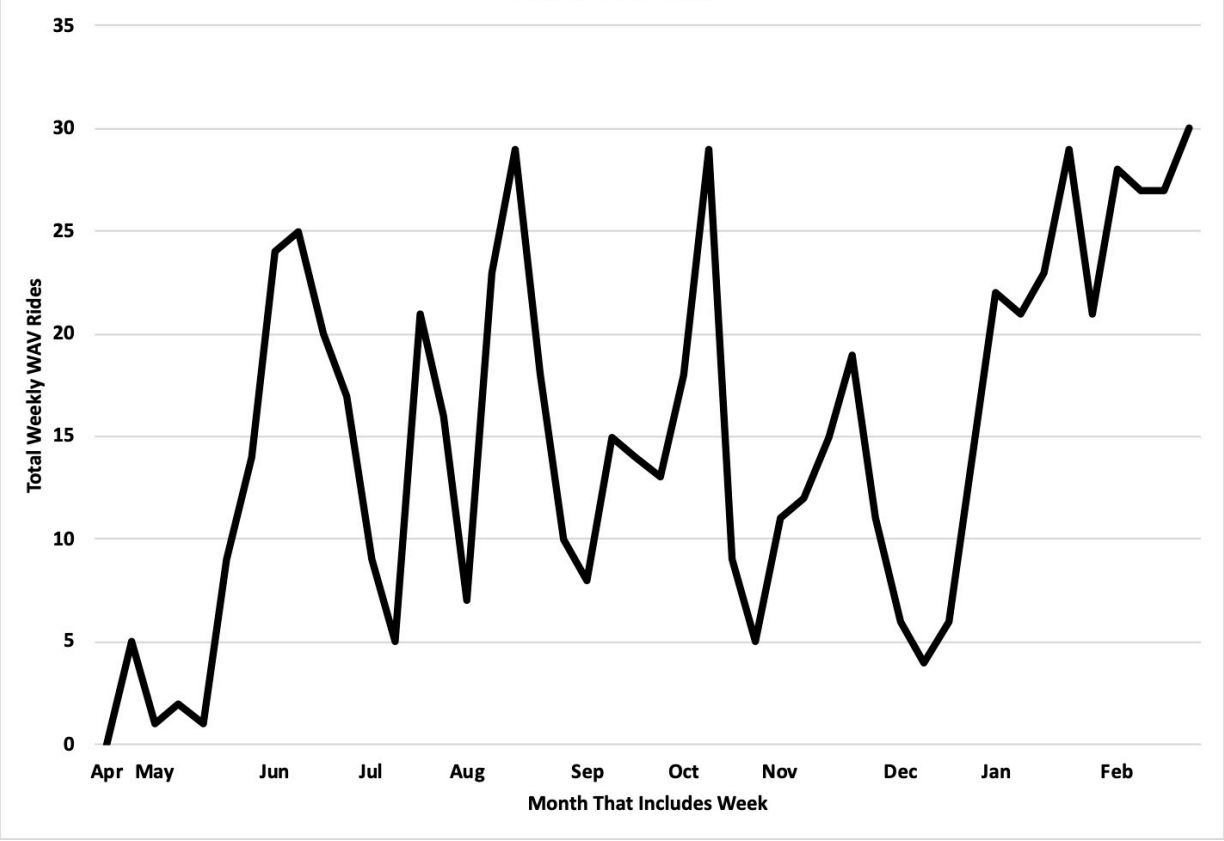
Ride requests for wheelchair accessible vehicles (WAVs) were a small fraction of all Via trips. A total of 701 WAV rides were completed before March 2020. These completed WAV rides were just under 0.32 percent of completed Via trips. Requests for WAV rides also started very slowly, with the first WAV ride happening on April 25, 2019, nine days into the pilot service. The tenth WAV ride did not occur until May 22nd, well over a month after the pilot project started. However, from that point on, WAV rides were taken on just under 81 percent of days. The most WAV rides taken on any day were eight. This milestone occurred on four separate occasions: August 12 and Oct 11, 2019, and January 2 and February 7, 2020.

Once WAV ridership started, it grew fairly quickly, but weekly ridership levels were highly variable throughout the course of the pilot project. WAV ridership declined heavily during the holiday season of November and December, although WAV trips were taken on most of the holidays themselves. Ridership rebounded to robust levels in January and February of 2020, before the end of the pilot as a result of the COVID-19 pandemic.

Much of the highly variable nature of the WAV trip making can be explained by the fact that a large fraction of WAV travel involved a small number of individuals. Only 41 unique ORCA cards were used to reserve completed WAV rides. The top five of those WAV users made 66 percent of all WAV trips. When these individuals were actively traveling, WAV trip frequency increased. When these individuals were not traveling (e.g., they were out of town on business), then few WAV rides were made.

In contrast to these high frequency users, twelve WAV users (29 percent) made only one or two trips. While this rate of "infrequent Via users" was similar to the 33 percent of all users who used Via only once or twice, the small total number of WAV riders means that these individuals' infrequent trip making was insufficient to "smooth out" the weekly graph shown in Figure 10.

Figure 10: Weekly Wheelchair Rides Completed during the Pilot Project



WAV rides were not evenly distributed among the five service areas. Othello had considerably more WAV rides, both in total and as a percentage of total rides, in comparison to any of the other service areas. Othello had more than twice as many WAV rides (412) than any other service area and also had more than twice as high a percentage of total trips that were WAV requests.

One significant difference between WAV travel and non-WAV travel was that WAV travel happened just as often on weekends as on weekdays, while non-WAV travel was heavily weekday oriented. Taken across the entire pilot project's duration, the mean number of WAV trips per weekend day was 2.76, while 2.97 WAV trips were taken on the average weekday, a ratio of 0.93 weekend to weekday trips. For non-WAV trips, 341 trips were taken each weekend, while 826 trips were taken each weekday, for a ratio of 0.41.

4.5 Frequency of Via Use

Data on the frequency of Via use were based on the reservations made for completed Via trips, and hashed IDs were used to determine how often individual riders used the Via system. These data included only the individuals making the ride reservation, as the Via data systems did not observe the IDs of other individuals who were part of larger parties, and the ORCA readers in the vehicles did not function reliably during the pilot.

A total of 8,154 unique rider IDs were observed completing Via trips during the pilot. The rider with the greatest number of trips took 790 trips, an average of just over 2.4 trips per day on Via over the duration of the entire study period.

Of those 8,154 riders, 1,734 riders (21 percent) used Via just once. Another 963 (12 percent) used Via exactly twice, and 1,272 used Via between three and five times. Combined, these low frequency users constituted almost 49 percent of the unique users of the Via service, but less than 4 percent of the trips. Conversely, the top 1 percent of Via users took 27,710 trips, or just over 12 percent of the total reserved and completed trips.

An examination of the frequency of use by passenger type showed that Seniors were more likely to use the system very infrequently, whereas Low-Income and Youth riders were more likely to be high frequency users (see Table 5). Of the Seniors who used Via, 66 percent took it less than six times, while only one percent took it more than 80 times. Conversely, 18 percent of both Low-Income and Youth riders took Via more than 80 times during the pilot.

Table 5: Percentage of Users by Passenger Type Who Were Very Low or Very High Frequency Via Users

	Adult	Disabled	Low-Income	Senior	Youth	Not Available	All Riders
Only 1 Trip	19%	14%	14%	29%	12%	21%	21%
1 or 2 Trips	32%	22%	24%	48%	19%	32%	33%
Fewer than 6 Trips	49%	30%	39%	66%	33%	46%	49%
More than 80 Trips	11%	10%	18%	1%	18%	10%	11%
More than 150 Trips	5%	3%	8%	1%	9%	3%	5%

4.6 Rider Characteristics

There were two major sources of information on the ridership of Via, the ORCA cards used for fare payment and the Via Rider Survey. The survey data provided the most detailed information about riders but comparing those data to the actual payment information revealed some bias in the survey responses. Therefore, while very informative, the survey response data had to be used with care. Not surprisingly, the survey over-represented high frequency Via users and under-represented low frequency users. The survey also under-represented younger users, particularly individuals young enough to pay for Via with Youth ORCA cards.

4.7 Via Use by Type of Rider

By matching the ORCA card numbers used to request Via rides to the ORCA cards used for bus and rail payments, it was possible to determine the ORCA passenger type (Adult, Youth, Disabled, Low-Income, Senior) of roughly 75 percent of all completed Via trip reservation—or 67 percent of all Via riders—as a reservation could be made for more than one person but did not include the ORCA card number of additional riders. Table 6 shows the number of Via trips made by passenger type[5] and reported station used.[6] Table 7 shows trip making by passenger type as the

[5] In this table, when a ride reservation was made for more than one person, all riders in that reservation were assumed to be of the passenger type of the individual making the reservation, as Actual payment data were not reliably collected because of issues with the ORCA card reader carried in the Via vehicles.

[6] Note that a small fraction (less than 0.2 percent) of trips was not associated with specific Link stations within the Via database.

percentage of trips made within each service area by each type of passenger. This table includes the fraction of trips for which it is not possible to identify the passenger type. Table 8 shows these same percentage values under the assumption that travelers for whom we lacked passenger type data were similar to those for whom we had information. Table 8 also shows the fraction of conventional transit trips made in each service area during the winter 2019 "before" period. (The summer period had roughly similar percentages, with the exception that Youth boardings declined 6 to 10 percent in comparison to winter boardings, with most of that percentage shift appearing in the adult category. The winter 2019 ORCA data were chosen as the comparison value because they were expected to be more representative of the ten-month Via test.)

Table 6: Number of Trips Made by Passenger Type by Service Area

	Adult	Disabled	Low-Income	Senior	Youth	Not Available	Grand Total
Columbia City	23,719	251	1,501	833	6,725	8,578	41,607
Mount Baker	9,329	454	1,176	486	3,157	5,155	19,757
Othello	27,081	990	3,882	651	13,860	19,042	65,506
Rainier Beach	59,817	995	5,521	794	15,387	28,258	110,772
Tukwila	5,800	435	135	257	736	2,058	9,421
Total All Trips	**125,746**	**3,125**	**12,215**	**3,021**	**39,865**	**63,091**	**247,063**

Table 7: Percentage of Trips Made by Passenger Type by Service Area

	Adult	Disabled	Low-Income	Senior	Youth	Not Available
Columbia City	57%	1%	4%	2%	16%	21%
Mount Baker	47%	2%	6%	2%	16%	26%
Othello	41%	2%	6%	1%	21%	29%
Rainier Beach	54%	1%	5%	1%	14%	26%
Tukwila	62%	5%	1%	3%	8%	22%
Total All Trips	**51%**	**1%**	**5%**	**1%**	**16%**	**26%**

Table 8: Percentage of Trips by Known Passenger Type by Service Area (Via / Bus & Link)

	Adult	Disabled	Low-Income	Senior	Youth
Columbia City	72% / 72%	1% /3%	5% / 7%	3% / 4%	20% / 14%
Mount Baker	64% / 60%	3% / 6%	8% / 9%	3% / 6%	22% / 19%
Othello	58% / 65%	2% / 4%	8% / 11%	1% / 4%	30% / 16%
Rainier Beach	73% / 65%	1% / 4%	7% / 9%	1% / 3%	19% / 19%
Tukwila	79% / 77%	6% / 4%	2% / 10%	4% / 4%	10% / 5%
Total All Trips	**68% / 68%**	**2% / 4%**	**7% / 9%**	**2% / 4%**	**22% / 15%**

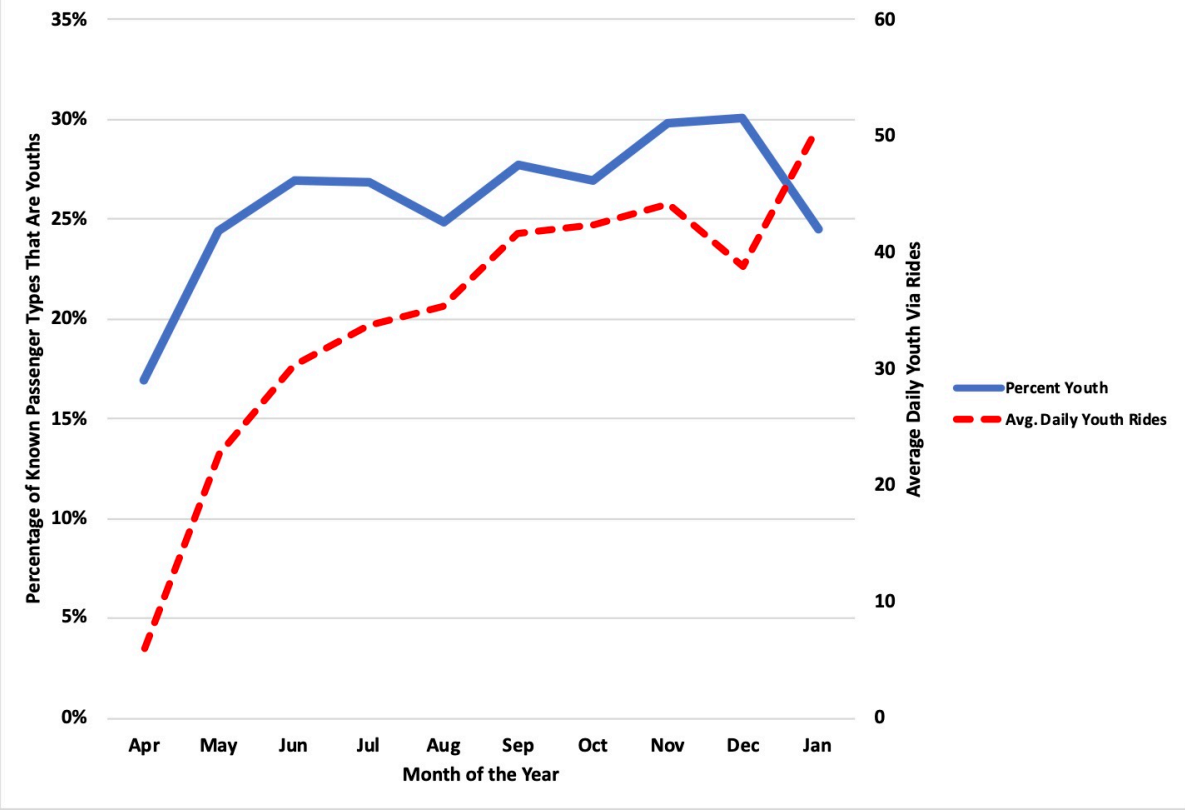
Adult ORCA users made the majority (almost 70 percent) of all Via trips. Youths made up just over 20 percent of trips, and ORCA Lift riders (Low-Income riders) made up just under seven percent of trips, with Disabled and Senior riders being just under two percent each. The primary variations in these overall patterns were as follows:

- Othello had a much higher fraction of Youth trips (30 percent), while Tukwila had low Youth usage (10 percent).

- Othello and Mount Baker had a modestly higher fraction of Low-Income trips (eight percent).
- Mt. Baker and Tukwila experienced a higher fraction of both Disabled and Senior trips (three percent for both at Mt. Baker, and six and three percent, respectively, for Tukwila).

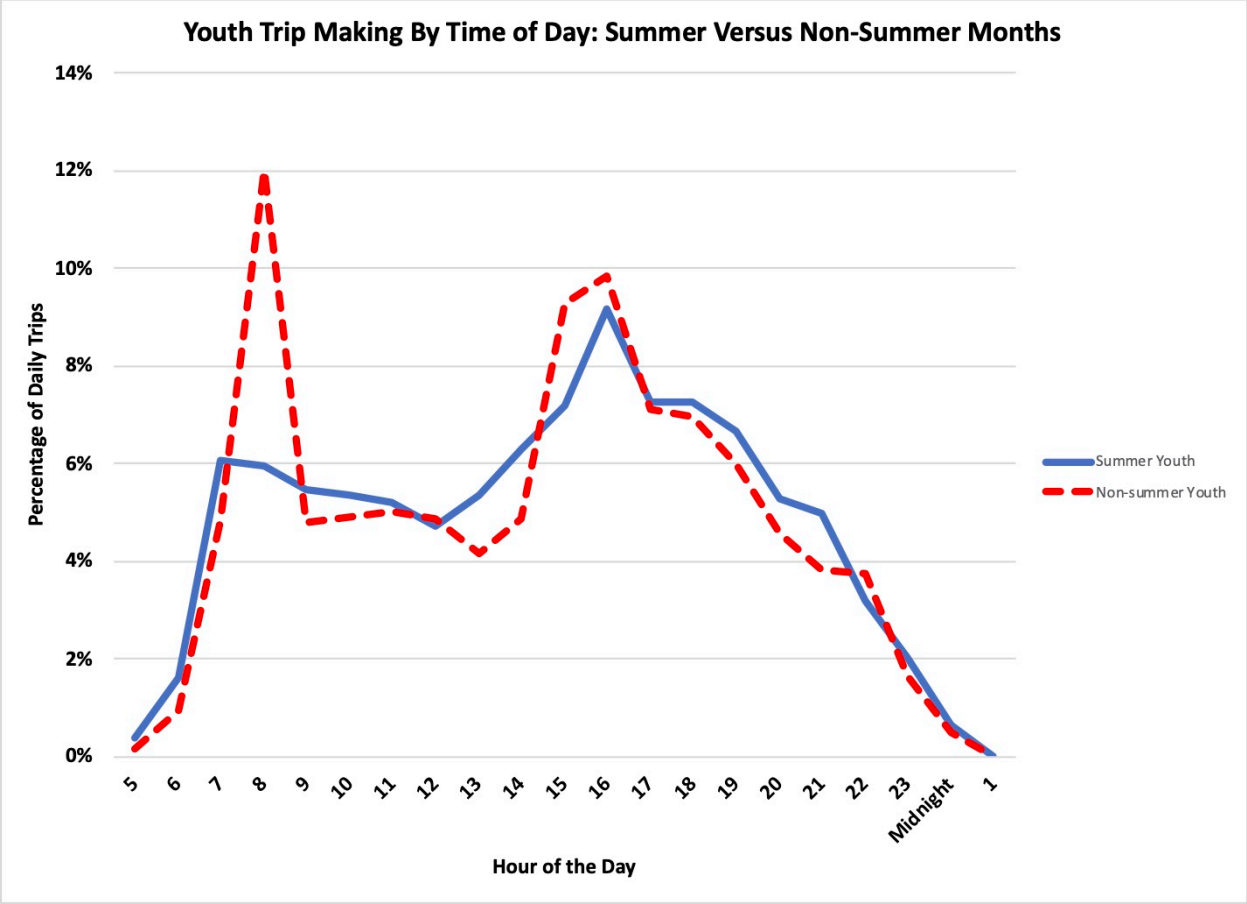
A portion of the large Youth ridership can be attributed to the fact that Franklin High School is located within walking distance of the Mt. Baker station, and many students traveled to that school by using Link. However, an analysis of summer Via and Link usage in the Othello service area showed that Youth ridership remained very high during the summer. This suggests that once students became familiar with the Via service, they continued to use it, even when school was not in session. This is shown in Figure 11, which was produced to examine Youth travel at Othello, the service area with the highest use by Youth. The fact that many Youth riders appeared to use Via to get to school is shown later in this report, as part of the time of day.

Figure 11: Percentage of Othello Station Via Trips Made by Youth by Month



We are confident that the students were taking trips to school given the time-of-day distribution of those trips. For example, Figure 12 shows the time-of-day distribution for Youth trips on Via at Othello for the months when school was open and compares that distribution to the summer months when school was not in session. The morning school peak movement in Figure 12 is very clear.

Figure 12: Youth Trip Making at Othello Station by Time of Day, Summer Months versus When School Was in Session



In a comparison of the distribution of use by the five passenger types to the overall bus and Link ridership patterns observed in the winter 2019 ORCA data, the primary difference observed was the higher proportional use of Via by Youth riders and the corresponding drop in the percentage of riders in the other three subsidized ORCA passenger type categories—Seniors, Low-Income, and Disability riders—each of which decreased by about 2 percent.

Minor differences in these patterns occurred within the five different station areas. Rainier Beach, where the highest Via ridership occurred, showed higher Adult use of Via in comparison to bus and Link. In contrast Othello showed a substantially higher fraction of trips taken on Via by Youth than on bus and Link. Tukwila experienced very low use of the Via service by low-income users (2 percent), while that station area had a slightly higher than average percentage of low-income bus and Link users (10 percent).

4.8 Via Rider Survey Data

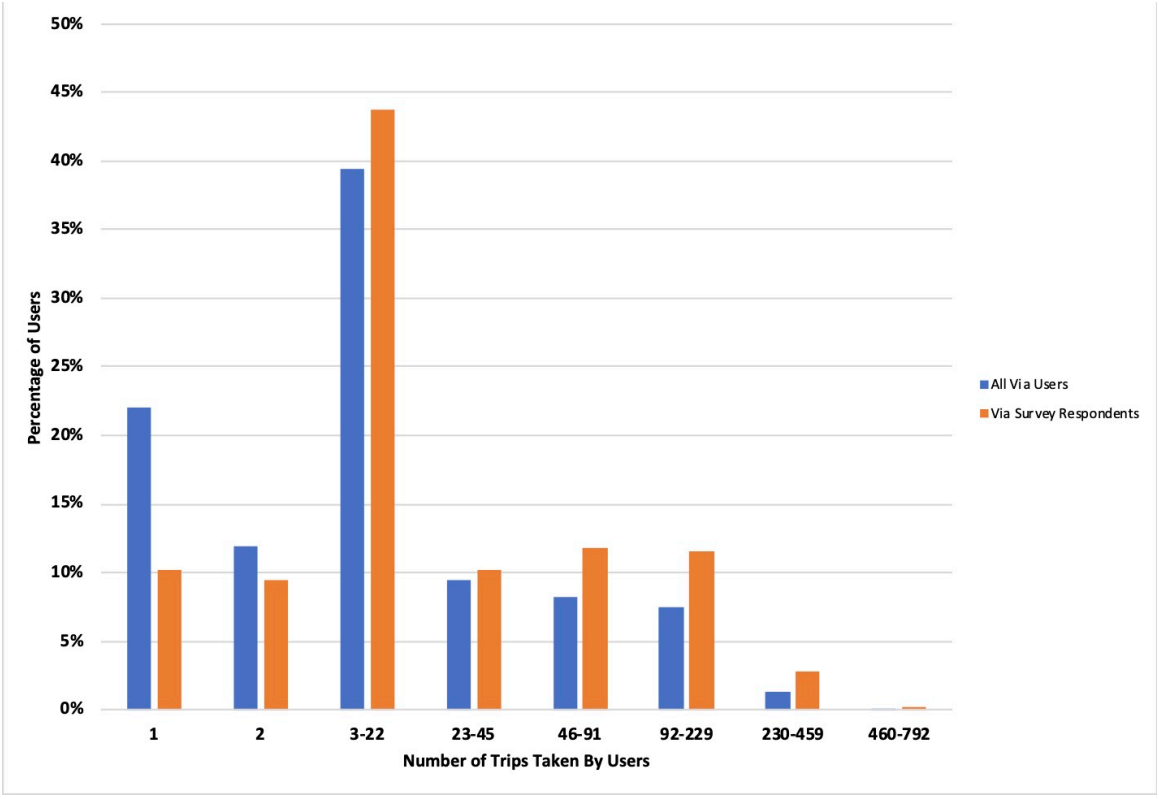
The Via Rider Survey design allowed the survey responses to be linked to anonymized rider IDs. This allowed some basic analysis of how well the survey responses represented the individuals taking Via trips.

Frequent Via Riders Were Over-Represented in the Via Rider Survey

Not surprisingly, the individuals responding to the survey were more likely to be high frequency Via users than the general population of Via users. This is illustrated in Figure 13.

The combined Via trip data indicated that 33 percent of individuals who used Via took fewer than two trips on the service. These infrequent users made up less than 10 percent of the survey sample. Conversely, users who took an average of more than five trips per week made up just over one percent of the Via users, but over three percent of the survey respondents. Individuals who took Via between once and twice a week made up 24 percent of the survey population but only 15 percent of the user population.

Figure 13: Comparison of the Frequency of Via Use, Via Rider Survey Versus Completed Reservations



Gender

Gender information was not available from ORCA data but was available from the two surveys. For those individuals who answered the survey's gender question, more self-identified women (55 percent) than self-identified men (41 percent) filled out the Via Rider Survey, and four percent of respondents identified as non-binary (see Table 9). All stations had very similar patterns, with two exceptions: 1) Mt. Baker had nearly as many male respondents as female (47 percent to 48 percent), and 2) Othello had a lower non-binary response rate than the other four stations.

Table 9: Reported Gender Identity from the Via Rider Survey / Pre-Via Intercept Survey

Station Last Used	Female	Male	Non-Binary
Mount Baker	48% / 49%	47% / 47%	5% / 3%
Columbia City	56% / 48%	39% / 50%	5% / 1%
Othello	59% / 44%	40% / 53%	1% / 3%
Rainier Beach	55% / NA	41% / NA	3% / NA
Tukwila	58% / 51%	38% / 47%	4% / 2%
Grand Total	**55% / 48%**	**41% / 49%**	**4% / 2%**

These gender response rates differed somewhat from the responses to the Intercept Survey conducted before the start of the pilot study. In that survey, the male and female response rates were essentially equal. Overall responses from the pre-Via Intercept Survey for individuals who agreed to answer the gender question were 49 percent female, 49 percent male, and 2 percent non-binary.

A comparison of gender with the frequency with which hashed respondent IDs appeared in the Via trip data showed that female respondents were somewhat more likely to be infrequent users of the Via service, and males were more likely to be high frequency users of the service. Table 10 shows the change in gender ratio with frequency of Via service use, as examined through the survey responses. (Individuals who chose to not respond to the gender survey question were considered to occur in the same percentages as those who did respond to the question.) An examination of total Via trip making by individuals whose gender had been declared showed that 49 percent of trips were made by people who identified as female, 48 percent by people who identified as male, and three percent by people who identified as non-binary.

Table 10: Reported Gender Identity versus Frequency of Use

Gender Identity	Only 1 Trip	Four or Fewer Trips	200 or More Trips	Total Survey Response
Female	50%	54%	44%	55%
Male	45%	42%	52%	41%
Non-Binary	4%	5%	4%	4%
Total Number of Respondents in the Category	115	339	48	1168

Age Distribution

More significant differences were found between the Via Rider Survey and ORCA payment data in the ages represented than in the gender responses. Table 11 shows the detailed distribution of reported ages, and Table 12 shows a more aggregated version of those age groups. The two tables show that the Via Rider Survey revealed that Mt. Baker had a much higher fraction of older adults (21 percent) than the other four service areas (four to 12 percent). However, this pattern was not present in the Via and ORCA usage data. In those data, only nine percent of the trips made to and from Mt. Baker were made by Seniors, and that percentage was not significantly different from what was found in the other Via service areas. When examined across all survey responses, the 11 percent 65+ response was only marginally higher than the fraction of Senior cards observed in the ORCA data.

Table 11: Age Distribution from the Via Rider Survey by Station

Station	Age of Survey Respondent								
	13-15	16-17	18-19	20-24	25-34	35-44	45-54	55-64	65+
Mount Baker	0%	1%	2%	3%	20%	21%	12%	19%	21%
Columbia City	1%	3%	1%	3%	28%	21%	18%	13%	12%
Othello	0%	4%	3%	10%	26%	21%	16%	11%	8%
Rainier Beach	1%	3%	2%	5%	28%	26%	15%	13%	7%
Tukwila	3%	0%	7%	7%	22%	28%	16%	14%	4%
Grand Total	**1%**	**3%**	**2%**	**5%**	**26%**	**23%**	**16%**	**14%**	**11%**

Table 12: Summary Age Distribution from the Via Rider Survey by Station

Station	High School and Younger	College Age (18 – 24)	Post College Working Age (25 – 64)	65+
Mount Baker	1%	5%	72%	21%
Columbia City	4%	4%	80%	12%
Othello	5%	13%	74%	8%
Rainier Beach	3%	7%	82%	7%
Tukwila	3%	14%	80%	4%
Grand Total	**3%**	**8%**	**78%**	**11%**

The data in Table 8 show that 15 percent of all winter 2019 ORCA trips were paid for with Youth cards. Although 22 percent of Via trips were taken by Youth, less than 4 percent of survey respondents were Youth (less than 18), while in the Pre-Via Intercept Survey 10 percent of respondents were 18 or younger. Conversely, only two percent of the Via users and 4 percent of bus/Link users from winter 2019 used Senior ORCA cards, while 11 percent of Via survey respondents indicated that they were 65 or older. The Pre-Via Intercept Survey also showed four percent of Link riders as 65 or older. Therefore, the Via Rider Survey under-represented Youth riders and over-represented Seniors.

Disabilities

A total of 63 survey respondents out of 1,273 reported one or more disabilities. Ten of the respondents reported two disabilities and one reported three disabilities. Table 13 shows the number of reported disabilities by type of disability and the station the respondent last used. The total number of reported disabilities was 72. The vast majority of the "other" responses involved a description of why the individual had difficulty walking long distances. These included a variety of physical ailments, as well as pregnancy.

Table 13: Summary of Reported Travel Disabilities by Station

Station	Reported Travel Disability						
	Wheelchair Disability	No Stairs Disability	Vision Disability	Hearing Disability	Animal Disability	Other Disability	Total Reported
Mount Baker	1	4	4	3		5	17
Columbia City	1	3	4	4	1	14	27
Othello		4	3	2	1	4	14
Rainier Beach		1	1	1		8	11
Tukwila International Boulevard		1			1	1	3
Grand Total	**2**	**13**	**12**	**10**	**3**	**32**	72

Ethnicity

Of the 1,273 respondents to the Via Rider Survey, 1,062 (83.4 percent) selected one ethnicity, 71 (5.6 percent) selected more than one ethnicity, and the remaining 140 (11.0 percent) did not select an ethnicity. Table 14 shows the reported ethnicities by Link station in both surveys and from the 2018 American Community Survey, five-year summary. This table allows the self-reporting by the Via users to be compared with responses by the general Link user population in the Pre-Via Intercept Survey and also with general population ethnicities identified by the Census. Individuals who selected more than one ethnicity were included in the "other" category. (Note that in the Via Rider Survey, all individuals who selected American Indian also selected at least one other ethnicity.)

Table 14: Summary of Reported Ethnicities (Via Rider Survey / Pre-Via Intercept Survey / Census) by Station

Station	Reported Ethnicity					
	Latino	Black	White	Asian / Pacific Islander	American Indian	Other
Mount Baker	4% /5% /6%	3% / 14% / 22%	68% / 48% /44%	15% / 21% / 21%	0% / 1% / 1%	9% / 10% / 6%
Columbia City	4% / 4% / 6%	4% / 9% / 15%	67% /60% / 43%	15% / 19% / 29%	0% / 0% / 0%	10% / 8% / 7%
Othello	5% / 7% /8%	6% / 18% / 24%	51% / 43% / 21%	27% / 22% / 41%	0% / 1% / 0%	12% / 10% / 6%
Rainier Beach	4% / NA / 11%	15% / NA / 26%	52% / NA / 24%	21% / NA / 33%	0% / NA / 0%	7% / NA / 6%
Tukwila	7% / 6% / 18%	21% / 15% / 17%	43% / 47% / 33%	22% /22% / 23%	0% / 1% / 1%	7% / 13% / 7%
Grand Total	**4% / 6% / 10%**	**8% / 15% / 21%**	**58% / 47% / 32%**	**20% / 22% / 30%**	**0% / 1% / 1%**	**9% / 10% / 6%**

The Pre-Via Intercept Survey was not conducted at the Rainier Beach station.
Portions of some census block groups fell within two different Link station service areas. For the census figures in Table 14, the population of each of these block groups was assigned to the service area with the largest number of trips to that service area from that block group.

Both the Via Rider Survey and the Pre-Via Intercept Survey indicated that people of color used transit services at lower rates than individuals self-reporting as white. In both surveys, white individuals were over-represented in comparison to their populations reported in the census data.

In general, the Intercept Survey more closely replicated the ethnic population distributions reported in the census than the Via Rider Survey. Besides whites, only the "Other" group—which included all individuals reporting more than one ethnic background—was over-represented in the survey responses. The Intercept Survey results suggested that people of color used the transit system somewhat less often than whites, and the Via Rider Survey results suggested that this bias was slightly exacerbated in the use of the Via service.

However, an important caveat to this conclusion is that the ORCA data showed that the Via Survey responses under-represented Youth riders. Youth riders made over 20 percent of the Via trips but supplied only three percent of the Via Survey responses. Because over 73 percent of Youth rides occurred in the Othello and

Rainier Beach station service areas, and these areas had the two highest Black population percentages and the two lowest percentages of white populations, it is likely that a large fraction of the Youth riders who did not respond to the surveys were people of color. This suggests that Via was used by people of color somewhat more than the Via Survey indicated. In addition, the two station areas with the highest Via use were Rainier Beach and Othello. These areas, along with Tukwila, had the highest percentage use of Via by people of color.

Income

Both the Via Rider Survey and Pre-Via Intercept Survey respondents were asked for their annual household income. Nearly one-third (32 percent) of Via respondents either specifically declined to give an income value or left the income question blank. For the Pre-Via Intercept survey, 36 percent of respondents declined to provide a household income level. Table 15 attempts to compare these two sets of survey response.

Table 15: Household Income Levels[f] by Station (Via Survey / Pre-Via Intercept Survey / Census)

Income Level	Mount Baker	Columbia City	Othello	Rainier Beach[a]	Tukwila International Boulevard	Grand Total
$100,000 or more	57% / 34%/ 40%	59% / 47%/ 44%	48% / 25%/ 30%	53% / NA/ 32%	53% / 20% / 24%	54% / 32%/ 34%
$50,000-$99,999	28% / 26%/ 22%	24% / 22% 30%	27% / 30%/ 28%	30% / NA / 31%	25% / 24% / 32%	27% / 28%/ 29%
$35,000-$49,999[b]	6% / 14% / 13%	7%/ 11% / 7%	8% / 14% / 11%	7% / NA / 11%	6% / 13% / 16%	7% /13%/ 11%
$25,000-$34,999[b]	2% / 6% / 7%	5% / 7% / 8%	4% / 7% / 9%	3% / NA / 9%	8% / 5% / 10%	4% / 6% / 9%
$20,000-$24,999	2% / 6% / 3%	1% / 3% / 1%	3% / 7% / 4%	1% / NA / 2%	4% / 12% / 3%	2% / 7% / 3%
$15,000-$19,999[c]	2% / 2% / 3%	0% / 0% / 2%	1% / 3% / 6%	1% / NA / 4%	2% / 0% / 5%	1% / 1% / 4%
$10,000-$14,999[d]	0% / 3% / 4%	1% / 3% / 2%	1% / 4% / 5%	2% / NA / 4%	0% / 2% / 3%	1% / 3% / 4%
Under $9,999[d]	3% / 9% / 8%	3% / 7% / 5%	7% / 11% / 8%	4% / NA / 6%	2% / 12% / 7%	4% / 10% / 7%
Mean income	$82,300 / $63,100 / $108,100	$82,200 / $71,500 / $110,500	$74,100 / $57,200 / $86,600	$79,500 / NA / $87,500	$78,300 / $56,600 / $72,800	$79,600 / $62,100 / $92,800

[a] Rainier Beach station was not included in the Pre-Via Intercept Survey
[b] The Pre-Via Intercept Survey categories were $33,000 - $49,999 and $24,000 - $32,999
[c] The Pre-Via Intercept Survey lower bound for this category was $16,000
[d] The Pre-Via Intercept Survey used categories of $12,000 - $15,999 and <$12,000.

One problem was that two slightly different income distributions were used in the surveys. Table 15 shows only those surveys that included an income response.

It can be seen in that table that more than 50 percent of Via Rider Survey respondents reported a household income of more than $100,000 per year. This result was higher than that found both in the Pre-Via Intercept Survey, in which only 32 percent of respondents reported a household income of greater than $100,000, and in the census data, in which only 34 percent of households in the Via service area made more than $100,000. This indicates that the Via Rider Survey was somewhat biased toward individuals with higher incomes, while the Pre-Via Intercept Survey more closely replicated the census results. In the Via Rider

Survey, only 19 percent of respondents reported living in households that made less than $50,000 per year, while the census data indicated that 37 percent of the households had less than $50,000 in annual income. There were modest differences in income levels among stations, with Columbia City and Mt. Baker having the highest income levels, and Othello and Tukwila having the lowest reported income levels.

An examination of income distributions by age group showed that a significant portion of the very low-income households (i.e., reported annual household income of less than $24,000) were reported by younger respondents. Forty-nine percent of incomes reported by individuals 19 or younger in the Pre-Via Survey indicated a household income of less than $24,000, while 33 percent of this age group in the Via Rider Survey reported incomes of less than $25,000.[7]. Conversely, in the Via Rider Survey 53 percent of the individuals ages 25 to 34 and 73 percent of the individuals ages 35 to 44 reported an annual household income of greater than $100,000. In the Pre-Via Intercept Survey, these values were 29 percent (ages 25 to 34) and 50 percent (ages 35 to 50).

An examination of income by ethnicity in the Via Rider Survey data (see Figure 14) showed that the general shape of the income distribution curve was similar for all ethnicities. Table 15 shows that the majority of Via Survey respondents fell in the two higher income categories when ethnicity was not considered. However, there were observable differences in income distributions by ethnicity. The Black, American Indian, and Asian/Pacific Islander groups all showed both a lower percentage of high-income households and a higher percentage of very low incomes.

These basic trends were summarized by assigning a dollar value to each income distribution category. The midpoint of each category was used except for the highest and lowest categories, in which $100,000 and $5,000 were used. The result was an estimate of the mean income for the survey respondents in each ethnic group (see Table 16). For the Via Rider Survey, this resulted in all three of these groups having a mean annual income that was more than $10,000 less than that of white respondents.

The Pre-Via Intercept Survey showed a lower income distribution for all ethnicities. Table 15 also includes a mean income row from the Pre-Via Survey also computed from the mean values of the survey income categories. In the Pre-Via Intercept

[7] Note that just under one-third of survey takers declined to provide an income level. Therefore, while 863 income responses were obtained, when those responses were divided into the cells of income x age group, many cells had very few entries.

Survey responses, 44 percent of the white respondents reported an annual income of greater than $100,000. 23 percent of Asian/Pacific Islanders reported this level of income, while all other ethnic groups included less than 20 percent of respondents with this level of income.

Figure 14: Income Distribution by Ethnicity from Via Rider Survey Responses

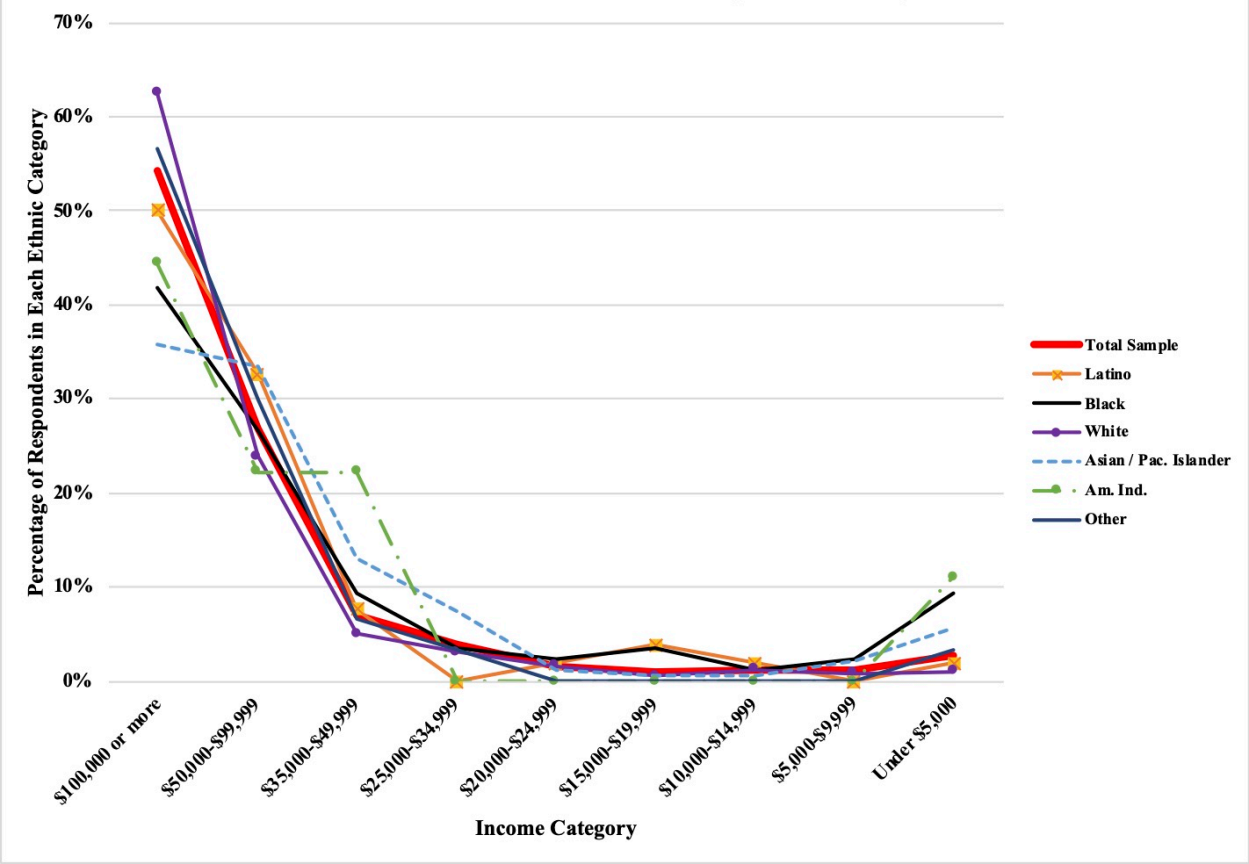


Table 16: Mean Household Income by Reported Ethnicity

Ethnic Group	Via Survey Mean Income	Pre-Via Intercept Survey Mean Income
White	$84,260	$72,250
Other	$83,170	$49,010
Latino	$79,230	$53,010
American Indian	$71,110	$42,370
Asian / Pacific Islander	$69,590	$57,200
Black	$68,840	$42,380
Entire Sample	**$79,620**	**$61,960**

These responses further suggested that the Via users tended to have higher incomes than the overall population of Link light rail users.

Access to Bank Accounts

Both surveys asked respondents to indicate whether they had bank accounts. Table 17 shows that a significant percentage of the respondents to the Intercept Survey conducted before the Via pilot did not have a checking account. Via Rider Survey respondents had a much lower fraction of unbanked respondents.

Table 17: Percentage of Survey Respondents without a Checking Account

	Pre-Via Intercept Survey	Via Rider Survey
Mt. Baker	10%	1%
Columbia City	6%	2%
Othello	8%	3%
Rainier Beach	NA	3%
Tukwila	13%	2%
Total	9%	2%

Trip Purpose

The two surveys for this study also produced very different distributions of trip purposes (see Table 18). In the Pre-Via Intercept Survey, more than 50 percent of respondents said that trips were taken for work and 19 percent were for school. In the Via Rider Survey, work trips were less than 40 percent of travel purposes and school trips were less than eight percent.

Table 18: Trip Purpose

	Via Rider Survey	Pre-Via Intercept Survey
Work	38.9%	56%
School	7.8%	19%
Errands	17.6%	9%
Recreation	30.0%	10%
Other	5.7%	6%

It is unclear whether these differences in trip purpose were an artifact of the need to use two different survey methodologies or accurately indicated that Via users were substantially different from those who agreed to the take the Intercept Survey. The Pre-Via Intercept Survey responses were heavily weighted to the AM and PM peak periods, as ridership was heaviest in those time periods, and therefore, more survey responses were collected during those periods (41 percent in the AM, 32 percent in the PM, and only 27 percent at midday). In contrast, the Via Rider Survey was conducted as an on-line response to an email prompt. While the survey requested the rider's "last trip," no time stamp was associated with the trip(s) being described, and it is highly possible that survey takers responded with non-work trips because they had not just completed a work trip when they took the survey.

It is also known that the Via Rider Survey under-represented school trips because of the low number of school age respondents relative to the high level of Youth trips observed in the Via and ORCA Link/bus trip databases. We have considerable confidence that many students were taking trips to school, given the time-of-day distribution of those trips and the change in that distribution during the summer. (See Figure 12.)

Previous Mode

The two surveys provided insight into how Link riders accessed or departed from Link stations. Both surveys showed that the modes taken to access Link stations were similar to the modes used to depart from the stations; however, some significant differences were observed between the two surveys. Table 19 shows the total number and percentage of responses for each mode from the Via Rider Survey, as well as the comparison percentages from the Pre-Via Intercept Survey.

Table 19: Previous Mode Taken to Access and Egress Link

	Via Rider Survey Access TO Station		Pre-Via Survey	Via Rider Survey Egress FROM Station		Pre-Via Survey
	Number of Responses	Percentage of Responses		Number of Responses	Percentage of Responses	
Bike	11	1.3%	2.2%	2	0.8%	2.8%
Bus	200	23.8%	18.7%	58	24.6%	25.4%
Did not use this station	91	10.8%		29	12.3%	
Drove	125	14.9%	12.4%	39	16.5%	7.9%
Lyft/Uber	64	7.6%	1.3%	14	5.9%	1.4%
Other (please specify)	45	5.4%	2.2%	19	8.1%	6.5%
Picked Up / Dropped Off	83	9.9%	7.5%	25	10.6%	3.4%
Skateboard	1	0.1%	0.3%			
Walked/wheelchair	219	26.1%	54.9%	50	21.2%	51.1%

The pattern of access/egress mode differed somewhat from one station to another. Table 20 shows the access/egress mode (both directions combined) by station reported in the Via Rider Survey. The largest changes from station to station were that Rainier Beach had a much higher rate of both bus and car access, and Tukwila had a much higher rate of car access. In contrast Columbia City and, to a lesser extent, Mt. Baker had higher rates of pedestrian access. The fact that at Tukwila, the only station that has a park and ride associated with it, a high level of respondents reported they "previously drove to the station" suggests that Via did open some spaces in that overcrowded park and ride to other users, one of the desired goals of the service.

Table 20: Modes Used for Access Before Via, as Reported in the Via Rider Survey

	Columbia City	Mount Baker	Othello	Rainier Beach	Tukwila International Boulevard	Grand Total
Bike	2%	2%	2%	0%	0%	1%
Bus	19%	18%	20%	34%	18%	24%
Did not use this station	7%	10%	20%	8%	13%	11%
Drive	13%	7%	9%	20%	33%	15%
Lyft/Uber	6%	9%	3%	10%	13%	8%
Other (please specify)	7%	4%	4%	5%	7%	5%
Dropped Off	9%	15%	10%	10%	4%	10%
Walk/wheelchair	36%	35%	32%	13%	13%	26%

The vast majority of "other" category responses shown in Table 20 described one of two situations. In the first, the survey respondent described a "compound trip" being used to access or egress the Link station. For example, "I had a long walk to a bus stop" or "I drive and park and then walk to the station." This group of respondents represented individuals with poor access to the station without Via. The second type of "other" response described the use of a variety of different modes depending on the day or situation. For example, "walked, picked up, or used bus coming home from airport with luggage" or "all but skateboard." This category of responses represents people with multiple access modes who used those alternative modes for different trip purposes or perhaps under different weather or time constraint conditions.

The big difference observed between the Via Rider Survey and the Pre-Via Intercept Survey was a significant reduction in the number of survey respondents who said that they walked to/from the station. In the Pre-Via Intercept Survey, 55 percent of Link riders said that they walked (or used a wheelchair) to get to or from the station. In the Via Rider Survey, only 26 to 29 percent of respondents indicated that before taking Via, they walked (or used a wheelchair) to the station. The biggest difference in walking was at Othello, where in the Pre-Via Survey, 63 to 74 percent of respondents reported walking to the station, whereas for the Via Rider Survey only 31 to 32 percent of respondents reported having previously walked. This suggests that people who typically walked to the station were less likely to use Via

than other riders who traveled from farther away. Because the walk percentage was much higher in the Pre-Via Intercept Survey, it was not surprising that the reported usage of most of the other modes was lower in the pre-survey than in the Via Rider Survey. The Via riders reported using motorized pick-up and drop-off services (combined TNCs and carpools) at roughly twice the rate as the general public's response in the Pre-Via Intercept Survey (about 18 percent versus 8 to 10 percent).

4.9 Via Performance

Between the start of the pilot and the end of February 2020,[8] a total of 298,697 Via trip requests were initiated. 221,127 trips were completed, carrying 247,845 passengers. That is an average of over 690 ride reservations per day from the April 2019 start through the end of February 2020, which resulted in carrying over 776 passengers per day. On weekdays, completed ride reservations exceeded 950 per day by the end of the pilot in February. (Note that additional rides occurred in March before the cancelation of the service because of the COVID-19 pandemic.)

Not all ride requests were successfully completed. Table 21 shows the overall outcome of the just under 300,000 ride requests. Table 21 also shows how those outcomes differed when the ride request was a WAV request.

[8] Via service did continue into March 2020. Most of the Via ridership data and comparisons in this evaluation section are based on data through the end of February. This was selected as the end date for the evaluation data collection because in March the COVID-19 pandemic significantly affected all transit use. For evaluation purposes, it is felt by the evaluation team that March data created unusual biases in the data.

Table 21: Via Ride Requests and Request Outcomes

Request Outcome	Number of Non-WAV Trip Requests	Percentage of Total Trip Requests	WAV Requests	Percentage of WAV Trip Requests
admin_cancelled	430	0%	38	4%
completed	220,440	74%	687	67%
invalid_request	3,502	1%	15	1%
no_show	3,079	1%	26	3%
other_error	44,304	15%	132	13%
rider_cancelled	21,272	7%	43	4%
seat_unavailable	4,641	2%	88	9%
Grand Total	**297,668**		**1029**	

The ride request numbers in Table 21 show that WAV requests were 0.3 percent of total Via to Transit requests. However, they resulted in 8.1 percent of all administrative cancelations and 1.9 percent of seat-unavailable responses. WAV requests were a small fraction of total ride requests, and they typically experienced a lower level of performance. For example, while 0.1 percent of non-WAV trip requests were administratively cancelled, just under four percent of WAV requests resulted in administrative cancelations. Similarly, nine percent of WAV requests were declined because seats were unavailable, whereas only two percent of non-WAV trip requests were not served for this reason. Because of "other errors," 15 percent of non-WAV trips were not provided. This is one category in which WAV requests were better served, as only 13 percent of WAV requests resulted in some "other error." Finally, non-WAV customers were almost twice as likely to cancel a trip request (seven percent versus four percent), but individuals who made WAV requests were three times more likely to not show (three percent versus one percent).

The characteristics of completed Via trips are summarized in Table 22. The average trip distance was just over 1.5 miles, with WAV trips being slightly shorter, on average, than non-WAV trips. The standard deviations of those distances were similar for WAV and non-WAV trips. On average, WAV trips took slightly longer (by roughly 34 seconds) than non-WAV trips. Via trips averaged just under 7.5 minutes. The mean time between the ride request and the arrival of the Via van for completed trips was just under nine minutes. On average, the expected time of arrival (ETA) value differed from the actual arrival by just under two minutes,

although these errors were fairly evenly distributed about zero, as the mean error was just over 12 seconds. WAV performance was slightly worse than non-WAV Via service in these areas, as WAV riders waited an average of three minutes more than non-WAV riders for their ride, and there was a higher degree of variability and error in the ETA they were given.

Table 22: Via Trip Length Characteristics

	Non-WAV Trips	WAV Trips
Mean Trip Distance (miles)	1.57	1.30
Standard Deviation of Trip Distance	0.73	0.75
Mean Trip Duration (minutes)	7.49	8.05
Standard Deviation of Trip Duration	4.02	5.58
Mean ETA (minutes)	8.77	11.91
Mean Absolute Difference ETA Minus Actual Arrival	1.958	2.829
Mean ETA minus Actual Arrival (minutes)	0.216	-0.551

Figure 15 shows the distribution of distances (in miles) of trips taken on Via. These distributions are shown for each service area and for all trips combined. More than 95 percent of all trips were for less than three miles. Trips longer than three miles were commonly taken in only two of the five service areas, Rainer Beach and Tukwila, the two largest service areas. These two service areas also had the smallest fraction of trips of less than one mile, which were very common in the Mt. Baker service area.

Figure 15: Frequency Distribution of Via Trip Distances

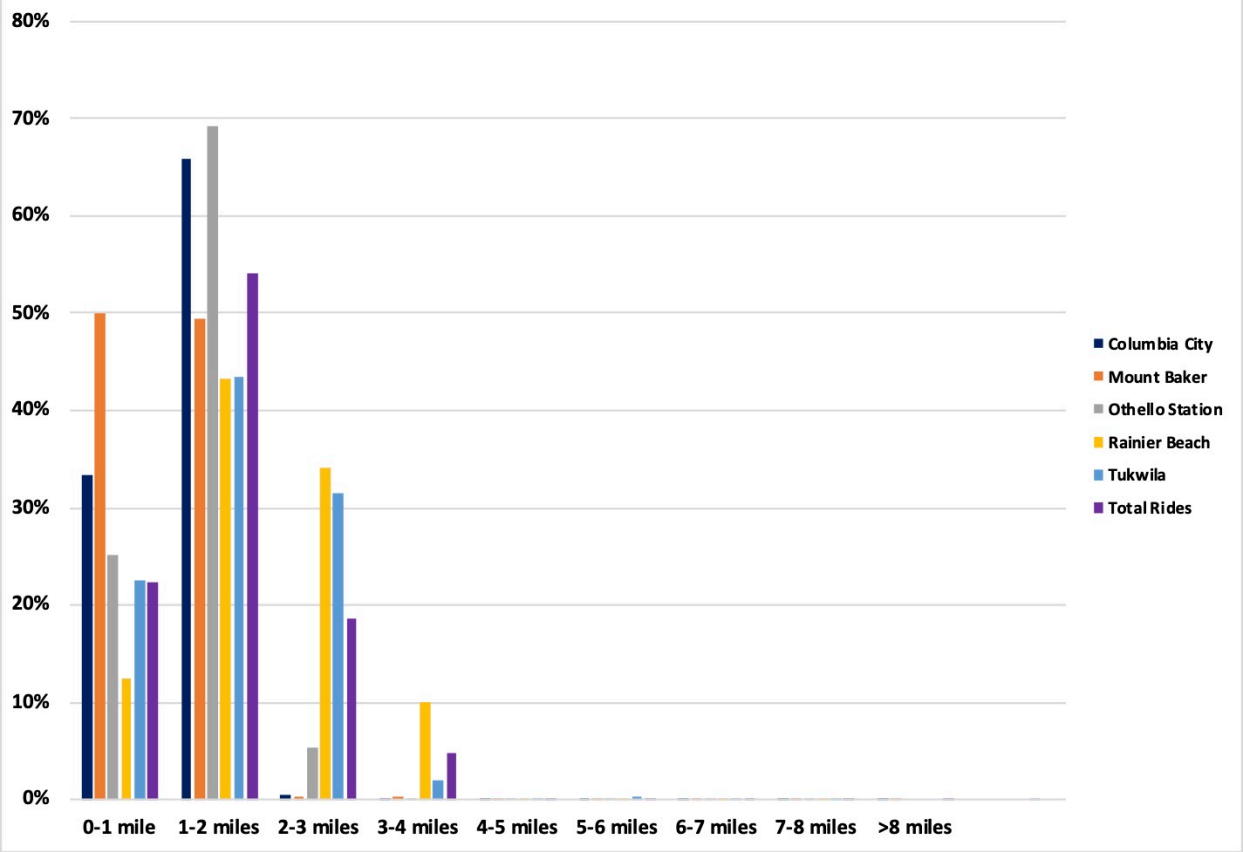
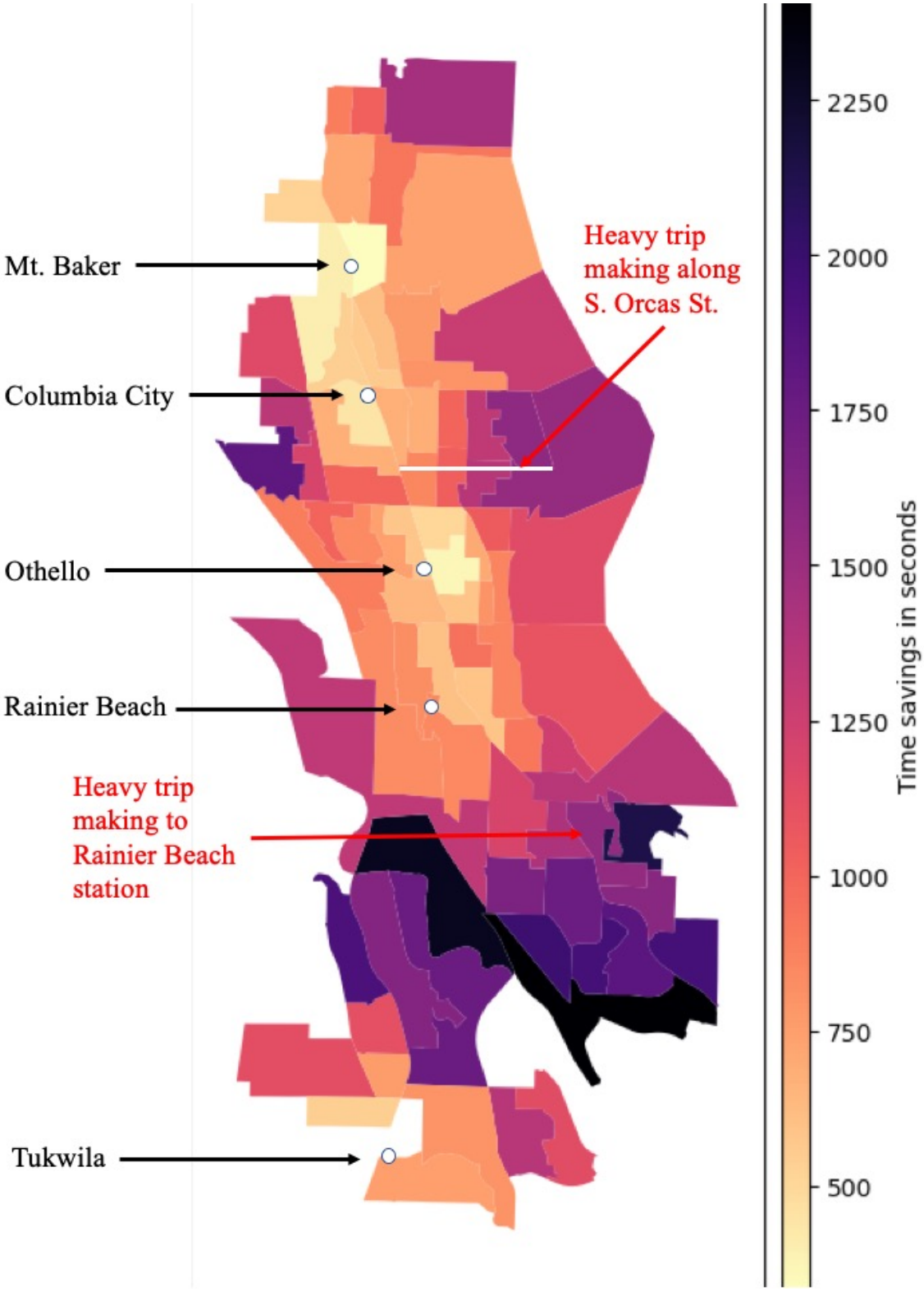


Figure 16 is a map that shows in which areas within the Via service areas users saved the most time by taking Via instead of walking or taking conventional bus service. The map illustrates the mean savings, in seconds, for all trips taken either to or from a census block group and a Link station. If Figure 16 is compared with Figure 5, it is apparent that block groups with the highest ridership (the southeast) had good average time savings, but the blocks with the highest time savings were not the highest ridership areas. This illustrates that factors in addition to time savings played a significant role in users' decision making.

Figure 16: Illustration of Mean Travel Time Savings by Location



4.10 Overall Use of Link Rail and Bus Transit

A total of 5,458 unique ORCA cards were observed in both the Via trip data set and one or both of the ORCA winter and summer data sets. The winter ORCA data set before the start of the Via project included 4,138 individuals who took Via at least once during the pilot test. Of those individuals, 430 (10.6 percent) were not observed to take a non-Via trip during the summer (July and August) of 2019. This group stopped using transit in the summer. For reference they will be called "Lost riders."

In the Via trip data were 5,028 unique ORCA cards also found in the summer ORCA data set. Of those, 1,329 (26.4 percent) were not observed in the winter data set. This group is considered to be "New riders" to bus, Link or other transit services. They constituted almost one-quarter of the Via riders observed in the ORCA bus and train usage data. This strongly suggests that the Via service either increased the number of transit customers, or at least converted cash paying customers into ORCA users. (4,023 unique ORCA cards that were observed in the Via trip data were observed in the winter 2020 ORCA data set. This was slightly lower than the number observed in the winter 2019 data set, which is surprising, given the large number of Via users.)

A total of 3,699 individuals were observed in both the summer and winter data sets. These are called "Continuing riders."[9]

With one pair of exceptions, no significant difference in the distribution of observed ORCA passenger types was observed among these three groups (Lost riders, New riders, Continuing riders). In all three groups, roughly 75 percent of the ORCA cards were standard "Adult" passenger types. Just under two percent were Disability ORCA cards, and just under five percent were Senior ORCA cards. Another 14 percent of rider IDs were Youth ORCA cards, and the remaining four percent were Low-Income (Lift) ORCA cards. The one paired exception was that New Riders had a higher percentage of Low-Income cards (7.5 percent) and consequently a slightly lower fraction of Youth cards (10.6 percent). This suggests that 1) to a limited extent, Low-Income riders were able to take advantage of the Via service, and 2) new Youth cards were likely not distributed to students in the Seattle school system until after August. Given the heavy use of Via by Youth riders, it is not considered likely that Youth were slow to try using Via services. The

[9] Nine additional ORCA cards were observed in the Via data set but made no successfully complete Via trips that were recorded in the Via data set. The users of these cards made reservations, but the trip was either cancelled or a seat was unavailable for that user.

growth in Low-Income users is a good social equity outcome for the Via program, although Low-Income users were still a very modest fraction of overall Via users.

Ideally, the before/after analysis of changes in bus ridership would compare ridership for time periods of similar conditions, often the same portion of the calendar year. Unfortunately, winter 2020 Link ridership was significantly affected by the Connect 2020 construction, which resulted in a substantial decrease in Link service levels and resulted in a 23 percent systemwide ridership drop on Link during January and February 2020. Then the COVID-19 pandemic started in March, resulting in even greater ridership reductions. Therefore, there were significant complications in comparing winter 2019 ridership with winter 2020 ridership within the study area. Consequently, the best available ridership comparisons required comparing the winter period before the Via pilot and the summer period during the Via pilot. This means that seasonal changes in ridership affected the before/after comparisons. Therefore, whenever possible, the analysis included in this report attempted to account for these seasonal and construction changes in ridership.

4.11 Link Ridership Changes

Table 23 shows the average number of weekday Link boardings paid for with ORCA for winter 2019, summer 2019, and winter 2020 at the five Link stations that were part of the pilot project. The table also shows the changes in ridership in both absolute and percentage terms. Snow days in 2019 and COVID days (all of March 2020) were removed from the data sets. Holidays (Martin Luther King Day, President's Day, and the July Fourth) were not removed from the data.

Table 23: Average Weekday Link Boarding Statistics

Station	Winter Pre-Via Test	Jan+ Feb 2020	Winter 2020 - Winter 2019	Percentage Winter 2019 - 2020 Change	Summer During Via Test	Change Summer - Winter 2019	Percentage Change Summer - Winter 2019
Mt. Baker	1854	1462	-392	-21%	1496	-357	-19%
Columbia City	2091	1778	-314	-15%	2196	105	5%
Othello	2112	1772	-340	-16%	2078	-35	-2%
Rainier Beach	1534	1381	-153	-10%	1552	19	1%
Tukwila	1966	1463	-503	-26%	1823	-143	-7%
Total	**9556**	**7856**	**-1701**	**-18%**	**9146**	**-411**	**-4%**

* Change computed as (Summer - Winter): Negative number means a loss in ridership

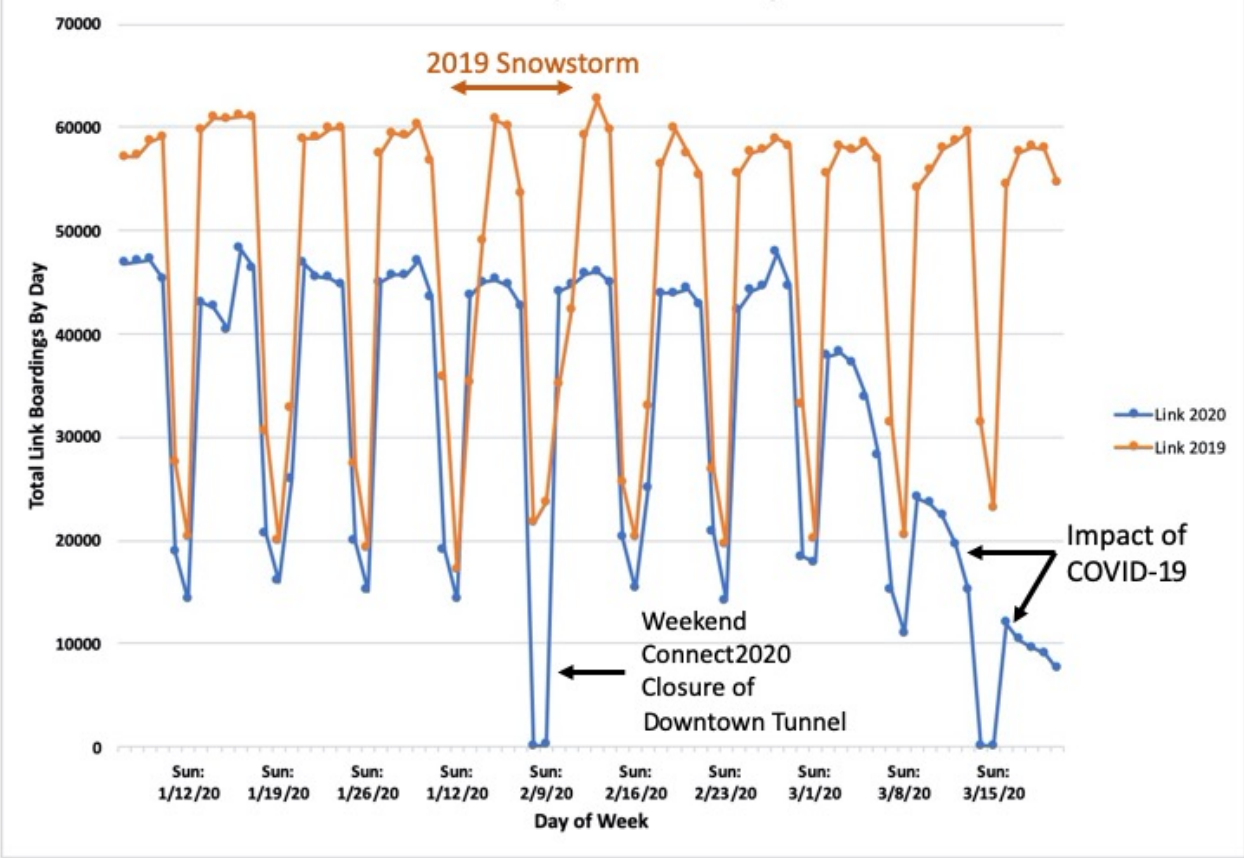
The winter 2019 data set contained 46 weekdays and two holidays. The summer data included 44 weekdays and one holiday. The winter 2020 data included 39 weekdays (two of which were holidays) and 15 weekend days. In addition to the pandemic, starting on January 6, 2020, Sound Transit started a major construction project called "Connect 2020," which appears to have significantly depressed Link ridership systemwide throughout the time for which data were collected for the winter 2020 data set.

There was a substantial reduction in Link boardings from the winter of 2019 to the winter of 2020. Much of this reduction can be attributed to a systemwide reduction in Link ridership caused by Connect 2020. Interestingly, the smallest reduction in Link boardings occurred at the Rainier Beach station, which also had, by far, the largest number of Via trips. This suggests that Via did cause an increase in Link ridership. Tukwila and Mt. Baker had the largest reductions in Link boardings and the lowest Via use. This strongly suggests that the high levels of Via use at Rainier Beach, and to a lesser extent Columbia City and Othello, limited what would have otherwise been larger reductions in Link use.

Figure 17 shows the daily systemwide Link boardings paid for with ORCA cards across all Link stations for the winter 2019 and winter 2020 data sets. In Figure 17, the days of the week for the two data sets are paired, e.g., Tuesday January 8, 2019, is paired with Tuesday January 7, 2020. In the figure the impact of COVID-19 on ridership in March is readily apparent. The impact of snow on Link ridership in

2019 is apparent, but not as obvious as the reduction in ridership due to the pandemic.

Figure 17: Comparison of Daily Systemwide Link Boardings with ORCA 2019 versus 2020



In a comparison of winter and summer 2019, three of the five Link stations participating in the study had lower average weekday Link ridership in the summer than they did during the winter. The other two stations (Columbia City and Rainier Beach) showed modest increases in ridership. The average ridership across all five stations dropped by 4.3 percent. A simple computation of total weekday ORCA trip making on Link across all Link stations (but not including the February snow days) showed that weekday Link ridership was down 2.3 percent from winter to summer. Consequently, the 4.3 percent decrease in Link ridership within the pilot study area was slightly larger than that found systemwide.

Importantly, the vast majority (96 percent) of the lost daily ridership was due to a decrease in the number of Youth ORCA cards used at these stations. Total weekday ridership across all five stations dropped by 411 ORCA boardings per day. Youth ridership dropped 393 boardings per day. The vast majority of this loss in Youth

riders occurred at Mt. Baker, near Franklin High School. With school out for the summer, it is not surprising that Youth ridership on Link decreased.

Table 24 shows average weekday ORCA ridership by passenger type for each of the five Link stations for winter and summer, 2019, along with the change in ridership. (No snow days were included in the average winter weekday computation.) The table shows that the vast majority (96 percent) of the lost daily ridership was due to a decrease in the number of Youth ORCA cards used at those stations, as discussed above.

Table 24: Average Weekday ORCA Link Boardings by Passenger Type (Winter / Summer / Change)

Station	Adult	Youth	Senior	Disabled	Low Income	Total
Mt. Baker	1105 / 1049 / -56	474 / 170 / -304	64 / 66 / 2	62 / 67 / 5	149 / 144 / -5	1854 / 1496 / -357
Columbia City	1705/ 1816 / 111	158 / 139 / -18	63 / 67 / 4	42 / 42 / 0	124 / 132 / 8	2091 / 2196 / 105
Othello	1543 / 1537 / -7	242 / 213 / -29	61 / 63 / 2	68 / 75/ 7	198 / 191 / -8	2112 / 2078 / -35
Rainier Beach	1147 / 1196 / 49	198 / 166 / -32	28 / 28 / 0	38 / 39/ 1	122 / 123 / 1	1534 / 1552 / 18
Tukwila	1541 / 1443 / -99	107 / 98 / -9	65 / 63 / -2	77 / 71 / -6	176 / 149 / -26	1966 / 1823 / -143
Total Riders/Day	**7042 / 7041 /-1**	**1178 / 786 /-393**	**281 / 288 / 6**	**286 / 293 / 7**	**769 / 738 / -30**	**9556 / 9146 / -411**

* Change Computed as (Summer - Winter): A negative number means a loss in ridership from winter to summer

Table 25 describes the changes in Link boardings for weekends and compares those changes to changes in average daily (weekdays and weekend) volumes. It can be seen that on weekends, total Link boardings increased in the summer at all five pilot area stations in comparison to winter weekend boarding volumes. However, the growth in weekend use was not sufficient to cause average daily Link boardings to grow in the summer at the three stations where weekday boardings declined from winter to summer.

Table 25: Changes in Weekend and Average Daily ORCA Link Boardings

	Winter Weekend Riders/Day	Summer Weekend Riders/Day	Change* in Average Daily Weekend Boardings	Change* in Average Daily Boardings	Percentage Change* in Weekend Boardings	Percentage Change* in Average Daily Boardings
Mt. Baker	741	795	54	-259	7.3%	-16.5%
Columbia City	1022	1185	164	107	16.0%	5.9%
Othello	1059	1130	71	-19	6.7%	-1.0%
Rainier Beach	593	685	93	27	15.7%	2.1%
Tukwila	989	1004	15	-112	1.5%	-6.5%
Total Riders / Day	**4403**	**4798**	**396**	**-255**	**9.0%**	**-3.1%**

* Change computed as (Summer - Winter): Negative number means a loss in ridership

An examination of only Link boardings by Via users (Table 26) showed that average daily Link ridership increased slightly in the summer mostly because of an increase in weekend use, that is, roughly 36 trips per day, spread across all five stations. Conversely, winter 2020 showed a decrease in ridership, although this decrease only occurred in the Adult and Youth rider categories. Low-Income and Disabled Via users increased their Link boardings in the Via service area, despite the Connect 2020 declines in systemwide Link use. Senior Link use remained essentially unchanged.

Table 26 demonstrates that individuals who had used Via at some point during the pilot increased their use of Link at the five pilot Link stations from winter to summer. Conversely, the total population of ORCA users decreased their use of Link from the winter to the summer. However, by winter 2020, the two largest groups of Link users (Adults and Youth) had both decreased their use of Link. The evaluation team believes this is primarily due to the degradation of Link service during the Connect 2020 construction project, when peak hour headway increased from 7 minutes to 14 minutes.

Table 26: Changes in Average Daily ORCA Link Boardings by Users of Via

	Total (non-COVID) Winter 2020 Link Boardings (54 days)	Total Summer Link Boardings (62 days)	Total (No Snow) Winter Link Boardings (65 days)	Average Daily Winter 2020 Link Boardings	Average Daily Summer Link Boardings	Average Daily Winter 2019 Link Boardings	Change in Daily Boardings (Winter 2020 – Winter 2019	Change in Daily Boardings (Summer – Winter)	Winter 2020-Winter 2019 Percentage Change)	Summer-Winter 2019 Percentage Change*
Adult	28,037	35,730	35,573	519	576	547	-28	29	-5%	5%
Disabled	632	723	636	12	12	10	2	2	19%	19%
Low Income	1,732	1,886	1,612	32	30	25	7	6	29%	23%
Senior	730	822	846	14	13	13	0	0	4%	2%
Youth	4,788	6,003	6,339	89	97	98	-9	-1	-9%	-1%
Grand Total	**35,919**	**45,164**	**45,006**	665	**729**	**692**	**-27**	**36**	**-4%**	**5%**

* Change computed as (Summer - Winter): Negative number means a loss in ridership

Not surprisingly, not all Via users' behavior followed the basic pattern shown in Table 26. In general, the more an individual used Via, the more likely they were to increase transit use from winter to summer. Table 27 compares the frequency of Via use in the July-August time period with a user's change in Link use between the winter and summer time periods. In this table, Via users are categorized on the basis of the number of completed Via trips they reserved in July and August. In addition, data in this table are included only from Via users who appeared in BOTH the winter and summer ORCA data sets. This removed from the analysis individuals who did not previously live or work in the Via service area before the Via service began. It also removed from the analysis riders who did live in the area but previously did not ride Link, or who did not own an ORCA card. The table's Via rider categories are mutually exclusive. The categories include 1) not taking a Via trip in July or August (meaning they used Via during some other month), 2) taking one Via trip in July or August, 3) taking fewer than four Via trips (but more than one), 4) taking fewer than ten trips, 5) taking fewer than 22 trips, 6) taking fewer than 44 trips, or 7) taking more than 44 trips. (Note: 44 trips represents taking an average of just less than one Via trip per weekday, while ten trips is roughly equivalent to taking one Via trip per week.)

Table 27: Frequency of July-August Via Use versus Changes in Link Boardings

Frequency of Via Use in July and August	Number of Winter Link Boardings At Pilot Stations	Number of Individuals in Via Category in Winter	Trips / Person Winter	Number of Summer Link Boardings At Pilot Stations	Number of Individuals in Via Category in Summer	Trips / Person Summer	Change* in Link Boardings
No Via Rides	14,076	1,026	13.7	11,879	1,057	11.2	-2,197
One Via Ride	5,564	462	12.0	5,228	521	10.0	-336
1 < Via rides < 4	5,595	405	13.8	5,182	452	11.5	-413
3 < Via rides < 10	6,476	412	15.7	6,564	469	14.0	88
9 < Via rides < 22	5,182	285	18.2	5,828	330	17.7	646
21 < Via rides < 44	4,718	219	21.5	5,800	258	22.5	1,082
43 < Via rides	3,395	139	24.4	4,683	148	31.6	1,288
No Link Trips (only bus trips)		760	0.0		464	0.0	
Total	**45,006**	**3,699**	12.2	**45,164**	**3,699**	12.2	**158**

* Change computed as (Summer - Winter): Negative number means a loss in ridership

Table 27 shows that individuals who used Via frequently in July and August made more Link trips in the summer than they did in the winter. The more Via trips individuals took, the greater their increase in Link trips from winter to summer. Conversely, individuals who did not take Via showed the largest decrease in Link trip making, a reduction of 2.5 Link trips per person from winter to summer. The more Via trips taken by a user, the smaller the reduction in Link trip making. Individuals who took fewer than 22 Via trips typically had fewer Link trips in the summer than the winter. Individuals who took more than 21 Via rides showed an average of one extra Link trip, and an average of seven additional Link trips in the summer occurred when they took more than 43 Via rides.

Finally, 464 individuals out of 3,700 Via summer users (12.5 percent) did not take a Link trip but used only buses. Comparatively, 760 Via riders used only buses during the winter (20.5 percent).

The following is a summary of the above findings about the relationship between Link use and Via use.

- Over one quarter of Via users observed in the summer were not observed in the winter. This suggests that Via increased the number of unique Link users by over 900 individuals.
- Despite the increase in the number of unique users of Link, overall seasonal trends caused a decline in Link use from winter to summer.
- Individuals who used Via had a smaller average decrease in Link use from winter to summer than Via users who did not use Link, indicating that Via encouraged Link use, but to a modest extent.
- Heavy users of Via typically demonstrated a fairly substantial increase in Link use (just under one extra trip per week) during the summer in comparison to their winter behavior.

4.12 Bus Ridership Changes

One of the major concerns about adding Via service was that Via might simply reduce the use of existing conventional transit in the area, as bus riders switched from using buses to using Via. Responses to the Via Rider Survey suggested that around one quarter of Via users previously took buses to access or leave Link stations.

For the following discussions, bus ridership to and from the Tukwila station were not included in the ridership analysis because of data collection errors in the summer that were caused by a major construction project at the Tukwila Link station. The construction project required a temporary relocation of the Tukwila station bus stops. This in turn caused errors in the location assignment for bus boardings for both conventional and bus rapid transit (BRT) buses serving the station.

Table 28 shows the average weekday winter and summer bus boardings at bus stops next to the four Seattle area Link stations that were the focus of the Seattle portion of the Via pilot study. As with the Link analysis, data for the winter 2019 snowstorm were removed and holidays were retained in all weekday data analyses. winter 2020 is not included in this table because Link ridership was significantly

affected by the Connect 2020 construction event, and therefore, bus ridership to the Link stations in winter 2020 did not provide a useful comparison with earlier bus ridership to determine the impact of the Via service.

The transit stops included in Table 28 are those that riders exiting a Link train would use when transferring to a bus to continue their journey.

Table 28: Changes in Average Daily ORCA Link Boardings in Via Service Area by Users of Via

Station	Average Weekday Winter 2019 Bus Boardings	Average Weekday Summer 2019 Bus Boardings	Change in Average Weekday Bus Boardings	Percentage Change* in Average Weekday Bus Boardings
Mt. Baker	1304	911	-393	-30%
Columbia City	199	160	-39	-19%
Othello	564	453	-111	-20%
Rainier Beach	474	367	-107	-23%
Total	2541	1891	-650	-26%

* Change computed as (Summer - Winter): Negative number means a loss in ridership

Table 28 shows that weekday bus boardings declined between 20 and 30 percent from winter to summer at transit stops that would be used by individuals transferring from Link to bus. Table 29 describes how the changes shown in Table 28 were distributed by passenger type. Table 30 shows these changes in percentage terms.

Table 29: Change* in Average Weekday ORCA Bus Boardings at Link Stations by Passenger Type

Station	Adult	Youth	Senior	Disabled	Low-Income	Total
Mt. Baker	-170	-189	-5.5	-14.4	-14.5	-393
Columbia City	-7	-31	-0.6	0.0	-0.1	-38
Othello	-36	-55	-6.9	-1.7	-11.0	-111
Rainier Beach	-55	-48	-0.2	0.5	-4.4	-107
Total	**-268**	**-323**	**-13.2**	**-15.7**	**-29.9**	**-650**

* Change computed as (Summer - Winter): Negative number means a loss in ridership

Table 30: Percentage Change* in Average Weekday ORCA Bus Boardings at Link Stations

Station	Adult	Youth	Senior	Disabled	Low-Income	Total
Mt. Baker	-25%	-58%	-8%	-14%	-11%	-30%
Columbia City	-7%	-56%	-4%	0%	0%	-19%
Othello	-14%	-37%	-17%	-4%	-16%	-20%
Rainier Beach	-19%	-50%	-2%	2%	-9%	-23%
Total	**-20%**	**-52%**	**-10%**	**-9%**	**-11%**	**-26%**

Use of ORCA data also allowed analysis of transfer activity, as the ORCA system tracks consecutive boarding movements in order to provide riders with discounted transfers. Transfer activity from Link to bus at these bus stops dropped by 23 percent from winter 2019 to summer 2019. That is slightly lower than the observed change in total bus boarding activity. On an average weekday in the winter of 2019, 1,286 transfers occurred from Link to buses at these stops. In the summer, only 987 transfers occurred on an average weekday. This resulted in a loss of 300 bus boardings each weekday at these transit stops. This reduction in transfer activity was equivalent to just under half of the total bus ridership loss occurring in the summer at those bus stops.

Importantly, 130 (43 percent) of the 300 "missing" transfers were Youth ORCA cards. Youth transfer activity from Link to bus at these four Link stations dropped 50 percent from winter to summer, from 257 to 129 transfers per weekday. Youth

made up 20 percent of all transfer activity to buses at the Seattle Link station bus stops in the winter but dropped to only 13 percent of that activity in the summer. In the winter, Youth ORCA cards made up 10.1 percent of all boardings (transfer and non-transfer) at these Link stations. In the summer, they dropped to 6.3 percent.

Total weekday bus boarding activity at the stops that did NOT include a transfer (meaning riders boarding at these stops were coming from local residences or activities) declined by 19 percent from winter to summer. Youth boardings on weekdays at those bus stops that did not involve a transfer dropped by 55 percent.

In total, the loss of Youth ridership accounted for 50 percent of the reduction in bus boardings at the Seattle Link station bus stops in the summer, and about 40 percent of that reduction in Youth activity was due to a loss in transfer activity from Link.

The conclusion is that the reduction in Youth ridership due to summer school closure, and the significant use of the transit system by Youth as a means to get to, and leave from, Franklin High School, played a large role in the reduction of observed bus boarding activity at the stations. However, with or without consideration of the reduction in transit use caused by summer school closure, the reduction in weekday transit use at the four Seattle Link stations ranged between 330 boardings per day (not counting Youth) and 650 boardings per day (including Youth).

To examine the potential impact of Via on bus ridership, the next step was to examine Via ridership during the summer. Table 31 shows the average weekday Via ridership in both directions, to and from the Link stations. (Note that the bus transit boardings discussed above were all trips leaving the station and thus represent only half of the movements shown in Table 31, which include both coming to and going from the stations.) Approximately 400 riders used Via to leave the four Seattle Link station areas each weekday in the summer (half of the 800, non-Tukwila Via users shown in Table 31). This number can be compared with the 300-transfer reduction from Link to buses that occurred at these stations. If all of the reductions in transfer activity were caused by a shift to Via, then the 300 transfers would represent 75 percent of the total Via ridership. Removing the 130 Youth transfers that did not occur because school was out would mean that the 170 remaining "lost" transfers were 42.5 percent of all Via trips. This estimate is larger than the 100-transfer (roughly 25 percent) estimate that the Via Rider Survey indicated should occur, given the fraction of Via users who reported riding buses before using Via. This suggests that either other factors (e.g., seasonal changes in

ridership) drove down transfer activity, or that the Via Rider Survey under-estimated the replacement of bus use by Via users.

Table 31: Average Weekday Via Ridership in July and August by Link Station

	Adult	Disabled	Low Income	Senior	Youth	Passenger Type Not Available*	Total of All Via Users	Total ORCA Users	Grand Total Without Youth or N.A.
Mount Baker	42.1	2.5	5.0	2.0	13.6	8.8	73.9	72.6	51.6
Columbia City	102.9	1.4	6.7	3.0	21.8	19.5	155.4	150.8	114.0
Othello Station	112.3	3.3	10.7	2.3	47.1	27.6	203.3	196.7	128.6
Rainier Beach	250.7	4.3	17.9	3.7	60.9	57.7	395.3	386.8	276.7
Tukwila	29.6	2.3	0.4	1.4	2.8	6.4	43.0	41.3	33.7
Grand Total	537.6	13.8	40.8	12.4	146.2	120.0	870.8	848.0	604.6

* Passenger Type Not Available includes both individuals that pay with a method other than ORCA, and ORCA cards that have not been observed in the Winter or Summer ORCA transit data sets, and as a result, the project team does not have data on the passenger type associated with that ORCA card.

Table 32 shows the changes in ridership for the routes that served the four Seattle Link stations participating in the pilot project. Average weekday ORCA ridership is shown for each of those routes for both the winter 2019 and summer 2019 periods. The change in average weekday ridership from winter to summer is also shown. To provide a control data set for insight into the broader effects of seasonal behavior and changing economic and travel behavior between the winter and summer periods, the total numbers of boardings for all King County Metro Routes numbered 1 through 373 are also shown in Table 32. This table includes all boardings. It does not differentiate between boardings that were the first boarding of a trip and those that were transfers from another route or transit service.

Table 32: Change* in ORCA Boardings by Route for the Entire Route

Bus Route	Average Weekday Winter** Boardings	Average Weekday Summer Boardings	Change in Average Weekday Boardings	Percentage Change
7	5494	5207	-287	-5%
8	6614	6519	-96	-1%
9	669	550	-119	-18%
14	1904	1706	-197	-10%
36	5613	5331	-282	-5%
48	4266	2969	-1297	-30%
50	1723	1689	-35	-2%
106	2938	2783	-155	-5%
107	1814	1392	-422	-23%
124	2215	2287	73	3%
128	1668	1371	-298	-18%
Total Via Impacted Routes	34,917	31,802	-3,115	-9%
Control: Total all KCM Routes 1 to 373	**244,098**	**217,894**	**-26,204**	**-11%**

* Change computed as (Summer - Winter): Negative number means a loss in ridership
** The February snow days are not included in the computation of average weekday winter bus boardings.

Table 32 shows that the changes in average weekday bus ridership experienced on the routes that served the four Seattle transit stations in this pilot project were similar in size and pattern to the changes experienced systemwide within King County. That is, the reduction in ridership measured on the routes serving the four Link stations in Seattle (nine percent) was similar to the reduction in ridership experienced systemwide within King County (11 percent). Because Via was not serving the rest of King County, it can be concluded that much of the decline in bus ridership at the four Link stations in the Via pilot can be attributed to seasonal change in ridership, not the effects of the Via service. While Via contributed to some loss of bus ridership by removing some transfers from Link, those changes were likely modest relative to ridership on the complete route.

The overall conclusion from this analysis of bus ridership patterns is that the Via service did attract current bus riders to Via. As a result, transfers between buses

and Link did decline. That shift appears to have been on the order suggested by the Via Rider Survey (~25 percent of Via riders), but that reduction in ridership does not appear to have resulted in a significant loss of bus ridership on the routes serving the Link stations.

4.13 Changes in the Transit Trip Making Behavior of Via Users

Another way to examine the impact of Via on transit use is to examine the changes in transit use by Via users. The basic question being answered is whether access to Via caused users of Via to use conventional transit service more or less often. To help answer that question, the following analyses compared the amount of transit trip making behavior observed in the winter and summer ORCA data sets for those 3,699 individuals that both 1) used Via at least once, and 2) were observed in both the winter and summer ORCA data sets. To simplify changes in trip making, individuals were classified into a number of categories that described where they increased or decreased their transit trip making, and whether those changes were large or small. The categories used in most cases were as follows;

(1) no change
(2) increasing or decreasing by one to four trips over the entire two-month July through August period in comparison to the winter period of January 7 through March 23, but without snow days
(3) increasing or decreasing by five or more but fewer than ten trips
(4) increasing or decreasing by ten or more but fewer than 22 trips
(5) increasing or decreasing by 22 or more but fewer than 44 trips
(6) increasing or decreasing by 44 or more trips.

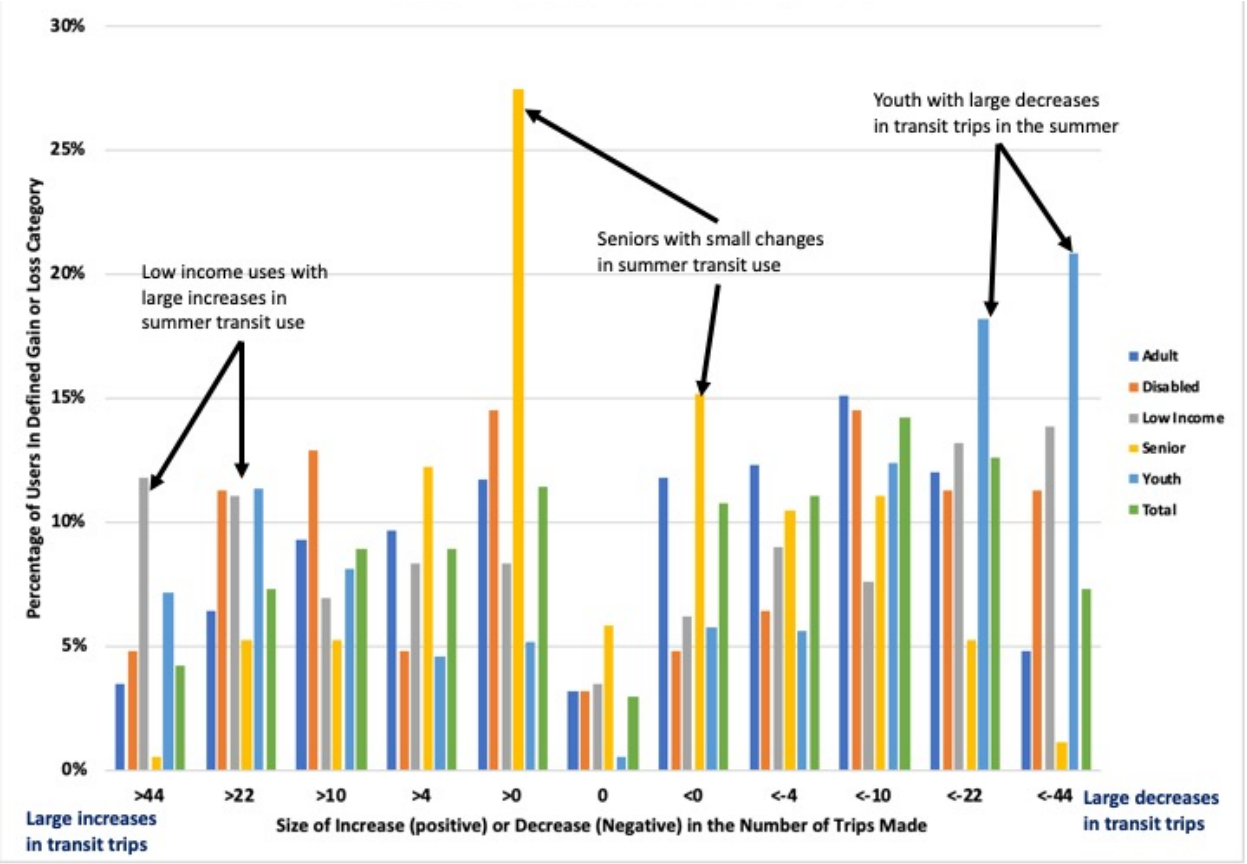
Note that for this analysis, because total travel activity was being compared, no attempt was made to modify the data to account for the fact that the winter data set had 65 days of trips (46 weekdays, two holidays, and 17 weekends), while the summer data set contained 62 days of trips (44 weekdays, one holiday, and 17 weekends). Therefore, all things being equal, there should have been a slight bias toward slightly lower trip making in the summer, simply because there were slightly fewer days on which trips could be made.

The data showed that slightly more Via users decreased their transit trip making[10] than increased their transit trip making in a comparison of winter and summer travel. Figure 18 shows the distribution of changes in trip making behavior between

[10] For this analysis, a "transit trip" counted only the first boarding of a linked trip. Transfer boardings were not counted as "trips," as they represented a second boarding of a trip, not a separate trip.

winter and summer, by passenger type. While there were definite differences in behavior by passenger type, all five passenger types exhibited the same patterns: modestly more users decreased their trip making than the number of users who increased their trip making.

Figure 18: Changes[11] in Total ORCA Trip Making from Winter to Summer



Not surprisingly, because of the loss of school trips in the summer, Youths comprised the largest percentage of individuals with a decrease of more than ten trips (51 percent). Interestingly, 27 percent of Youths showed an increase in travel in the summer. Seniors comprised the smallest percentage of individuals with a decrease in trip making of more than ten trips (18 percent). Seniors also comprised the smallest percentage of individuals who increased their travel by ten or more trips (11 percent).

[11] Categories were 0 = no change, "<0" = decreasing by one to four trips,"<-4" = decreasing by five or more but less than ten trips, "<-10" = decreasing by ten or more but fewer than 22 trips, "<-22" decreasing by 22 or more but fewer than 44 trips, "decreasing by 44 or more trips. The same categories applied for the "increasing" side of the figure.

Adult cards made up 75 percent of users, and 32 percent of Adults decreased their trip making in the summer by more than ten trips, whereas 19 percent increased their travel by more than ten trips.

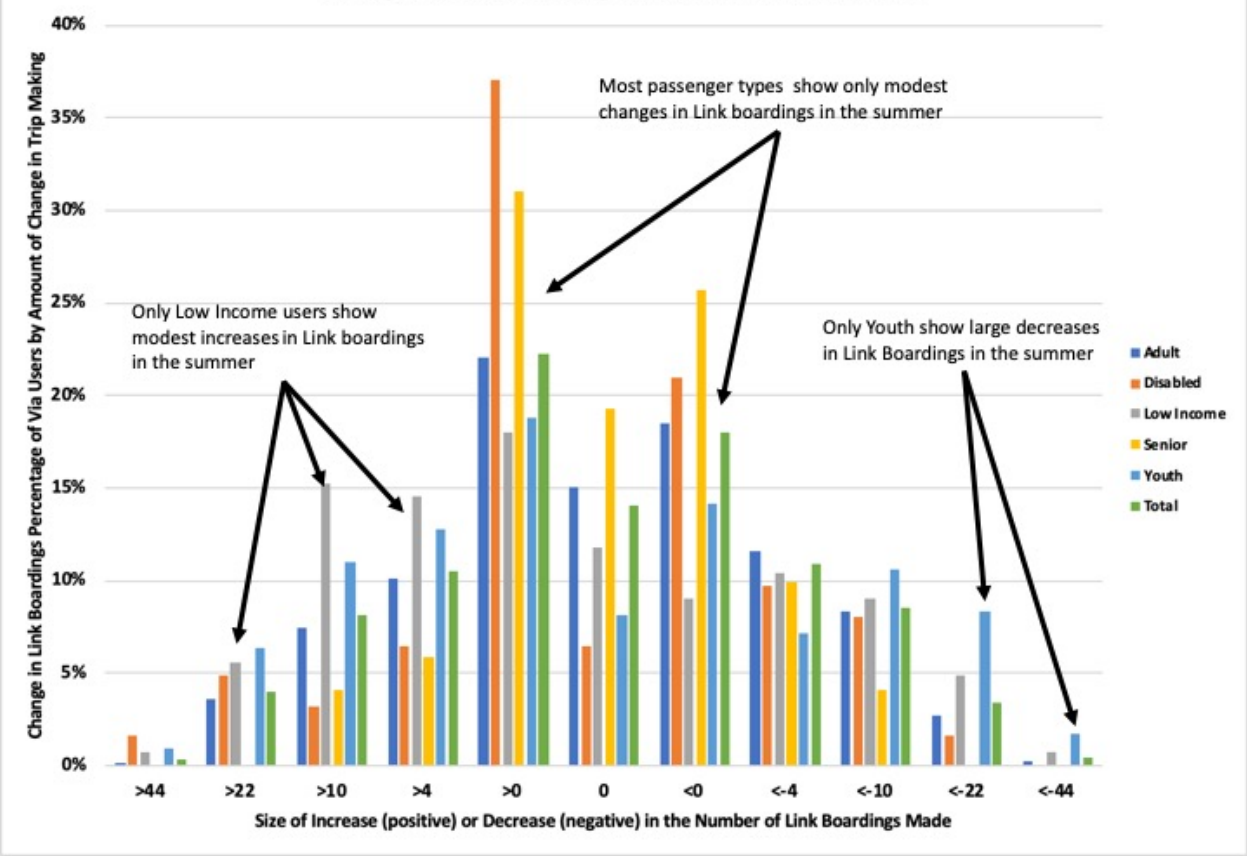
Low-Income users comprised the highest percentage of substantially increased transit trip making (over 12 percent of low-income card users showed an increase of greater than 44 trips from winter to summer). However, a substantial (27 percent) fraction of low-income users decreased their transit trip making by more than 22 trips in the summer.

4.14 Link Boardings in the Service Area

Figure 19 shows a different view of Via user behavior. Instead of "total trips," this graph is based on a performance metric of Link boardings at the five stations in the pilot service areas. In this figure, unlike the total trips shown in Figure 18, the distribution of changes is more "normal" in shape, with many Via users showing fairly modest changes in the number of Link trips they made at the pilot Link stations between the winter and summer periods, and only a few users showing major changes in travel behavior. The fraction of all users who increased their Link use in the Via service areas was almost equal to the fraction who decreased their use of these Link stations. In fact, the fraction of all Via users who increased Link use by more than ten trips (12.4 percent) was equal to the fraction of Via users who decreased Link boardings by more than ten trips at those stations (12.4 percent).

When examined by passenger type, Low-Income card users were more likely to show a significant increase in Link use within the pilot area than a decrease (22 percent versus 15 percent), whereas Youth card users were more likely to show a significant decrease in Link use (18 percent increasing, 21 percent decreasing). The other passenger types showed equal distributions.

Figure 19. Change in Total ORCA Trip Making from Winter to Summer



4.15 Transfer to Link from Bus Within the Service Area

Another question of interest in the evaluation was what would happen to the use of bus service as the means to access Link. The answer is that there was a decrease in the use of bus transit to access the Link stations that were part of the pilot project. The following statistics are based only on ORCA cards that were associated with at least one Via trip.

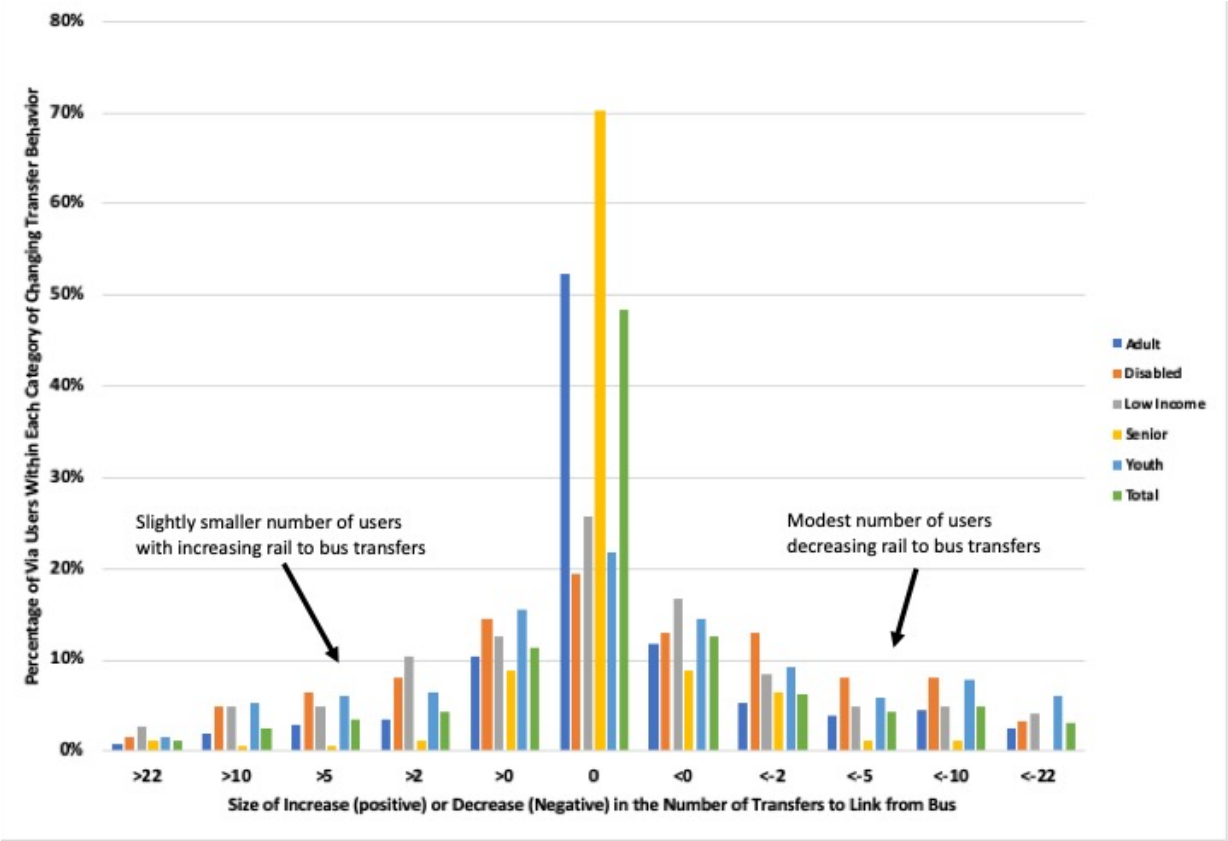
In the summer, 8,955 transfers from bus to rail occurred, made by 1,467 users, while 55,749 Link boardings occurred at the five pilot area Link stations, made by 4,293 unique users. After Via service began (and summer travel patterns prevailed), 34 percent of the Link riders at the five study locations transferred from bus to rail at least once during the ten-week summer period, while those transfers made up only 16 percent of Link boardings in the study area.

In the (non-snow day) winter period, 1,427 unique riders made 11,969 bus to Link transfers. During that same period, 49,149 Link boardings occurred at the five pilot stations, made by 3,261 unique users. People who transferred from bus to Link at least once made up 43 percent of the user base but 24 percent of the Link boardings

in the winter. Both of these values were larger than those found in the summer. (That is, more transfers from bus to Link were made, and a higher percentage of users made transfers from bus to Link, during the winter than in the summer). Therefore, it can be concluded that after Via service was implemented, there was a modest drop in the number and percentage of individuals arriving at the Link station via bus.

Figure 20 shows the degree to which individual user behavior changed. A total of 290 users decreased their transfer activity (going to Link from bus) by more than ten trips; 130 individuals increased their transfer activity by ten or more trips.

Figure 20: Changes in Transfer Activity from Bus to Rail at the Pilot Link Stations



5. Conclusions

The Via to Transit service ridership grew steadily for five months and then leveled off. By the end of February, before the impacts of the COVID-19 pandemic, Via carried over 950 riders each weekday. This is a substantial level of ridership, representing just under 5 percent of all Link users in the pilot service area. While the greatest use of Via occurred during the peak commute periods, Via was frequently used during all times of the day, although late night use (after midnight) was marginal.

It is unclear whether the Via service actually produced an increase in Link use. Daily ridership on Link and bus in the pilot service areas declined modestly from winter 2019 to summer 2020, but much of the observed difference in Link travel can be attributed to school being out of session and to other seasonal effects. The Link station with the highest Via ridership actually saw an increase in Link ridership during the summer, despite a decrease in student riders.

Similarly, the impacts of the Connect 2020 construction project disrupted this study's ability to attribute measured changes in Link use to the Via pilot. During Connect 2020, peak period Link service frequency decreased from a train every seven minutes to a train every 12 to 14 minutes. This caused a 23 percent systemwide decrease in Link ridership. However, the two highest performing Link stations in the Via pilot area saw only ten percent (Rainier Beach) and 16 percent (Othello) Link ridership decreases during Connect 2020. This suggests that the Via service at least partially countered the negative impacts of the Connect 2020 service disruption.

The availability of Via service had mixed impacts on individual Link use. It is true that Via was directly associated with a large increase in the number of ORCA cards observed. In the summer, over 1,300 "new" ORCA cards were observed in both the Via and Link data that had not been observed in the winter of 2019. This strongly suggests that the Via service either increased the number of transit customers or at least converted cash paying customers into ORCA users. However, there is no definitive proof that these new ORCA users became ORCA users only as a result of the Via service. What is apparent is that individuals who used Via frequently were more likely to increase their use of Link than either individuals who did not use Via or used it only rarely.

Over 50 percent of Link riders stated that they previously walked (or used a wheelchair) to reach or leave the Link station. However, only about 25 percent of Via users reported previously walking to or from the station, indicating that Via

users likely came from farther away from the Link station than the exiting population of Link users.

Roughly ten percent of Via users had not previously used the Link station at which surveys were taken.

One-quarter of Via users reported previously using transit to access and egress Link stations.

The shift of these individuals to Via appeared to result in a decrease in bus use at the transit stops nearest the Link stations, as well as a decrease in transfer activity at those stops. Despite these reductions in bus use, King County Metro transit routes serving the four Seattle Link stations did not show ridership changes that were significantly different than changes at routes not served by the Via pilot service.

While the pilot project included a number of features intended to increase access to transit to groups with disadvantages, the Via service did not appreciably increase use of Link by those communities. Low-income riders (ORCA Lift card users) took about seven percent of Via trips. This was a lower use rate than that observed for bus service in the pilot study area (10.5 percent), but it was higher than Link ridership as a whole (5.6 percent) and close to the rate at which low-income users boarded Link at the five stations in the pilot study (8.8 percent).

One group that did use Via extensively was the ORCA Youth card population. This group took roughly 20 percent of all Via trips. Youth trips made up about 17 percent of all conventional transit trips in the Via service area during months when school was in session but only 11 percent in the summer. Unfortunately, few Via users of Youth age responded to the Via Rider Survey, so little is known about this group of Via users. Of those youth who did respond to the survey, 11 percent indicated that they came from families that would qualify for a low-income ORCA card. This compares to roughly seven percent of the adult rider population. If these young riders were included in the "Low-Income" category instead of the "Youth" category, the fraction of low-income riders being served by Via would increase to roughly the same rate as current Link use within the pilot study area.

The general conclusion is that Via service was accessible to the lower income population, but that the low-income population generally did not increase its transit usage as a result of the Via pilot.

In terms of ethnicity, the two surveys conducted for this project suggested that the Via service was used less frequently by individuals of color than by individuals who

self-identified as white. Both surveys also indicated that in comparison to the Census' estimates of residential population by ethnicity, people of color used Via less frequently than did individuals who identified as white. White individuals made up 47 percent of Intercept Survey respondents and 58 percent of the Via Rider Survey respondents, but were only 32 percent of the population in the combined population of the five service areas.

The ultimate conclusion is that the Via service was generally well used and was used by a wide range of individuals of different income levels and ethnicities, but that the service did not succeed in increasing the use of transit by people of color or the low-income population.

Appendix: Modeling Use of Via

To provide insight into the factors that encourage or discourage use of Via to Transit ridership, and to potentially provide the transit agencies with a tool that could predict Via ridership for future deployments, the evaluation team built and tested a number of mathematical models designed to predict daily Via to Transit use. The models were built at the census block group geographic level. Three different possible model formulations were tested:

- Multi-variate, Poisson regression,
- Gradient boosting machine learning (xgboost), and
- Neural network.

Model Data

All three models were built to use daily trip records. Each analysis record included statistics that described the number of Via trips made to or from individual census block groups. For each day between July 1, 2019, and February 29, 2020, the number of trips taken from each census block group was computed, as were the mean service characteristics for those trips on that day (e.g., mean travel time, mean time savings over alternative trip modes). An analysis record existed for each day for each census block group in the study area. Travel from April 16 through June 30, 2019 was not included in the model development since Via use was still ramping up during that period.

The summary travel statistics input in the model development process included the following:

- Link station from which the Via trip departed, or to which the trip was bound
- Mean travel time for all trips to/from a census block group for that day (minutes)
- Mean time savings for all trips to/from a census block group for that day (seconds)
- Mean wait time (minutes)
- Mean absolute difference between estimated wait time provided to the rider when the reservation is made and the actual wait time experienced for that trip (minutes)
- Mean speed for the trip (mph)
- Mean travel distance (miles)

- Number of Via vehicle trips made on each day
- Mean number of Via passengers per vehicle trip.

To compute the time savings for each trip, the following process was used:

- Estimate the transit travel times from the Via trip's pick-up point to the trip's drop-off point by using Google Maps'™ trip planning software at the time and day for that trip.
- Estimate the walking travel times from the Via trip's pick-up point to the trip's drop-off point by using Google Maps'™ trip planning software.
- Select the faster of those two travel times.
- Compute the time savings for that trip by subtracting the actual Via travel time from the fastest of the transit and walking alternative trips.

As a result of this process, both the mean travel time and the mean travel time savings varied on a daily basis for all census block groups. For each daily analysis record, the day of the week was also recorded.

These daily travel statistics were then combined in the model's analysis record with the demographic characteristics of the individual block groups. The American Community Survey five-year summary statistics for 2018 were used to provide the census demographics.

The census block group variables tested for use in the model included the following:

- Total population
- Median family income
- Number of households with zero cars
- Percentage of male versus female
- Percentages of the population in the block group that were white, Black, Latino, Asian, or non-white[12]
- Percentage of the population above/below 200 percent of the federal poverty line
- Population by age gender and age group (5-17, 18-34, 35-49, 50-59, 55+, 60+.

[12] These were not meant to be mutually exclusive but were tested as different inputs to the models being developed and tested.

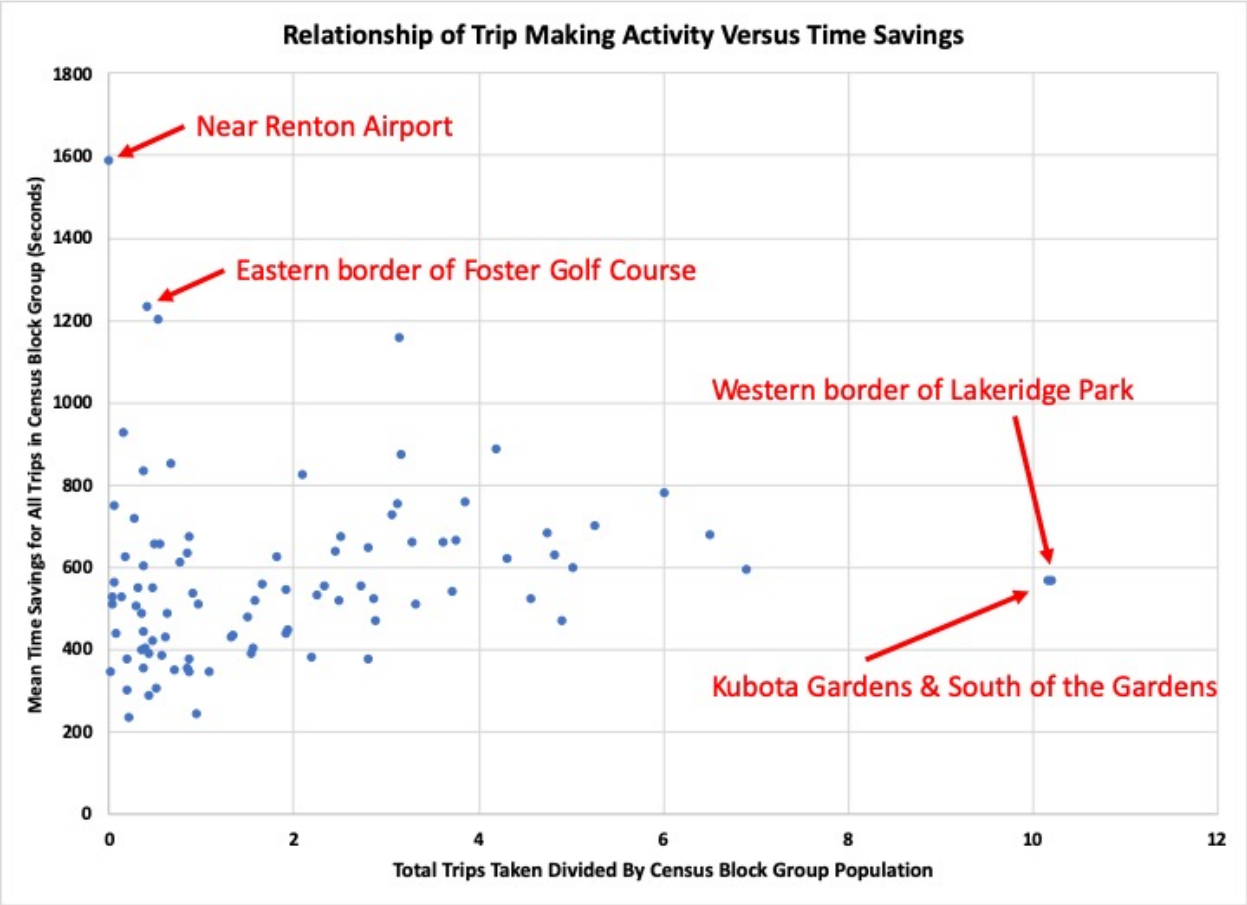
Several census block groups were removed from the model development and testing. The list of removed block groups is shown at the end of this appendix. A census block group was removed from the analysis if it did not experience at least 200 trips between July 2019 and February 2020. This removed 1208 trips from the subsequent analysis. A total of 185,967 trips and 81 block groups remained in the analysis after this rule was applied. Three additional block groups were removed because no income information was available for the block group. This resulted in 78 block groups being used in the analysis.

In addition to removing entire block groups from the analysis, individual Via trips were removed and not used in the daily aggregation process when the trip data included invalid speed measurements, or extraordinary travel times.

Initial Data Exploration

A preliminary analysis of the relationship of some of these input variables showed that simple models would not accurately predict use of the Via service. For example, Figure 21 shows the relationship of mean time savings for all days in the analysis by block group versus the total number of Via trips taken per person for that block group.

Figure 21: Total Trips Taken Per Block Group Population Versus Mean Time Savings



While a basic trend is clearly visible (greater time savings typically result in more trips being taken per person), the scatter is very large, especially at the left-hand side of the graph, where many block groups show low trip making per person, but where travel time savings range from modest to very large.

As described in the main body of the report, in many parts of the service area, it appears that the time and distance required to reach a Link station is too far to make use of Link a competitive mode choice for trips from some census block groups, even given the large time savings associated with Via. Travelers who live in the census block groups included in the upper left of this figure are most likely choosing other modes to reach their destinations. That is, they are simply not traveling to Link.

Other input variables showed even less consistent relationships. Figure 22 shows the relationship between median household income for a census block group and the number of Via trips made per resident. This shows that some block groups with

high income do not use Via heavily, while some block groups with modest median income levels used Via fairly heavily.

Figure 22: Total Trips Taken per Block Group Population versus Median Household Income

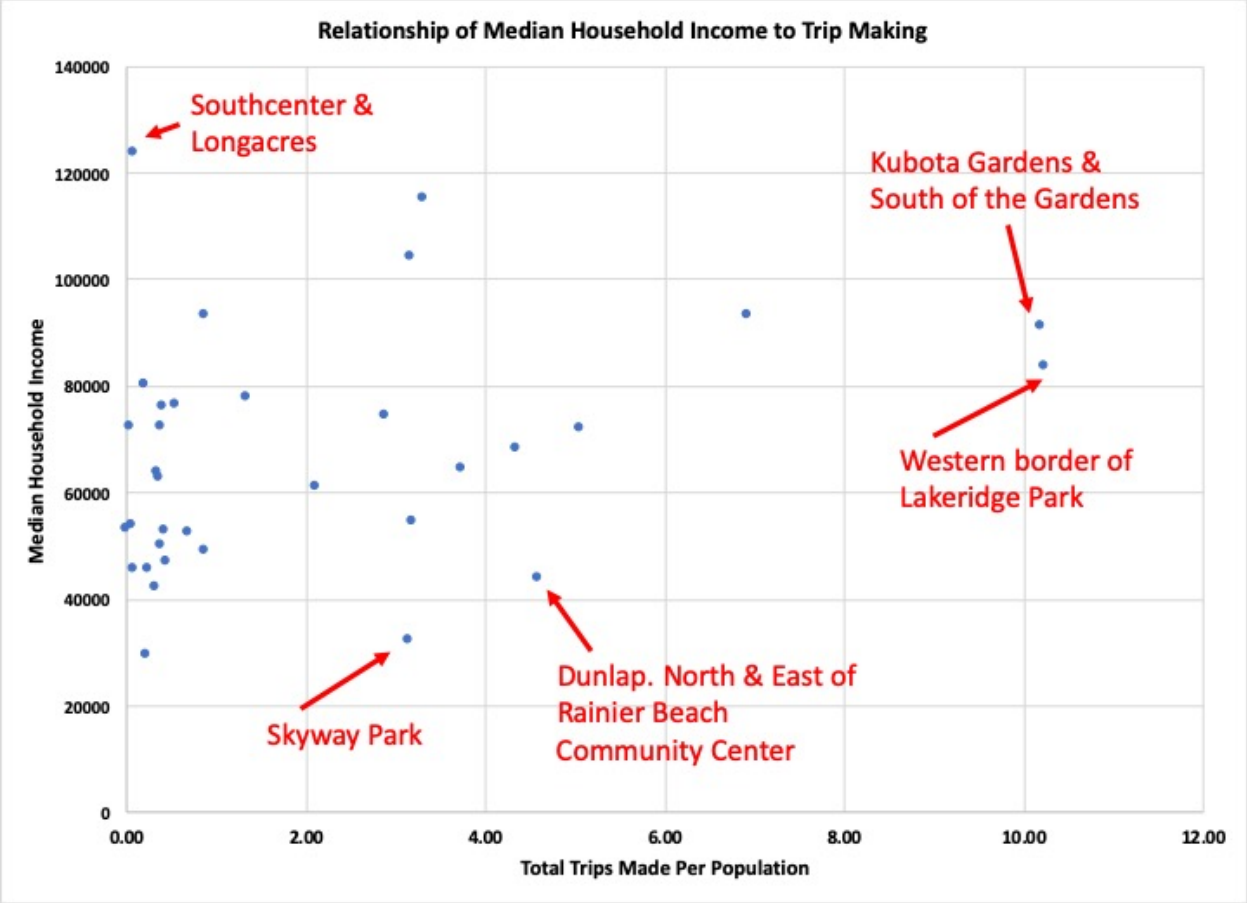


Figure 23 shows a different version of the relationship between household income and trip making. Rather than using summary variables (total trips for the Via demonstration), this graph is built on the ~240 daily trip statistics from each census block group. It shows the relationship between the number of trips taken on multiple days (each grey dot is the number of trips taken on a specific date) for individual block groups. The log of the number of trips taken on each day is shown on the X-axis, while the Y-axis shows the value of the census block group's median household income. The vertical lines of dots on the graph show the daily variation in the number of trips taken within the census block groups.

A best fit curve is then overlaid on these data points, along with an error bound for that curve. The best fit curve is a cubic relationship between income and trip making. That is, in this graph, starting with block groups with very low median

family income (~$17,000 per year), as income rises, Via trip making declines. However, once median family income reaches roughly $55,000 per year, Via trip making starts increasing as the median income grows. However, after median family income reaches about $125,000 per year, further increases in income are associated with decreasing Via use.

Once again, the conclusion is that while income played a factor in the use of Via (too little income likely resulted in lower overall trip making, while high incomes might be associated with greater use of cars), other factors, such as the built environment and the origin/destination patterns of the residents in the zones, also played a role in the mode choice of residents.

Figure 23: Comparison of Median Household Income and Daily Trip Making: Log-Linear Relationship

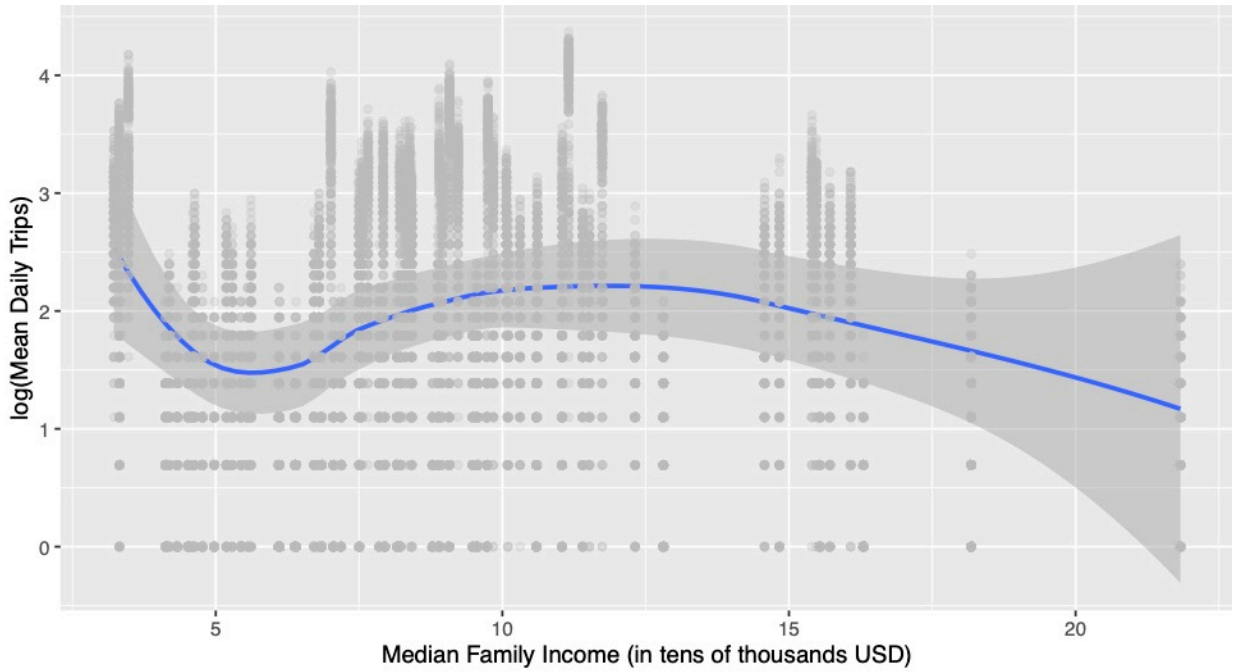


Figure 24 shows the basic relationship of between time savings and the log of the number of trips from a census block group. This graph shows that when time savings were small, fewer Via trips were taken. As time savings from taking Via increased, trip making increased. However, after reaching about 15 minutes of savings, this effect reversed, and then trip making became fairly stable, until at very high savings, trip making declined. The project team suggests that this final decline was due to the overall trip to/from the station itself taking so long that the Link trip was not competitive with some other mode of travel (e.g., a direct trip via bus or the use of a car).

Figure 24: Daily Trips Taken versus Mean Daily Time Savings

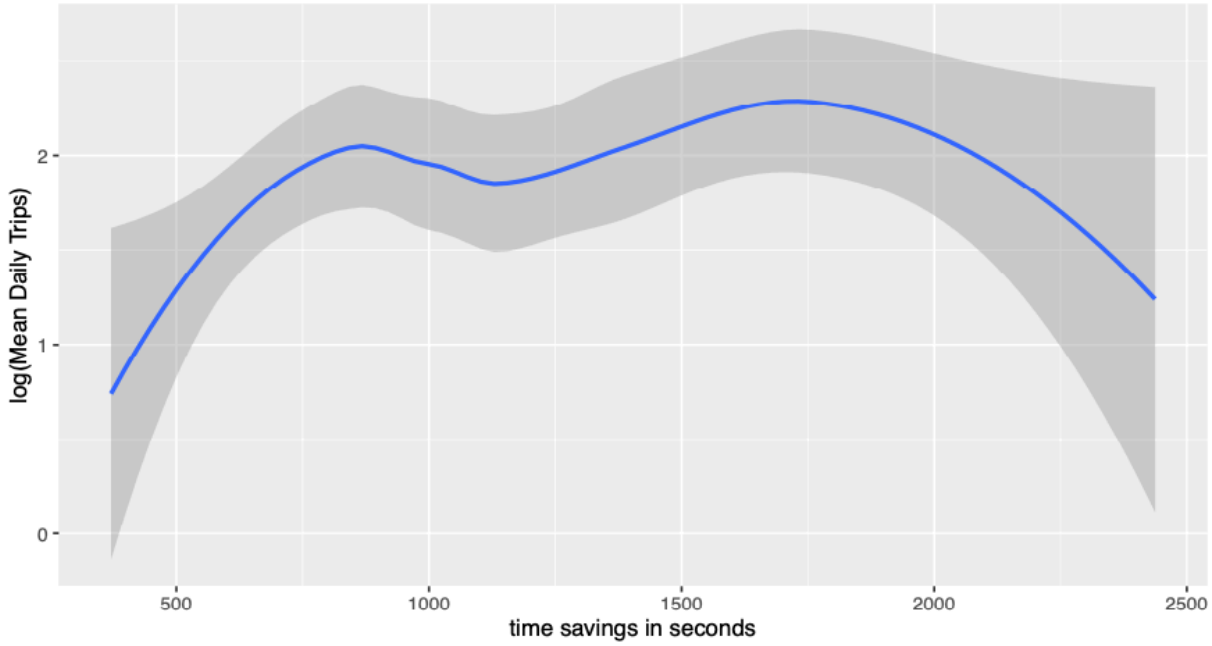
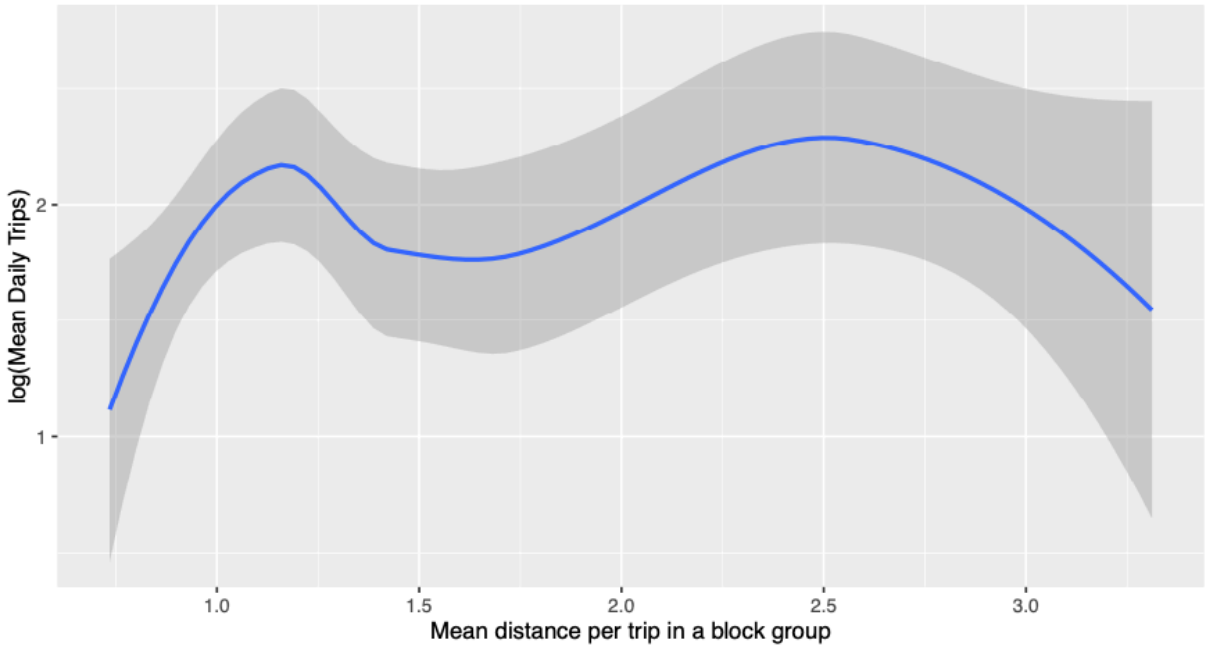


Figure 25 reinforces the conclusions drawn from Figure 24. Figure 25 shows the relationship of the distance traveled on Via versus the number of trips taken during a day. This figure has a similar shape to the time savings graph shown in Figure 24. When trip distance was very small, few Via trips were taken; walking was likely the major mode choice for accessing the station. As distance grew, more Via trips were taken. However, near 1.25 miles, increasing distance resulted in a decrease in trip making, until a trip distance of 1.6 miles, when increasing distance again resulted in more trips. And finally, beyond a distance of 2.5 miles, Via trip making declined again as distance continued to grow.

Figure 25: Daily Trips Taken versus Mean Via Trip Distance



The project team's interpretation of this graph is that different factors accounted for these patterns. At very short distances, walking was faster than waiting for a Via ride, and Via trips were taken only when it was difficult for the traveler to make that trip (e.g., they were carrying something heavy) or bad weather made waiting under cover for a Via ride worthwhile. As trip distance increased, Via became a more beneficial option and Via use increased. At large distances, alternative modes with more direct travel, other than the use of Via to Link, may have influenced the decline in use of Via (and Link). What is less clear is the cause of the drop in Via use from 1.25 to 1.6 miles. This may simply have been an artifact of the built environment of the pilot study area, or this distance may reflect the fact that bus service was more competitive at this distance, especially for trips going to the Link station, when riders could use OneBusAway to time their arrival to the bus stop, thereby reducing their expected wait time for the bus.

Model Development

Because of the complexity of the relationships between the input variables and trip making, the project team focused on multivariate models. The initial modeling effort assumed a Poisson regression formulation. This formulation assumed that the Y-axis (in this case, the number of daily trips from a census block group) had a Poisson distribution, and its expected value could be modeled by a linear combination of parameters. Given the shapes of the curves illustrated in Figures 23, 24, and 25, it was decided that the model development would include testing the use of variables raised to various exponents. That is, mean time savings would be

considered as an input variable, and mean time savings squared would also be considered as an input variable. This approach allowed an input variable to be incorporated more than once into the regression equation, with each use requiring a different exponent. This allowed the regression model to account for the varying patterns observed in Figures 23 through 25, where the impact of a variable changed with the size of that variable.

The initial regression model resulted in the use of the following census block group variables: population; mean time savings; median household income; average ride distance; average number of passengers; mean expected wait time; average trip speed, whether the ride was a weekday, Saturday, or Sunday; and whether the ride was to Tukwila. (Because Tukwila service levels were much lower than those to the four Seattle Link stations, the amount of trip making should be different given other inputs being identical. The "Is_Tukwila" variable was intended to allow the model to capture those effects.)

This model produced daily ride estimates that had modest levels of accuracy. The mean absolute error from the model was six trips per day from a census block group. On average, the model slightly over-predicted the number of trips from a block group. The model performed least well for some of the highest use census block groups, as well as for a small number of the many low use census block groups.

Two additional rounds of model development were then performed. In the second round, two machine learning modeling approaches that do not rely on a linear relationship were tested, a boosted forest (xgboost in our case) and a neural network. The intent was to determine whether the non-linear effects would be better handled with those models.

The third round of testing explored adding features (variables) from the census data to determine whether those variables (e.g., ethnic make-up of a block group, gender, age distribution) would improve the accuracy of the initial regression model.

Figure 26 shows the outcome of the three models. The initial regression format is used in these graphs, not the regression model at the end of the third round of testing, as that model showed only marginal improvements. Figure 26 shows a comparison of the actual mean daily trip volume by census block group versus the predicted mean daily trip volume from each of these three primary modeling efforts.

Figure 26: Modeled Mean Daily Trips by Census Block Group versus Actual Mean Trip Making

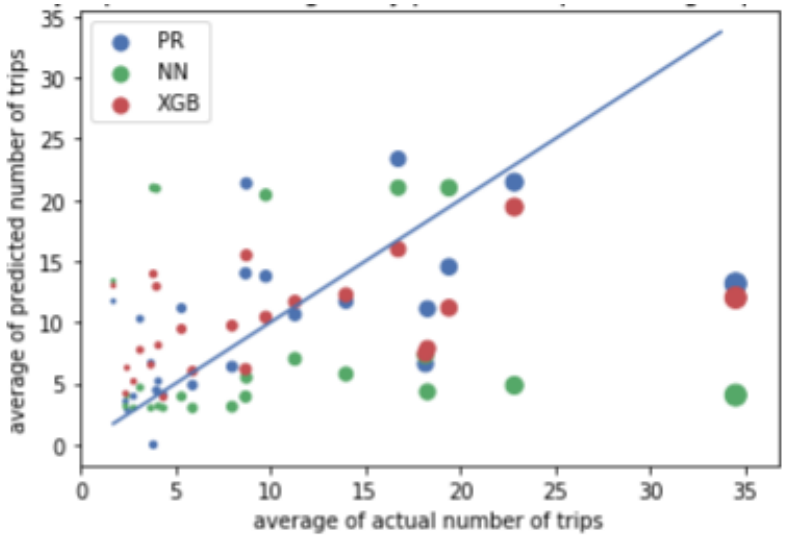


Figure 27 shows a scatter plot of actual daily trip making behavior versus the predicted daily trip making behavior for those days for all three models. This graph shows both the wide variation in daily trip making and the overall inability of any of the models to estimate that large amount of variability, even though the models often performed a reasonable job of estimating the mean trip making condition for many census block groups. None of the models did a very good job of estimating the number of trips taken on days when a very large number of trips were taken, although the regression model tended to predict more trips on those high use days than either the xgboost model (which was second best) or the neural network model.

Figure 27: Daily Trip Predictions versus Actual Daily Trip Making

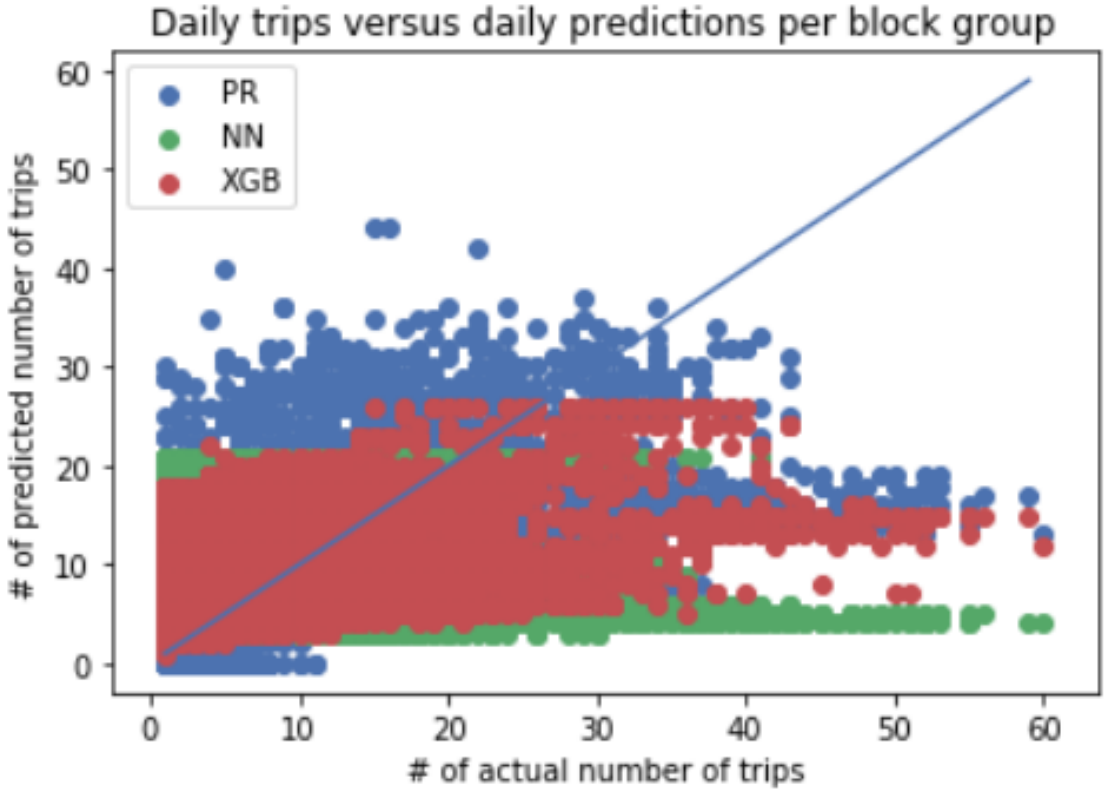
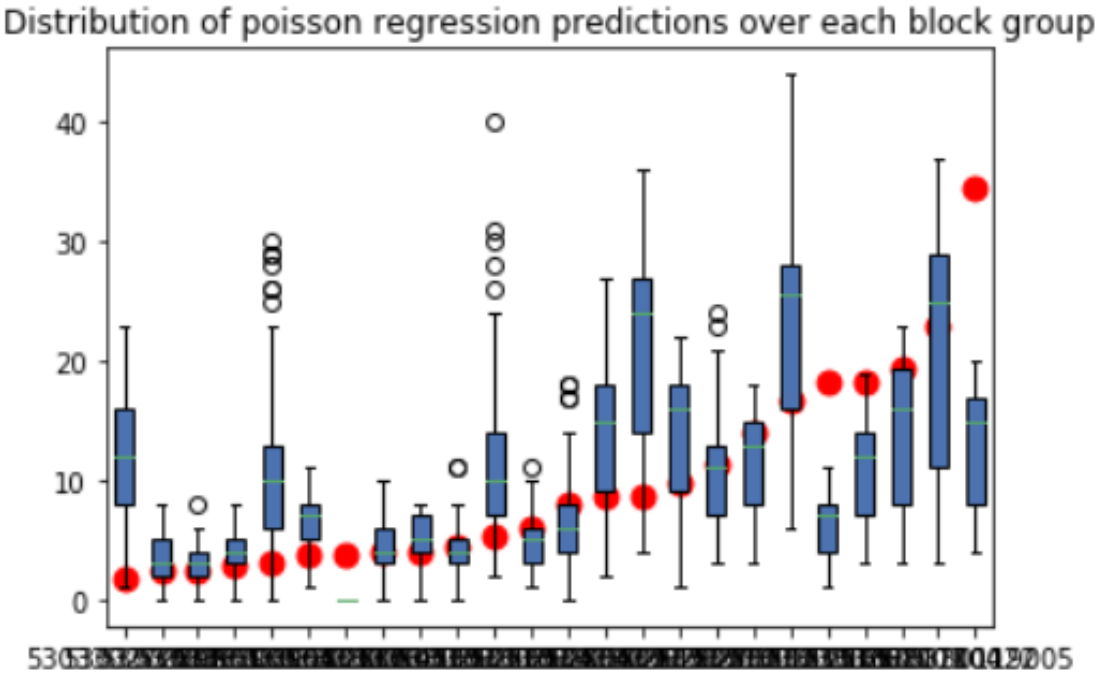


Figure 28 shows the results of the initial Poisson regression model in comparison to the size of the trip making occurring in census block groups. The red dots in Figure 28 represent the actual mean number of daily trips for the block group. The box displays the mean (the horizontal line barely visible in the box), 25th, and 75th quartiles of the predictions (the upper and lower edges of the box). The whiskers are the expected extremes within the distribution, and outliers are the circles. In Figure 28, the X-axis references specific census block groups. The Y-axis is the number of trips per day from the block group. Where the red dot falls within the "box" of the box and whiskers plot, the model produces a reasonable estimate of travel for that block group. Where the red dot falls outside of the box for a given block group, those estimates are not good. (Note that this graph includes all census block groups, but many of those block groups overlay and are not visible. The block groups are ordered from lowest volume to highest volume, going from left to right.)

Figure 28: Regression Model Forecasts versus Actual Trip Making



In Figure 28, it can be seen that the regression model results generally tracked the individual census block group means. A few specific block groups were poorly modeled, but there were relatively few block groups for which the predicted outcomes did not track the actual means, and those block groups were not concentrated in specific trip volume ranges. That is, the model was not particularly good or bad at estimating trip making in either high use or low use census block groups. The sizes of the boxes and whiskers also illustrate the wide variability in the predicted daily trip making behavior, but as in Figure 27, that variability did not always match the actual behavior on a day-to-day basis.

Figure 29 shows this same graph for the neural network-based model. Figure 30 shows this graph for the xgboost model. It can be seen in Figure 29 that the neural network model was particularly bad at estimating trips in those census block groups where actual trip making was the highest. It also typically predicted the least variability in day-to-day travel of the three models. Conversely, the xgboost model worked quite well in some volume ranges but poorly in others. It tended to overpredict trip making in block groups with lower trip activity and under-predict trips in block groups with higher trip activity.

Figure 29: Neural Network Model Forecasts versus Actual Trip Making

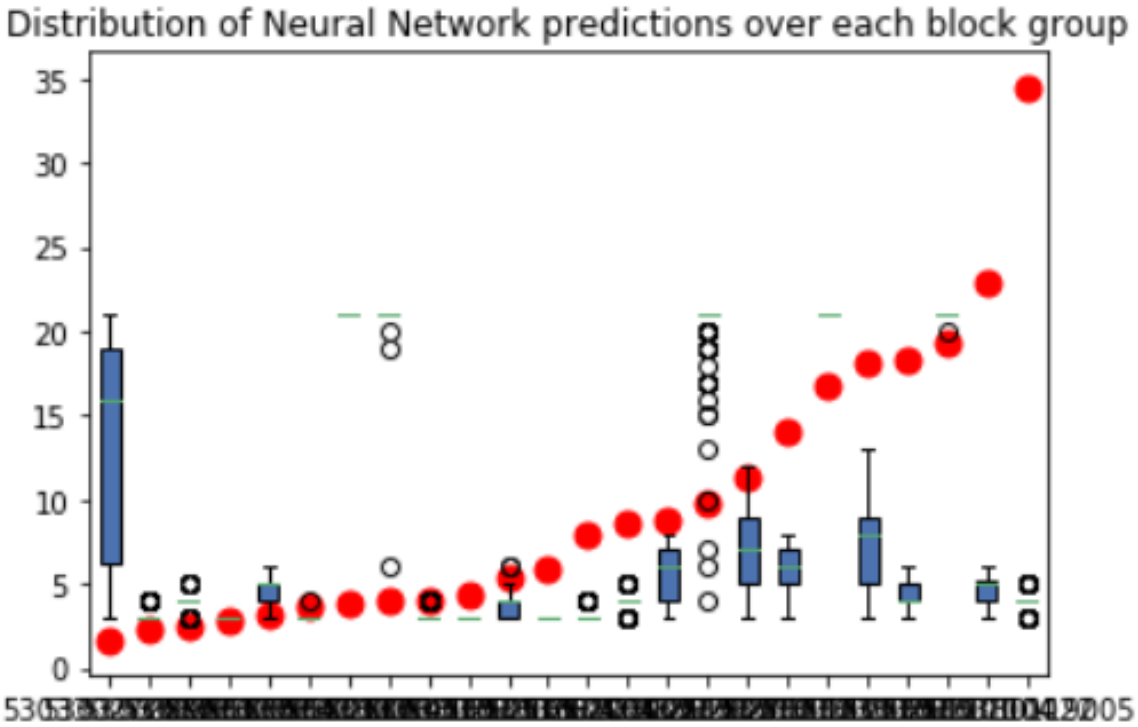
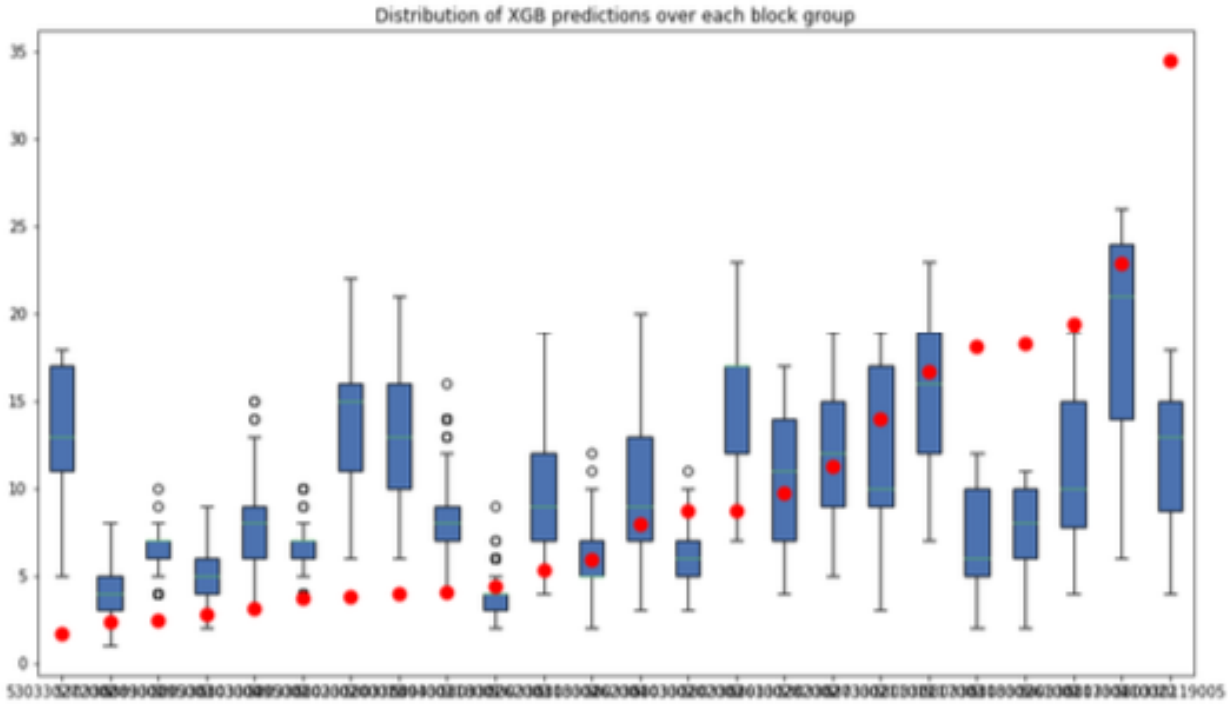


Figure 30: Xgboost Model Forecasts versus Actual Trip Making



On the basis of the results illustrated in figures 26 through 30, the researchers decided to keep using the Poisson regression approach and add additional input variables. Variables that were added during this third round of modeling were focused on the ethnicity, age, and gender of the residents of the block groups, with the hope that these variables would explain more of the variability between block groups.

While adding in variables on the ethnic make-up of a census block group (i.e., the percentage of population that was Black, Asian, or white) marginally improved the model estimates, these improvements were not significant. When variables describing the age and gender distributions were added, further minimal improvements occurred. However, including these population descriptors did not produce mean daily estimates that were practically different from the original Poisson regression model, while it added considerable complexity to the model.

Unfortunately, one set of variables that could not be obtained within the scope of this project were those to indicate the size of non-residential oriented trip activity within a census block group. The regression model is thus probably not able to account for travel that is not based on residential travel activity. That is, it will probably not do a good job at estimating trips made by individuals who live elsewhere but travel to and from activities in the census block groups. This would include trips bound for various land-use "attractions" such as shops, churches, or recreational facilities. This limitation in the available model inputs may be an important reason that none of the models effectively estimated travel to the census block groups with the highest volume use.

Model Outcome Formulation

As a result of the finding that adding ethnicity, age, and gender variables provided only marginal improvements in the model's effectiveness, the model selected for presentation in this report was the original Poisson regression model. The model predicts total daily Via trips (both to and from the station) from a census block group. The model is as follows:

$$\begin{aligned}\text{Ln(DailyTrips)} = \log(\lambda) = {} & -2.185 + (0.000343 * \text{Population}) \\ & + (0.001753 * \text{Mean Time Savings}) - (0.00000060 * \text{Mean Time Savings}^2) \\ & - (0.116900 * \text{Median Income}) + (0.016670 * \text{Median Income}^2) - (0.000688 * \text{Median Income}^3) \\ & + (1.168 * \text{Average Ride Distance}) - (0.271 * \text{Average Ride Distance}^2) \\ & - (0.007302 * \text{Average Number of Passengers}) \\ & - (0.004644 * \text{Mean Expected Difference in Wait Times}) \\ & + (0.3242 * \text{Average Trip Speed}) - (0.001256 * \text{Average Trip Speed}^2)\end{aligned}$$

$$+ (0.000105 * \text{Average Trip Speed}^3)$$
$$- (1.406 * \text{IsTukwila}) – (0.3107 * \text{IsSaturday}) - (0.4302 * \text{IsSunday}) + (0.4091 * \text{IsWeekday})$$

where:

Population = the census block group population.

Average Number of Passengers = the mean number of passengers per trip carried that day.

Average Trip Speed = the mean of the average trip speed for all trips to or from that census block group for that day, reported in mph.

Median Income = the 2018 reported median income for the census block group, reported in dollars.

Mean Expected Difference in Wait Times = the mean for that day and that census block group of the absolute value for the difference between the expected wait time predicted by the Via ride request app (eta_at_proposal) and the actual wait time experienced by the rider (actual_wait_time_minutes), reported in seconds.

Mean Time Savings = the mean value of the time, reported in seconds, saved by taking Via for that day for trips from that census block group. Computed as the difference between actual ride duration and the fastest alternative trip, as computed by using the Google Maps trip planner. The alternative trips are computed from the Via pick-up location to the Link station, and can be made by walking or via transit, whichever is fastest for that trip.

IsTukwila = a binary flag indicating that the prediction is for the Tukwila International Boulevard station, which both has a park and ride and does not have mid-day or weekend service.

IsSaturday = a binary flag indicating that the day for which trips are being predicted is a Saturday.

IsSunday = a binary flag indicating that the day for which trips are being predicted is a Sunday.

IsWeekday = a binary flag indicating that the day for which trips are being predicted is a weekday.

General Model Result Observations

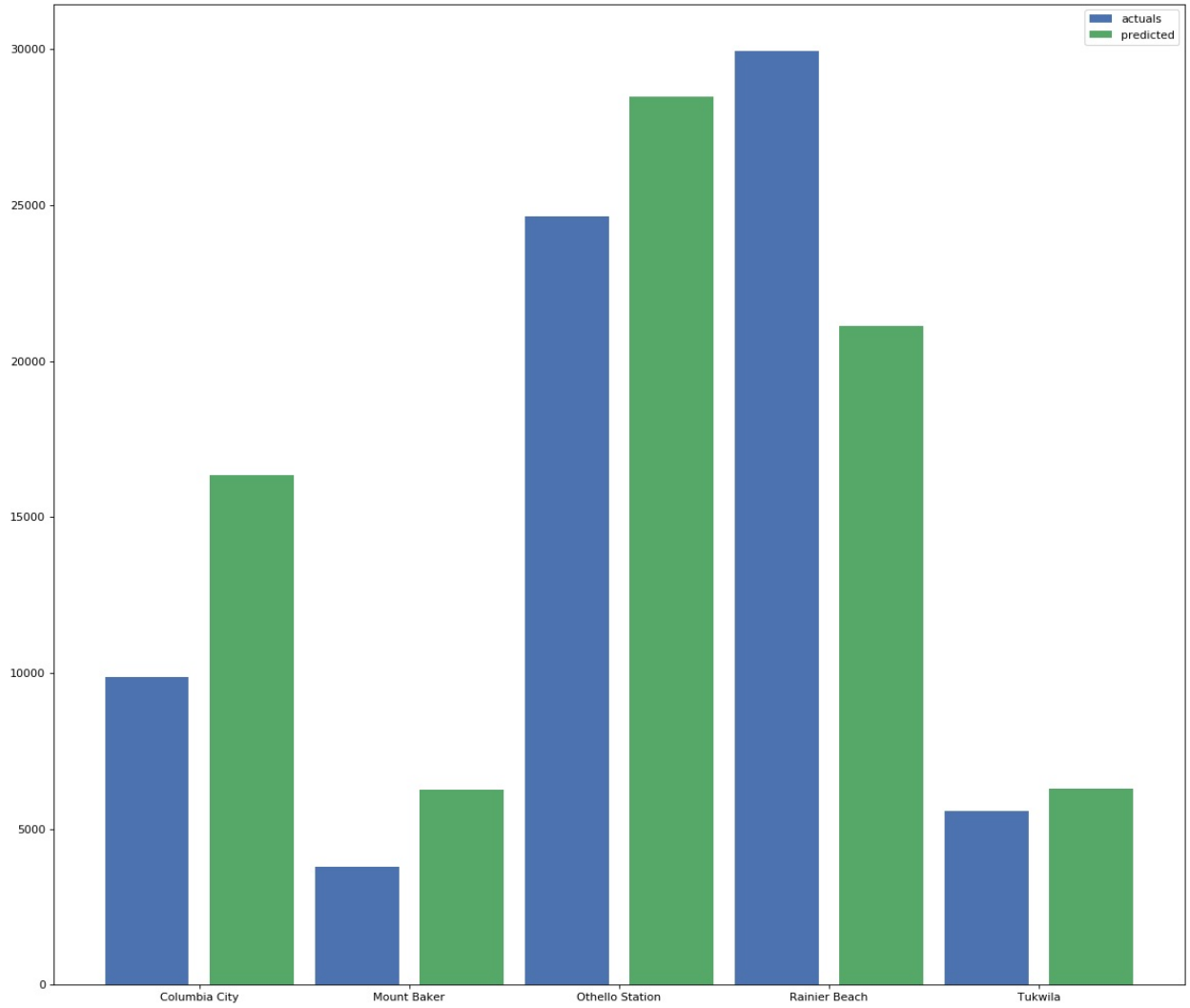
Because all of the models developed were trained (calibrated) by using static demographic data, the only variation in the daily input variables came from the Via trip data variables; average distance traveled, average speed, number of

passengers, travel time savings, and the expected difference in wait time. As a result, the models did not incorporate many of the factors that cause travel to vary day to day. For example, while work and school trips are typically repeatable, trips for most other trip purposes are not typically repeated on a day-to-day basis. Neither were factors such as weather or special events included in the model, making it hard for any of the models to predict why many trips occurred today and not tomorrow.

The other factor that limited the ability of the models to predict daily travel was the modest number of individuals making trips from any census block group, and the modest number of trips made each day from a block group. Generally, the smaller the sample size, the less likely that random effects even out from day to day. With a larger population of Via users, the random effects of these day-to-day variations would more likely be muted. But given the population size at the census block group level combined with the modest fraction of that population that used Via, the overall Via user population was too small to allow random effects to be smoothed out by population size. As a result, the complex models (the neural network and gradient boosting techniques) appear to have overfit on the nuances in various speed or time saving thresholds, resulting in lower than desired model accuracy. The simpler Poisson regression approach, despite its limitations, achieved slightly better outcomes, although it too had considerable error on a day-to-day basis.

By aggregating the census block group predictions (and actual trip making behavior) by the station they were going to or from, it was possible to examine the overall effectiveness of the modeling effort at the Link station level. Figure 31 shows this comparison. This shows whether the errors in daily trip predictions made in one block group were cancelled out by similarly sized errors, but with the opposite sign, at other nearby block groups. The answer was basically "no." Instead, Figure 31 shows that the sum of trip predictions from all block groups feeding the Rainier Beach station were routinely under-estimated, while trips to Mt. Baker, Columbia City and Othello were routinely over-estimated. Estimates of trip making to and from Tukwila were fairly accurate.

Figure 31: Link Station Summary of Model Prediction Accuracy



Note that the Rainier Beach station ridership shed contained several of the census block groups with the largest trip making activity. Figures 27 through 30 show that all of the models underpredicted the high-volume trip making behavior from these block groups. Since all of the highest trip making block groups were in the Rainier Beach service area, it makes sense that the models under-predicted total trip making in that service area. At the same time, since the models used data from all census block groups to calibrate a single equation for predicting ridership, the underestimated trip predictions in Rainier Beach were balanced by over-estimated travel predictions in the other Seattle service areas.

Consequently, the evaluation team concludes that there are some systematic biases in the model. That is, there were factors that influenced travel in the Rainier Beach station's service that were not captured in the input variables used in the model. It was unclear what those biases were.

It is possible that there are activities occurring in this geographic area that were generating a large numbers of Via trips to and from the Rainier Beach station that were not based on the size of the residential population. For example, an attraction like the Kubota Gardens, could be the source of the higher number of trips in Rainier Beach. However, the Via Rider survey did not indicate that there were significant differences between the service areas in terms of the fraction of trips made by trip purpose. (The Rainier Beach station reported a slightly higher fraction of Work Trips compared to the other Seattle service areas, but only modestly so.) Neither did the ridership data for Rainier Beach exhibit a different time of day or weekday/weekend pattern than observed in the other Seattle service areas. Thus, the evaluation team was not able to discern why the Rainier Beach station had such a large ridership compared to the other stations in the pilot.

The errors in the model predictions do not mean that the model results are not useful for identifying factors that will play a role in determining the potential success of a future first-mile / last-mile service. They do mean that the accuracy of the forecasts is mediocre at best at the level of daily trip making at the census block group level.

The final Poisson model did show the following:

- Via trip making in a census block group will generally *increase* when population, travel time savings, Via trip distance, or mean Via trip speed increase, although the effect of both time savings and Via trip distance will eventually become negative as these values grow to large values.
- Via trip making in a census block group will *decrease* when median household income, the mean absolute difference between predicted and actual wait times, and the mean number of people traveling together increase. The income effect is not constant, with increasing income causing a modest increase in trip making between about $55,000 and $125,000 in annual income.
- The model also showed that trip making will also decrease on the weekends and to the Tukwila station, while increasing if the day being modelled is a weekday.

These basic relationships are likely to be true for other locations where Via or services similar to Via are being considered.

Census Block Groups Removed from Analysis

Block groups removed for a lack of Via trip making include:

530330094005

530330100023

530330100024

530330104024

530330253022

530330262001

530330262002

530330271002

530330273004

530330281002

530330282003

Block groups removed for lack of income data.

530330118002

530330103003

530330095004

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CONTACT US:
publicaffairs@enotrans.org