FTA RESEARCH

FEDERAL TRANSIT ADMINISTRATION

Mobility on Demand (MOD) Sandbox Demonstration: Valley Metro Mobility Platform

Evaluation Report

NOVEMBER 2020

FTA Report No. 0175 Federal Transit Administration

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U.S. Department of Transportation
Federal Transit Administration

COVER PHOTO

Courtesy of Valley Metro

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Metric Conversion Table

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

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This report evaluates the Valley Metro Mobility Platform project, part of the Federal Transit Administration (FTA) Mobility on Demand (MOD) Sandbox program. Valley Metro currently provides a Valley Metro Ridekick™ mobile application for its users that features trip planning for light rail and buses. The Mobility Platform project aimed to develop new trip planning features and an integrated payment system for public and private transportation in an updated pilot app called Pass2Go, but integration with private transportation was not achieved and the app was discontinued, eventually to be replaced by another app. The evaluation of the project explored its effect on user travel and planning times, accessibility, and connectivity to different modes of transportation. Overall, the results showed that the Pass2Go app was an enhancement over the existing Ridekick™ app. The evaluation supported hypotheses that wait and planning times were reduced, planning methods were improved, and that the platform enhanced accessibility and connectivity to different transportation options. Also, the project provided a platform for other public transportation agencies to exchange travel information and produced lessons learned. Most hypotheses within this evaluation were supported and, overall, the project was found to perform very well.

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ABSTRACT

This report evaluates the Valley Metro Mobility Platform project, part of the Federal Transit Administration (FTA) Mobility on Demand (MOD) Sandbox program. Valley Metro currently provides a Valley Metro Ridekick™ mobile application for its users that features trip planning for light rail and buses. The Mobility Platform project aimed to develop new trip planning features and an integrated payment system for public and private transportation in an updated pilot app called Pass2Go, but integration with private transportation was not achieved and the app was discontinued, eventually to be replaced by another app. The evaluation of the project explored its effect on user travel and planning times, accessibility, and connectivity to different modes of transportation. Overall, the results showed that the Pass2Go app was an enhancement over the existing Ridekick™ app. The evaluation supported hypotheses that wait and planning times were reduced, planning methods were improved, and that the platform enhanced accessibility and connectivity to different transportation options. Also, the project provided a platform for other public transportation agencies to exchange travel information and produced lessons learned. Most hypotheses within this evaluation were supported and, overall, the project was found to perform very well.

EXECUTIVE SUMMARY

The Federal Transit Administration (FTA) is leading an initiative, the MOD Sandbox Program, to explore how public transportation agencies could incorporate new technologies that complement and support the traditional functions of public transportation. One of the projects was the Valley Metro Mobility Platform. Valley Metro partnered with Routematch, Lyft, GR:D BikeShare, West Group, and the City of Phoenix to implement a project aimed at improving trip planning and trip payments via a smartphone app.

Valley Metro (Phoenix, Arizona area) currently provides the Ridekick™ mobile application to the public, which features trip planning for light rail and buses. Valley Metro's MOD Sandbox Demonstration aimed to develop new trip planning features with different transportation options and transit schedule information in addition to an integrated payment system for public and private transportation in a pilot app called Pass2Go. Some enhanced trip planning features encompassed the ability to 1) reverse route, 2) "favorite" a trip, 3) deep link to Transportation Network Companies (TNCs) – GR:D BikeShare, Lyft, and Uber, 4) use voice activation for nearest stop and hear options, 5) see information presented in a more clear, concise manner, and 6) have a customer profile that would save this information. However, integration with private rideshare services did not work out as planned, and the app was discontinued at the end of the project, to be replaced by another app.

This report presents the results of the independent evaluation of the Mobility Platform project as implemented with the Pass2Go app. The Valley Metro Mobility Platform was one of 11 MOD Sandbox Demonstrations partially funded by FTA. The independent evaluation (IE) was sponsored by the USDOT Intelligent Transportation Systems Joint Program Office (ITS JPO) and FTA. The evaluation was guided by 12 hypotheses analyzed using survey data, app activity data, and expert (stakeholder/project partner) interview data. A series of "before" and "after" surveys was conducted over three waves, each lasting three months. Results of the evaluation are summarized below.

Hypothesis 1: The average travel time of Pass2Go Pilot users declines to a degree that is statistically significant.

A key objective of a trip planner is to provide a convenient solution that saves users time. Hypothesis 1 aimed to evaluate if the Pass2Go Pilot app decreased the travel time of its users. This was evaluated by comparing self-reported travel times for average and recent bus and rail trips in "before" and "after" surveys. The analysis did not show statistically significant changes in average travel time measurements due to the Pass2Go app; however, 29% of respondents reported that their travel times had decreased, 64% reported no change, and only 4% reported longer travel times. The results partially supported Hypothesis 1; the measurement was not precise enough to detect any change in travel time, but a sizable minority reported that use of the app had reduced their travel time.

Hypothesis 2: The average wait time of Pass2Go Pilot users declines to a degree that is statistically significant.

Similar to Hypothesis 1, Hypothesis 2 aimed to evaluate if use of the Pass2Go Pilot app decreased the wait time of its users. This was evaluated by comparing self-reported wait times for average and recent bus and rail trips in "before" and "after" surveys. The analysis showed statistically significant decreases of approximately one minute for rail trips and two minutes for bus trips due to the Pass2Go app. This finding was possible due to the trip planner decreasing wait time at bus or rail stations by better aligning the arrival time of users to those stations. Since wait times account for a small fraction of a trip, time changes are expected to be small, within the range of a few minutes. In addition, similar to the finding of Hypothesis 1, 28% of respondents reported shorter perceived wait times, 66% reported no change, and only 5% reported longer wait times. The analysis found that Hypothesis 2 was supported.

Hypothesis 3: The average time to plan a trip ahead of time declines to a degree that is statistically significant.

Similar to Hypothesis 2, Hypothesis 3 sought to evaluate if the Pass2Go Pilot app decreased the planning time of its users. This was evaluated by comparing self-reported planning times for average and recent bus and rail trips in "before" and "after" surveys. The analysis found that the app decreased planning time for users by a statistically significant margin of one minute, on average, for both bus and rail trips. Since planning accounts for a small fraction of trip time, time changes were expected to be small, within the range of only a few minutes. The analysis also found that 37% of respondents reported shorter perceived planning times, 54% reported no change, and only 5% reported longer planning times. Taken together, the results of the analysis supported Hypothesis 3.

Hypothesis 4: The number of downloads increases month over month.

Hypothesis 4 evaluated if downloads of the Pass2Go Pilot app increased over time. This was evaluated using app activity data, which included the number of downloads and active devices over time. Analysis of the data showed that downloads increased at the beginning of each of the three waves and activity increased within each wave. Because the activity of the project was cyclical during the three-month waves, the analysis had to focus on activity during these periods independently. Under these considerations, the findings supported Hypothesis 4.

Hypothesis 5: The number of persons with disabilities using the Pass2Go Pilot increases.

A key objective of the project was to provide an accessible platform for persons with disabilities. The evaluation of "before" and "after" survey data showed that 11 respondents used a wheelchair, and/or required special accommodations for transportation and/or required Americans with Disabilities Act (ADA) accessible vehicles and infrastructure to get around. From an app accessibility compliance point of view, 75% of 24 respondents who used smartphone accessibility features rated the app 7 or higher out of 10 as being compatible with those features. Also, the 11 respondents with disabilities gave an average rating of approximately 8 out of 10 for their abilities to get/to from Valley Metro's bus and rail network. These ratings slightly increased after using the Pass2Go app, but changes were not significant. The hypothesis ultimately could not confirm an increase in the number of users because the number was small, but it was found that a majority of those using the accessibility features designed to support the use of persons with a disability were satisfied with the app. The findings exploring Hypothesis 5 support the result that the accessibility features implemented in the app were functional and well-received by users but inconclusive regarding if there was any increase in the number of persons with disabilities using the service.

Hypothesis 6: Users report greater connectivity with public transportation using information augmented in the Pass2Go Pilot.

Hypothesis 6 was evaluated using "before" and "after" survey data in which respondents were asked to rate their abilities to get to/from Valley Metro's bus and rail services and public transportation in the Phoenix area in general. For all respondents, the "before" and "after" ratings of their abilities to get to and from Valley Metro's bus and rail services were compared using the Wilcoxon signed rank test. The results showed that respondents who rated their ability to get to and from Valley Metro public transportation exhibited a statistically significant increase, at the 5% level. This showed that the distribution of ratings in the "after" survey were, on balance, greater than those in the "before" survey by a statically significant margin. In addition, 74% of respondents reported improved access to public transportation due to using the Pass2Go Pilot app, suggesting that the app led to greater connectivity of users on public transportation. The results of the analysis supported Hypothesis 6.

Hypothesis 7: User behavior shows greater use of connecting modes through measured activity.

Survey data were also used to compare the mode share of users to connect to and from public transportation before and after using the Pass2Go Pilot app. The results show that 26% of respondents indicated that they had used on-demand transportation such as Uber/Lyft/taxi more frequently to get to and from public transit as a result of using the Pass2Go app. Around 80% of respondents walked to and from their recent bus trip, and this proportion did not change significantly after using the Pass2Go app. The survey also asked respondents how they accessed and egressed rail on their most recent trip. The results show that walking, personal bicycle, and Valley Metro bus were the most frequently-used modes. A significant proportion of respondents also drove alone or were dropped off by family or a friend to get to a recent rail trip. In general, no significant changes were observed in the shares of connecting modes used for the recent bus and rail trips before and after using the Pass2Go app. However, analysis of the frequencies of modes used to connect to and from Valley Metro public transportation led to more significant results. Use frequencies were aggregated to analyze the behavior of frequent users who use a given mode at least once per week, and the Stuart-Maxwell test, a non-parametric test, was applied to the "before" and "after" mode shares of frequent users. The results found a statistically significant increase at a 1% level, which indicates that the "before" and "after" mode choices of frequent users to connect to/from public transportation increased to a degree that is statistically significant. The results supported Hypothesis 7.

Hypothesis 8: Users pay for multiple different transportation modes using the Pass2Go Pilot app.

A key objective of the platform was to provide an integrated payment system for public and private transportation options, but private transportation integration was not successful and the Pass2Go app was eventually discontinued. Hypothesis 8 evaluated if users paid for different modes of transportation using the Pass2Go Pilot app. However, the app payment data available did not include any mode information; thus, payments were analyzed irrespective of the mode used. The data included 12,239 transactions for 626 users from March 2018 through November 2019. Of these transactions, 11,760 passes were activated that expired the next day after activation at 2:59 AM. The average time to activate a pass after its purchase was 89 hours, and the median was 19 hours. The average number of passes purchased per user was 20, of which 19 were activated and 1 were not activated, on average. For a flat rate of $4 per pass, the average sales amount per user was $78, and the total amount of sales was $48,956. Ultimately, Hypothesis 8 could not be evaluated in the form originally stated due to data limitations. The analysis found that transactions during the pilot project were very active and that about 95% of all passes purchased on the platform were used. The hypothesis that users pay for multiple modes using the app might be assumed at the level of use observed and the fact that respondents reported a healthy mix of public bus and rail use, but because use of all modes was at a flat fare and the data did not have any other attributes defining which mode was being purchased, the conclusions of the Hypothesis 8 analysis are inconclusive.

Hypothesis 9: Pass2Go Pilot users consider the travel experience to be enhanced with real-time travel information and routing.

Hypothesis 9 was evaluated using "before" and "after" survey data. Only 120 respondents had used the previous Ridekick™ app; they were asked to rate the Ridekick™ app and the Pass2Go app. Their responses were paired as "before" and "after" ratings of the Ridekick™/Pass2Go apps. The results were statistically significant at the level 1%, showing that the Pass2Go app had higher ratings overall for planning and for access to real-time traveler information for public transportation. Specifically, a rating of 7 or higher out of 10 was given for 1) the overall functionality of the app (89% of 332 Pass2Go users vs. 32% of 120 Ridekick™ users), 2) trip planning with the app (58% Pass2Go users vs. 36% Ridekick™ users), and 3) access to real-time traveler information for public transportation with the app (55% Pass2Go users vs. 41% Ridekick™ users). From a perception point of view, 58% of respondents experienced improved access to real-time traveler information and 55% experienced improved trip planning methods. Overall, the results supported Hypothesis 9.

Hypothesis 10: Pass2Go Pilot users with disabilities who are also persons with disabilities find that trip planning methods are improved with the app.

Hypothesis 10 was evaluated using "before" and "after" survey data; users with disabilities were asked to rate trip planning with the Pass2Go app and indicate if it improved their trip planning abilities. The analysis showed that 6 of the 11 users with disabilities reported improved trip planning and access to real-time traveler information for public transportation as a result of using the Pass2Go app. Also, 7 of the 11 respondents gave a rating of 7 or above for trip planning with the Pass2Go app, of which 5 gave a rating of 10. The results of the analysis were encouraging, in that a majority of respondents with disabilities reported improvements in the trip planning capabilities from the app. However, the sample size of respondents with disabilities was not large enough to produce a definitive conclusion, leading to an inconclusive finding for Hypothesis 10.

Hypothesis 11: Transit agencies are able to view and exchange travel information.

Hypothesis 11 evaluated if Valley Metro could view and exchange travel information via a system integrated with the Pass2Go app. This hypothesis was motivated by the project objective of having an open data platform that permits the agency to see information related to purchase activity. The open data platform was made accessible to researchers and was inspected for functionality and performance. Screenshots of the platform were taken, and the data display features were tested. This inspection supported the confirmation of Hypothesis 11, that the platform provided allowed transit agencies to view and exchange travel information of the system.

Hypothesis 12: The process of deploying the project produces lessons learned and recommendations for future research and deployment.

Hypothesis 12 was evaluated by conducting expert interviews regarding lessons learned from the Valley Metro project. Interviews with experts close to project implementation revealed several findings related to contractual negotiations, project operation and expansion, accessibility challenges, and other issues related to the continuation of the project. The interviews found that participants were generally satisfied with the project, even though it did not grow as initially expected with regard to app feature development. The project proved successful in providing users with increased transportation options, integrated trip planning and payment for public transportation, transit schedule information, and accessibility for people with disabilities, although this metric was based on a small sample size of users with disabilities. However, single-payment integration with private transportation providers did not work out as planned and was not implemented. The results support Hypothesis 12.

The report that follows presents the detailed findings of the evaluation of the Valley Metro project, with lessons learned that potentially can help advance similar initiatives within other transit systems.

Table ES-1

Summary of Findings

Hypothesis	Status	Key Finding
1. The average travel time of Pass2Go Pilot users declines to a degree that is statistically significant.	Partially supported	Travel time measurements did not show any significant change, but a sizable minority reported that the app had reduced their travel time.
2. The average wait time of Pass2Go Pilot users declines to a degree that is statistically significant.	Supported	Wait time measurements showed significant decreases for bus and rail trips, and a sizable minority reported that the app had reduced their wait time.
3. The average time to plan a trip ahead of time declines to a degree that is statistically significant.	Supported	Planning time measurements showed significant decreases for bus and rail trips, and a sizable minority reported that the app had reduced their planning time.
4. The number of downloads increases month over month.	Supported	The number of downloads did increase at the beginning of each of the three waves but activity increased within each wave.
5. The number of persons with disabilities using the Pass2Go Pilot increases.	Inconclusive	The hypothesis ultimately could not confirm an increase in the number of users with disabilities because the number was small, but it found that a majority of those using the accessibility features designed to support the use of persons with a disability were satisfied with the app.
6. Users report greater connectivity with public transportation using information augmented in the Pass2Go Pilot.	Supported	Ratings of the app's ability to connect to/from public transportation increased, and a sizable majority reported improved access to public transportation due to the app, suggesting that the app led to greater connectivity of users on public transportation.
7. User behavior shows greater use of connecting modes through measured activity.	Supported	The frequency of use of connecting modes to/from public transportation increased to a degree that is statistically significant.
8. Users pay for multiple different transportation modes using the Pass2Go Pilot app.	Inconclusive	The hypothesis could not be evaluated in the form originally stated due to data limitations. The analysis found that transactions during the pilot project were very active and that almost all passes purchased on the platform were used.
9. Pass2Go Pilot users consider the travel experience to be enhanced with real-time travel information and routing.	Supported	Around half of respondents experienced improved access to real-time traveler information and improved trip planning methods. Ratings of the Pass2Go app were significantly higher than those of Ridekick™.
10. Pass2Go Pilot users with disabilities find that trip planning methods are improved with the app.	Inconclusive	The results of the analysis were encouraging, in that a majority of respondents with disabilities reported improvements in the trip planning capabilities from the app. However, the sample size of respondents with disabilities was not large enough to produce a definitive conclusion.
11. Transit agencies are able to view and exchange travel information.	Supported	Hypothesis 11 was supported by inspection of the open data platform used by the transit agency.
12. The process of deploying the project produces lessons learned and recommendations for future research and deployment.	Supported	Project stakeholders/partners were generally satisfied with the project, which produced lessons learned for future work.

SECTION 1

Introduction

Overview of MOD Sandbox Demonstrations

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

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

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

Table 1-1

Overview of MOD Sandbox Projects

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

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

This report focuses on the independent evaluation of the project with the Valley Metro Transit System implemented in and around the Phoenix, Arizona, metropolitan area. The project, entitled Mobility Platform, consisted of developing an upgrade to the current Valley Metro Ridekick™ mobile application to add new trip planning features and integrated payment for public and private transportation options. This upgrade was tested via the development of the Pass2Go app, which was deployed to a beta test group over the course of three waves. The evaluation of this project involved exploring a number of hypotheses surrounding the project's impact on travel time, accessibility, and connectivity to and from public transportation. Following a more detailed overview of the project, these hypotheses are explored in the sections that follow.

Evaluation Framework

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

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

SECTION

2

Valley Metro MOD Sandbox Project Summary

Valley Metro is the regional public transportation agency in Maricopa County, Arizona, and provides coordinated, multimodal transit options to approximately four million residents of the Phoenix metropolitan region. With a core mission of developing a regional and fully-integrated transit network, Valley Metro plans, develops, and operates the regional bus and light rail systems and alternative transportation programs for commuters, older adults, and people with disabilities.

Valley Metro currently provides a Ridekick™ mobile application for its users that features trip planning for light rail and buses. However, Ridekick™ was not accessible for people with disabilities and limited users' ability to plan multimodal trips. If passengers wanted to know all possible travel options in their immediate vicinity and use and pay for one of those services, they would need to use multiple applications on their smartphone. For example, riders need to access Ridekick™ for bus and rail schedules, Uber or Lyft for TNC choices, and other apps for shared micromobility.

For these reasons, the Valley Metro MOD Sandbox Demonstration aimed to develop new trip planning features and integrate payment for public and private transportation options in a pilot app called "Pass2Go." The project was divided into two phases; Phase 1 included developing the app as a trip planner with public transportation schedule information and a single payment system, and Phase 2 focused on integrating private rideshare services; for this phase, the required programming was completed but its integration into the mobile app was more challenging than expected and could not be completed as planned.

The Valley Metro Mobility Platform built on Ridekick's current functionality by developing and testing features not available to users through that platform. The envisioned Mobility Platform enabled users to receive transit travel information, purchase tickets for public transportation, and improve their trip planning. The objective of this enhanced integration was to improve the level of connectivity throughout the transit network, thereby decreasing the first/last-mile challenge facing public transportation users and allowing them to smoothly complete their trip from their point of origin to their destination. This mobile application also was designed to allow Valley Metro to better measure activity among riders and improve information available to users.

To test the proposed platform, this evaluation was set up in three three-month waves that were used to inform the results. Participants would be asked to use the app at least four times per month for three months and complete a pre- and post-study survey. Wave 1 started on March 30, 2018, Wave 2 started on June 5, 2018, and Wave 3 started on September 2, 2018.

Project Timeline

The main project milestones are as follows:

- **January 25, 2017** – Mobility Platform project execution date
- **March 15, 2018** – Phase I goes live
- **December 31, 2019** – Demonstration completion

The Valley Metro team collected data relevant to this MOD Sandbox Demonstration between March 2018 and November 2019 and shared the data with the IE team to conduct the evaluation.

SECTION

3

Evaluation Approach, Planning, and Execution

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

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

The logic model was effectively a table, with one row containing five cells, each populated with the components described above. The content of the logic model was also populated in advance of project implementation, for which knowledge of the project trajectory and exact data collected were uncertain. The components of the logic model constructed for the evaluation of the Valley Metro project are presented in Table 3-1.

Table 3-1

Project Goals, Evaluation Hypotheses, Performance Metrics, and Data Sources for the Valley Metro Sandbox Project

Project Goals	Evaluation Hypothesis	Performance Metric	Data Elements	Data Sources
Reduce the travel time of users with the improvements to Pass2Go Pilot.	The average travel time of Pass2Go Pilot users declines to a degree that is statistically significant.	"Before" and after travel times of Pass2Go Pilot users	Ridership and activity data, survey data	Valley Metro
Reduce the wait time of users with the improvements to Pass2Go Pilot.	The average wait time of Pass2Go Pilot users declines to a degree that is statistically significant.	"Before" and after wait times of Pass2Go Pilot users	Ridership and activity data, survey data	Valley Metro
Reduce the trip planning time of users with the improvements to Pass2Go Pilot.	The average time to plan a trip ahead of time declines to a degree that is statistically significant.	"Before" and after trip planning times of Pass2Go Pilot users	Survey data, Pass2Go pilot app data	Valley Metro
Improve adoption of mobile-based technology.	The number of downloads increases month over month.	"Before" and "after" application download rates; "before" and "after" number of active users	Pass2Go pilot app data	Valley Metro
Improve accessibility of the mobile application to a broader audience.	The number of persons with disabilities using Pass2Go Pilot increases.	"Before" and "after" compliance with Web Content Accessibility Guidelines (WCAG2.0); "before" and "after" satisfaction rating of ADA beta testing group; "before" and "after" application download rates among accessibility community	Pass2Go pilot app data, survey data	Valley Metro
Improve user-perceived connectivity throughout the transit network.	Users report greater connectivity with public transportation using information augmented in Pass2Go Pilot.	User-reported perception of connectivity as a result of Pass2Go Pilot app enhancements	Survey data	Valley Metro
Improve first/last-mile connectivity.	User behavior shows greater use of connecting modes through measured activity.	"Before" and "after" number of first/last-mile trips made by Pass2Go Pilot users	Survey data, ridership and activity data	Valley Metro
Provide a single payment system for public/private transportation modes.	Users pay for multiple transportation modes using the Pass2Go Pilot app.	Number of multimodal trips paid for by Pass2Go Pilot users, including average number of modes used per trip	Pass2Go pilot app data, payment data	Valley Metro
Enhance the customer's Valley Metro experience by providing improved traveler information and traveler-centric service.	Pass2Go Pilot users consider the travel experience to be enhanced with real-time travel information and routing.	Reported perception of near real-time traveler information and routing capabilities within augmented Pass2Go Pilot app	Survey data	Valley Metro
Enhance trip planning methods for persons with disabilities.	Pass2Go Pilot users who are also persons with disabilities find that trip planning methods are improved with the app.	Reported perception among persons with disabilities that trip planning is better with enhanced Pass2Go Pilot app	Survey data	Valley Metro
Open data platform allows transit agencies to view and exchange travel information.	Transit agencies are able to view and exchange travel information.	Evaluation of open data platform	Open data, access and download logs	Valley Metro
Produce lessons learned through stakeholder interviews.	The process of deploying the project produces lessons learned and recommendations for future research and deployment.	Qualitative documentation from stakeholder interviews	Stakeholder interview data	Valley Metro and project partners

The quantitative and qualitative evaluation methods used in the Valley Metro evaluation include the following:

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

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

Data Collected

A variety of datasets was used to conduct the evaluation. These datasets were collected in collaboration with the Valley Metro team and were in the form of surveys, Pass2Go Pilot app data, payment activity data, and stakeholder interview data. A general description of the available datasets is as follows:

- **Survey Data** – A pre- and post-study survey was launched in three three-month waves. The survey was designed to ask questions about traveler behavior patterns such as key destinations to which users travel using the Pass2Go Pilot app, trip planning time with and without the Pass2Go Pilot app, perceptions of connectivity to public transportation, and use of modes connecting to and from public transportation. Also, the "after" survey asked attributional impact questions that probed user responses on how Pass2Go Pilot had influenced their travel behavior.
- **Pass2Go Pilot App Data** – Included app metrics such as number of installs and active devices over time.
- **Payment Data** – Included transaction activity metrics such as passes purchased, activated, and not activated.
- **Stakeholder Interview Data** – Conducted with several experts directly connected to the project team and who had deep knowledge of the project, including representatives of the City of Phoenix, Valley Metro, and West Group.

These datasets were applied to evaluate the hypotheses defined in the evaluation plan. In the sections that follow, these hypotheses are explored and evaluated using the data available.

SECTION 4

Evaluation Results

Hypothesis 1: The average travel time of Pass2Go Pilot users declines to a degree that is statistically significant.

Performance Metric	Key Finding
"Before" and "after" travel times of Pass2Go Pilot users	Travel time measurements showed no significant change, but a sizable minority reported that the app had reduced their travel time.

The first hypothesis explored as part of the evaluation was if the project decreased the average travel time of Pass2Go Pilot app users. This hypothesis was evaluated using the "before" and "after" survey data of Pass2Go Pilot app users. Respondents were asked to report their average travel times for recent and average bus and rail trips before and after using the Pass2Go Pilot app.

Respondents were asked if they experienced any change in travel times as a result of using the Pass2Go Pilot app. Figure 4-1 shows that 64% of respondents reported no change in travel times, 4% reported longer travel times, and 29% reported shorter travel times as a result of the Pass2Go Pilot app. These results were used to group respondents into three categories—total population of respondents, those who reported no change, and those who reported shorter travel times. The self-reported travel times in the "before" and "after" surveys were then compared and tested for statistical significance across the three groups to evaluate if a decrease in travel time, should it exist, was due to using the Pass2Go Pilot or due to other reasons that may have affected the population of users and decreased their travel times exogenously. Since the app functioned as a trip planner, it was expected to impact the planning and/or waiting time of users. Note that self-reported travel times and perceptions of changes in travel time are a function of perception and may not reflect users' exact experiences; however, since travel times could not be directly measured, the survey responses constituted the best way to capture information of the respondent's experience.

As noted, to measure changes in travel time, two types of travel time were queried related to bus and rail travel—average travel time and travel time of their most recent trip using the mode. The former measure captured respondent perception of average travel time across all trips, and the latter focused on the specific recollection of the most recent trip. The former captured a general sense across several experiences, and the latter sought the precision of the most recent trip recollection in exchange for randomness related to the events specific to that trip.

Figure 4-1

Change in Travel Times as a Result of Using Pass2Go Pilot App

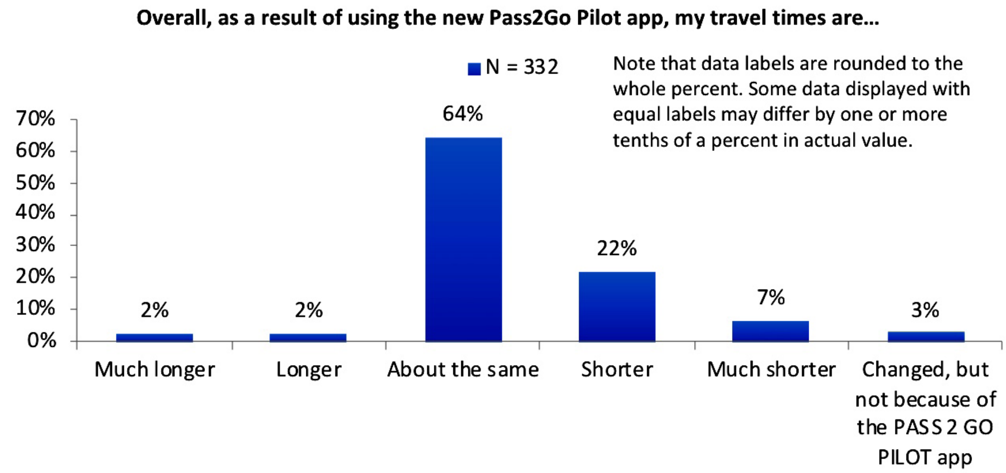


Figure 4-2 shows the average self-reported travel times for the average bus trip for each of the three groups. The travel times of the total population and those who reported no change decreased by one minute, on average, and travel times decreased by three minutes, on average, for those who reported shorter travel times due to the Pass2Go app.

Figure 4-2

Travel Times for Average Bus Trip

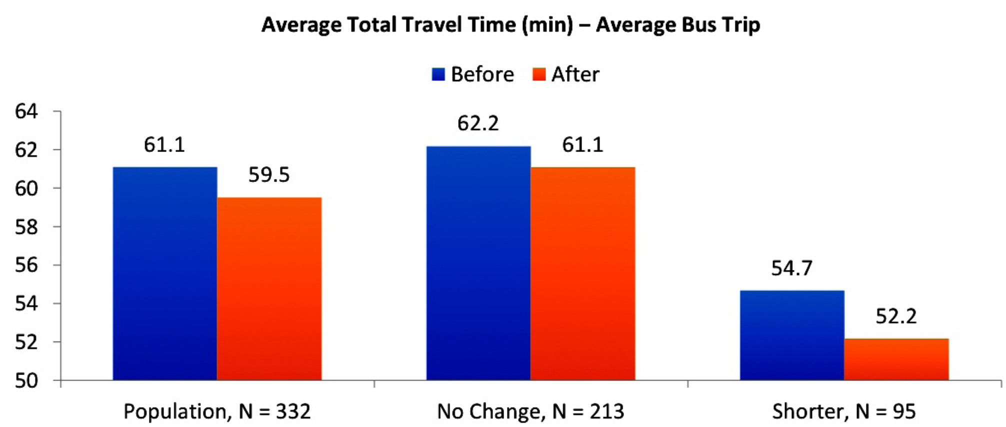


Figure 4-3 shows the average travel times for the recent bus trip reported by each of the three groups. For the recent trip, average travel times increased by one minute across the survey sample. Figure 4-4 shows the average travel times for the average rail trip reported by each of the three groups. Travel time of the population of users remained approximately the same; for those who reported no change, it decreased by one minute, on average, and for those who reported shorter travel times, it increased by three minutes on average.

Figure 4-3

Travel Times for Recent Bus Trip

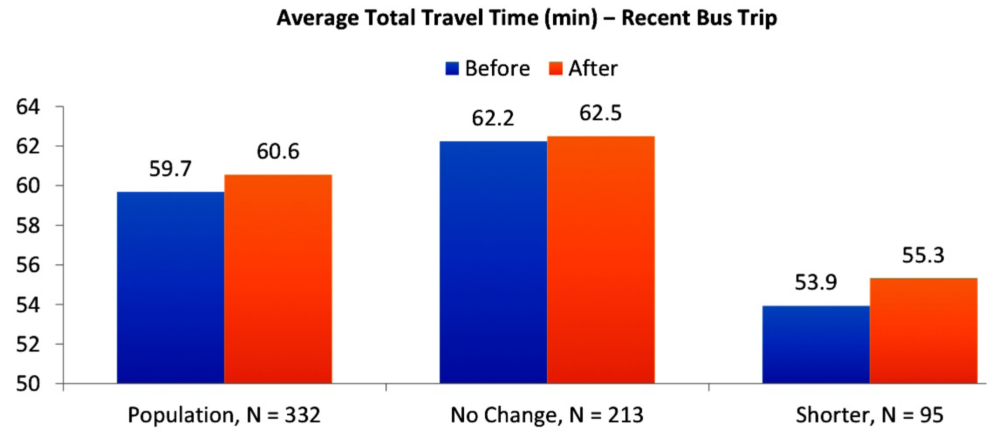


Figure 4-4

Travel Times for Average Rail Trip

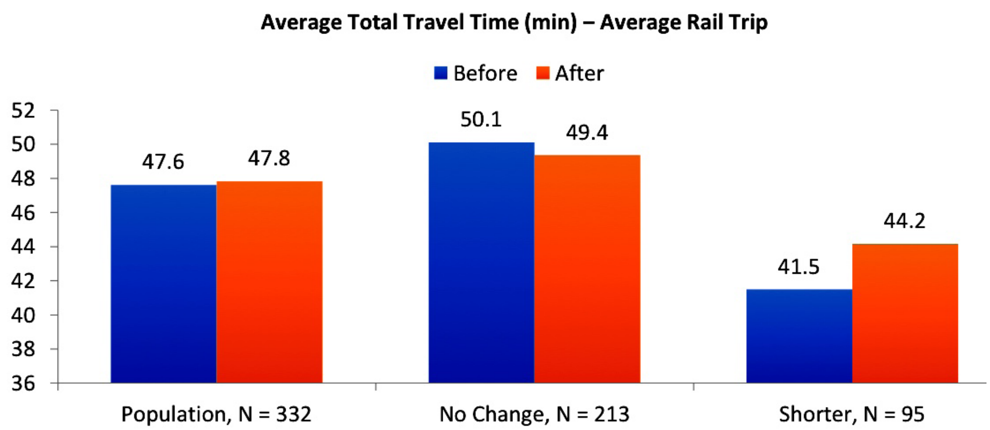
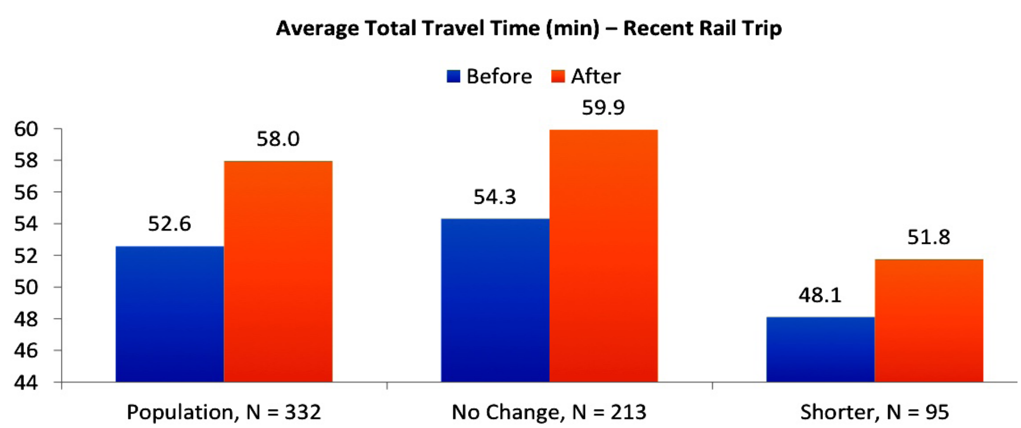


Figure 4-5 shows the average travel times for the recent rail trip reported by each of the three groups. The travel times of the population increased by five minutes, on average; for those who reported no change, it increased by six minutes, on average, and for those who reported shorter travel times, it increased by four minutes on average.

Figure 4-5

Travel Times for Recent Rail Trip



To test the statistical significance of the changes in travel times before and after the Pass2Go Pilot, a one-tailed paired t-test was conducted, and the obtained P-values are reported in Table 4-1. For a P-value less than 0.05, the change in travel times was considered significant at 5%. The results show that changes in travel times were not significant in general except for the recent rail trip, for which the increases in travel times were significant for both the total population and those who reported no change, but they were not significant for those who reported shorter travel times. Hence, travel times were subject to variations due to operational performance, and use of the Pass2Go app did not appear to shorten them based on users' reported experience. However, a sizable minority of about 30% of respondents felt that the app did cause them to have shorter travel times.

Table 4-1

Statistical Test Results for Travel Times

Trip	Group	Average Total Travel Time (min)		t-test (P-value)
		Before	*After*	
Average bus trip	Population, N = 332	61	60	0.20
	No change, N = 213	62	61	0.30
	Shorter, N = 95	55	52	0.26
Recent bus trip	Population, N = 332	60	61	0.34
	No change, N = 213	62	63	0.46
	Shorter, N = 95	54	55	0.36
Average rail trip	Population, N = 332	48	48	0.46
	No change, N = 213	50	49	0.39
	Shorter, N = 95	41	44	0.23
Recent rail trip	Population, N = 332	53	58	0.00
	No change, N = 213	54	60	0.01
	Shorter, N = 95	48	52	0.12

The travel times of the average bus trip showed a decline, which is consistent with the hypothesis, but this measurement was not statistically significant. Other measurements showed no statistical difference or, in the case of the recent rail trip, a statistically significant increase. However, a sizable minority perceived a decline in travel times due to using the Pass2Go app. This mixed collection of results suggests that Hypothesis 1 is only partially supported.

Hypothesis 2: The average wait time of Pass2Go Pilot users declines to a degree that is statistically significant

Performance Metric	Key Finding
"Before" and "after" wait times of Pass2Go Pilot users.	Wait time measurements showed significant decreases for bus and rail trips, and a sizable minority reported that the app had reduced their wait time.

The second hypothesis explored was if the project decreased the average wait time of Pass2Go app users. This hypothesis was evaluated using the "before" and "after" survey data of Pass2Go app users. Similar to the measurement of travel time, the surveys asked respondents to report their average wait times for their recent and average bus and rail trips before and after using the Pass2Go app.

Respondents were asked about their changes in wait times as a result using of the Pass2Go app. Figure 4-6 shows that 66% of respondents reported no change in wait times, 5% reported longer wait times, and 28% reported shorter wait times as a result of the Pass2Go app. These results were used to group respondents into three categories—total population of respondents, those who reported no change, and those who reported shorter wait times. Self-reported wait times in the "before" and "after" surveys were compared and tested for significance across the three groups to determine if a decrease in wait time, if it existed, was due using to the Pass2Go Pilot or other uncaptured reasons that may have affected the population of users and decreased their wait times. Since the app functioned as a trip planner, it was hypothesized to impact the wait time of users; however, the expected change could be small since wait time accounts for only a small fraction of a trip. As with the measurement of travel time, the self-reported wait times and perceptions of changes in wait time are a function of perception and may not reflect their exact experiences. Similarly, however, since wait times could not be directly measured, the survey responses constituted the best way to capture information of the respondent's experience with wait times.

Figure 4-6

Change in Wait Times as a Result of Using Pass2Go Pilot

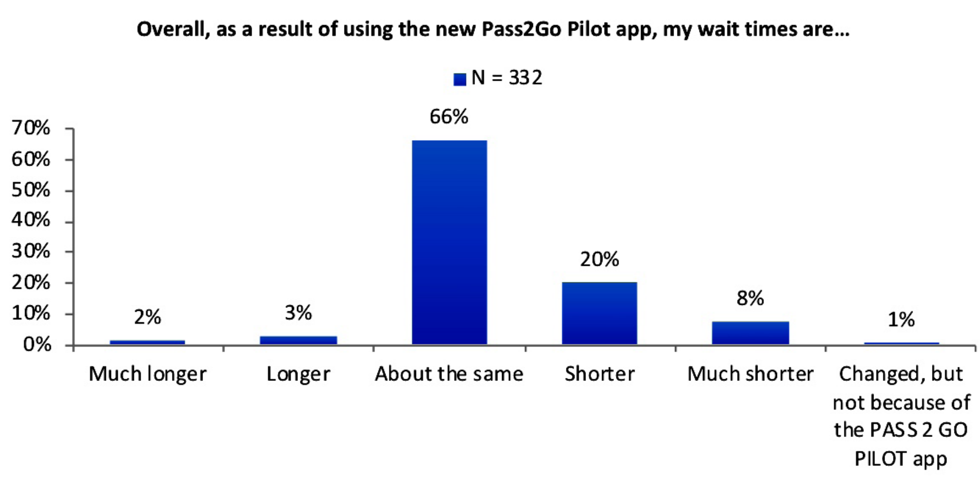


Figure 4-7 shows the average wait times for the average bus trip reported by each of the three groups. The wait times of the population and those who reported no change decreased by one minute, on average, and the wait times decreased by two minutes, on average, for those who reported shorter wait times due to the Pass2Go app. Figure 4-8 shows the average wait times for the recent bus trip reported by each of the three groups. The wait times of the total population decreased by one minute, on average; for those who reported no change, it remained the same, and for those who reported shorter wait times, it decreased by two minutes on average. These results were in concurrence with those of the average bus trip, suggesting that the app impacted users either by actually decreasing their wait times or by enhancing their trip planning experiences. Figure 4-9 shows the average wait times for the average rail trip reported by each of the three groups. The wait times of the total population and those who reported no change decreased by one minute, on average, and the wait times remained the same, on average, for those who reported shorter wait times due using to the Pass2Go app. Figure 4-10 shows the average wait times for the recent rail trip reported by each of the three groups, indicating that they decreased by approximately one minute, on average.

Figure 4-7

Wait Times for Average Bus Trip

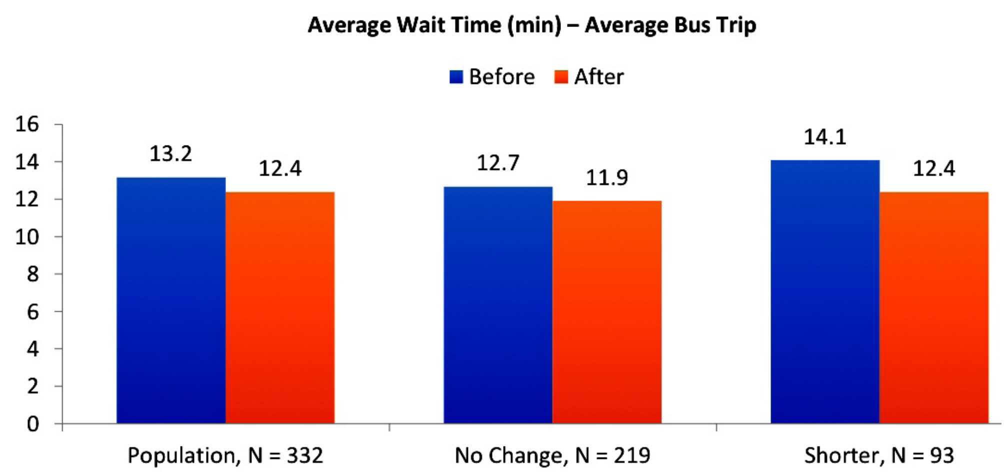


Figure 4-8

Wait Times for Recent Bus Trip

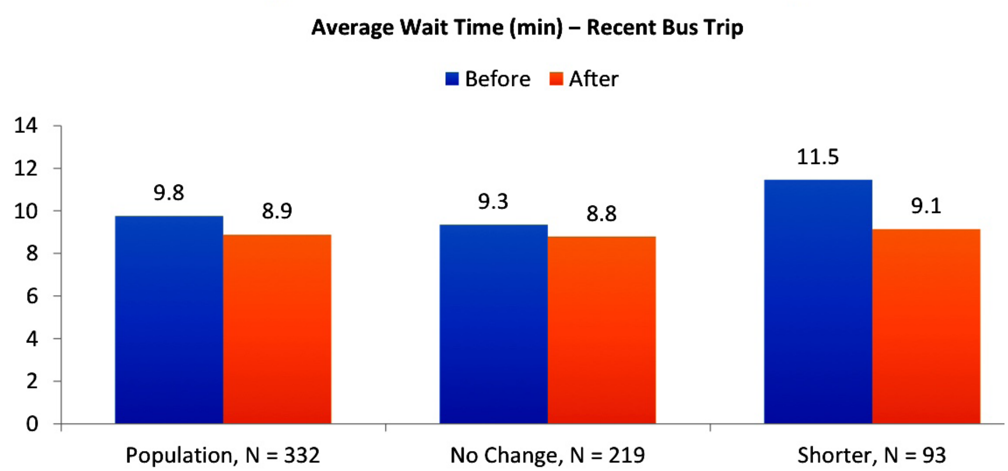


Figure 4-9

Wait Times for Average Rail Trip

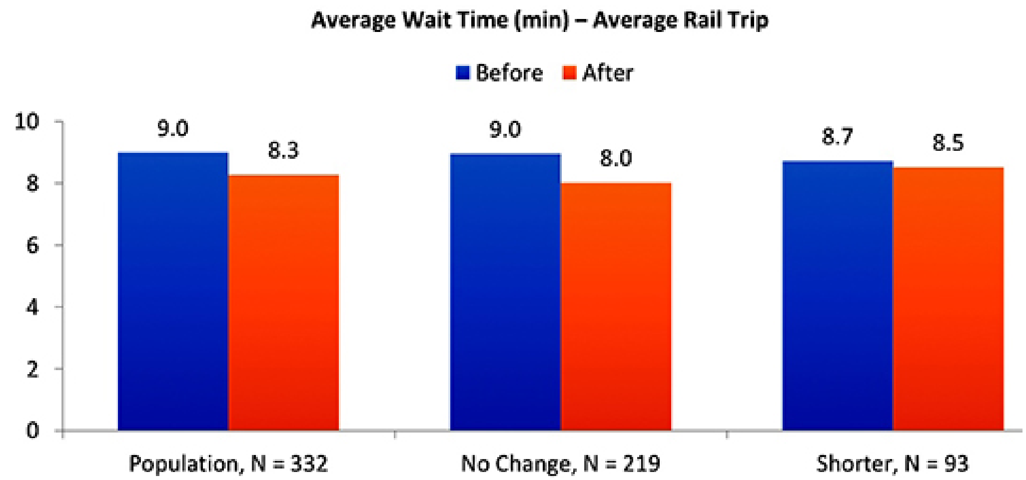
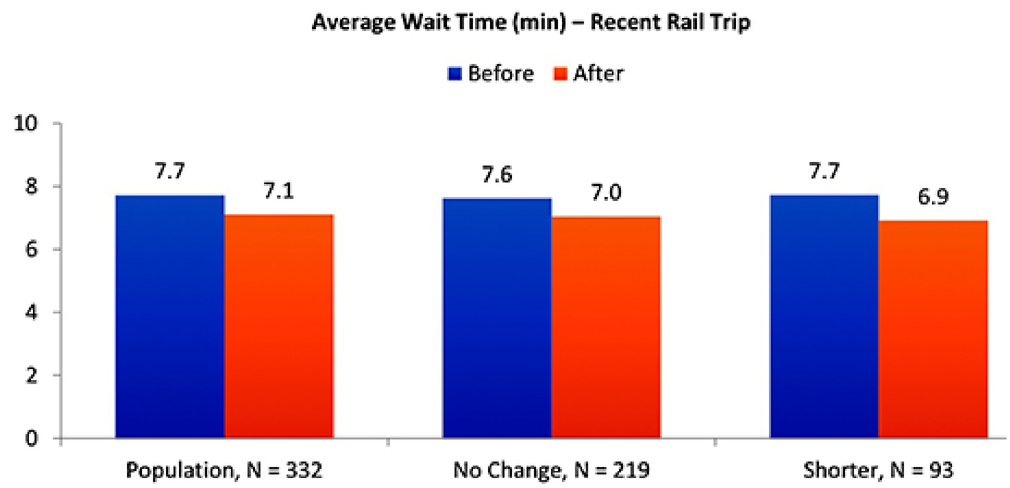


Figure 4-10

Wait Times for Recent Rail Trip



To test the statistical significance of the changes in wait times before and after using the Pass2Go Pilot, a one-tailed paired t-test was conducted, and the obtained P-values are reported in Table 4-2. For a P-value less than 0.05, the change in wait times was considered statistically significant at the 5% level. The results show that the decreases in wait times for the average and recent bus trips were significant for each of the three groups. The statistically significant decrease in wait time was two minutes for those who reported shorter wait times compared to the one-minute decrease for the other two groups and suggests that using the Pass2Go Pilot decreased the wait time of users. Results for the recent rail trip were close to significance but show a decrease of one minute only. This may be because rail trips tend to have few or no delays compared to bus trips, which leaves little room for improvement.

Table 4-2

Statistical Test Results for Wait Times

Trip	Group	Average Wait Time (min)		t-test (P-value)
		Before	*After*	
Average bus trip	Population, N = 332	13	12	0.03
	No change, N = 219	13	12	0.04
	Shorter, N = 93	14	12	0.04
Recent bus trip	Population, N = 332	10	9	0.02
	No change, N = 219	9	9	0.12
	Shorter, N = 93	11	9	0.01
Average rail trip	Population, N = 332	9	8	0.01
	No change, N = 219	9	8	0.00
	Shorter, N = 93	9	9	0.37
Recent rail trip	Population, N = 332	8	7	0.02
	No change, N = 219	8	7	0.06
	Shorter, N = 93	8	7	0.05

Overall, the statistically significant declines in reported wait times, which were slightly stronger for the group of respondents (28%) who reported the Pass2Go app as causing their wait times to decline, leads to conclusions supporting Hypothesis 2, that the app did reduce wait times.

Hypothesis 3: The average time to plan a trip ahead of time declines to a degree that is statistically significant.

Performance Metric	Key Finding
"Before" and "after" trip planning times of Pass2Go Pilot users.	Planning time measurements showed significant decreases for bus and rail trips, and a sizable minority reported that the app had reduced their planning time.

The third hypothesis explored was if the project decreased the average planning time of Pass2Go Pilot users. This hypothesis was evaluated using the "before" and "after" survey data of Pass2Go Pilot users. Respondents were asked to report their planning times for their recent bus and rail trips before and after using the Pass2Go app and also were asked to rate trip planning with using the Pass2Go Pilot app and evaluate its effect on their trip planning methods.

Respondents were asked about their changes in planning times as a result of using the Pass2Go app. Figure 4-11 shows that 54% of respondents reported no change in planning times, 5% reported longer planning times, and 37% reported shorter planning times as a result of using the Pass2Go app. As with Hypothesis 1 and Hypothesis 2, these results were used to group respondents into three categories. The self-reported planning times in the "before" and "after" surveys were then compared and tested for significance across the three groups. The analysis follows with the same structure as Hypotheses 1 and 2. Figure 4-12 shows the average planning times for the recent bus trip reported by each of the three groups. The planning times of the total population and those who reported shorter times decreased by one minute, on average, and the planning times remained approximately the same for those who reported no change. Figure 4-13 shows the average planning times for the recent rail trip reported by each of the three groups. The planning times remained approximately the same for the total population and those who reported no change, and the planning times decreased by one minute, on average, for those who reported shorter times.

Figure 4-11

Change in Planning Times as a Result of Using Pass2Go Pilot

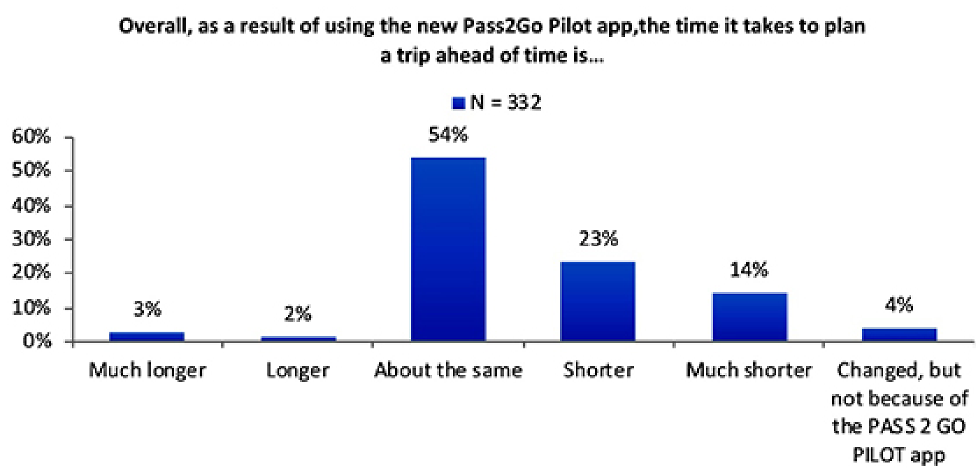


Figure 4-12

Planning Times for Recent Bus Trip

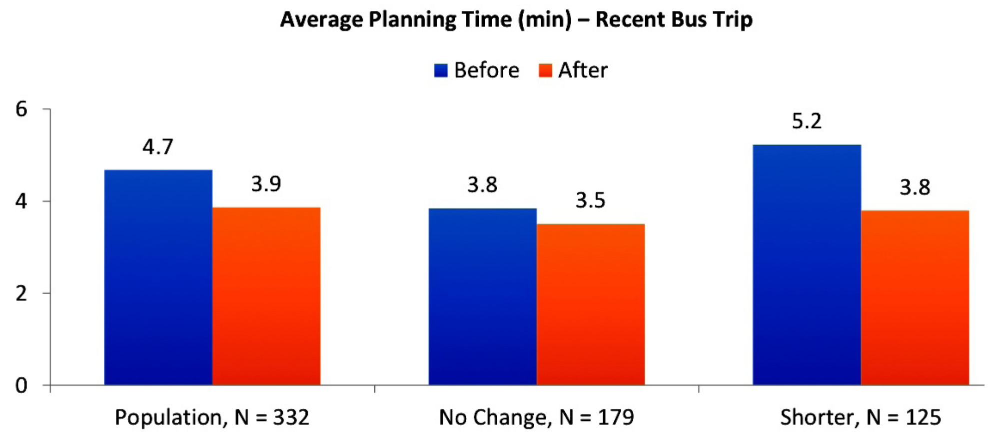
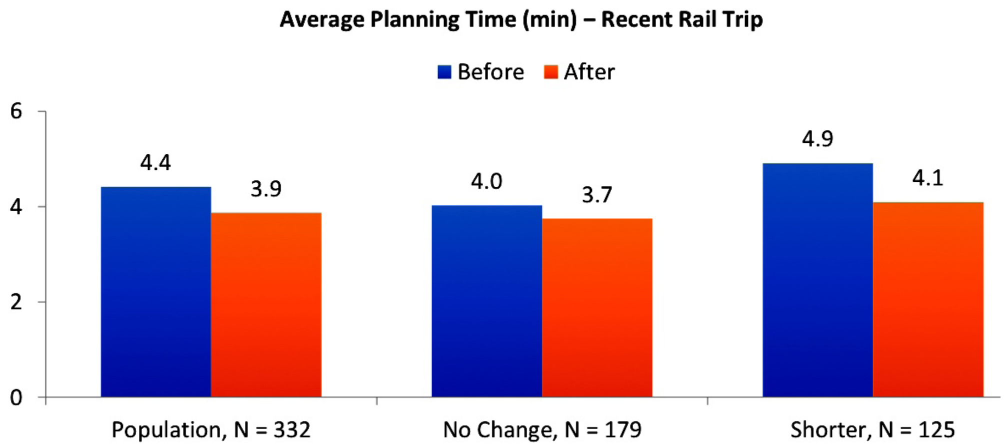


Figure 4-13

Planning Times for Recent Rail Trip



To test the statistical significance of the changes in planning times “before” and “after” the Pass2Go Pilot, a one-tailed paired t-test was conducted, and the obtained P-values are reported in Table 4-3. For a P-value less than 0.05, the change in travel times was considered statistically significant at the 5% level. The results show that the decreases in planning times for the user population and those who reported shorter times, for both the recent bus trip and rail trip, were statistically significant. This suggests that the Pass2Go app decreased the wait time of users, but the effect was not perceived by everyone.

Table 4-3

Statistical Test Results for Planning Times

Trip	Group	Average Planning Time (min)		t-test (P-value)
		Before	After	
Recent bus trip	Population, N = 332	5	4	0.02
	No change, N = 179	4	4	0.22
	Shorter, N = 125	5	4	0.02
Recent rail trip	Population, N = 332	4	4	0.06
	No change, N = 179	4	4	0.29
	Shorter, N = 125	5	4	0.06

The survey also asked respondents to rate trip planning using the new Pass2Go app. Overall, 57% of respondents gave a rating of 7 or higher, as shown in Figure 4-14; only 23% rated the app 5 or lower. This suggests that the trip planning functionality of the app was effective among users. The survey also asked respondents to describe the effect of using the Pass2Go app on their trip planning methods. In total, 55% reported improvements, as shown in Figure 4-15, and 39% reported no change in their planning methods due to the app.

Figure 4-14

Trip Planning Rating with Pass2Go App

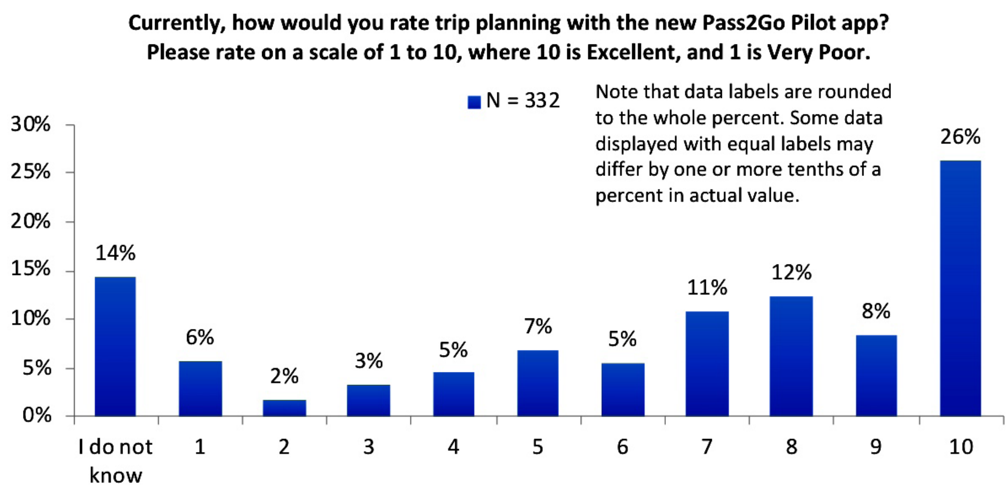
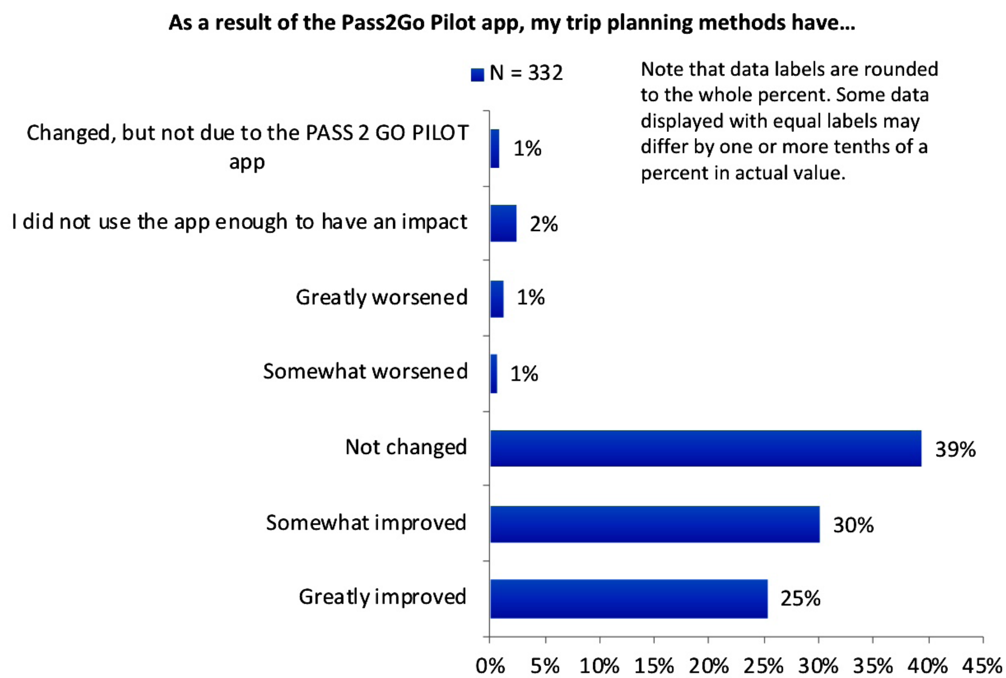


Figure 4-15

Effect of Pass2Go App on Trip Planning



Overall, the planning time changes and qualitative responses indicate that using the Pass2Go app decreased the average time to plan a trip ahead of time to a certain extent, but this effect was not perceived equally among the population of users. The findings generally supported Hypothesis 3.

Hypothesis 4: The number of downloads increases month over month.

Performance Metric	Key Finding
"Before" and after application download rates; "before" and "after" number of active users.	The number of downloads increased at the beginning of each of the three waves, and activity increased within each wave.

Figure 4-16 shows the number of app installations as a function of time, and Figure 4-17 shows cumulative installs. Wave 1 was from the end of March 2018 to the beginning of July 2018, Wave 2 was from the beginning of June 2018 to the beginning of October 2018, and Wave 3 was from the beginning of September 2018 to the end of December 2018. A few installs occurred in 2019. Both figures show an increased number of app installs at the beginning of each wave.

Figure 4-18 shows the number of active devices as a function of time. This number increased at the beginning of each wave, reached a peak, and then decreased toward its end. The number of active devices was an independent data point tracked by the pilot data system that counted the number of Android devices that had the app installed. Declines occurred when the app was uninstalled.

Figure 4-16

Installs by User

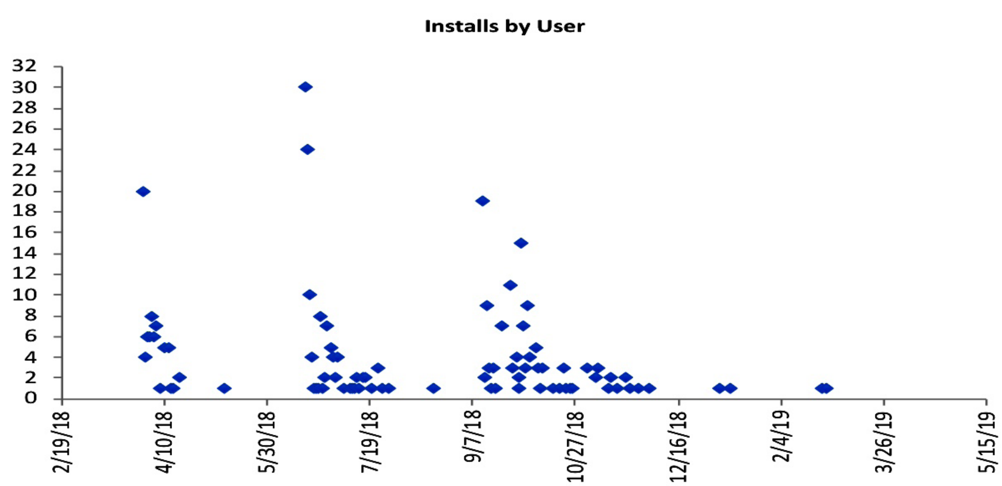


Figure 4-17

Cumulative Installs by User

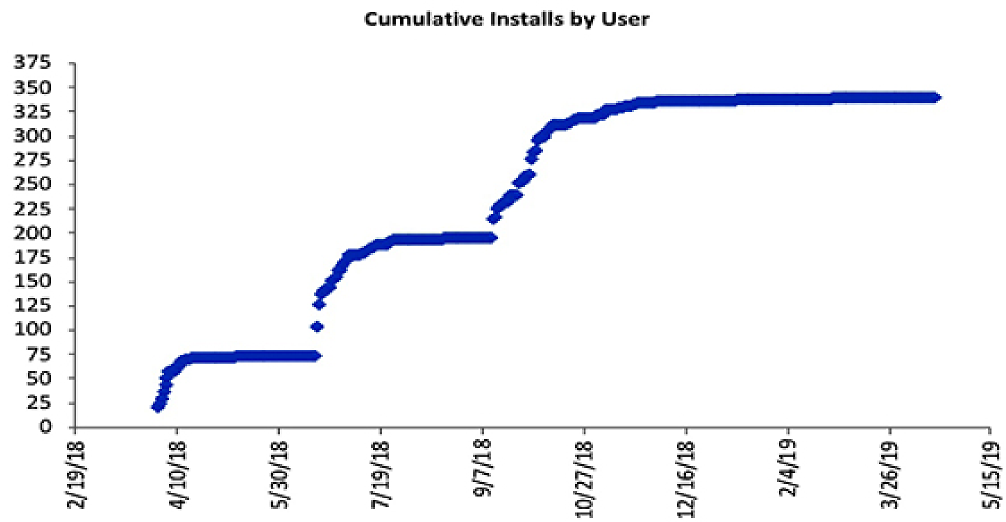
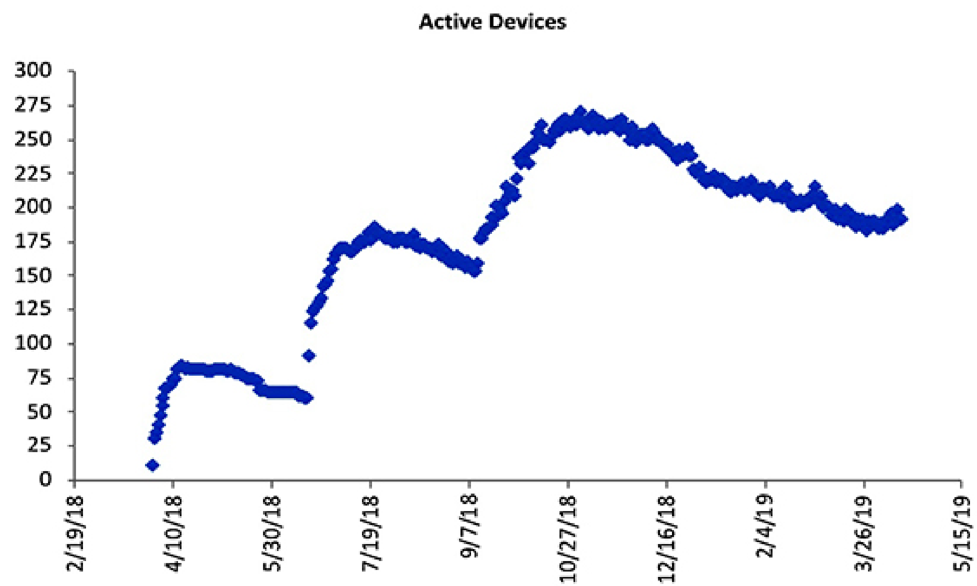


Figure 4-18

Number of Active Devices



Overall, the findings supported Hypothesis 4.

Hypothesis 5: The number of persons with disabilities using Pass2Go Pilot increases.

Performance Metric	Key Finding
"Before" and after compliance with Web Content Accessibility Guidelines (WCAG2.0); "before" and "after" satisfaction rating of ADA beta testing group; "before" and "after" application download rates among accessibility community.	The hypothesis ultimately could not confirm an increase in the number of users with disabilities, as the number of users was small, but it found that a majority of those using the accessibility features designed to support use by persons with a disability were satisfied with the app.

The “before survey” identified 11 respondents with disabilities, of which 4 used a wheelchair, 6 required special accommodations for transportation, and 7 required ADA-accessible vehicles and infrastructure to get around. The results are shown in Figures 4-19, 4-20, and 4-21.

Figure 4-19

Users with Disabilities – Wheelchair Users

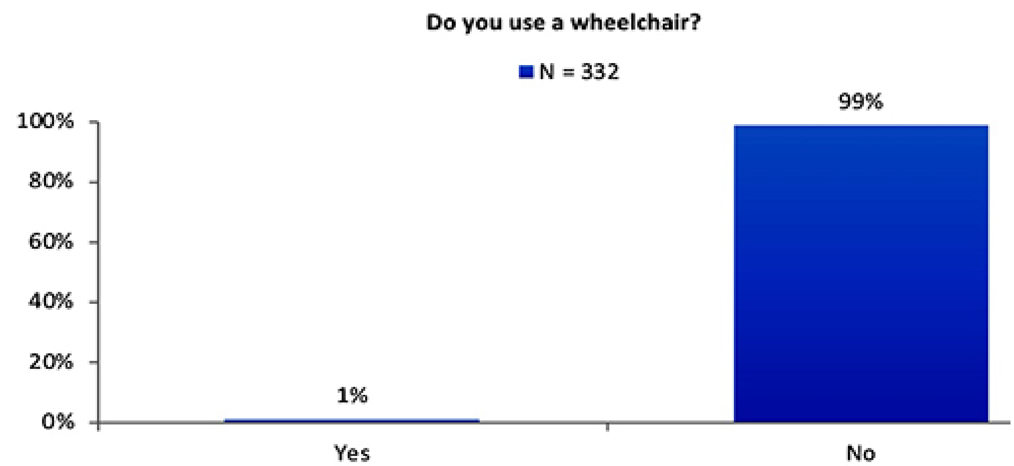


Figure 4-20

Users with Disabilities – Specialized Accommodations Required

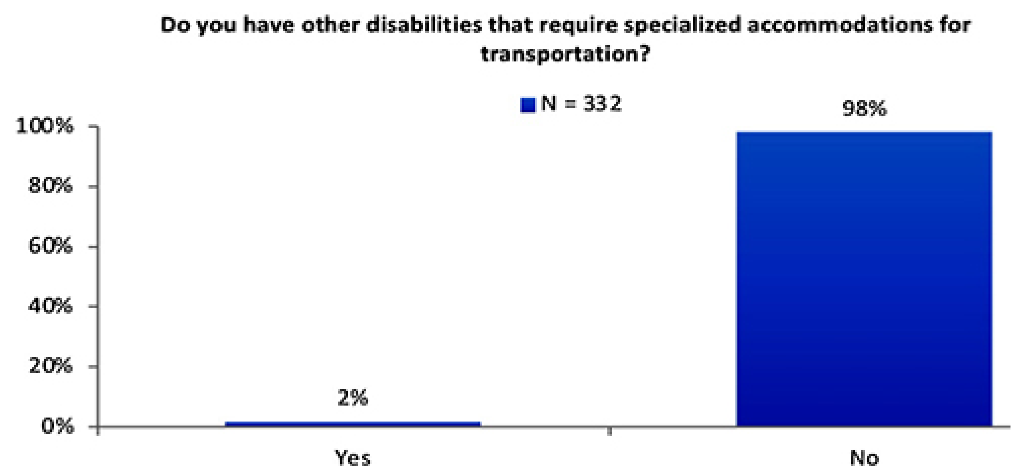
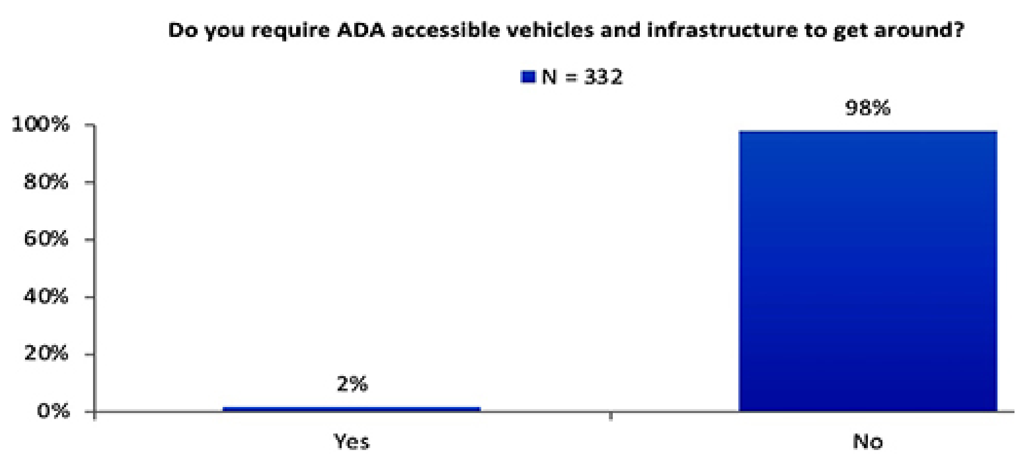


Figure 4-21

Users with Disabilities – ADA-Accessible Vehicles and Infrastructure Needed



The "after" survey asked app users if they had used any smartphone accessibility features. Figure 4-22 shows that 24 respondents had used such features. Some of the accessibility features used are highlighted in Figure 4-23 and include screen reader, text magnification, color contrast, and dictation. They also were asked to rate the compatibility of the Pass2Go app with accessibility features; Figure 4-24 shows that 75% gave a rating of 7 or higher.

Figure 4-22

Smartphone Accessibility Features

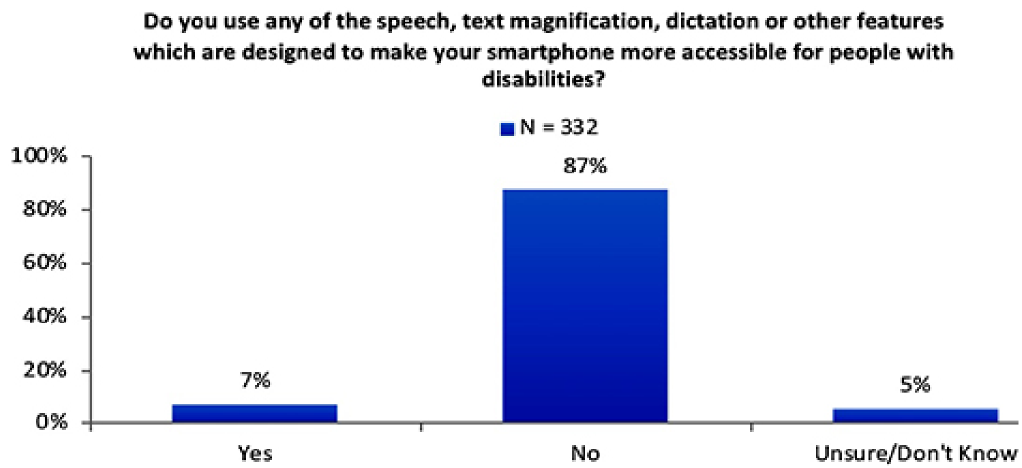


Figure 4-23

Smartphone Accessibility Features Used

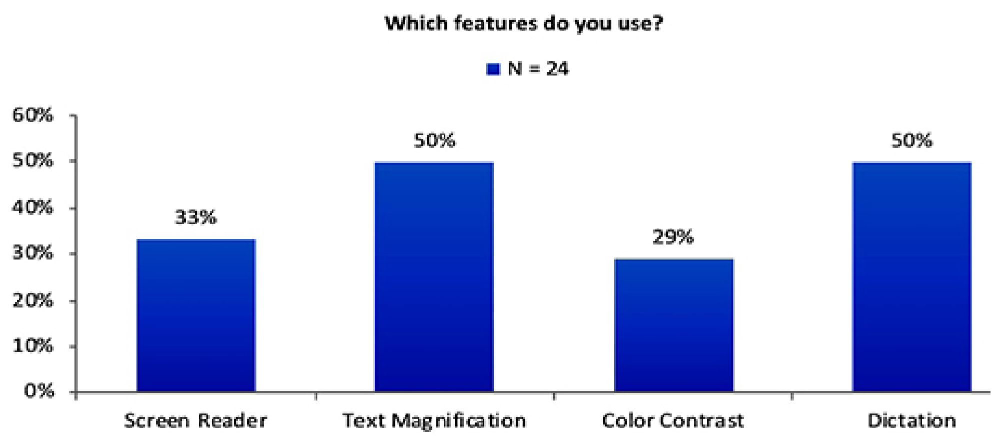
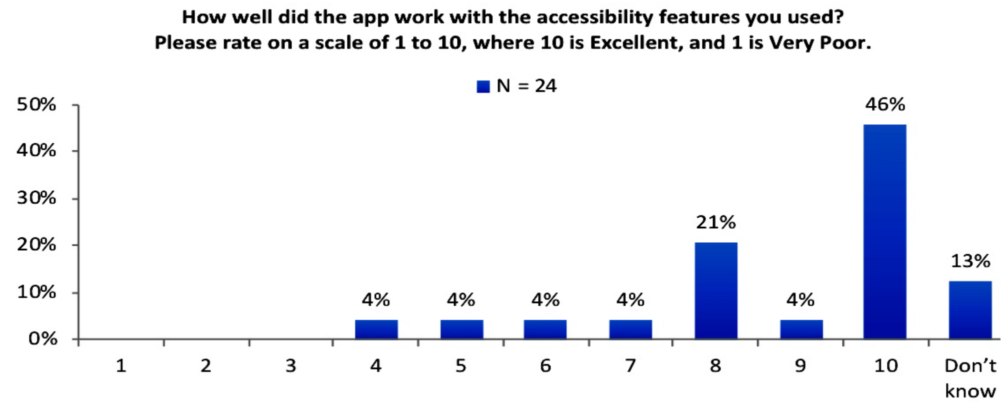


Figure 4-24

Pass2Go Smartphone Accessibility Features Rating



To test if people with disabilities experienced improved mobility due to the ADA components of the Pass2Go app, the "before" and "after" surveys asked them to rate their abilities to get to/from Valley Metro bus services, the Valley Metro rail line, and public transportation in the Phoenix area in general. The distributions of the results are shown in Figure 4-25 through Figure 4-29. To test if the "before" and "after" differences in ratings are statistically significant for each question, a Wilcoxon signed rank test was applied on the paired ratings at the 5% level. This non-parametric test is compatible with smaller sample sizes, and the results showed that the Pass2Go Pilot did not lead to a significant difference in ratings.

Respondents with disabilities generally rated their ability to get to transit to be pretty good. As shown, "before" and "after" ratings of access and egress abilities were generally reported to be 7 or above. Also, the average ratings appear to increase after using the app, except for that shown in Figure 4-29, which shows a slight decrease in average rating. However, the small sample size of 11 respondents is not enough to draw generalizations.

Figure 4-25

Users with Disabilities – Rating of Ability to Get to Valley Metro Bus

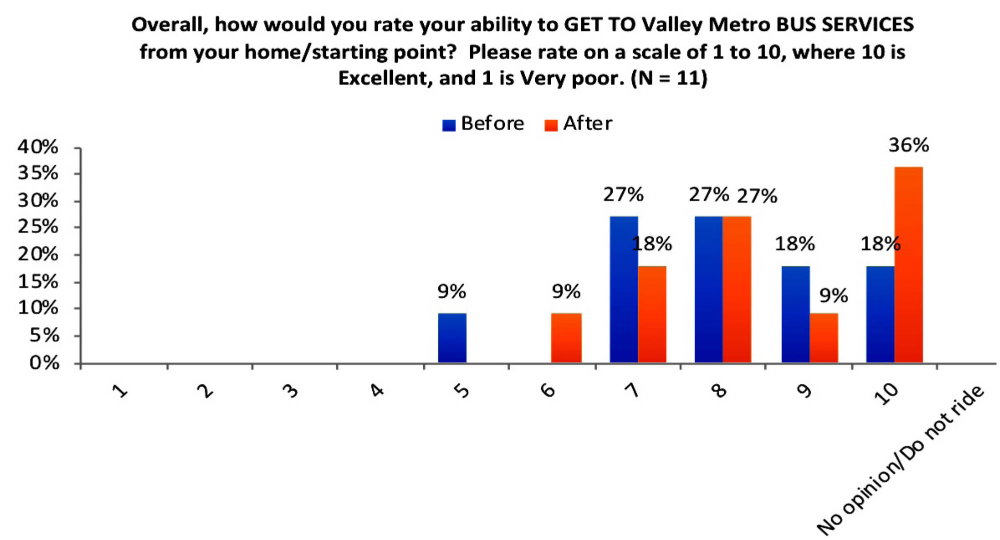


Figure 4-26

Users with Disabilities – Rating of Ability to Get from Valley Metro Bus

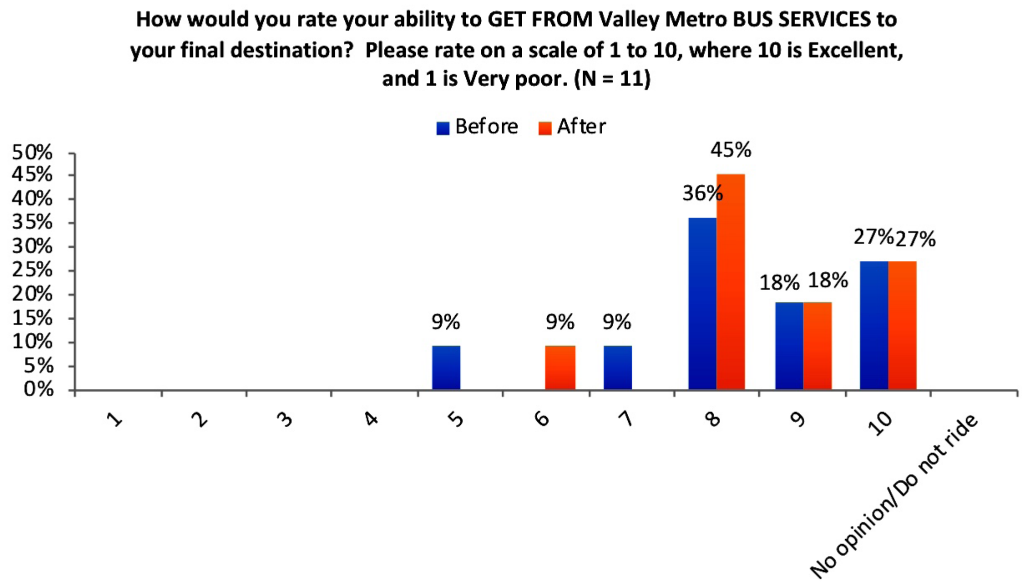


Figure 4-27

Users with Disabilities – Rating of Ability to Get to Valley Metro Rail

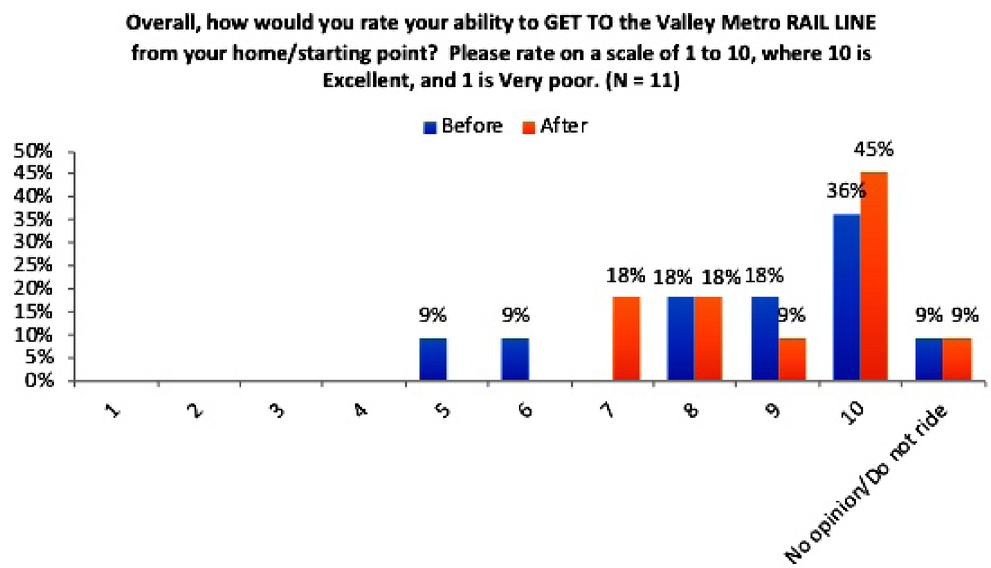


Figure 4-28

Users with Disabilities – Rating of Ability to Get from Valley Metro Rail

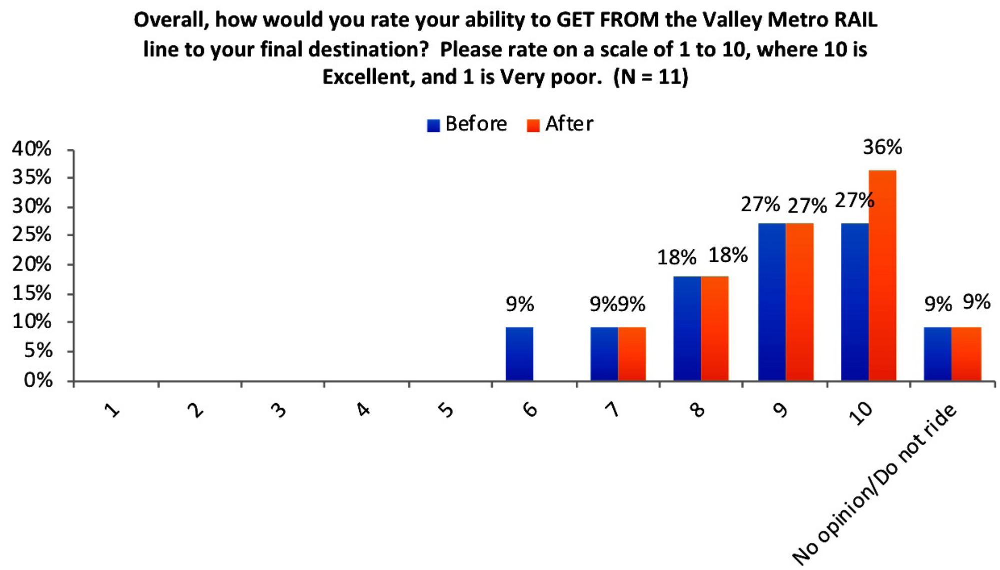
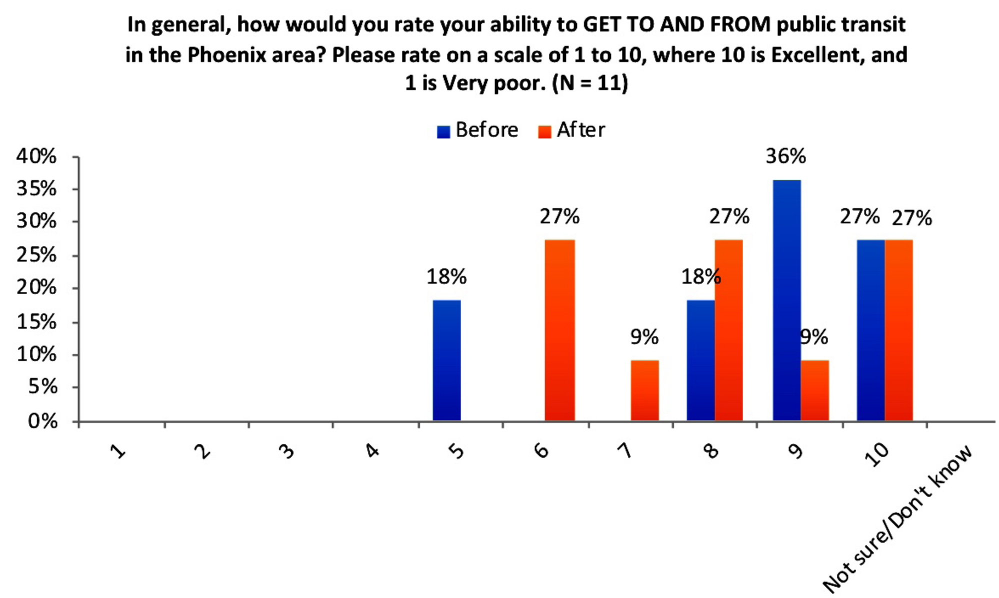


Figure 4-29

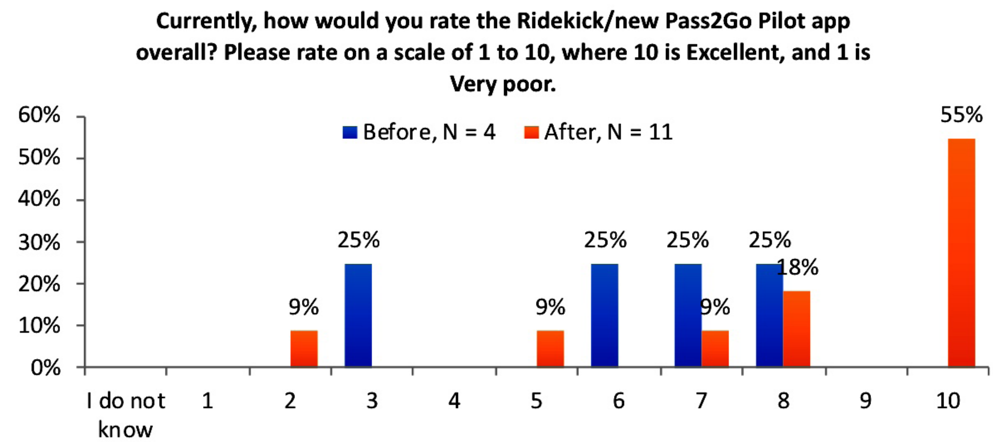
Users with Disabilities – Rating of Ability to/from Public Transportation in Phoenix



The "before" and "after" surveys also asked users with disabilities to rate the overall functioning of the Ridekick™ and Pass2Go apps, as shown in Figure 4-30. As only 4 users with disabilities had used the Ridekick™ app compared to 11 who used the new Pass2Go app, a "before" and "after" comparison was infeasible. Nevertheless, the results of the "after" survey show that 6 of 11 respondents gave a rating of 10.

Figure 4-30

Users with Disabilities – Ridekick™/Pass2Go App Overall Rating



In general, the results suggest that the users with disabilities surveyed were satisfied with the overall functioning of the Pass2Go app and clearly considered it to be an improvement. Although the results were promising, the small sample size limited the capacity for more generalized conclusions regarding if the number of users with disabilities increased. Therefore, the evidence supporting Hypothesis 5 is considered to be inconclusive.

Hypothesis 6: Users report greater connectivity with public transportation using information augmented in Pass2Go Pilot.

Performance Metric	Key Finding
User-reported perception of connectivity as a result of the Pass2Go Pilot app enhancements.	Ratings of the app's ability to connect to/from public transit increased, and a sizable majority reported improved access to public transit due to the app, suggesting that it led to greater connectivity of users on public transportation.

To test if Pass2Go app users experienced greater connectivity with public transport, the "before" and "after" surveys asked them to rate their abilities to get to/from Valley Metro bus services, the Valley Metro rail line, and public transportation in the Phoenix area in general. Distributions of the results are shown in Figure 4-31 through Figure 4-35. To test if the "before" and "after" differences in ratings were statistically significant for each question, a Wilcoxon signed rank test was applied on the paired ratings at a significance level of 5%. The results were all statistically significant, in that the distribution of ratings in the "after" survey were on balance greater than those in the "before" survey by a statically significant margin. Also, observing the "before" and "after" distributions shows that responses are skewed towards ratings of 7 or above in general.

Figure 4-31

All Users – Rating of Ability to Get to Valley Metro Bus

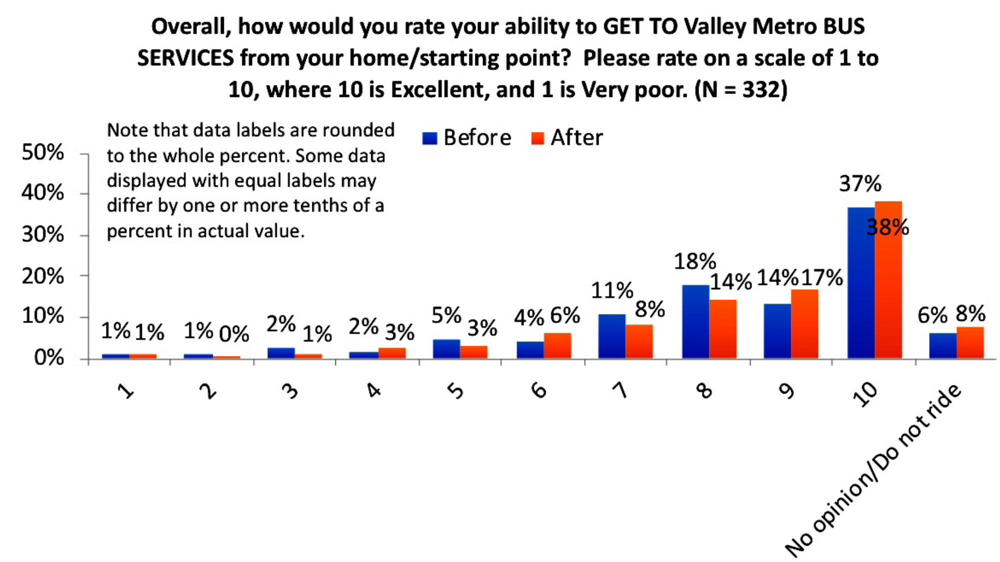


Figure 4-32

All Users – Rating of Ability to Get from Valley Metro Bus

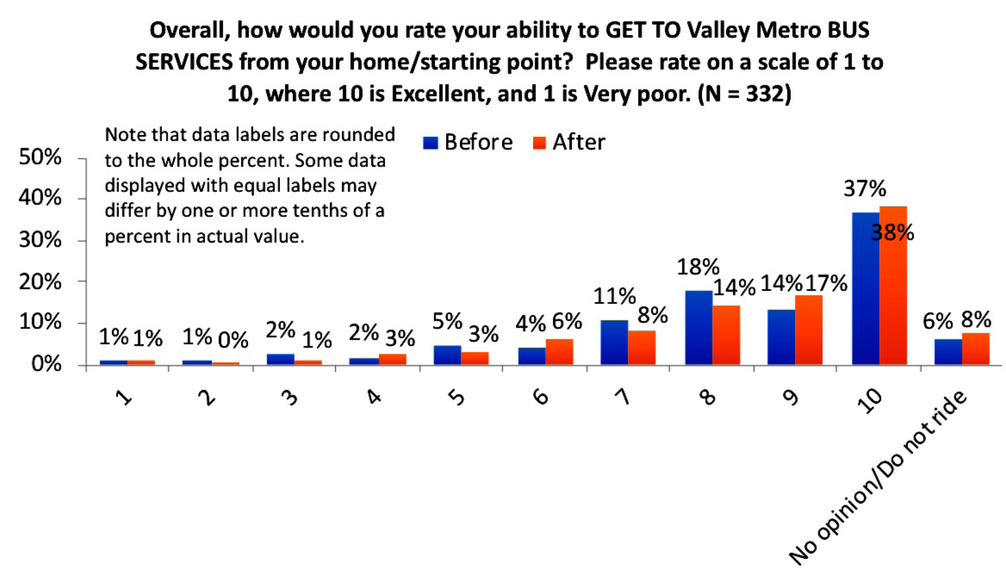


Figure 4-33

All Users – Rating of Ability to Get to Valley Metro Rail

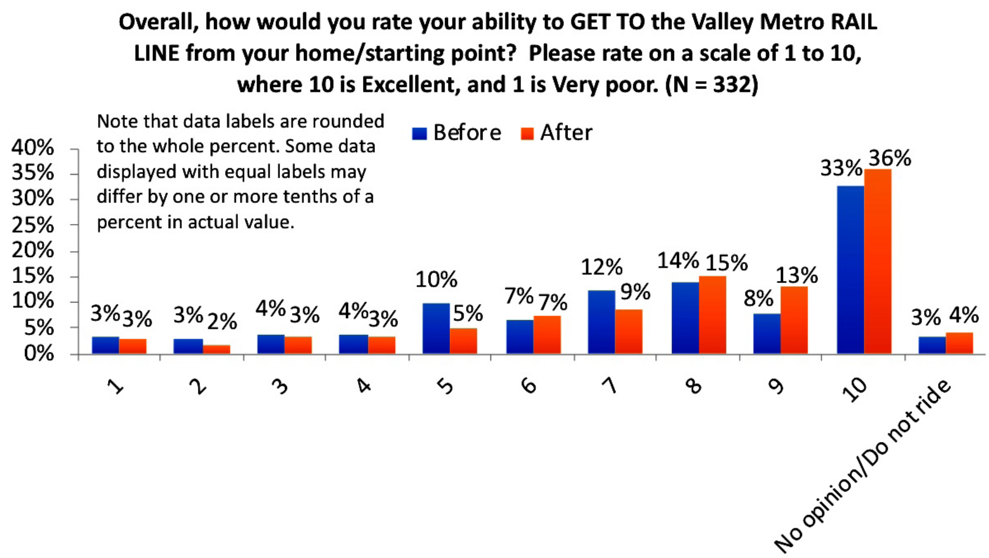


Figure 4-34

All Users – Rating of Ability to Get from Valley Metro Rail

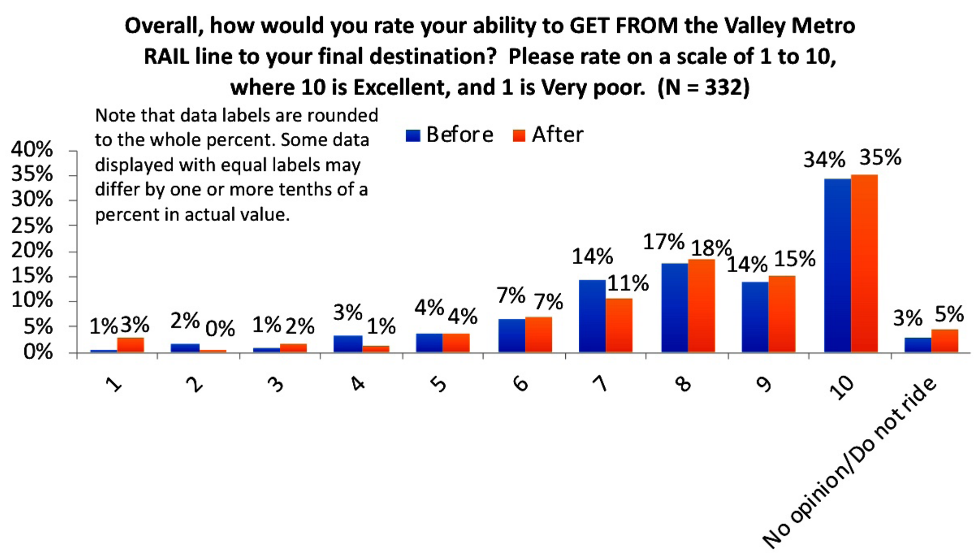
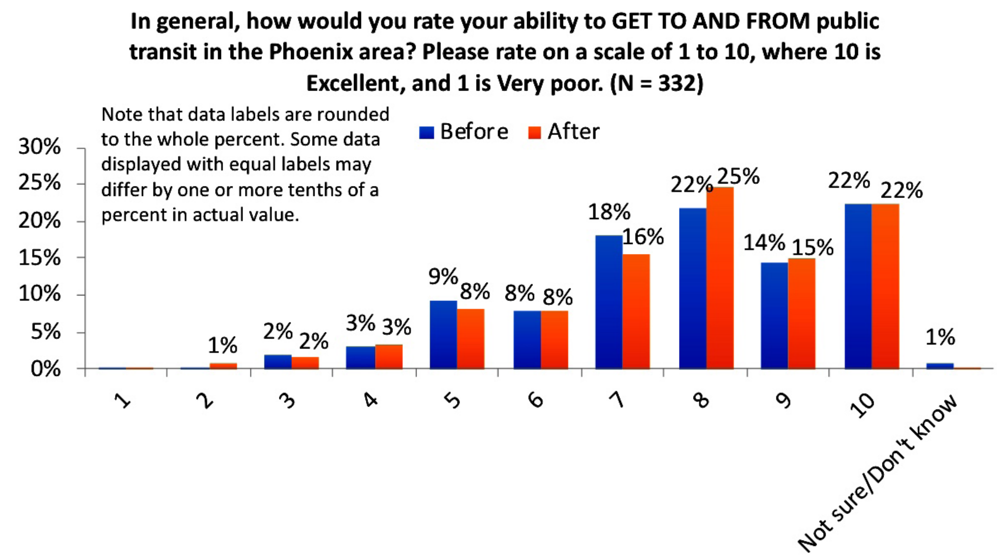


Figure 4-35

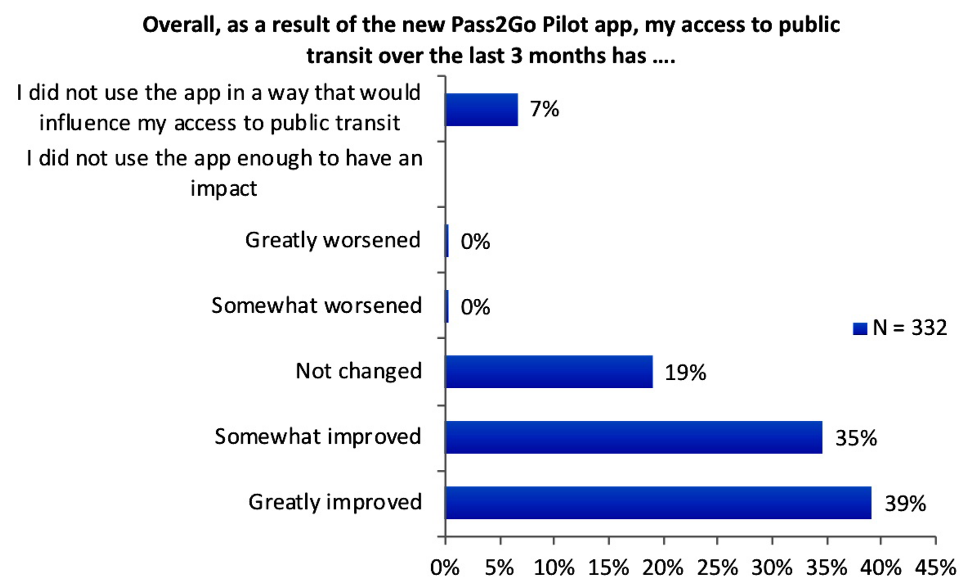
All Users – Rating of Ability to/from Public Transportation in Phoenix



Respondents were asked to assess the change in their access to public transportation as a result of using the Pass2Go app. Results in Figure 4-36 show that 74% reported improved access to public transportation due to using the Pass2Go app, and 19% reported no change.

Figure 4-36

All Users – Effect of Pass2Go App on Access to Public Transportation



Overall, the results show that users reported greater connectivity with public transportation using information augmented in Pass2Go app, supporting Hypothesis 6.

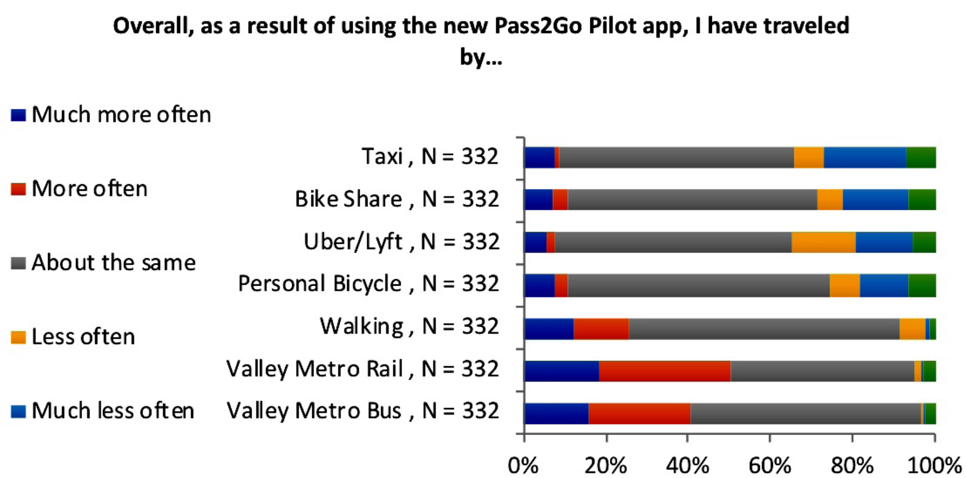
Hypothesis 7: User behavior shows greater use of connecting modes through measured activity.

Performance Metric	Key Finding
"Before" and after number of first-mile/last-mile trips made by Pass2Go Pilot users	The frequency of use of connecting modes to/from public transit increased to a degree that is statistically significant.

To evaluate if respondents used connecting modes to public transportation more often, the survey asked about the effect of the Pass2Go app on frequency of use of certain modes. Results in Figure 4-37 show that 50% of Valley Metro rail and 41% of Valley Metro bus respondents reported traveling more often on these modes and more often by various modes that can connect to/from public transportation, with 26% by walking, 11% each by personal bicycle and bikeshare, 8% by Uber/Lyft, and 9% by taxi.

Figure 4-37

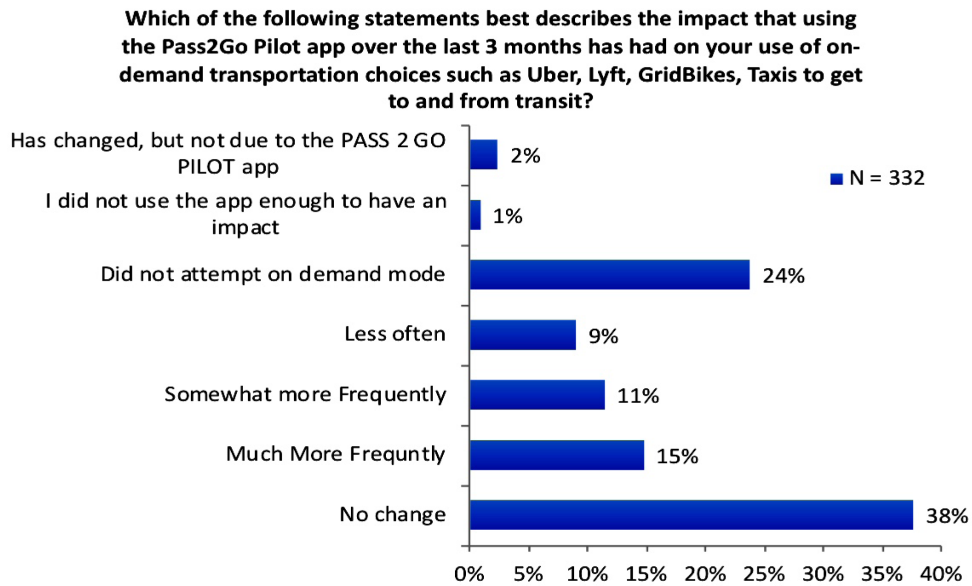
All Users – Effect of Pass2Go App on Mode Use Frequency



The survey also asked people to assess the change in their use of on-demand transportation to connect to and from transit as a result of the Pass2Go app. Results in Figure 4-38 show that 26% of respondents used on-demand transportation more frequently to connect to and from transit and 38% reported no change. This confirms the previous observation that users traveled more by connecting modes to/from public transportation due to the Pass2Go app.

Figure 4-38

All Users – Effect of Pass2Go App on On-Demand Transportation Use



Respondents were asked about their mode choice to get to/from their recent bus and rail trips. The "before" and "after" mode shares of users were compared to determine if there were any significant changes due to the Pass2Go app. Specifically, the Stuart-Maxwell test, which is a generalization of McNemar's test, was applied in this case. This is a non-parametric test that assesses if a statistically significant change in proportions have occurred at two points in time on the same population due to a certain treatment. In this case, the "before" and "after" mode choices were extracted at the user level to generate a "before" and "after" mode share matrix for each recent trip to/from bus and rail. The null hypothesis was that there are no changes in mode share "before" and "after" using the Pass2Go app. The test statistic follows a Chi-squared distribution and was tested at a 5% significance level. It should be noted that the test was conducted at a user level and may suggest significant changes, but the total mode share in the figures below may not show any differences.

Figure 4-39 through Figure 4-42 show the before-and-after mode shares of users to get to/from their recent bus and rail trips. No general trend can be observed, and the results of the Stuart-Maxwell test were insignificant for each of the four trips. The recent trip, while offering accuracy of recollection, may not represent a user's typical mode choice. Respondents were asked more generally to estimate their use frequencies of connecting modes to/from Valley Metro public transportation. Results were aggregated in Figure 4-43 to show the "before" and "after" mode share at a frequency of at least once per week to represent frequent users.

The Stuart-Maxwell test was conducted on the "before" and "after" distributions. The result was significant at the 1% level, indicating that the "before" and "after" mode choices of frequent users to connect to/from public transportation changed to a degree that is statistically significant.

Figure 4-39

"Before"/"After" Mode Share from Origin to Recent Bus Trip

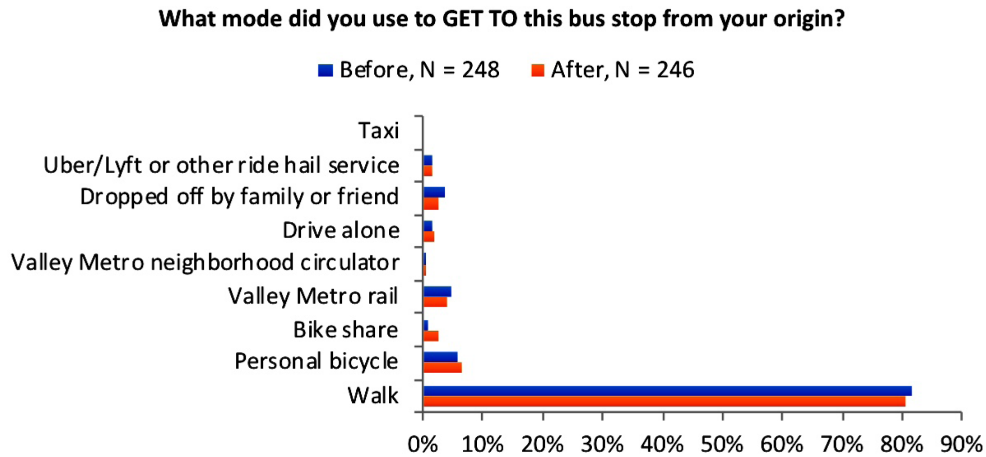


Figure 4-40

"Before"/"After" Mode Share from Recent Bus Trip to Destination

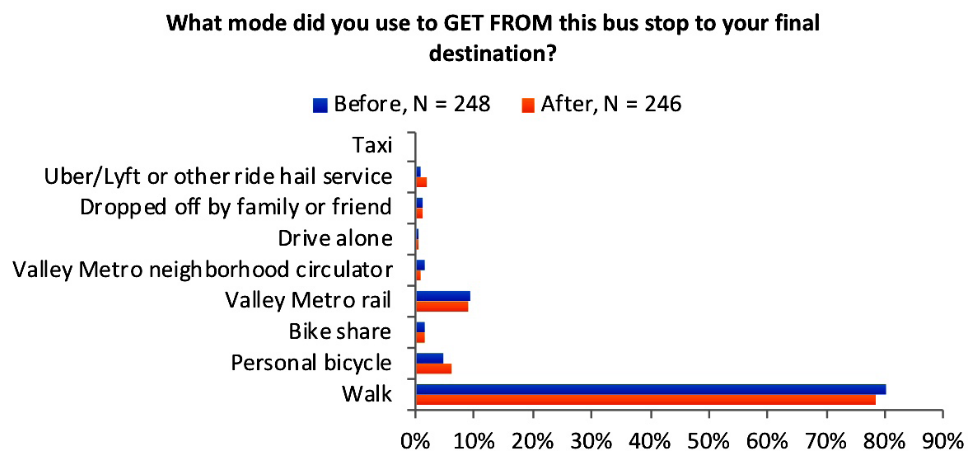


Figure 4-41

"Before"/"After" Mode Share from Origin to Recent Rail Tripn

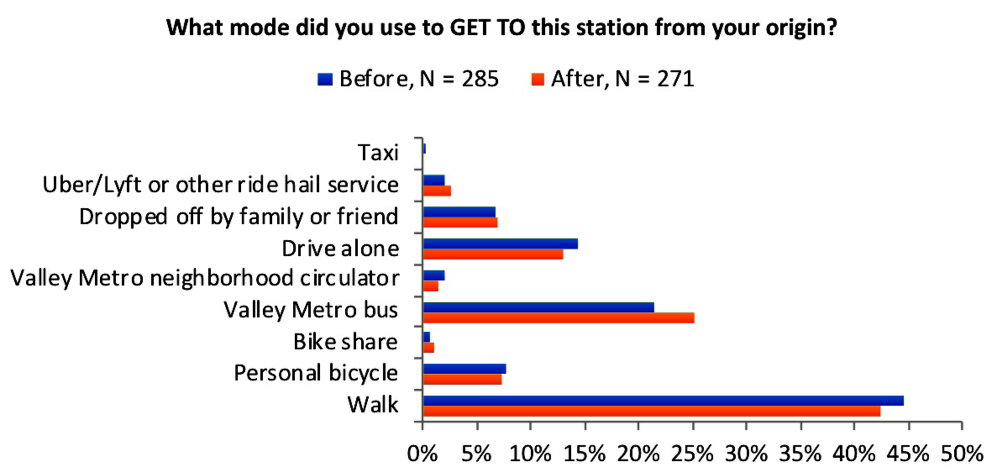


Figure 4-42

"Before"/"After" Mode Share from Recent Rail Trip to Destination

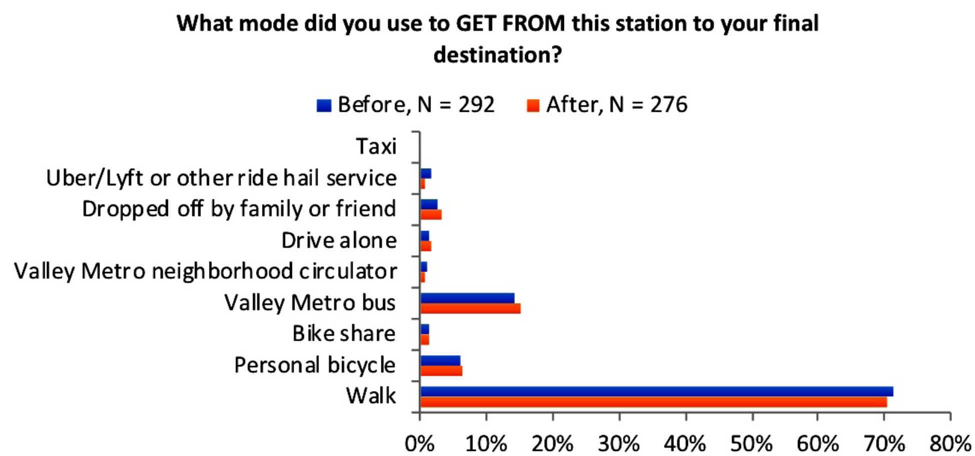
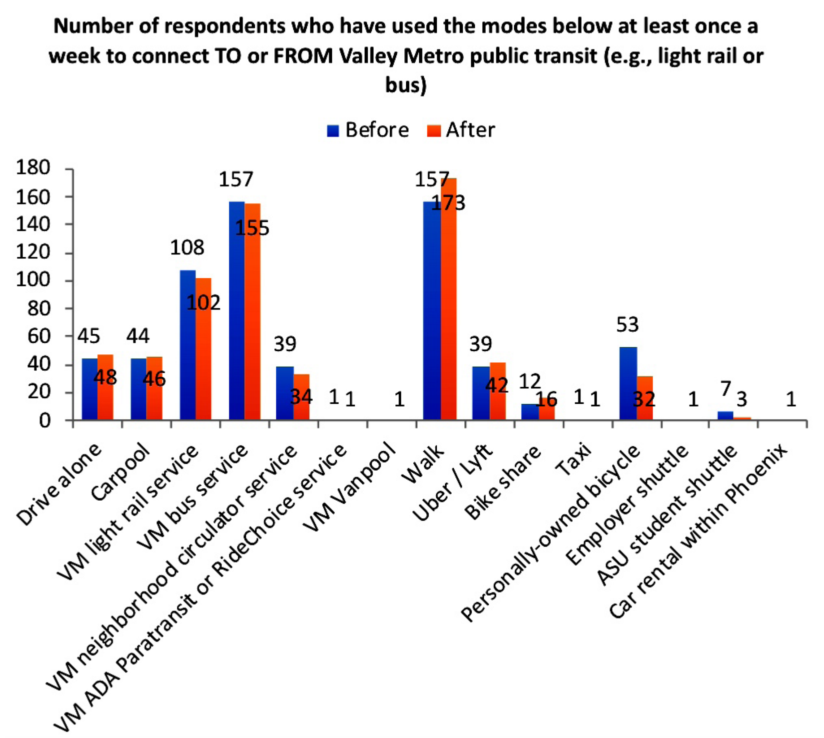


Figure 4-43

"Before"/"After" Mode Share (At Least Once a Week)



Overall, the results of the analysis generally support Hypothesis 7.

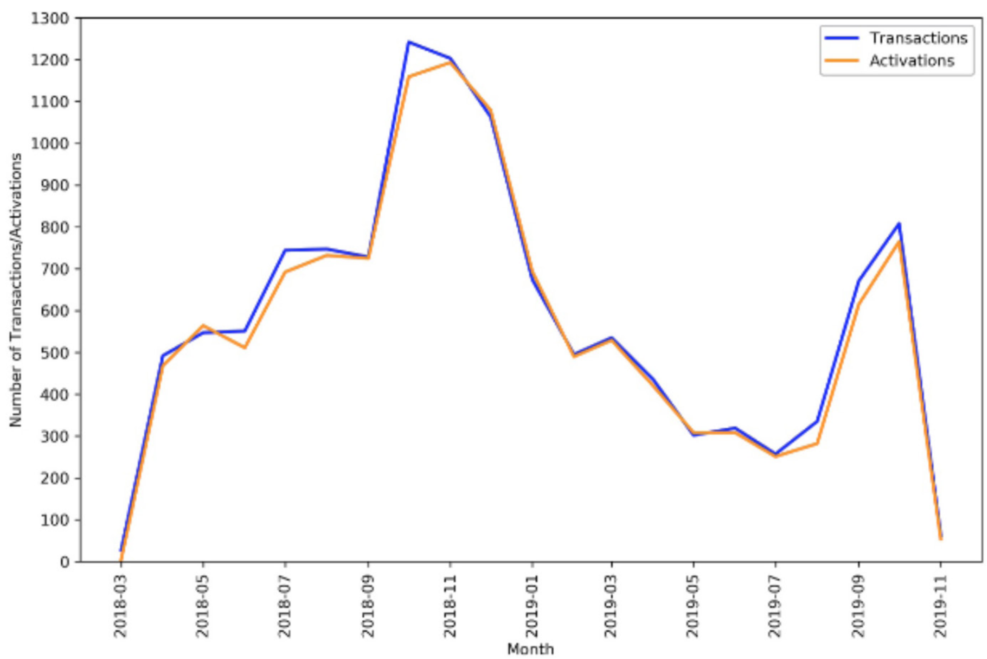
Hypothesis 8: Users pay for multiple different transportation modes using the Pass2Go Pilot app.

Performance Metric	Key Finding
Number of multimodal trips paid for by Pass2Go Pilot users, including average number of modes used per trip	The hypothesis could not be evaluated in the form originally stated due to data limitations. The analysis found that transactions during the pilot project were very active and that almost all passes purchased on the platform were used.

To test if users paid for multiple modes of transportation using the Pass2Go app, app payment data were analyzed. The intent of this hypothesis was to test the ability and effectiveness of an integrated single payment system; however, the data available did not include any mode information, and, thus, the hypothesis was tested regardless of the mode being used. The data included 12,239 transactions for 626 users from March 2018 through November 2019. The start dates of the three waves of this study were approximately as follows: Wave 1 started on March 30, 2018, Wave 2 started on June 5, 2018, and Wave 3 started on September 2, 2018. Using the Pass2Go app, users were able to purchase a pass at a flat rate of $4 and activate it at any time to access public transportation only. Once activated, the pass expired the next day at 2:59 AM. Figure 4-44 shows the distribution of pass transactions and activations per month over the study period.

Figure 4-44

Time Trend of Pass Transactions and Activations



Of the 12,239 transactions, 11,760 passes were activated, the average time to activate a pass after its purchase was 89 hours, and the median was 19 hours. Figure 4-45 and Figure 4-46 show the distributions of the time to activate a pass after its purchase.

Also, the data were aggregated at a user level, and Table 4-4 shows the calculated statistics. For a flat rate of $4 per pass, the average sales amount per user was $78, and the total amount of sales was $48,956. Figure 4-47 and Figure 4-48 show the distributions of the number of passes purchased/activated per user, and Figure 4-49 shows the distribution of the number of passes not activated per user.

Figure 4-45

Time to Pass Activation After Purchase (All Transactions)

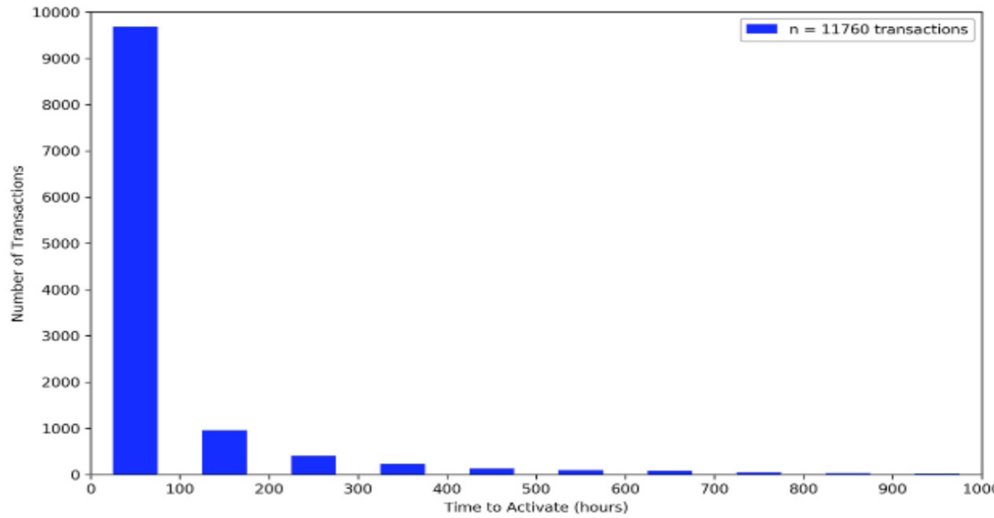


Figure 4-46

Time to Pass Activation After Purchase (95% of Transactions)

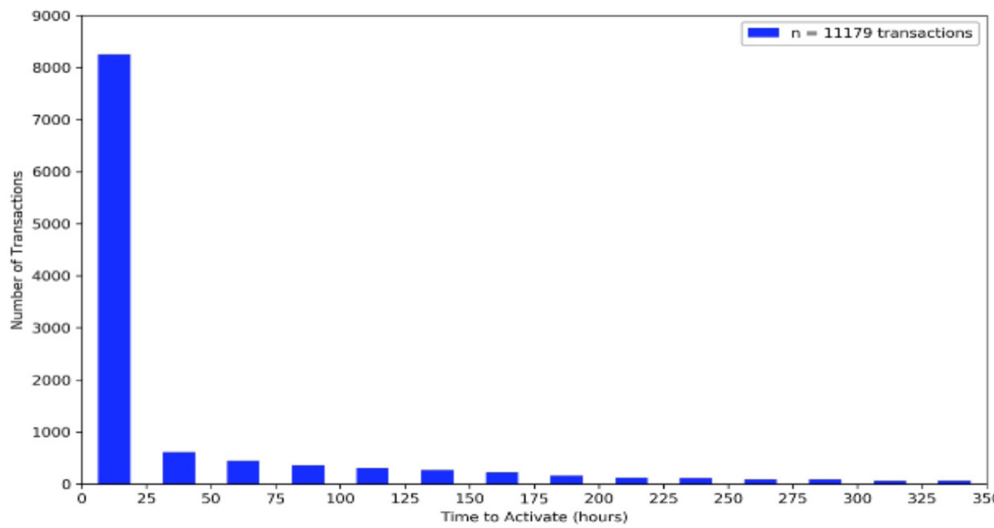


Table 4-4

Transaction Statistics at User Level

Statistic	Passes Purchased (per user)	Passes Activated (per user)	Passes Not Activated (per user)	Sales ($/user)
Minimum	1	0	0	4
Maximum	372	371	12	1488
Mean	20	19	1	78
Median	12	12	0	48

Figure 4-47

Passes Purchased/ Activated Per User (All Users)

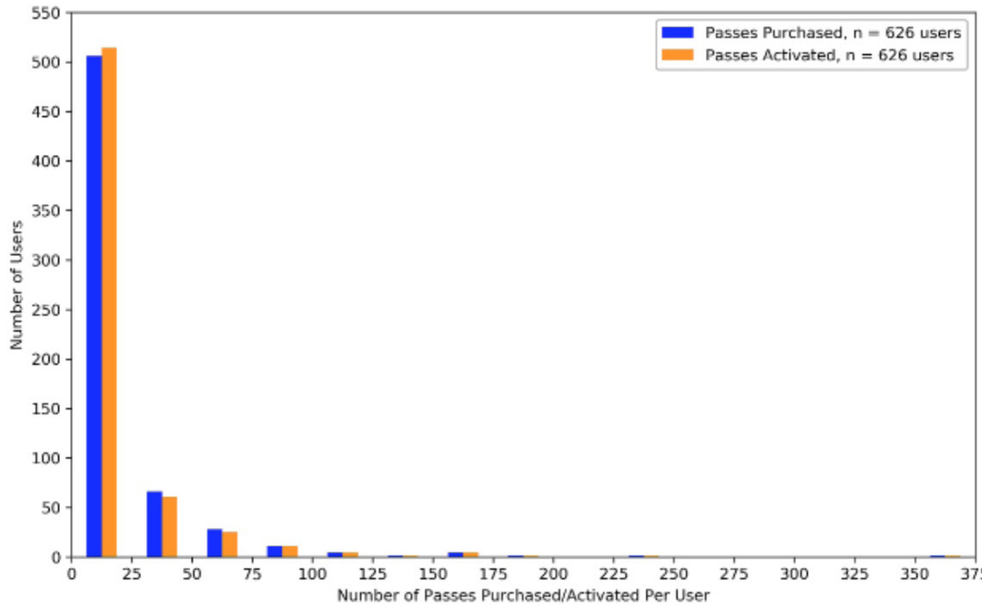


Figure 4-48

Passes Purchased/ Activated Per User (99% of Users)

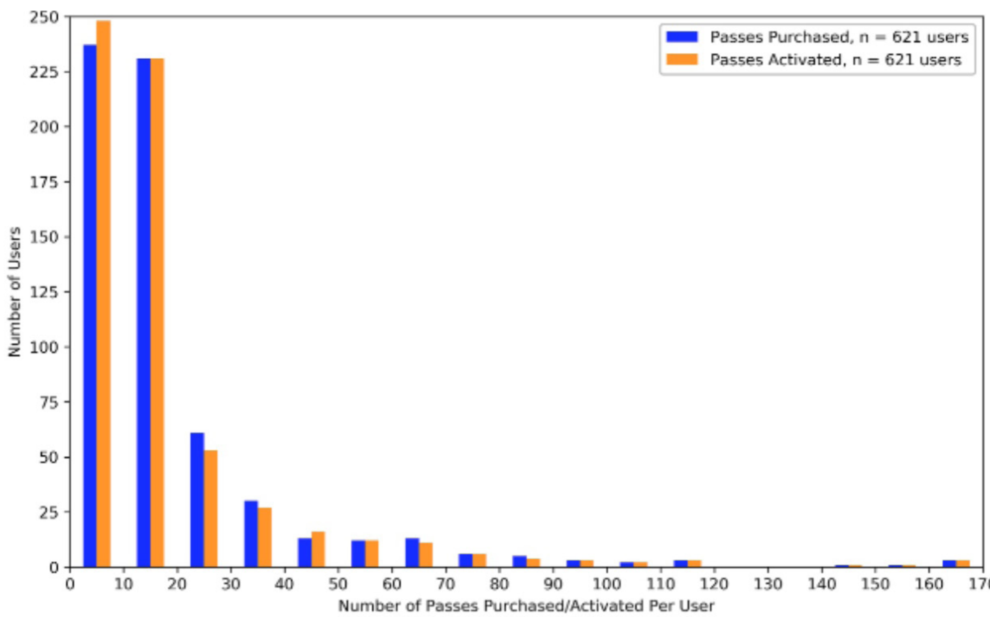
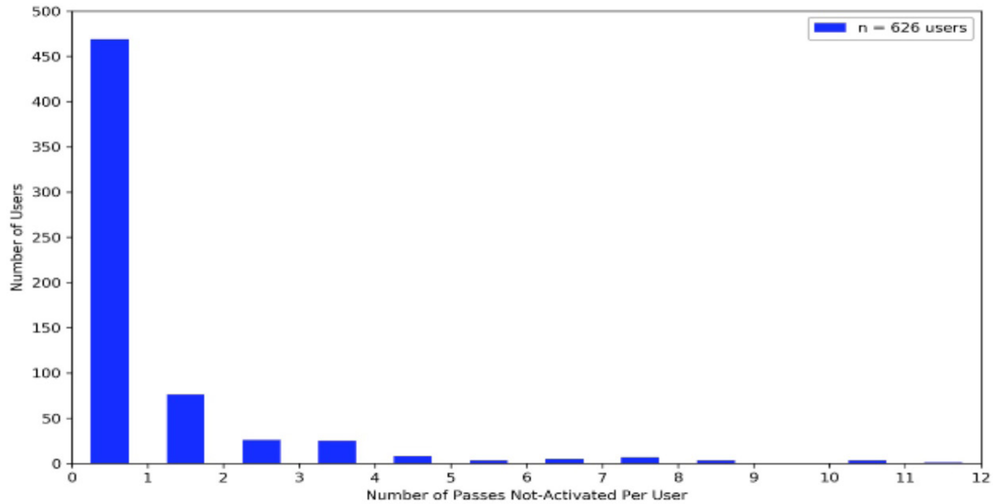


Figure 4-49

Passes Not Activated Per User



Because of the way the payment system was designed, Hypothesis 8 was not testable as originally intended because the price of using any mode was flat, and there was no way to determine which mode was used by an activated pass. However, the analysis found relatively robust payment activity and use of the app for transit pass purchases that continued after the waves had ended. Respondents continued to use the app, even though the wave in which they were included had ended. The hypothesis that users pay for multiple modes using the app might be assumed at the level of use observed and the fact that respondents reported a healthy mix of public bus and rail use. However, because use of all modes was a flat fare and the data did not have any other attributes defining which mode was being purchased, the conclusions of the Hypothesis 8 analysis are mixed.

Hypothesis 9: Pass2Go Pilot users consider the travel experience to be enhanced with real-time travel information and routing.

Performance Metric	Key Finding
Reported perception of near real-time traveler information and routing capabilities within the augmented Pass2Go Pilot app.	Around half of respondents experienced improved access to real-time traveler information and improved trip planning methods. Ratings of the Pass2Go app were significantly higher than those of Ridekick™.

To test if Pass2Go app users considered their travel experience to be enhanced, the “before” and “after” surveys asked them to rate the overall functionality, trip planning, and real-time traveler information with the Ridekick™ and Pass2Go apps, with results shown in Figure 4-50, Figure 4-51, and Figure 4-52. To test if the “before” and “after” differences in ratings were statistically significant for each question, the Wilcoxon signed rank test was applied on the paired ratings at the 5% level. As only 120 users had used Ridekick™ previously, only 120 “before” and “after” pairs of ratings were used as input for the test. The results were all statistically significant, indicating that the ratings in the “after” survey were, on balance, greater than those in the before survey.

Figure 4-50 shows that 89% of respondents gave a rating of 7 or higher for the overall functionality of the Pass2Go app, Figure 4-51 shows that 58% gave a rating of 7 or higher for trip planning with the Pass2Go app, and Figure 4-52 shows that 55% gave a rating of 7 or higher for their access to real-time traveler information for public transportation with the Pass2Go app. The survey also asked users to assess the change in their real-time traveler information and routing capabilities as a result of the Pass2Go app. Results in Figure 4-53 show that 59% of respondents experienced improved access to real-time traveler information due to the Pass2Go app and 32% experienced no change. The survey also asked users to assess the change in their trip planning methods as a result of the Pass2Go app. Results in Figure 4-54 show that 55% of respondents experienced improved trip planning methods due to the Pass2Go app and 39% experienced no change.

Figure 4-50

All Users – Ridekick™/Pass2Go App Overall Rating

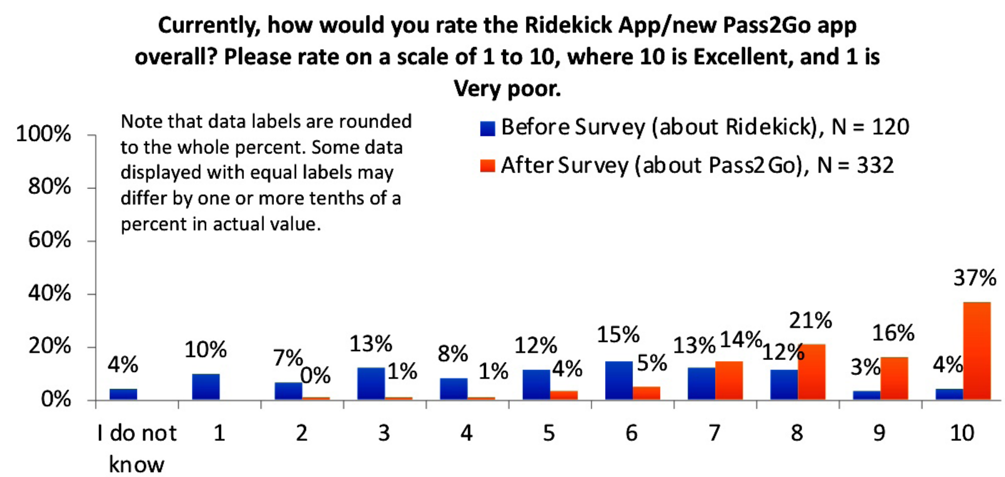


Figure 4-51

All Users – Ridekick™/Pass2Go App Trip Planning Rating

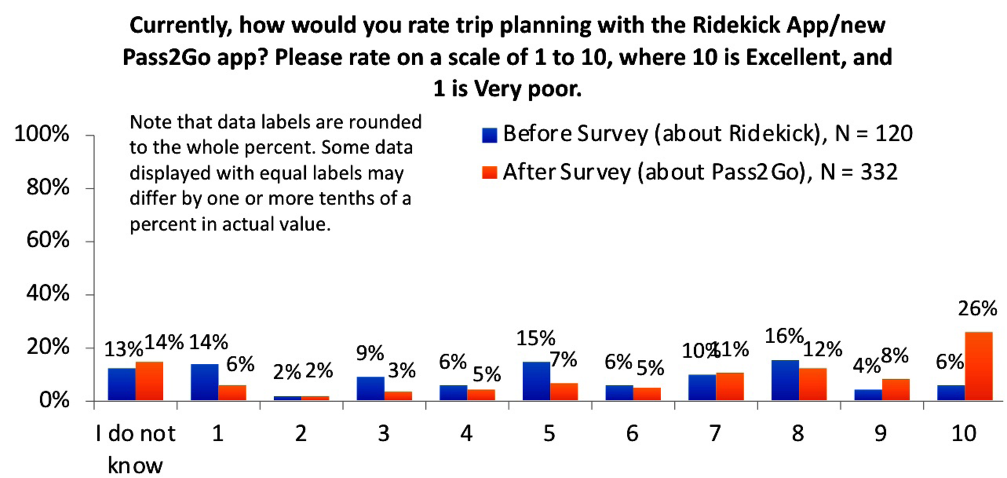


Figure 4-52

All Users – Ridekick[TM]/Pass2Go App Access to Real-Time Traveler Information Rating

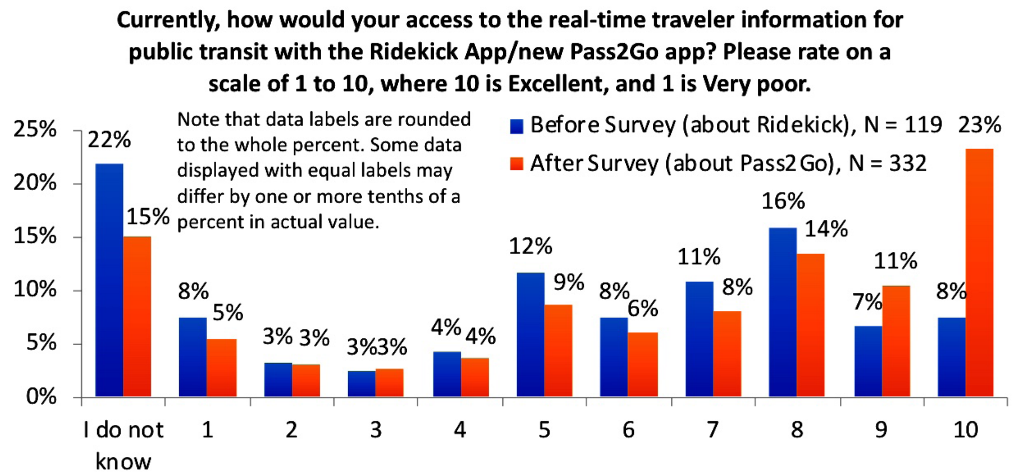


Figure 4-53

All Users – Effect of Pass2Go App on Real-Time Traveler Information

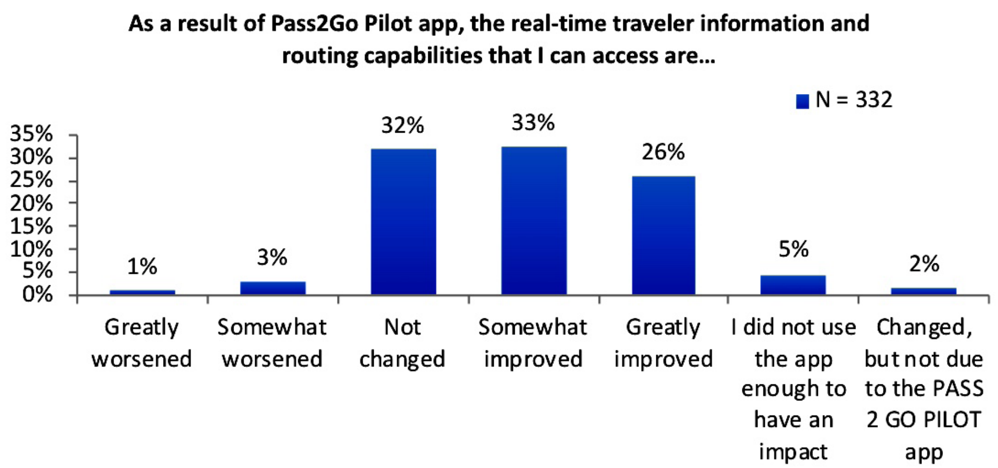
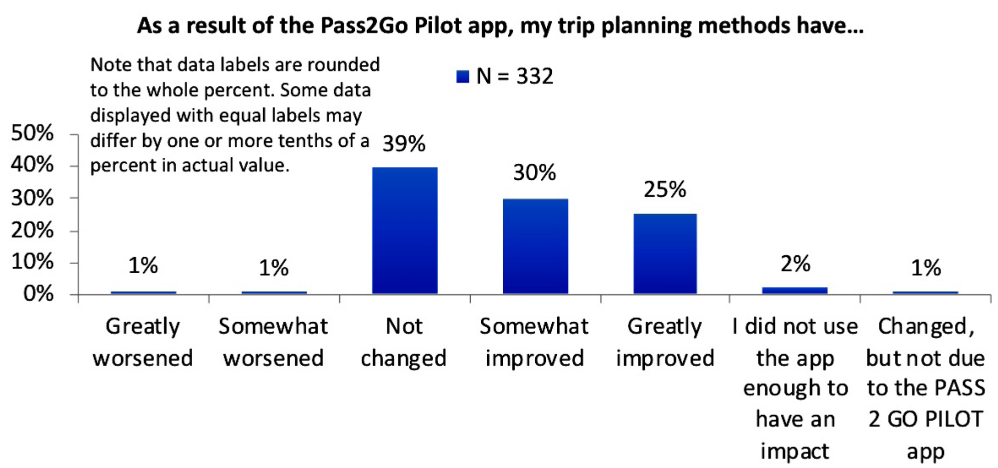


Figure 4-54

All Users – Effect of Pass2Go App on Trip Planning Methods



Overall, Pass2Go app users considered their travel experience to be enhanced with real-time travel information and routing capabilities of the app, supporting Hypothesis 9.

Hypothesis 10: Pass2Go Pilot users who are also persons with disabilities find that trip planning methods are improved with the app.

Performance Metric	Key Finding
Reported perception among persons with disabilities that trip planning is better with the enhanced Pass2Go Pilot app.	Results of the analysis were encouraging, in that a majority of respondents with disabilities reported improvements in the trip planning capabilities of the app. However, the sample size of respondents with disabilities was not large enough to produce a definitive conclusion.

To test if users with disabilities had experienced improved trip planning, the "before" and "after" surveys asked them to rate their access to trip planning and real-time traveler information with the Ridekick™ and Pass2Go apps; results are shown in Figure 4-55 and Figure 4-56. However, only 4 users with disabilities had used the Ridekick™ app compared to the 11 who had used the new Pass2Go app, which made a "before" and "after" comparison infeasible.

Figure 4-55 shows that 7 of 11 respondents gave a rating of 7 or above for trip planning with the Pass2Go app, of which 5 gave a rating of 10. Figure 4-56 shows that 8 of 11 gave a rating of 7 or above for their access to real-time traveler information for public transportation with the Pass2Go app, of which 4 gave a rating of 10. The survey also asked users with disabilities to assess the change in their real-time traveler information and routing capabilities as a result of the Pass2Go app. Results in Figure 4-57 show that 6 of the 11 respondents experienced improved access to real-time traveler information due to the Pass2Go app and 5 experienced no change. The survey also asked users with disabilities to assess the change in their trip planning methods as a result of the Pass2Go app. Results in Figure 4-58 show that 6 of the 11 respondents experienced improved trip planning methods due to the Pass2Go app and 5 experienced no change.

Figure 4-55

Users with Disabilities – Ridekick™/Pass2Go App Trip Planning Rating

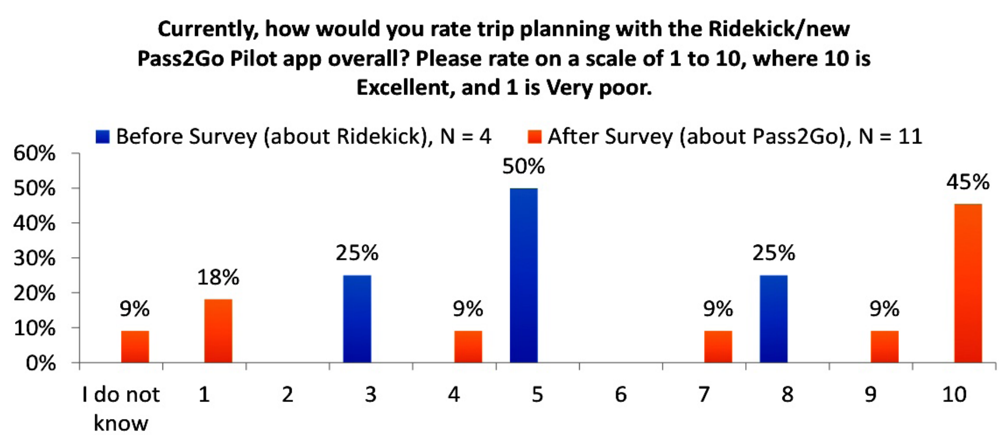


Figure 4-56

Users with Disabilities – Ridekick™/Pass2Go App Access to Real-Time Traveler Information Rating

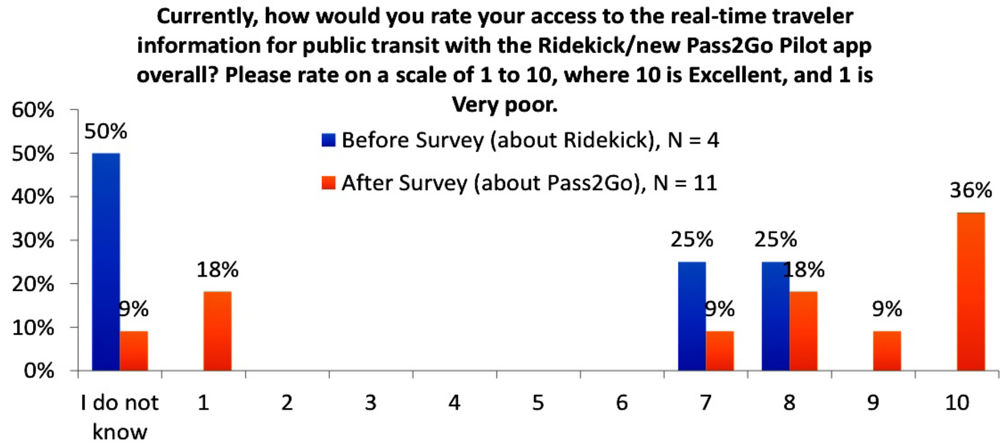


Figure 4-57

Users with Disabilities – Effect of Pass2Go App on Real-Time Traveler Information

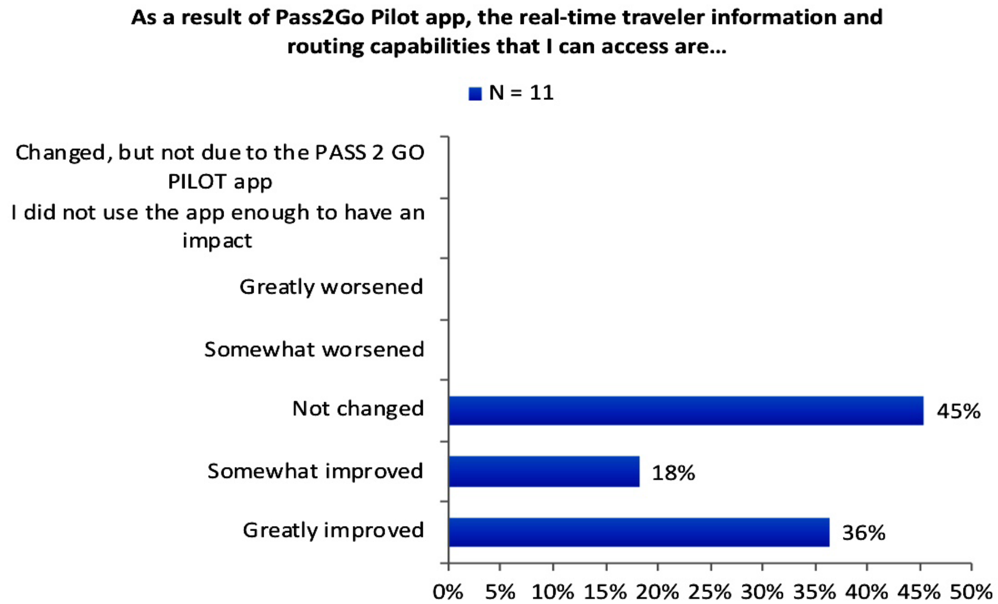
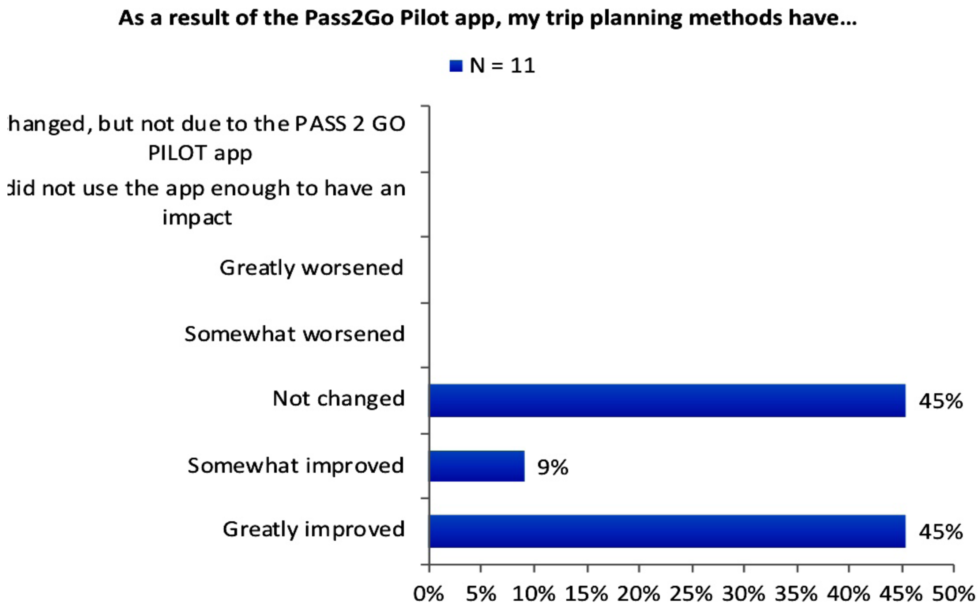


Figure 4-58

Users with Disabilities – Effect of Pass2Go App on Trip Planning Methods



Overall, the results of the Hypothesis 10 analysis suggested promising findings that persons with disabilties would find their trip planning methods improved; however, the sample size of the respondent pool was not large enough to draw generalizable conclusions, leading to an inconclusive finding for Hyporthesis 10.

Hypothesis 11: Transit agencies are able to view and exchange travel information.

Performance Metric	Key Finding
Evaluation of open data platform.	Hypothesis 11 was supported by inspection of the open data platform used by the transit agency.

Hypothesis 11 sought to verify that Valley Metro could view and exchange travel information via a system integrated with the Pass2Go app. This hypothesis was motivated by the project objective of having an open data platform that permits the agency to see information related to purchase activity to provide more detail with respect to travel demand than many transit agencies usually have about their ridership. This hypothesis could not be evaluated by any quantitative method because the hypothesis was inherently structured around verifying the existence and function of a visualization tool. The variable of interest was binary in nature; either it exists and can correctly display information about basic travel activity from purchases, or it cannot. The hypothesis was confirmed by visual and operational inspection of the open data platform used by Valley Metro and confirmed if the platform was able to deliver the travel information related to app performance and activity.

The function of the platform is shown as screenshots from the dashboard in Figure 4-59 and Figure 4-60. Figure 4-59 shows the functionality of the dashboard to the data platform, indicating the trend in purchasing and activation over time. The trends are shown for users within each wave of the evaluation. Note that Wave 3 was most active, given that it was the most recent wave to engage with the app and experienced the greatest overall functionality. The platform also enabled key interaction features with the data generated by the app activity, including review of activity data and the ability to download that data for analysis. Figure 4-60 shows an example of the data display within the platform.

Overall, the project was able to incorporate a data platform in which they could view and exchange travel information, as generated by the app, supporting Hypothesis 11.

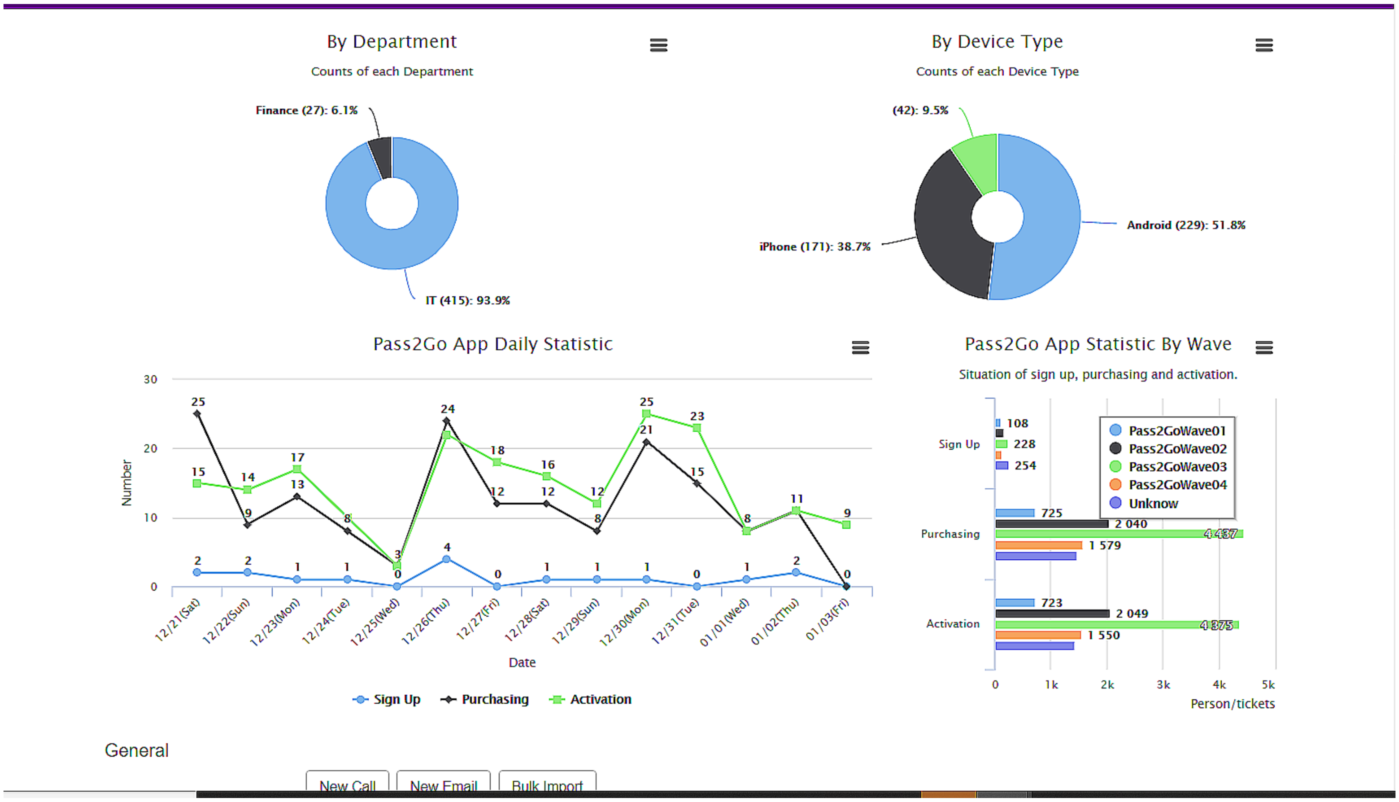
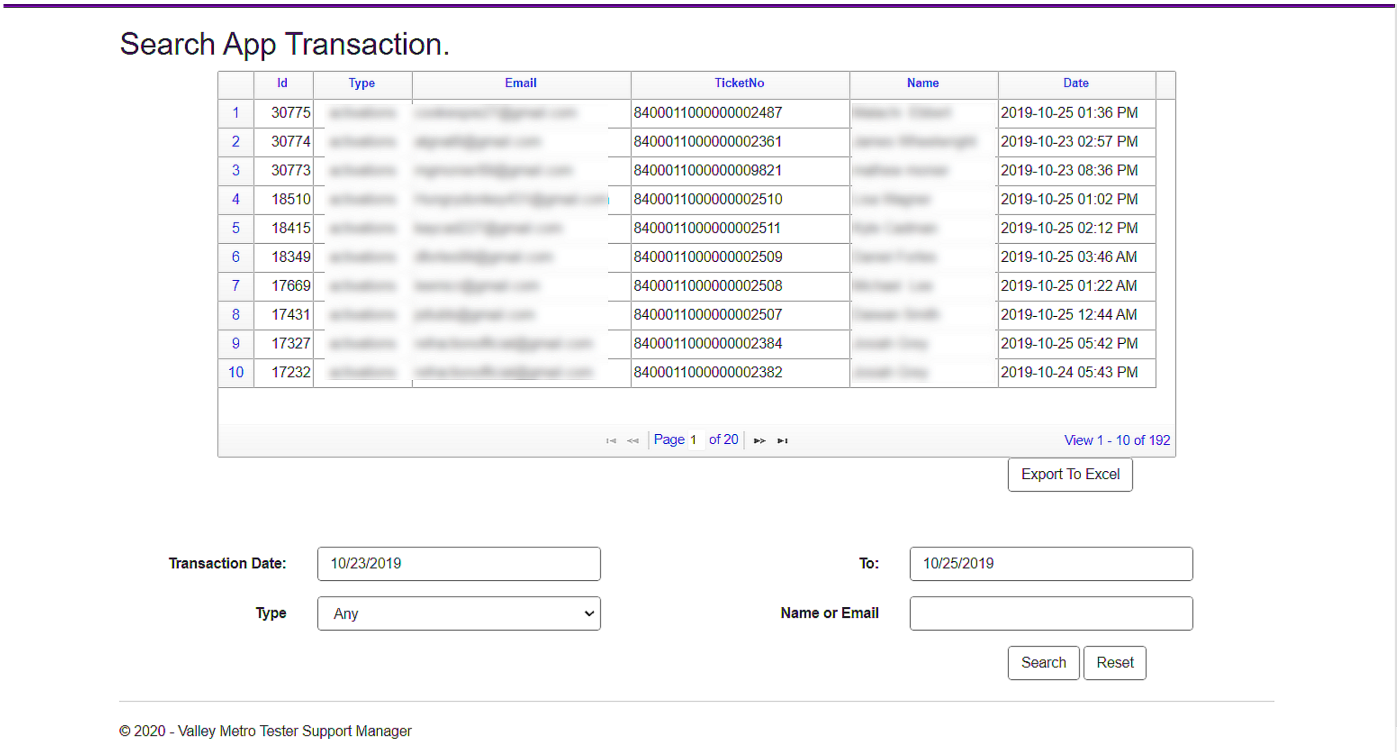


Figure 4-59

Pass2Go App Dashboard



Search App Transaction.

	Id	Type	Email	TicketNo	Name	Date
1	30775	[redacted]	[redacted]	8400011000000002487	[redacted]	2019-10-25 01:36 PM
2	30774	[redacted]	[redacted]	8400011000000002361	[redacted]	2019-10-23 02:57 PM
3	30773	[redacted]	[redacted]	8400011000000009821	[redacted]	2019-10-23 08:36 PM
4	18510	[redacted]	[redacted]	8400011000000002510	[redacted]	2019-10-25 01:02 PM
5	18415	[redacted]	[redacted]	8400011000000002511	[redacted]	2019-10-25 02:12 PM
6	18349	[redacted]	[redacted]	8400011000000002509	[redacted]	2019-10-25 03:46 AM
7	17669	[redacted]	[redacted]	8400011000000002508	[redacted]	2019-10-25 01:22 AM
8	17431	[redacted]	[redacted]	8400011000000002507	[redacted]	2019-10-25 12:44 AM
9	17327	[redacted]	[redacted]	8400011000000002384	[redacted]	2019-10-25 05:42 PM
10	17232	[redacted]	[redacted]	8400011000000002382	[redacted]	2019-10-24 05:43 PM

Page 1 of 20 View 1 - 10 of 192

Export To Excel

Transaction Date: 10/23/2019 To: 10/25/2019

Type Any Name or Email

Search Reset

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Figure 4-60

Pass2Go App Transaction Database

Hypothesis 12: The process of deploying the project produces lessons learned and recommendations for future research and deployment.

Performance Metric	Key Finding
Qualitative documentation from stakeholder interviews.	Project stakeholders/partners were generally satisfied with the project, which produced lessons learned for future work.

The evaluation team conducted interviews with several experts directly connected to the project team and who had deep knowledge of the project to better understand challenges, barriers, successes, and broader lessons learned from the implementation of the project. Section 5 is a synthesis of those interviews and the findings related to Hypothesis 12.

SECTION

5

Lessons Learned from Program Partners

Expert interviews were conducted with staff from several organizations who were directly connected to the project team and had deep knowledge of the project, including the City of Phoenix, Valley Metro Transit, and West Group. This section summarizes the challenges and lessons learned from the deployment of the Valley Metro Mobility Platform based on these interviews and discusses next steps for the project.

Challenges

Planning Process

Valley Metro's Chief Technology Officer (CTO) initially developed the idea for an improved mobile trip planning and integrated single-payment application with first/last-mile trip segment options. Valley Metro began the process by engaging various stakeholders, including the Maricopa Association of Governments (MAG) and the City of Phoenix. Over time, stakeholder engagement and coordination began to evolve organically across the agencies at both high and lower staff levels on more technical aspects and desired outcomes.

During the planning process, Valley Metro encountered some challenges. At the project outset, the CTO and Routematch, the project's software developer, had established a very ambitious timeline without consideration of the institutional steps needed to roll out a new application. In general, project partners did not understand the app development cycle and the steps required for the process and thought it was faster and easier than it was in reality. For example, a key goal of the project was to incorporate paratransit into the app. As Valley Metro does not have jurisdictional oversight of paratransit valley-wide, like many other MOD Sandbox grantees, it acknowledged a difficult start in which institutional partners and vendors who developed the technology were overly optimistic in spite of numerous technical and data challenges.

App Development

Another challenge encountered by Valley Metro was TNC integration in the app. Like other public agencies, Valley Metro quickly learned that it could not work with TNCs via traditional contracting terms and vendor relationships. For Valley Metro, its TNC partners were initially very interested in integrating their services into the new app. However, attorneys became concerned that private industry data could be exposed given Arizona's" sunshine law" (with the exception of Personal Identifiable Information). To overcome these challenges, Valley Metro decided to have Routematch form a relationship directly with Lyft, as no rides were being subsidized by Valley Metro. In addition to data concerns, Lyft expressed concerns about the user experience and functions that would occur outside of Lyft's app. To overcome this challenge, Routematch met with Lyft and obtained an application programming interface (API) compatible with a mobile environment for those who had subsidized fare programs. Ultimately, the Lyft integration did not go forward within this project. In spite of these challenges, Valley Metro praised Routematch for doing everything possible to meet contractual expectations.

Lessons Learned

Valley Metro's MOD Sandbox project identified six key lessons learned, summarized below.

User Engagement

Direct user engagement and targeted marketing were identified as best practices for encouraging app use and conducting a longitudinal study. The pilot required that participants had to use public transportation, but they could not be regular users with monthly passes; the pilot targeted periodic riders who use daily passes. Valley Metro hired West Group, a well-known local market research firm familiar with the local area, to assist with participant recruitment and to develop an implementation strategy to incentivize participants and solicit feedback. At the time of the MOD Sandbox award, West Group had a pre-existing five-year contract with Valley Metro and was able to bring in the group's expertise as part of that existing relationship. It linked its project management software with Routematch through an API to enable it to share information about pilot participation and, thus, was able to track users through key pilot milestones, such as taking the before survey, downloading the app, purchasing tickets, and completing the after survey. In doing so, West Group was able to conduct targeted outreach and marketing to engage users, document participation, and identify best practices and lessons learned.

West Group found that a high level of personal engagement was key to recruitment. Initial pilot recruitment was conducted predominantly through social media, e-mail marketing, and news stories. Prospective users who passed a pre-qualification survey were placed into an internal dashboard, and West Group would then contact them to makes sure they understood what they were signing up for and that they understood all terms and conditions. The API also allowed West Group to provide targeted marketing and support throughout the pilot (e.g., if someone signed up but did not use the app, they could reach out directly to users and offer technical assistance). Project stakeholders indicated that personal assistance was particularly valuable for iOS users who had a more complicated sign-up and installation process via the Apple store. West Group found that the app generally worked well and people were self-motivated by the features of the app. The API also allowed West Group to establish flags to identify duplicate users (e.g., people who signed up multiple times in error or who wanted to get the user incentive more than once).

Stakeholder Training

Internal and external stakeholder training was key to educating stakeholders about the pilot. A key component of the Pass2Go rollout was the internal and external communication and training required for bus drivers, rail operators, security, and operations teams to understand how the pass worked. As part of this training, Valley Metro developed internal memoranda, frequently- asked questions, PowerPoint training presentations, and posters for operations and customer service facilities. It also used internal monitors with custom messages and held team-building and lunchtime activities to demonstrate the app on different devices and what constituted a valid pass. At times, the agency was met with challenges in conducting outreach to contractors employed by the City that resulted in occasional situations in which riders would encounter bus operators unfamiliar with a pass who would require riders to purchase another pass. Valley Metro also created a webpage with a phone number and email address to report technical issues and an internal dashboard for tracking customer service help tickets, a high percentage of which were about how to join the pilot or how to install the app once enrolled in the pilot.

Third-Party Digital Accessibility

Getting third-party app developers to create accessible platforms was difficult, and there was a need to hire a professional accessibility firm to overcome digital accessibility challenges. A notable success story was that the demonstration enabled Valley Metro to hire an independent tester to improve digital accessibility and conform to WCAG. Although this was not a fast development process, Valley Metro believes that the accessibility testing resulted in a better user interface and experience for all and may result in reduced paratransit reliance if additional accessible options are made available.

Technical Expertise

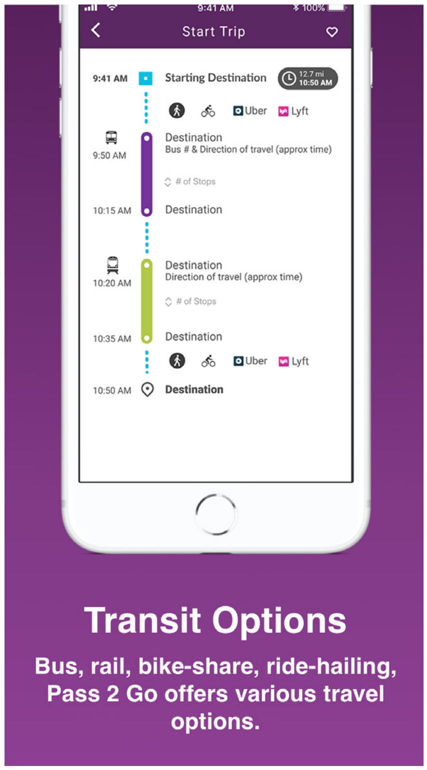
Public transportation agencies need an on-staff web developer even if development is outsourced to a third-party vendor, as public agencies need someone who can “speak the language” and can represent the agency while translating information for the vendor. Valley Metro also learned the importance of having in-house technical knowledge so it could provide appropriate mobile app support to customers who had questions, concerns, or technical challenges.

It is important to involve all partners early at project inception and have reasonable timelines and management expectations given the lead time required for stakeholder engagement and app development.

Third-Party Integration

Figure 5-1

Example Pass3Go Transit Options screen.



The project integrated information from the APIs of TNCs and the local GR:D Bike Share into the app that consisted of presenting modes within trip planning information as presented to users. Such information showed where modes were available during the course of a trip. An example of this information and how it was presented in Pass2Go is given in Figure 5-1 The integration of third-party providers went as far as this presentation of options trip planning information; further integration was planned as part of Phase 2, in which users could directly purchase and interact with the third-party systems within the app. This was discussed extensively with Lyft for Phase 2, with much discussion and negotiation, but it was concluded that this was not a viable option due to contractual limitations.

The results of these efforts led to a few lessons learned. **Ultimately, a more complete integration of third-party platform requires several objectives to be achieved.** Third party-providers, as private entities, may need to realize a compelling business case for the more advanced effort required to achieve more extensive integration. They also may face competitive exposure through that integration that may present unknown risks and increase the level of caution with which the arrangement is approached. The reasons for not achieving further integration can also be a function of limited time and resources among the parties that would have to implement the integration for a specific application. With many competing demands on engineering time, some efforts simply may not be achievable within the timeframe of a project as originally planned.

Next Steps

In the Phoenix metropolitan region, the City of Phoenix manages the fare collection system, which is supported by City information technology (IT) staff, and revenue is distributed to metro partners. The City procured a new fare collection system with VIX and Unwired, which includes an existing mobile collection system with VIX and Unwired, which includes an existing mobile app; thus, Pass2Go was closed down at the end of December 2019. Valley Metro would like to have a single app that incorporates a suite of modal and transportation demand management options, such as shared mobility, vanpooling, carpool matching, transit information (including trip planning, ticketing, and fare payment), and telecommuting information. Discounted fares for older adults and people with disabilities could be purchased using this app on-board buses, at vending machines, and at sales outlets. However, people are not able to currently purchase these fares over the Pass2Go app. In the future, Valley Metro hopes to incorporate these additional fare options with some type of validation to reduce misuse of fare discounts. One option being considered is some type of smartcard identification that is tied to a user's demographic profile, thereby enabling it to be used as a fare instrument (where people of a certain age or with disabilities have access to discounted fares). In doing so, a person's profile and smartcard could also be linked to their smartphone app, extending verification to the person's digital fare payment as well. For the real-time transit information, customers currently receive transit schedules via a GTFS (General Transit Feed Specification) feed, which is not real-time. Real-time data requires CAD (Computer-Aided Dispatch)/AVL (Automatic Vehicle Location) installed on the entire fleet. The City recently installed CAD/AVL; however, it is not working correctly and has not been released to the public yet.

SECTION

6

Conclusions

The results of the evaluation found that the Valley Metro MOD Demonstration project achieved a number of its objectives as defined by the hypotheses. The evaluation of self-reported travel times for bus and rail trips did not show any significant changes due to the Pass2Go app; however, a similar comparison of wait times showed statistically significant declines of approximately one minute for rail trips and two minutes for bus trips due to using the Pass2Go app. Also, using the app decreased user planning time significantly, by one minute, on average, for both bus and rail trips. These results were as expected, as the Pass2Go app was a planning app that did not affect the operational performance of the transit system but would impact planning and wait times through improved information on routes and arrivals. Since planning and wait times account for a small fraction of a trip, time changes were expected to be small within the range of few minutes. The survey also evaluated perceptions related to travel, wait, and planning time change and found that 29% of respondents perceived shorter travel times, 28% perceived shorter wait times, and 37% perceived shorter planning times.

Pass2Go app data showed that downloads increased at the beginning of each wave while activity increased at the beginning of each of the 3 waves to reach a peak and then decreased toward the end of the wave.

The evaluation of the "before" and "after" survey data showed that 11 of respondents used a wheelchair, required special accommodations for transportation, and/or required ADA-accessible vehicles and infrastructure to get around. From an app accessibility compliance point of view, 75% of 24 respondents who used smartphone accessibility features rated the app 7 or higher out of 10 as being compatible with those features. Also, the 11 users with disabilities gave an average rating of approximately 8 out of 10 for their abilities to get/to from Valley Metro bus and rail. These ratings slightly increased after using the Pass2Go app, but changes were not significant. Regarding the app functionality, 6 of the 11 respondents with disabilities reported improved trip planning and access to real-time traveler information for public transportation as a result of using the Pass2Go app.

For all 332 respondents, results showed a statistically significant increase in their ability to get to and from Valley Metro public transportation, and 74% reported improved access to public transportation due to using the Pass2Go app. This shows that the app led to greater connectivity of users with public transportation.

Survey data were used to compare the mode share of users to connect to and from public transportation "before" and "after" using the Pass2Go app. To get to and from a recent rail trip, frequently-used modes included walking, personal bicycle, and Valley Metro bus; a significant proportion of respondents drove alone or were dropped off by family or friends to get to a recent rail trip. In general, no significant changes were observed for recent trips as a result of using the Pass2Go app. However, the evaluation of reported mode-use frequencies to connect to and from Valley Metro public transportation led to more significant results. Frequencies of use were aggregated to analyze the behavior of more frequent users who used a certain mode at least once per week. The result was statistically significant at the 1% level, which indicates that the "before" and "after" mode choices of frequent users to connect to/from public transportation significantly changed.

The implementation of a single integrated payment system for public and private transportation options did not occur, and payment with Pass2Go was possible only for public transportation passes. Pass2Go app activity data including 12,239 transactions for 626 users from March 2018 through November 2019 was analyzed; of these, 11,760 passes were activated, with passes expiring the day after activation at 2:59 AM. The average time to activate a pass after its purchase was 89 hours, and the median was 19 hours. The average number of passes purchased per user was 20, of which 19 (95%) were activated across the population. For a flat rate of $4 per pass, the average sales amount per user was $78.

Only 120 of respondents had used the previous Ridekick™ app, so their responses were used as paired "before" and "after" ratings of the Ridekick™/ Pass2Go apps. The obtained results were all statistically significant at a 1% level, revealing that the Pass2Go app had higher ratings overall for planning and for access to real-time traveler information for public transportation. Specifically, a rating of 7 or higher out of 10 was given by 89% for the overall functionality of the app, 58% for trip planning, and 55% for access to real-time traveler information for public transportation. From a perception point of view, 58% experienced improved access to real-time traveler information and 55% experienced improved trip planning methods.

The Pass2Go app offered an integrated system in which Valley Metro could view and exchange travel information. This aligned with the project's objective of having an open data platform that permitted the agency to see information related to purchase activity.

The Valley Metro project offered lessons learned to build on future projects. Expert (stakeholder/ project partner) interviews with those close to project implementation revealed several findings related to contractual negotiations, project operation and expansion, accessibility challenges, and other issues related to the continuation of the project. The main lessons learned include the importance of the following:

- Direct user engagement and targeted marketing to encourage app use and conduct a longitudinal study
- Training internal and external stakeholders about the pilot
- Testing the platform's digital accessibility to provide enhanced user experience
- Hiring technical staff to work with third-party vendors
- Engaging stakeholders early during the project
- Establishing reasonable project timelines that account for stakeholder engagement and app development

With respect to third-party integration, understanding the risks and business dynamics faced by third-party operators that may engage in more advanced integration with project systems and recognizing that the negotiation of those risks and dynamics can take considerable time. Federal regulations did not serve as a major barrier to the implementation of the project; however, a recurring theme with respect to interactions between public and private sector entities was the security and protections of industry data that may be shared as a result of participation in a project or system. Such concerns are impacted by State and federal laws permitting the open solicitation of government information. Although such laws are well-motivated by the objectives of ensuring a good measure of transparency in public agency operation, there is the concern that such measures extend into private sector data that passes through public systems to achieve system integrations aimed at advancing public objectives. As these laws are derived from State and federal legislation, it is not clear that much can be done to immediately address the concerns and inhibitors they can present for public-private partnerships. However, provisions and regulations do exist that protect against the disclosure of personally identifiable information as well as classified information pertinent to national security.

For example, although the Freedom of Information Act (FOIA) is a disclosure statute, there are times when it is appropriate to withhold records or portions of records to protect against certain harms (e.g., national security, personal privacy). Of the nine FOIA exemptions, one protects "trade secrets and commercial or financial information obtained from a person [that is] privileged or confidential." There is a federal process for FOIA requests, and it is not guaranteed that an exemption will necessarily result in withholding a record, in part or in full. Should provisions exist to protect the disclosure of corporate information related to trade secrets, market share, or competitive positions in the industry, the data-side limitations to public-private collaborations may become less pronounced in future pilot programs.

Interviews found that participants were generally satisfied with the project, even though it did not grow as expected in regard to app feature development. However, the project proved successful in providing users with increased options, integrated trip planning and payment for public transportation, transit schedule information, and accessibility for people with disabilities even though this outcome was based on a limited sample size of users with disabilities. The lessons learned from the pilot project should allow for future projects to build on this experience and advance common objectives with similar initiatives within other transit systems.

APPENDIX

A

Additional Survey Results

"Before" Survey

The following figures show raw summaries of the "before" survey results. The figures are in the general order of questions asked. Only questions not presented in the report are presented in this Appendix.

Figure A-1

"Before" Survey – Household Size

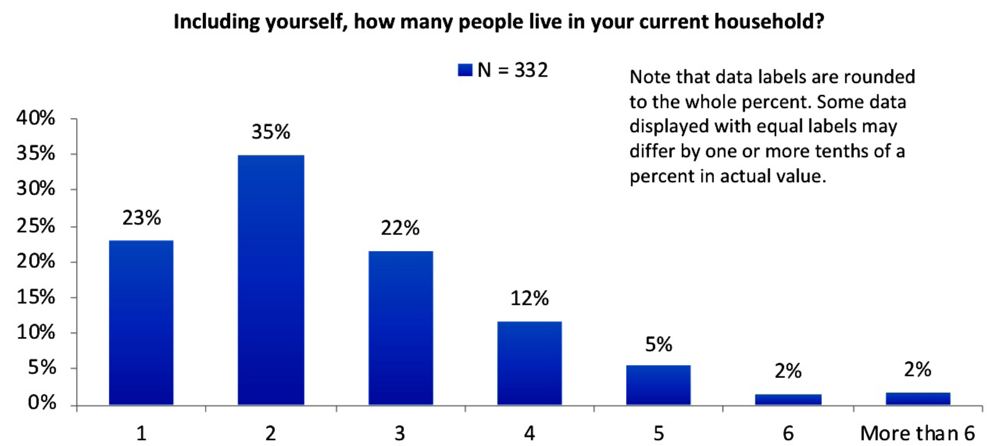


Figure A-2

"Before" Survey – Household Relationships

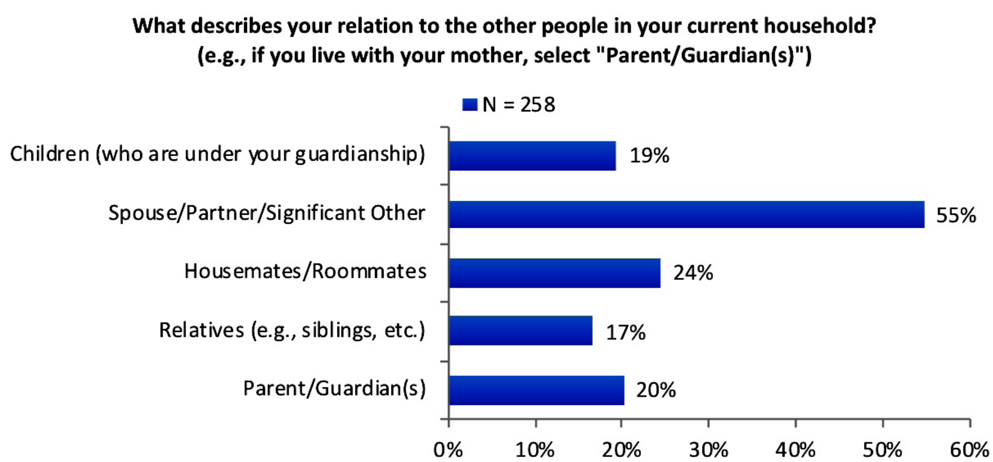


Figure A-3

"Before" Survey – Vehicle Ownership

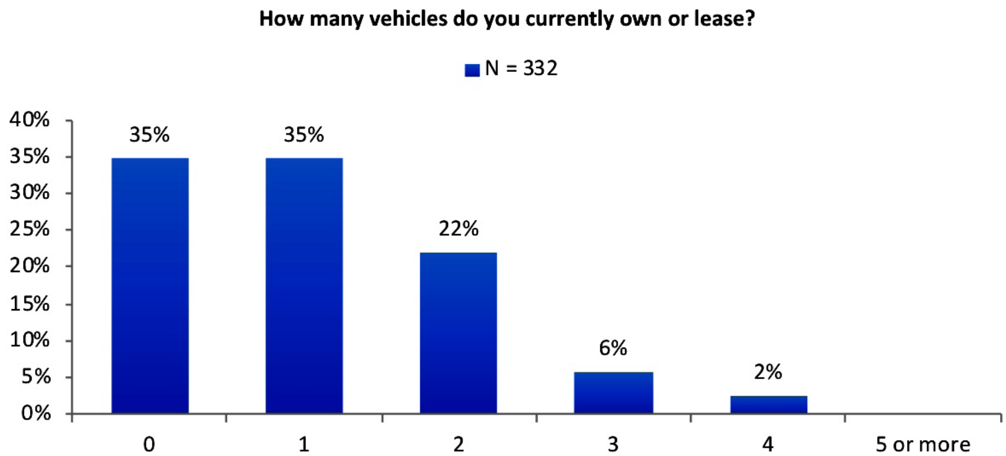


Figure A-4

"Before" Survey – Transportation Mode Use

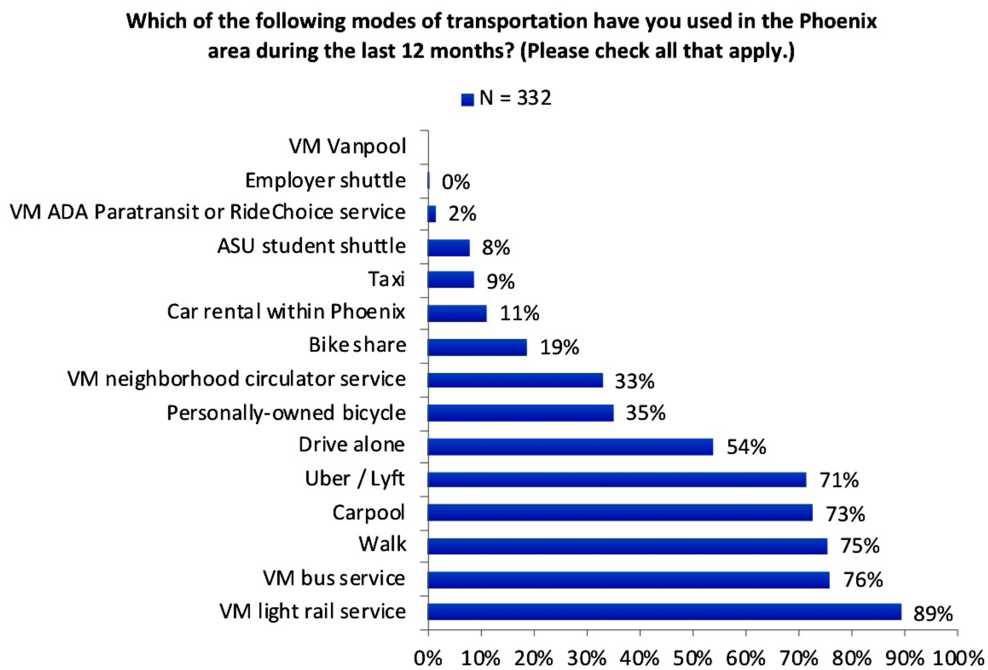


Figure A-5

"Before" Survey – Transportation Mode Use Frequency

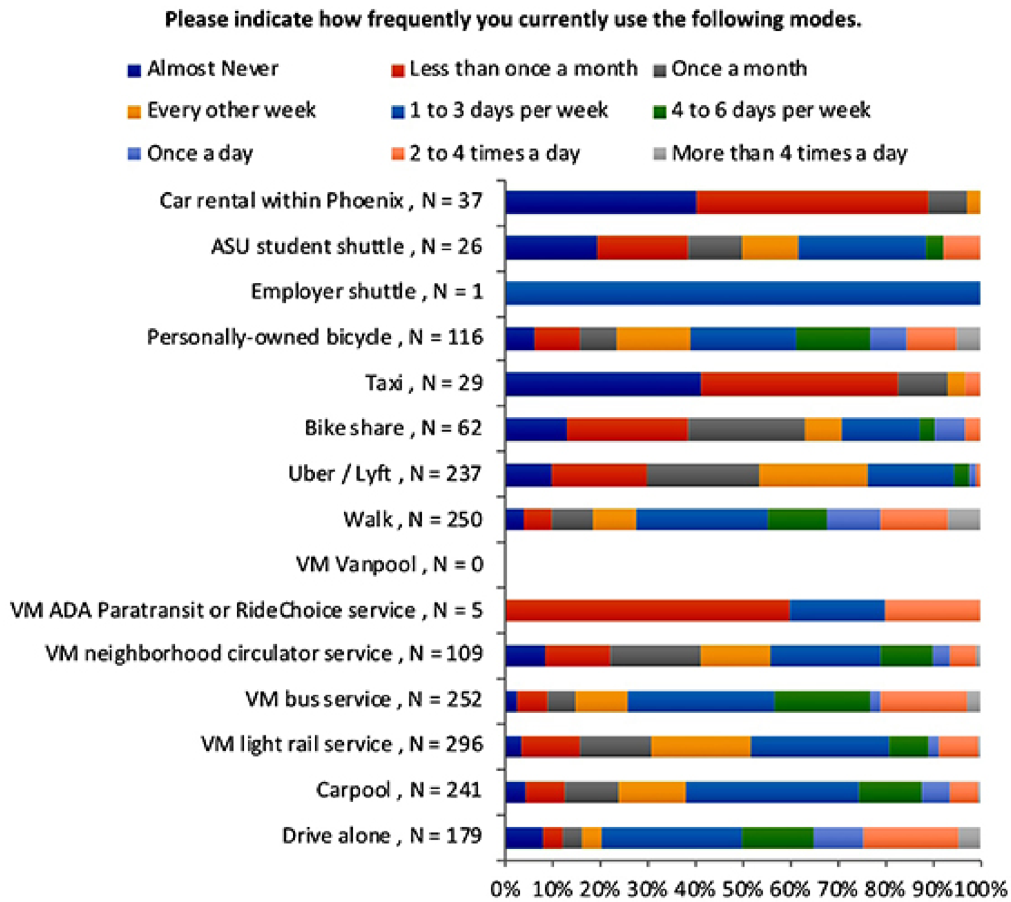


Figure A-6

"Before" Survey – Average Bus Trip Total Travel Time

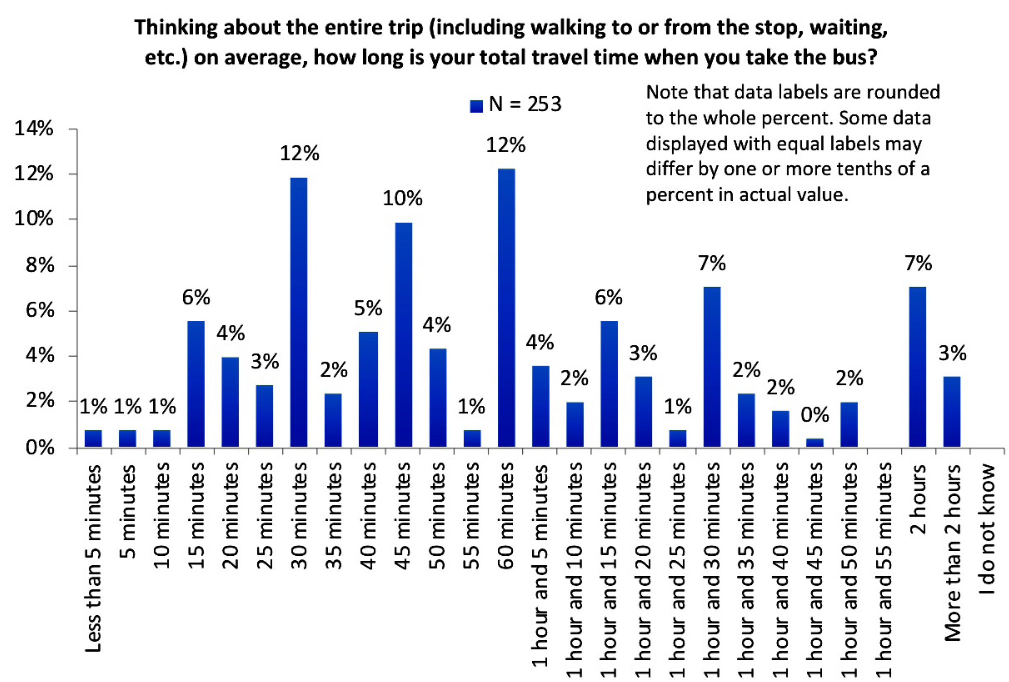


Figure A-7

"Before" Survey – Average Bus Trip Wait Time

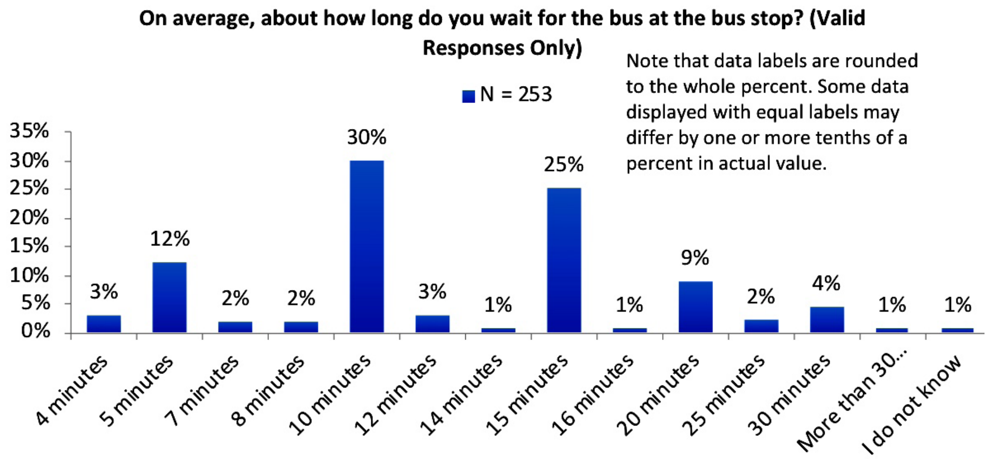


Figure A-8

"Before" Survey – Recent Bus Trip Origin

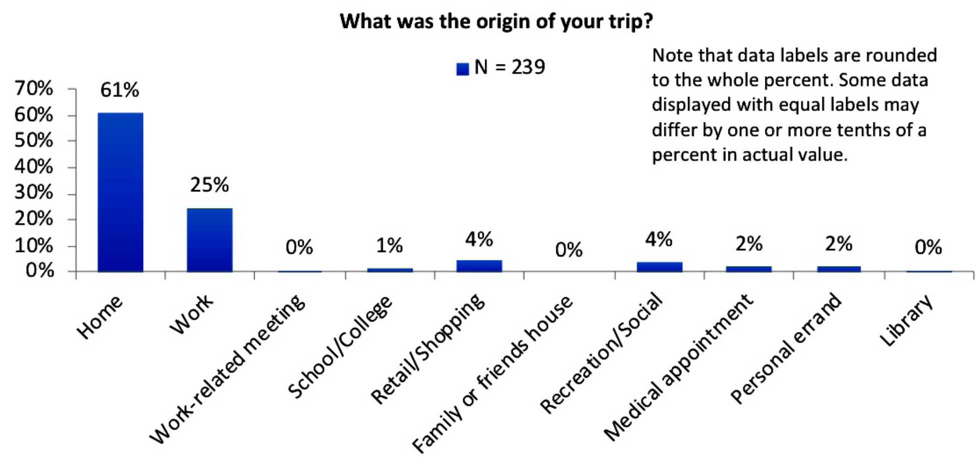


Figure A-9

"Before" Survey – Recent Bus Trip Destination

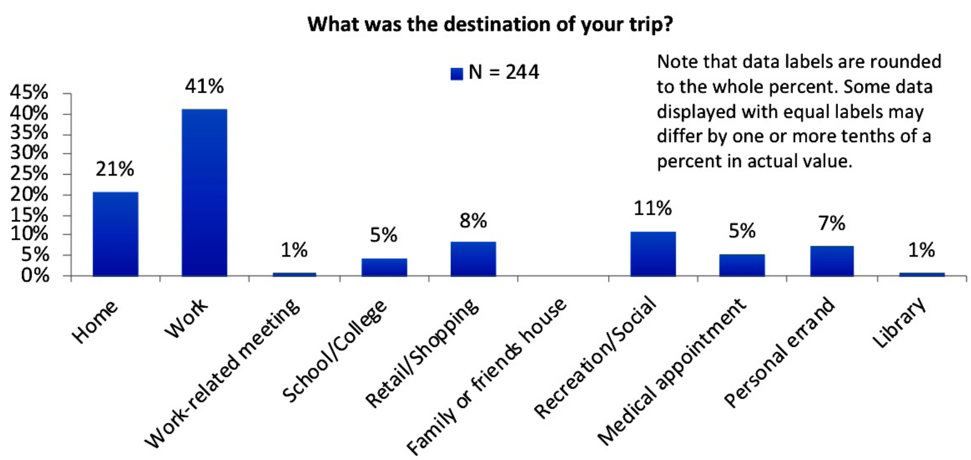


Figure A-10

"Before" Survey – Recent Bus Trip Planning Time

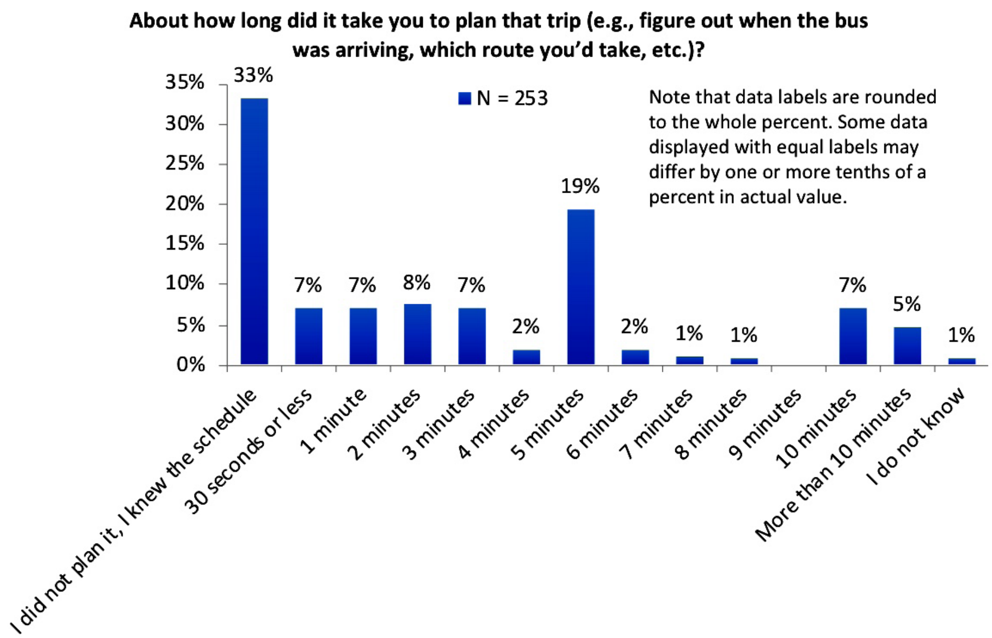


Figure A-11

"Before" Survey – Recent Bus Trip Planning Method

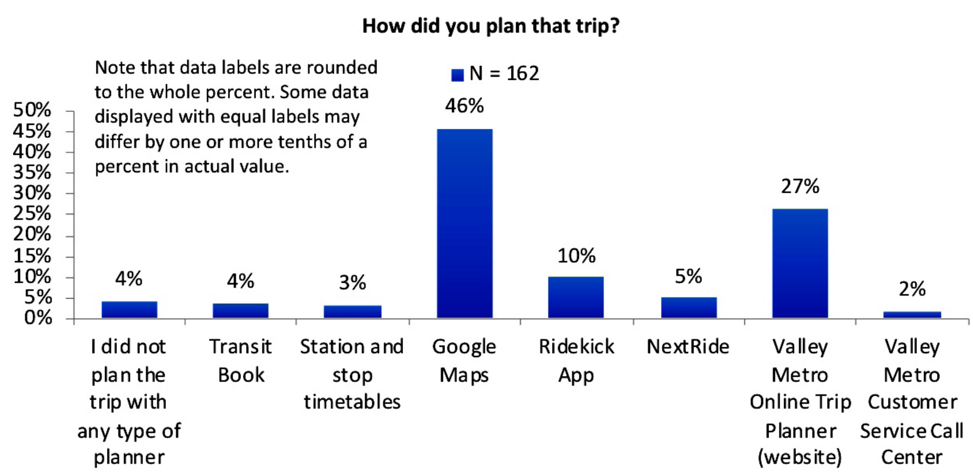


Figure A-12

"Before" Survey – Recent Bus Trip Wait Time

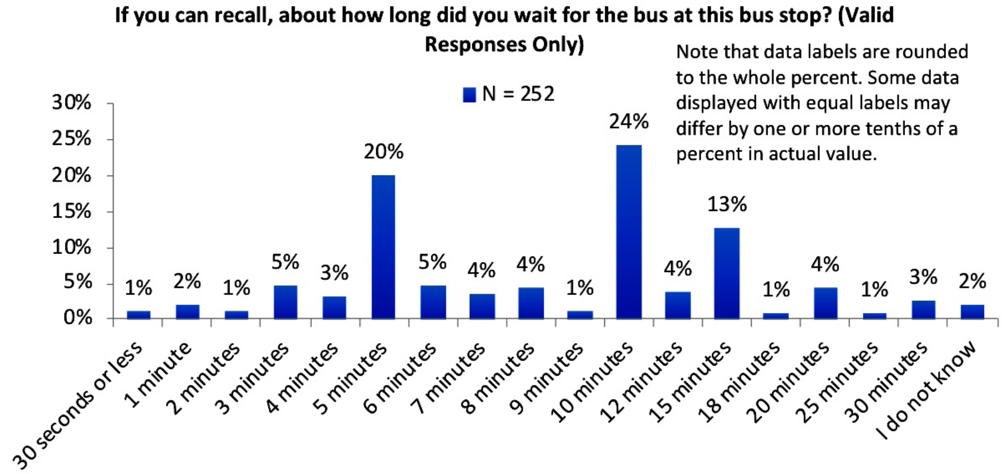


Figure A-13

"Before" Survey – Recent Bus Trip Total Travel Time

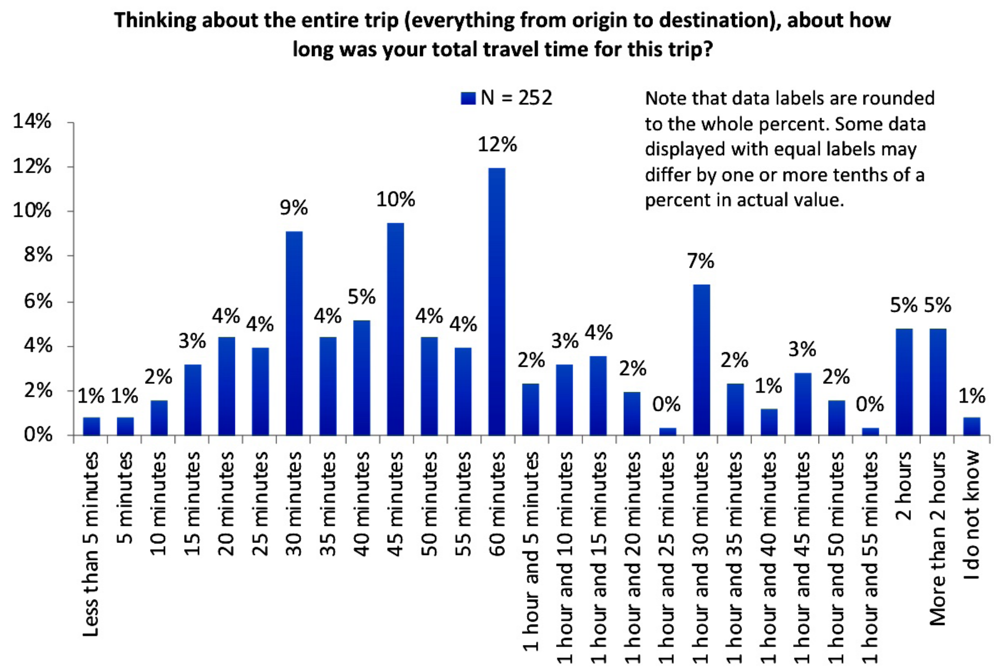


Figure A-14

"Before" Survey – Recent Bus Trip Transfers

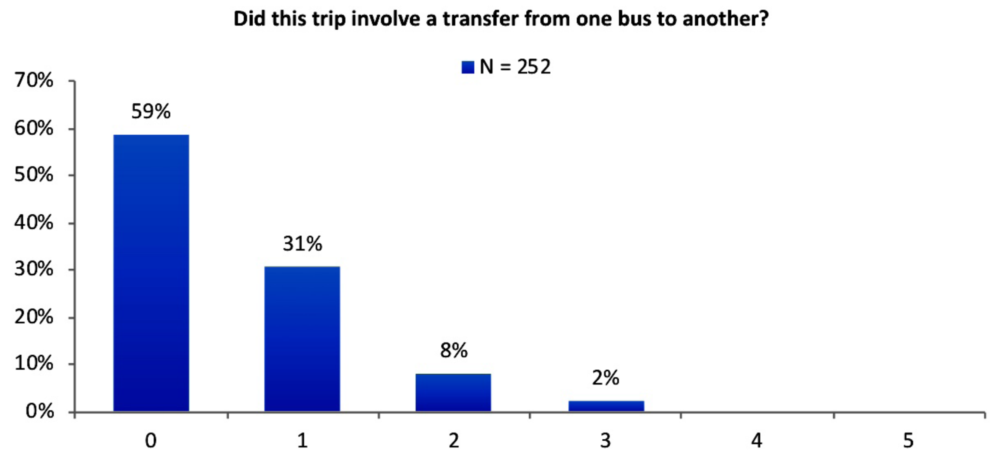


Figure A-15

"Before" Survey – Most Common Mode to Get to Bus

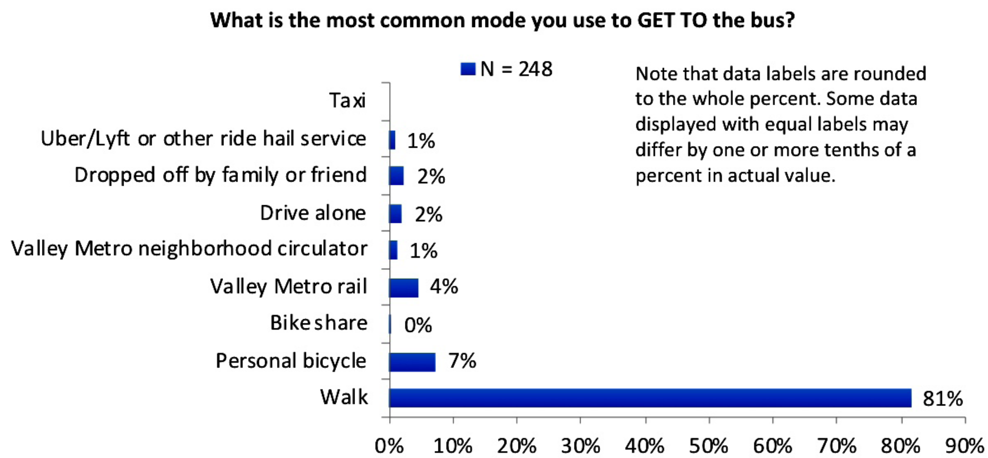


Figure A-16

"Before" Survey – Most Common Mode to Get from Bus

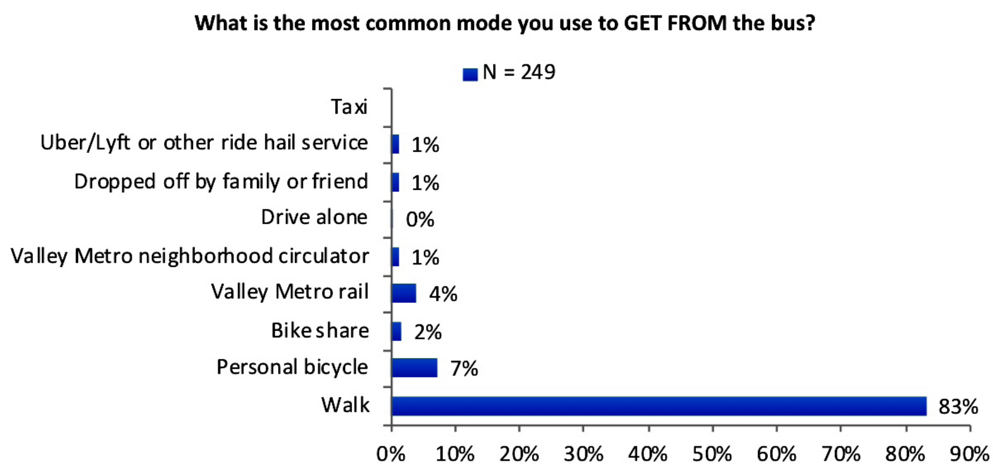


Figure A-17

"Before" Survey – Average Rail Trip Total Travel Time

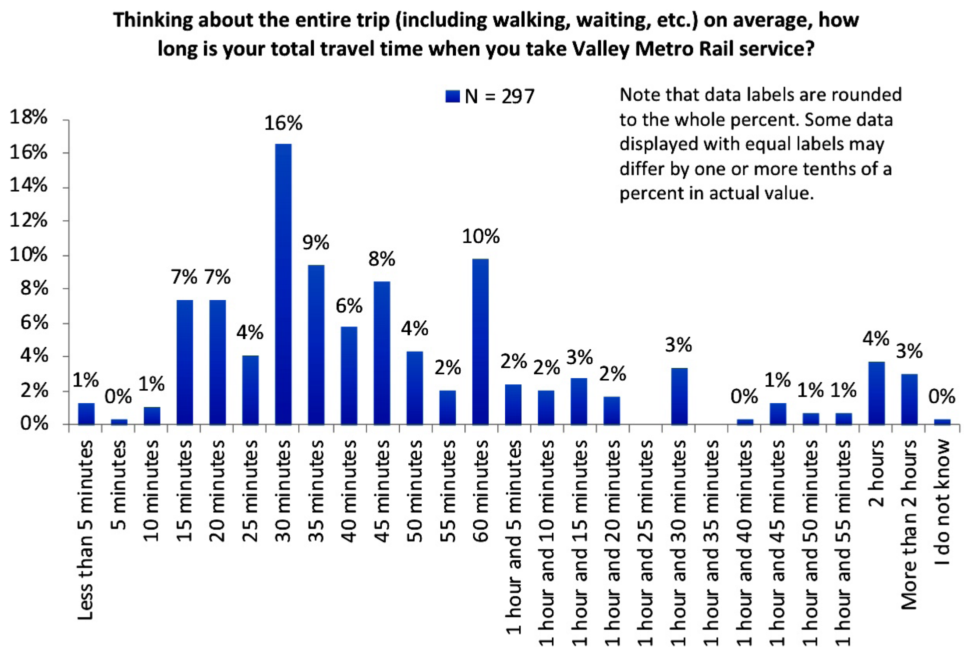


Figure A-18

"Before" Survey – Average Rail Trip Wait Time

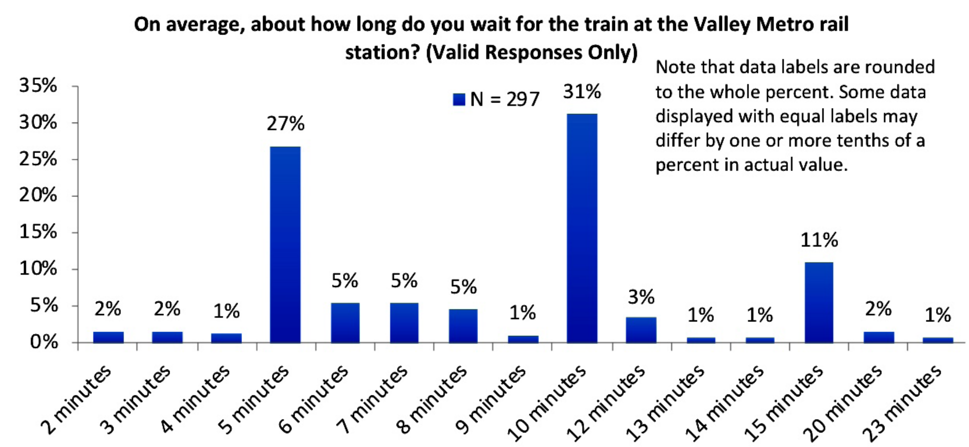


Figure A-19

"Before" Survey – Recent Rail Trip Origin

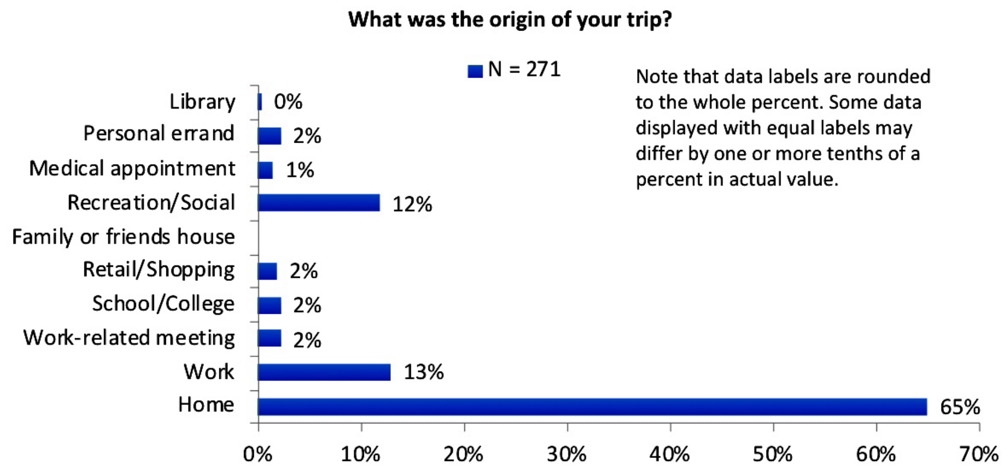


Figure A-20

"Before" Survey – Recent Rail Trip Destination

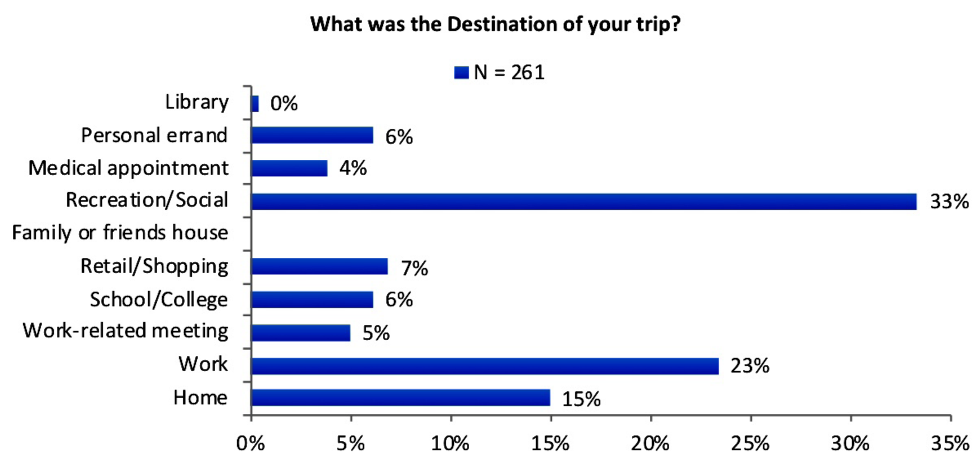


Figure A-21

"Before" Survey – Recent Rail Trip Planning Time

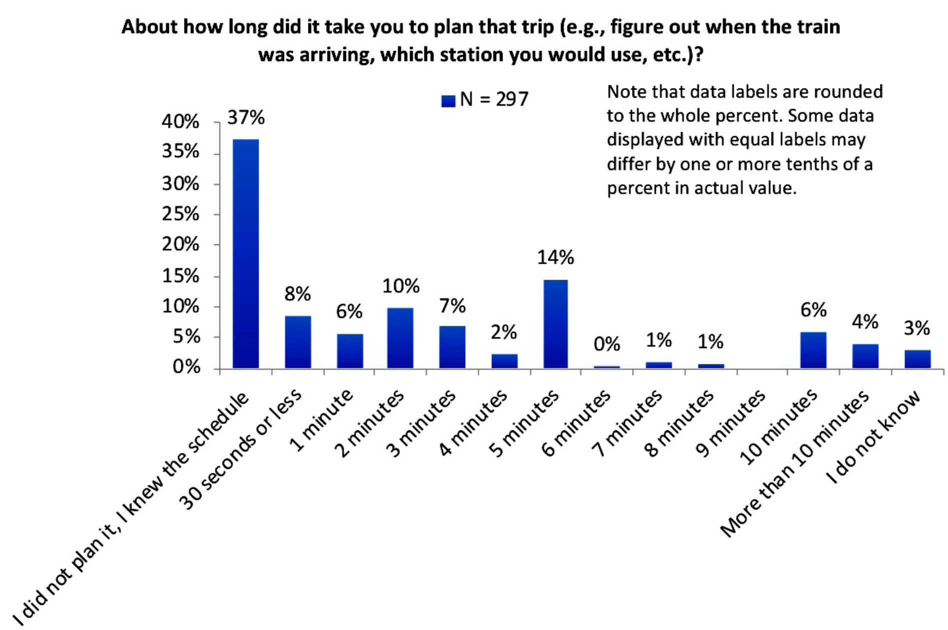


Figure A-22

"Before" Survey – Recent Rail Trip Planning Method

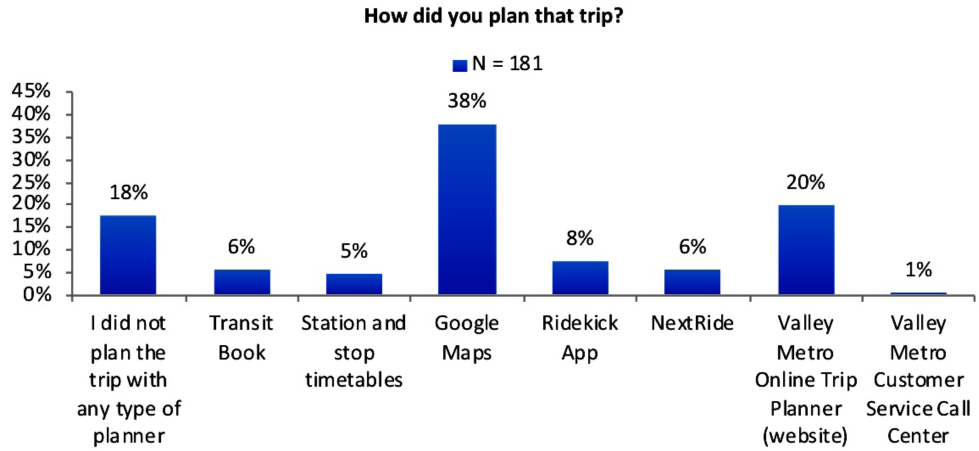


Figure A-23

"Before" Survey – Recent Rail Trip Wait Time

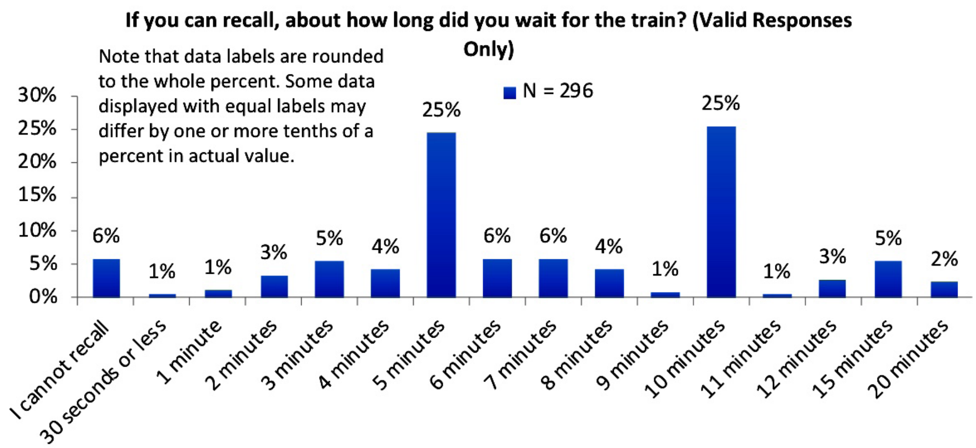


Figure A-24

"Before" Survey – Recent Rail Trip Total Travel Time

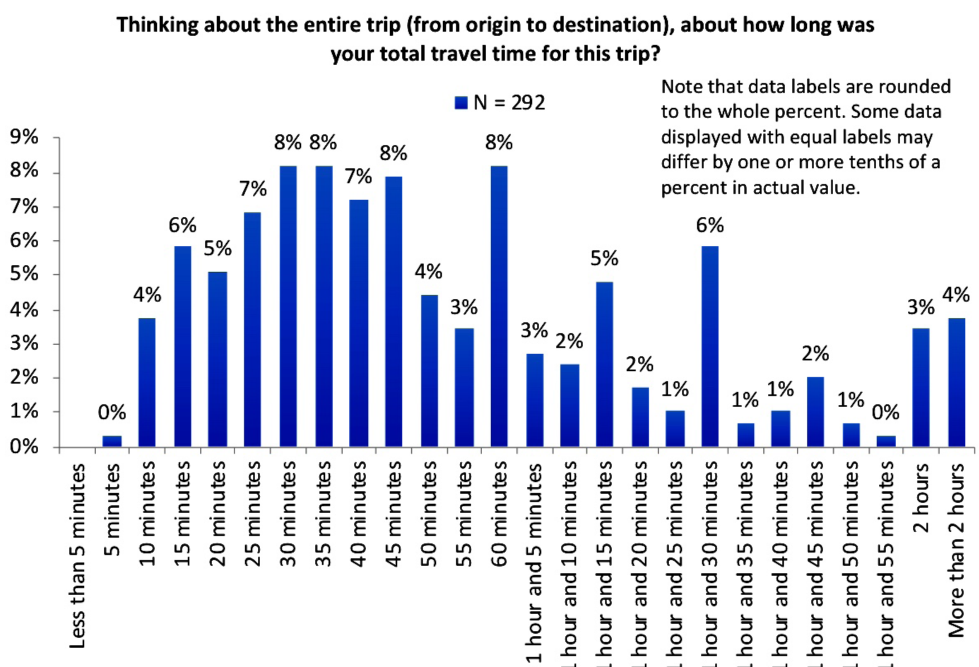


Figure A-25

"Before" Survey – Most Common Mode to Get to Rail

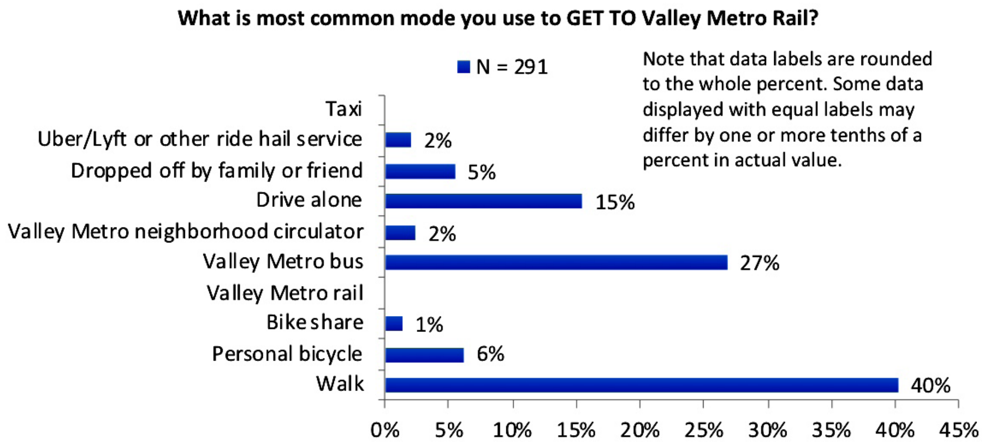


Figure A-26

"Before" Survey – Most Common Mode to Get from Rail

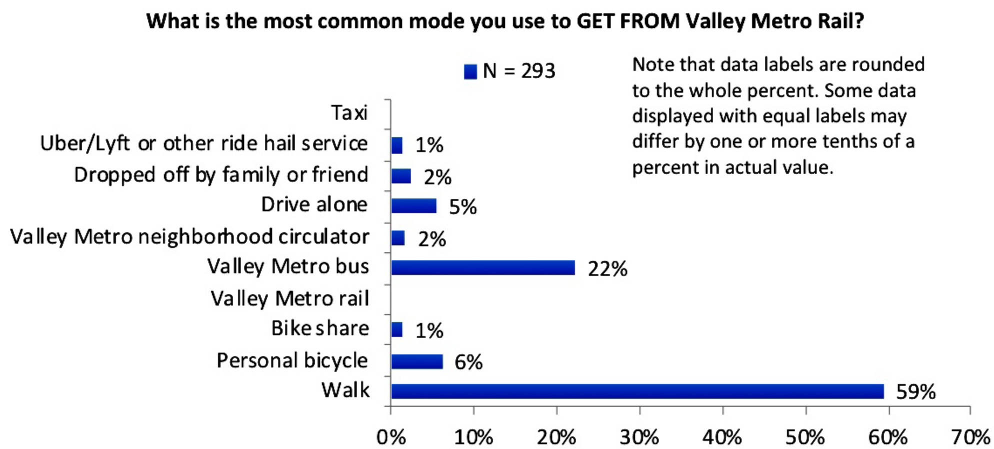


Figure A-27

"Before" Survey – Transportation Mode Use Frequency to/from Public Transit

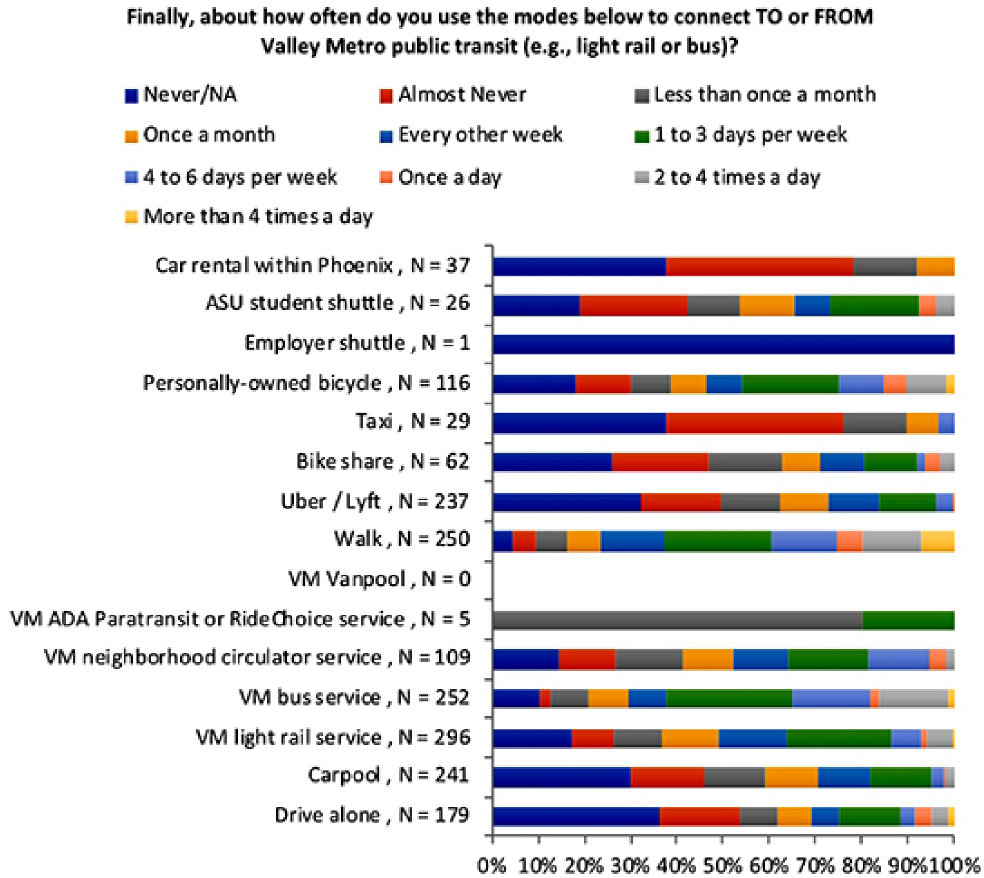


Figure A-28

"Before" Survey – Rating of Access to NextRide Real-Time Traveler Information

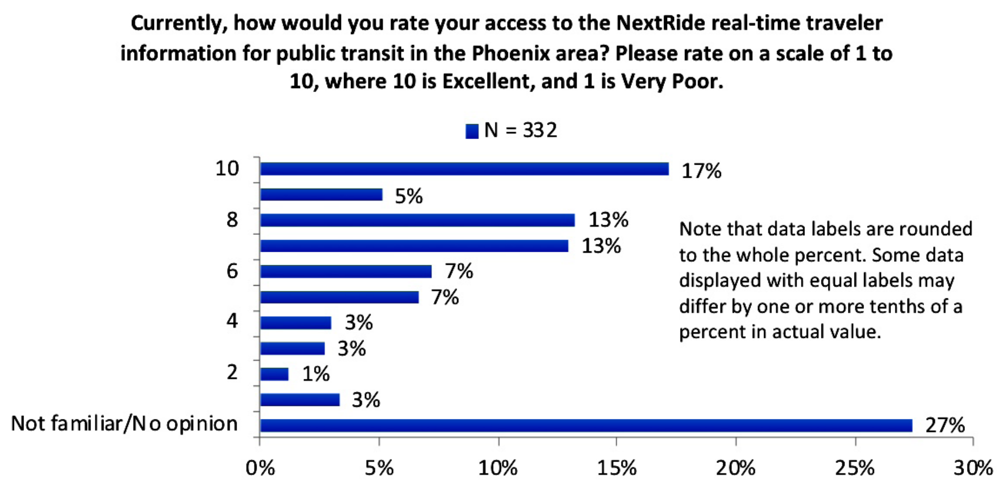


Figure A-29

"Before" Survey – Preferred Methods to Access Real-Time Traveler Information

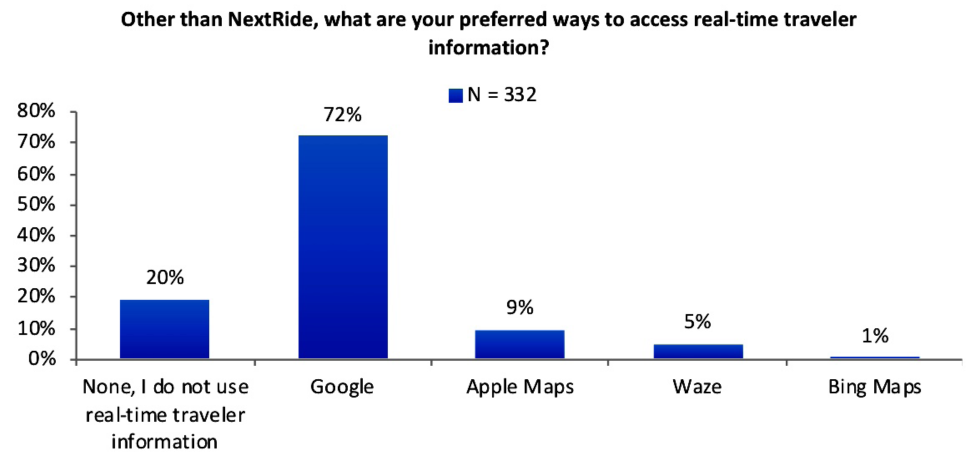


Figure A-30

"Before" Survey – Previous Use of Ridekick™ App

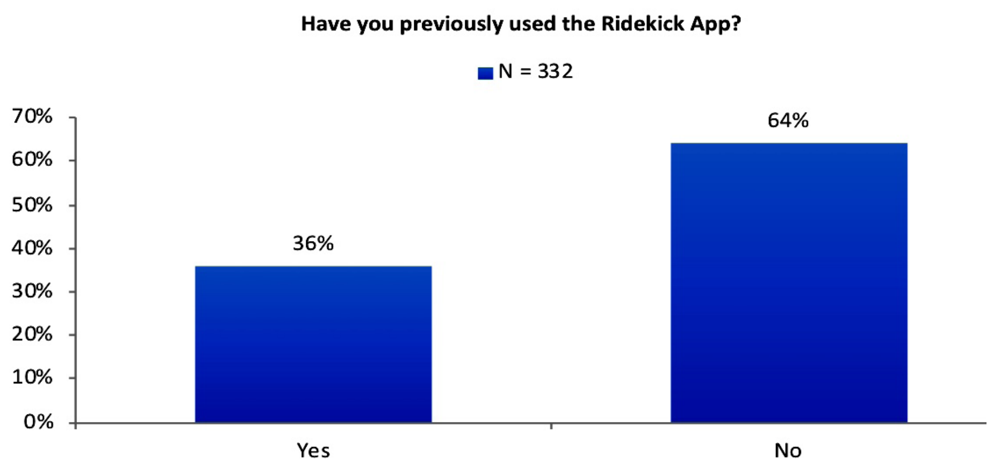


Figure A-31

"Before" Survey – Rating of Bus Safety

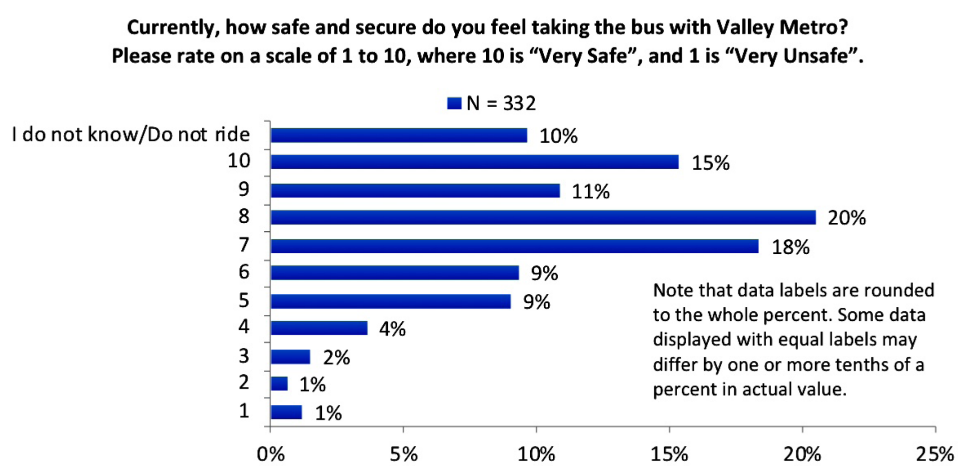


Figure A-32

"Before" Survey – Rating of Rail Safety

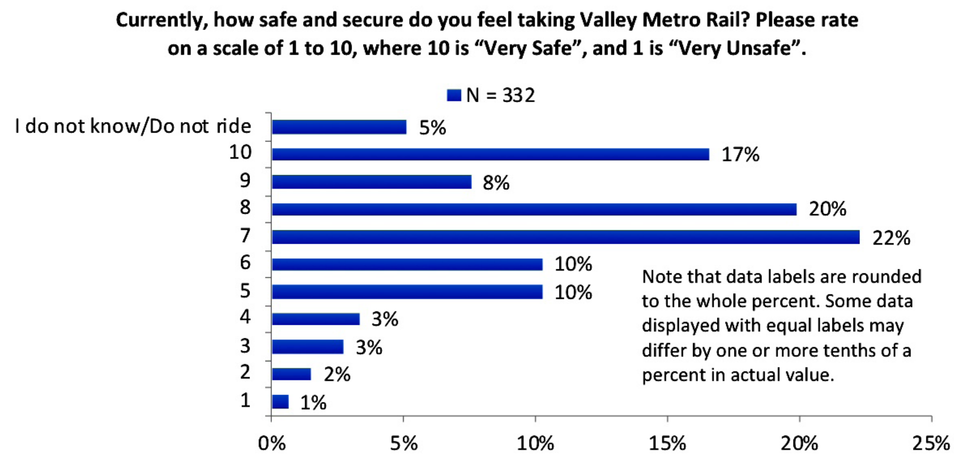


Figure A-33

"Before" Survey – Gender

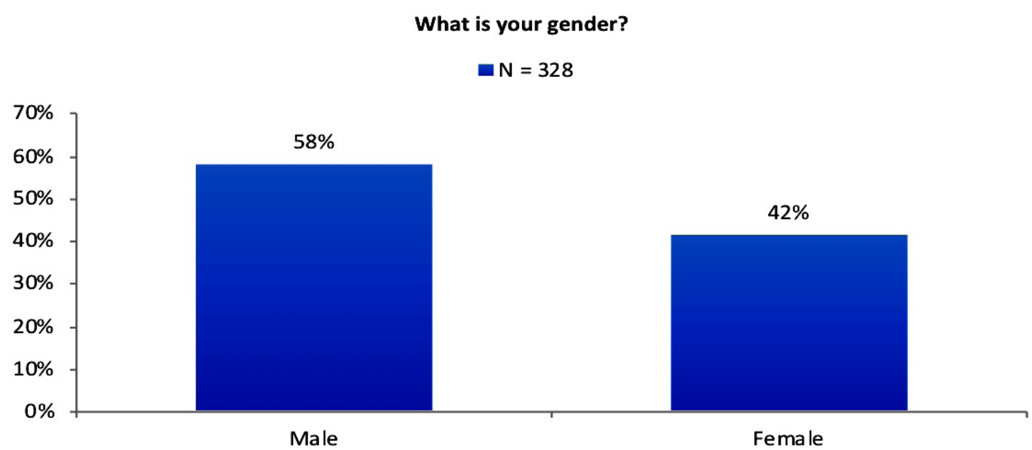


Figure A-34

"Before" Survey – Level of Education

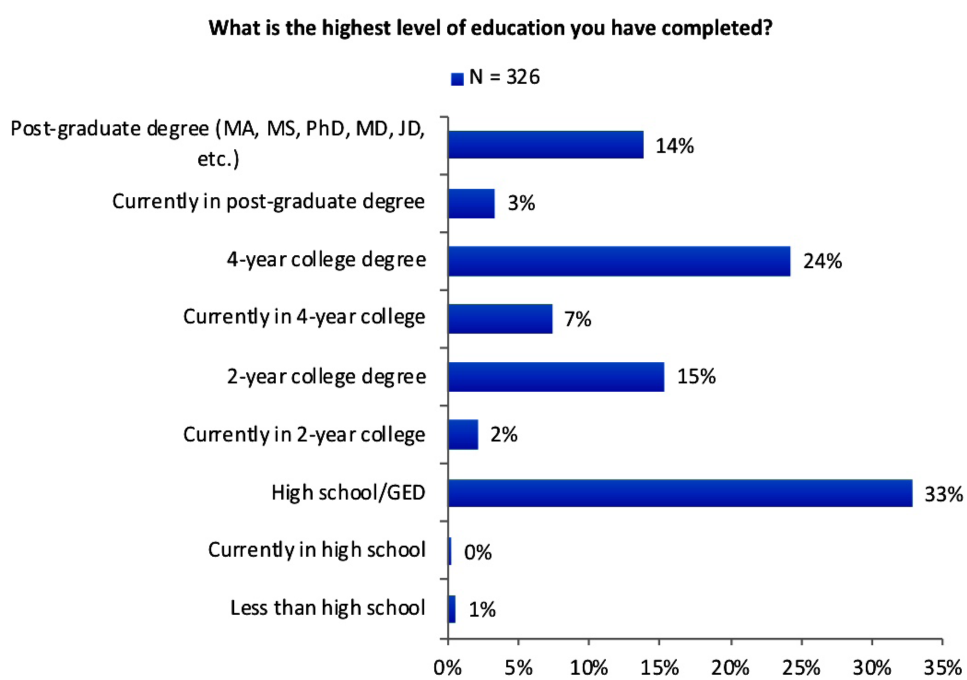


Figure A-35

"Before" Survey – Race or Ethnic Identification

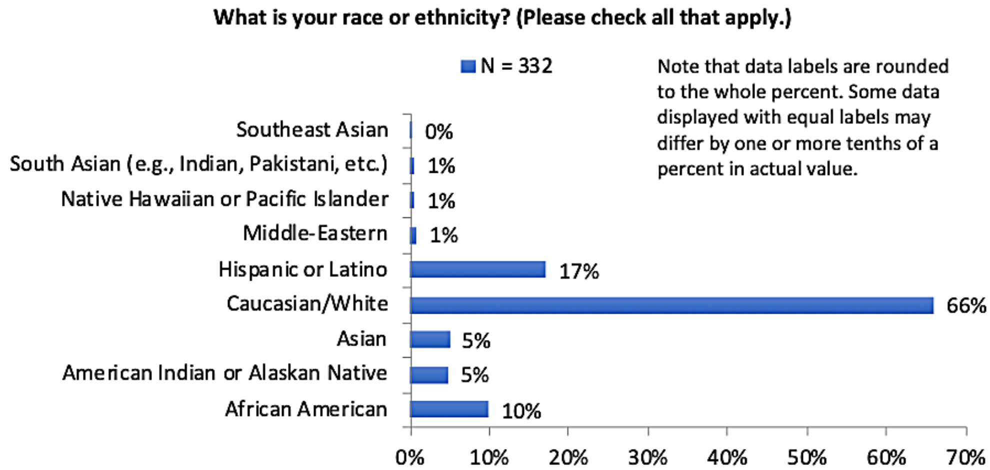


Figure A-36

"Before" Survey – Housing Type

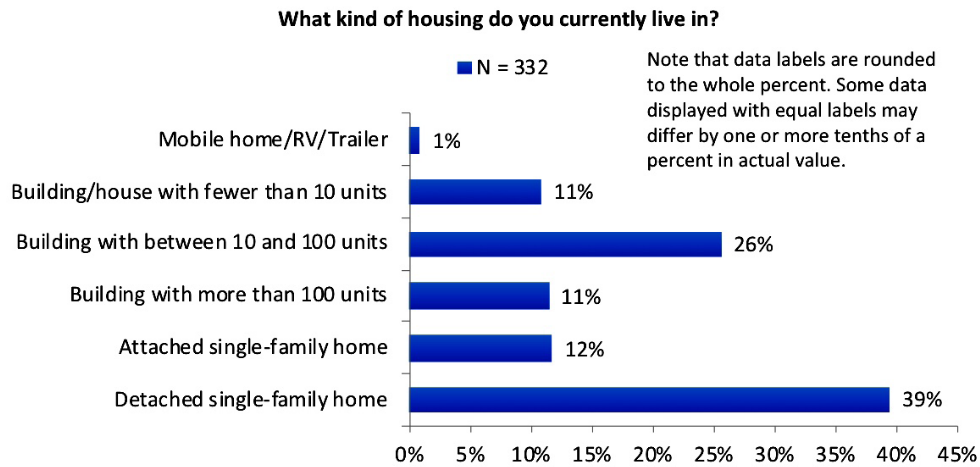
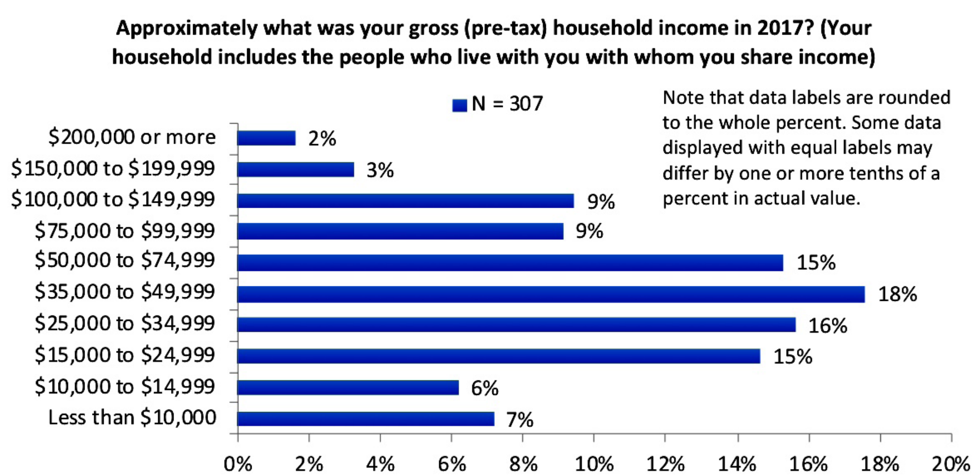


Figure A-37

"Before" Survey – Household Level of Income



"After" Survey

The following plots show raw summaries of the "after" survey results. The figures are in the general order of questions asked. Only questions not presented in the report are presented in this Appendix.

Figure A-38

"After" Survey – Household Size

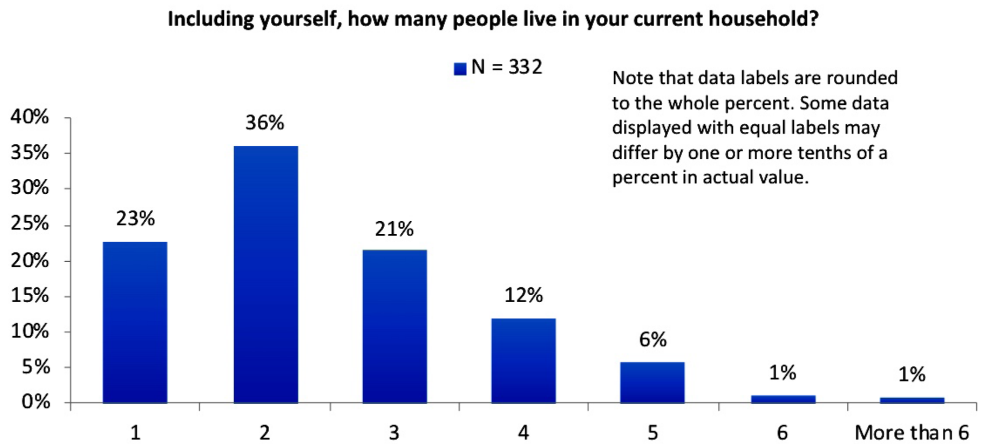


Figure A-39

"After" Survey – Household Relationships

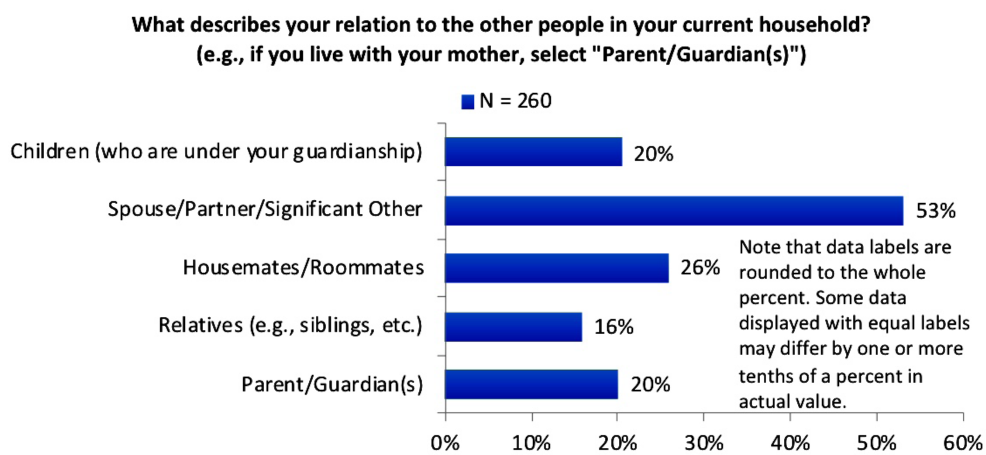


Figure A-40

"After" Survey – Household Age Distribution

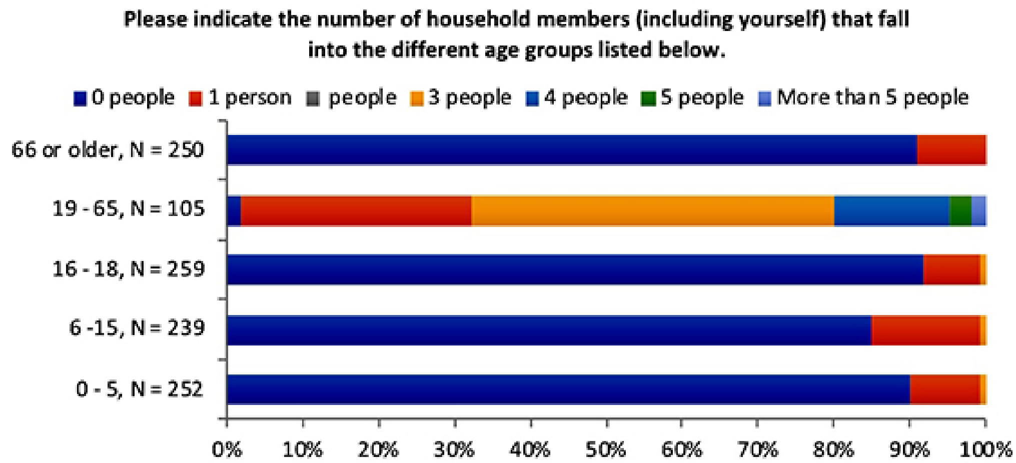


Figure A-41

"After" Survey – Household or Individual Categorization

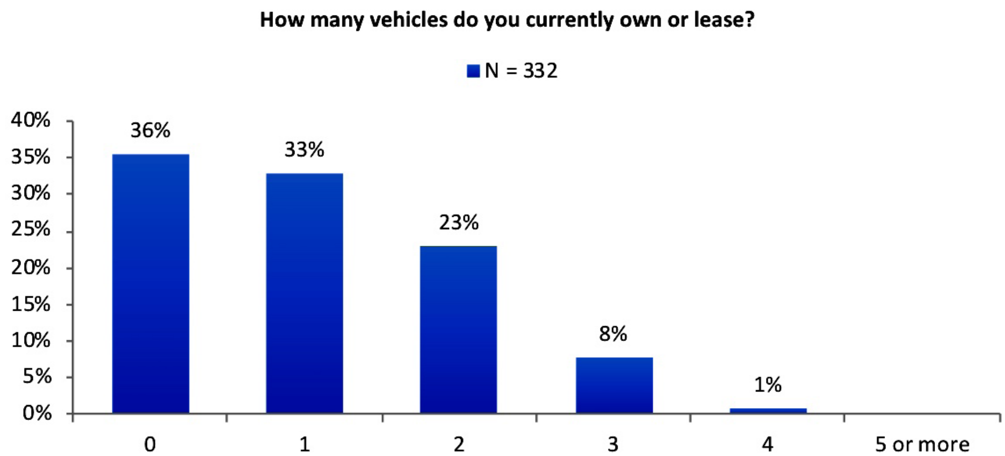


Figure A-42

"After" Survey – Vehicle Ownership

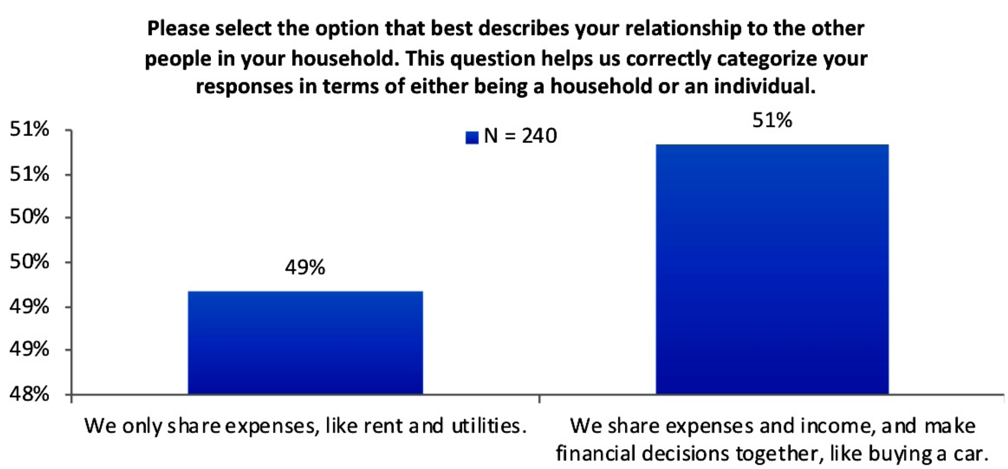


Figure A-43

"After" Survey – Impact of Use of Pass2Go App on Driving

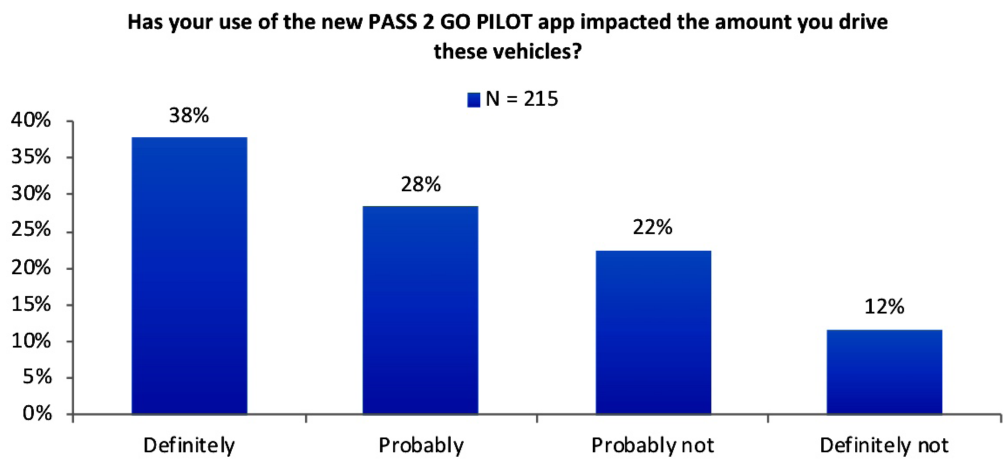


Figure A-44

"After" Survey – Change in Driving as a Result of Use of Pass2Go App

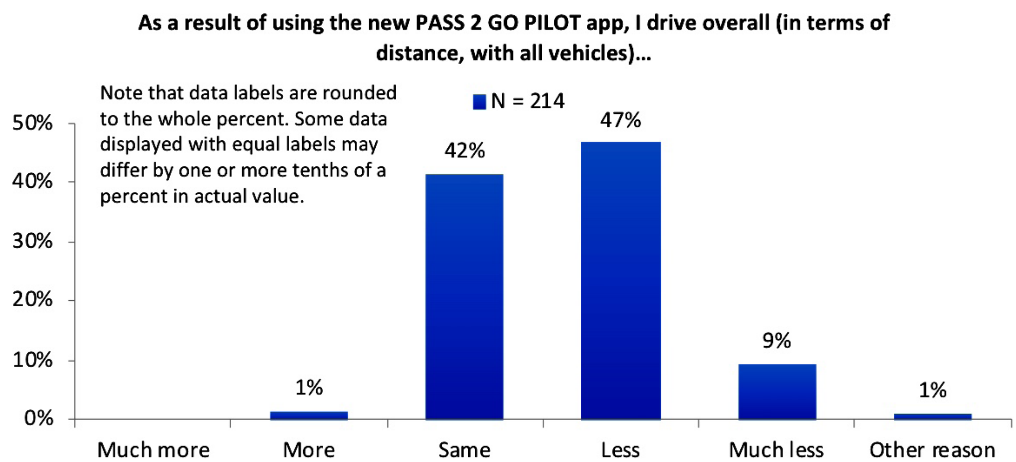


Figure A-45

"After" Survey – Importance of Pass2Go App for Driving Change

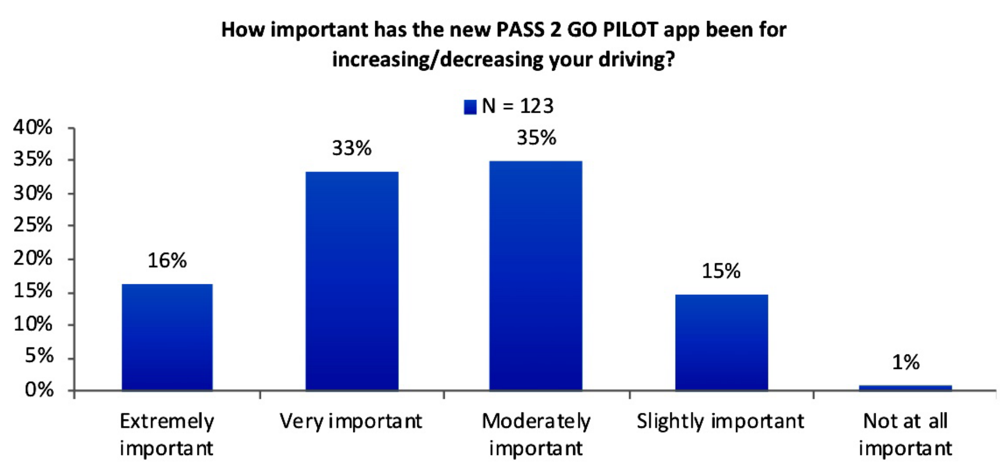


Figure A-46

"After" Survey – Transportation Mode Use

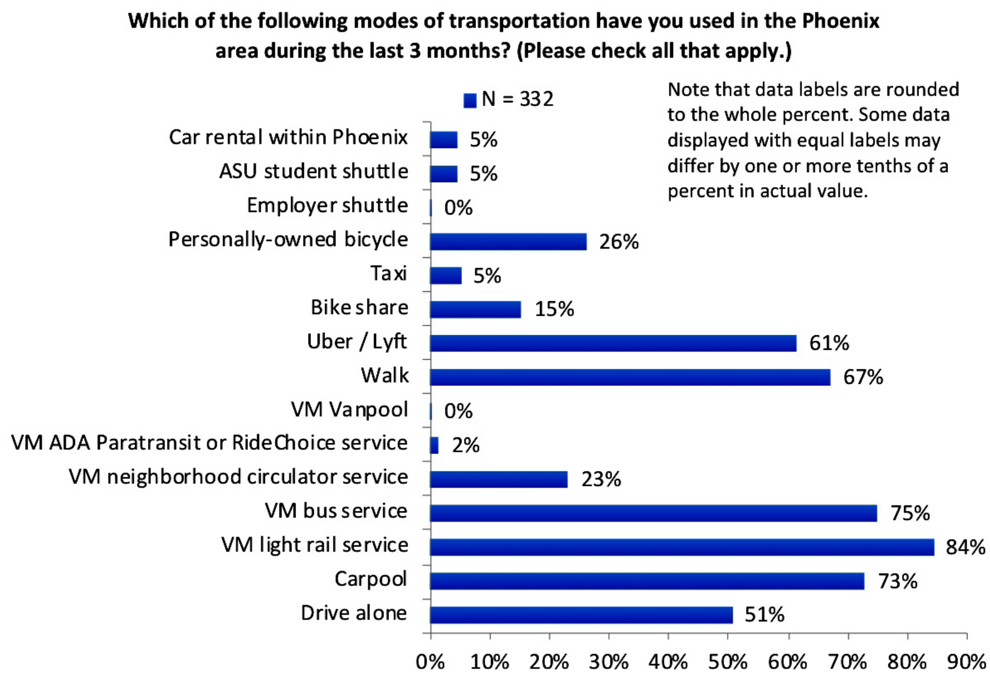


Figure A-47

"After" Survey – Transportation Mode Use Frequency

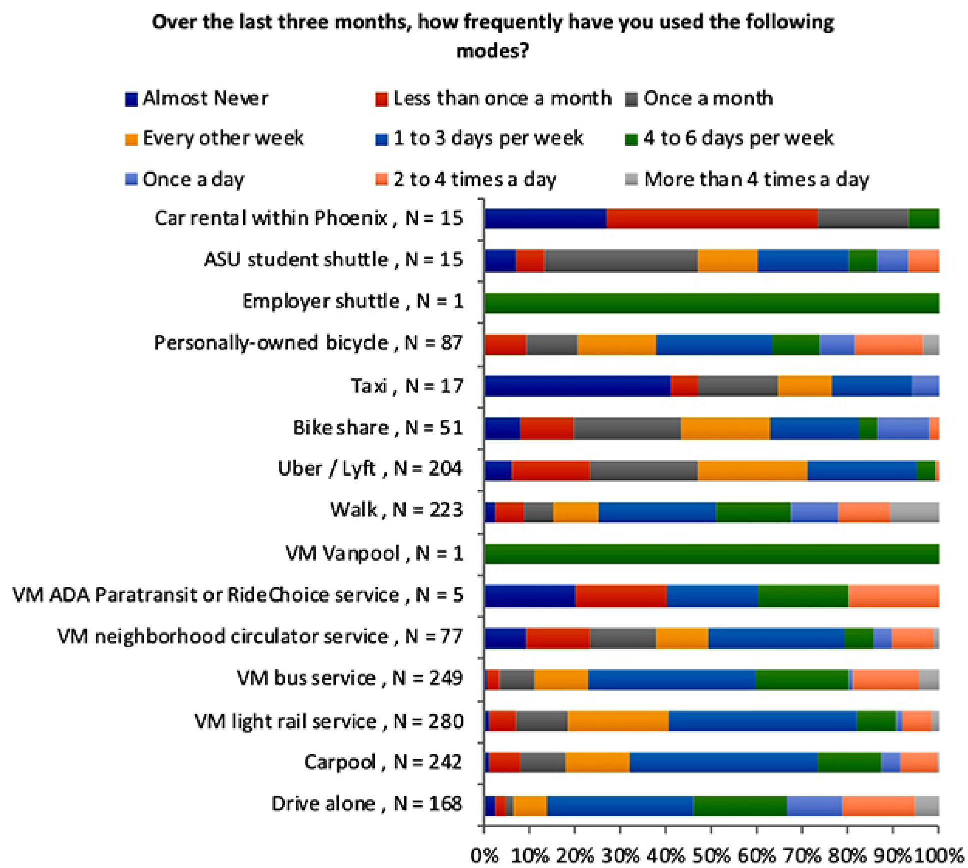


Figure A-48

"After" Survey – Average Bus Trip Total Travel Time

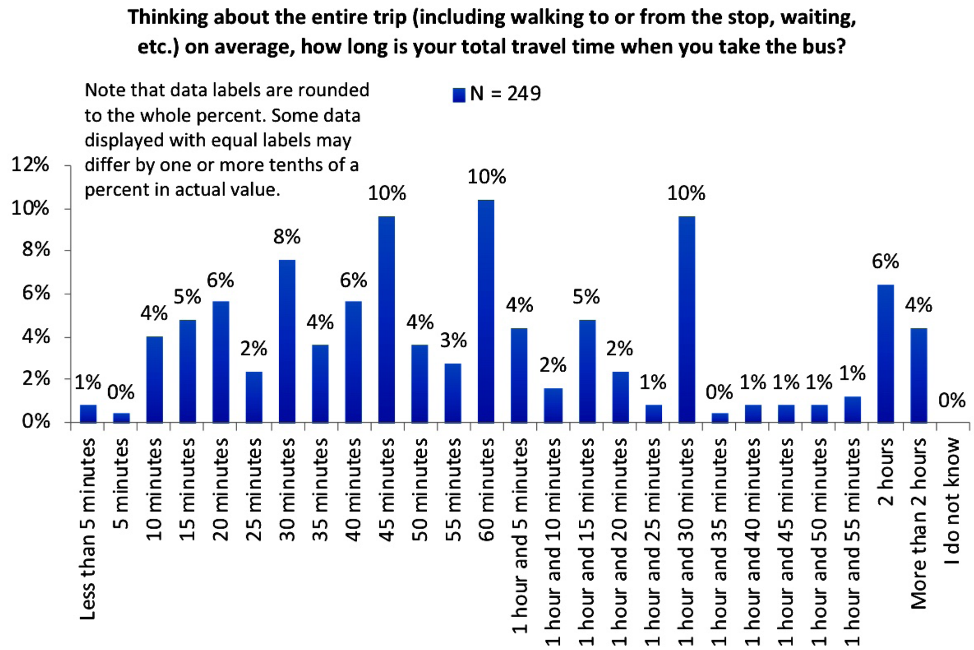


Figure A-49

"After" Survey – Average Bus Trip Wait Time

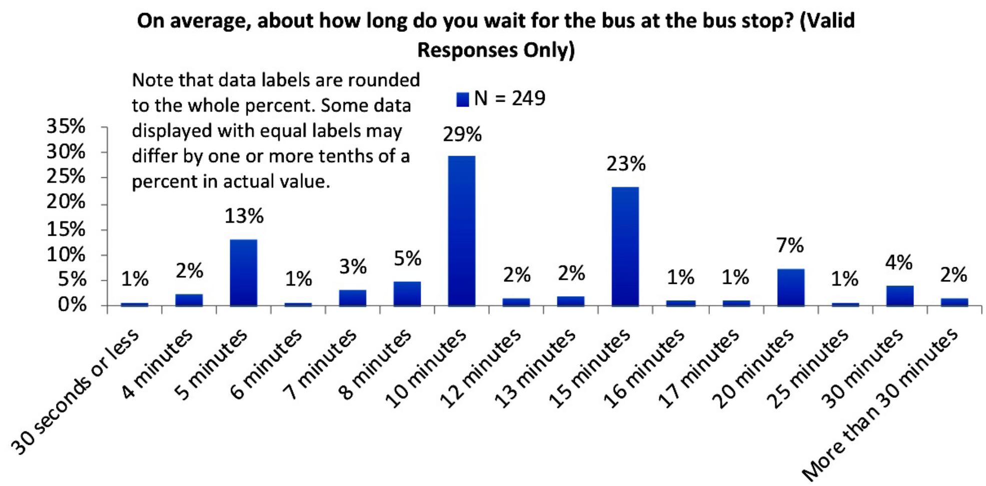


Figure A-50

"After" Survey – Recent Bus Trip Origin

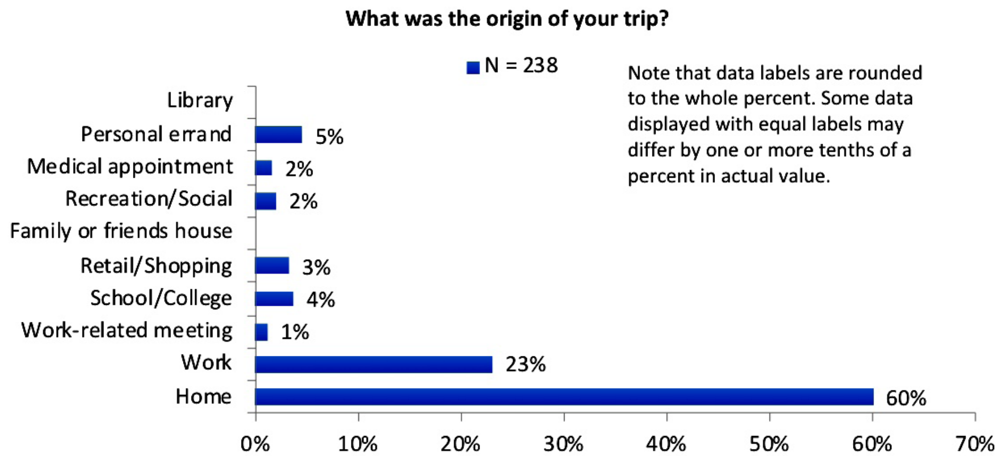


Figure A-51

"After" Survey – Recent Bus Trip Destination

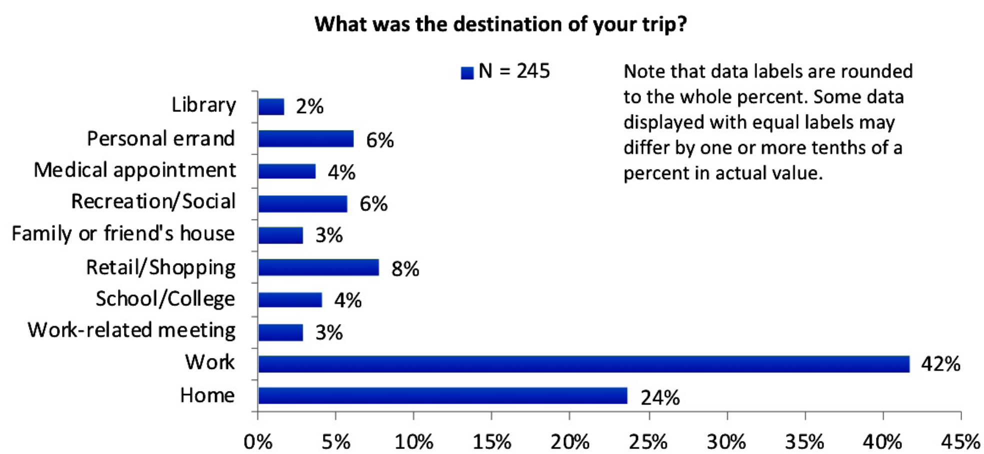


Figure A-52

"After" Survey – Recent Bus Trip Start Time

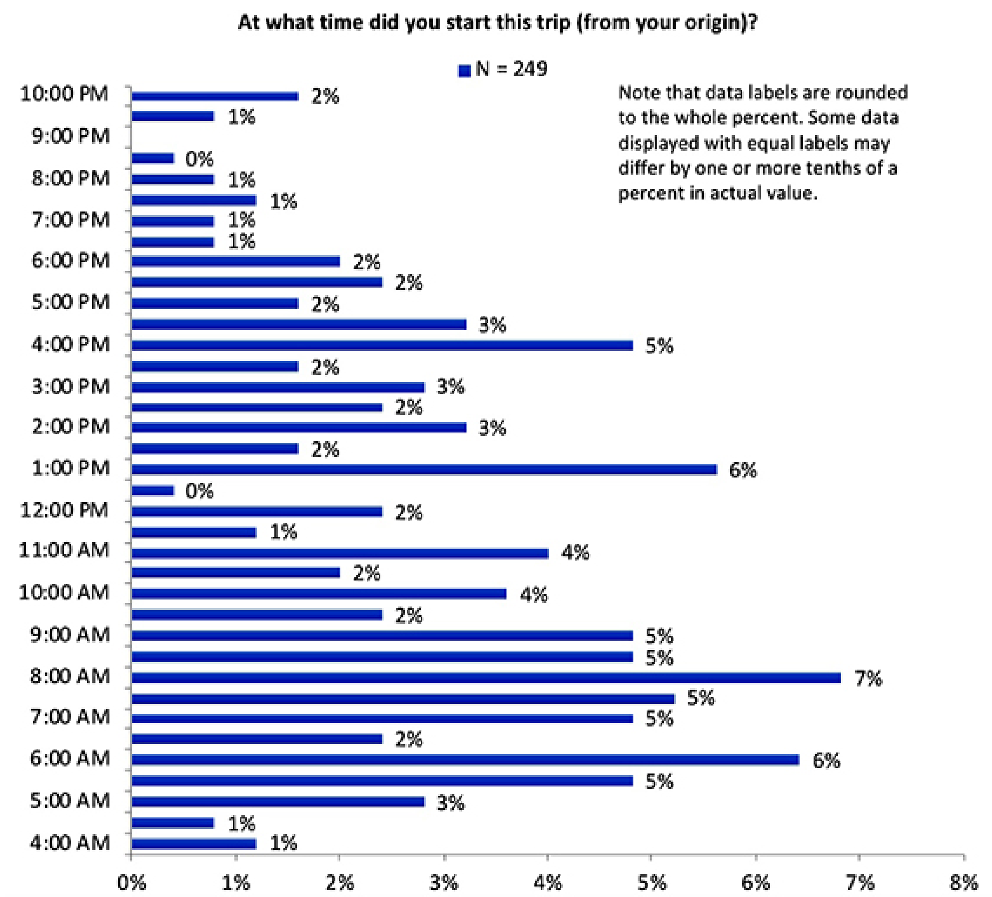


Figure A-53

"After" Survey – Recent Bus Trip Day of Use

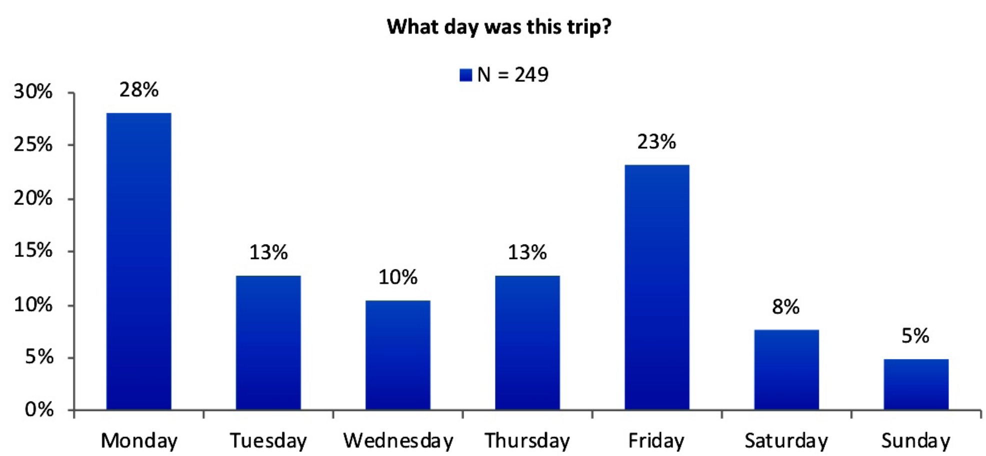


Figure A-54

"After" Survey – Recent Bus Trip Planning Time

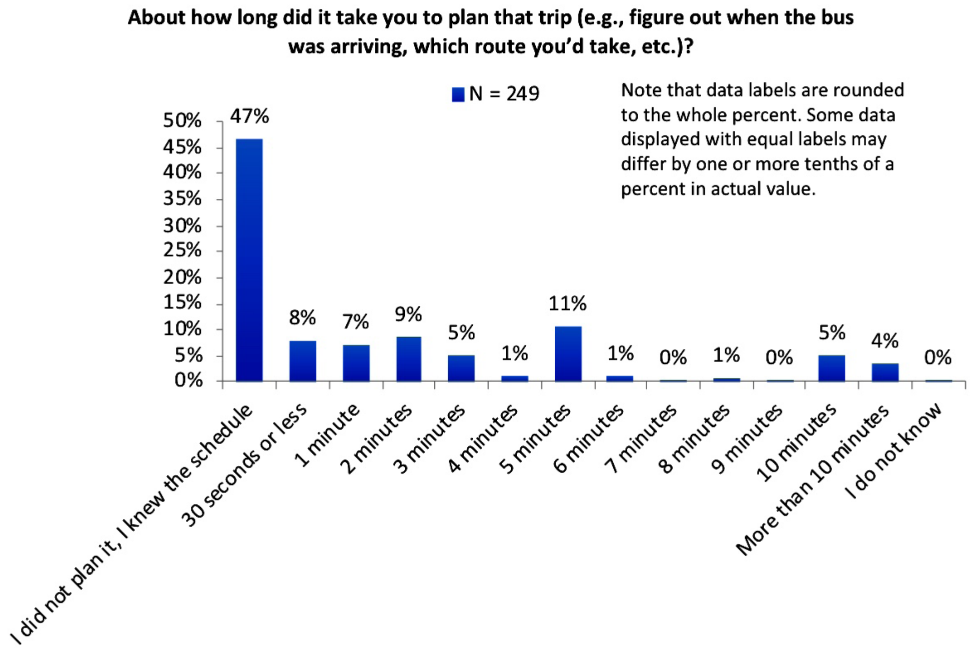


Figure A-55

"After" Survey – Recent Bus Trip Planning Method

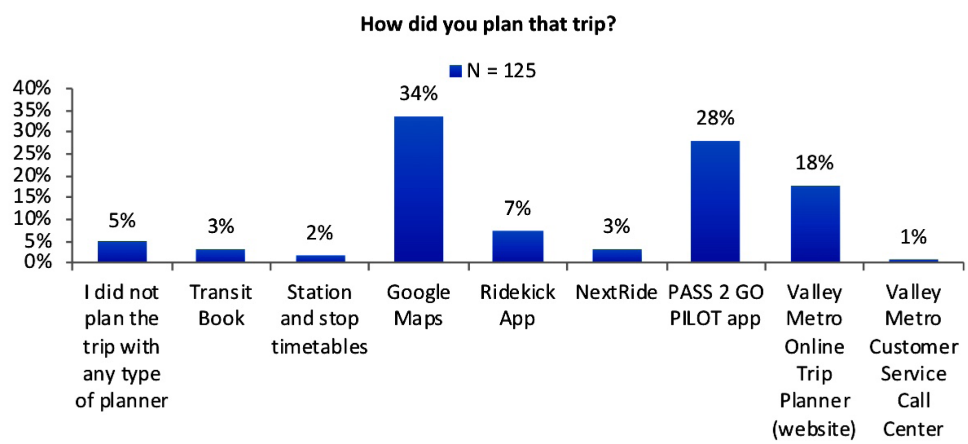


Figure A-56

"After" Survey – Recent Bus Trip Time from Origin to Bus Stop

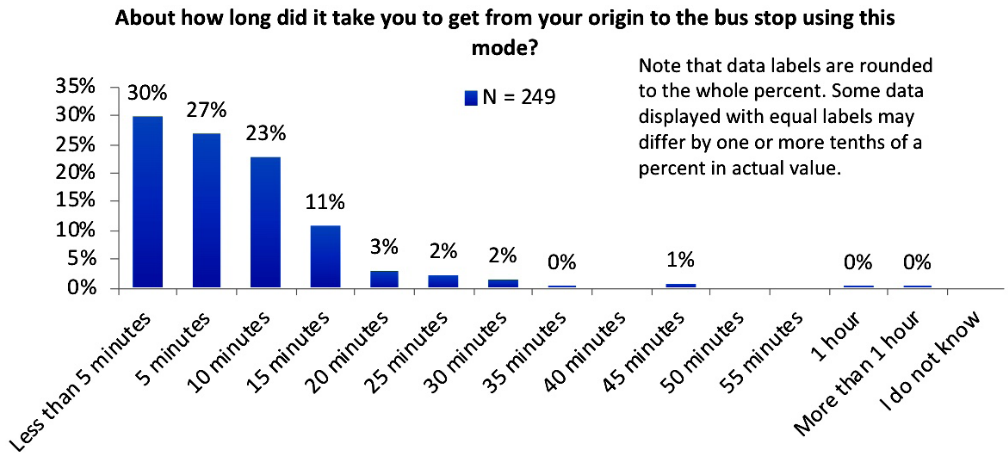


Figure A-57

"After" Survey – Recent Bus Trip Wait Time

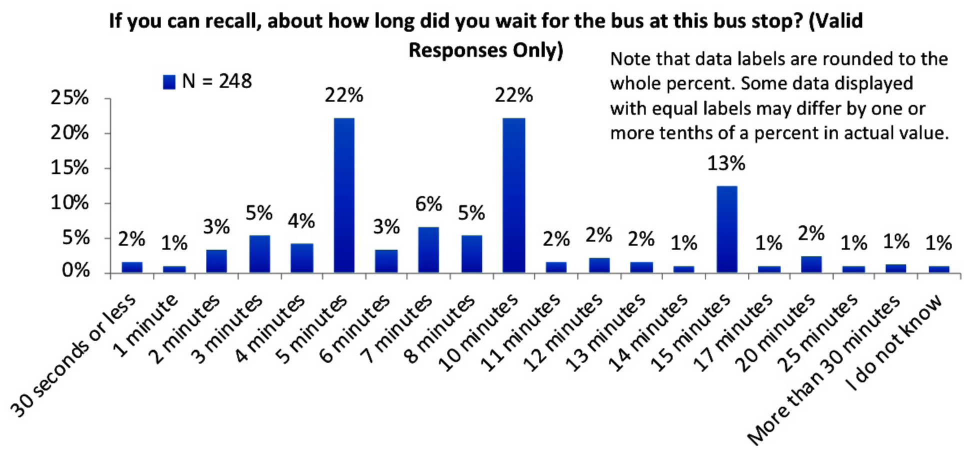


Figure A-58

"After" Survey – Recent Bus Trip Time from Bus Stop to Destination

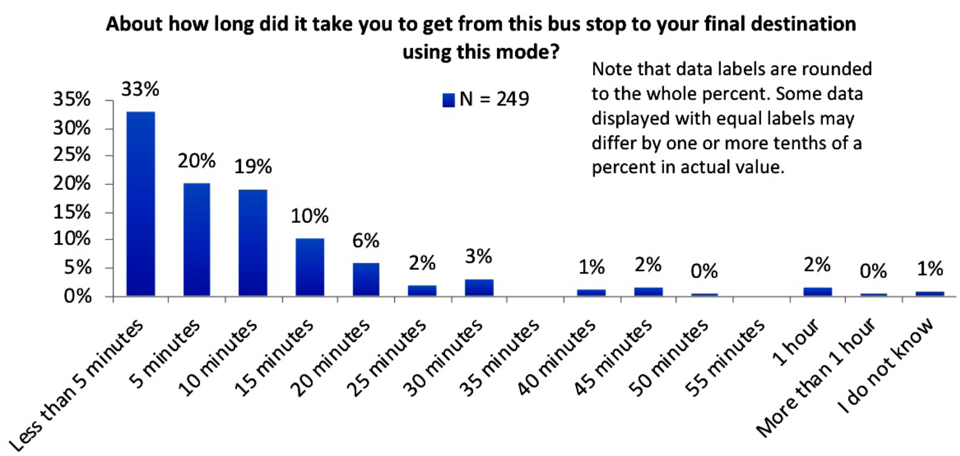


Figure A-59

"After" Survey – Recent Bus Trip Total Travel Time

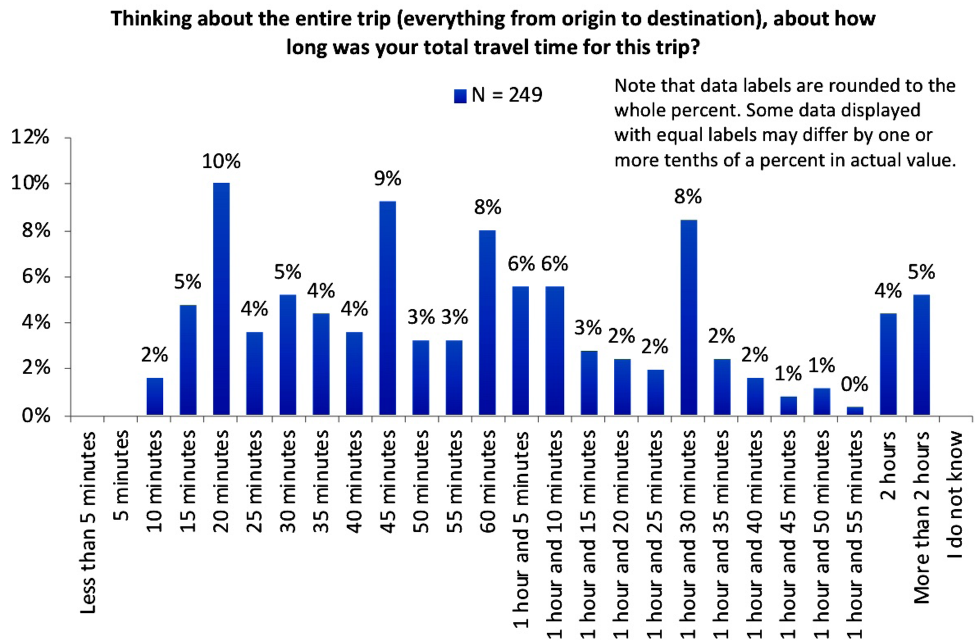


Figure A-60

"After" Survey – Recent Bus Trip Transfers

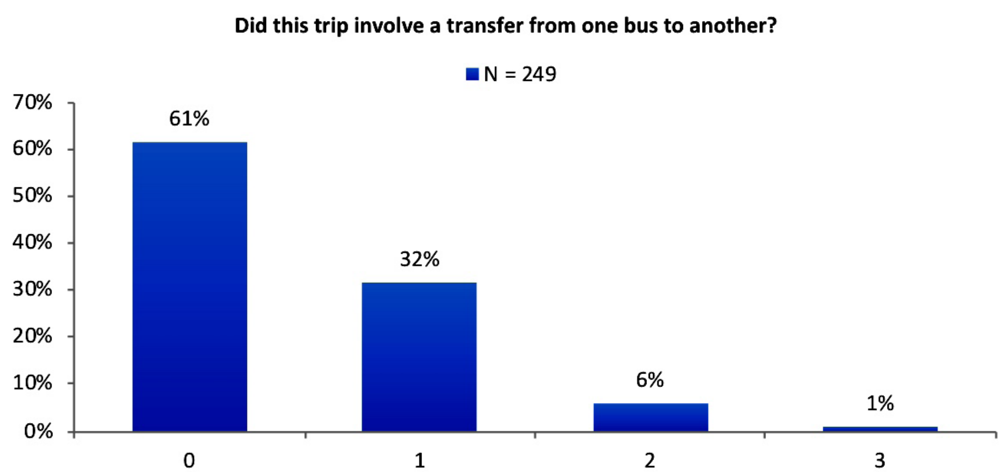


Figure A-61

"After" Survey – Average Rail Trip Total Travel Time

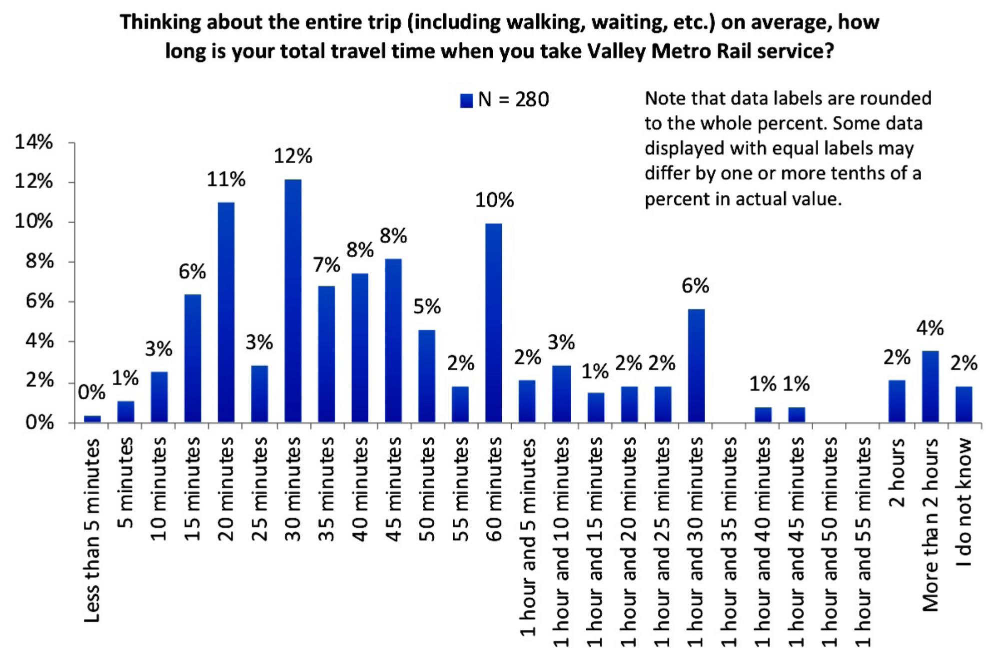


Figure A-62

"After" Survey – Average Rail Trip Wait Time

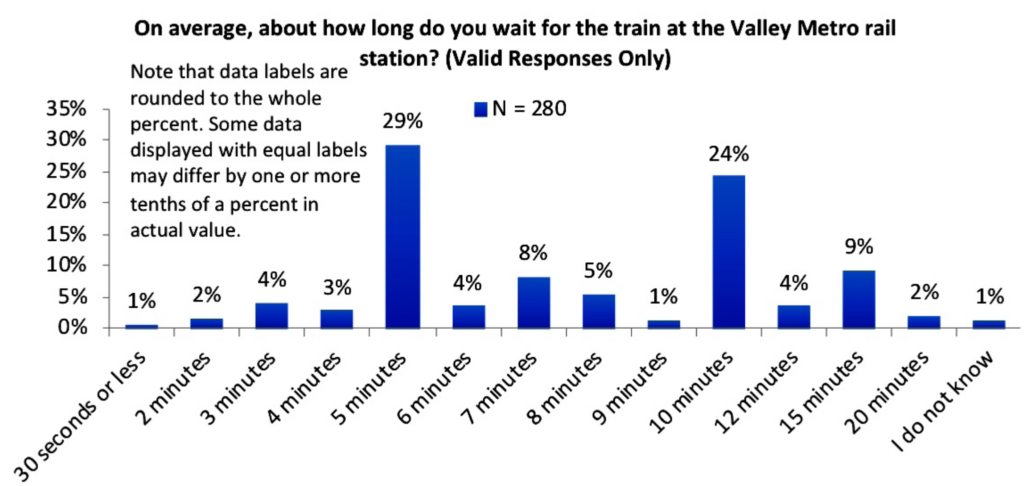


Figure A-63

"After" Survey – Recent Rail Trip Origin

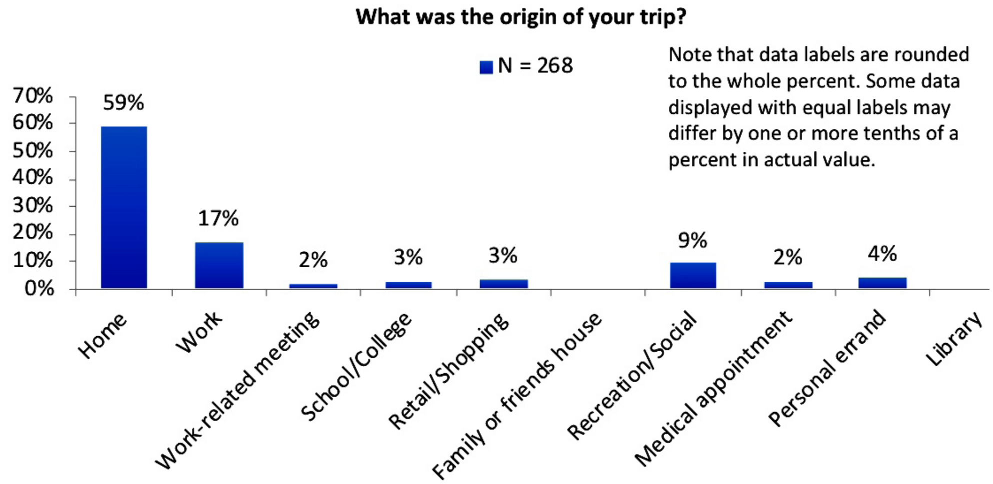


Figure A-64

"After" Survey – Recent Rail Trip Destination

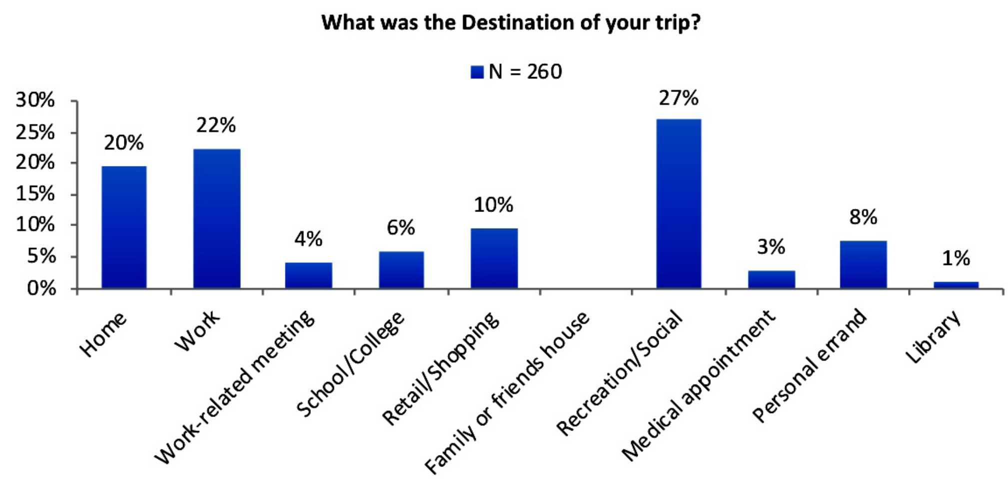


Figure A-65

"After" Survey – Recent Rail Trip Start Time

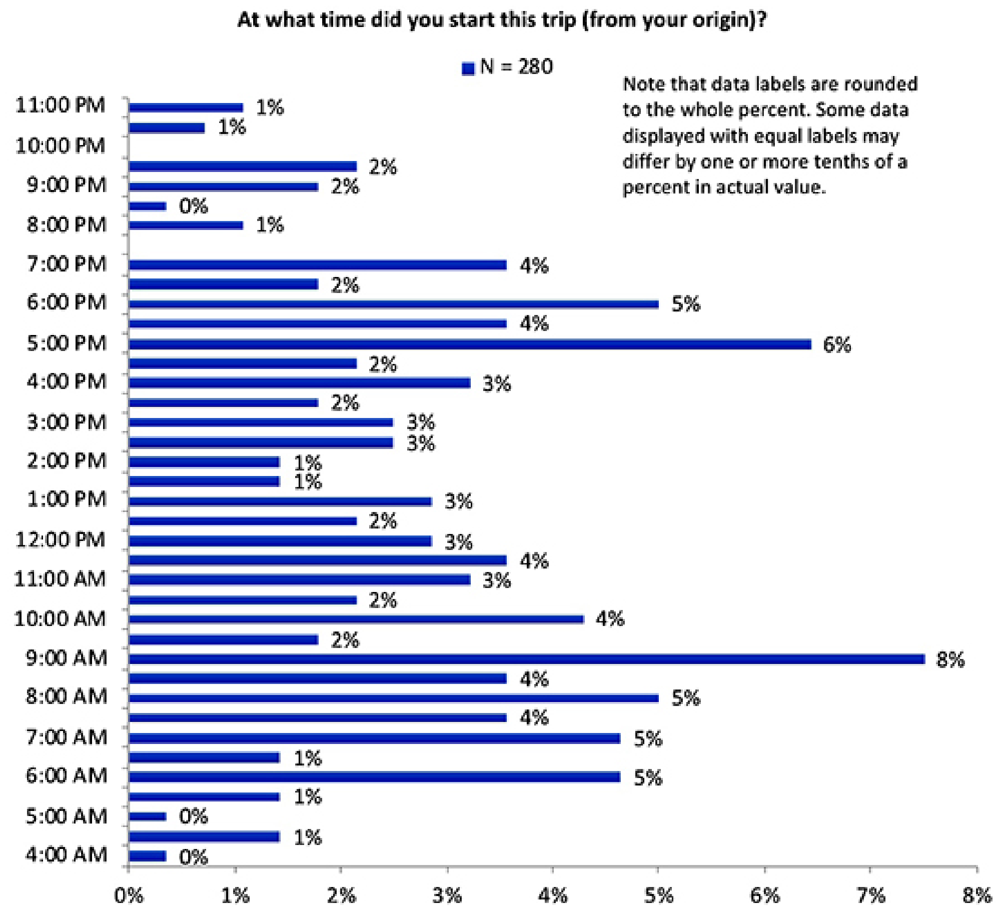


Figure A-66

"After" Survey – Recent Rail Trip Day of Use

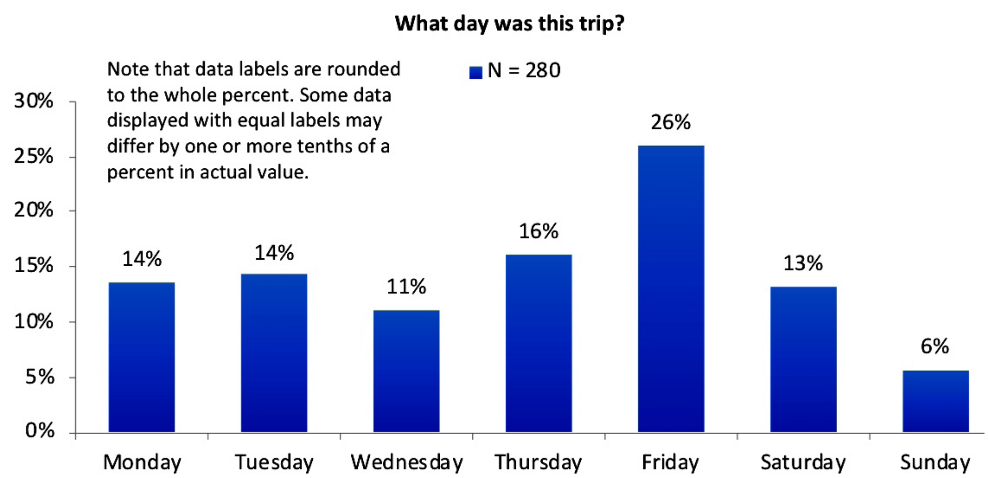


Figure A-67

"After" Survey – Recent Rail Trip Planning Time

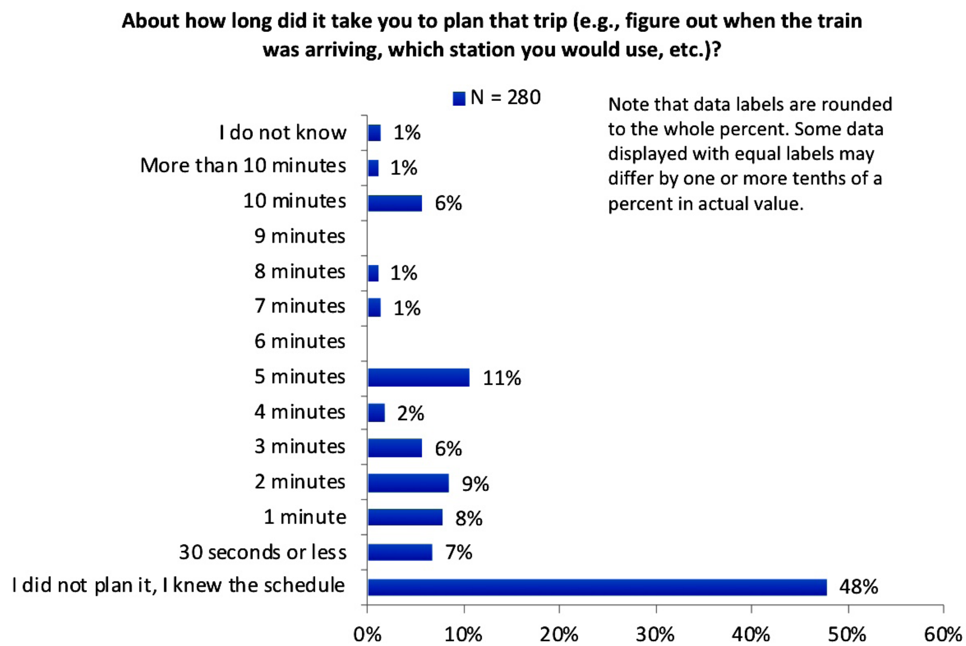


Figure A-68

"After" Survey – Recent Rail Trip Planning Method

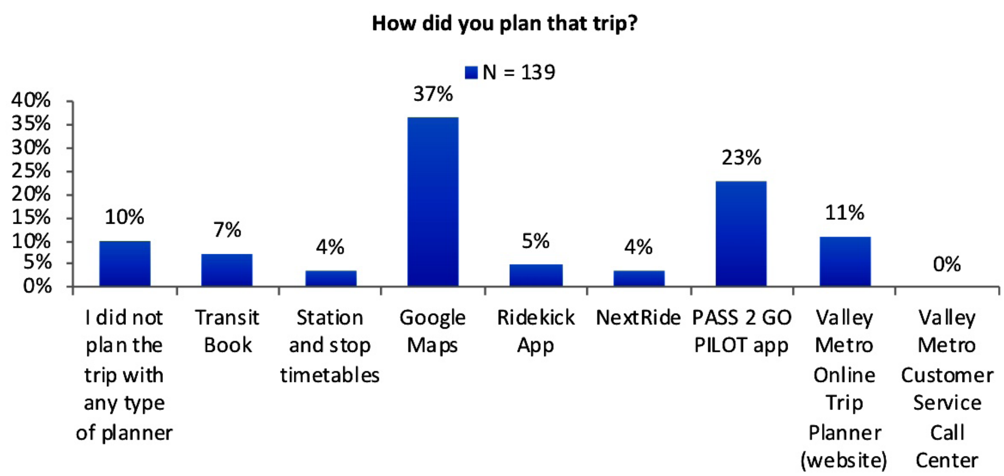


Figure A-69

"After" Survey – Recent Rail Trip Time from Origin to Rail Station

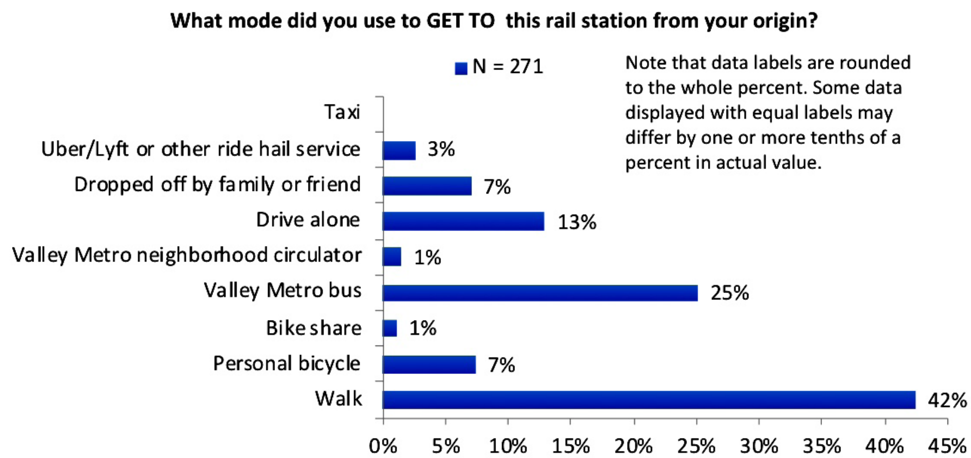


Figure A-70

"After" Survey – Recent Rail Trip Wait Time

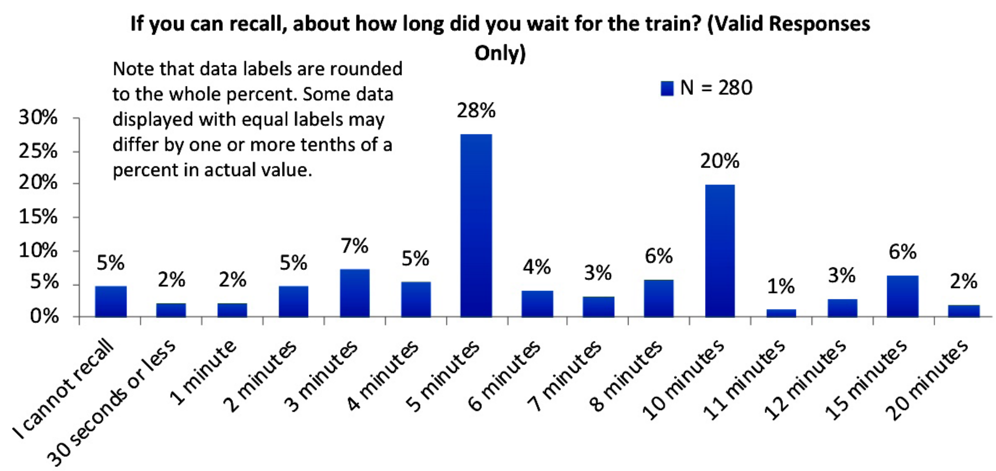


Figure A-71

"After" Survey – Recent Rail Trip Time from Rail Station to Destination

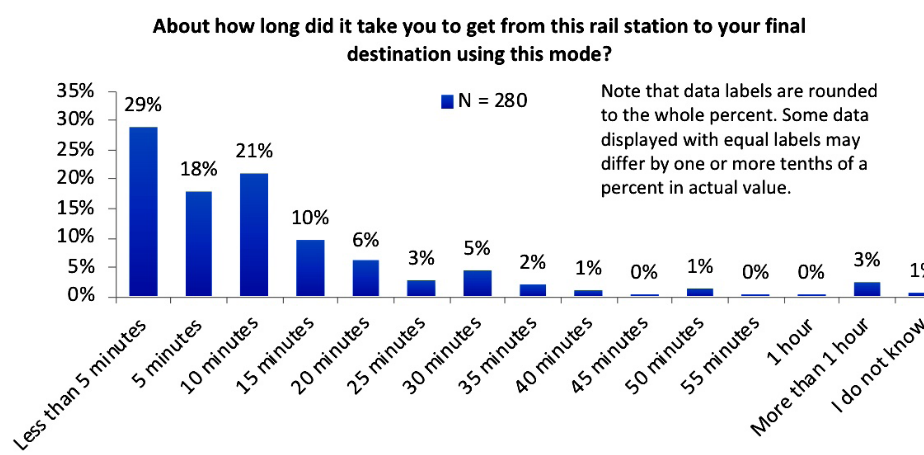


Figure A-72

"After" Survey – Recent Rail Trip Total Travel Time

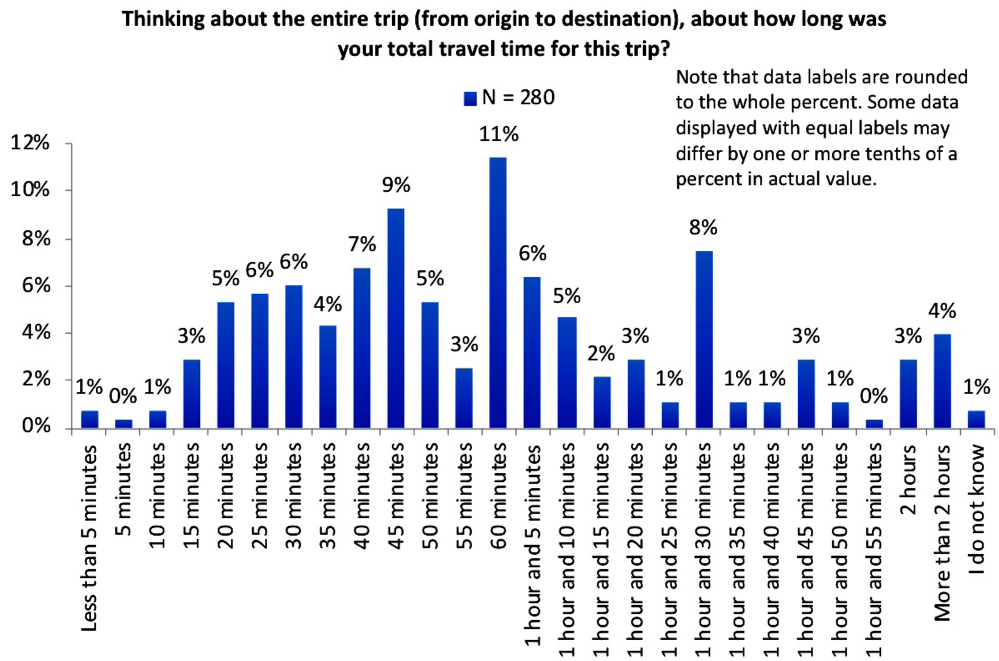


Figure A-73

"After" Survey – Most Common Mode to Get to/from Bus Stops and Rail Stations

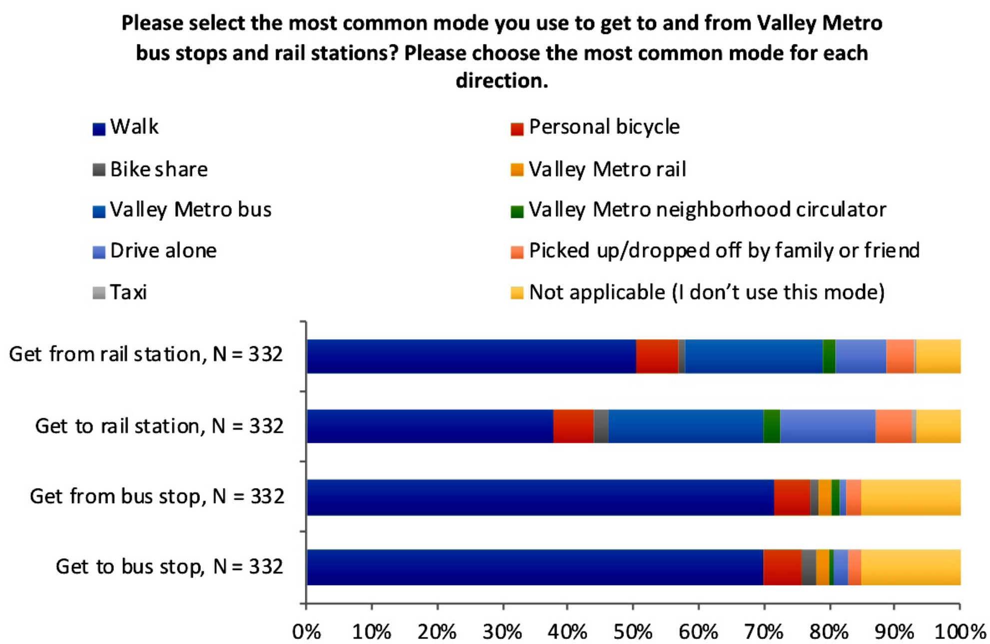


Figure A-74

"Before" and "After" Use of Frequently Used Modes to/from Public Transit

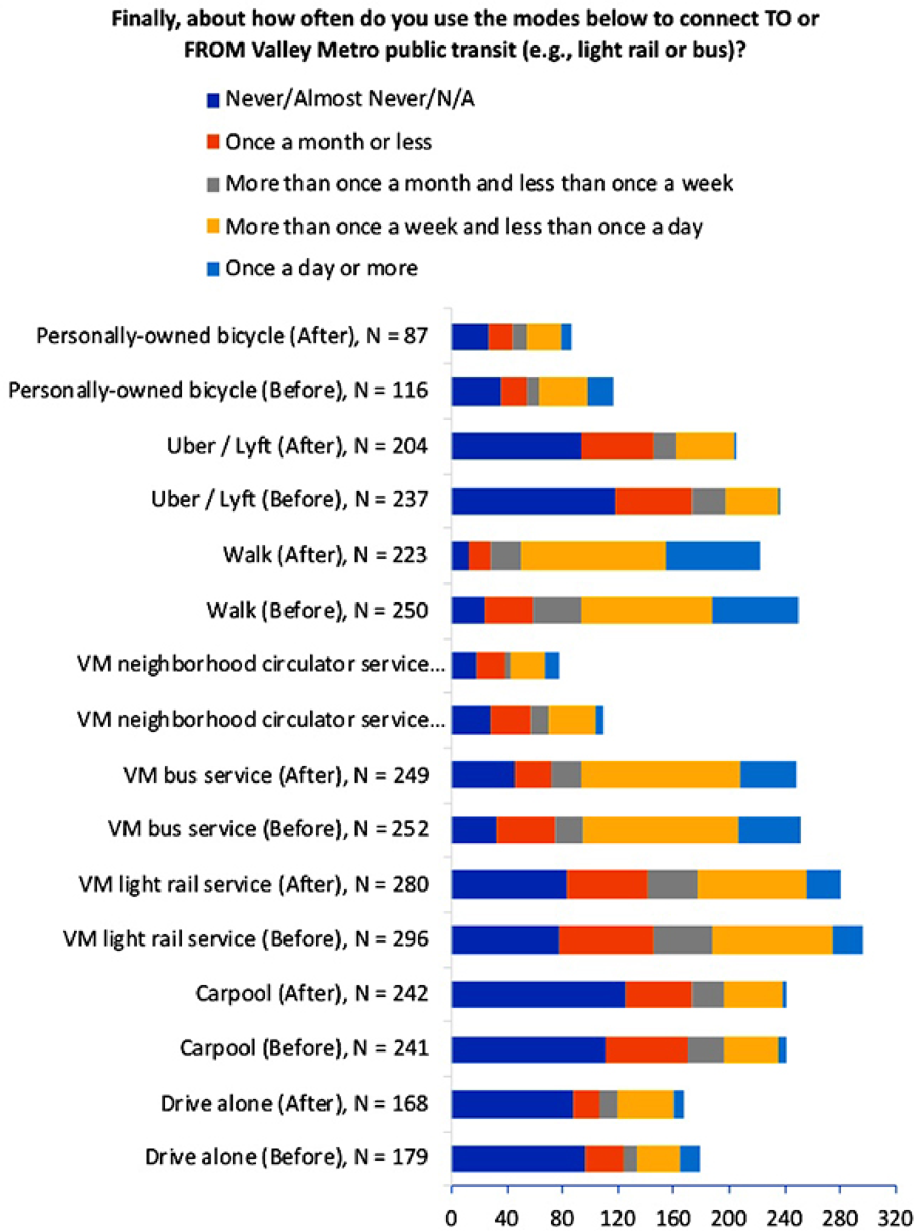


Figure A-75

"After" Survey – Rating of Bus Safetyy

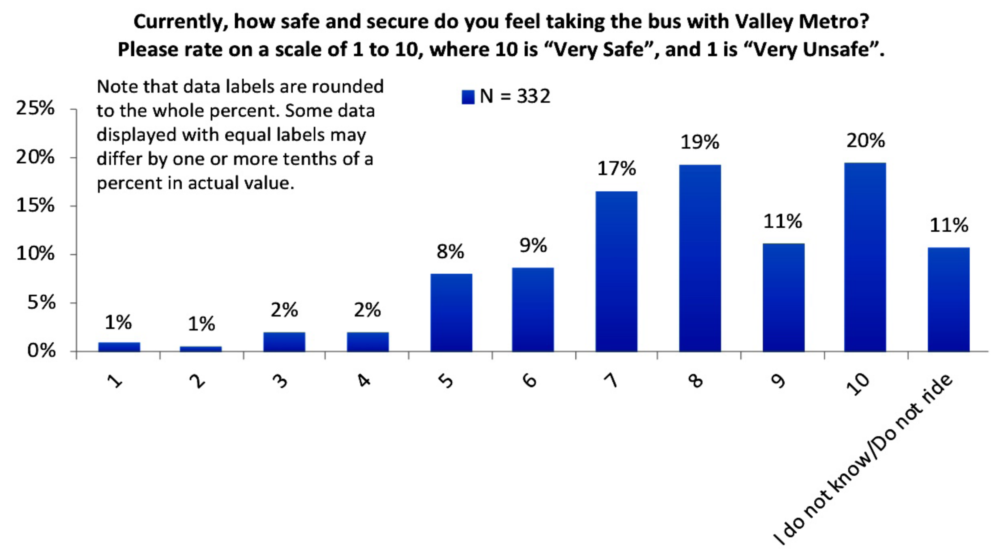


Figure A-76

"After" Survey – Rating of Rail Safety

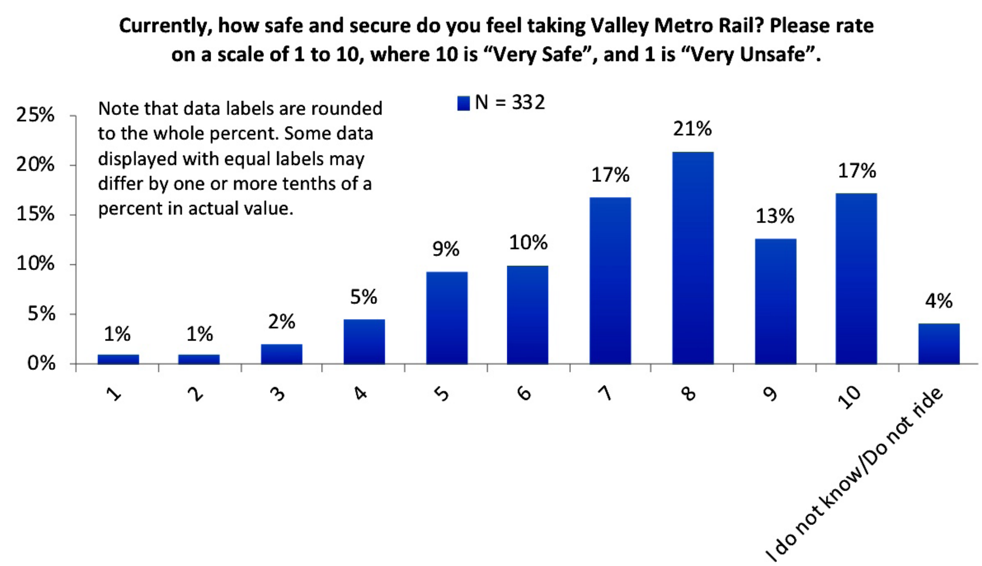
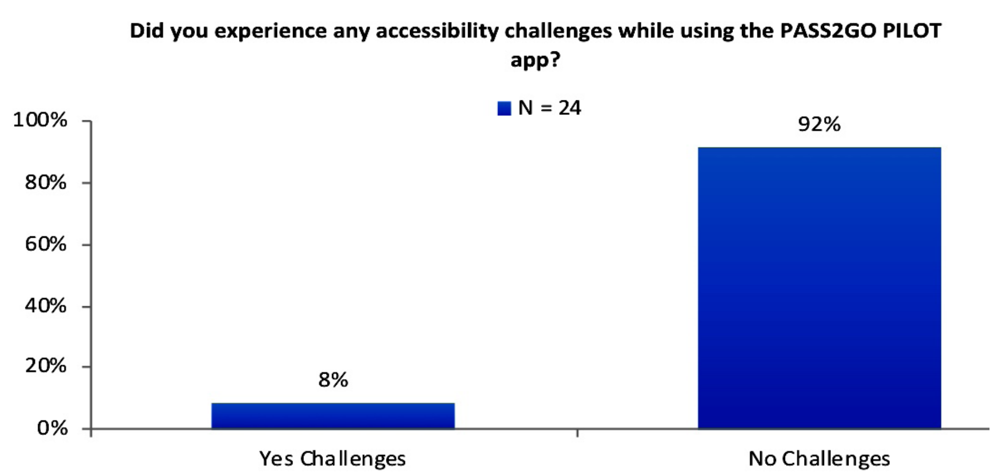


Figure A-77

"After" Survey – Challenges Using Pass2Go App



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