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FTA RESEARCH
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Mobility on Demand (MOD) Sandbox Demonstration: City of Palo Alto and Bay Area Fair Value Commuting

Evaluation Report

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U.S. Department of Transportation
Federal Transit Administration

DECEMBER 2021

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1200 New Jersey Avenue, SE
Washington, DC 20590

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Metric Conversion Table

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

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Acknowledgments

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Abstract

This report documents the results of an independent evaluation of the City of Palo Alto and Bay Area Fair Value Commuting (FVC) Demonstration project, part of the Federal Transit Administration (FTA) Mobility on Demand (MOD) Sandbox program. Commuter transportation in the San Francisco Bay Area is still predominated by single-occupant vehicle (SOV), and the use of alternative commute modes among employees remains low. This is mainly due to the unavailability of alternative modes in certain areas and their low level of convenience in areas where they do exist, which decreases the ability of commuters to conduct multimodal trips given a lack of integrated trip planning, interoperability between transportation service providers, and a unified payment system. To reduce the use of SOVs in the Bay Area, this project aimed to develop two key concepts—an integrated trip planning platform and a cashout system. The demonstration was conducted in the California cities of Cupertino, Menlo Park, Mountain View, and Palo Alto. The evaluation analyzed the project's impacts on SOV use, commute vehicle miles traveled (VMT), energy consumption and emissions, public transit ridership, and accessibility and mobility of lower-income employees.

Overall, the results of the analysis showed that the pilot program reduced SOV commuting in the Bay Area, which led to a decrease in total commute VMT, energy consumption, and carbon dioxide emissions. Additionally, the pilot encouraged employees to use alternative modes of transportation and enhanced more positive attitudes toward public transit. Most hypotheses in this evaluation were supported, and the project produced lessons learned that may advance the design of similar projects in the future.

Executive Summary

The Federal Transit Administration (FTA) is leading an initiative, the Mobility on Demand (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 in this program was the City of Palo Alto and Bay Area Fair Value Commuting (FVC) Demonstration, (Bay Area FVC) project. The California cities of Cupertino, Menlo Park, Mountain View, and Palo Alto partnered with Prospect Silicon Valley, RideAmigos, and Commuter Wallet to implement a project aimed at reducing Bay Area single-occupant vehicle (SOV) commutes by implementing a set of FVC strategies.

Commuter transportation in the San Francisco Bay Area is still dominated by SOVs, and the use of alternative commute modes among employees remains low. This is due to the limited number of alternative modes that exist in low-density areas that do not support traditional public transit service and to the low level of attractiveness and convenience of these modes where they exist, which hinders the ability to conduct multimodal trips given a lack of integrated trip planning, lack of interoperability and communication between transportation service providers, and different payment systems. Some alternative commute programs exist but do not have a sustainable funding mechanism to ensure their continuity in most cases.

To reduce the use of SOVs, the Bay Area FVC project aimed to demonstrate two key concepts—an integrated trip planning platform and a cashout system. The trip planning software, called "Commuter Wallet," provided users with the ability to plan, compare, and pay for alternative transportation modes and incorporated available commute incentives and benefits. The cashout system was an incentive-based program in which an incentive was paid to employees who used non-SOV commute modes.

This report presents the results of the independent evaluation of the Bay Area FVC project as implemented in the cities of Cupertino, Menlo Park, Mountain View, and Palo Alto. The project was one of 11 MOD Sandbox Demonstrations partially funded by FTA. The evaluation was sponsored by the USDOT Intelligent Transportation Systems Joint Program Office (ITS JPO) and FTA. The evaluation was guided by nine hypotheses analyzed using survey data, app activity data, and expert (stakeholder/project partner) interview data. "Before" and "after" surveys were conducted for each of the four cities. Results of the evaluation are summarized below and in Table ES-1.

Hypothesis 1: The mode share of commuting by SOVs for both participating employees and the broader population declines as a result of the FVC strategy. This mode share is defined as a function of trips.

A key objective of the FVC strategy was to decrease SOV commuting. Hypothesis 1 aimed to evaluate whether the pilot decreased the mode share of commuting by SOVs for both pilot participants and the broader population. This was evaluated using trends of the number of trips made using different modes over the duration of the pilot. The statistical analysis of trip activity data showed a decline in SOV commuting by pilot participants compared to other individuals. Additionally, survey data showed that 70% of 20 pilot participants drove alone less often as a result of pilot program components (e.g., information, rewards, etc.). Overall, the analysis results support Hypothesis 1.

Hypothesis 2: The total commute VMT for participating employees as well as the broader population declines.

Hypothesis 2 was evaluated using trip activity data and survey data simultaneously. Activity data consisted of the travel behavior of individuals during the pilot and indicated different trip attributes such as transportation mode used and trip distance. "Before" and "after" surveys asked respondents to report their commute travel behavior before and after participating in the pilot. Survey responses showed a significant decrease in driving accompanied by a significant increase in the use of alternative modes such as public transit, personal bicycle, walk, and carpool.

These survey responses were used to construct a two-dimensional mode substitution matrix for individuals before and after participating in the pilot program. The aim of this matrix is to obtain a distribution that describes the mode substitution that occurred as a result of the pilot. This distribution was used to randomly assign a mode shift for each trip within the activity data set, which then can be used to generate a rough estimate of the likely change in direction of vehicle miles traveled (VMT). These random assignments were repeated multiple times to check for robustness and sensitivity of the overall VMT change to redistributions of individual mode shift. Overall, the combined analysis of survey and trip activity data showed that the total commute VMT for participating employees decreased by 40% as a result of the pilot program and thus supported Hypothesis 2.

Hypothesis 3: The total energy consumption and carbon dioxide-equivalent (CO_2-e[1]) emissions from participating employees as well as the broader population declines.

The analysis of Hypothesis 3 built off of Hypothesis 2 and was also based on trip activity data and survey data. The survey administered to pilot participants asked respondents if they owned or leased a car in addition to the make, model, and year of that car. Based on a database published by the U.S. Environmental

[1] CO_2-e, or carbon dioxide equivalent, is a standard unit for measuring carbon footprints, including carbon dioxide and all other gases.

Protection Agency (EPA), it was possible to generate a fuel economy distribution for the vehicles owned by 47 pilot participants. This discrete distribution was used to estimate a smooth probability density function based on a non-parametric method called kernel density estimation (KDE). The latter continuous distribution was used to randomly sample fuel economies and assign them to individual commute trips and then calculate the likely change in fuel consumption and corresponding CO_2 emissions. These random fuel economy assignments were repeated multiple times to check for robustness and sensitivity of the overall fuel consumption change to redistributions of individual vehicle fuel economy. Overall, the combined analysis of survey and trip activity data showed that the total energy consumption decreased by 46%, and CO2 emissions decreased by 10.2 metric tons for participating employees, supporting Hypothesis 3.

Hypothesis 4: The FVC benefits lower-income workers more than higher-income workers.

The analysis evaluated the spatial distribution of home locations of program participants relative to the employee population and the incomes of program participants relative to the employee population. The analysis of home locations at the ZIP code level found that program participants were concentrated southeast of the cities of employment. The employee population was naturally more widely distributed, but with a center of concentration overlapping the cities of employment. The comparative distributions suggest that the program served those within moderate commute distances, mostly through some of the more congested corridors of the region. Analysis of the data found that the FVC project benefitted lower-income workers more than higher-income workers. The data showed that the average cost savings within the activity data was distributed relatively evenly across income levels. Employees of all income levels participated in the program, with both high incomes and lower incomes over-represented relative to the overall population of employees (a more widely spread distribution). As a percentage of income, lower-income employees received a greater benefit, as their savings were larger as a percentage of their income. In general, the findings of Hypothesis 4 were supported.

Hypothesis 5: Improved access to pre-tax payments increases public transit ridership.

The data showed that public transit ridership generally increased as a result of the project, although it was difficult to isolate this specifically to increased access to pre-tax payments. More broadly, the drive-alone mode fell as a result of the project, and increases in public transit were found in both the survey data and the activity data provided by RideAmigos. These changes were somewhat limited in magnitude (imperceptible in aggregate ridership), but they show that public transit increased as a result of the project. Given the mix of supportive findings, the hypothesis is found to be partially supported.

Hypothesis 6: The mobility aggregator, a feebate or cashout policy, and gap-filling analytics positively impact the propensity of commuters to take non-SOV modes.

Hypothesis 6 was evaluated primarily using survey data to assess the mode choice of individuals after participating in the pilot and whether they increased their use of non-SOV modes as a result of specific benefits provided by the FVC strategy. Survey responses indicated a significant shift from driving to using alternative modes such as public transit, walking, biking, and carpooling. Most of the benefits and services provided by the program significantly increased public transit use by pilot participants. The most effective benefits were 1) public transit cost reimbursement, 2) loaded public transit cards (i.e., Clipper transit fare cards with a pre-loaded balance), 3) the “Challenges and Rewards Program” (a set of named challenges that had rewards associated with meeting specific goals), and 4) alternative mode incentives or cashouts. Survey results also showed that a sizeable minority of individuals would consider using e-bikes or scooters as part of their commute in Cupertino and Mountain View. In addition, a majority of survey respondents perceived incentives as an effective way to influence a change in their commute in the cities of Menlo Park, Mountain View, and Palo Alto. Specifically, a minority of these individuals indicated that receiving a carpool stipend would encourage them to carpool, and they would be willing to participate in a City-supported vanpool program for employees. Apart from survey data, trip activity data analyzed in Hypothesis 1 also showed that pilot participants in all four cities significantly increased their non-SOV use at a 95% confidence level. Overall, the results of the analysis supported Hypothesis 6.

Hypothesis 7: The attitudes of employees toward public transit become more positive.

Hypothesis 7 was evaluated using “before” and “after” survey data, where pilot participants were asked to rate their perceptions of public transit and to evaluate the effect of different pilot benefits on their use of alternative modes. Survey results showed that the FVC strategy significantly enhanced the positive perception of public transit by pilot participants: 40% of 57 respondents reported a rating of 7 or higher (out of 10) before participating in the pilot, and this metric increased to include 60% of respondents after participating in the pilot. The average rating of public transit across the four cities increased from 5.5 to 7 due to the pilot; this increase was most significant for the cities of Palo Alto and Menlo Park.

The FVC strategy also provided benefits to pilot participants to encourage commuting by public transit. Survey results showed that the most effective benefits included a form of direct reimbursements to support the use of alternative modes, including 1) public transit cost reimbursement, 2) loaded public transit cards, 3) the "Challenges and Rewards Program," and 4) alternative mode incentives or cashouts. Overall, the analysis results supported Hypothesis 7.

Hypothesis 8: The commute feebate or cashout is financially sustainable at participation rates achievable during or after the pilot.

The feebate component of the project could not be implemented as originally planned. As such, Hypothesis 8 could not be evaluated in its original form. The project, while impacting people's behavior as reported in other analyses, did not collect revenue and, therefore, could not achieve a measure of financial sustainability through this mechanism. Hypothesis 8 could not be evaluated and thus is inconclusive.

Hypothesis 9: The project produces a series of lessons learned that will be documented through expert interviews with project stakeholders.

Hypothesis 9 was evaluated by conducting expert interviews regarding lessons learned from the Bay Area FVC project. Expert interviews with those close to project implementation revealed four notable findings—1) the original scope of the Palo Alto demonstration was complex and "overly ambitious" with respect to its goals and number of partners; 2) developing a transportation demand management (TDM) program is a labor- and institutionally-intensive process, requiring staff to champion TDM concepts, recruit employees to participate, train participants how to use various tools, and engage staff to encourage behavior change; 3) identifying departmental champions is key to assisting employees and co-workers to complete trip logs and incentive applications; and 4) incentives should be sufficient to encourage mode shift, particularly among longer distance commuters who may have higher public transit fares.

A summary of findings is provided in Table ES-1.

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

Table ES-1 *Summary of Findings*

	Hypothesis	Status	Key Finding
1	The mode share of commuting by SOVs for both participating employees and the broader population declines as a result of the FVC strategy. This mode share is defined as a function of trips.	Supported	Statistical analysis of trip activity data showed a decline in the mode share of commuting by SOVs, and a majority of pilot participants reported that the pilot had reduced their driving alone.
2	The total commute VMT for participating employees, as well as the broader population, declines.	Supported	Combined analysis of survey and trip activity data showed that the total commute VMT for participating employees decreased by 40%.
3	The total energy consumption and CO2-e emissions from participating employees, as well as the broader population, declines.	Supported	Combined analysis of survey and trip activity data showed that the total energy consumption decreased by 46% and CO2 emissions decreased by 10.2 metric tons for participating employees.
4	The FVC benefits lower-income workers more than higher-income workers.	Supported	Project participation spanned multiple income levels, with benefits distributed across participants of all incomes. The savings experienced by lower-income participants was higher as percentage of their income relative to higher-income participants.
5	The improved access to pre-tax payments increases public transit ridership.	Partially supported	Public transit ridership was found to increase among some pilot participants as a result of the project. Driving alone was found to decrease. While the project was connected to these changes, it was not conclusive as to whether it was specifically due to access to pre-tax payments.
6	The mobility aggregator, feebate or Cashout policy, and gap-filling analytics positively impact the propensity of commuters to take non-SOV modes.	Supported	The different benefits provided by the pilot program increased number of commutes by non-SOV modes.
7	The attitudes of employees toward public transit become more positive.	Supported	The FVC strategy significantly enhanced the perception of public transit by pilot participants.
8	The commute feebate or cashout is financially sustainable at participation rates achievable during or after the pilot.	Inconclusive	The fee of the feebate, which was originally planned as part of the project, was ultimately not implemented. Absent this revenue-raising component, this hypothesis could not be evaluated.
9	The project produces a series of lessons learned that will be documented through expert interviews with project stakeholders.	Supported	The project navigated a number of planning and implementation challenges but was ultimately able to implement the project similar to its original vision. The process of planning and implementation produced lessons learned for future designs of similar project.

Section 1

Introduction

Overview of MOD Sandbox Demonstrations

The Federal Transit Administration (FTA) Mobility on Demand (MOD) Sandbox 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, and ridesourcing/Transportation Network Company (TNC) and other shared mobility operators.

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

Table 1-1 *Overview of MOD Sandbox Projects*

Region	Project	Description
		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.

Table 1-1 (cont.) *Overview of MOD Sandbox Projects*

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

An independent evaluation (IE) is required by Federal public transportation law (49 U.S.C. § 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 Bay Area Fair Value Commuting (FVC) project, which aimed to reduce Bay Area single-occupant vehicle (SOV) commute share and was implemented in the California cities of Cupertino, Menlo Park, Mountain View, and Palo Alto. The project developed an integrated software platform that allowed users to plan, compare, and pay for trips using alternative commute modes and applied a cashout system to fund incentives for use of these modes. Parking cashout is a program that allows employers who provide subsidized parking for their employees to offer a cash allowance in lieu of a parking space. The evaluation of this project involved exploring a number of hypotheses surrounding the project's impact on SOV use, commute vehicle miles traveled (VMT), energy consumption and carbon dioxide (CO_2) emissions, public transit ridership, and accessibility and mobility of low-income individuals. 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 the quantitative and qualitative evaluation methods used.

Section 2 Palo Alto MOD Sandbox Project Summary

The California cities of Cupertino, Menlo Park, Mountain View, and Palo Alto partnered with Prospect Silicon Valley, RideAmigos, and Commuter Wallet to implement a MOD Sandbox Demonstration project aimed at reducing San Francisco Bay Area SOV commuting by implementing an FVC set of strategies. Prospect Silicon Valley served as a main facilitator of the project, linking the initiative across the four cities and commercial partners.

Commuter transportation in the Bay Area is still dominated by SOVs, and the use of alternative commute modes among employees remains low. This is due to the limited number of alternative modes that exist in low-density areas that do not support traditional public transit service and the low level of attractiveness and convenience of these modes where they do exist. This hinders the ability to conduct multimodal trips given a lack of integrated trip planning, lack of interoperability and communication among transportation service providers and different payment systems. Some alternative commute programs exist but do not have a sustainable funding mechanism to ensure their continuity in most cases.

To reduce the use of SOVs, the Bay Area FVC project aimed to demonstrate two key concepts—1) an integrated trip planning platform and 2) a feebate/cashout system. The trip planning software, "Commuter Wallet," provided users with the ability to plan, compare, and pay for trips using alternative transportation modes and incorporated available commute incentives and benefits. The cashout system was an incentive-based program in which an incentive was paid to employees who used non-SOV commute modes.

As initially envisioned, the Palo Alto MOD Sandbox Demonstration comprised five components:

1. **Component #1 – Enterprise Commute Trip Reduction (ECTR) software platforms** that automate employer commute programs. ECTR platforms integrates with employer human resources and payroll functions and distribute benefits such as loading Clipper transit fare cards and allows pre-tax commuter benefits purchase of transit passes while collecting and reporting commuter mode choices. The project partner vendor is RideAmigos.
2. **Component #2 – Commuter Wallet** is a mobile multimodal trip planning and payment app that serves a combination of public/private transit, bikeshare, rideshare, carshare, and electric scooter/bike share modes.

3. **Component #3 – "Revenue-neutral workplace parking feebate"** that charges a fee for SOV commutes and rebates that revenue to non-SOV commutes, structured so there is no cost to employers. This ultimately was not implemented as originally planned. The "fee" component of the feebate was not implemented; instead a "cashout" system was used to incentivize non-SOV commutes. The project distributed benefits to pilot participants that included:
   - **Scoop carpool subsidy** – offered to carpoolers through Scoop, where participants could earn up to $100 in gift certificates for every 10 carpool days tracked.
   - **Caltrain GoPass** – unlimited all-zone pass.
   - Walking benefit (pilot) – allowed participants to earn $1.50 per day for walking or earn $75 for walking 11+ days per month.
   - **Pre-tax benefit for bicycle maintenance and repairs** – offered a 100% pre-tax subsidy up to $20 per month for bicycle maintenance and repairs.
   - **E-bike & e-scooter trial** – allowed participants to borrow an e-bike or e-scooter for a two-week trial
   - **RideAmigos challenges (Pilot)** – presented challenges and virtual challenges for RideAmigos users.
   - **Free parking** – offered free parking pass.
   - **Pre-tax benefit for transit fares** – offered a 25% subsidy on a maximum $265 per month pre-tax + $235 post-tax transit fares and/or a GoNavia card that could be applied towards Clipper.
4. **Component #4 – "Gap Filling,"** which describes analytics to identify commutes with poor alternatives and subsequent attempts to improve them. Examples of gap filling actions include subsidizing Lyft/Uber rides to and from public transit stops, e-scooter loan-to-own to provide first/last mile connections to public transit, bike network improvements to connect to public transit, and microtransit to provide first/last mile service to higher-order public transit services (e.g., express bus, bus-rapid transit, light and heavy rail). Such actions were not directly part of the project but could be implemented in the future with insights drawn from gap filling analytics.
5. **Component #5 – Identifying systemic obstacles and alleviating them**, for example by enabling better public transit routes that cross county borders, integrating public transit fares better within multi-agency trips, integrating transportation payment systems, and developing a healthy, interoperable mobility software ecosystem following open standards.

The Palo Alto Sandbox Demonstration was able to implement all of these project components except the feebate system, for which the program had to pivot to a parking cashout model. Parking cashout is a commuter benefit in which an employer offers employees the option to accept taxable cash income instead of a free or subsidized parking space at work. The Palo Alto demonstration program encountered notable challenges implementing a feebate program because free parking ended up being a perk that was part of employment agreements.

Project Timeline

The Palo Alto demonstration project underwent a notable evolution from the time the project was selected in October 2016 until Fall 2018. During that two-year period, the principal investigators changed, the project was rescoped, and numerous vendors and partners left and joined the project. The following timeline presents the main project milestones:

- **October 2016** – Project selected
- **February 2017** – Executed FTA Cooperative Agreement with City of Palo Alto
- **August to November 2017** – Project rescoping
- **April 2018** – Updated Statement of Work submitted to FTA
- **July 2018** – Prospect Silicon Valley joined project
- **September 2018** – Luum vendor replaced
- **August 2019** – Pilot implementation
- **December 2019** – Pilot end

In Summer and Fall 2017, the project was rescoped and scaled back. Additionally, a new principal investigator with Prospect Silicon Valley was selected in November 2017. The rescope of the project included two key changes. First, the feebate part of the project changed to parking cashout. With respect to feebates, parking became an increasingly polarized issue for private sector Silicon Valley workers. Employers believed that their employees, often "super-commuters" with limited public transit options, were parking-dependent. Private sector partners also expressed equity concerns about charging displaced workers for parking. Second, the project's complexity was reduced by shifting from a mix of 11 public and private sector pilot locations to just 4 sites corresponding to four municipal employers. In general, the project scope tended to appeal more to municipal governments, possibly because the nature of its objectives aligned well with general transportation policy objectives of the cities.

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 primarily built upon a logic model constructed by the IE team. The logic model had five basic components:

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

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

Table 3-1 *Project Goals, Evaluation Hypotheses, Performance Metrics, and Data Sources for Bay Area FVC MOD Sandbox Project*

Project Goals	Evaluation Hypothesis	Performance Metric	Data Elements	Data Sources
1. Reduce overall SOV commuting to participating employers.	1. The mode share of commuting by SOVs for both participating employees and the broader population declines as a result of the FVC strategy. This mode share is defined as a function of trips.	Number of commuter trips in SOVs among employees of each participating employer; number of commuter trips in SOVs among participating employees	Survey data, commute activity data, employee data, feebate or cashout data	Cities of Cupertino, Menlo Pak, Mountain View, Palo Alto
2. Reduce overall SOV VMT among commuters of participating employers.	2. The total commute VMT for participating employees as well as the broader population declines.	Measured VMT in any vehicle among employees of each participating employer; measured VMT in any vehicle among participating employees	Survey data, employee data	Cities of Cupertino, Menlo Pak, Mountain View, Palo Alto
3. Reduce overall SOV fossil fuel consumption among commuters of participating employers.	3. The total energy consumption and CO_2-e emissions from participating employees as well as the broader population declines.	Sum of estimated marginal additional fuel consumption (from any mode) among employees of each participating employer; sum of estimated marginal additional fuel consumption (from any mode) among participating employees	Survey data, commute activity data	Cities of Cupertino, Menlo Pak, Mountain View, Palo Alto
4. Benefit lower-income workers more than higher-income workers.	4. The FVC benefits lower-income workers more than higher-income workers.	Dollar amount of rebates received by employees	Feebate or cashout data, employee data, survey data	Cities of Cupertino, Menlo Pak, Mountain View, Palo Alto
5. Improve accessibility of pre-tax payments for public transit by allowing such funds to be filled up on Clipper cards.	5. Improved access to pre-tax payments increases public transit ridership.	Number of unlinked trips (public transit ridership) among participating employees	Public transit ridership data, survey data, employee data	Cities of Cupertino, Menlo Pak, Mountain View, Palo Alto

Table 3-1 (cont.) *Project Goals, Evaluation Hypotheses, Performance Metrics, and Data Sources for Bay Area FVC MOD Sandbox Project*

Project Goals	Evaluation Hypothesis	Performance Metric	Data Elements	Data Sources
6. Develop a mobility aggregator, feebate, or cashout policy and gap-filling analytics to encourage reduced use of SOVs in work commutes.	6. The mobility aggregator, feebate or cashout policy and gap-filling analytics positively impact the propensity of commuters to take non- SOV modes.	Survey response to questions probing change in SOV commuting (causality of individual components identified through survey)	Survey data, commute activity data, gap filling data, feebate or cashout data, employee data	Cities of Cupertino, Menlo Pak, Mountain View, Palo Alto
7. Attitudes of participating employees shift toward more favorable opinions of transit.	7. The attitudes of employees toward public transit become more positive.	Survey response to questions probing attitudes toward public transit	Survey data	Cities of Cupertino, Menlo Park, Mountain View, Palo Alto
8. Across participating employers, generate a commute feebate or cashout system that charges SOV commuters, and pays non- SOV commuters.	8. The commute feebate or cashout is financially-sustainable at participation rates achievable during or after the pilot.	Net revenue (profit/ loss) of feebate or cashout policy	Commute activity data, employee data, feebate or cashout data	Cities of Cupertino, Menlo Pak, Mountain View, Palo Alto
9. Develop lessons learned through experimental deployment of FVC policies and systems.	9. The project produces a series of lessons learned that will be documented through expert interviews with project stakeholders.	Qualitative documentation from stakeholder interviews	Stakeholder interview data	Cities of Cupertino, Menlo Pak, Mountain View, Palo Alto, project partners

CO_2-e, or carbon dioxide equivalent, is a standard unit for measuring carbon footprints, including carbon dioxide and all other gases.

The quantitative and qualitative evaluation methods used in the Bay Area FVC evaluation included the following:

- Time series and cross-sectional analysis
- Activity data analysis
- Survey analysis
- Ridership data analysis
- Summary of expert (stakeholder/project partner) interviews

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

Data Collected

A variety of datasets were used to conduct the evaluation. These datasets were collected in collaboration with the Palo Alto team and were in the form of surveys, commute activity data, feebate or cashout data, and stakeholder interview data. The project's participants were City employees recruited by the cities. Each City had a designated pilot site manager who acted as a single point of contact for the project. The pilot site manager recruited colleagues who were labeled as "Commute Champions" or "Commute Buddies" and had experience with alternative commutes. The project team also produced employee handouts and sample communications for employee dissemination and described how baseline survey results would be used to identify participant candidates. The pilot cities also developed checklists, booklets, and waivers for employees (riding scooters and e-bikes) to sign as infrastructure-supporting employee recruitment and participation. Ultimately, project participants were employees that opted into participation and were willing to receive project-related incentives for their commute decisions and guidance on travel options to inform those decisions.

A general description of the available datasets is as follows:

- **Survey Data** – A pre- and post-study survey (N=507, pre-survey and N=389, post-survey) was launched in each of the four cities—Cupertino, Menlo Park, Mountain View, and Palo Alto. The pre-survey was launched from June to August 2019, and the post-survey was launched from January to February 2020. The surveys were designed to ask questions about traveler behavior patterns such as modes used to commute to/from work, recent commute trip attributes, perceptions of mobility and accessibility, and use of commuter incentives and benefits. Also, the "after" survey asked attributional impact questions that probed user response on how the cashout policy had influenced their travel behavior.

- **Commute Activity Data** – This included employee commute trip attributes such as travel mode and trip distance, cost, and emissions. These data were provided by RideAmigos (spanning August–December 2019) and Commuter Wallet (spanning September–December 2019).
- **Employee Data** – Cities provided de-identified employee population information on income and home locations at the ZIP code level of aggregation.
- **Public Transit Ridership Data** – Ridership data were provided by the local public transit agency serving the region.
- **Cashout Data** – This included transaction activity metrics such as incentives and benefits received for commute trips. These data were provided by Commuter Wallet, a system used to track rewards provided to program participants and spanned the period from period from August–December 2019.
- **Stakeholder Interview Data** – The evaluation team conducted expert interviews in 2020 with several people who were directly connected to the project team and had deep knowledge of it. This included employees of the Cities of Cupertino, Menlo Park, Mountain View, and Palo Alto.

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. The methods applied for the different analyses depended on the hypothesis being addressed. Survey data were analyzed through direct analysis of questions and response distributions. Data also were appropriately cross-tabulated with demographic attributes (such as income) to evaluate the impact on program participants with different household incomes. Data on home locations of the program participants and employee population were mapped to comparatively analyze spatial distributions of residential locations. Statistical and time-series analysis of commute activity data were used to determine changes in SOV and non-SOV mode share. Bootstrap simulation was applied to the activity data in combination with the survey data to estimate changes in commute VMT and the associated changes in emissions. Limitations to the study included standard limitations associated with survey data and self-reported responses as well as limitations in the precision of activity data fields. Stakeholder interviews were also limited by self-interpreted responses and recollection of project details and events.

Section 4 Evaluation Results

Hypothesis 1: The mode share of commuting by SOVs for both participating employees and the broader population declines as a result of the FVC strategy. This mode share is defined as a function of trips.

Performance Metric	Key Finding
Number of commuter trips in SOVs among employees of each participating employer; number of commuter trips in SOVs among participating employees	Statistical analysis of trip activity data showed a decline in the mode share of commuting by SOVs, and a majority of pilot participants reported that the pilot had reduced their driving alone.

The first hypothesis explored as part of the evaluation was whether the FVC strategies decreased the mode share of commuting by SOVs for both pilot participants and the broader population. This hypothesis was evaluated using the trends of the number of trips made by different modes over the duration of the pilot, August–December 2019. Also, after surveys asked pilot participants to report the effect of the pilot on their use of different modes.

Trip activity data, recorded by RideAmigos, were used to generate time series distributions for mode share in each of the four participating cities. Modes used throughout the pilot included drive, walk, transit, bike, carpool, vanpool, and telework. For the purpose of this analysis, modes were grouped to distinguish between SOV modes (drive), non-SOV modes, and telework. Trip activity data also defined an individual taking a trip to be either a pilot participant, non-participant, or transportation demand management (TDM) manager. The entire dataset, across the four cities, included trips by 78 Individuals who were categorized into 62 pilot participants, 11 non-participants, and 5 TDM managers.

Figure 4-1 shows the mode share time series distribution aggregated across all four cities and among all individuals. Over the duration of the pilot, 9,417 trips were conducted in total and split into 78% by non-SOV modes, 21% by SOVs, and 1% telework. The trends show a slight increase in non-SOV use matched by a slight decrease in SOV use, while telework remained constant and almost negligible.

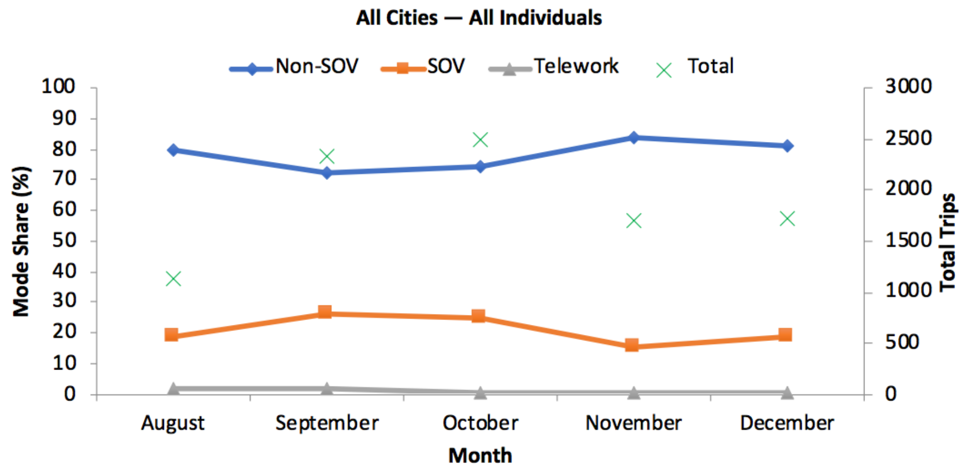


Figure 4-1 *Trip Mode Share Distribution Aggregated Across All Cities – All Individuals*

To examine the effect of the FVC strategy on the employees of each city, Figure 4-2, Figure 4-3, and Figure 4-4 show the mode share time series distributions for each of the four cities, among all individuals.

Figure 4-2 shows significant increases and decreases in non-SOV and SOV use, respectively, for Cupertino, with exception of August 2019, when trip activity was negligible compared to the following months. An interesting observation is seen toward the end of the pilot where the trends reverse in December 2019. Figure 4-3 shows a similar result for Menlo Park, with significant changes suggesting a positive impact of the FVC strategy on mode use. The figure also shows a slight reverse in trends toward the end of the pilot, similar to that of Cupertino. In parallel to Cupertino and Menlo Park, Mountain View followed similar trends in mode use, except for reverse in trends for December 2019, as shown in Figure 4-4. Unlike the first three cities, the mode share for Palo Alto remained almost constant, as shown in Figure 4-5.

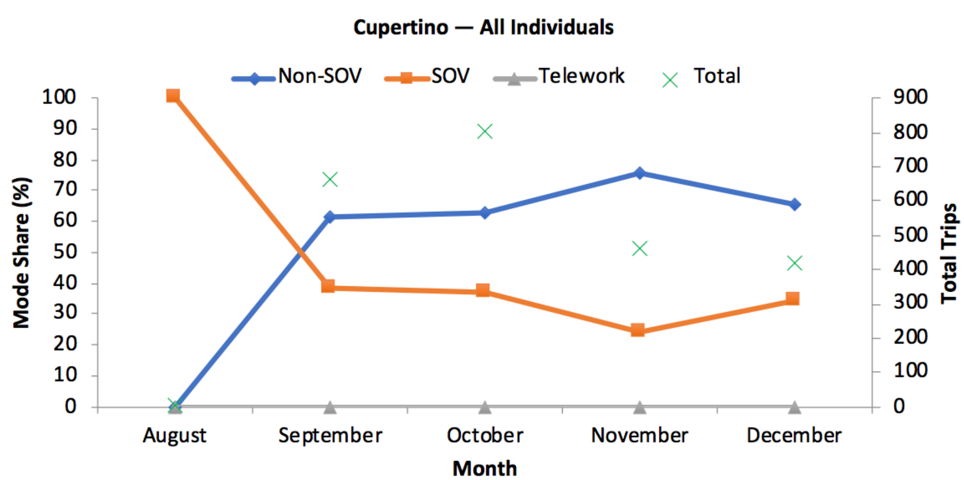


Figure 4-2 *Trip Mode Share Distribution for Cupertino – All Individuals*

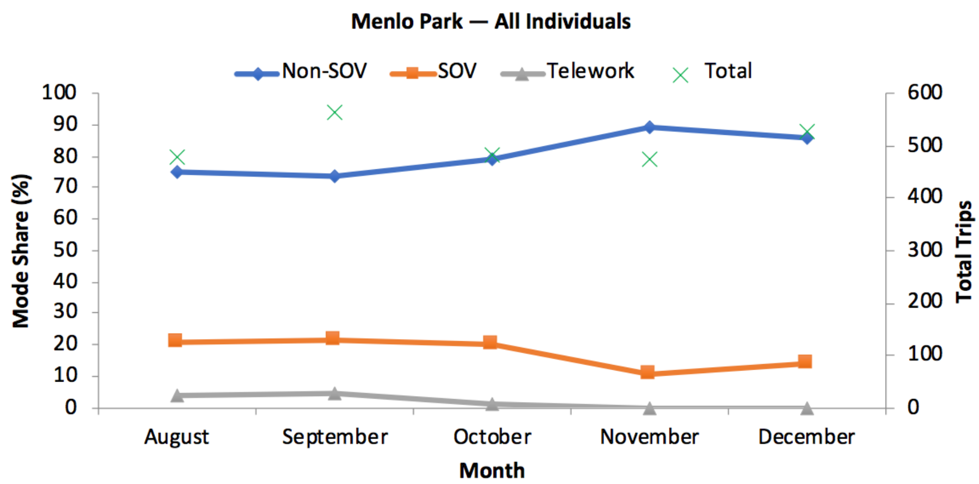


Figure 4-3 *Trip Mode Share Distribution for Menlo Park – All Individuals*

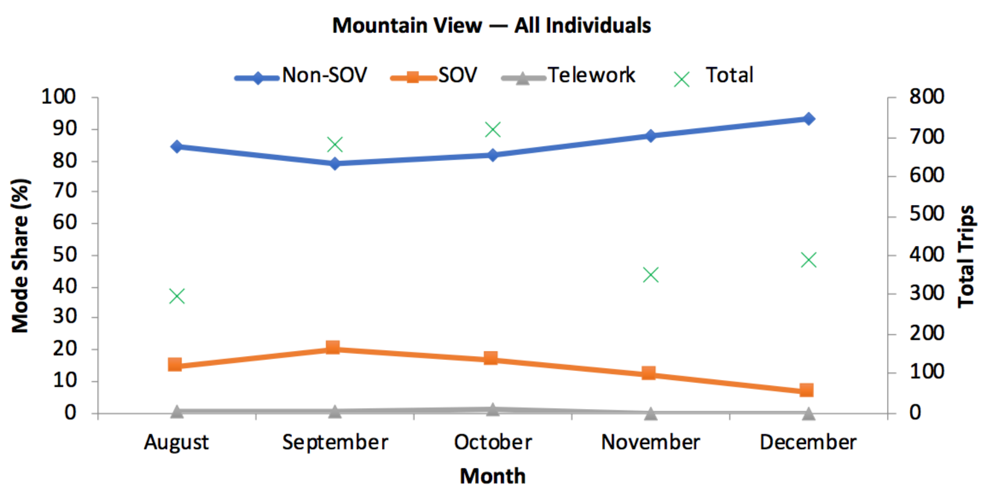


Figure 4-4 *Trip Mode Share Distribution for Mountain View – All Individuals*

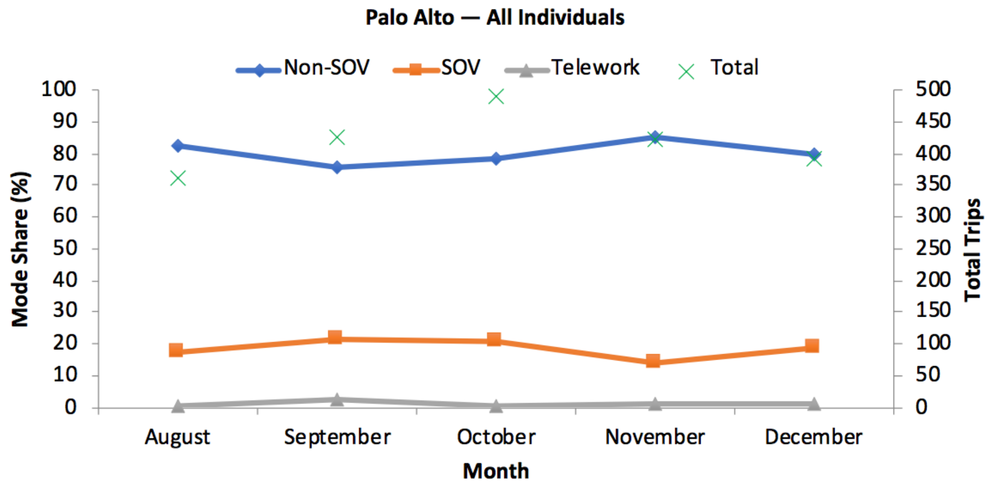


Figure 4-5 *Trip Mode Share Distribution for Palo Alto – All Individuals*

Figure 4-6, Figure 4-7, and Figure 4-8 show the time series mode share distributions for the three individual categories— Pilot Participants, Non-Participants, and TDM Managers—for all cities combined. It should be noted that the plots show a few missing observations, as individual categories were not equally active throughout the pilot. Additionally, the dataset did not include any trips by non-participants for Mountain View and Palo Alto.

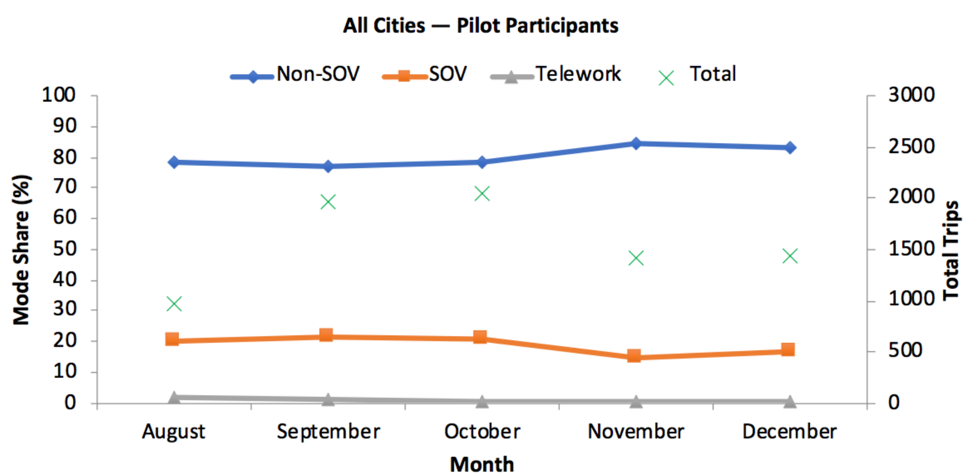


Figure 4-6 *Trip Mode Share Distribution Aggregated Across All Cities – Pilot Participants*

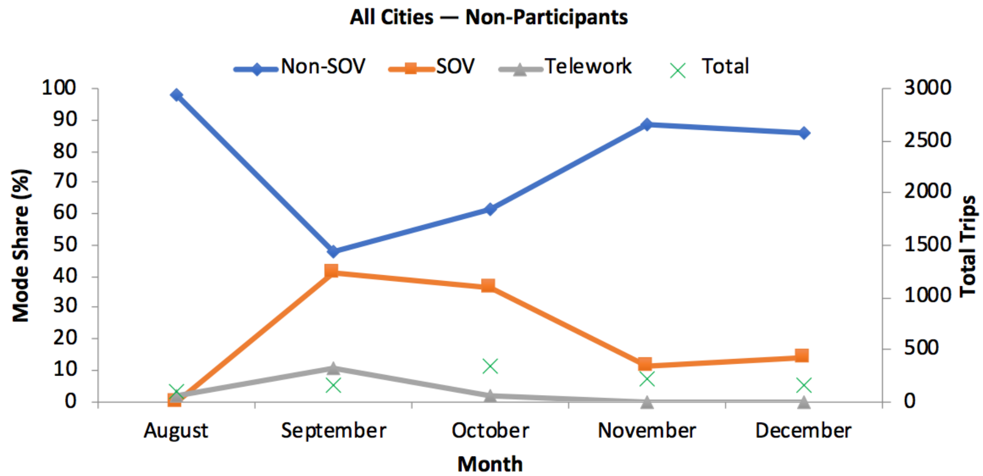


Figure 4-7 *Trip Mode Share Distribution Aggregated Across All Cities – Non-Participants*

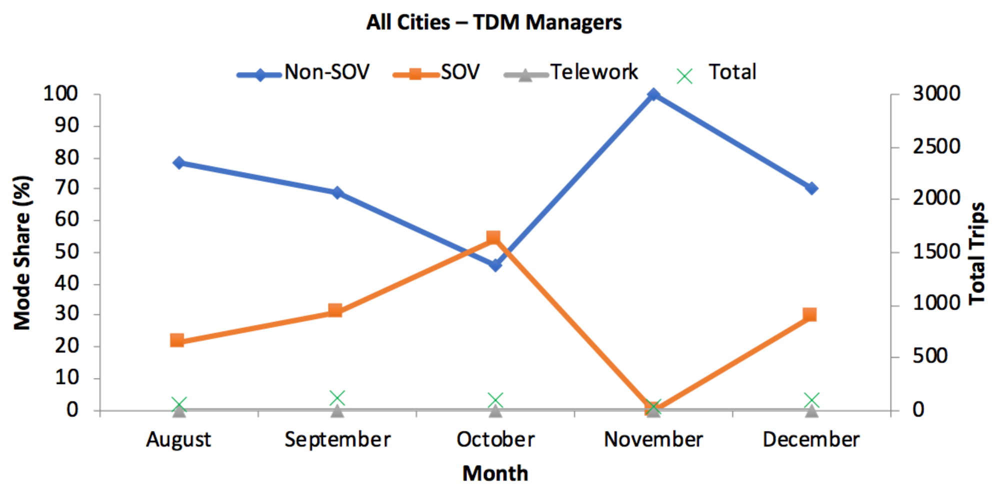


Figure 4-8 *Trip Mode Share Distribution Aggregated Across All Cities – TDM Managers*

To evaluate the significance of changes in mode share distributions, a linear regression model was developed and applied for each non-SOV and SOV share time series of different city and individual category combinations. Trip activity data were aggregated on a weekly basis over the duration of the pilot, 23 weeks. Then, the following equation regression model was applied:

$$\text{Mode Share}_i = \beta_0 + \beta_1\ \text{Time}$$

Where i = {Non-SOV, SOV} and Time = time trend variable corresponding to the week of the pilot {1, 2, …, 23}.

Table 4-1 shows the estimated coefficients, their corresponding p-values, and the adjusted R^2 of the different regression models applied. Ultimately, significant and positive time variable coefficient estimates (β1) for the non-SOV share of pilot participants indicate that the FVC strategy increased commute by non-SOV modes. Similarly, significant and negative estimates for the SOV share of pilot participants indicate that the pilot decreased commute by SOVs. Statistical significance was tested at a confidence level of 95%, which means that for a p-value less than 0.05, the estimated coefficient would be considered significant and different from zero.

Table 4-1 *Trip Mode Share Regression Results*

Location	Individual Category	Non-SOV Share			SOV Share		
		Coefficient Estimate (p-value)		Adjusted R^2	Dependent Variable (Coefficient Estimate)		Adjusted R^2
		Constant (β_0)	*Time* (β_1)		*Constant* (β_0)	*Time* (β_1)	
All Cities	All Individuals	75.3 (~0)*	0.30 (0.1)	0.08	22.4 (~0)*	-0.19 (0.3)	0.01
	Pilot Participants	74.7 (~0)*	0.32 (0.03)*	0.16	23.1 (~0)*	-0.20 (0.17)	0.04
	Non-Participants	71.3 (~0)*	0.92 (0.2)	0.03	19.9 (0.01)*	-0.53 (0.34)	-0.003
	TDM Managers	72.4 (~0)*	0.29 (0.71)	-0.04	27.6 (0.01)*	-0.29 (0.71)	-0.04
Cupertino	All Individuals	40.9 (~0)*	1.55 (0.02)*	0.23	59 (~0)*	-1.55 (0.02)*	0.23
	Pilot Participants	48.2 (~0)*	0.94 (0.16)	0.05	51.8 (~0)*	-0.94 (0.16)	0.05
	Non-Participants	-13.8 (0.3)	5.86 (~0)*	0.74	113.8 (~0)*	-5.86 (~0)*	0.74
	TDM Managers	4.3 (0.82)	2.29 (0.09)	0.18	95.7 (~0)*	-2.29 (0.09)	0.18
Menlo Park	All Individuals	72.5 (~0)*	0.69 (0.01)*	0.27	21.7 (~0)*	-0.38 (0.08)	0.09
	Pilot Participants	65.3 (~0)*	0.97 (~0)*	0.44	28.8 (~0)*	-0.62 (0.02)*	0.2
	Non-Participants	83.9 (~0)*	0.69 (0.23)	0.02	N/A	N/A	N/A
	TDM Managers	N/A	N/A	N/A	N/A	N/A	N/A
Mountain View	All Individuals	78.6 (~0)*	0.42 (0.2)	0.03	20.8 (~0)*	-0.41 (0.21)	0.03
	Pilot Participants	78.2 (~0)*	0.44 (0.18)	0.04	21.3 (~0)*	-0.43 (0.19)	0.04
	Non-Participants	N/A	N/A	N/A	N/A	N/A	N/A
	TDM Managers	100.2 (~0)*	-0.56 (0.76)	-0.28	-0.2 (0.98)	0.56 (0.76)	-0.28
Palo Alto	All Individuals	78.7 (~0)*	0.2 (0.38)	-0.01	20.2 (~0)*	-0.19 (0.37)	-0.01
	Pilot Participants	82 (~0)*	0.07 (0.72)	-0.04	16.8 (~0)*	-0.06 (0.72)	-0.04
	Non-Participants	N/A	N/A	N/A	N/A	N/A	N/A
	TDM Managers	-10.6 (0.63)	4.17 (0.03)*	0.34	110.6 (~0)*	-4.17 (0.03)*	0.34

** Significant at 95% level*

It should be noted that for some location and individual category combinations, the time variable coefficient estimate appears to be equal in value but opposite in sign for each of the non-SOV and SOV share. For example, the estimate is 1.55 for the non-SOV share aggregated across all individuals in Cupertino, and it is -1.55 for that of the SOV share. The reason behind such cases is that modes were grouped into the three main categories—Non-SOV, SOV, and Telework. Thus, whenever the telework share is negligible, the non-SOV and SOV share trends behave as complements. However, it was still necessary to perform separate regressions for SOV and non-SOV due to the presence of the third mode which could affect the trends in mode share when observed over the pilot duration.

Of all 40 regression models, only 10 showed significant coefficient estimates. Results aligned with preliminary expectations that the pilot would lead to a decrease in SOV use and an increase in non-SOV use. Cupertino and Menlo Park showed significant increases in non-SOV commute when trips were analyzed at an aggregate level across all individuals. Also, pilot participants in Menlo Park significantly increased their use of non-SOV modes and decreased their driving over the duration of the pilot.

Overall, analyzing the mode choice of pilot participants across all four cities showed that they significantly increased their non-SOV use at a 95% confidence level, which aligns with the goals of the pilot.

To further analyze the travel behavior of pilot participants compared to non-participants and TDM managers, the mode share proportions of each group were compared to each other. The applied statistical test is the hypothesis test for the difference of two proportions for independent samples. This was applied to evaluate the difference in the non-SOV proportion of trips between pilot participants and each of non-participants and TDM managers. The null hypothesis is that the proportion is the same in both groups, and the alternative hypothesis is that the proportion of non-SOV trips is higher for pilot participants over the duration of the pilot. Let x, y, and z denote the number of non-SOV trips for each of pilot participants, non-participants, and TDM managers respectively.

$$H_0: p_x = p_y \text{ vs. } H_1: p_x > p_y$$

$$H_0: p_x = p_z \text{ vs. } H_1: p_x > p_z$$

Similarly, the same test was applied for the SOV proportion of trips, but in the opposite direction. Similarly to the above regressions, this test was also applied in the opposite direction due to the presence of the third mode, telework, which could affect the mode share proportions, and thus, cannot be neglected. The null hypothesis is that the proportion is the same in both groups, and the alternative hypothesis is that the proportion of SOV trips is lower for pilot participants over the duration of the pilot. Let j, k, and l denote the number of SOV trips for each of pilot participants, non-participants, and TDM managers respectively.

$$H_0: p_j = p_k \text{ vs. } H_1: p_j > p_k$$

$$H_0: p_j = p_l \text{ vs. } H_1: p_j > p_l$$

Table 4-2 shows the trip data available for each city and individual category combination for which the above hypothesis tests were applied. Table 4-3 shows the p-value for each hypothesis test conducted. Statistical significance was tested at a confidence level of 95% which means that for a p-value less than 0.05, the null hypothesis is rejected. For Cupertino and Palo Alto, results were significant at a confidence level of 99%, showing that over the pilot duration, pilot participants had a higher share of non-SOV trips and a lower share of SOV trips as compared to TDM managers, thus supporting this hypothesis.

Table 4-2 *Trip Mode Share Summary over Pilot Duration*

Location	Individual Category	Trips			
		Total	*Non-SOV Proportion*	*SOV Proportion*	*Telework Proportion*
All Cities	Pilot Participants	8,244	0.77	0.22	0.01
	Non-Participants	756	0.82	0.15	0.03
	TDM Managers	417	0.69	0.31	0
Cupertino	Pilot Participants	1,812	0.65	0.35	0
	Non-Participants	447	0.75	0.25	0
	TDM Managers	97	0.32	0.68	0
Menlo Park	Pilot Participants	2,049	0.77	0.22	0.01
	Non-Participants	309	0.92	0	0.08
	TDM Managers	170	1	0	0
Mountain View	Pilot Participants	2,403	0.84	0.15	0.01
	Non-Participants	N/A	N/A	N/A	N/A
	TDM Managers	39	0.95	0.05	0
Palo Alto	Pilot Participants	1,980	0.82	0.17	0.01
	Non-Participants	N/A	N/A	N/A	N/A
	TDM Managers	111	0.45	0.55	0

Table 4-3 *Trip Mode Share – Hypothesis Testing for Two-Sample Proportions*

Location	Hypothesis Test Groups	p-value	
		Non-SOV	*SOV*
All Cities	Pilot vs. Non-Pilot	$p_x < p_y$ (0.01)	$p_j > p_k$ (~0)
	Pilot vs. TDM	~0	~0
Cupertino	Pilot vs. Non-Pilot	$p_x < p_y$ (~0)	$p_j > p_k$ (~0)
	Pilot vs. TDM	~0	~0
Menlo Park	Pilot vs. Non-Pilot	$p_x < p_y$ (~0)	N/A
	Pilot vs. TDM	$p_x > p_z$ (~0)	N/A
Mountain View	Pilot vs. Non-Pilot	N/A	N/A
	Pilot vs. TDM	$p_x > p_z$ (0.03)	$p_j > p_l$ (0.03)
Palo Alto	Pilot vs. Non-Pilot	N/A	N/A
	Pilot vs. TDM	~0	~0

However, comparing the non-SOV and SOV shares between pilot and non-participants, the hypothesis test showed significant results but in the opposite direction. This means that the share of non-SOV trips was lower for pilot participants compared to other groups, opposite to *a-priori* expectations. A similar significant result appeared for Mountain View, showing that pilot participants had a lower share of non-SOV trips and a higher share of SOV trips as compared to TDM managers. These results may be influenced by external variables and individual travel behaviors. Also, the small sample size of trips in some cases for non-participants and TDM managers may not be representative of those groups and is significantly less than that of pilot participants.

According to the post-survey data aggregated across the four cities, Figure 4-9 shows that 74% out of 19 pilot participants drove alone less often as a result of the service and benefits provided by the pilot program.

Overall, the statistical analysis of trip activity data showed a decline in the mode share of commuting by SOVs for pilot participants as compared to other individuals, which aligns with Hypothesis 1. Also, survey data showed that a majority of pilot participants decreased their driving as a result of the pilot. This leads to a conclusion that Hypothesis 1 was supported. (Note: Where applicable, data labels have been rounded to the nearest whole number for display purposes.)

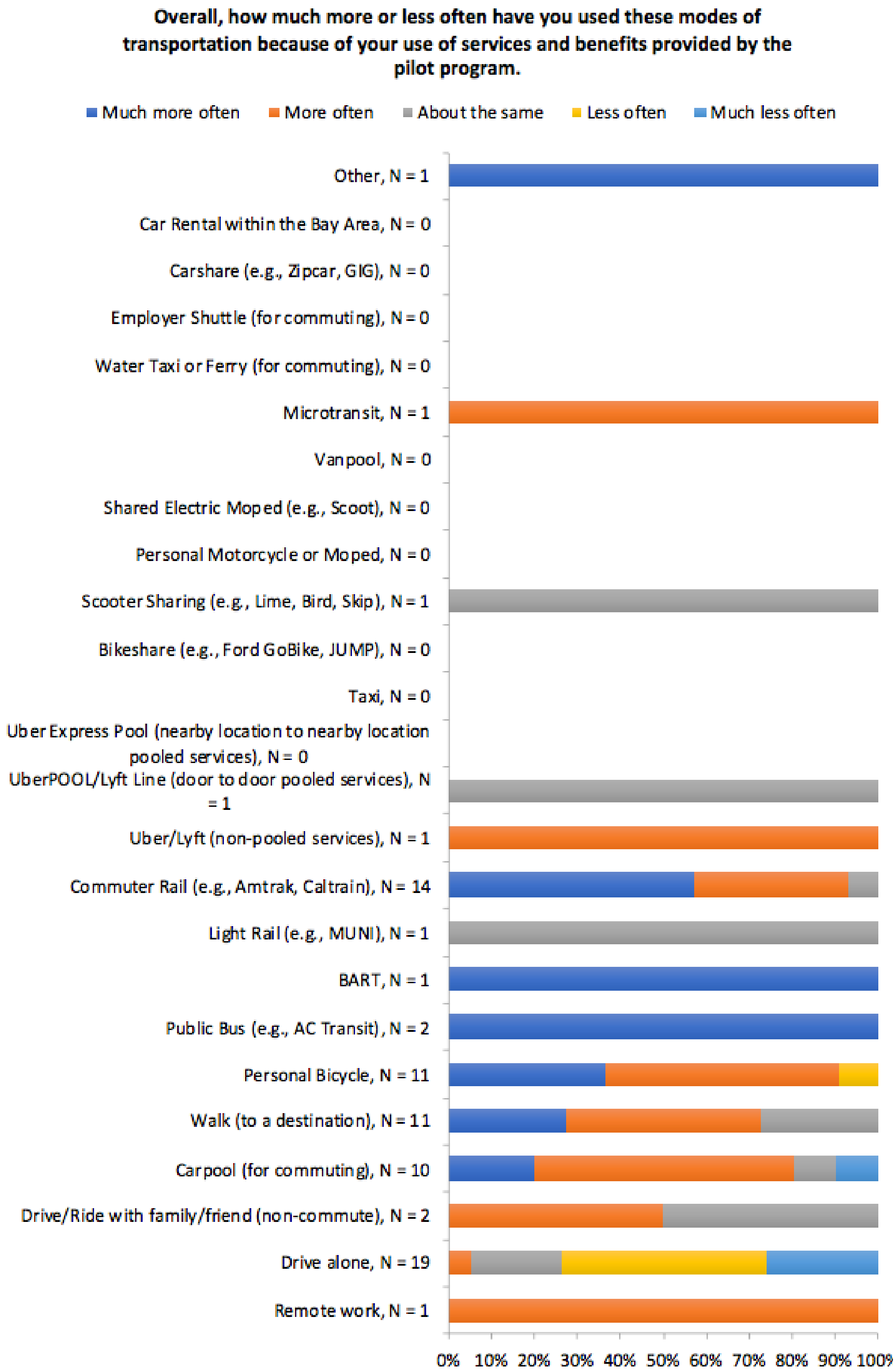


Figure 4-9 *Effect of Pilot on Mode Share*

Hypothesis 2: The total commute VMT for participating employees as well as the broader population declines.

Performance Metric	Key Finding
Measured VMT in any vehicle among employees of each participating employer; measured VMT in any vehicle among participating employees	Combined analysis of survey and trip activity data showed that total commute VMT for participating employees decreased by 40%.

The second hypothesis explored whether the FVC strategy decreased the total commute VMT for both pilot participants and the broader population. This hypothesis was evaluated using trip activity data and survey data simultaneously, given that both datasets were linked through a common de-identified identification number (De-ID) used to record an individual's survey responses and trip activity. The activity data recorded different trip attributes such as transportation mode used, trip distance, and individual category, and surveys asked respondents to report their travel behavior and mode choice when commuting to/from work, before/after participating in the pilot.

For activity data, Figure 4-10 shows the distribution of modes used by each individual category— Pilot Participants, Non-Participants, and TDM Managers. The majority of the trip activity data were recorded by pilot participants who used the different modes to a similar extent. In contrast, 58% of trips recorded by non-participants were using carpooling, followed by 15% each driving and using public transit. Similarly, 52% of trips recorded by TDM managers were using transit, followed by 31% using driving. This may be due to the limited sample size of trips by these two categories as compared to that by pilot participants.

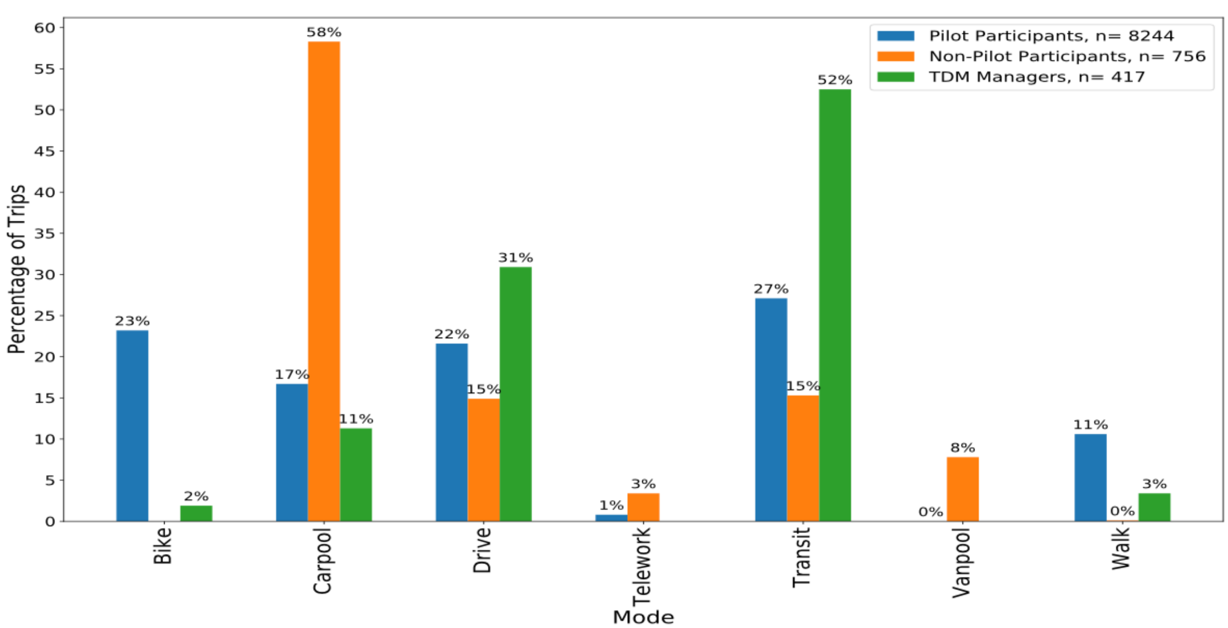


Figure 4-10 *Individual Category Distribution Across Different Modes‡*

Figure 4-11 shows the trip distance distribution for each of the modes used across 9,417 commute trips. The average trip distance for all trips was 15 miles; specified by mode, the average trip distance was 17 miles for drive, 2 miles for walk, 22 miles for transit, 4 miles for bike, 24 miles for carpool, and 3 miles for vanpool.

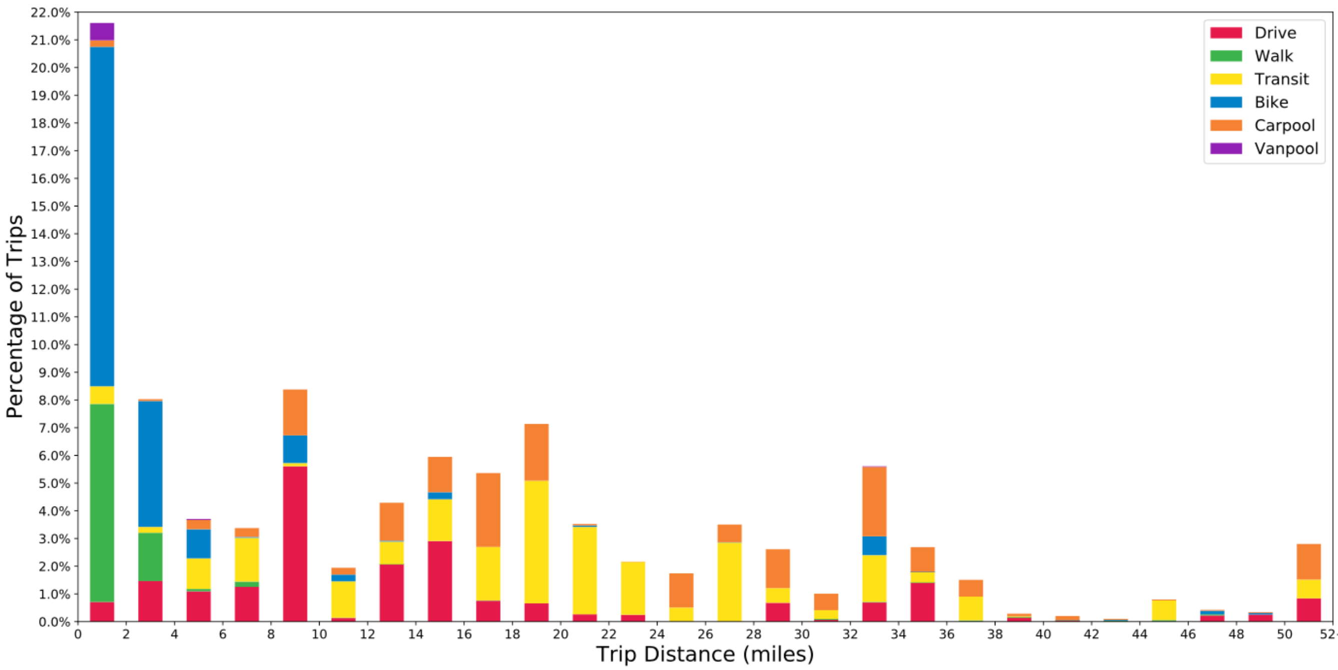


Figure 4-11 *Trip Distance Distribution Across Different Modes*

For survey data, Figure 4-12 shows 45 paired responses about the modes used by pilot participants before and after participating in the pilot. There were additional responses by pilot participants in the "after" survey, but these were not included in this figure. To present a more robust observation based on paired responses. Since this question asks about mode use in general, without any consideration of use frequency, results can show which new modes were explored by individuals as a result of participating in the pilot. However, there might be an additional increase in use frequency, not visible in this figure but explored later in the analysis. The figure shows an evident shift by pilot participants to explore non-SOV modes such as walking, biking, carpooling, and public transit.

To further evaluate the mode shift of individuals, the "after" survey asked about their change in use of different modes as a result of participating in the pilot. Figure 4-13 shows that 69% of 16 individuals changed their frequency of biking and walking to commute to work due to the services and benefits provided by the pilot program. A similar change in frequency of use was reported by 59% of 17 individuals commuting by carpooling, 49% of 39 individuals commuting by driving alone, and 44% of 32 individuals using commuter rail. Significant changes are also observed among other modes of public transit but with a smaller number of responses.

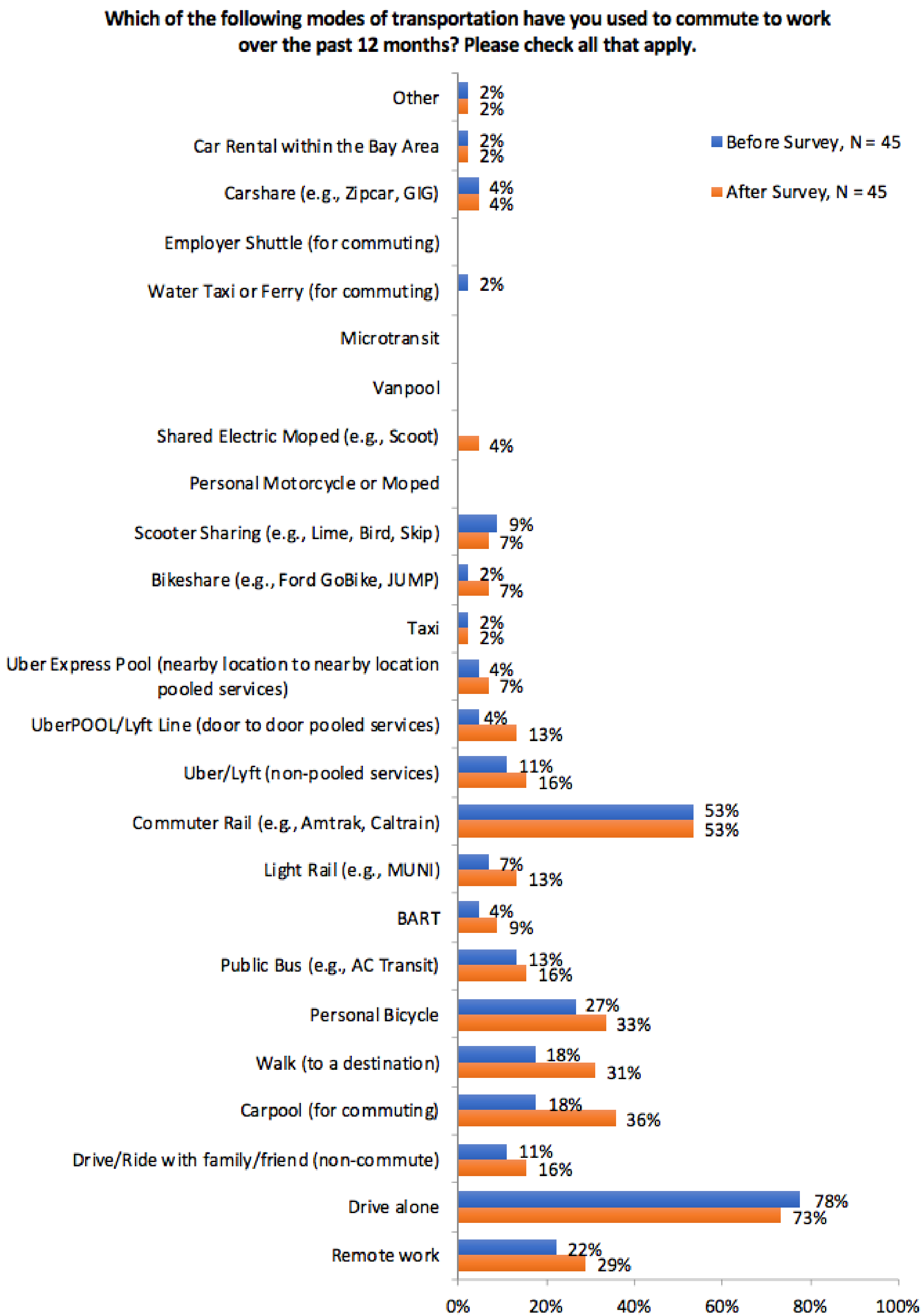


Figure 4-12 *Before/After Mode Use Distribution – Pilot Participants*

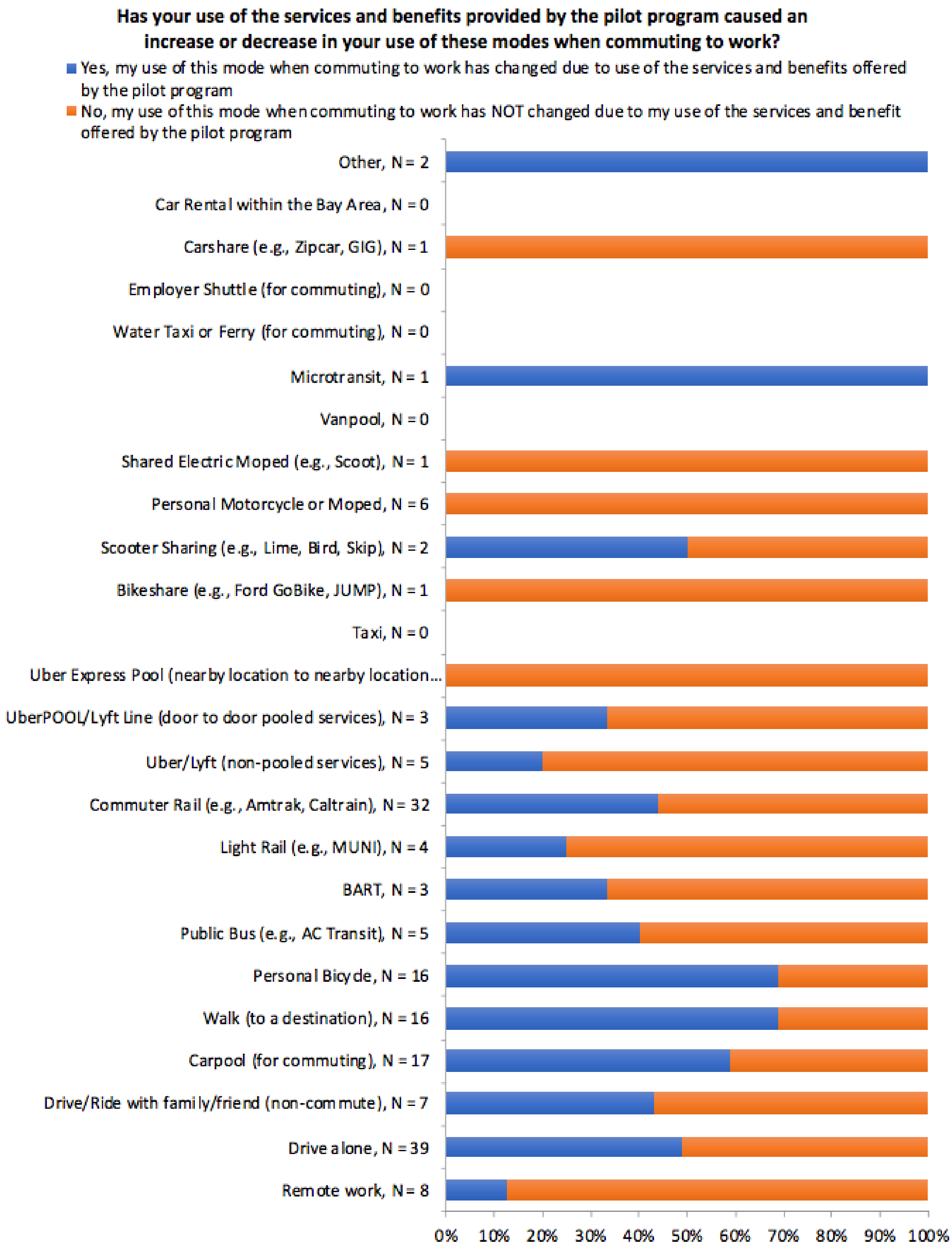


Figure 4-13 *Effect of Pilot on Mode Use*

The “after” survey then asked individuals who changed their use of different modes to report the direction of that change and estimate its magnitude. Figure 4-9 shows that as a result of participating in the pilot, 74% of 19 individuals drove less often, 93% of 14 individuals used commuter rail more often, 91% and 73% of 11 individuals biked and walked more often respectively, and 80% of 10 individuals carpooled more often.

The responses reported in both Figure 4-9 and Figure 4-13 were combined and used to construct a two-dimensional mode shift matrix for individuals before and after participating in the pilot program. The aim of this matrix is to obtain a distribution that describes the mode substitution that occurred as a result of the pilot. Figure 4-13 was used to determine the number of individuals who answered “No” to the question for each mode which means that they did not change their use of that mode as a result of the pilot. This allows to calculate the values on the diagonal of the matrix. For those who answered “Yes” in Figure 4-13, they were asked a follow-up question in Figure 4-9 to determine their change in mode use, which is used to calculate the remaining values in the matrix. For example, if an individual reported driving alone less often and carpooling more often, it means that they shifted their use of driving to carpooling as a result of the pilot. As the activity data reports the mode choice of individuals during the pilot, the matrix columns can be used to predict what mode could have been used for any specific trip in absence of the pilot. This distribution was constructed only for the modes reported in the activity data—drive alone, carpool, walk, personal bicycle, public transit, vanpool, and telecommute. Vanpool was excluded from the analysis due to the unavailability of survey responses to describe this mode shift. Similarly, telecommute was excluded, as the pilot did not have any components targeted to affect telecommute behavior; thus, any change in this mode might have been influenced by external factors. Table 4-4 shows the resulting mode shift matrix. The distribution does not show any shift to driving as a result of the pilot. This means that the pilot program led to definitive decrease in VMT.

Table 4-4 *Mode Shift Matrix*

		After Pilot				
		Drive Alone	***Carpool***	***Walk***	***Personal Bicycle***	***Public Transit***
Before Pilot	Drive Alone	100%	33%	30%	50%	22%
	Carpool	0%	67%	8%	0%	0%
	Walk	0%	0%	62%	0%	0%
	Personal Bicycle	0%	0%	0%	50%	0%
	Public Transit	0%	0%	0%	0%	78%
	Number of Shifts	24	12	13	10	36

To generate a rough estimate of the likely direction of VMT change, trips within the activity data set were randomly assigned a mode shift based on the above matrix. For each column, the rows represent what mode shares were used before the pilot as a substitution of the current mode recorded in the activity data. For example, of the total carpool trips recorded in the data set, 67% were considered to be carpool trips before the pilot, and the remaining 33% were considered to be driving trips. This means that 33% of those trips would have contributed to marginal decrease in VMT as a result of the pilot program. These random assignments were made in a similar manner to the remaining modes and across 8,244 trips recorded by 62 pilot participants. Then, for trips causing a decrease in VMT, their actual trip distances were summed to estimate the total VMT reduction, except for carpooling trips, which were assumed to contribute to only a 50% reduction in VMT. The reasoning for this is due to the actual dynamic of carpooling that depends on the individual mode shift of each carpooler and on the carpool size, both of which were not recorded in the dataset. For example, if two individuals shift from using public transit to carpooling, their activity would actually result in an increase in VMT. If one of them shifts from public transit and the other shifts from driving alone, their combined carpooling would lead to no change in VMT. However, if both individuals shift from driving alone, their carpooling would lead to a decrease in VMT. Thus, to account for this indeterminable dynamic, the marginal VMT decrease due to carpooling was reduced by half. The assignment was repeated multiple times to check for robustness and sensitivity of the overall VMT change to redistributions of individual mode shift. The analysis suggests that commute VMT of participants may have decreased by 40% as a result of the pilot program.

Hypothesis 3: The total energy consumption and CO_2-e emissions from participating employees as well as the broader population declines.

Performance Metric	Key Finding
Sum of the estimated marginal additional fuel consumption (from any mode) among employees of each of the participating employers; sum of the estimated marginal additional fuel consumption (from any mode) among participating employees	Combined analysis of survey and trip activity data showed that total energy consumption decreased by 46% and CO_2 emissions decreased by 10.2 metric tons for participating employees.

The third hypothesis explored as part of the evaluation was whether the FVC strategies decreased the total energy consumption and CO_2 emissions for both pilot participants and the broader population. Similar to Hypothesis 2, this hypothesis was also evaluated using trip activity data and survey data simultaneously.

As the survey asked pilot participants about their vehicle ownership including vehicle make, model, and year, it was possible to generate a distribution of fuel economies based on a database published by the U.S. EPA. The fuel economy used was that combined for city and highway. The resulting distribution was based on 47 survey responses and is shown in Figure 4-14. High fuel economies of 40–55 mpg corresponded to hybrid vehicles such as the Toyota Prius.

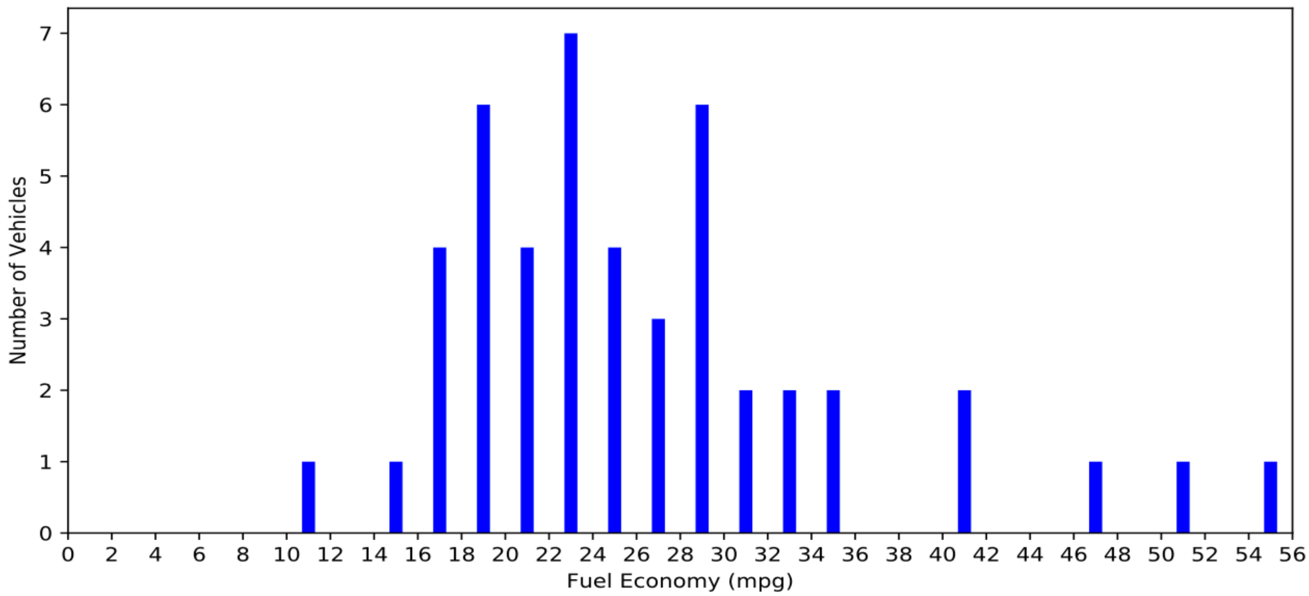


Figure 4-14 *Survey Fuel Economy Distribution*

As the above fuel economy distribution was obtained from 47 pilot participant responses, which do not cover all the possible range of fuel economies in the real world, the distribution was used to estimate a smooth probability density function based on a non-parametric method called kernel density estimation (KDE). Figure 4-15 shows the generated fuel economy distribution in addition to the survey data points used for estimation.

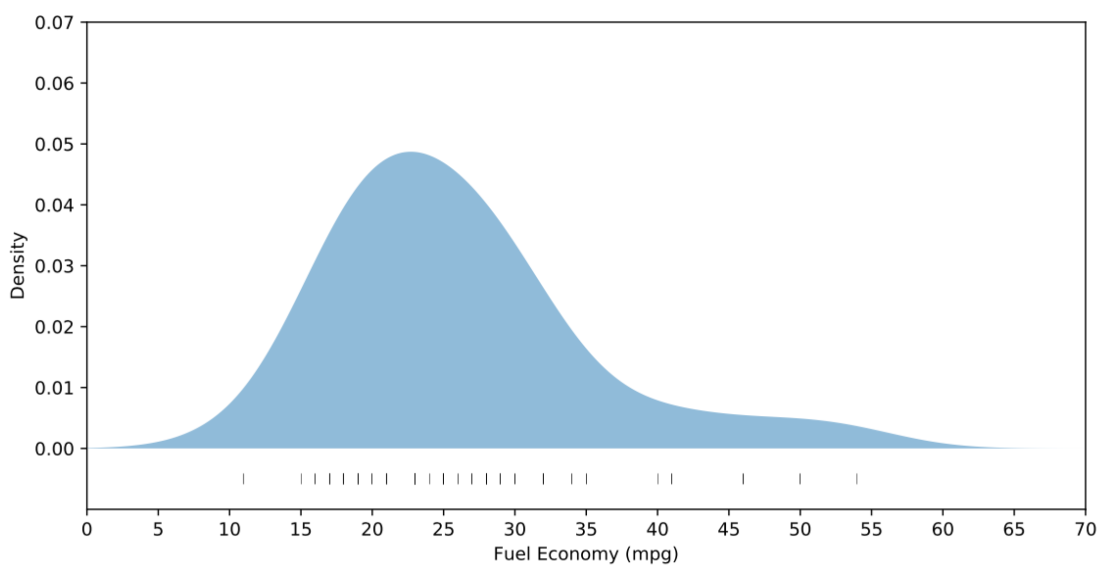


Figure 4-15 *KDE Distribution for Survey Fuel Economies*

The above kernel density estimation was used to randomly sample fuel economies and assign them to the 8,244 vehicle trips by pilot participants. Previously, the analysis of Hypothesis 2 randomly assigned which trips led to a decrease in VMT, which was then used along with the fuel economy assignment and the measured distance traveled to estimate a decrease in fuel consumption. Also, based on this fuel economy assignment, it was possible to calculate the fuel consumption by driving trips after the pilot. These random fuel economy assignments were repeated multiple times to check for robustness and sensitivity of the overall fuel consumption change to redistributions of individual vehicle fuel economy. The analysis showed that fuel consumption decreased by 46%, equivalent to 1,152 gallons of gasoline, as a result of the pilot program. According to the U.S. EPA, 8,887 grams of CO_2 are emitted from burning one gallon of gasoline. This means that the pilot program decreased CO_2 emissions from commuting by 10.2 metric tons. Overall, the combined analysis of survey and trip activity data showed that the total energy consumption decreased by 46% and CO_2 emissions decreased by 10.2 metric tons for participating employees. Hypothesis 3 was found to be supported.

Hypothesis 4: The FVC benefits lower-income workers more than higher-income workers.

Performance Metric	Key Finding
Dollar amount of rebates received by employees	Project participation spanned multiple income levels, with benefits distributed across participants of all incomes. The savings experienced by lower-income participants was higher as a percentage of their income relative to higher-income participants.

The evaluation explored whether the FVC benefitted lower-income workers more than higher-income workers. The evaluation team collected data on the incomes of the survey respondents and pilot participants. In addition, information on the incomes of the employee population of participating cities was provided for comparison with the pilot participants. The ZIP code of home locations of the employee population was also provided to gain insight on the spatial distribution of employees commuting to their respective city jobs. Shown in Figure 4-16, the employee population is naturally concentrated in the South Bay region and along the peninsula, but there is a notable spread of home locations in the East Bay and North Bay as well as inland in the Central Valley. Note that unlike the population, the sample of program participants concentrated away from the center of the employee population. The program appeared to have concentrated participation within the San Jose region just south of the cities of employment.

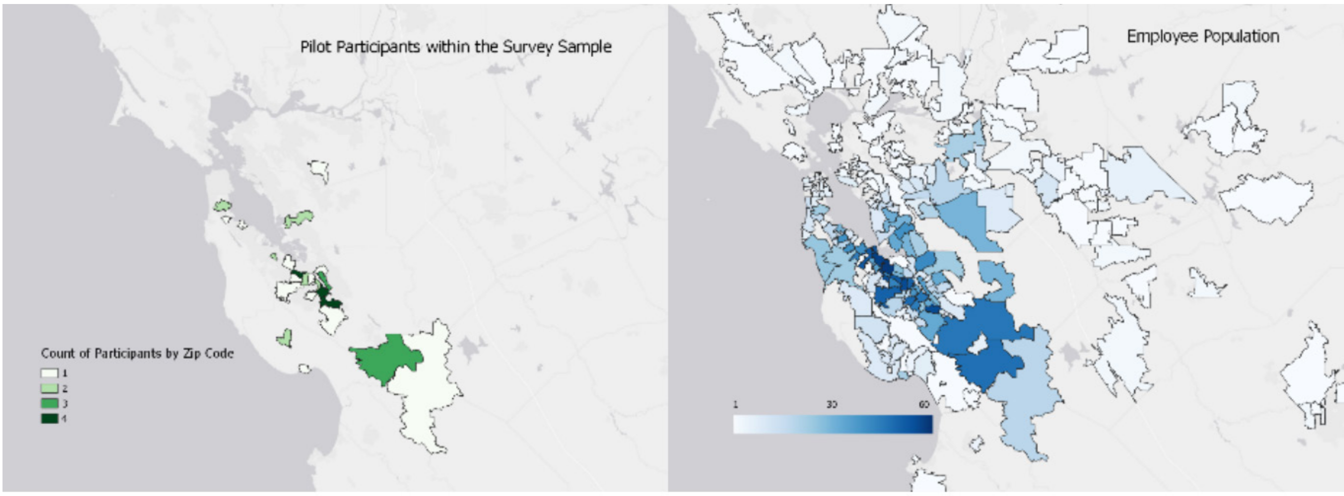


Figure 4-16 *Geographic Distribution of Program Participants in Survey Sample and Employee Population*

Figure 4-17 shows the distribution of income for the general population of City employees, the survey subsample of non-participants, and the survey subsample of respondents who reported participating in the pilot. The comparison of distributions suggests that the non-participants had the highest average incomes relative to the population. Survey respondents who were pilot participants had a wider distribution of income compared to the other two groups, with notable share of respondents in the higher income categories. For example, about 31% of participant respondents had annual household incomes of $150,000 or more, whereas the income of City employees had only 17% of respondents in this income range. At the same time, 17% of participants had incomes of less than $50,000. This stood relative to about 0% of respondents who were non-participants in this income range and 7% of the City employee population.

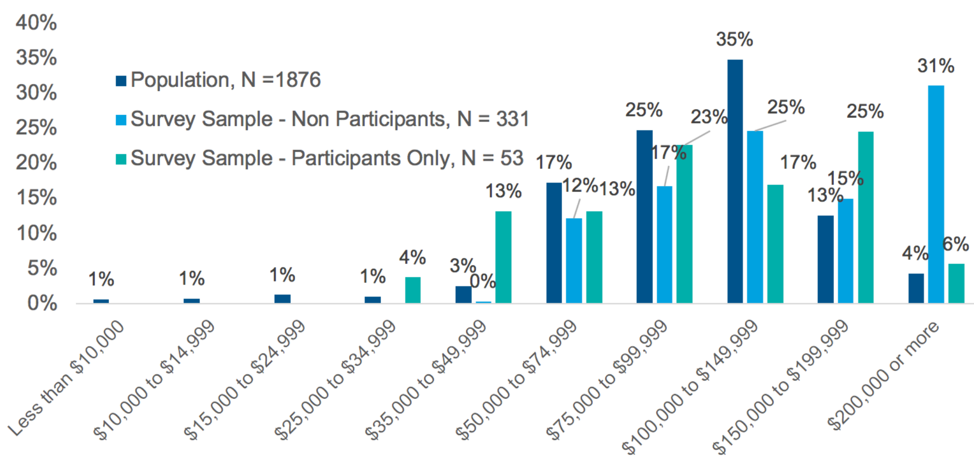


Figure 4-17 *Income Distributions of City Employee Population and Survey Samples*

Another related point of comparison was the median income of participants. For the City population and for non-participants, the median income was $100,000–$149,999. The median income for participants was in the lower category of $75,000–$99,999, and this is a function of the wider spread in incomes observed in this population. The City employee population also reflects only the income of individuals as opposed to households, whereas survey responses reflect household income, which means that some annual incomes could be a function of multiple income earners. Hence, the participant income would be shifted toward lower incomes for some respondents if only their income at the City was considered.

Activity data from the RideAmigos platform contained information on the savings achieved on a per-trip basis by users of the system. This savings was calculated as the difference in trip cost between the mode the user took and driving a personal vehicle. So, if the trip taken was a driving trip, the savings from the trip would be equal to $0. Other trips within the system had a lower per-trip cost and, depending on the mileage, mode, and costs of the mode, a savings of some value was calculated. Costs were calculated on a per-mile basis. As derived from the data, these per mile costs are shown in Table 4-5.

Table 4-5 *Costs per Mile of Project Commute Activity by Mode*

Mode	Cost per Mile
Bike	$0.00
Carpool	$0.283
Drive	$0.556
Transit	$0.18 or $0.45
Vanpool	$0.095
Walk	$0.00

These data also contained a de-identified identifier (De-ID), a unique study-specific number associated with each user. This number permitted the linking of RideAmigos activity data with specific survey responses. The average savings reported per trip from RideAmigos was aligned with the income of respondents, which enabled an examination of the average savings by income. The results are shown in Figure 4-18, which shows the average savings by income and the percent of average savings by income. The average savings per person was relatively constant across participants who responded to the survey. As a result, the percentage of savings as a function of income declined with increasing income.

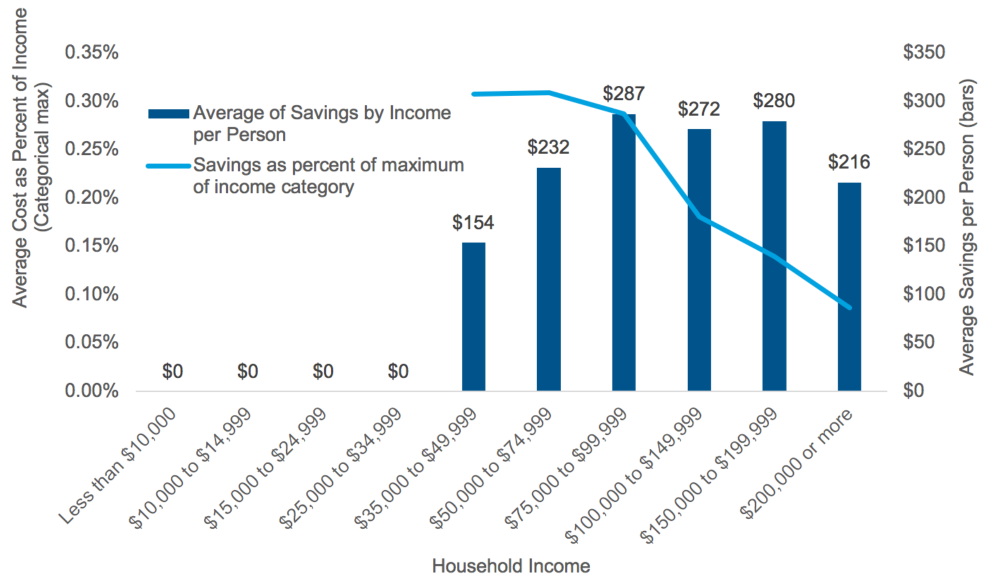


Figure 4-18 *Average User Savings by Participant Respondent Income*

Taken together, the results of Figure 4-17 and Figure 4-18 suggest that the hypothesis is supported. The respondents who were participants exhibited an income distribution with greater spread at the tails, having higher percentages of higher income and low-income participants than the general population. The activity data showed that average savings from mode choices within individual trips was relative, even across the participant subsample regardless of income. Hence, lower-income participants received a relatively higher benefit from participation than higher-income participants. At the same time, the program seemed to draw a relatively large share of higher-income participants, who also received similar magnitudes of benefit. Overall, the findings suggest that Hypothesis 4 is supported.

Hypothesis 5: The improved access to pre-tax payments increases public transit ridership.

Performance Metric	Key Finding
Number of unlinked trips (public transit ridership) among participating employees	Transit ridership increased among some pilot participants as a result of the project. Driving alone decreased. Although the project was connected to these changes, it was not conclusive as to whether it was specifically due to access to pre-tax payments.

The evaluation sought to determine if the FVC project had an impact on public transit ridership in the region of the cities served, which is served predominantly by VTA. Total weekday ridership for the months of project implementation by bus and rail lines serving the cities was about 483,000. The first step in this analysis was an evaluation of the activity data provided by RideAmigos that indicated the mode of travel used for each trip within the data set. The modes included drive, walk, transit, bike, carpool, telework, and vanpool. Across the entire the dataset, pilot participants took 7,842 trips over five months, from August–December 31, 2019. Figure 4-19 shows the distribution of modes over the entire dataset, where public transit (28%) was the most dominant mode, with bicycle (24%) and driving (19%) rounding out the top three.

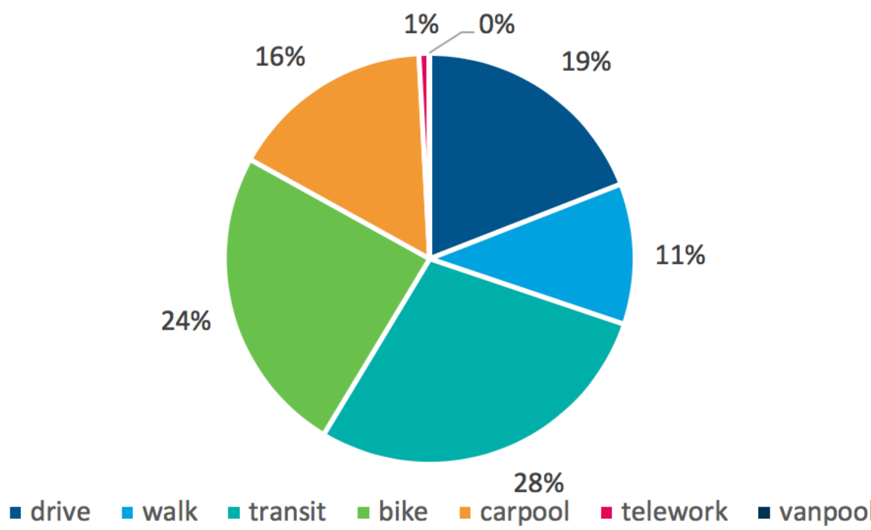


Figure 4-19 *Mode Split of Participants*

Over the course of the project, the share of the people using the available modes shifted for several key modes. The evolution of the modes is shown in Figure 4-20, where the percentage of a modes used is presented as a percent of all trips registered during a given month. The most prominent shift was with public transit and carpooling, which show an immediate exchange of percentages in the first month in favor of carpooling from August to September 2019. Public transit reversed this initial shift and gained slightly in the percentage trips over the course of the project. Drive alone also gradually declined, and walking and bicycling gained. The initial shift in public transit to carpooling was towards the growth in trips that occurred August–September 2019 and not due to a massive shift from public transit to carpooling. New users came online in September, and they heavily favored carpooling, whereas those using public transit generally kept their use of it constant.

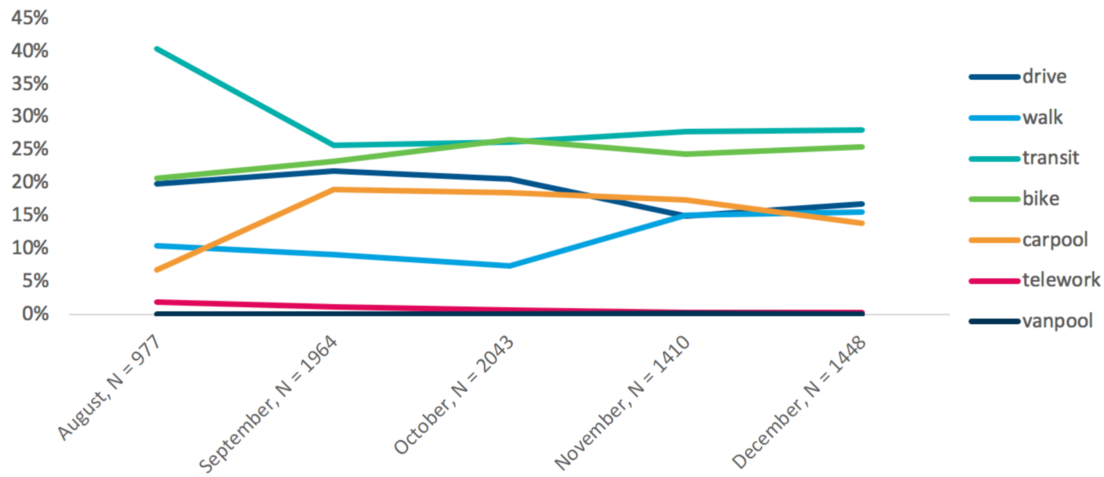


Figure 4-20 *Shift in Mode Use during Project (RideAmigos Activity Data)*

Additional insight on the impact that the project had on public transit can be drawn from the survey. Respondents were asked questions about how the project had impacted their use of modes. In this case, respondents were able to specifically attribute changes in behavior to the project. The results show that a few respondents indicated a positive shift toward public transit modes, mostly in the form of shifts toward commuter rail. This is a logical and expected shift in the form of public transit given that Caltrain's commuter rail service is the major rail provider within the region of the cities served. The number of respondents reporting shift was relatively limited (8), with other transit modes having only one respondent reporting a change in the other public transit modes as a result of the project. Carpooling and walking also receive reports of changes that are positive in magnitude. Notably, the drive-alone mode also received a large response, which showed that participants were shifting away from drive-alone as a result of the project. Figure 4-21 (a consolidated version of Figure 4-9) shows the respondent reported mode shift for key modes related to the hypothesis.

Overall, there is evidence showing some shift in behavior toward public transit as a result of the project. Survey respondents were asked about any benefits they used before the pilot and at the time of the survey. Although pre-tax benefits were used by some respondents, the vast majority (92%) did not use conventional pre-tax benefits before or after the project. However, by virtue of the project, pre-tax payments were accessible as a form of covering costs on per-trip basis. Evidence within the survey suggests the project enabled some movement of participants towards toward public transit and carpooling and away from driving alone. However, the size of this movement, while present, is not shown to be overwhelmingly large in the activity data. The argument is stronger if the modes of carpooling, bicycling, and walking are also considered. However, this is a conclusion of project impacts overall, and the data do not suggest that this movement was specifically due to pre-tax payments. As a result of these collective findings, the hypothesis is found to be partially supported.

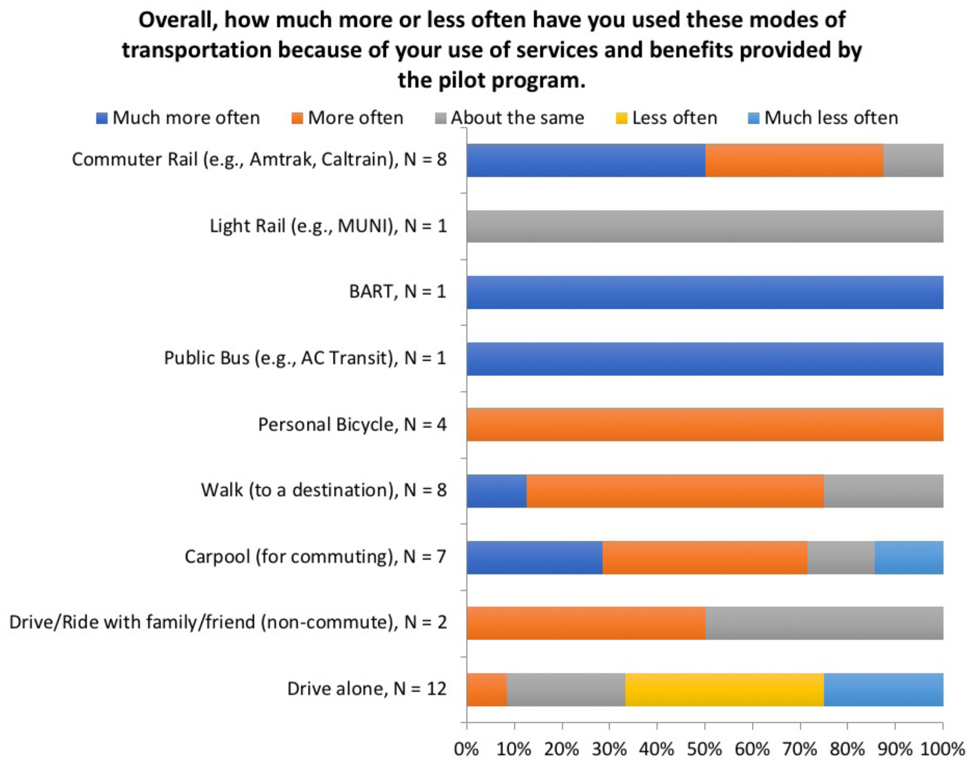


Figure 4-21 *Consolidated Mode Shift as a Result of Project*

Hypothesis 6: The mobility aggregator, feebate or cashout policy, and gap-filling analytics positively impact the propensity of commuters to take non-SOV modes.

Performance Metric	Key Finding
Survey response to questions probing change in SOV commuting (causality of individual components identified through the survey)	Different benefits provided by the pilot program increased commute by non-SOV modes.

The sixth hypothesis explored was whether the different components of the FVC strategy encouraged commutes by non-SOV modes. Effectively, this hypothesis evaluated explored whether the specific benefits provided by the program had a positive impact on shifting travel behavior away from SOV modes. The hypothesis was evaluated mainly using the survey data, which asked respondents about their travel behavior after participating in the pilot, and whether any specific components of the FVC strategy increased their use of non-SOV modes. Trip activity data analyzed in Hypothesis 1 also supported this hypothesis. Analyzing the travel behavior of pilot participants across all four cities (shown earlier), revealed that they significantly increased their non-SOV use at a 95% confidence level.

Figure 4-9 (presented earlier) shows the change in modes used by pilot participants due to specific benefits provided by the pilot. A significant shift from SOV modes to using non-SOV modes is evident. Survey responses show that 74% of 19 pilot participants drove less often as a result of the pilot. In contrast, the increase in use of non-SOV modes was mainly reported by 93% of 14 respondents using commuter rail like Amtrak and Caltrain more often, 91% and 73% of 11 respondents biking and walking more often, respectively, and 80% of 10 respondents carpooling more often.

The FVC strategy provided benefits to pilot participants to encourage commute by public transit. Figure 4-22 shows the effect of different benefits on the use of public transit by pilot participants. Results show that the most effective benefits included a form of direct reimbursements to support the use of alternative modes. Increase in use of public transit was mainly reported by 68% of 25 respondents who benefitted from transit cost reimbursement, 65% of 26 respondents who received loaded public transit cards, 59% of 27 respondents who participated in the "Challenges and Rewards Program," 58% of 31 respondents who received incentives or cashouts for alternative modes, 47% of 19 respondents who benefited from subsidized parking at transit stations, 44% of 18 respondents who benefited from e-scooter and e-bike "try before you buy," and 41% of 17 respondents as a result of each first/last mile connection to public transit and bike network improvements.

The array of benefits explored, in addition to the earlier analysis found in Hypothesis 1, suggests that the programmatic attributes applied during the project did influence behavior and use of public transit. It is important to recognize as part of this conclusion that not all incentives were initially planned. For example, the "fee" of the feebate was never deployed; however, the program broadly implemented an array of measures that were able to encourage shifts in behavior away from the use of the SOV for commuting. Collectively, these results show that the different incentives provided by the pilot program increased commute by non-SOV modes; thus, Hypothesis 6 is supported.

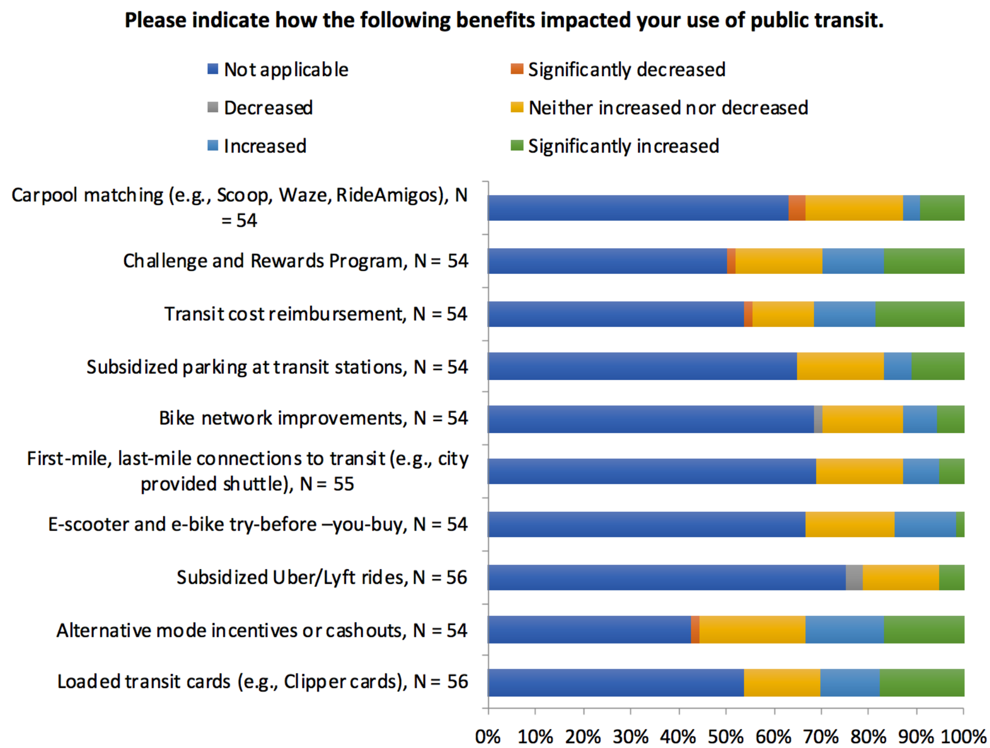


Figure 4-22 *Effect of Pilot Benefits on Public Transit Use*

Hypothesis 7: The attitudes of employees toward public transit become more positive.

Performance Metric	Key Finding
Survey response to questions probing attitudes toward public transit	The FVC strategy significantly enhanced the perception of public transit by pilot participants.

The seventh hypothesis explored whether the FVC strategy enhanced the attitudes of employees toward public transit. This hypothesis was evaluated using the before and after surveys, which asked respondents about their attitude toward public transit in general and whether any specific components of the FVC strategy influenced their attitude. Figure 4-23 shows the rating distribution of public transit by 330 respondents in the “before” survey aggregated across the four cities, where only 32% of respondents reported a rating of 7 or higher.

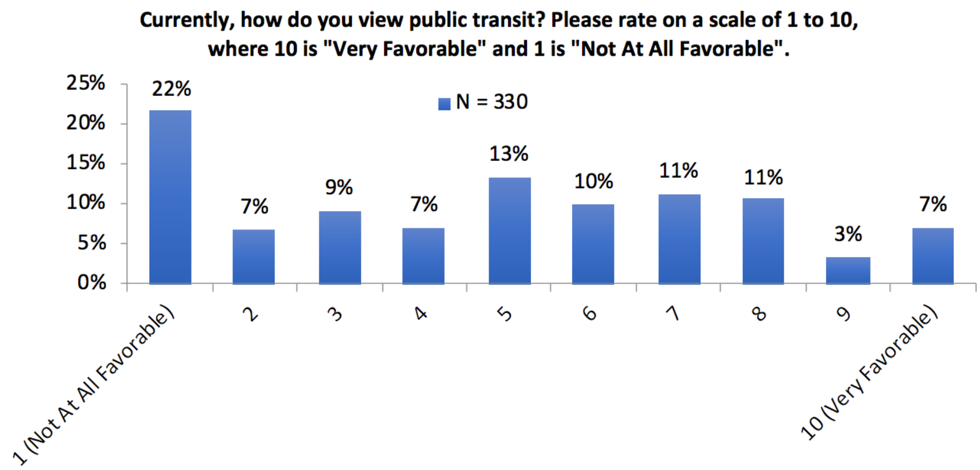


Figure 4-23 *"Before" Survey – Perception of Public Transit – All Cities*

The "after" survey asked pilot participants to rate their perception of public transit before and after participating in the pilot. Figure 4-24 shows a distribution of the results for 57 pilot participants, who reported a similar distribution of ratings before the pilot as compared to that reported by the larger sample in Figure 4-23, with around 40% of 57 respondents reporting a rating of 7 or higher before participating in the pilot. The effect of the FVC strategy on enhancing the attitudes of employees toward public transit is evident, with an increase to 60% of pilot participants reporting.

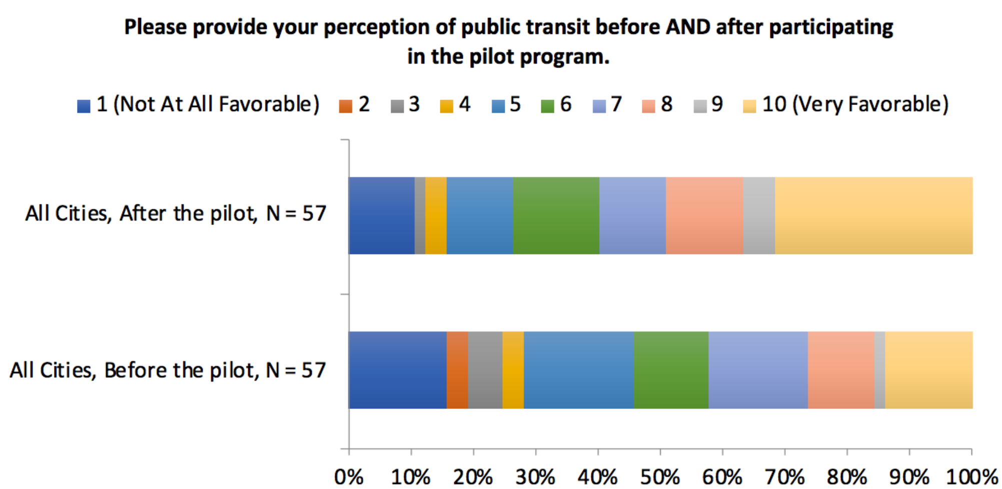


Figure 4-24 *Before/After Perception of Public Transit – All Cities*

To compare the change in public perception between the four cities, Figure 4-25 shows the before and after rating distributions on a city level. It is evident that the most significant increase in rating was by pilot participants in Palo Alto followed by those in Menlo Park. For 21 pilot participants in Palo Alto, the percentage of respondents reporting a rating of 7 or higher increased from 33% to 76%, shifting the average rating from 5 to 8. Similarly, for 8 pilot participants in Menlo Park, this metric increased from 38% to 50%, shifting the average rating from 6 to 7. However, for Cupertino and Mountain View, this metric did not change, but there was a minor positive shift in the perception of public transit which slightly increased the average rating.

The FVC strategy provided benefits to pilot participants to encourage commute by public transit. Survey results, as previously shown in Figure 4-22, indicate that almost all benefits led to a significant increase in public transit use. The most effective benefits were transit cost reimbursement, loaded transit cards, the "Challenges and Rewards Program," and alternative mode incentives or cashouts. Overall, survey results show that the FVC strategy significantly enhanced the perception of public transit by pilot participants. Hypothesis 7 is supported.

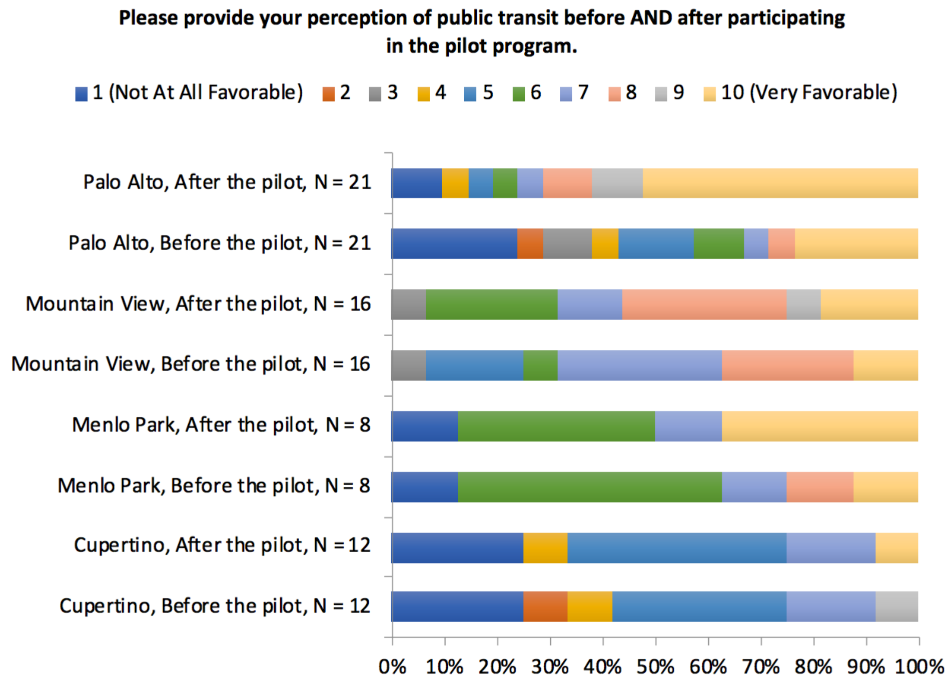


Figure 4-25 *Before/After Perception of Public Transit – City Level*

Hypothesis 8: The commute feebate or cashout is financially-sustainable at participation rates achievable during or after the pilot.

Performance Metric	Key Finding
Net revenue (profit/loss) of the feebate or cashout policy	The hypothesis cannot be evaluated.

The original intention of the program was to have a feebate, but ultimately it was not implemented. Therefore, no revenue was generated from the implementation of the project, and the financial sustainability could not be evaluated in the form originally planned. The project did distribute benefits to pilot participants; the distribution received through Commuter Wallet is presented in Figure 4-26. The most popular benefit was the walking benefit (36%) followed by the Caltrans GoPass (30%), the RideAmigos challenges (17%), and free parking (12%). In total, there were 156 observations of benefits delivered to 12 (19% of) pilot participants in the Commuter Wallet dataset. The data served to demonstrate that a diversity of benefits could be distributed to pilot participants within a similar program. However, given the absence of a fee component in the system, Hypothesis 8 was determined to be inconclusive.

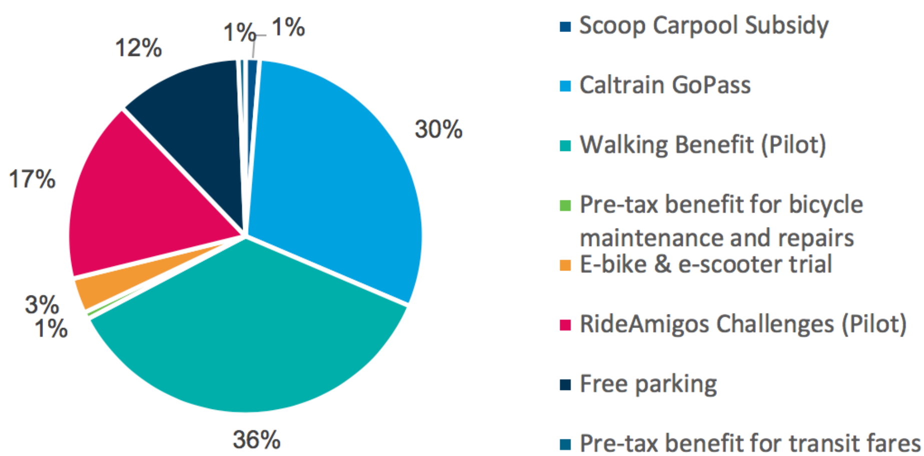


Figure 4-26 *Distribution of Benefits Received by Pilot Participants through Commuter Wallet*

Hypothesis 9: The project produces a series of lessons learned that will be documented through expert interviews with project stakeholders.

Performance Metric	Key Finding
Qualitative documentation from stakeholder interviews	The project navigated a number of planning and implementation challenges but was ultimately able to implement the project similar to its original vision. The process of planning and implementation produced lessons learned for future designs of similar project.

The IE team conducted interviews with several experts who were directly connected to the project team and 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 9.

Section 5 Lessons Learned from Project Partners

As noted, in Summer and Fall 2017 the project was rescoped, and a new principal investigator was selected in November 2017. The rescope of the project changed the feebate program to a parking cashout, and the number of pilot locations was reduced to four public sector sites. Palo Alto believed that neighboring cities would hold each other mutually accountable to help ensure programmatic success. Approximately nine months into the demonstration, differences in approach between the private-sector project management team and public-sector recipient and participants necessitated some notable changes across the partnership. Despite these challenges, the project partners noted that FTA wanted to see the project succeed and provided flexibility to help make the project a success. Demonstration stakeholders noted the importance of soft skills and attributed the project's success to the flexible nature and organizational culture of both the project recipient and FTA that enabled the project to be rescoped throughout the period of performance.

Public Sector Employee Focus

The original scope of the project was designed to include private sector employers in the region. Several private sector employers provided letters of support for the project proposal. However, once the project reached the planning stages, the original private sector stakeholders became non-committal, in part due to the overlap and redundancy of the project with their existing TDM programs. The project shifted focus to municipal partners, who generally agreed that inconvenience and affordability were important mobility challenges that created barriers to using public transit and shared mobility. Many city project partners interviewed reported that most of their employees live in nearby cities or commute in excess of 1–2 hours per a day from the East Bay, Morgan Hill, and Gilroy. Project partners noted that the rescoped project quickly became more narrowly focused on overcoming municipal employee commute challenges through a suite of TDM strategies that encouraged a reduction in SOVs, reduced parking demand, and lowered greenhouse gas emissions.

Each city project partner interviewed identified notable barriers to implementing their own TDM programs, such as long travel distances, technology challenges, and the process for disbursing incentives (e.g., workflow approvals such as tracking and reporting commute information for payroll, management, and auditing). To help overcome many of the challenges associated with tracking and disbursing incentives, the grantee used the RideAmigos platform, a turnkey software service that helped reduce the staffing required to administer the program. Partners generally said they liked the multi-city partnership because it helped cities work together to tackle common challenges and increased the potential pool of carpooling and vanpooling matches. Demonstration partners spoke positively about the RideAmigos platform, reporting that it helped provide visibility on project impact and data-driven decision-making through communications with staff and program participants.

Anecdotally, demonstration partners reported that project participants liked the gamified experience and leaderboards for “super carpoolers” and “super transit riders” to compare progress with co-workers. Palo Alto has negotiated to continue with RideAmigos for an additional year; however, the rest of the program (e.g., specific mode shift incentives and supporting commute needs analysis) was more uncertain given the growth of telecommuting associated with the global pandemic.

Parking Cashout

Demonstration partners reported that parking cashout added notable complexities to the MOD project. “Ledgering” was the process to convert the trips that were logged in RideAmigos into cash payments for each participating employee; however, each of the three parking cashout programs differed (including one that had two different award tiers for qualifying activity). The lack of uniformity across all participating cities created additional complexity for calculating participant rewards. Because employees were not required to use Commuter Wallet, the RideAmigos platform was used to track participant behavior. However, RideAmigos was not contractually scoped to manage these calculations or process parking cashout payments. To overcome this challenge, Prospect Silicon Valley developed a spreadsheet calculator for the cities.

Commuter Wallet

Commuter Wallet was deployed toward the end of the demonstration program. Project partners noted limited use of the Commuter Wallet, in part due to the staggered rollout of the program’s features. In hindsight, project partners would have preferred to integrate Commuter Wallet with RideAmigos and roll out both at the same time. Commuter Wallet attracted only approximately a dozen total users. It was generally believed that Commuter Wallet was not well-used because of the compressed project timeline. RideAmigos was deployed in August 2019, and Commuter Wallet did not become available until September.

A major update to the wallet was deployed in October 2019. Although a number of partners extended agreements with RideAmigos, Commuter Wallet ended in December 2019. Demonstration partners hypothesize that users had “software fatigue” and did not want to use Commuter Wallet because it was not required to participate in the program.

Feebate

The project had planned to implement a novel incentive that would function as a feebate for commuting, a policy structure that levies a charge for a certain purchase or action and a rebate for a different purchase or action. The core concept behind a feebate is that the policy can simultaneously encourage benevolent behaviors through incentives or reduced costs and discourage less desirable behaviors through increased costs. In theory, this can have advantages for changing the cost structure over policies that strictly impose fees or strictly offer incentives. For example, a feebate policy can achieve the same policy-imposed spread in costs between options (for example, $10) by charging half the spread as a fee (-$5) and providing the other half as an incentive (+$5). Another advantage of feebates is that the fees charged can fund the rebates, meaning that the desired cost spread between options can be advanced by partially or wholly self-funded incentives (depending on the balance of behaviors). The policy has been proposed for other areas of transportation and other industries as a method of encouraging benevolent behaviors more rapidly and lower net expense. One example area is that of car purchases, where state policies have been proposed that levy fees on inefficient vehicle purchases and provide rebates for more efficient vehicles.

Conceptually, feebates have many technical advantages over policies that include straight fees or straight incentives. But they often run into barriers that are political in nature, as critics charge that they are inequitable or unfair to whatever population or consumer group is getting charged. For example, inefficient vehicles (such as pickup trucks) sometimes are necessary for an individual's occupation, and a feebate policy might charge such consumers while sending cash to electric vehicle buyers. Such issues can be addressed by a "within vehicle class" feebate structure but can still be problematic from an equity perspective because inefficient vehicles can be cheaper within any vehicle class and thus the policy would target lower-income buyers.

The proposal to translate the feebate concept to commuting, where SOV drivers would be charged and non-SOV travel would be rebated ran into similar political challenges with respect to equity concerns. Some people charged by the policy may need to drive due to exogenous factors relating to income, housing locations, and/or family needs. The cities were simply not comfortable imposing this structure on its workforce and ultimately the policy was dropped from the portfolio of options.

Demonstration Stakeholder Engagement

Demonstration stakeholders reported that aspects of the project were oversold or overstated to FTA in the original proposal. In particular, some project partners provided letters of support but later did not commit, did not understand what they were committing to, and backed out of the demonstration. For example, initial demonstration supporters included Google, Facebook, LinkedIn, and other private-sector companies; however, each of these initial partners had TDM programs and employer shuttles and did not understand the value of the demonstration. This experience may inform future deployments of similar projects. Certain projects may propose initiatives that are or appear to be redundant to existing programs, and well-established systems may have little interest in programs that are or appear to be redundant. The fact that certain entities provided letters of support but then did not follow through is a risk for many different types of projects. There is value in conducting market research to understand which types of entities may most effectively benefit from the project design and how to best pivot if early partners in the project decline to fully participate.

In another example, a regional public transit agency remained a project supporter but declined to participate in the demonstration. Demonstration stakeholders also noted that despite the project team's pragmatic vision, when the project encountered challenges it became increasingly difficult to maintain relationships across the demonstration, causing further disruption to the project.

Additionally, demonstration stakeholders reported that developing a TDM program was very labor-intensive. They reported institutional and resource challenges with "selling" TDM concepts, recruiting employees to participate, training employees on how to use the various tools, and getting employees to stay engaged and actually change their behavior. To participate in the program, participants were offered two options—download the app or access a web portal. However, demonstration partners noted that several employees who wanted to participate could not easily do so because they did not have access to a computer as part of their job.

In general, partners said the process for logging trip behavior was viewed by participants as tedious for only a minimal incentive. Partners also noted employees with longer commutes generally had more public transit connections and fares, which increased cost and disincentivized longer commuters from using public transit due to the relatively small incentive. Demonstration partners noted that an additional monetary incentive may be needed to encourage behavioral change. Demonstration stakeholders also noted that numerous questions were raised about whether participants could receive an incentive to drive to Caltrain because a bus connection was unavailable. Partners estimate that up to 60% of full-time equivalent employees live within a 15-minute drive of a Caltrain station.

Demonstration partners also emphasized the importance of identifying a champion in each department who could assist their employees and co-workers with completing their trip logs and incentive applications. Additionally, stakeholders also noted that existing rules discourage incentivizing with gift cards and prohibit incentivizing with food. Partners said this was a particular challenge because of the prevalence of food incentives by private sector employers in the Silicon Valley. Demonstration partners also noted that many employees travel by car between city facilities during the day, and part-time employees were not eligible for the project program. This latter restriction was defined by the cities where, for example in Palo Alto, employees were considered eligible for the commuter benefits if they worked at least half-time and had a position that was benefits-eligible. Project partners hope to be able to expand the program to additional employees and use cases in the future.

Section 6 Conclusions

The City of Palo Alto and Bay Area FVC Sandbox Demonstration was able to implement all its planned components, except for the feebate system, during its deployment from August–December 2019. Pre-surveys implemented from June–August 2019 and post-surveys implemented in January and February 2020, along with other activity and agency data, were collected to evaluate the performance of the pilot in accordance with the evaluation plan. The pilot encountered notable challenges implementing a feebate program because free parking was a perk that was part of employment agreements; thus, the program had to pivot to a parking cashout incentive. The project was also rescoped, and several vendors and partners left and joined the project. Demonstration stakeholders noted the importance of soft skills and attributed the project's success to the flexible nature of both the grantee and FTA that enabled the project to rescoped throughout the period of performance.

Project partners noted that the rescoped project quickly became more narrowly focused on overcoming municipal employee commute challenges through a collection of transportation demand management (TDM) strategies that reduce commute by SOV, reduce parking demand, and lower greenhouse gas emissions. Each of the cities interviewed identified notable barriers to implementing their own TDM programs, such as long travel distances, technology challenges, and the process for disbursing incentives. To help overcome many of the challenges associated with tracking and disbursing incentives, the project partners used the RideAmigos platform, which helped provide visibility on project impact and data-driven decision-making through communications with staff and program participants.

Partners generally liked the multi-city partnership because it helped cities work together to tackle common challenges and increased the potential pool of carpooling and vanpooling matches. Anecdotally, demonstration partners reported that program participants liked the gamified experience and leaderboards for "super carpoolers" and "super transit riders" to compare progress with co-workers.

Demonstration partners reported that parking cashout added notable complexities to the MOD project. On one hand, the lack of uniformity across all participating sites created additional complexity for calculating participant rewards. On the other hand, Commuter Wallet was designed to manage and process these calculations, but its delayed rollout led to using RideAmigos to track participant behavior. Project partners would have preferred to integrate Commuter Wallet with RideAmigos and roll out both at the same time. Palo Alto has negotiated to continue with RideAmigos for an additional year, whereas the rest of the program is uncertain given the growth of telecommuting associated with the global pandemic.

The project proved successful in decreasing the mode share of commute by SOV and reducing total commute VMT, energy consumption, and greenhouse gas emissions among the pilot participant population. The program also provided effective incentives and benefits to encourage use of alternative modes of transportation and enhance perceptions of public transit. 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 commute systems.

The results of the evaluation found that the Bay Area FVC project achieved a number of its objectives as defined by the hypotheses. Analysis of trip activity data, recorded by pilot participants during their commute to/from work, showed a decline in SOV use accompanied by an increase in non-SOV use. Statistical analysis of activity data for Cupertino and Menlo Park showed significant increases in non-SOV commute when trips were analyzed at an aggregate level across all employees. Also, pilot participants in Menlo Park significantly increased their use of alternative modes and decreased their driving over the duration of the pilot. Overall, analyzing the mode use of pilot participants across all four cities showed that they significantly increased their non-SOV use at a 95% confidence level, supporting the goals of the pilot.

Analysis of “before” (N=507) and “after” (N=389) survey data showed that as a result of participating in the pilot, 74% of 19 individuals drove less often, 93% of 14 individuals used commuter rail more often, 91% and 73% of 11 individuals biked and walked more often, respectively, and 80% of 10 individuals carpooled more often.

Both trip activity data and survey data were analyzed simultaneously to construct a two-dimensional mode shift matrix for individuals before and after participating in the pilot program. The aim of this matrix was to describe the mode substitution that occurred as a result of the pilot. This allowed random assignment of a mode shift for each trip within the activity data to generate a rough estimate of the likely direction of VMT change. The assignment was repeated multiple times, across 8,244 trips recorded by 62 pilot participants, to check for robustness and sensitivity of the overall VMT change to redistributions of individual mode shift. This combined analysis showed that the pilot program led to a decline in VMT by 40%.

To study the effect of the pilot on energy consumption and CO_2 emissions, survey data were used to obtain information about the make, model, and year of vehicles owned by 47 pilot participants. Based on a database published by the U.S. EPA, it was possible to generate a discrete fuel economy distribution for these vehicles, which was then used to estimate a smooth probability density function based on a non-parametric method called kernel density estimation. In a similar manner to the VMT analysis, the obtained distribution was used to randomly assign fuel economies to individual commute trips and calculate the likely change in fuel consumption and corresponding CO_2 emissions. Overall, the energy analysis showed that the pilot decreased total energy consumption by 46% and CO_2 emissions by 10.2 metric tons.

Participating cities also provided information on income and ZIP code locations of the employee population. The distribution of population income was compared with the distribution of household income of survey sample participants and showed that the survey sample had pilot participants with over-representation in both the lower and higher incomes (a wider spread in incomes). This suggests that the program was accessible to a diverse set of employee incomes. Activity data from RideAmigos contained estimated savings achieved by the modes selected by the pilot participants for individual commute trips. Using a de-identified common identifier in both the survey and the activity data, income data could be matched with activity, and computation of average savings by income level was conducted. This showed that average savings per person was relatively level across incomes; thus, lower-income participants received a relatively higher benefit as a share of income.

The evaluation explored whether public transit ridership increased as a result of pre-tax payments derived from the project. The analysis found that public transit ridership and use did increase among pilot participants, but data were not sufficient to determine whether this was a result of pre-tax payments specifically. Driving alone declined in the data set, and public transit use and other modes such as carpooling and bicycling rose. Survey data showed that pilot participants mode- shifted as a result of the project more broadly, which was generally toward transit, carpooling, and other active modes. Driving alone was reported decrease specifically as a result of the project.

The Bay Area FVC project provided benefits to pilot participants to encourage commutes by public transit. Analysis of survey data showed that the most effective benefits included a form of direct reimbursements to support the use of alternative modes. Significant increase in use of public transit was mainly due to public transit cost reimbursement, loaded public transit cards, the “Challenges and Rewards Program,” and alternative mode incentives or cashouts. To further evaluate the effect of different benefits on the use of alternative modes, surveys asked pilot participants to rate their perceptions of public transit before and after participating in the pilot. Survey data showed that the FVC strategy significantly enhanced the perception of public transit by pilot participants. The average rating of public transit across the four cities increased from 5.5 to 7 as a result of the pilot; this increase was most significant for the cities of Palo Alto and Menlo Park.

Survey analysis also showed that a sizeable minority of individuals would consider using e-bikes or scooters as part of their commute in Cupertino and

Mountain View. In addition, a majority of survey respondents in Menlo Park, Mountain View, and Palo Alto perceived incentives as an effective way to influence a change in their commute. A minority of those individuals indicated that receiving a carpool stipend would encourage them to carpool and that they would be willing to participate in a city-supported vanpool program.

Finally, the Bay Area FVC project offered lessons learned to build on future projects. Interviews (n=8) with those close to project implementation revealed several findings related to project goals, development, and operation, accessibility challenges, and other issues related to the continuation of the project.

The main lessons learned include the importance of:

- Ensuring that a project design is not overly ambitious and can reasonably be deployed and completed within a demonstration timeframe,
- Recognizing that a TDM program is a labor- and institutionally-intensive process, requiring staff to champion TDM concepts, recruit employees to participate, train participants how to use various tools, and engage staff to encourage behavior change;
- Identifying departmental champions to assist employees and co-workers complete trip logs and incentive applications.
- Ensuring that incentives are sufficient to encourage mode shift, particularly among longer-distance commuters who may have higher commute costs.

Appendix A Additional Survey Results

"Before" Survey

The following plots 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. Where applicable, data labels for figures included in the appendix have been rounded to the nearest whole number for display purposes.

Figure A-1 *"Before" Survey – Household Size*

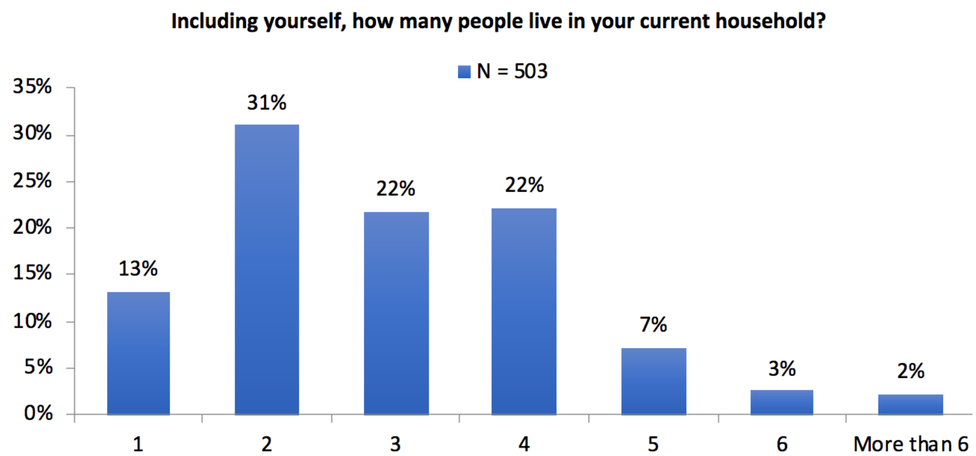


Figure A-2 *Before" Survey – Household Relation*

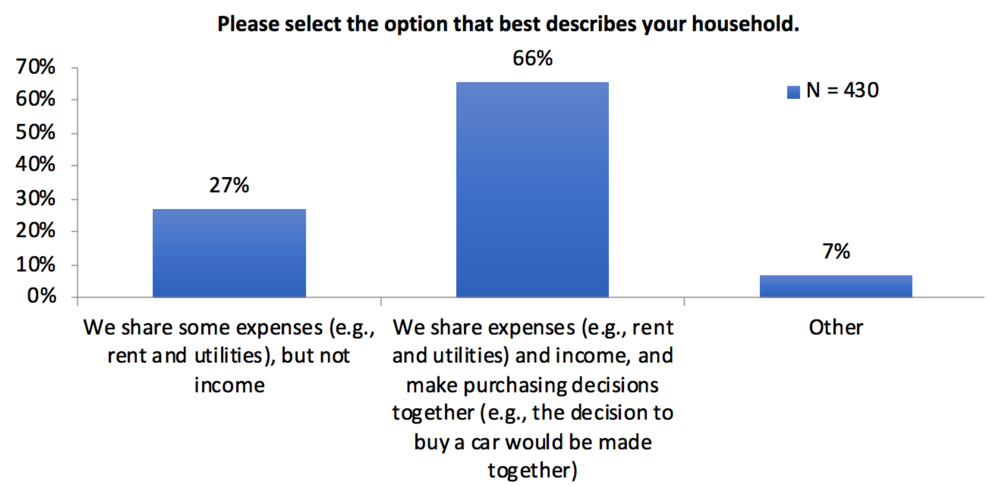


Figure A-3 *"Before" Survey – Vehicle Ownership*

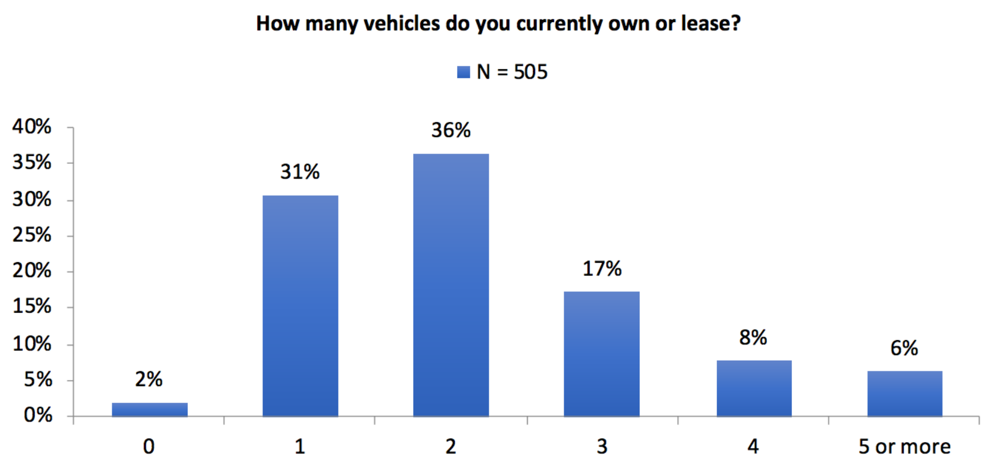


Figure A-4 *"Before" Survey – Miles Driven*

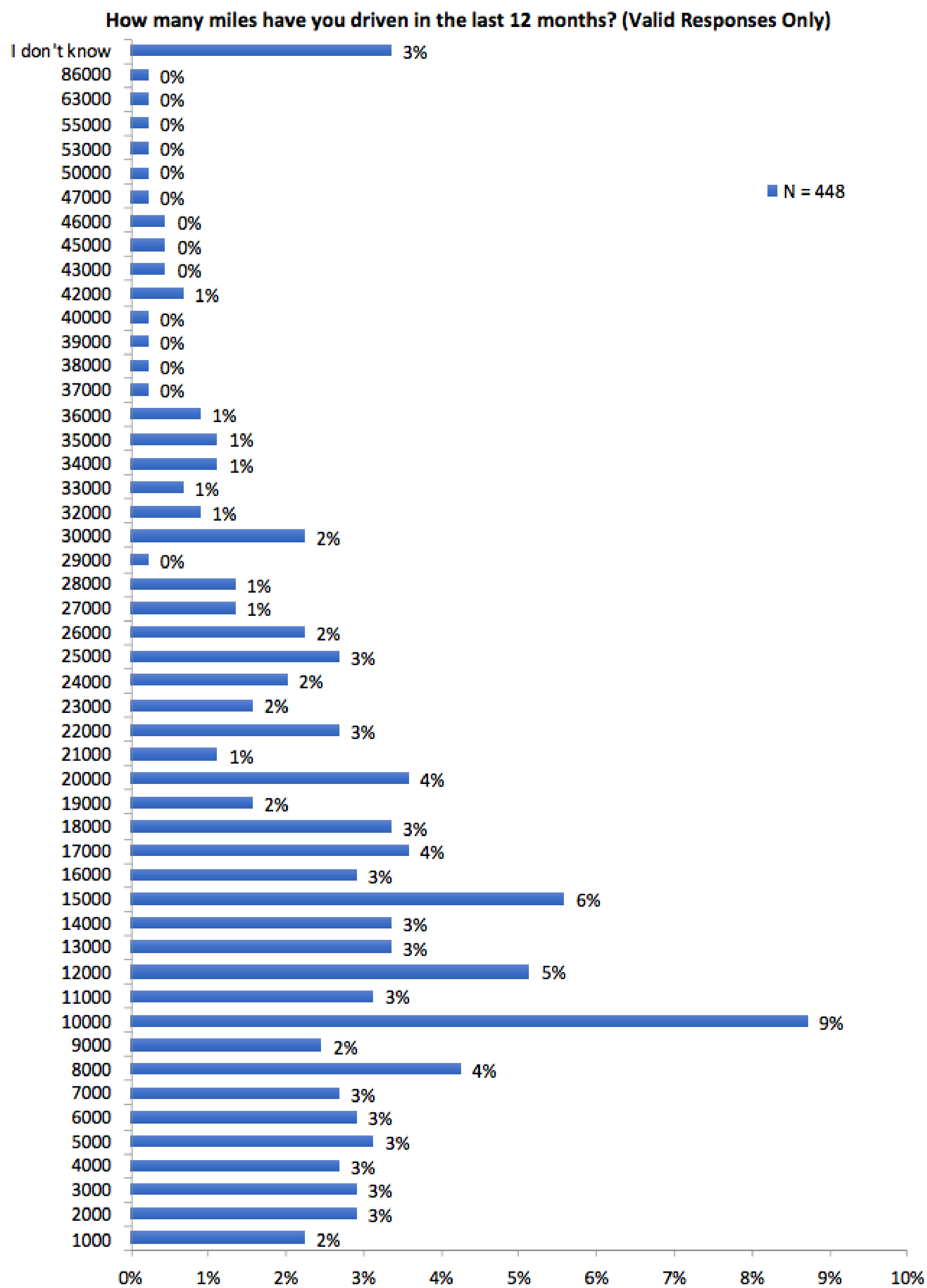


Figure A-5 *"Before" Survey – Mode Share Distribution*

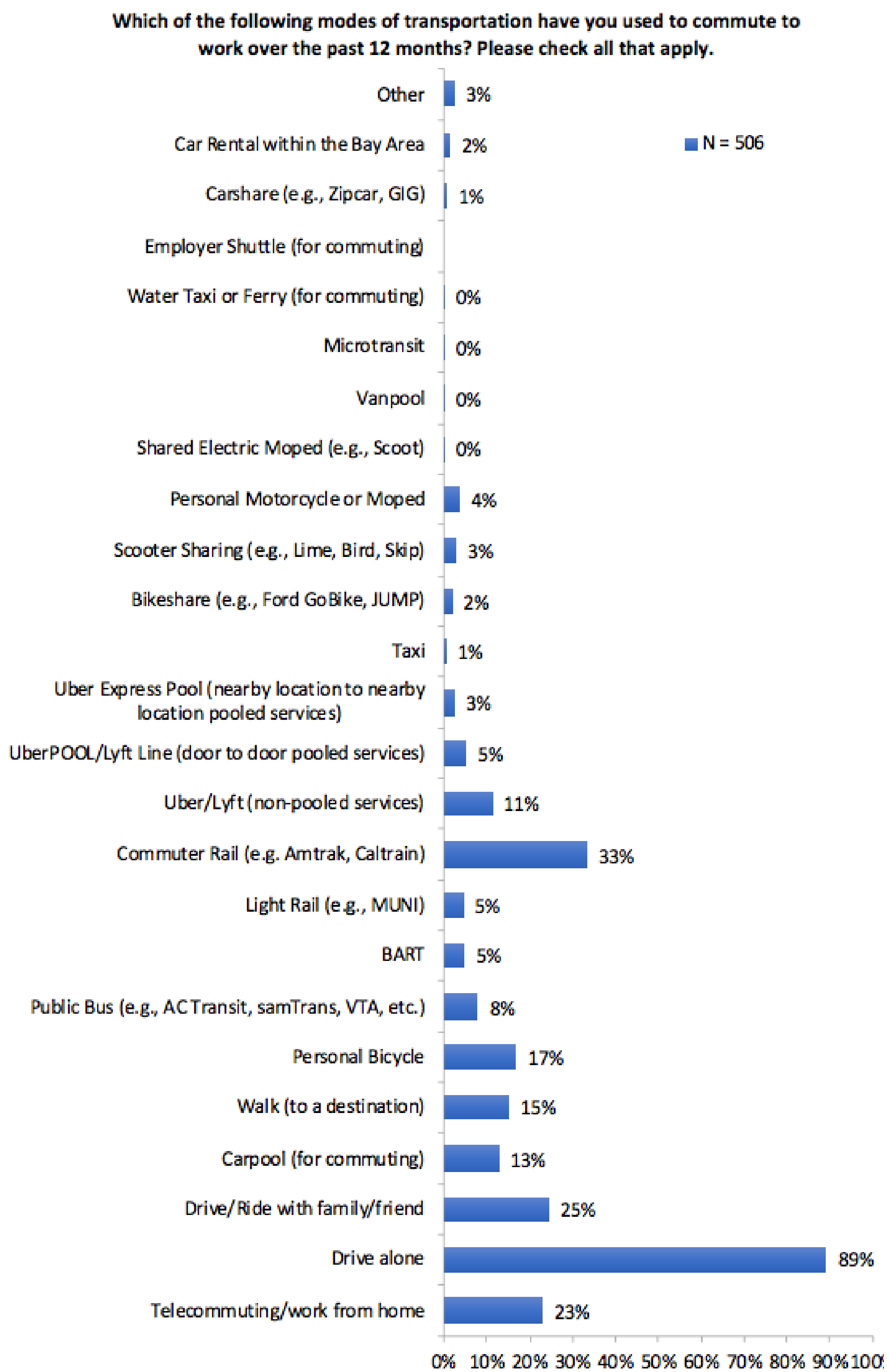


Figure A-6 *"Before" Survey – Working Days*

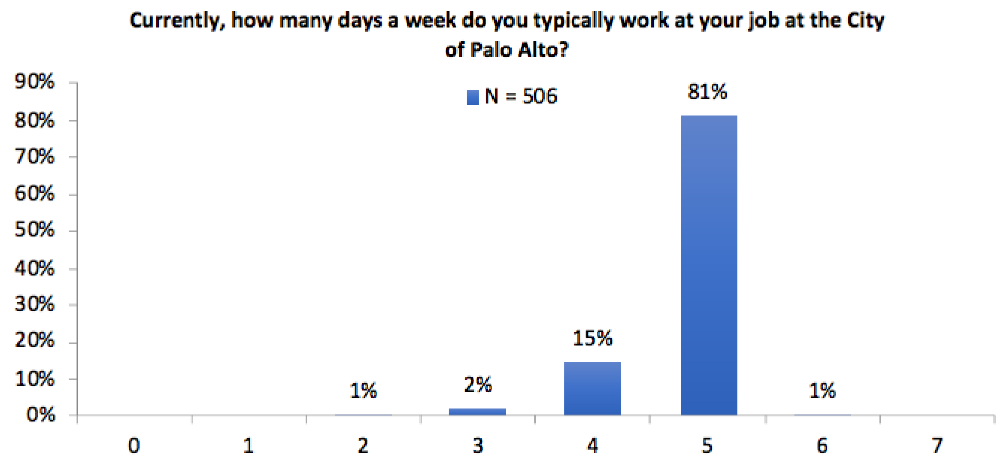


Figure A-7 *"Before" Survey – Mode Frequency of Use Distribution*

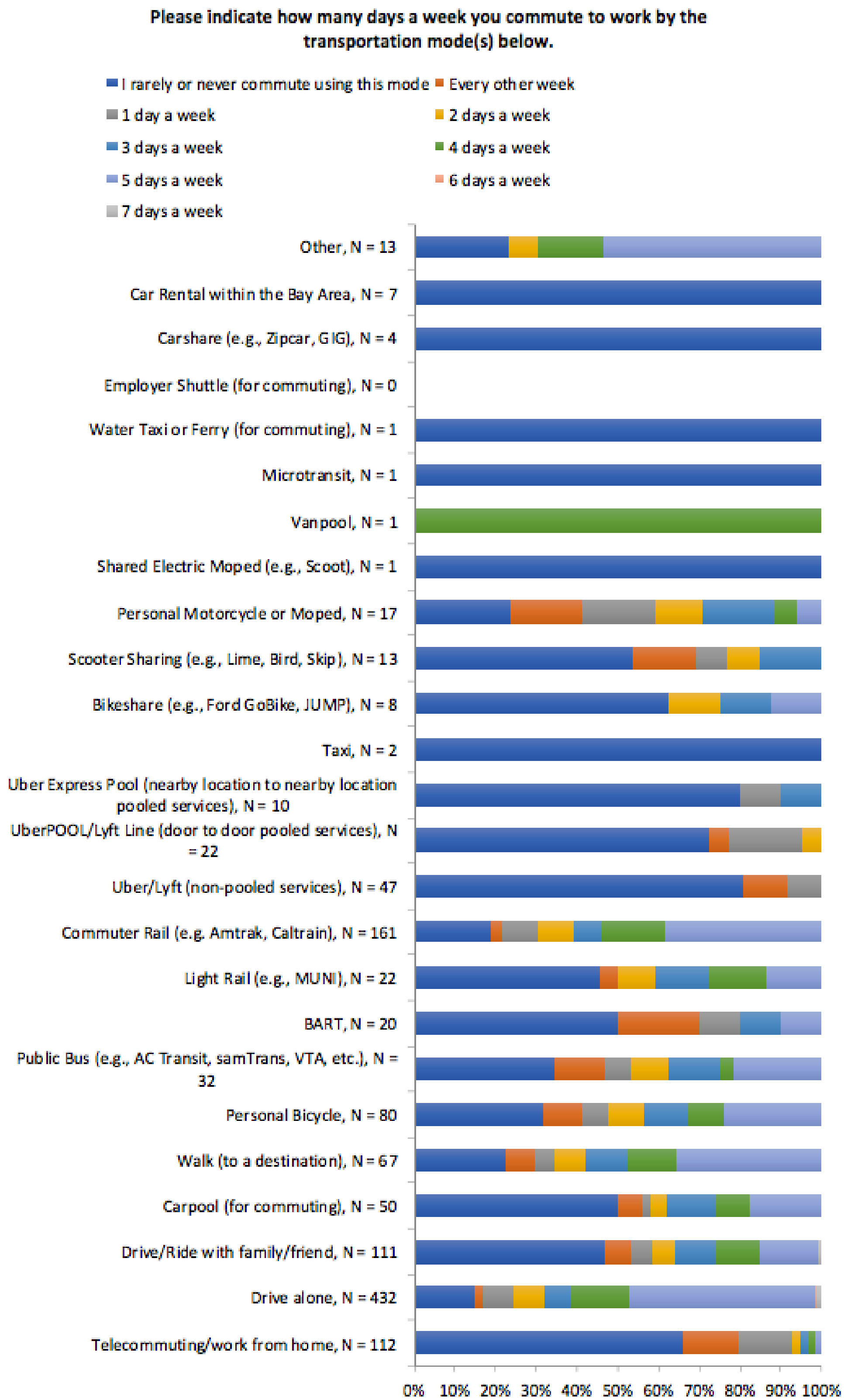


Figure A-8 *"Before" Survey – Commute Distance*

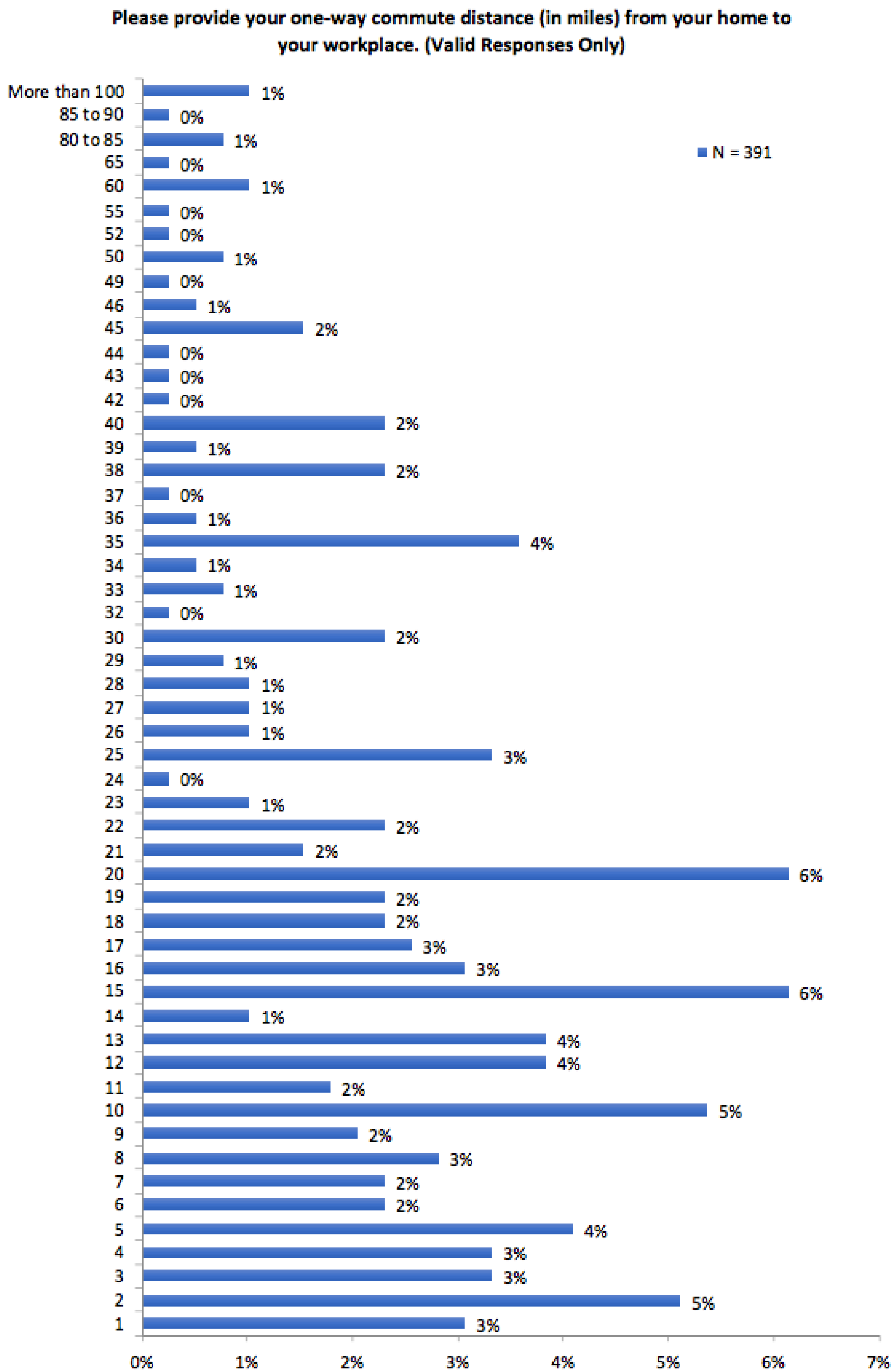


Figure A-9 *"Before" Survey – Typical Morning Commute*

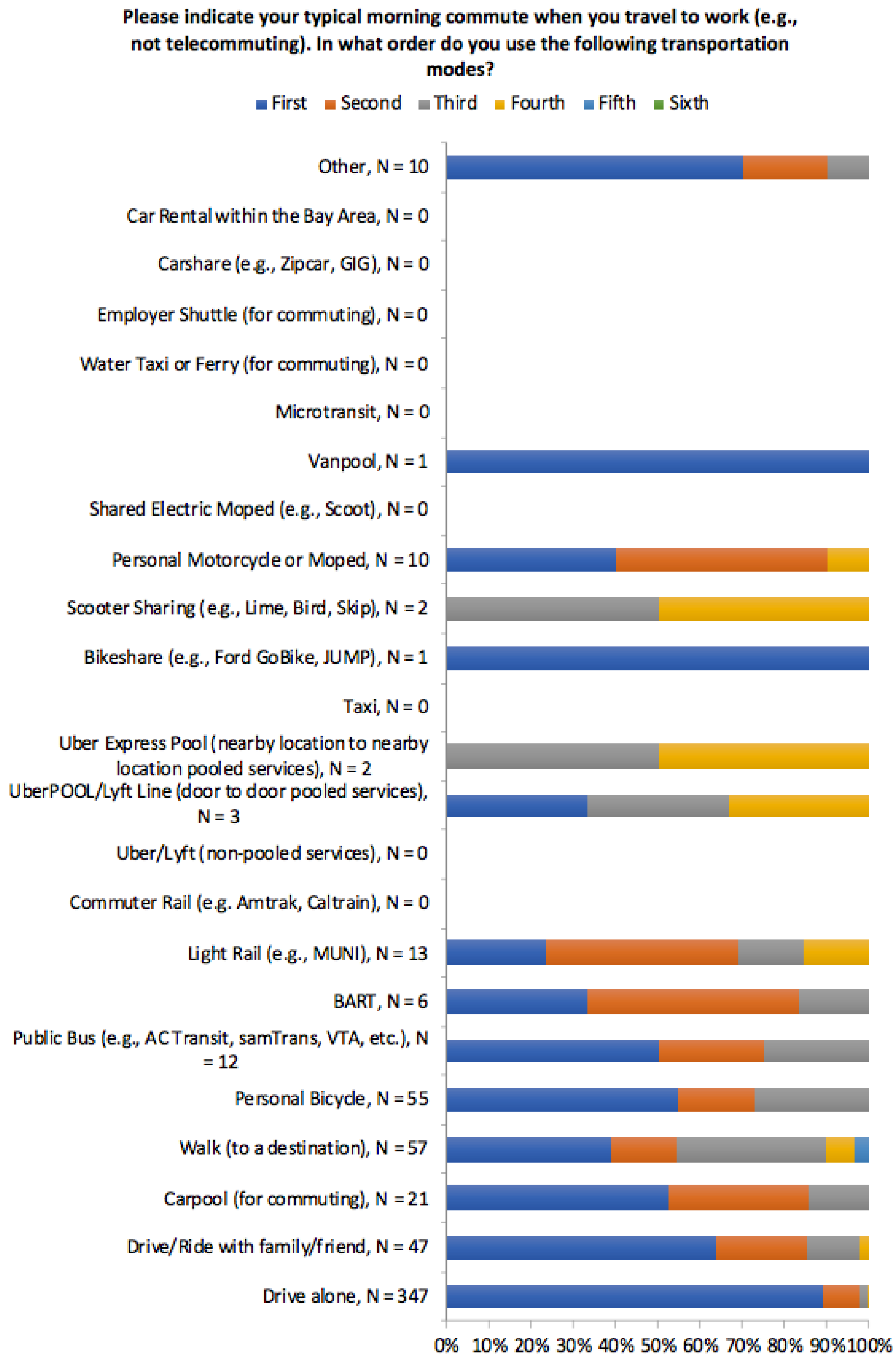


Figure A-10 *"Before" Survey – Evening Commute*

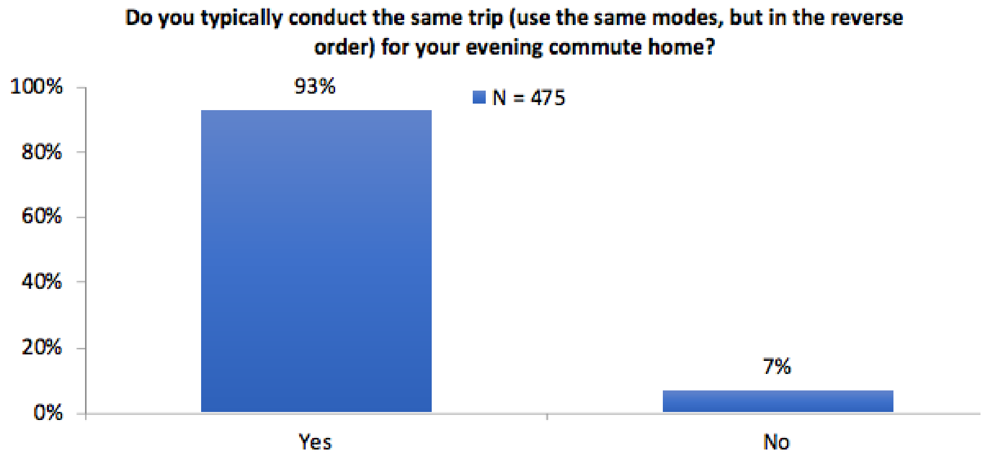


Figure A-11 *"Before" Survey – Typical Evening Commute*

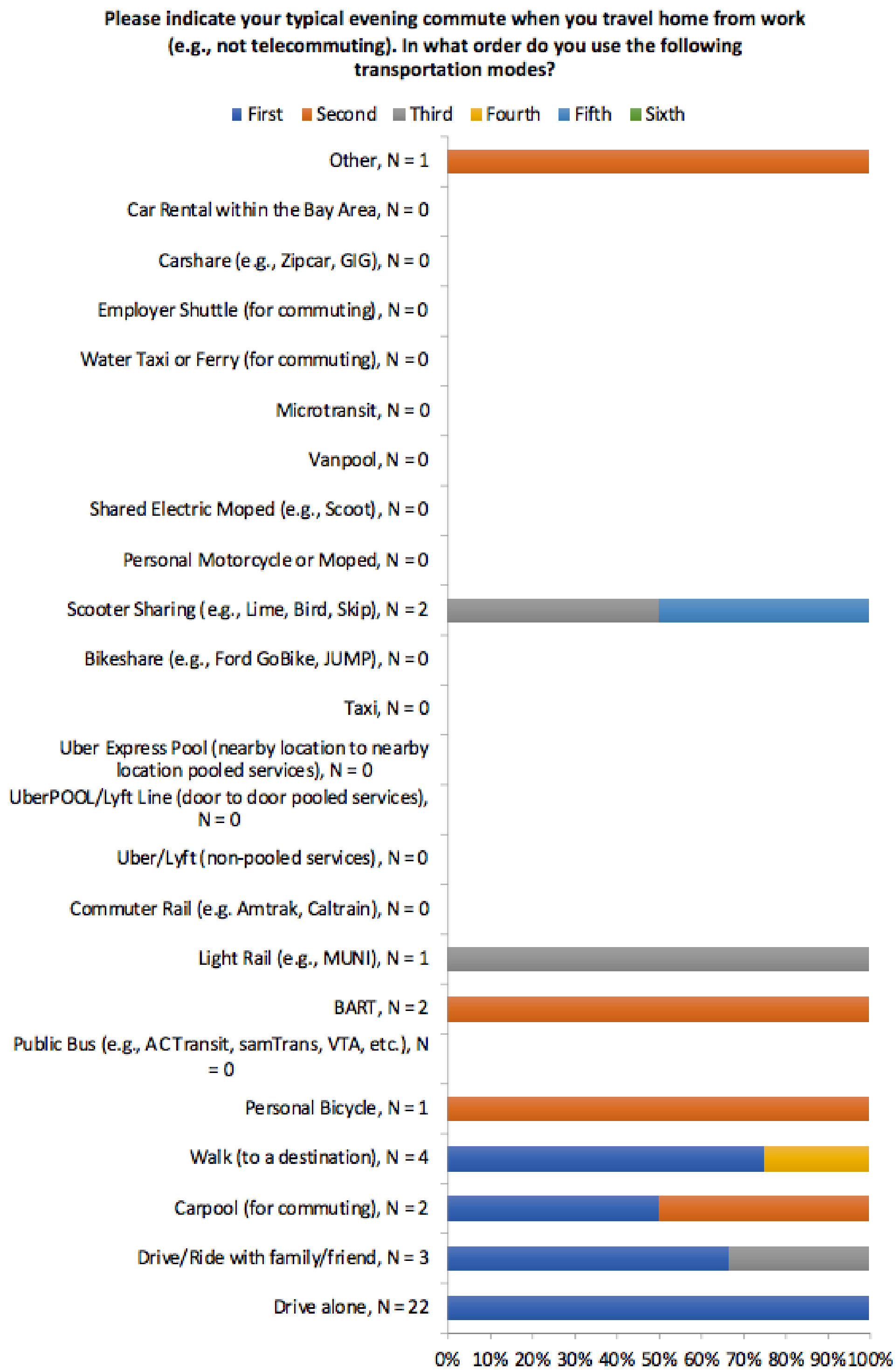


Figure A-12 *"Before" Survey – Morning Commute Start Time*

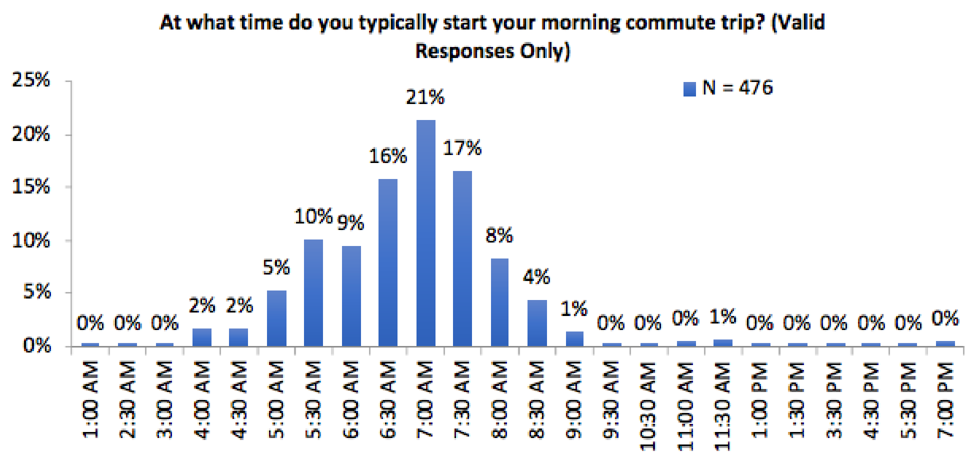


Figure A-13 *"Before" Survey – Morning Commute Days*

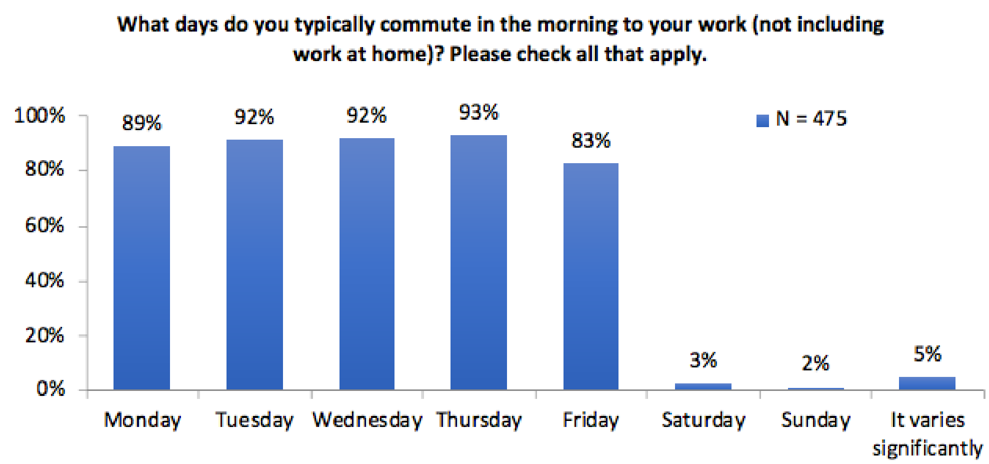


Figure A-14 *"Before" Survey – Child During Morning Commute*

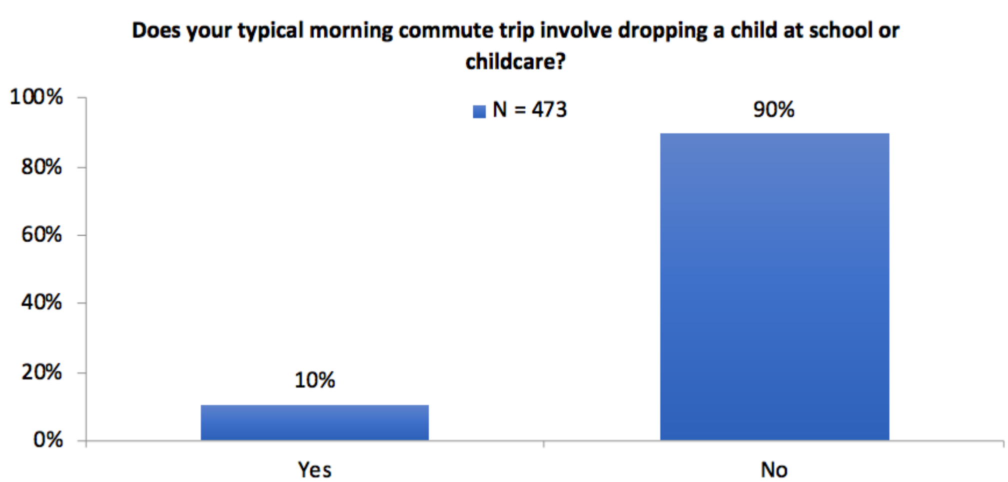


Figure A-15 *"Before" Survey – Parking Cost*

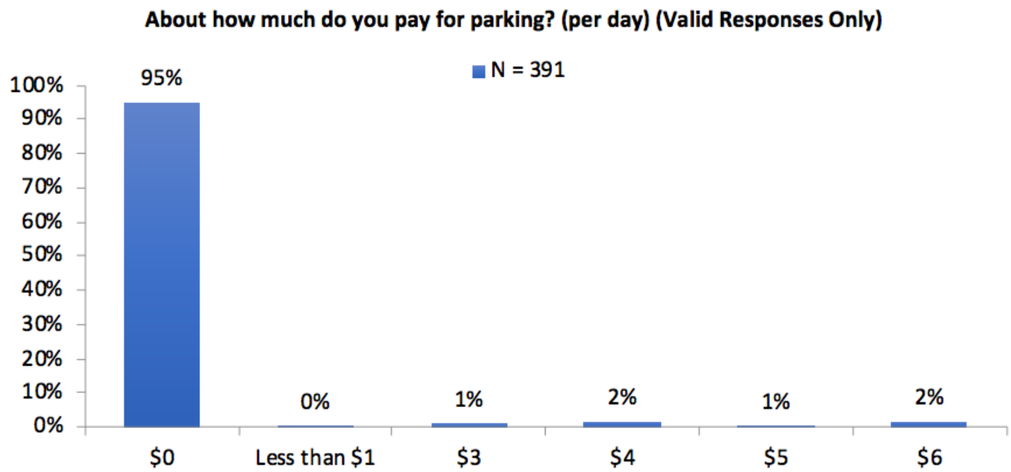


Figure A-16 *"Before" Survey – Tolls Cost*

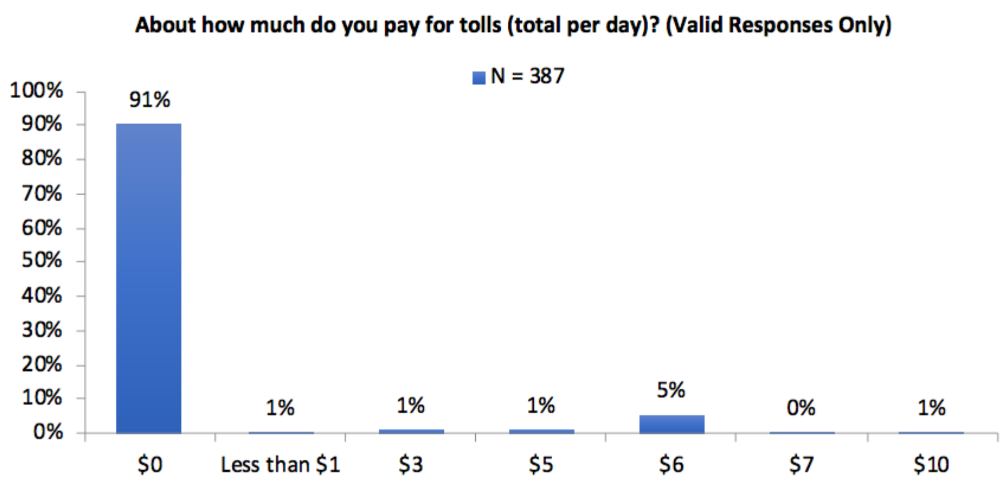


Figure A-17 *"Before" Survey – Alternative Mode to Get to Work*

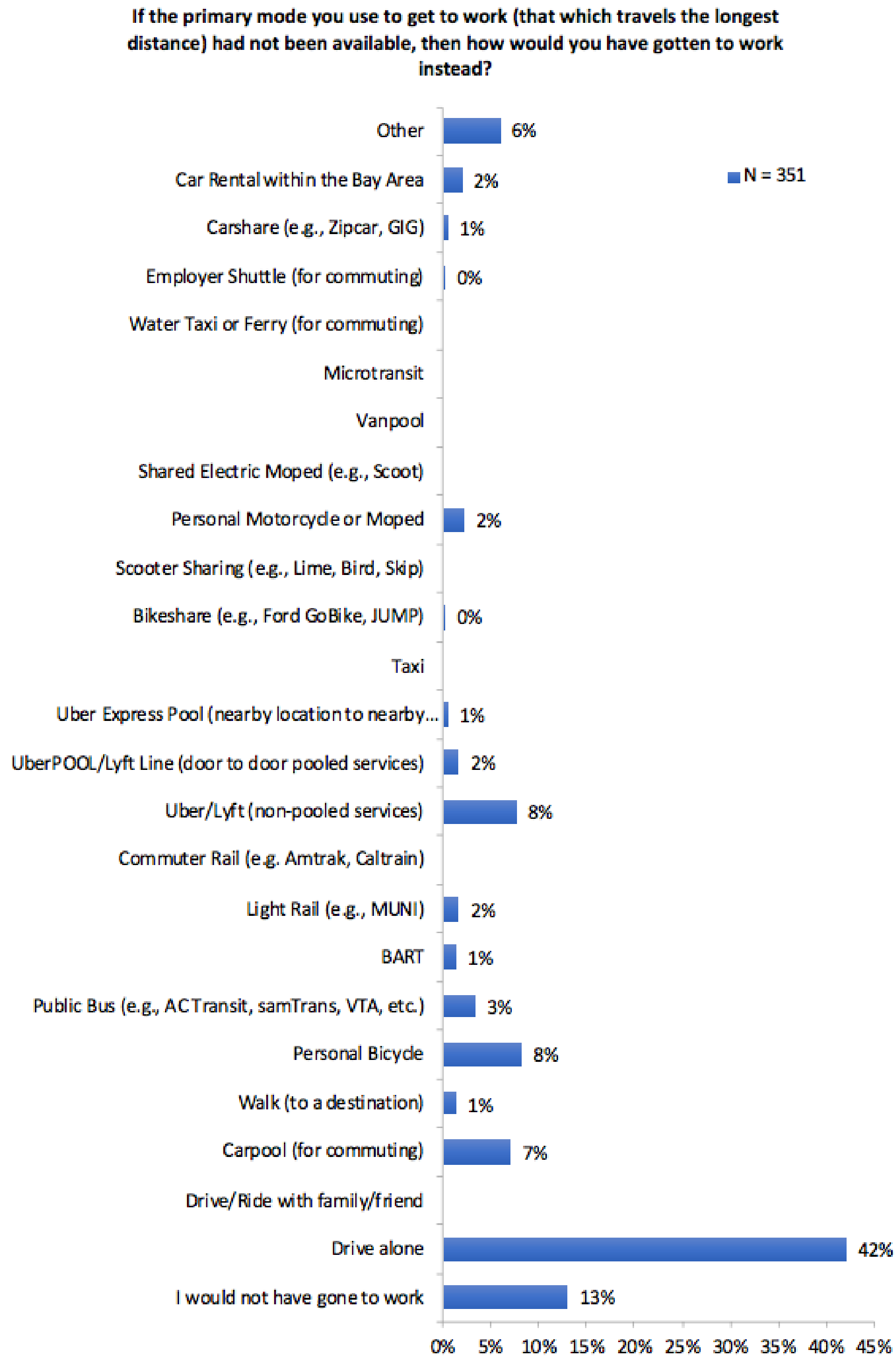


Figure A-18 *"Before" Survey – Evening Commute Start Time*

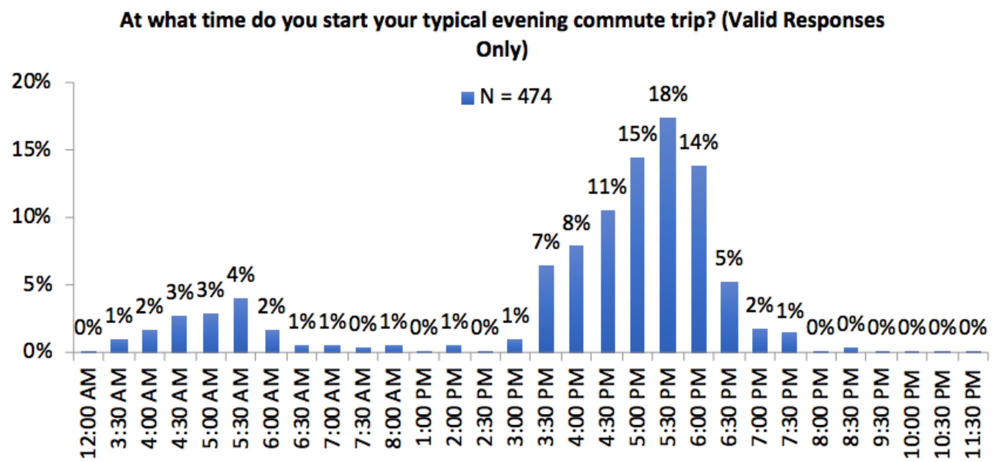


Figure A-19 *"Before" Survey – Alternative Mode to Get From Work*

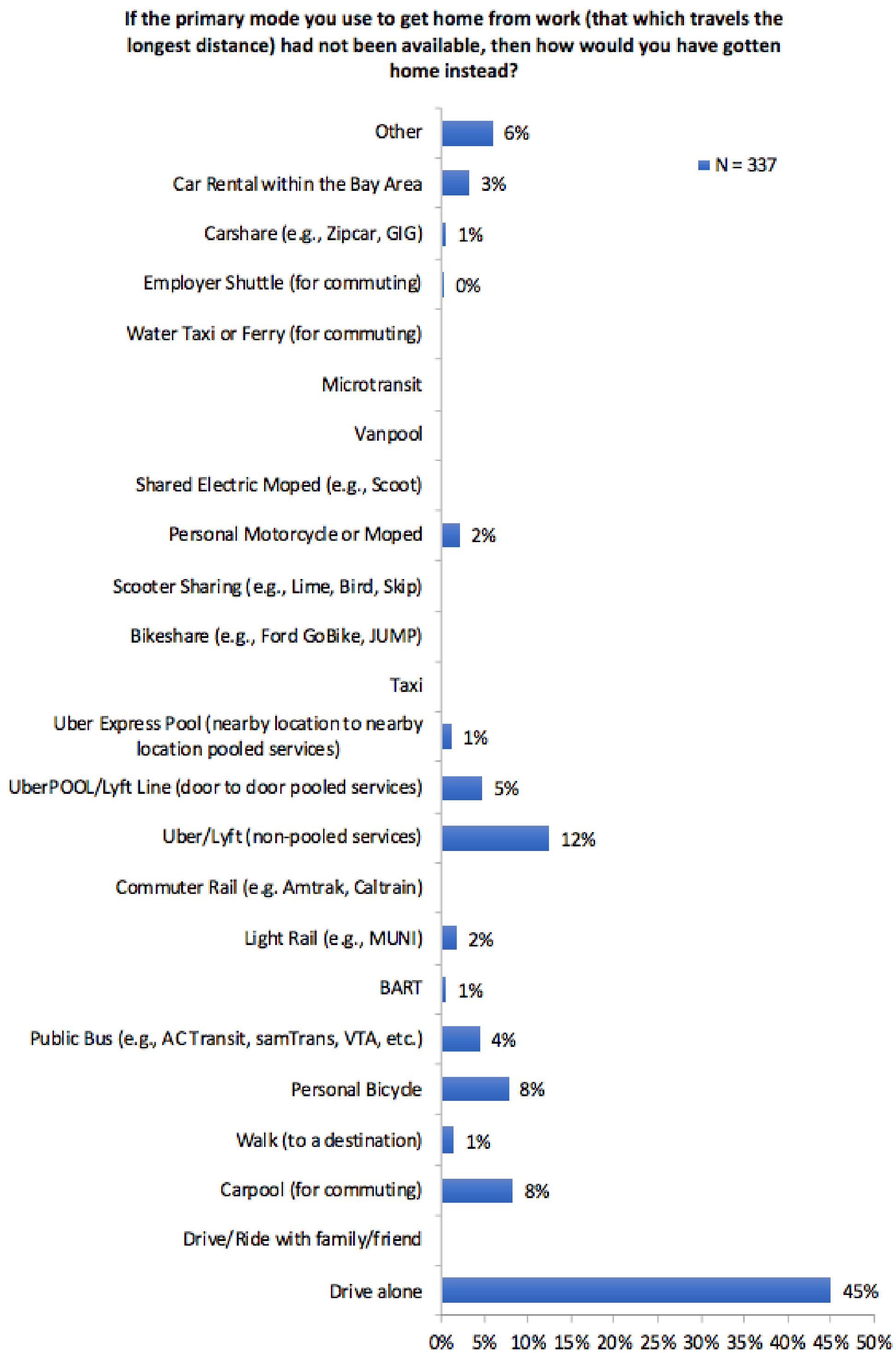


Figure A-20 *"Before" Survey – Child During Evening Commute*

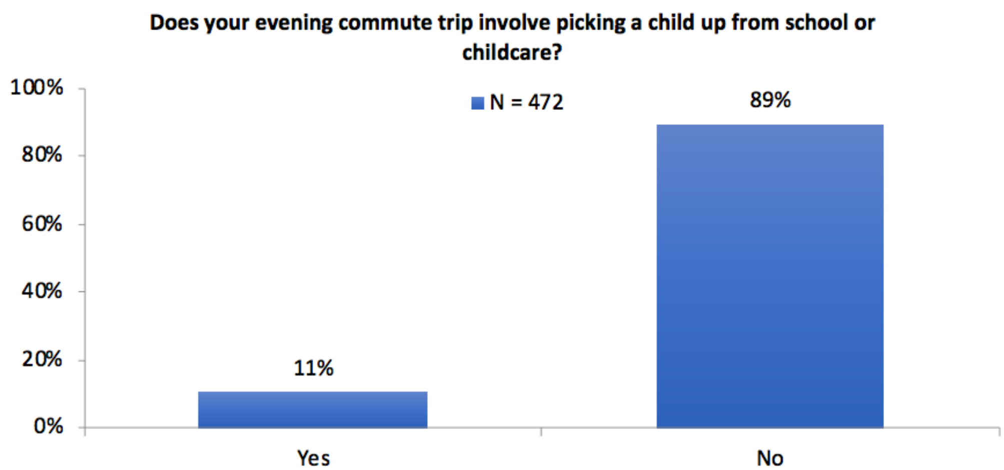


Figure A-21 *"Before" Survey – Commuter Benefits Received (1)*

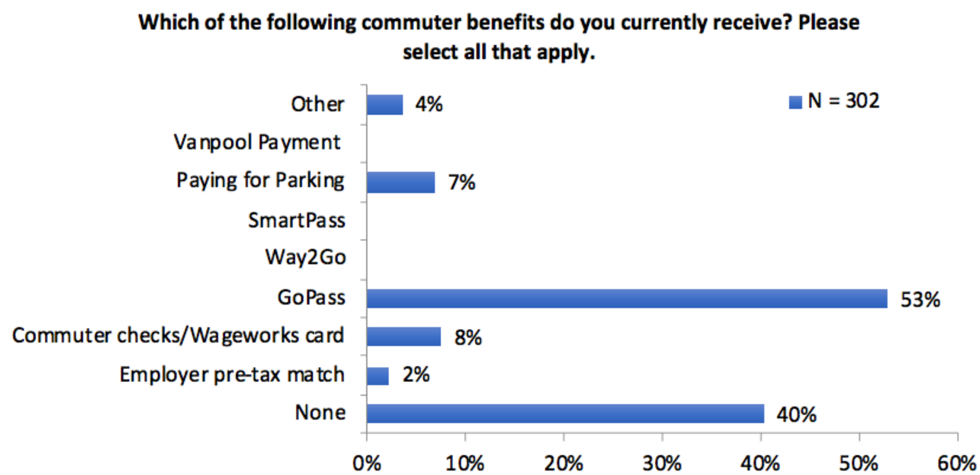


Figure A-22 *"Before" Survey – Commuter Benefits Received (2)*

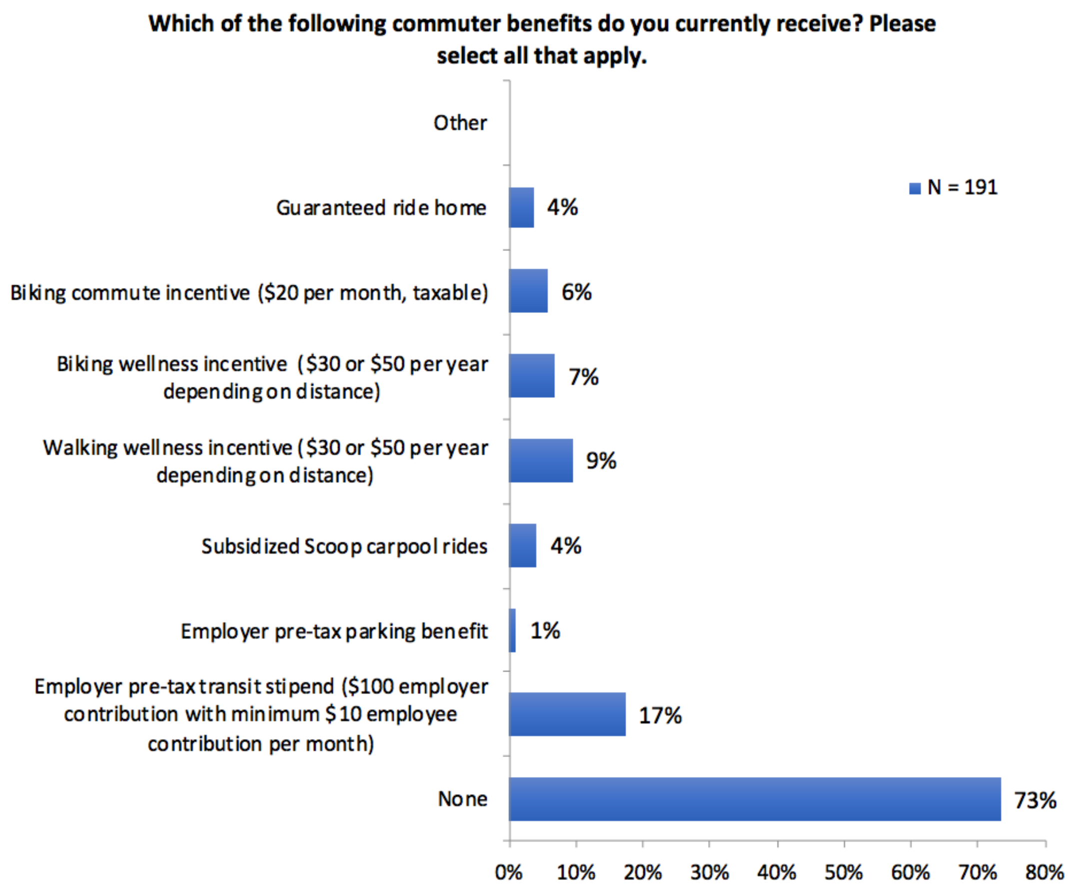


Figure A-23 *"Before" Survey – Cost of Commuter Benefits (1)*

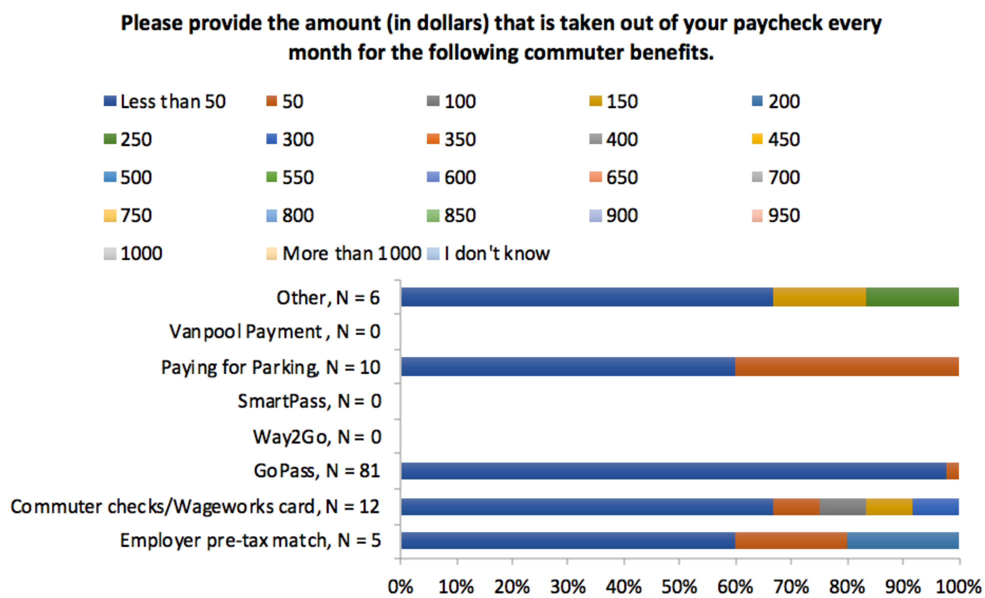


Figure A-24 *"Before" Survey – Cost of Commuter Benefits (2)*

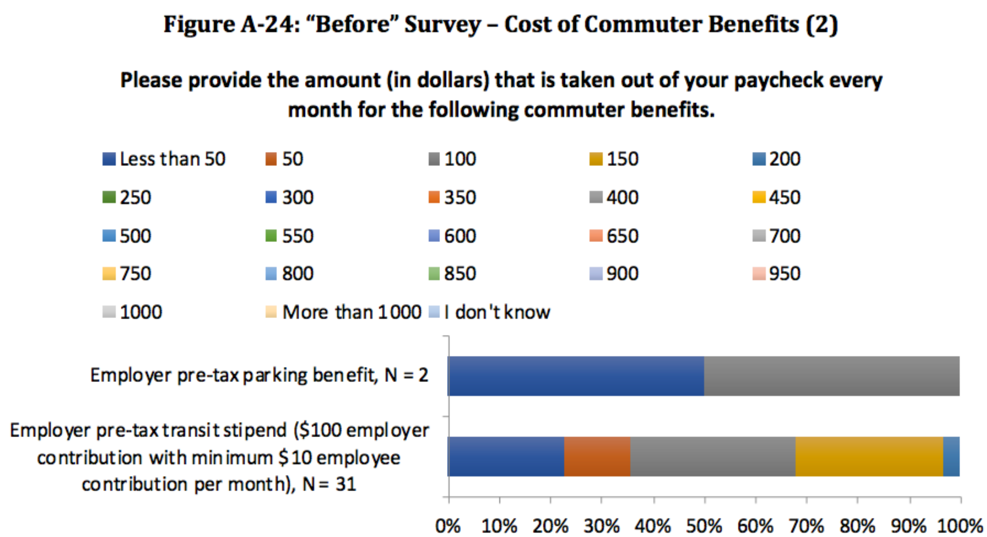


Figure A-25 *"Before" Survey – Perception of Public Transit*

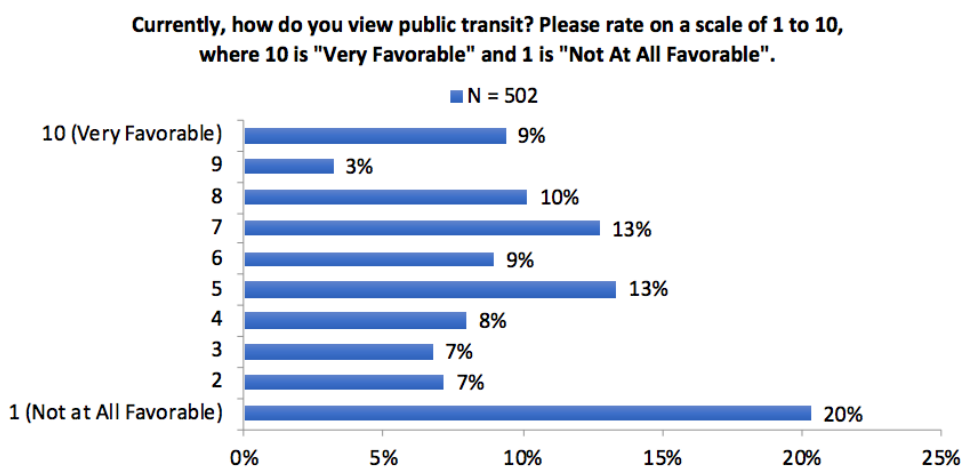


Figure A-26 *"Before" Survey – Perception of Public Transit – City Level*

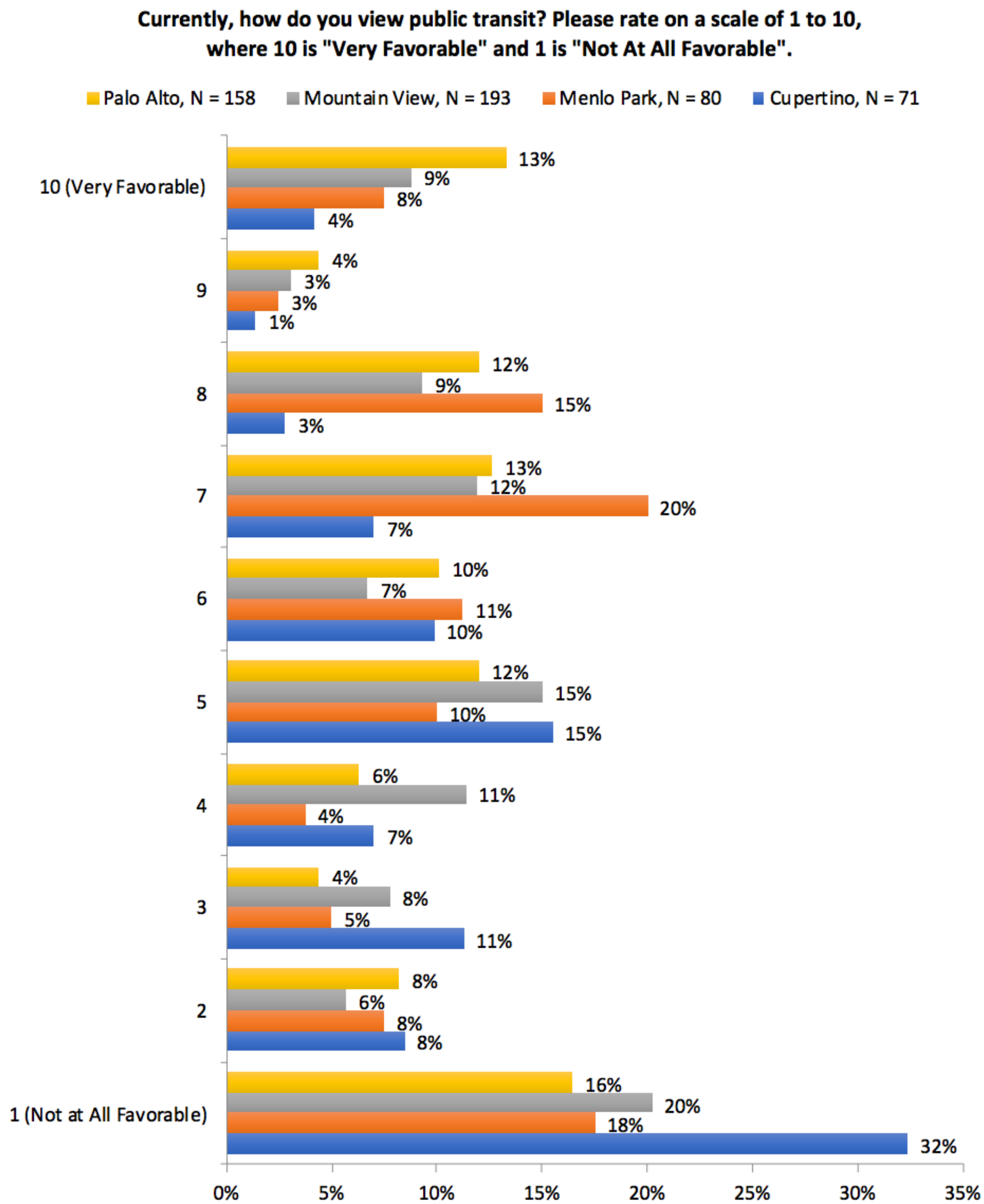


Figure A-27 *"Before" Survey – Gender*

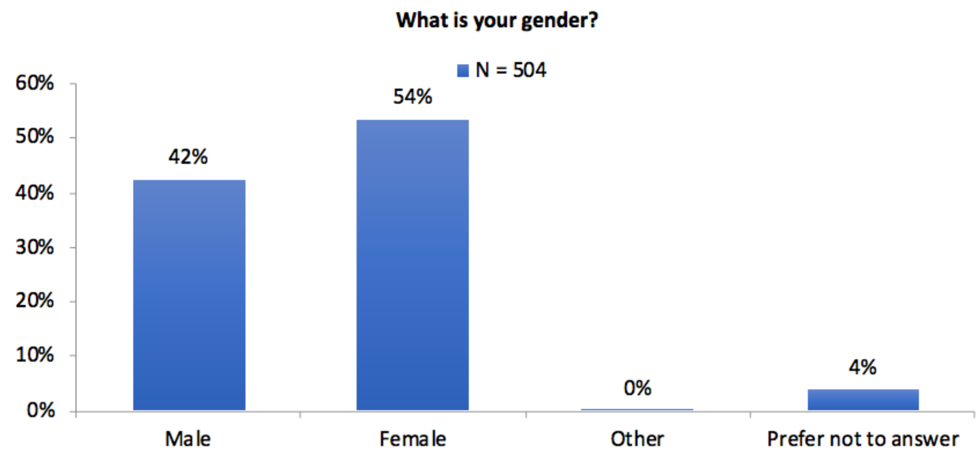


Figure A-28 *"Before" Survey – Wheelchair Use*

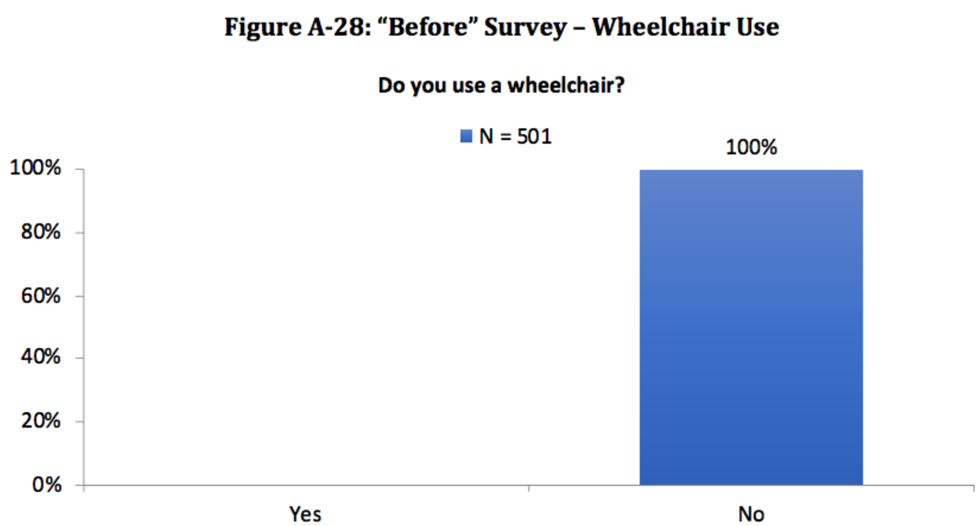


Figure A-29 *"Before" Survey – Transportation Specialized Accommodations*

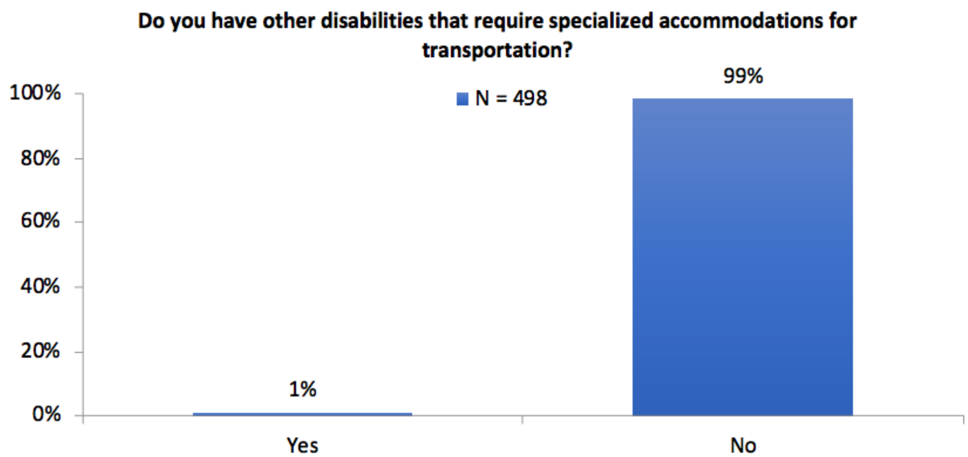


Figure A-30 *"Before" Survey –Need for ADA Compliant Transportation*

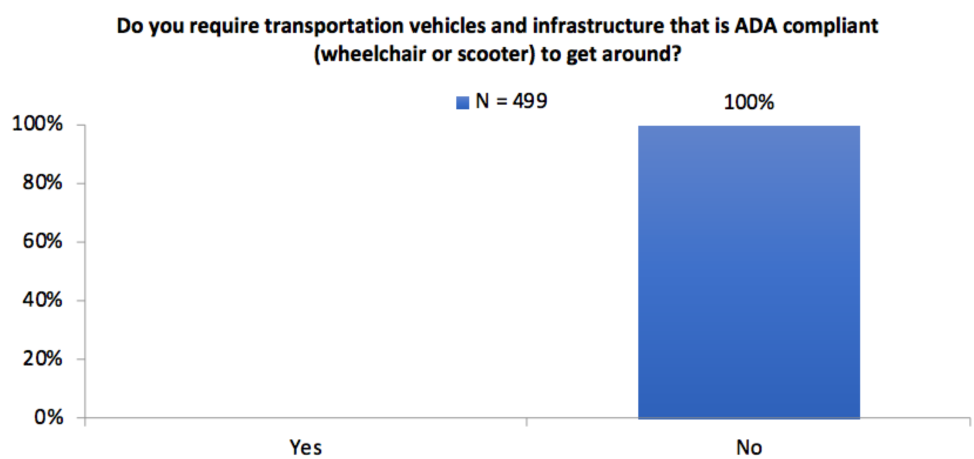


Figure A-31 *"Before" Survey – Education Level*

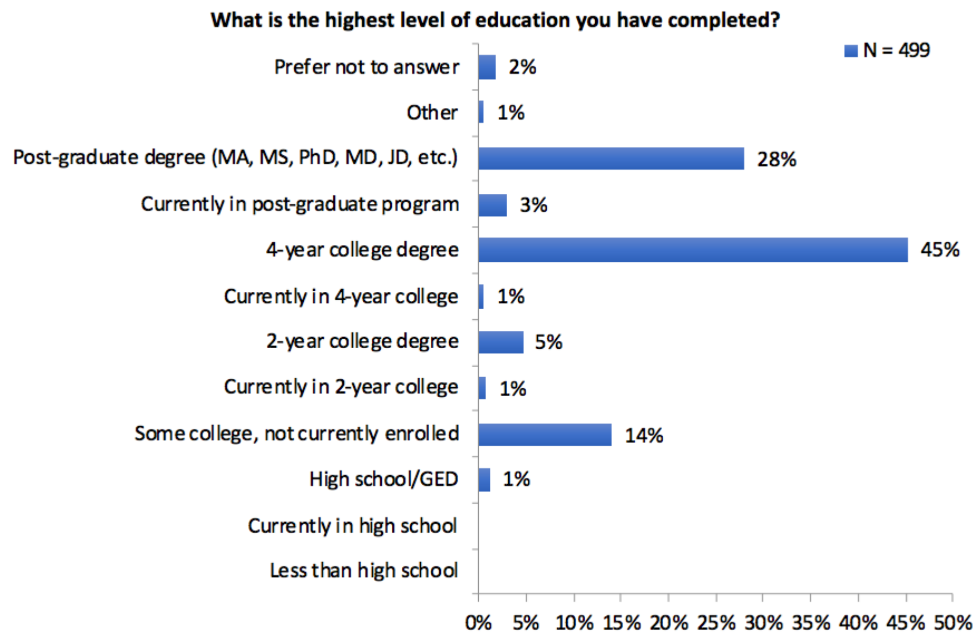


Figure A-32 *"Before" Survey – Race or Ethnic Identification*

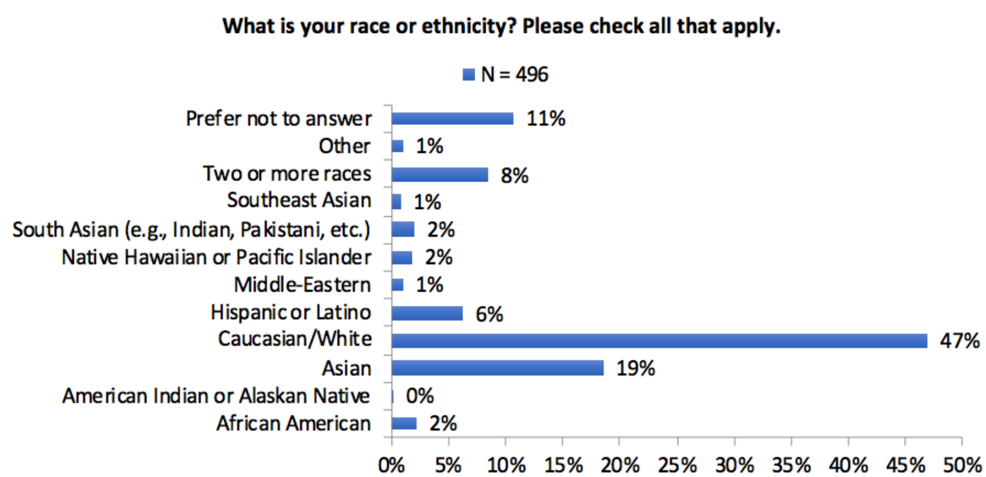


Figure A-33 *"Before" Survey – Household Age Distribution*

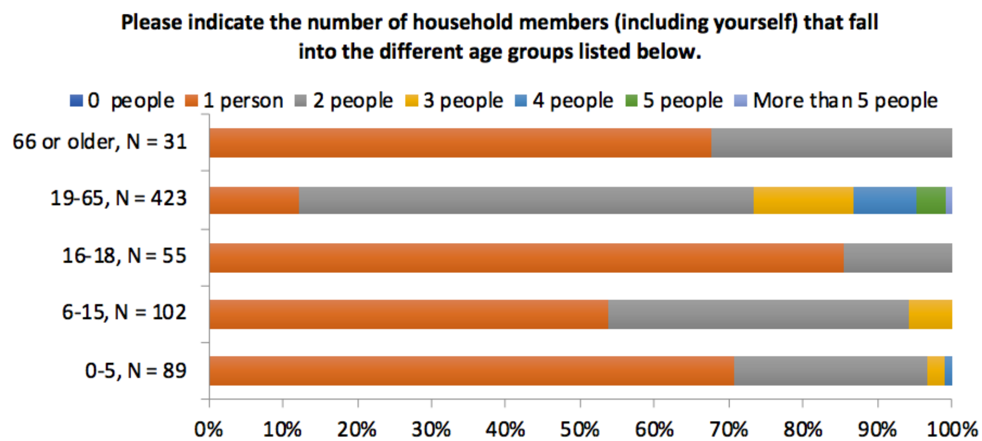


Figure A-34 *"Before" Survey – Housing Type*

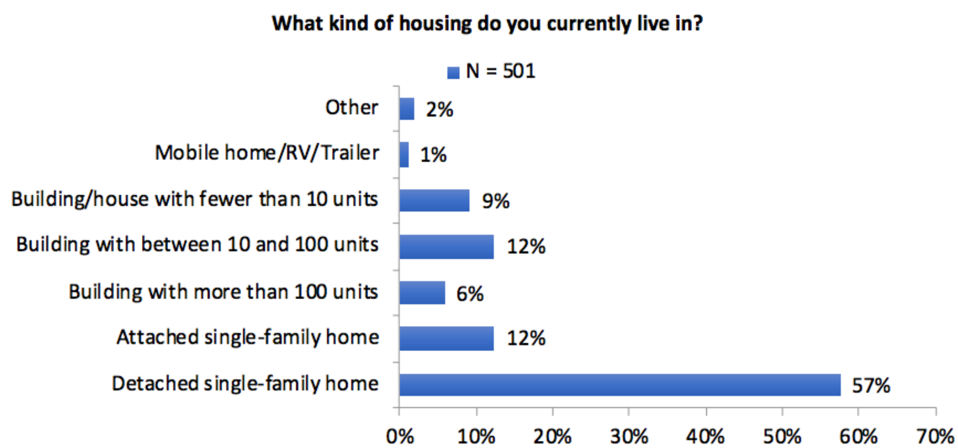
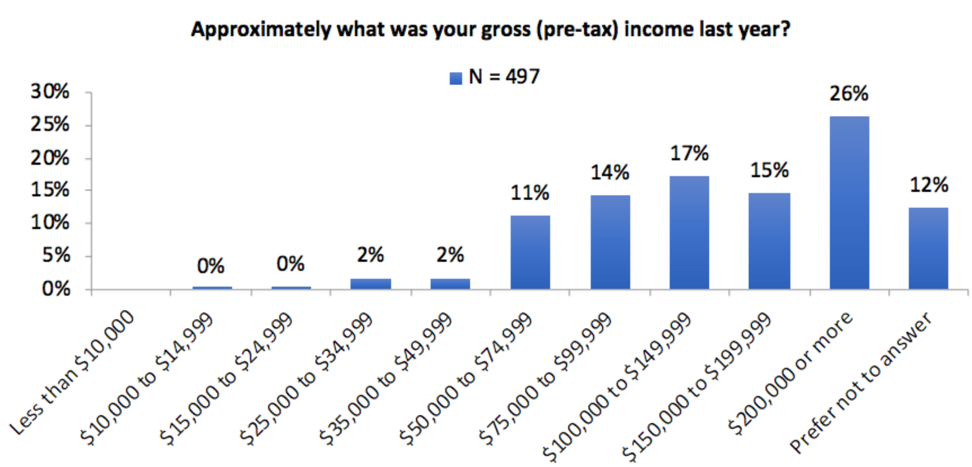


Figure A-35 *"Before" Survey – Household Income*



"After" Survey

The following plots show raw summaries of the "after" survey results. Respondents to the "after" survey were separated into three groups based on their pilot participation and completion of the "before" survey. Some questions were asked in common to all groups, and other questions were specific to one group. Group 1 included individuals who participated in the pilot and completed the "before" survey. Group 2 included individuals who participated in the pilot but did not complete the "before" survey. Group 3 included all other individuals. The figures are in the general order of questions asked. Only questions not presented in the report are presented in this appendix. Where applicable, data labels for figures included in the appendix have been rounded to the nearest whole number for display purposes.

All Groups

Figure A-36 *"After" Survey – All Groups – Household Size*

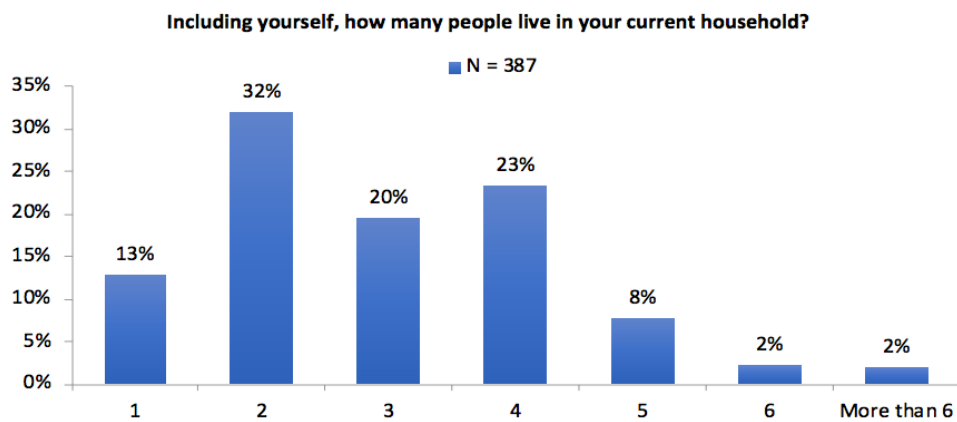


Figure A-37 *"After" Survey – All Groups – Household Relation*

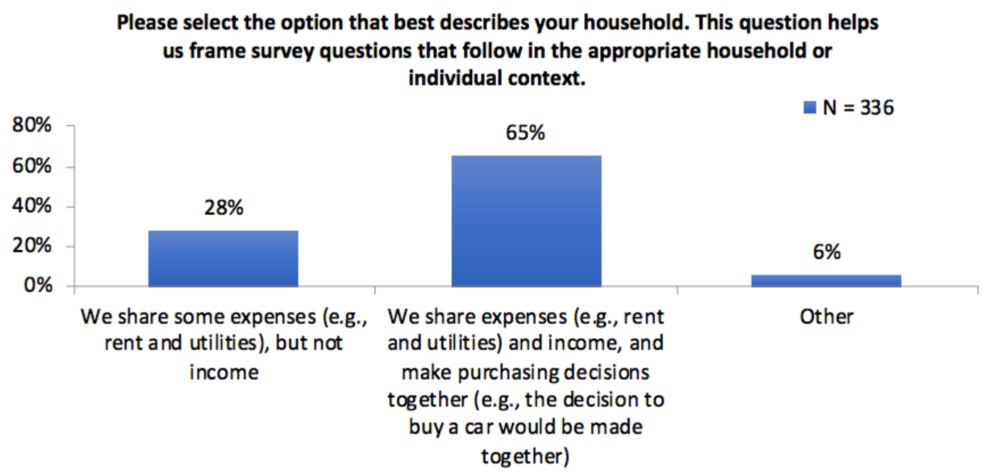


Figure A-38 *"After" Survey – All Groups – Pilot Participation*

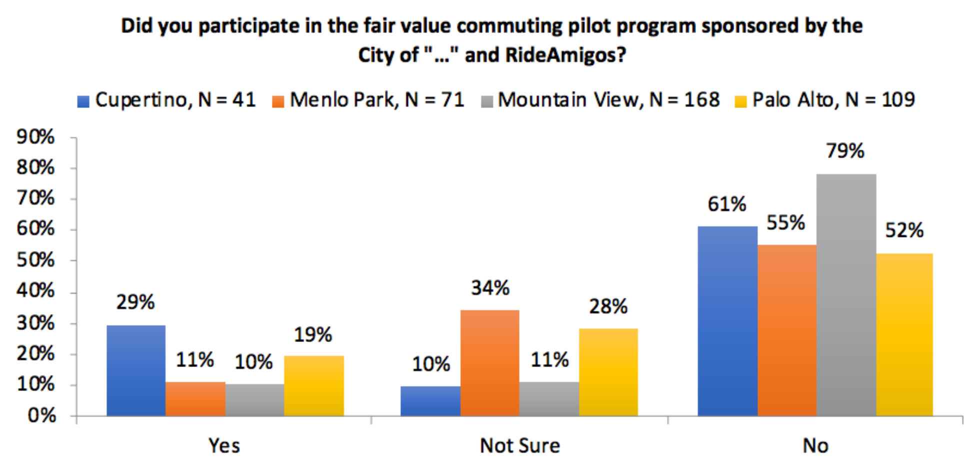


Figure A-39 *"After" Survey – All Groups – "Before" Survey Completion*

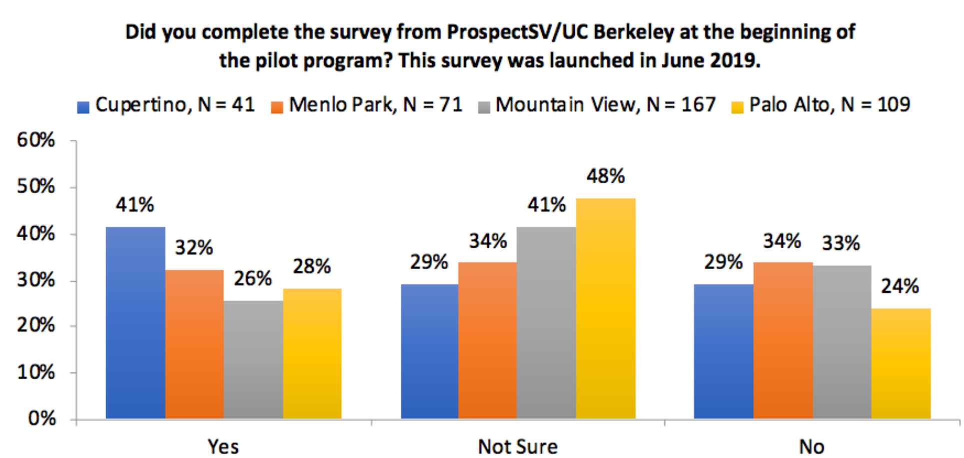
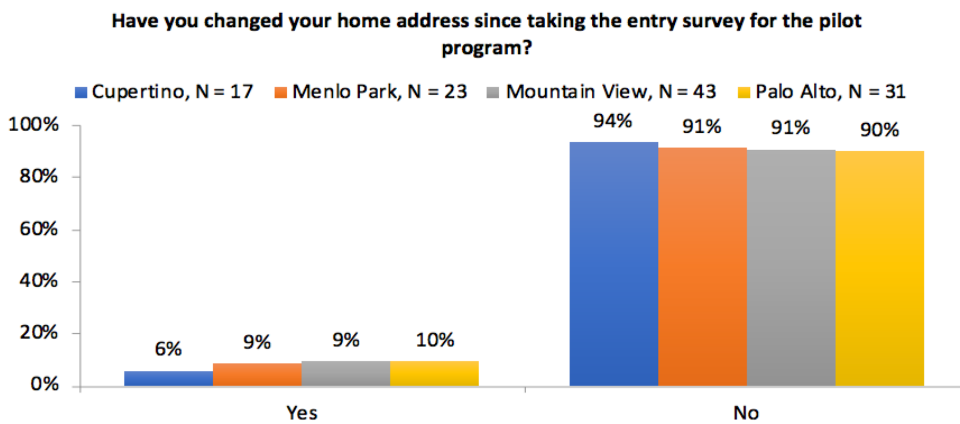


Figure A-40 *"After" Survey – All Groups – Change of Home Address*



Group 1

Figure A-41 *"After" Survey – Group 1 – Vehicle Ownership*

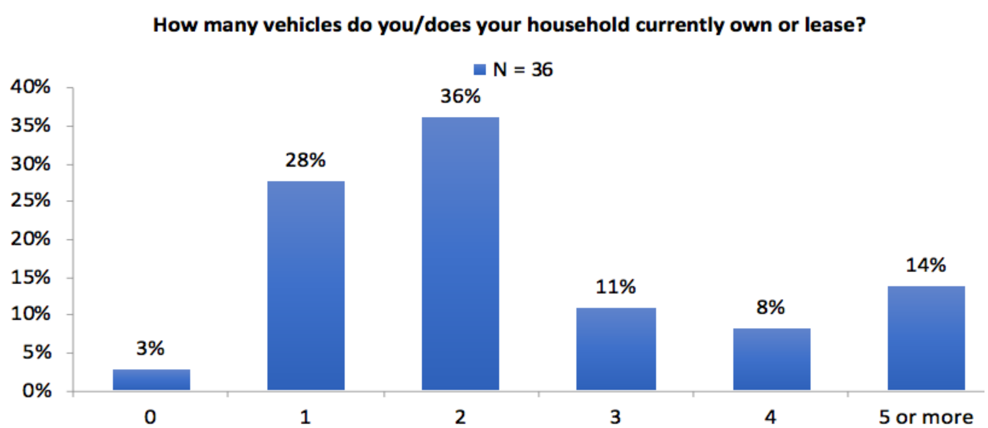


Figure A-42 *"After" Survey – Group 1 – Abandoned Vehicles*

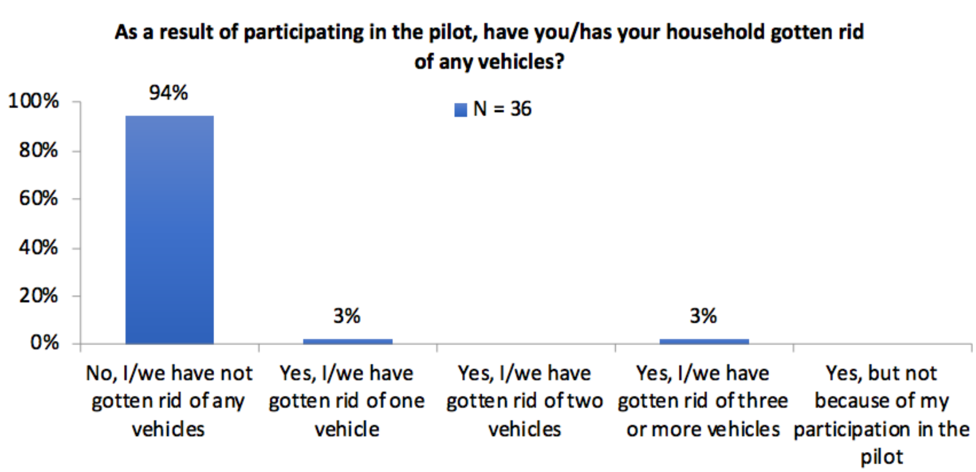


Figure A-43 *"After" Survey – Group 1 – Acquired Vehicles*

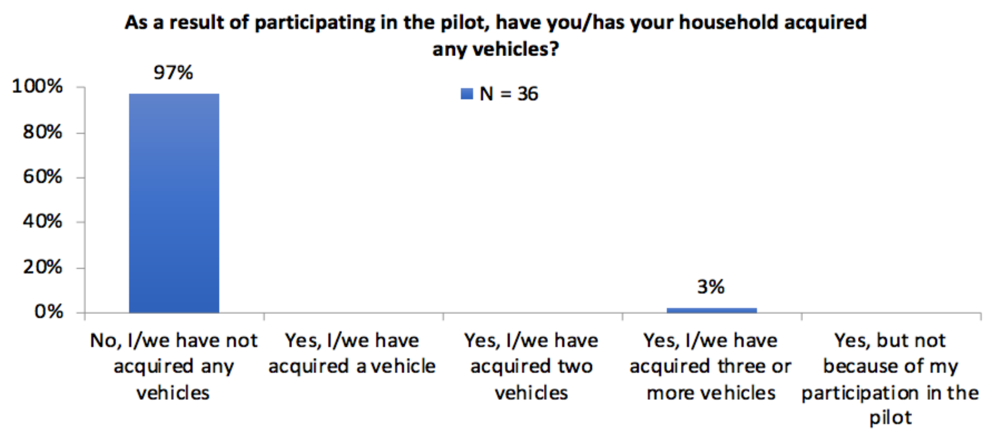


Figure A-44 *"After" Survey – Group 1 – Effect of Pilot on Acquired Vehicles*

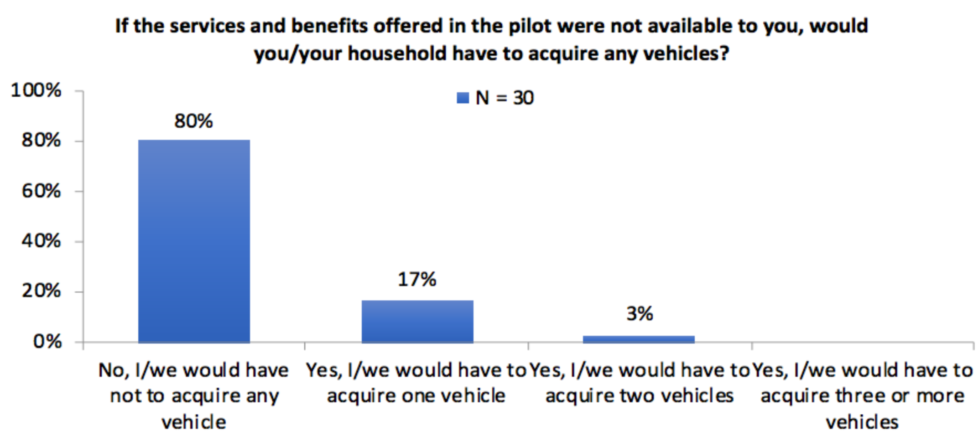


Figure A-45 *"After" Survey – Group 1 – Mode Share Distribution*

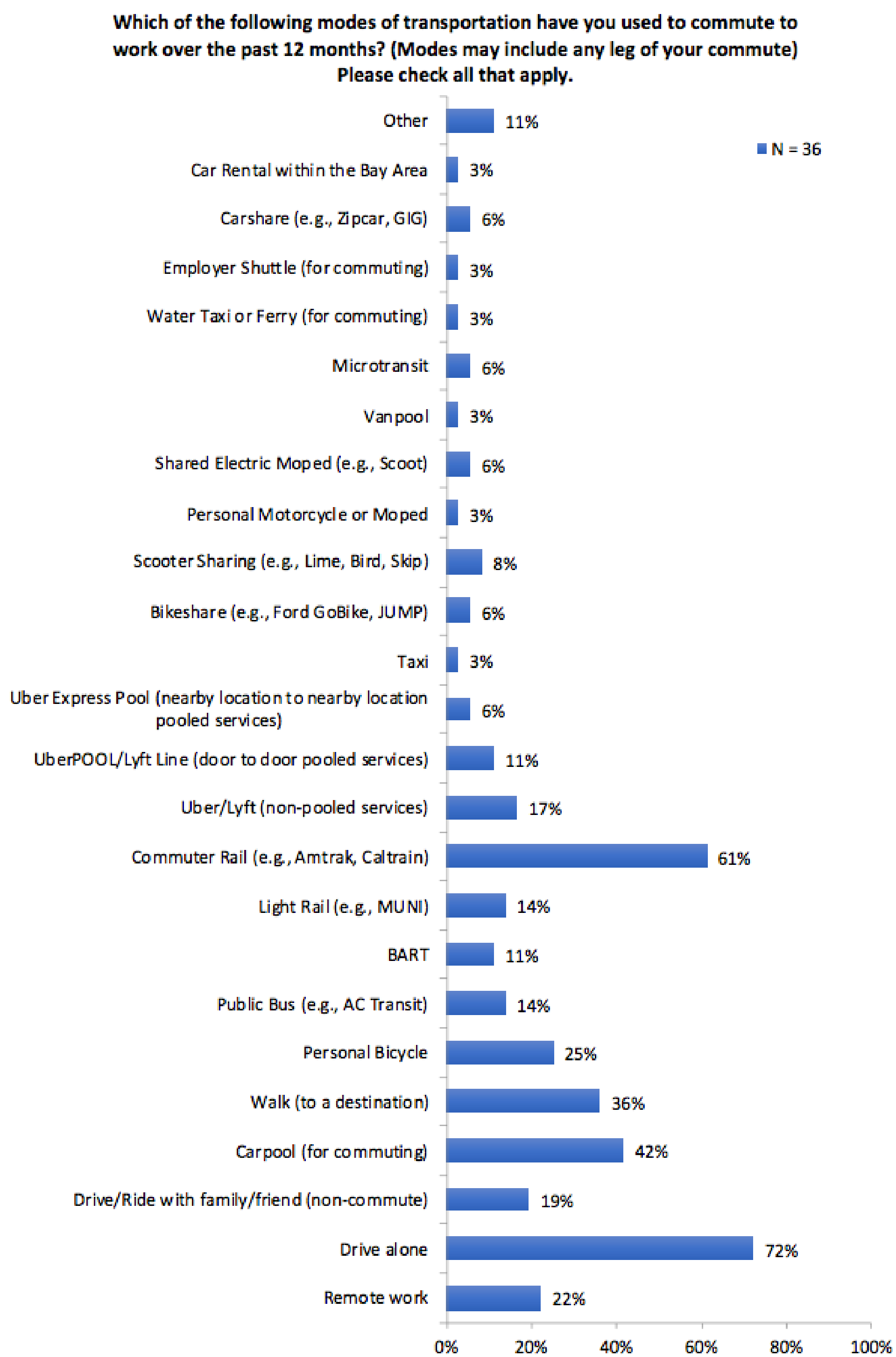


Figure A-46 *"After" Survey – Group 1 – Working Days*

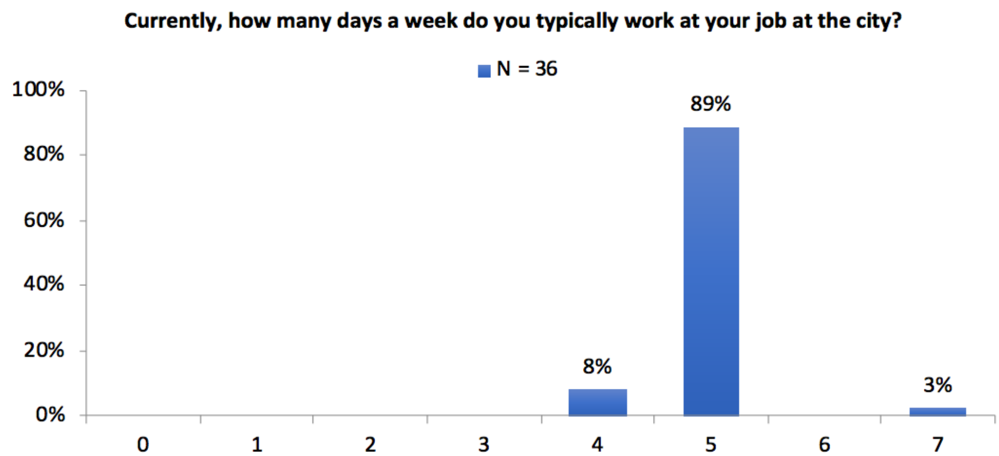


Figure A-47 *"After" Survey – Group 1 – Mode Frequency of Use Distribution*

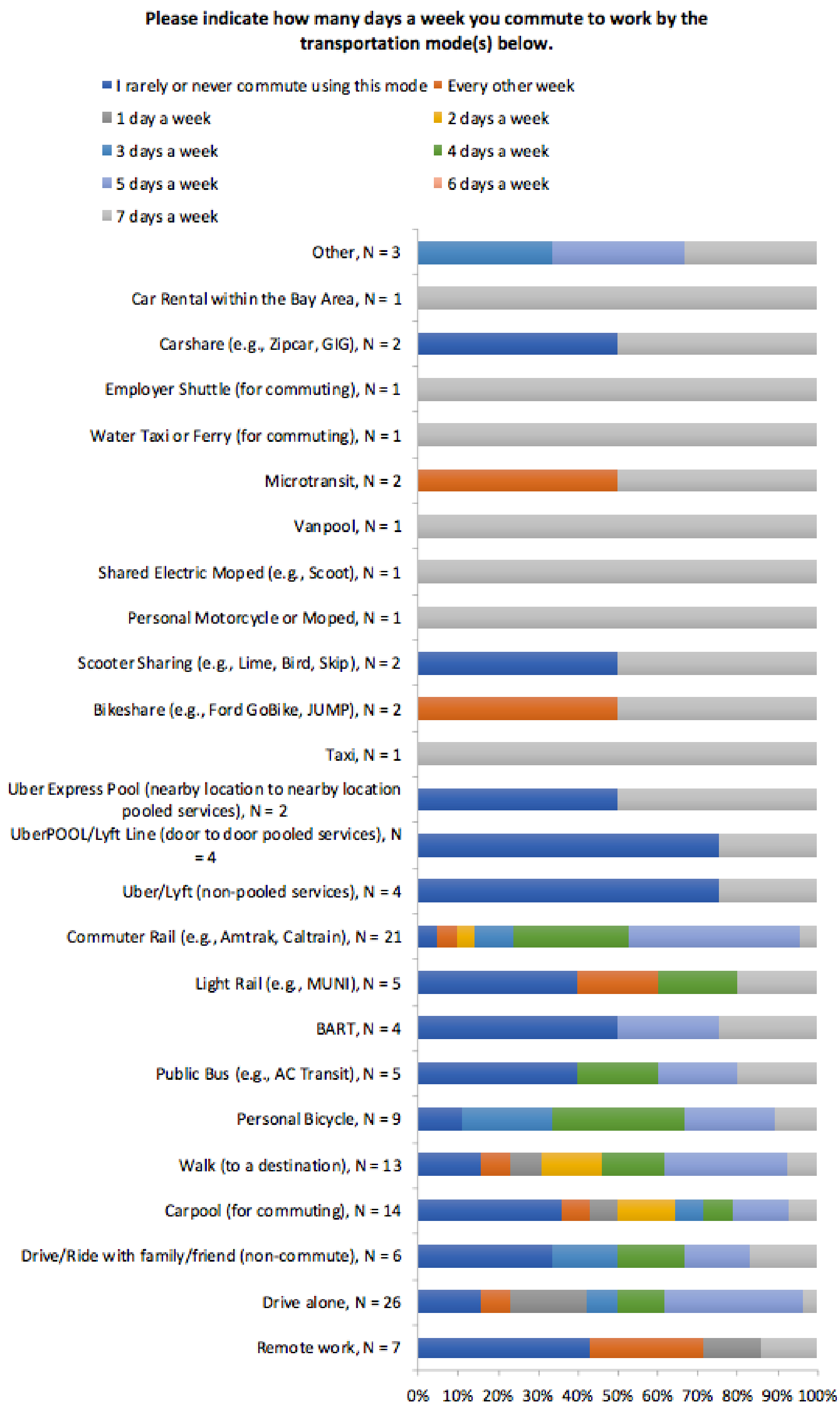


Figure A-48 *"After" Survey – Group 1 – Effect of Pilot on Mode Use*

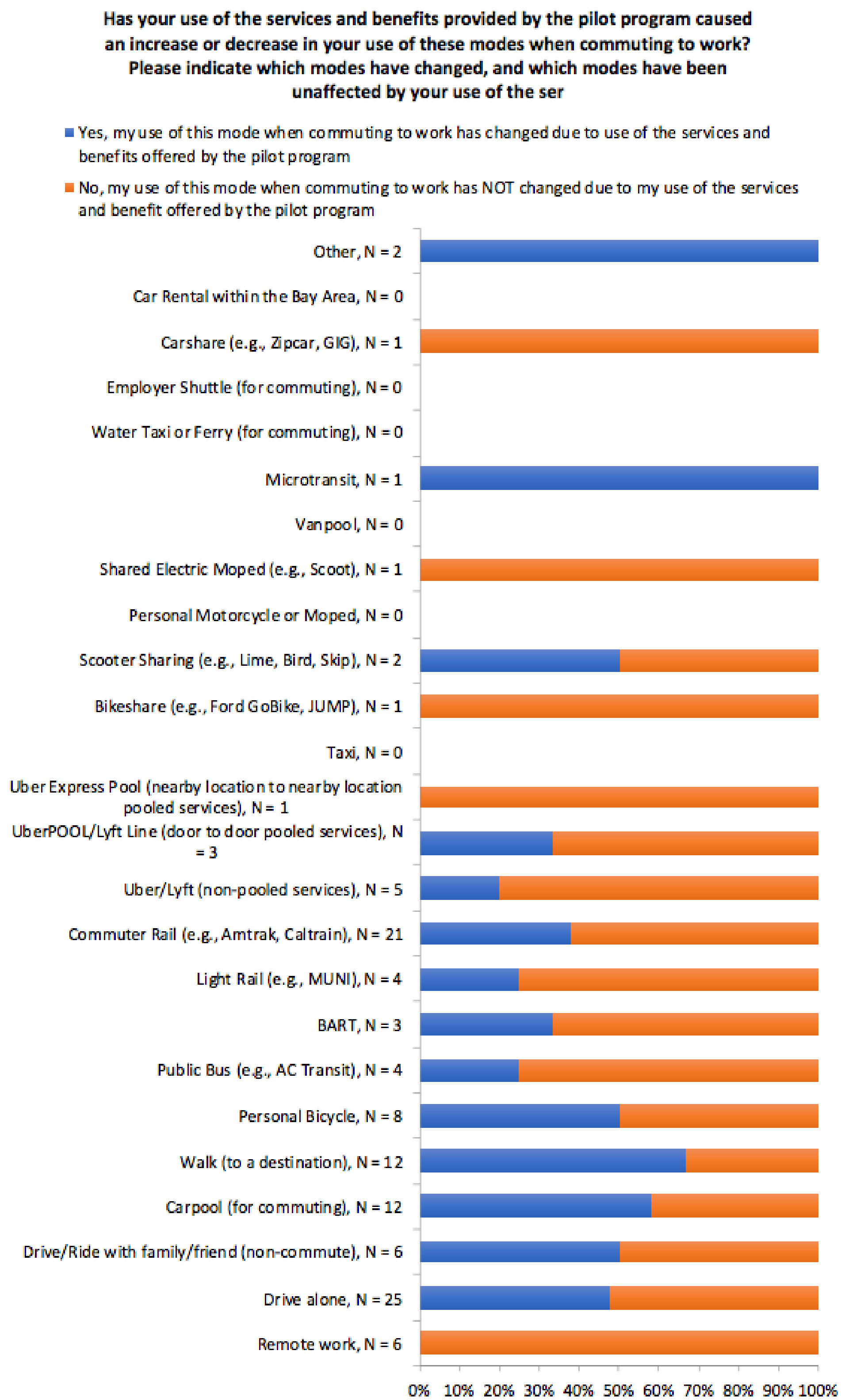


Figure A-49 *"After" Survey – Group 1 – Effect of Pilot on Mode Frequency of Use*

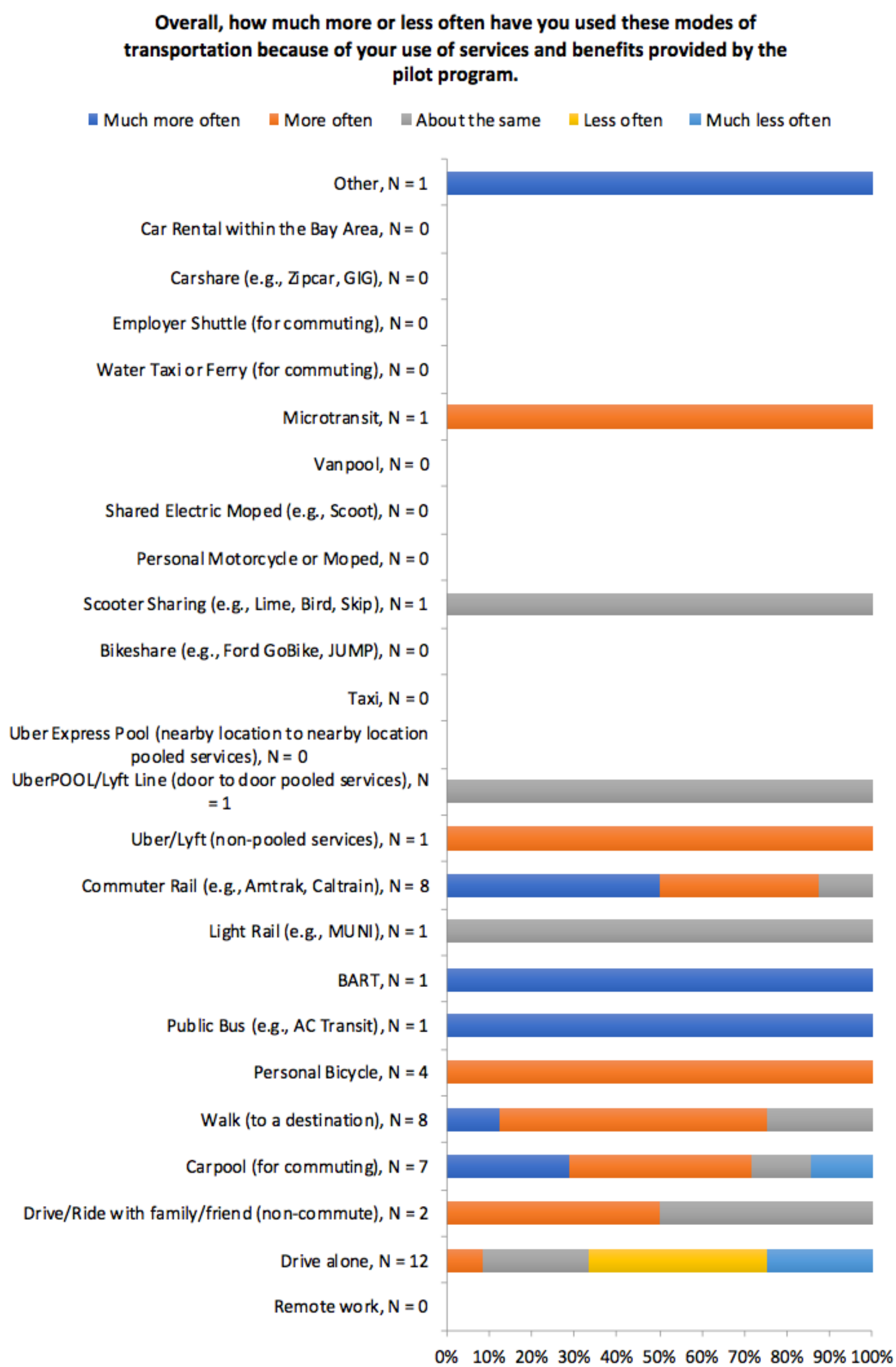


Figure A-50 *"After" Survey – Group 1 – Effect of Pilot on Increase in Mode Use*

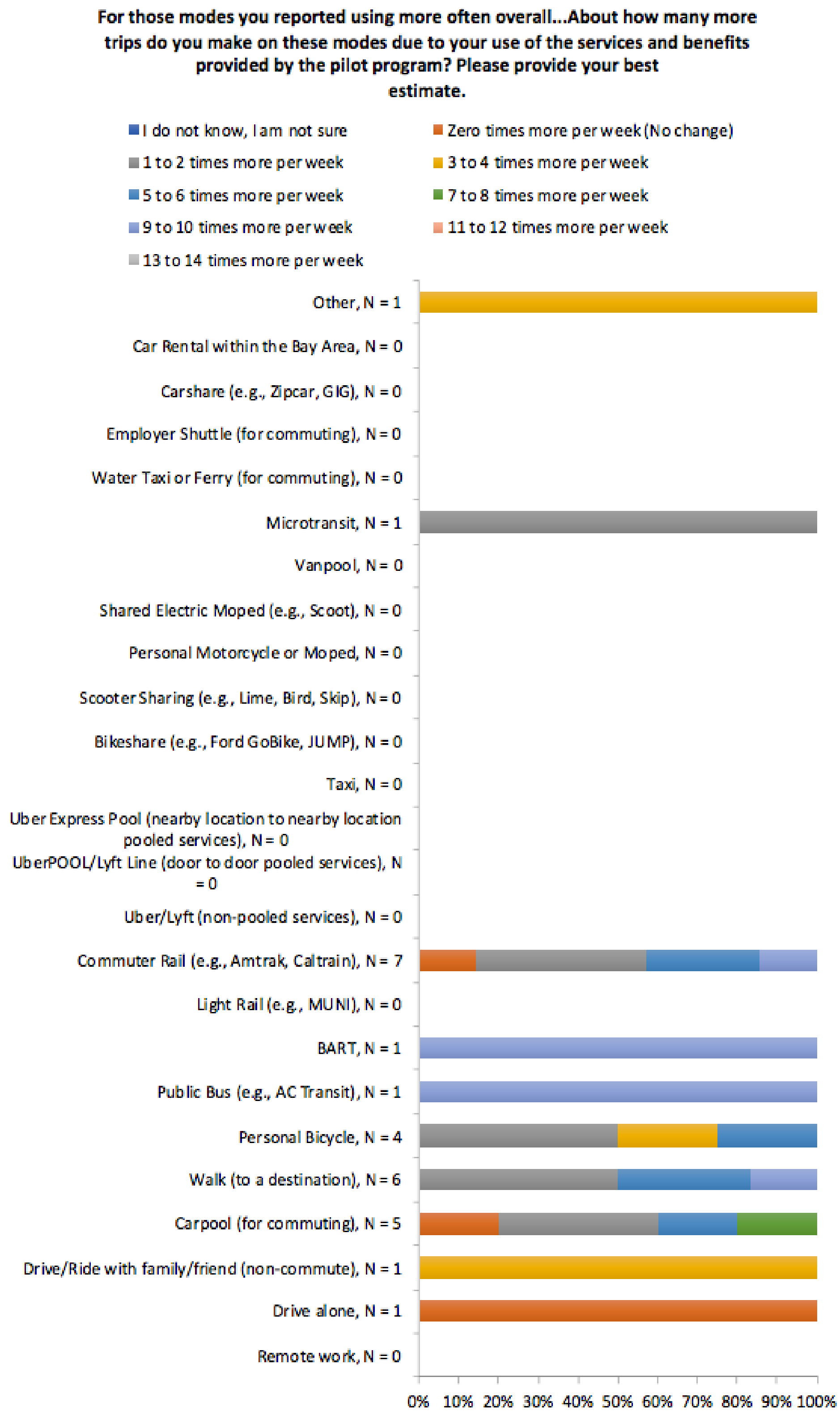


Figure A-51 *"After" Survey – Group 1 – Effect of Pilot on Decrease in Mode Use*

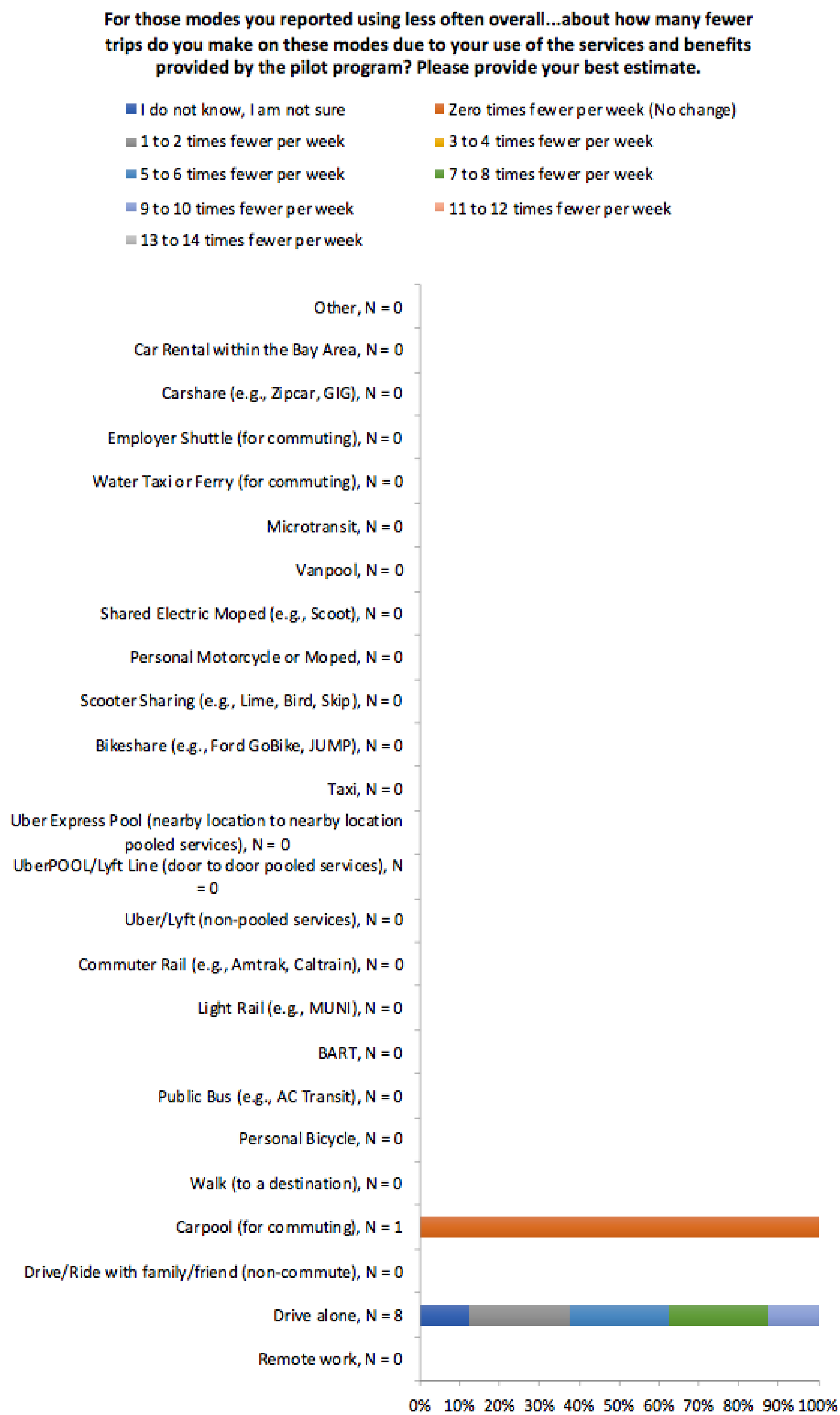


Figure A-52 *"After" Survey – Group 1 – Perception of Public Transit*

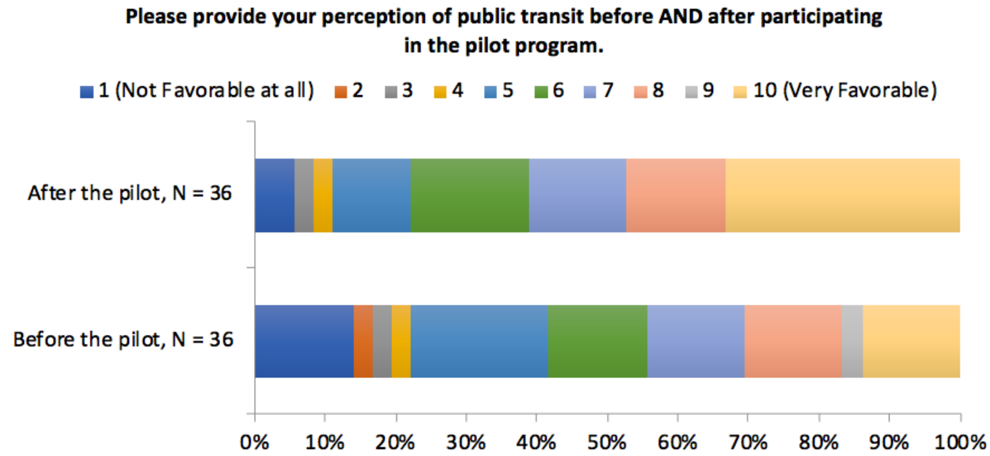


Figure A-53 *"After" Survey – Group 1 – Perception of Public Transit – City Level*

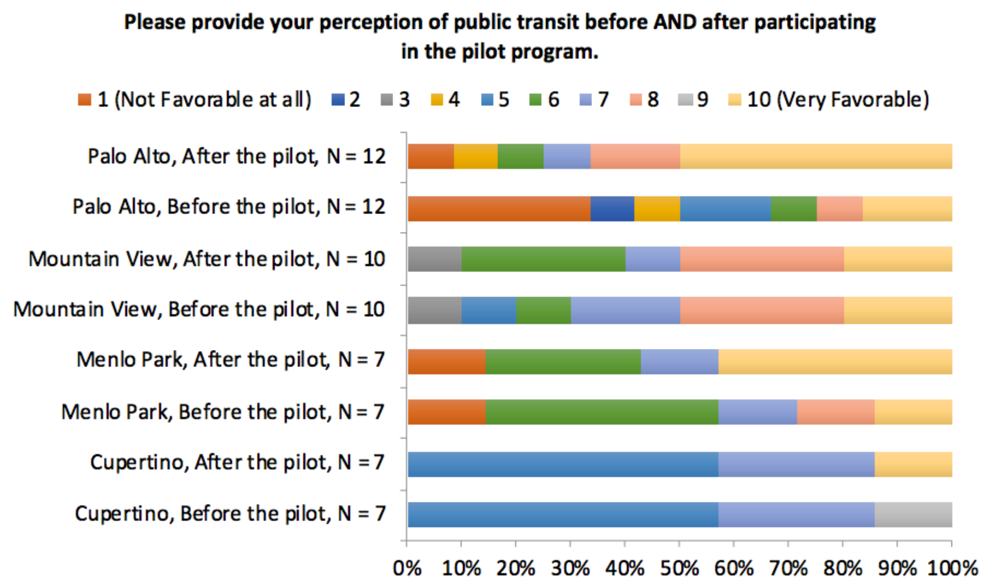


Figure A-54 *"After" Survey – Group 1 – Effect of Pilot Benefits on Public Transit Use*

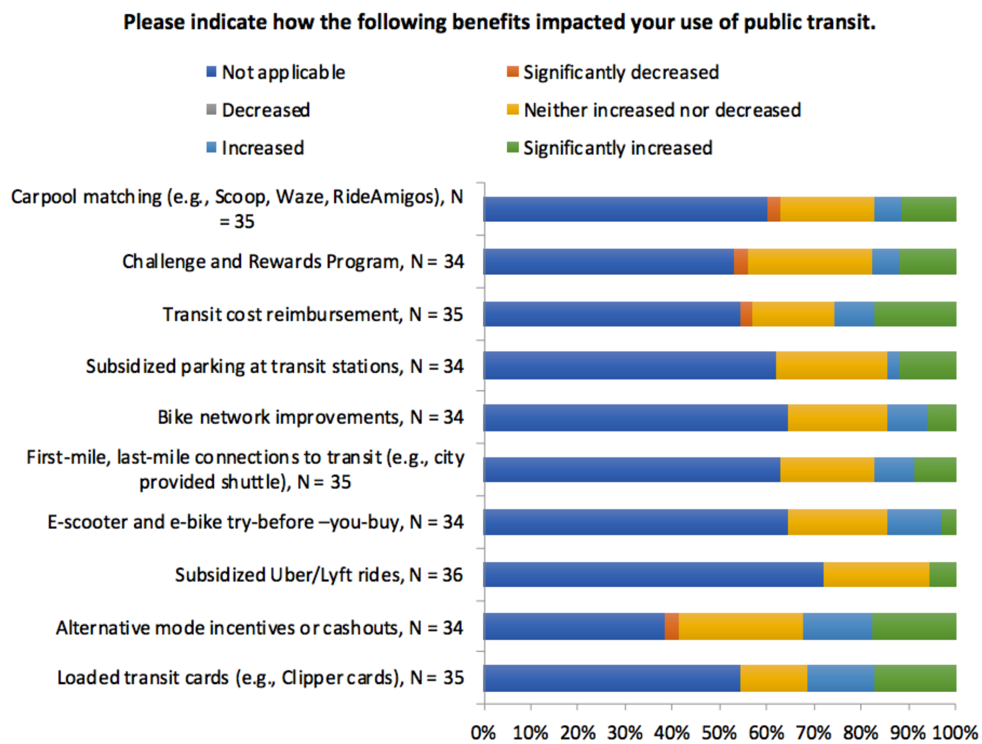


Figure A-55 *"After" Survey – Group 1 – Effect of Pilot on Accessibility*

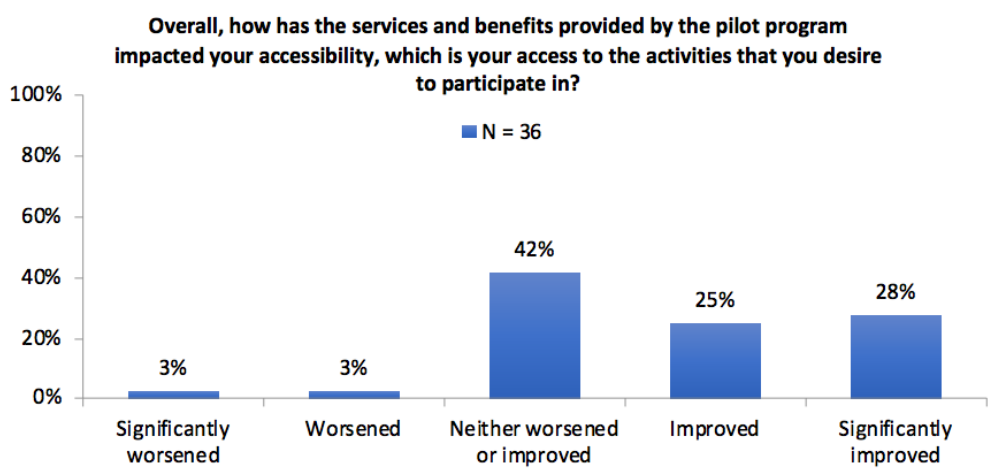


Figure A-56 *"After" Survey – Group 1 – Effect of Pilot on Mobility*

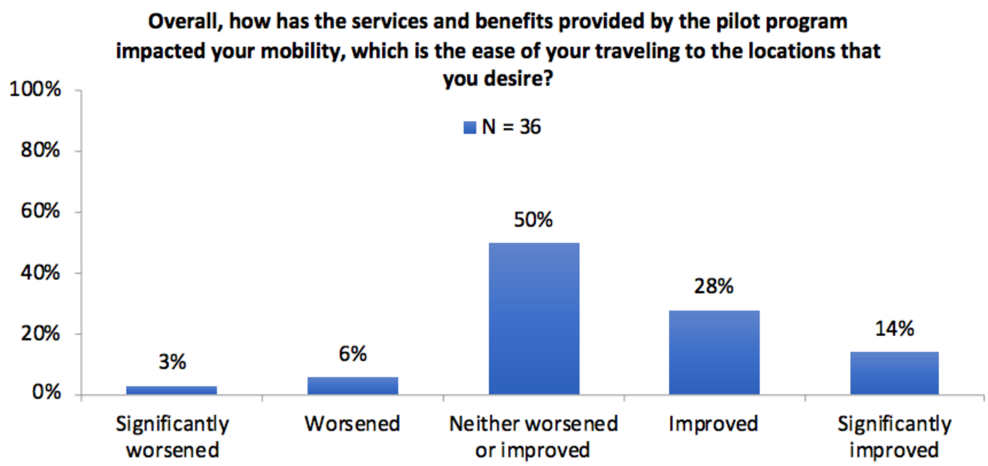
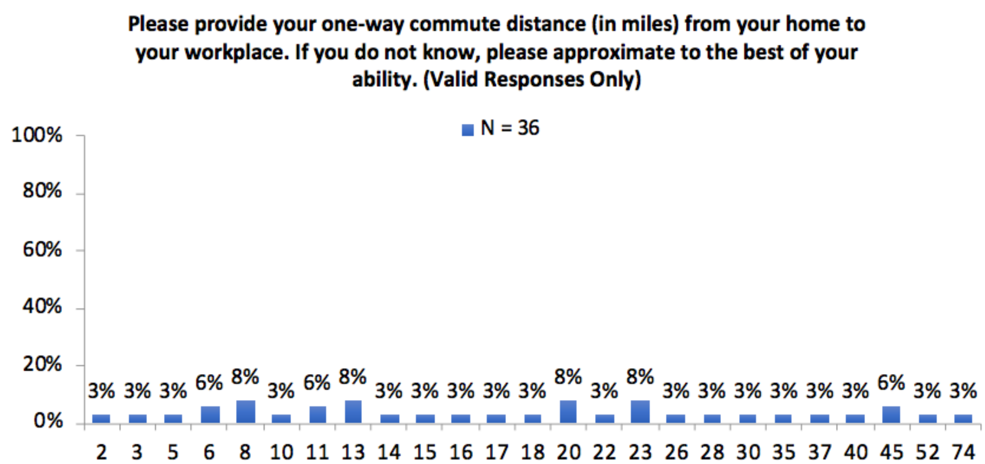


Figure A-57 *"After" Survey – Group 1 – Commute Distance*



Group 2

Figure A-58 *"After" Survey – Group 2 – Vehicle Ownership*

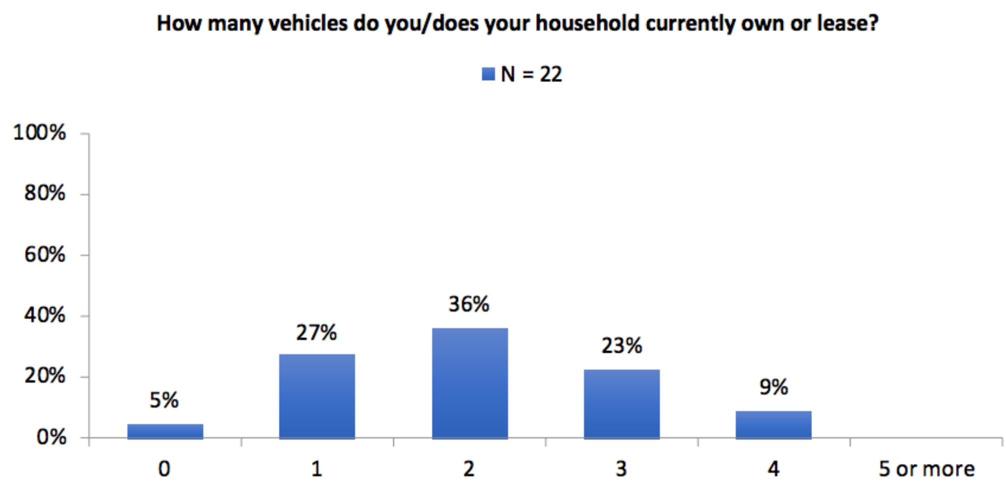


Figure A-59 *"After" Survey – Group 2 – Abandoned Vehicles*

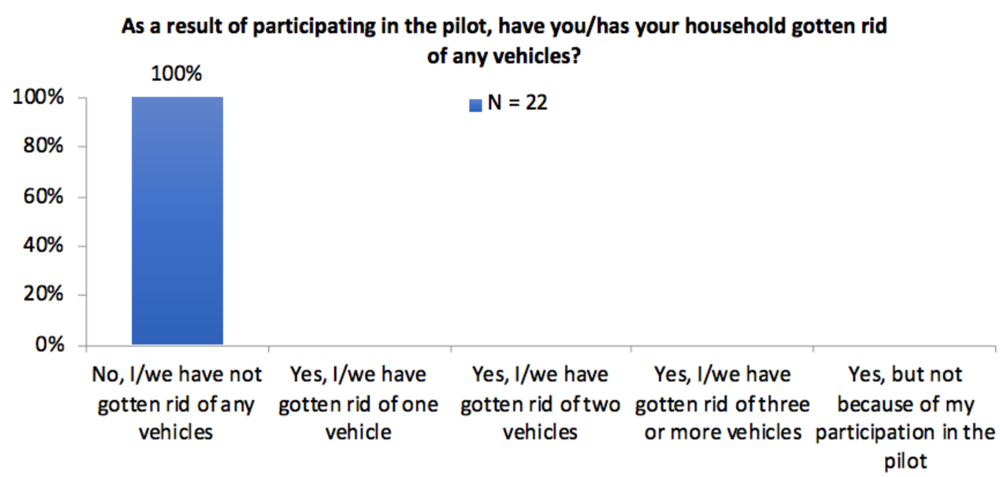


Figure A-60 *"After" Survey – Group 2 – Acquired Vehicles*

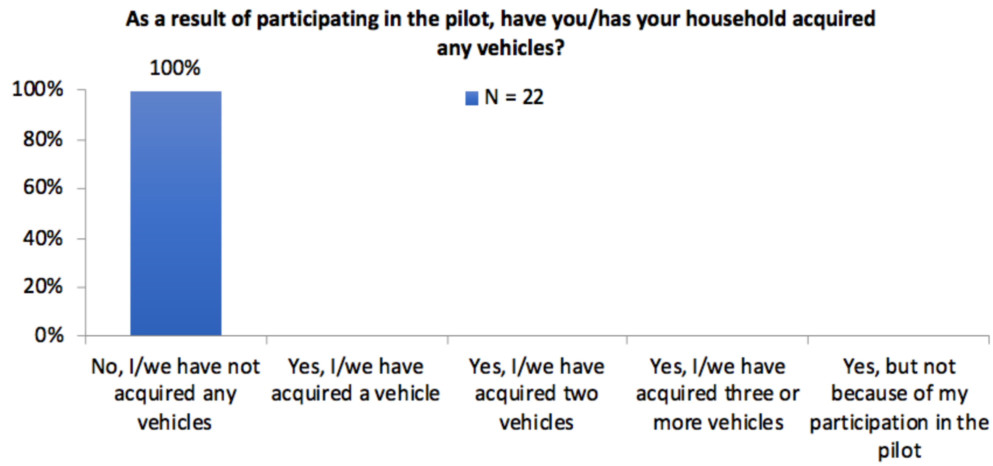


Figure A-61 *"After" Survey – Group 2 – Effect of Pilot on Acquired Vehicles*

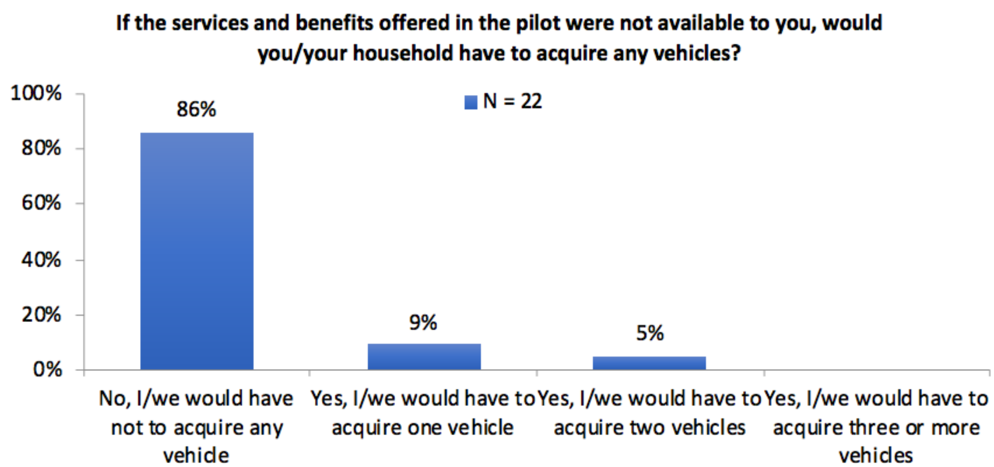


Figure A-62 *"After" Survey – Group 2 – Mode Share Distribution*

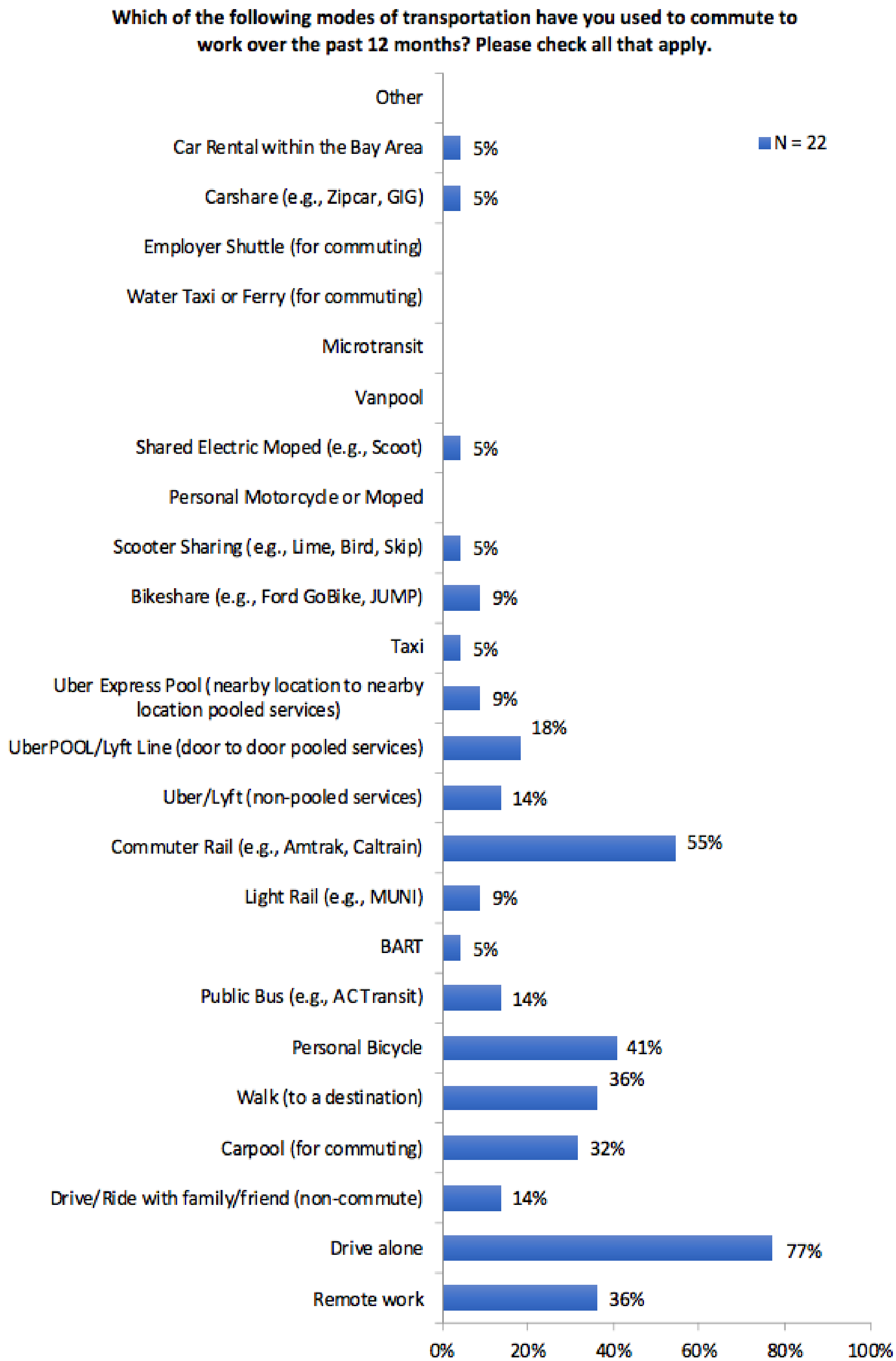


Figure A-63 *"After" Survey – Group 2 – Working Days*

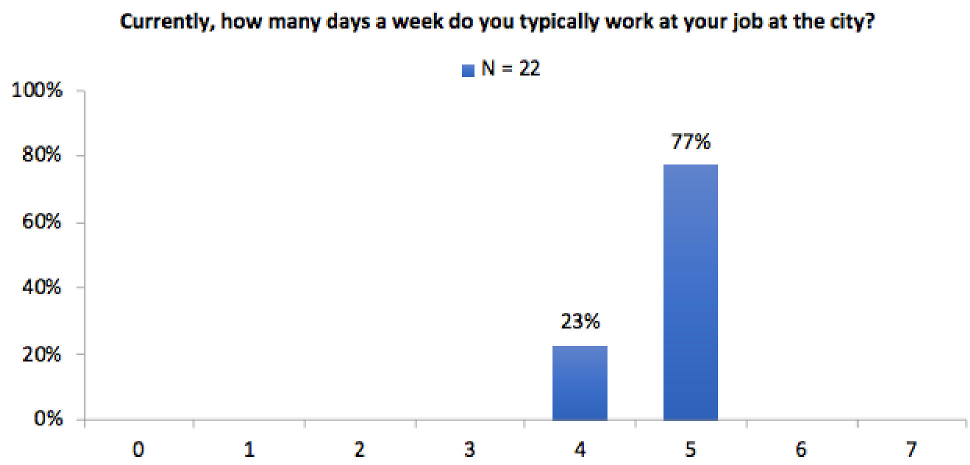


Figure A-64 *"After" Survey – Group 2 – Mode Frequency of Use Distribution*

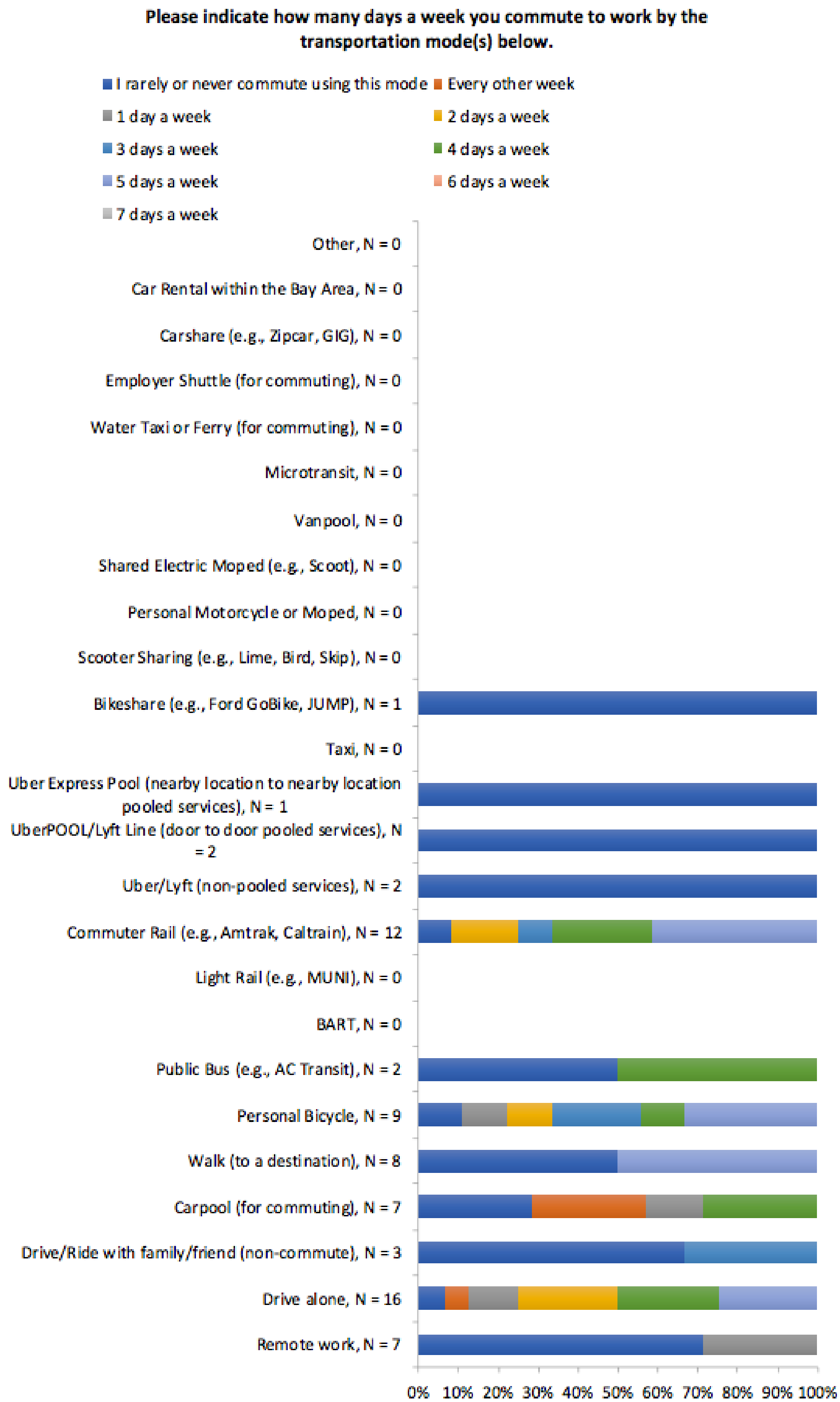


Figure A-65 *"After" Survey – Group 2 – Effect of Pilot on Mode Use*

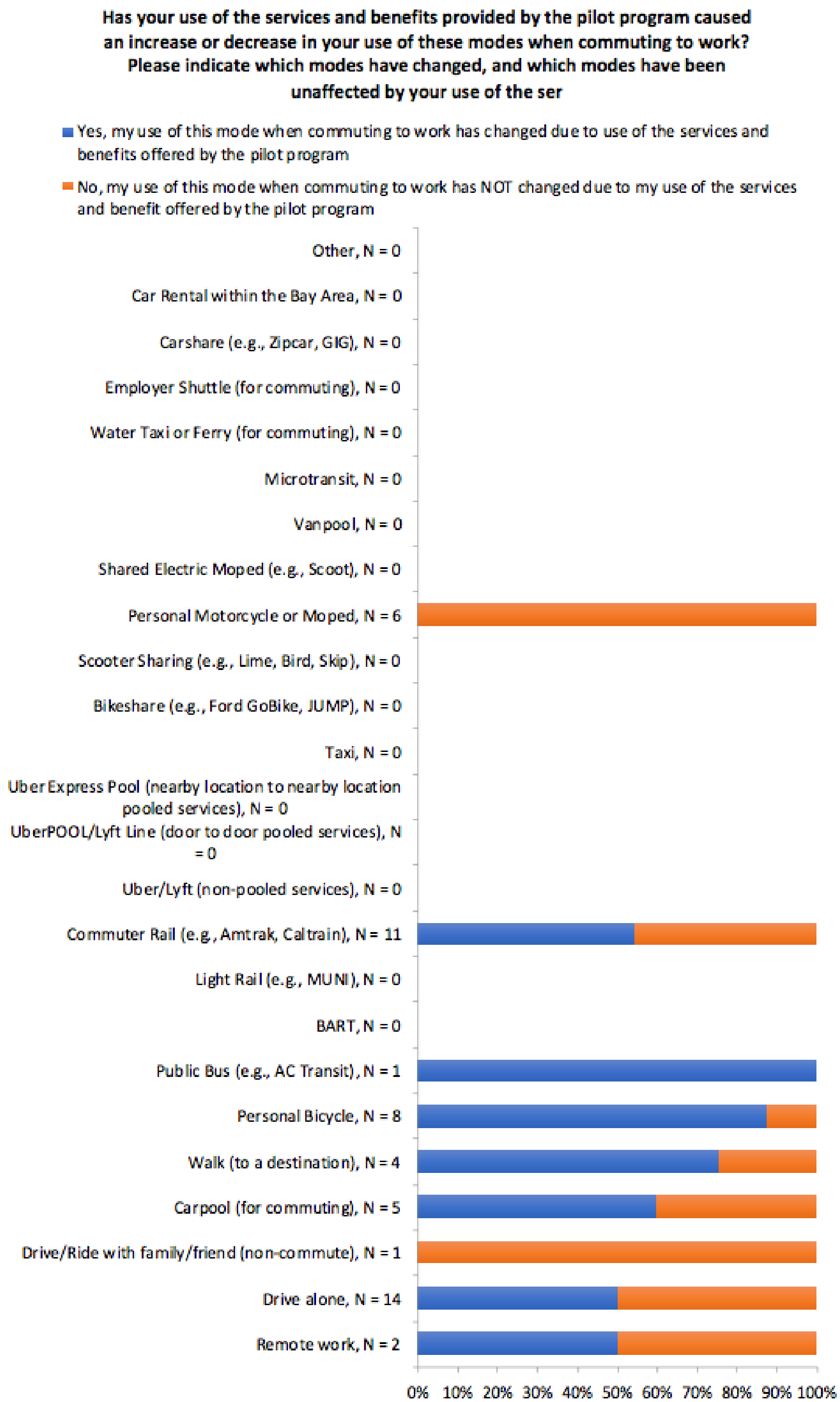


Figure A-66 *"After" Survey – Group 2 – Effect of Pilot on Mode Frequency of Use*

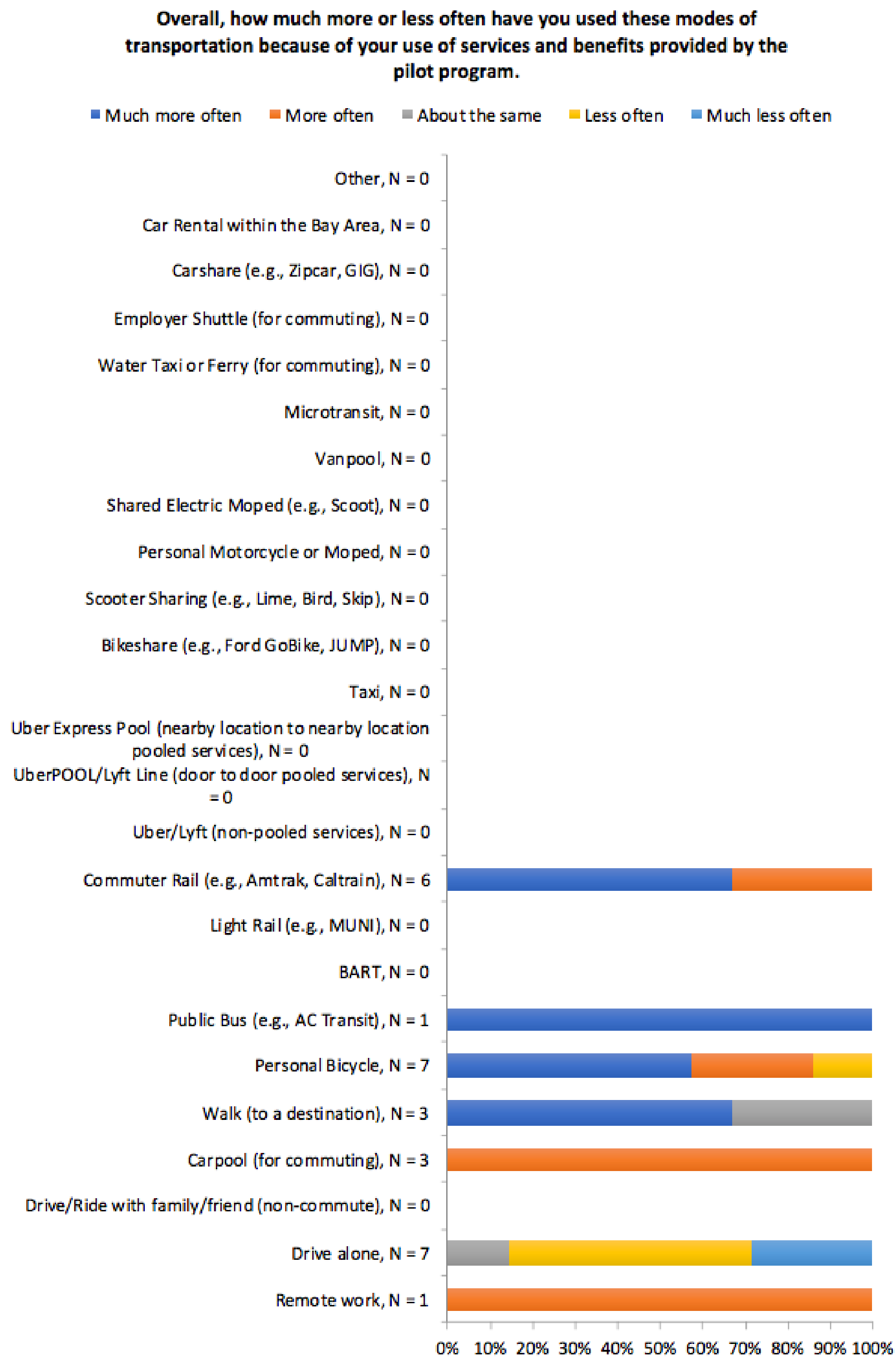


Figure A-67 *"After" Survey – Group 2 – Effect of Pilot on Increase in Mode Use*

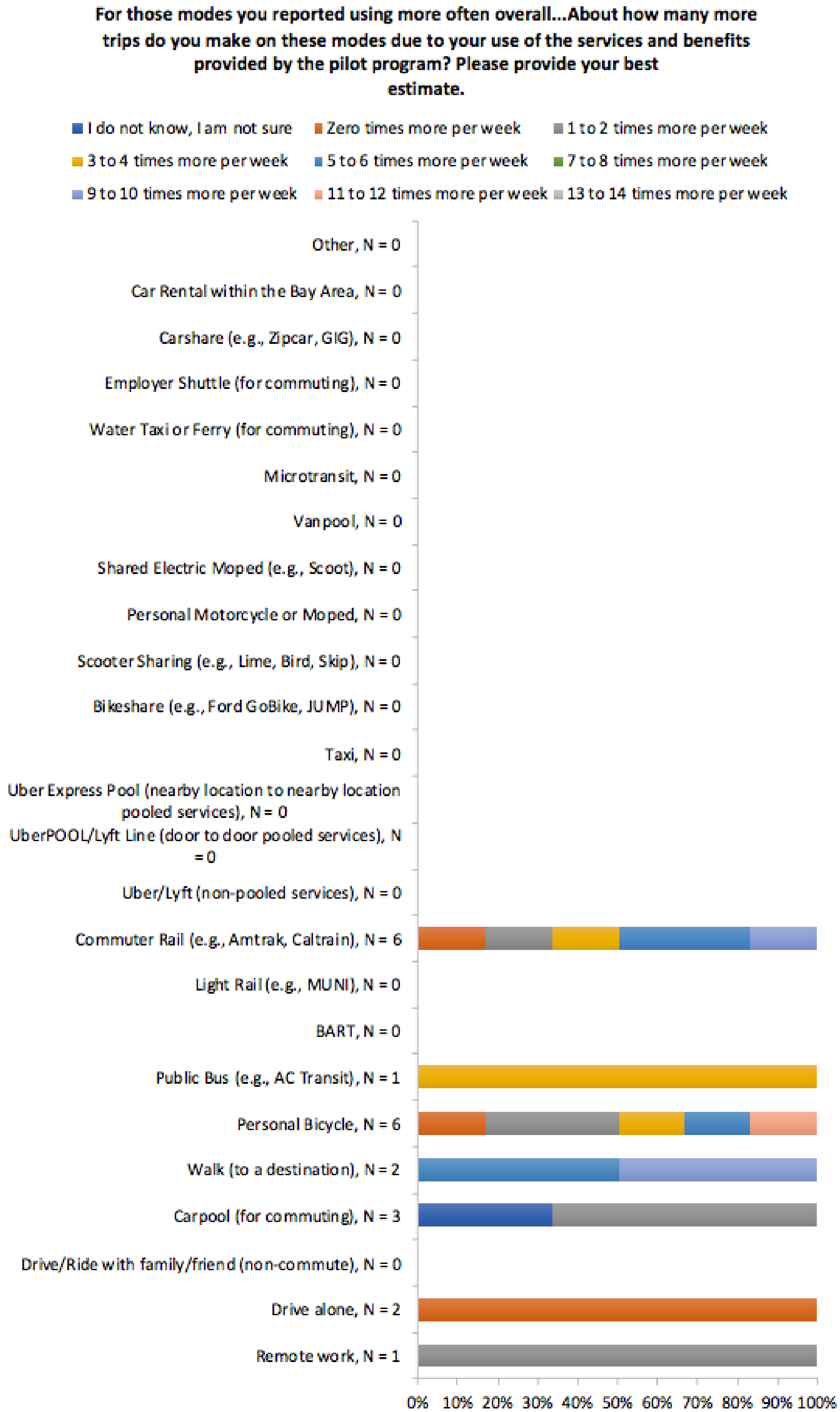


Figure A-68 *"After" Survey – Group 2 – Effect of Pilot on Decrease in Mode Use*

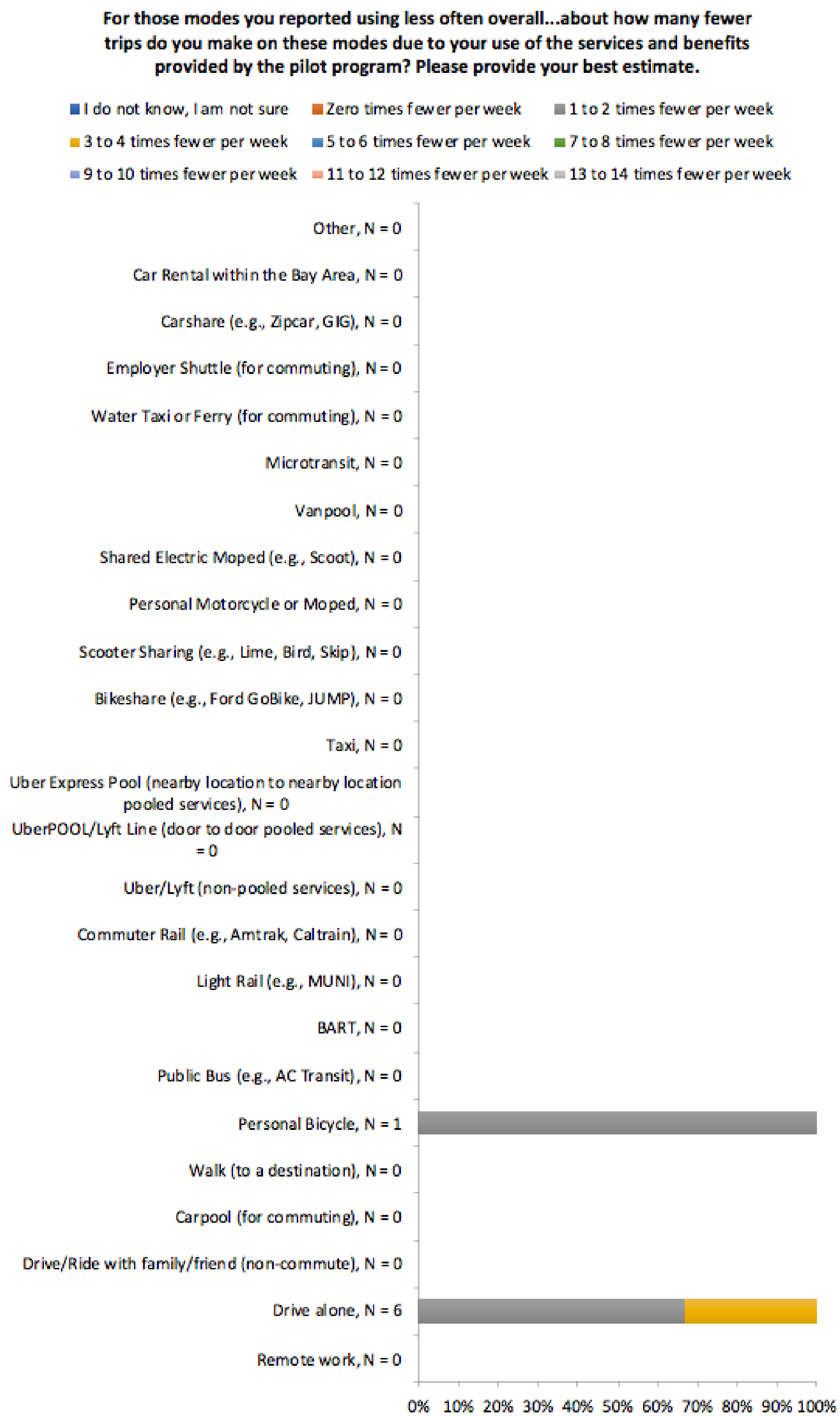


Figure A-69 *After" Survey – Group 2 – Perception of Public Transit*

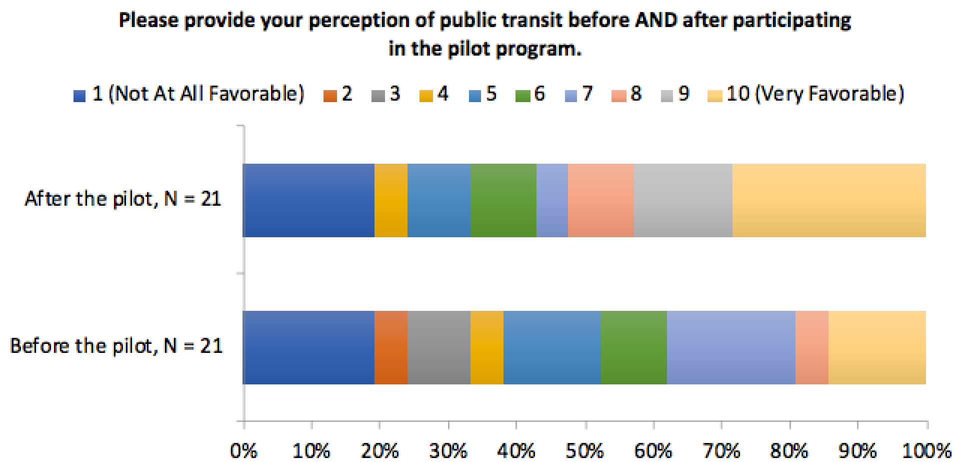


Figure A-70 *"After" Survey – Group 2 – Perception of Public Transit – City Level*

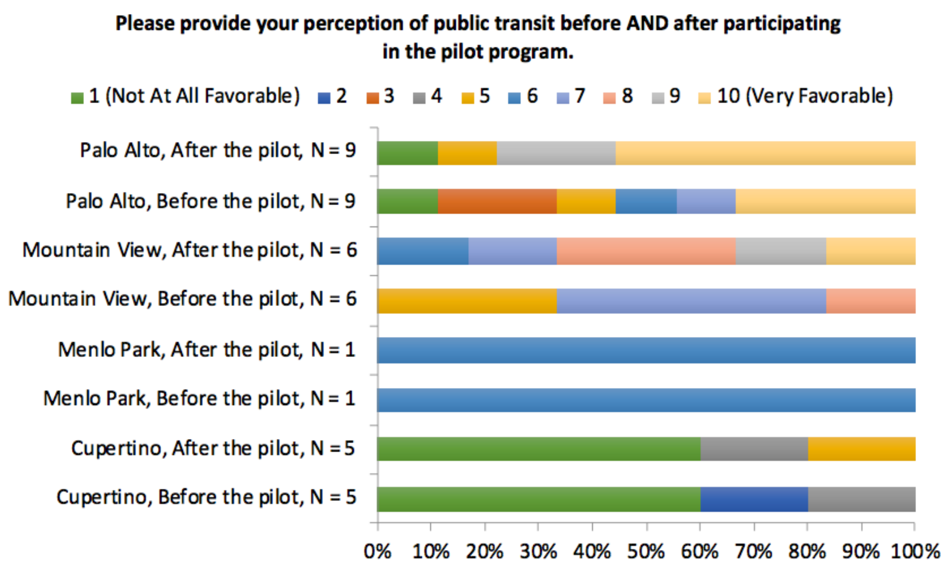


Figure A-71 *"After" Survey – Group 2 – Effect of Pilot Benefits on Public Transit Use*

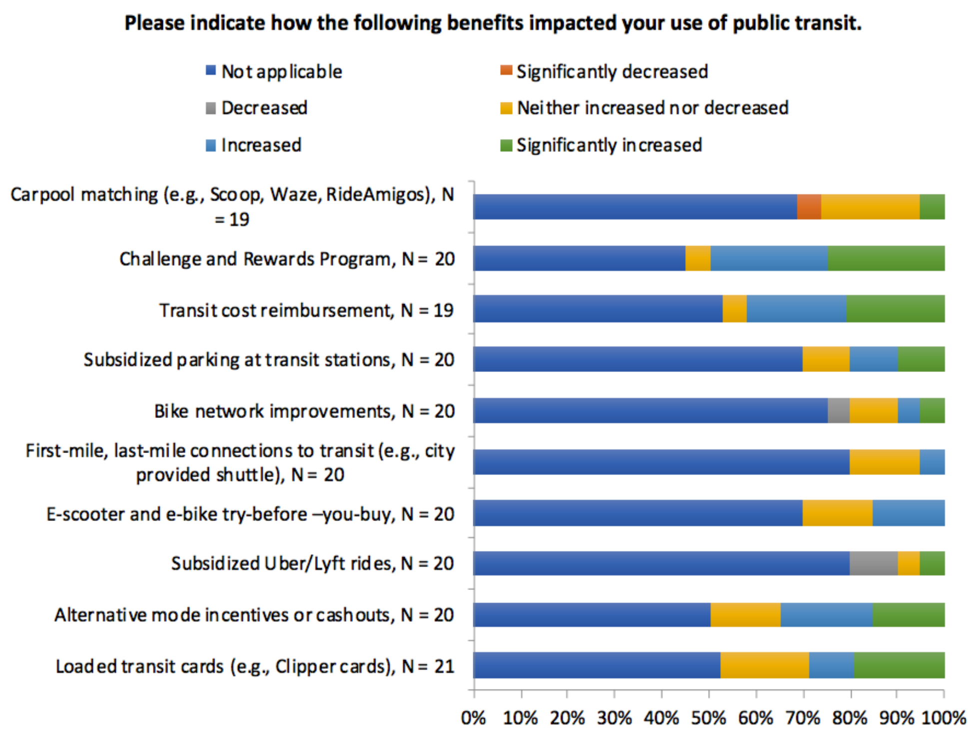


Figure A-72 *"After" Survey – Group 2 – Effect of Pilot on Accessibility*

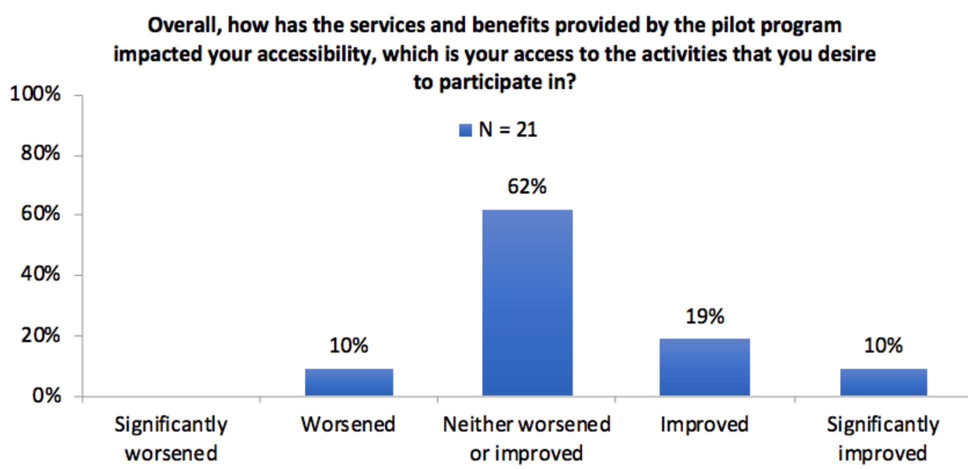


Figure A-73 *"After" Survey – Group 2 – Effect of Pilot on Mobility*

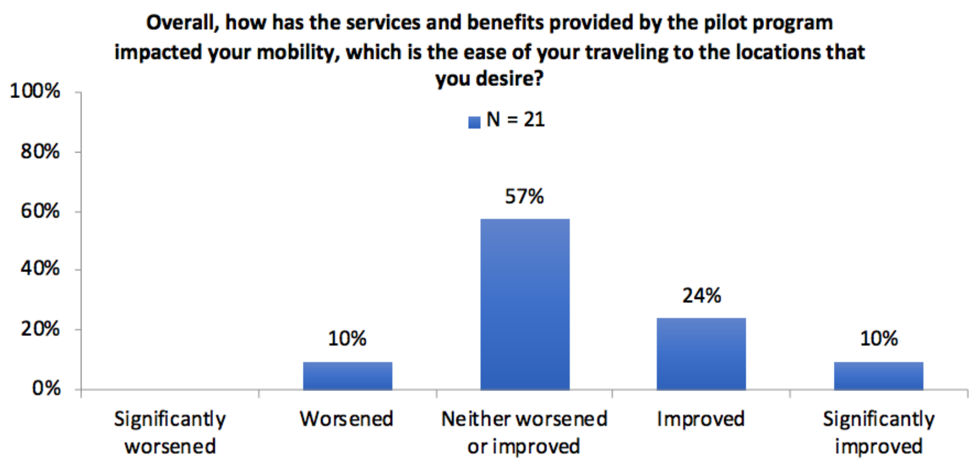


Figure A-74 *"After" Survey – Group 2 – Commute Distance*

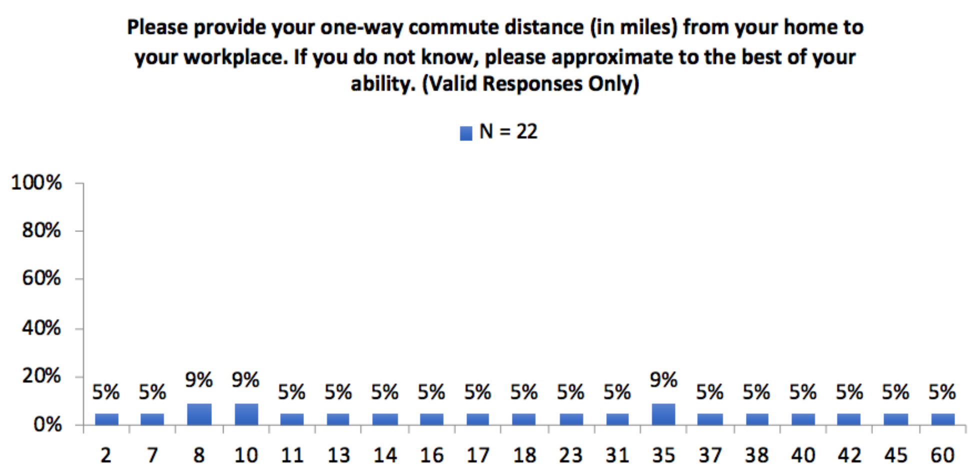


Figure A-75 *"After" Survey – Group 2 – Typical Morning Commute*

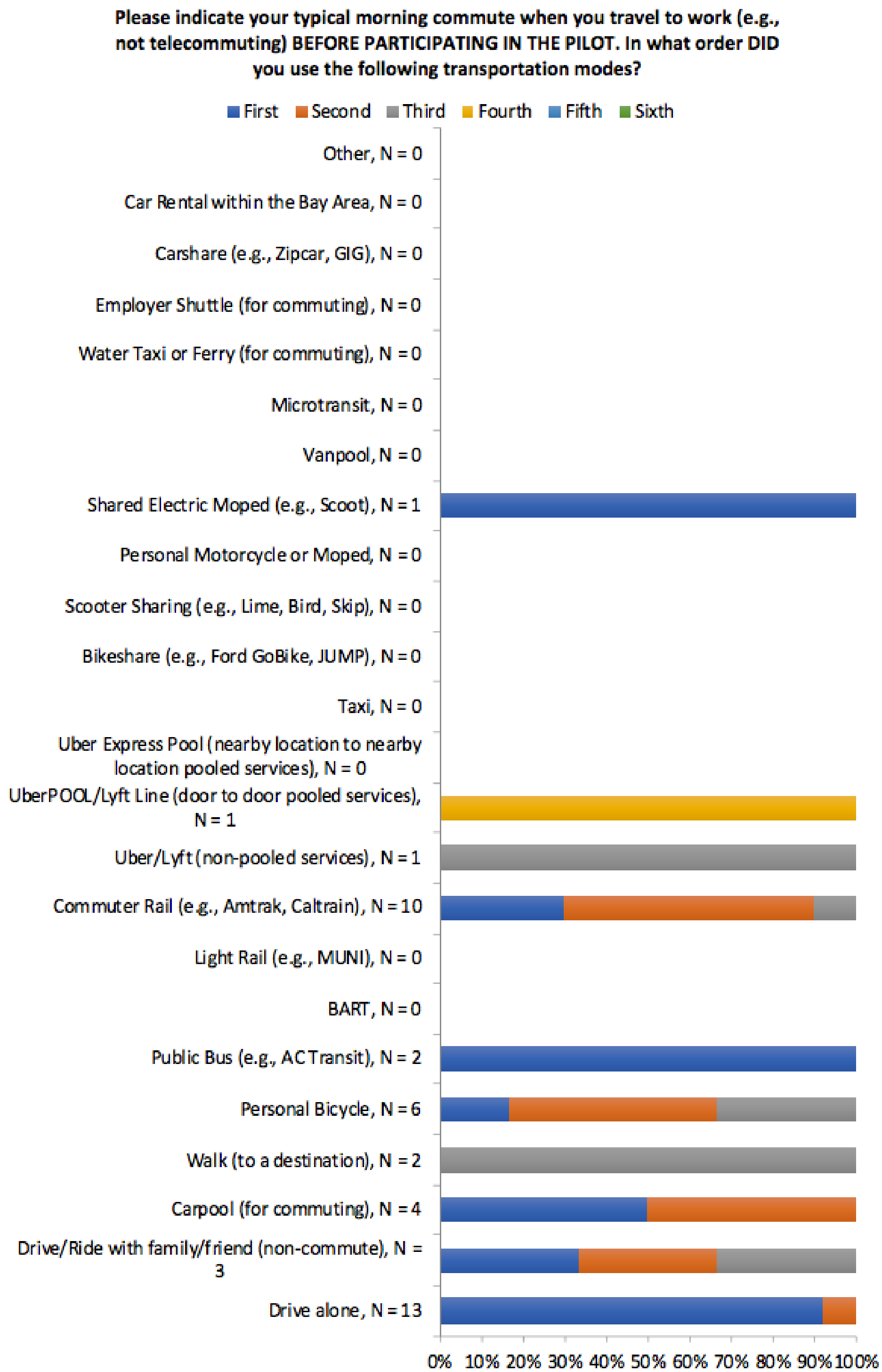


Figure A-76 *"After" Survey – Group 2 – Evening Commute*

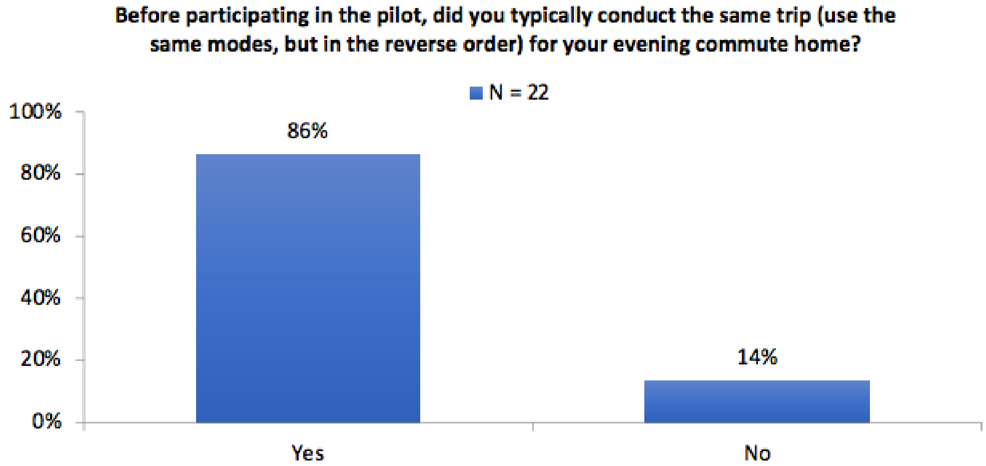


Figure A-77 *"After" Survey – Group 2 – Typical Evening Commute*

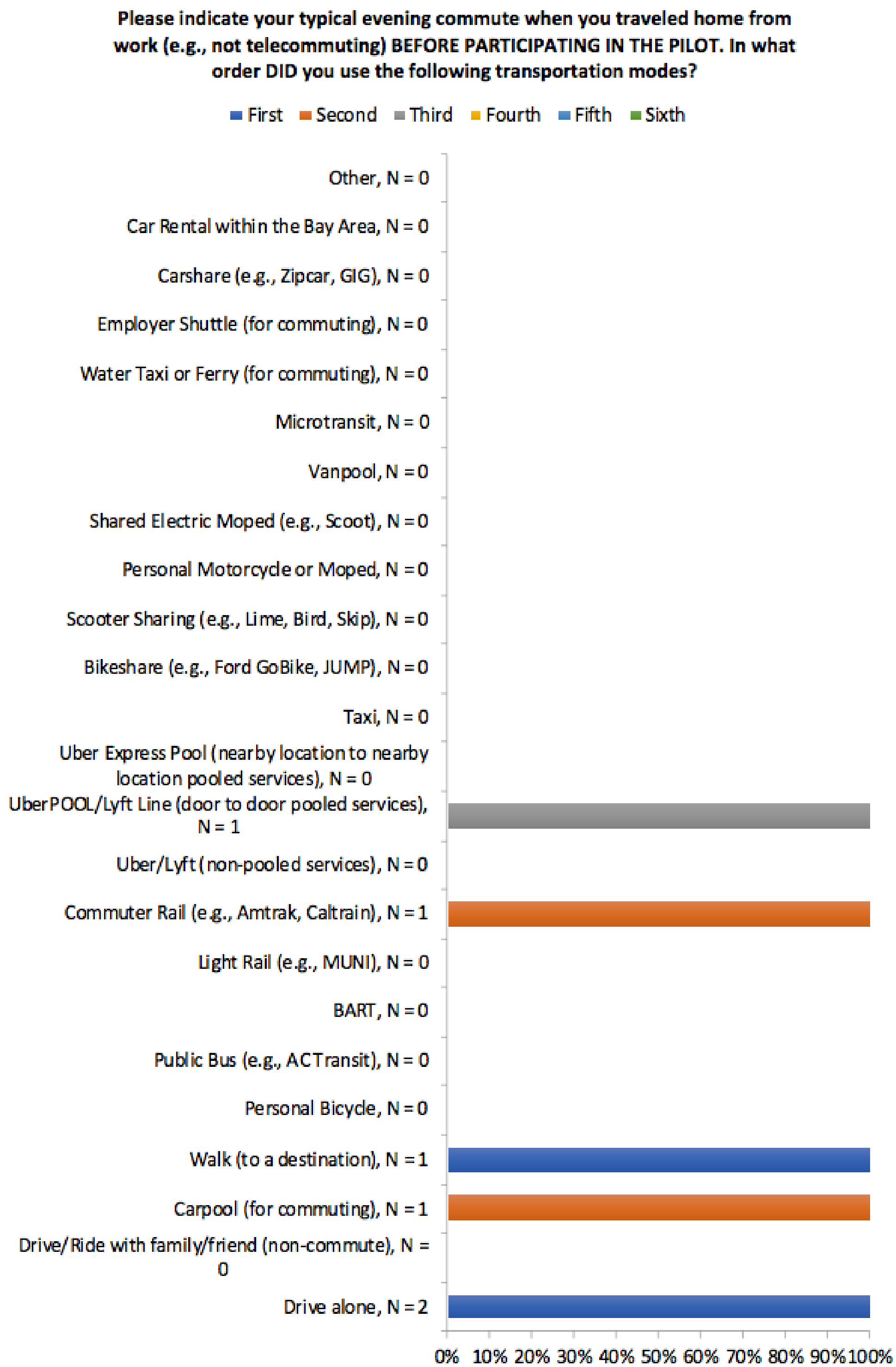


Figure A-78 *"After" Survey – Group 2 – Morning Commute Start Time*

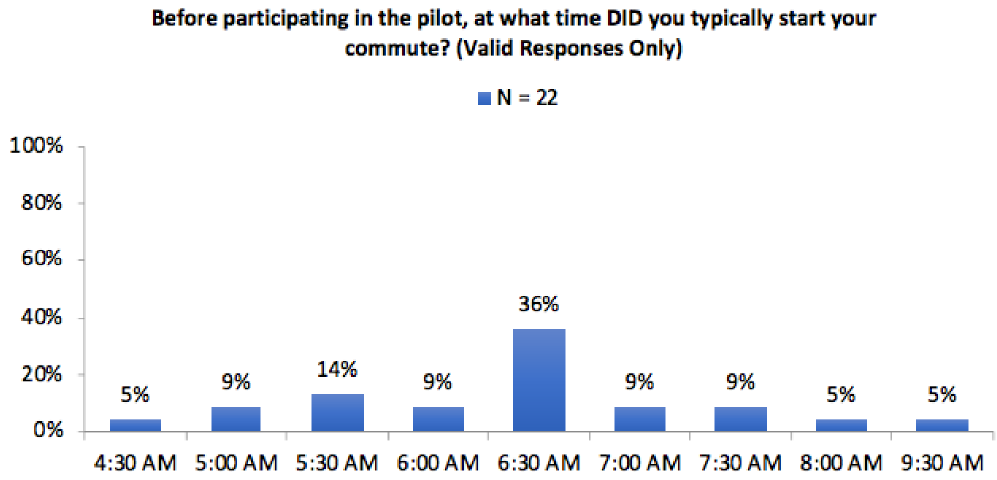


Figure A-79 *"After" Survey – Group 2 – Morning Commute Days*

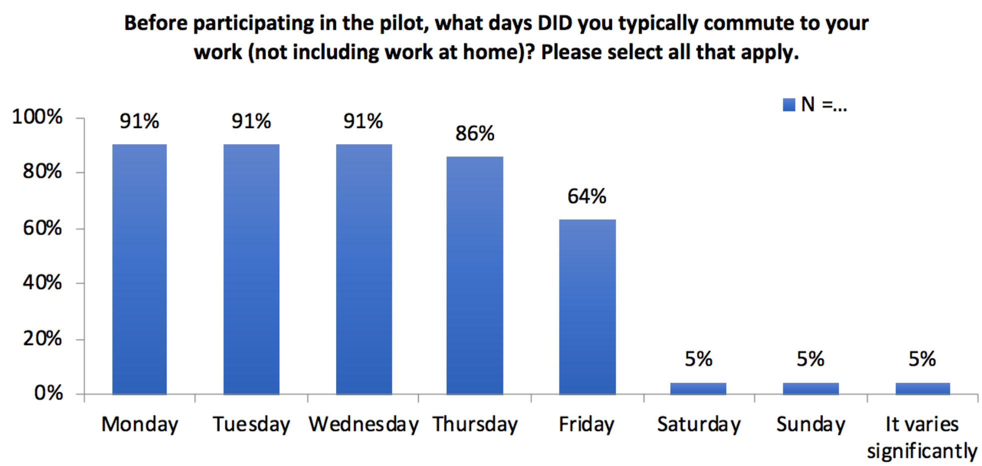


Figure A-80 *"After" Survey – Group 2 – Child During Morning Commute*

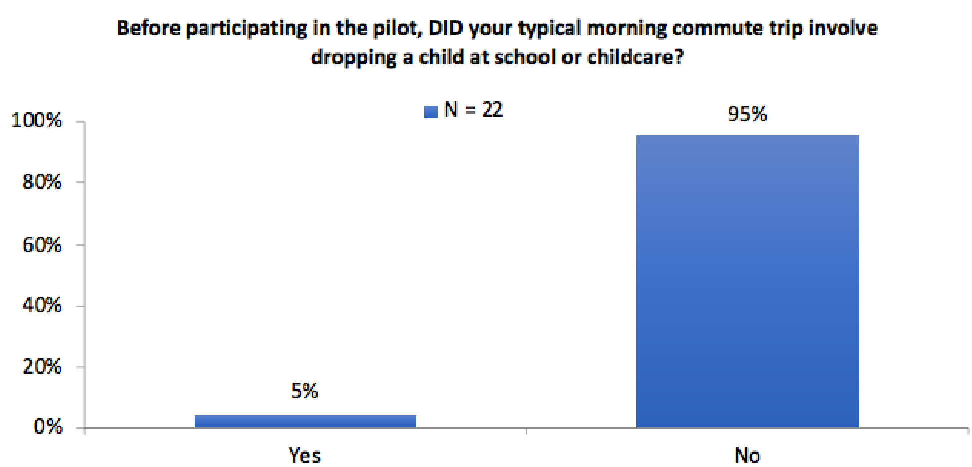


Figure A-81 *"After" Survey – Group 2 – Parking Cost*

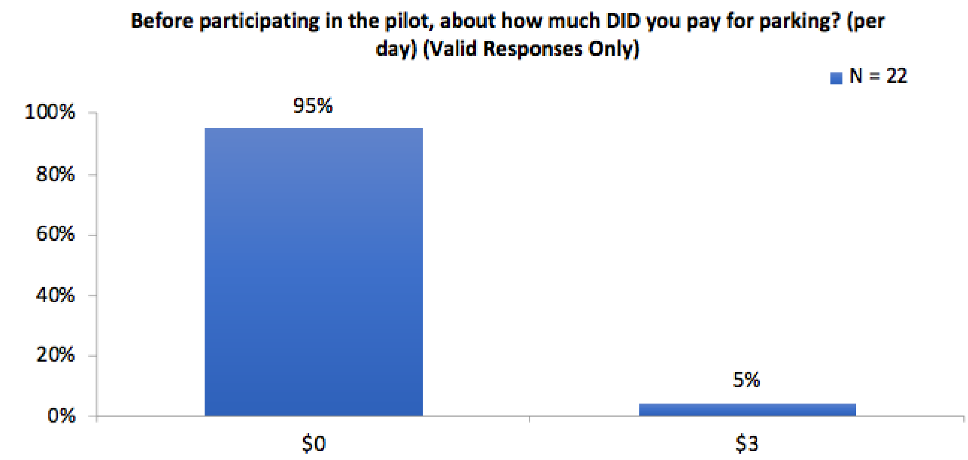


Figure A-82 *"After" Survey – Group 2 – Tolls Cost*

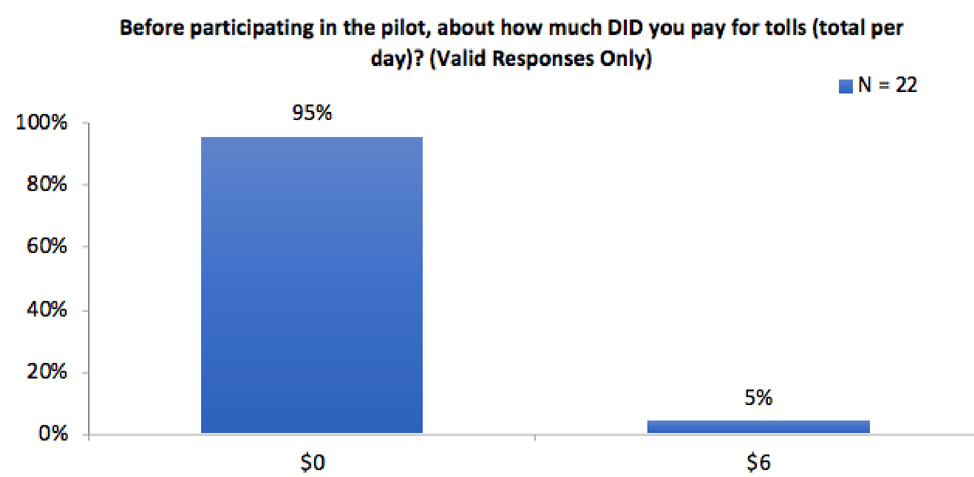


Figure A-83 *"After" Survey – Group 2 – Alternative Mode to Get to Work*

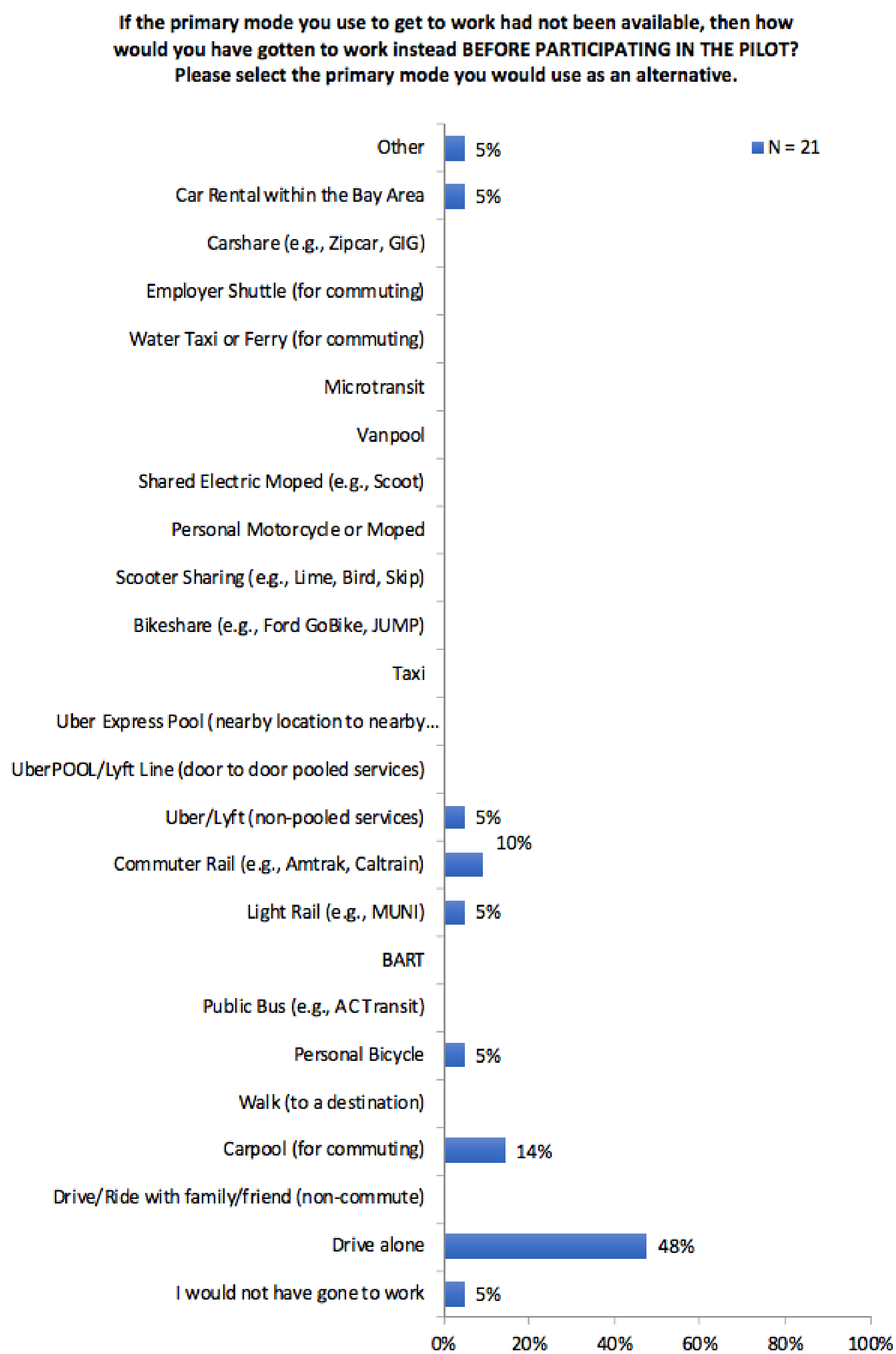


Figure A-84 *"After" Survey – Group 2 – Evening Commute Start Time*

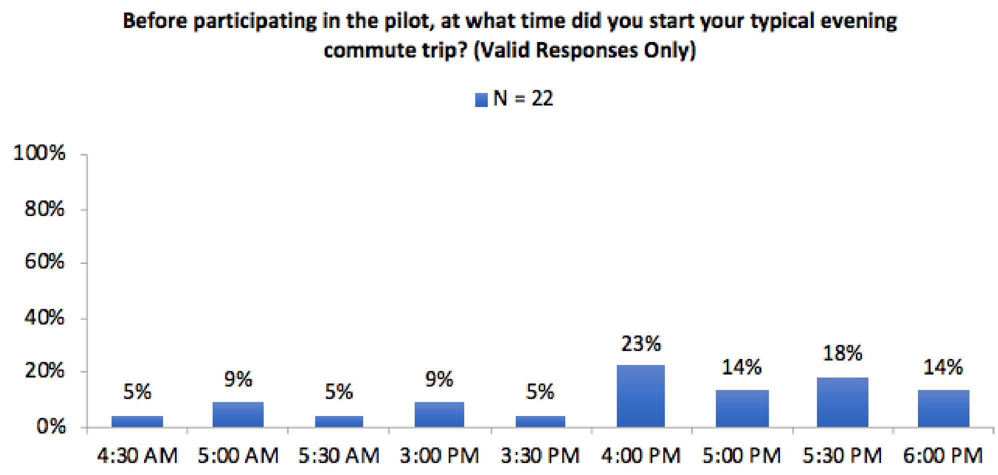


Figure A-85 *"After" Survey – Group 2 – Alternative Mode to Get from Work*

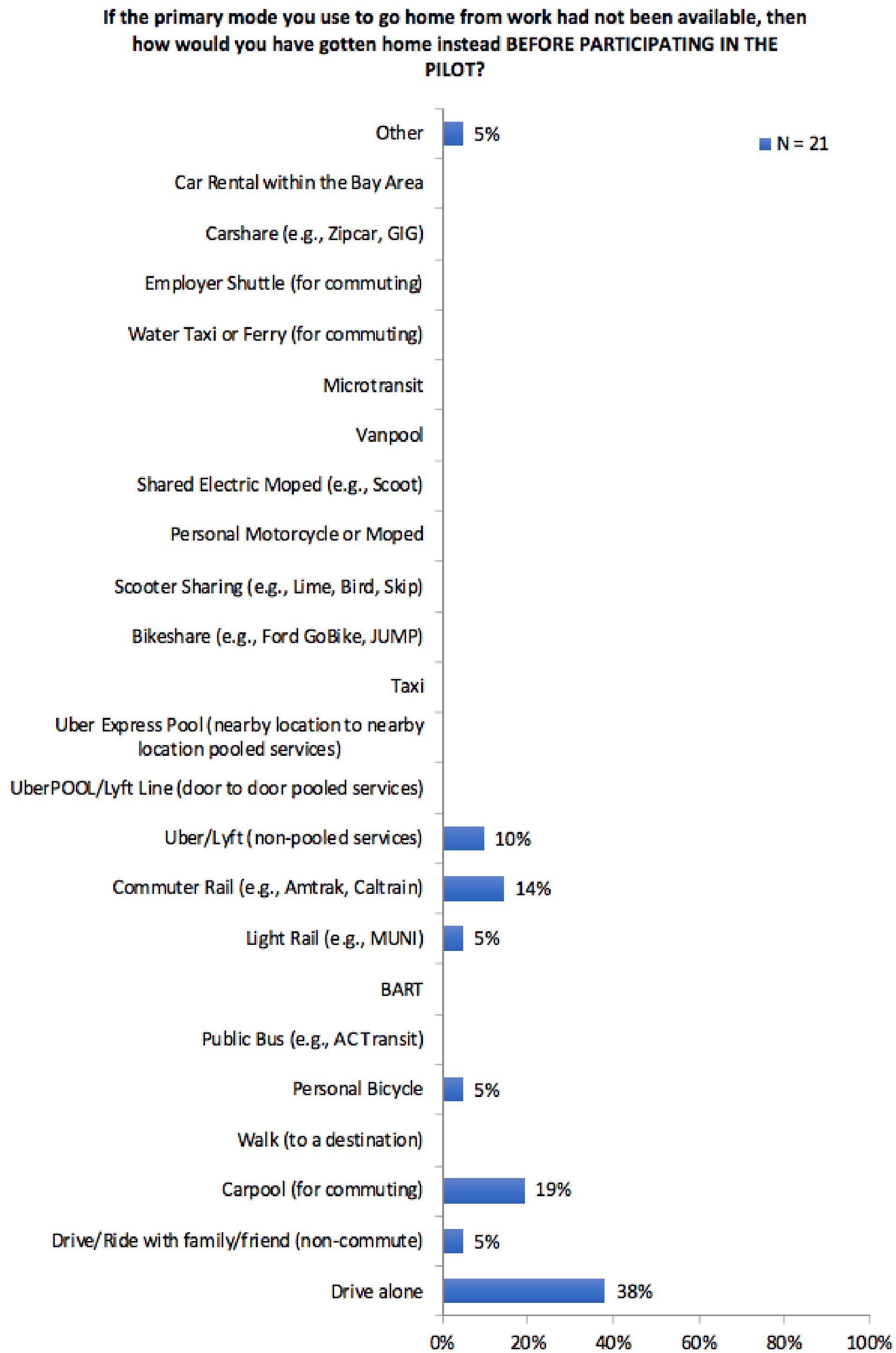


Figure A-86 *"After" Survey – Group 2 –Child During Evening Commute*

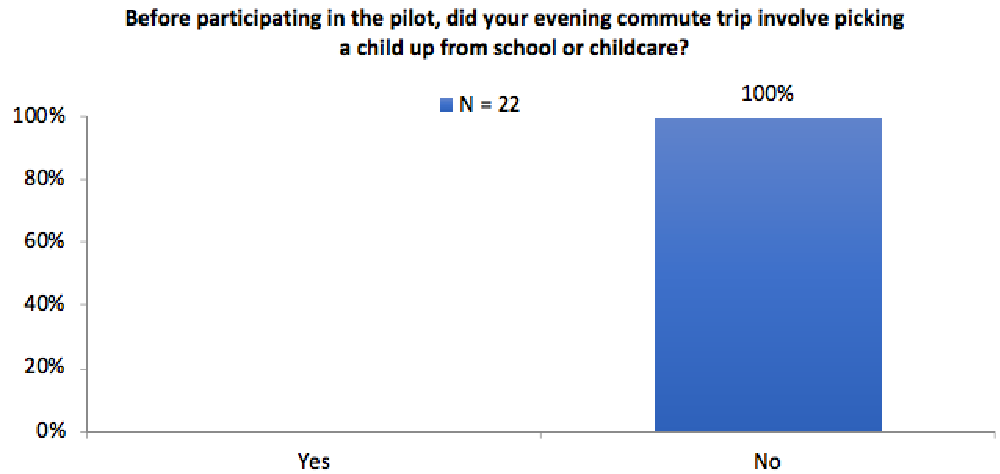


Figure A-87 *"After" Survey – Group 2 – Commuter Benefits Received (1) – Cupertino & Palo Alto*

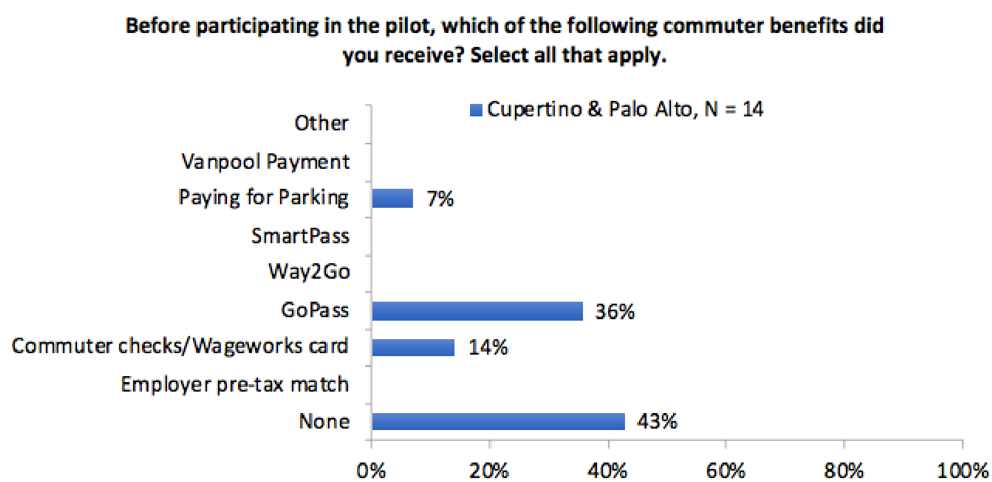


Figure A-88 *"After" Survey – Group 2 – Commuter Benefits Received (1) – Menlo Park*

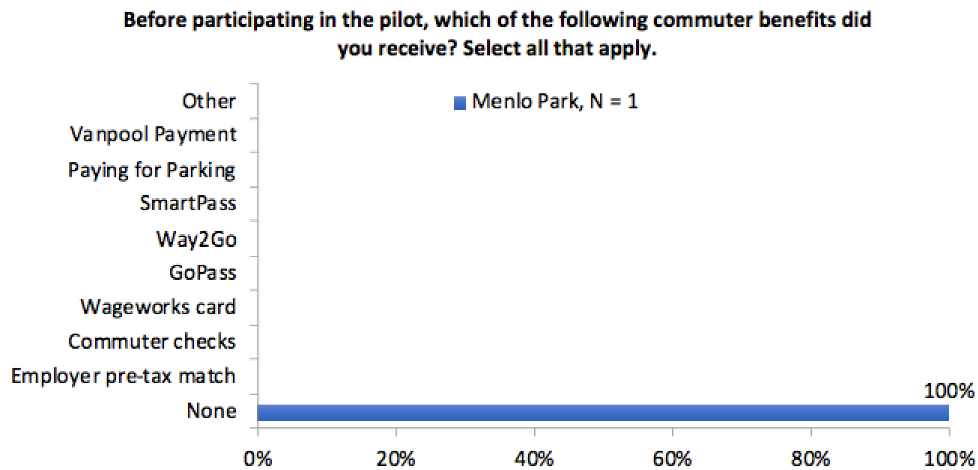


Figure A-89 *"After" Survey – Group 2 – Commuter Benefits Received (2) – Cupertino & Mountain View*

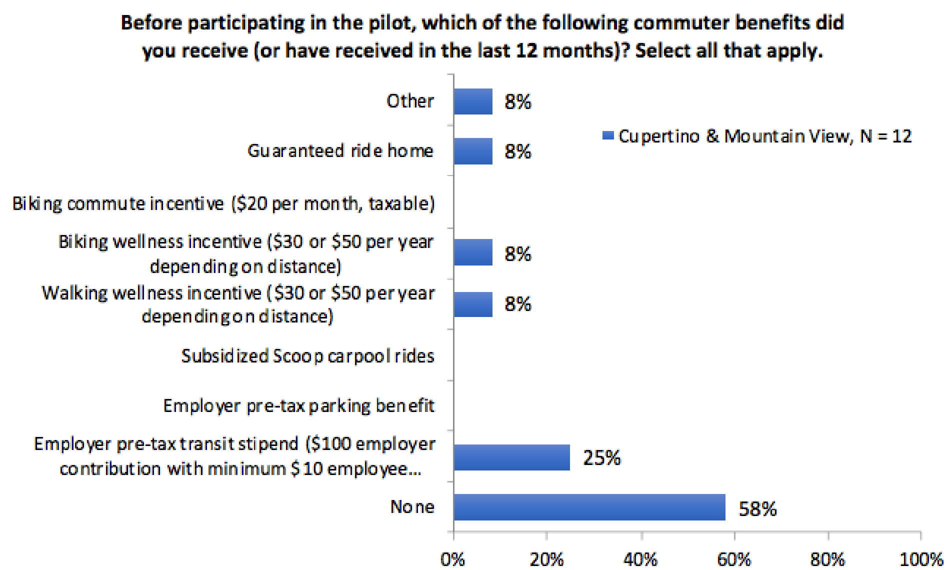


Figure A-90 *"After" Survey – Group 2 – Cost of Commuter Benefits (1) – Palo Alto*

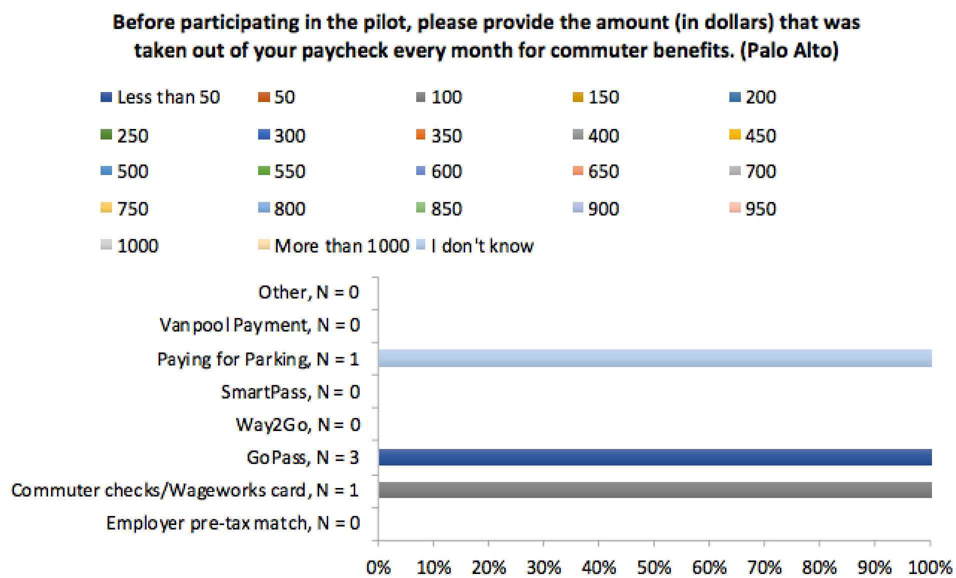
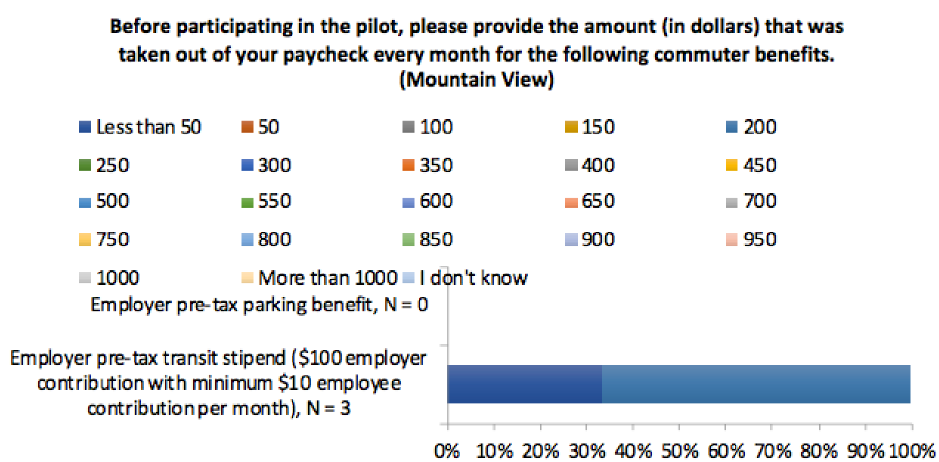


Figure A-91 *"After" Survey – Group 2 – Cost of Commuter Benefits (2) – Mountain View*



Group 3

Figure A-92 *"After" Survey – Group 3 – Vehicle Ownership*

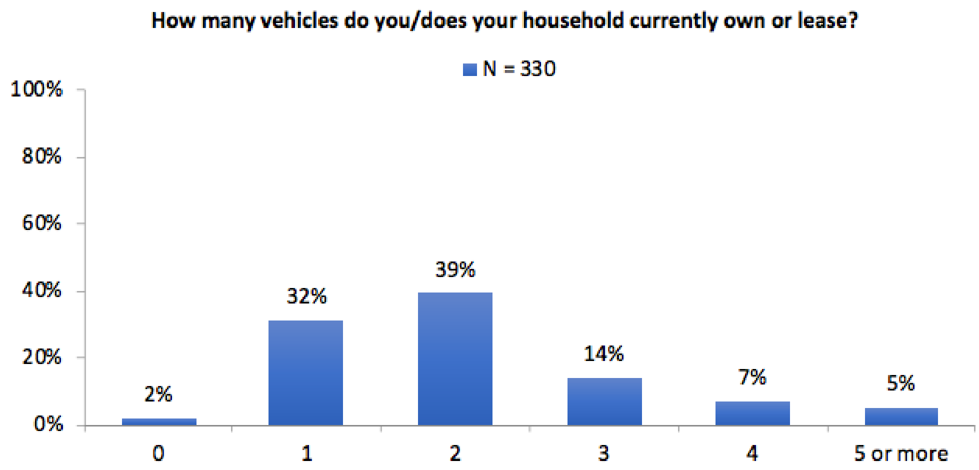


Figure A-93 *"After" Survey – Group 3 – Mode Share Distribution*

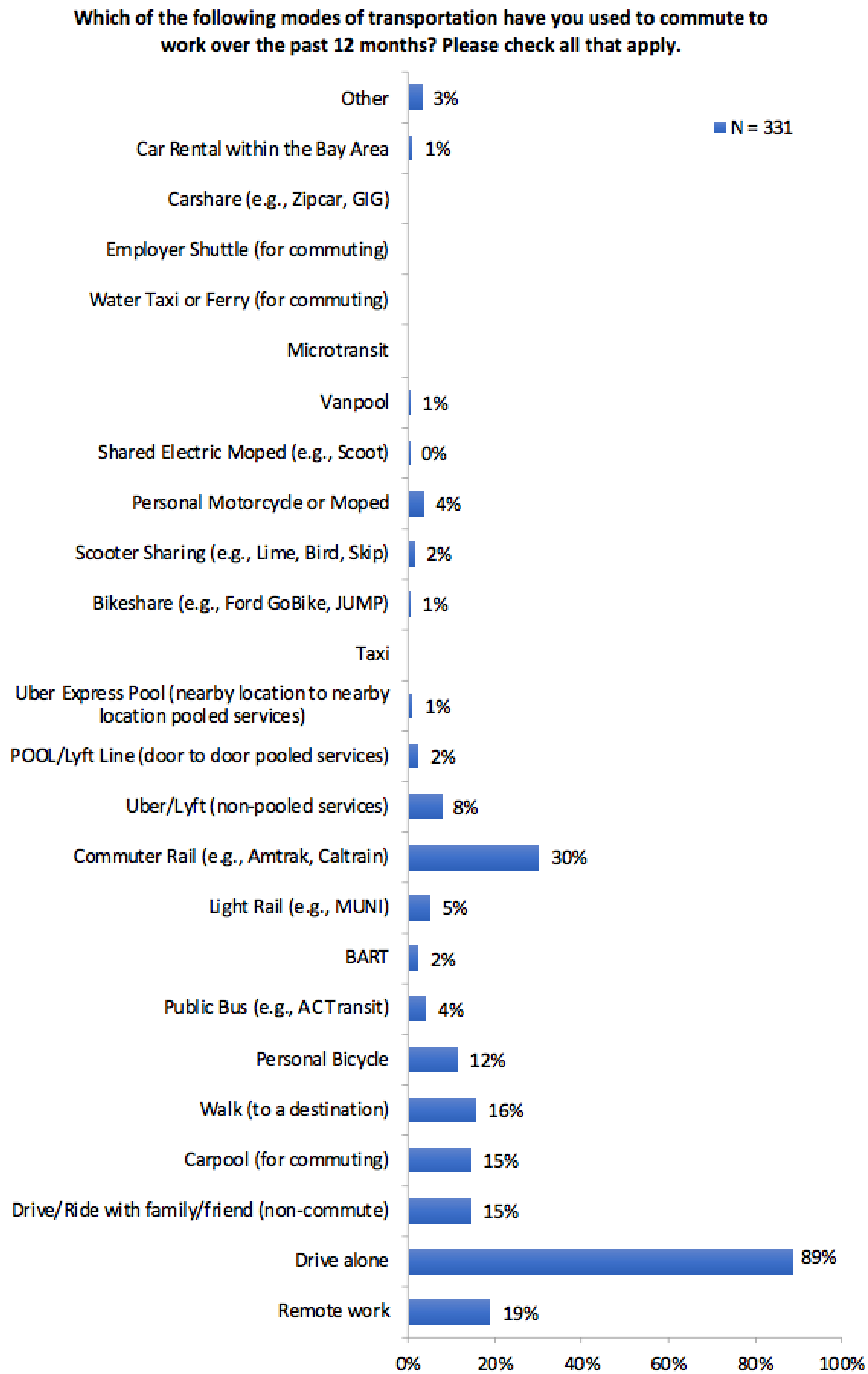


Figure A-94 *"After" Survey – Group 3 – Working Days*

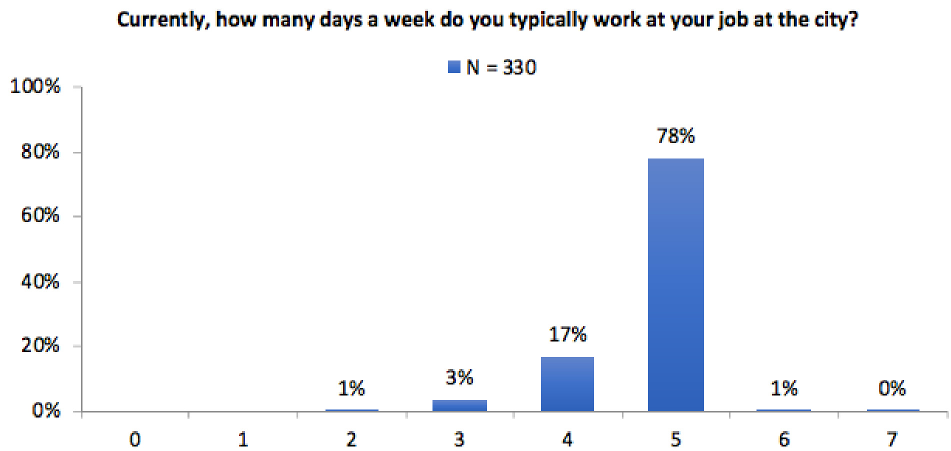


Figure A-95 *"After" Survey – Group 3 – Mode Frequency of Use Distribution*

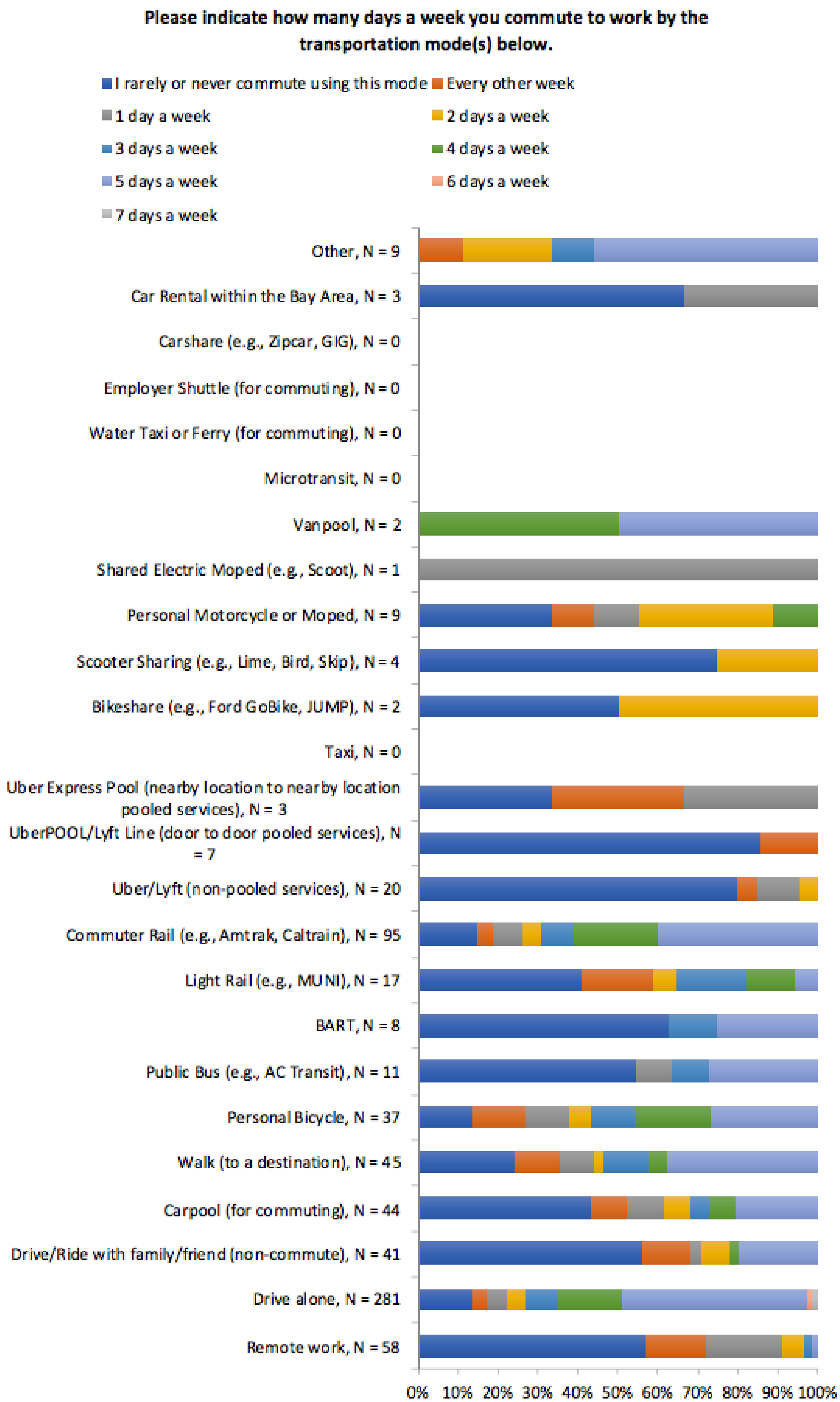


Figure A-96 *"After" Survey – Group 3 – Commute Distance*

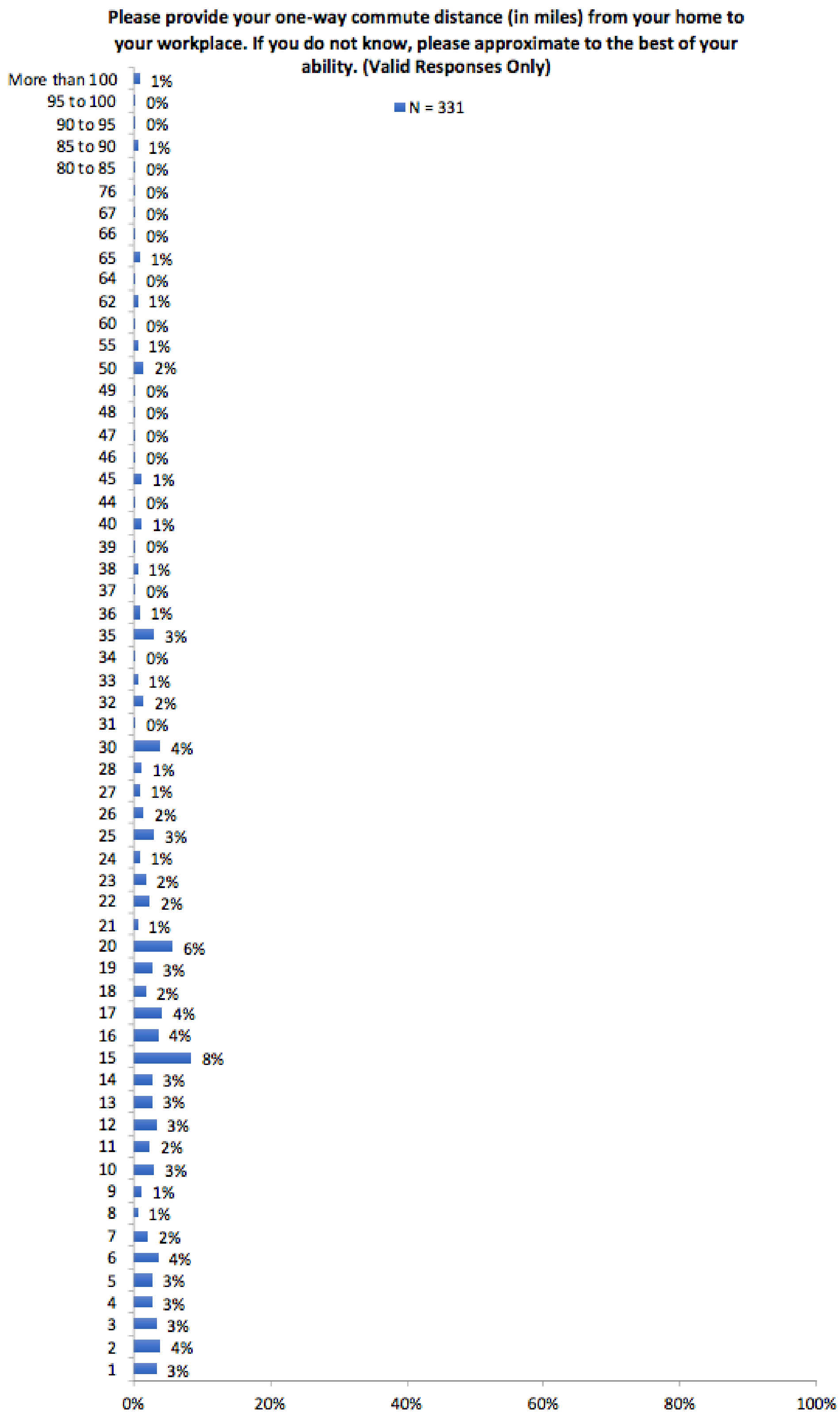


Figure A-97 *"After" Survey – Group 3 –Typical Morning Commute*

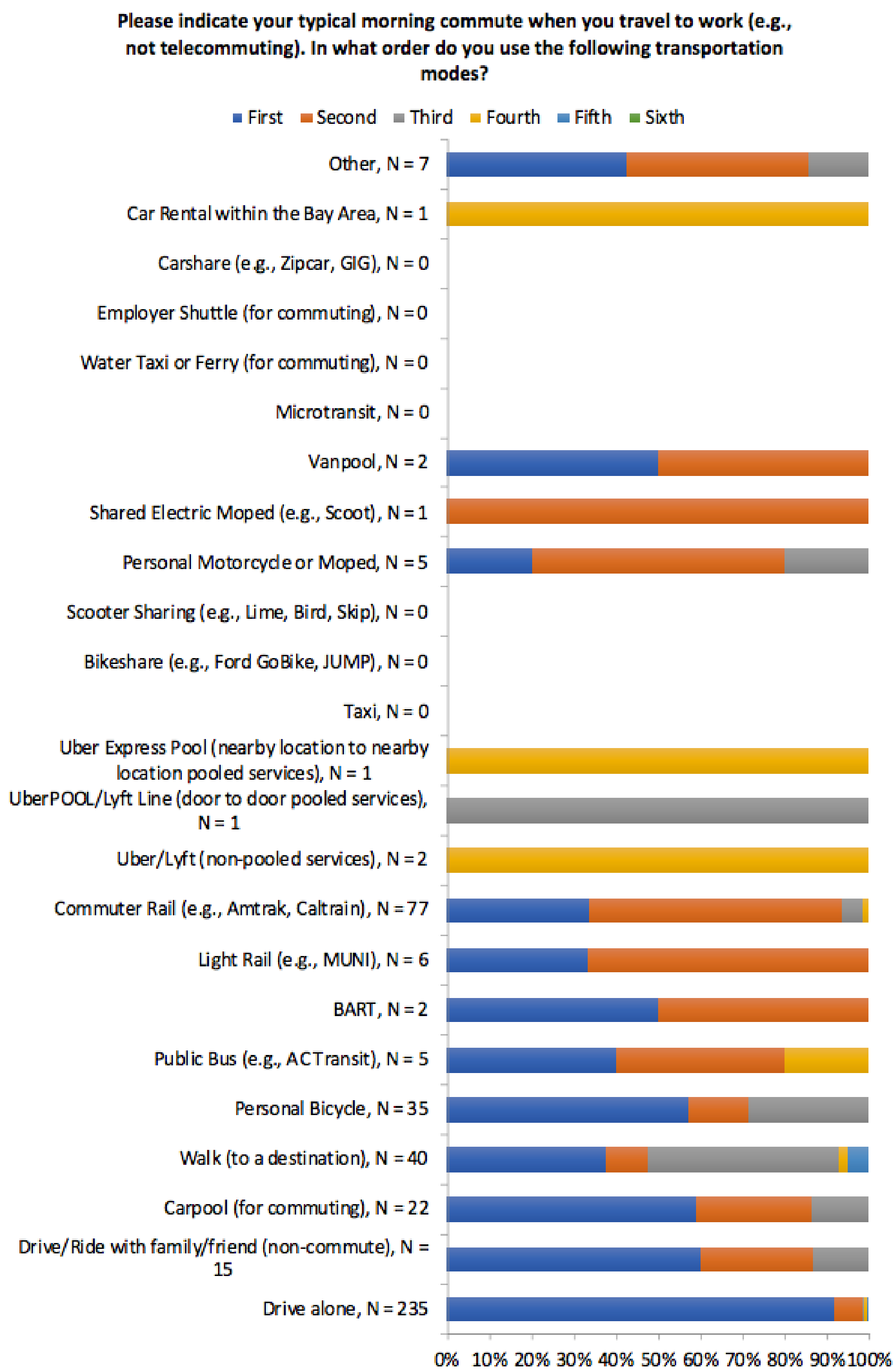


Figure A-98 *"After" Survey – Group 3 – Evening Commute*

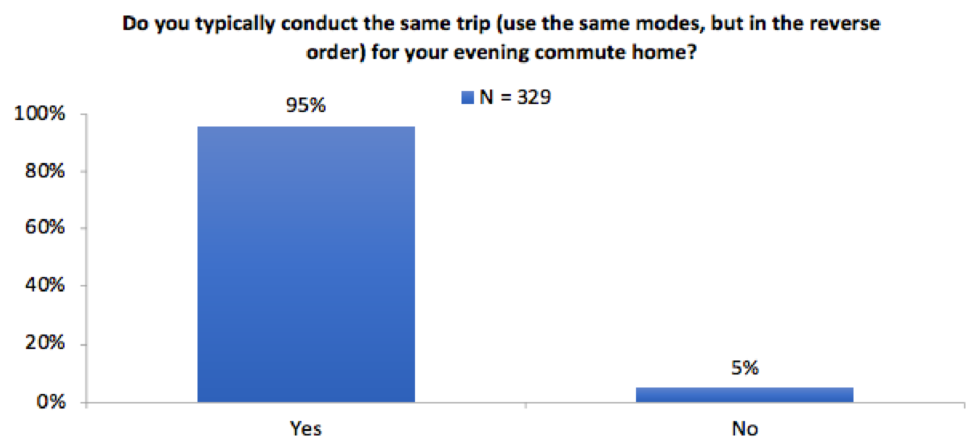


Figure A-99 *"After" Survey – Group 3 – Typical Evening Commute*

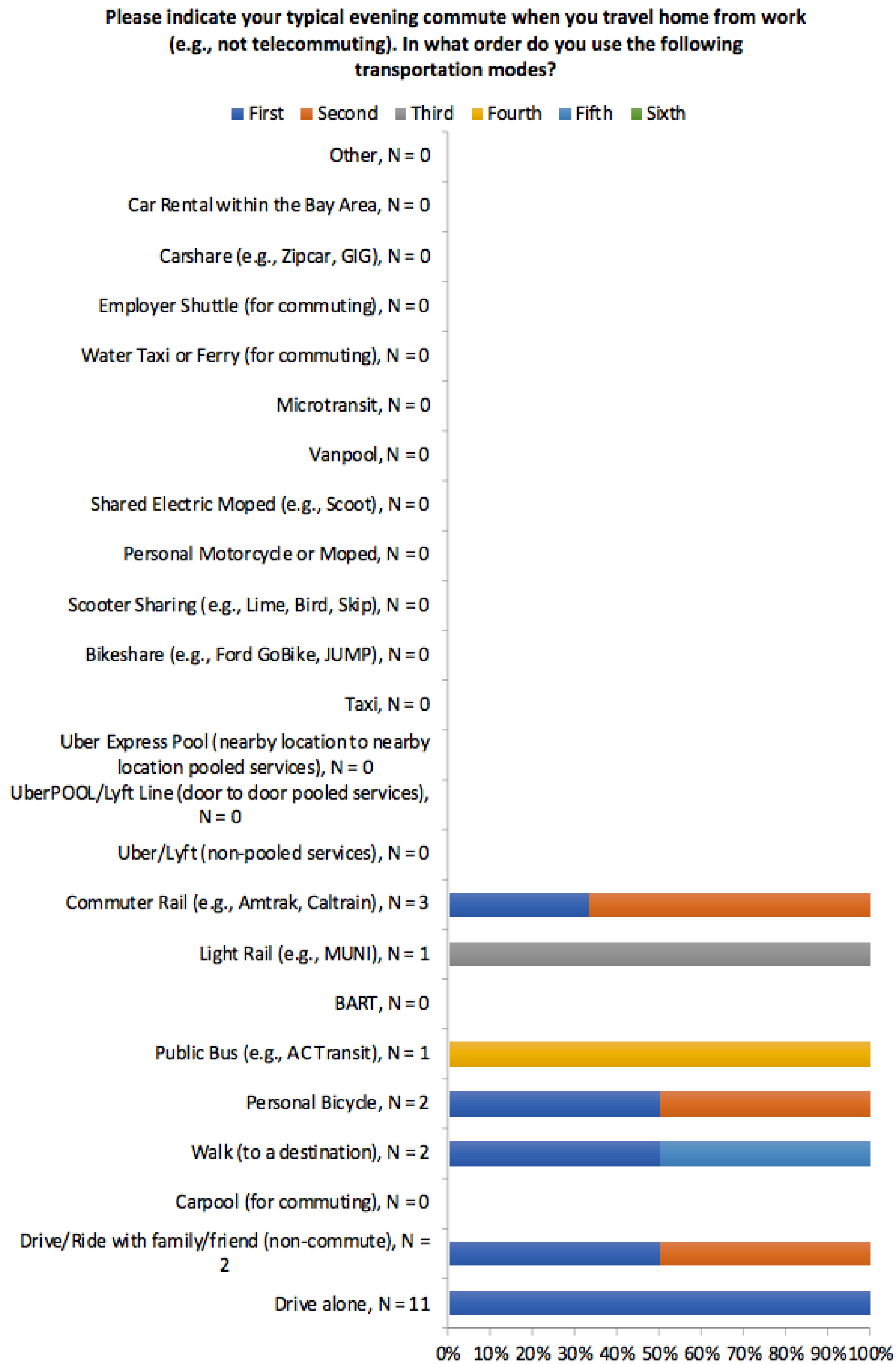


Figure A-100 *After" Survey – Group 3 – Morning Commute Start Time*

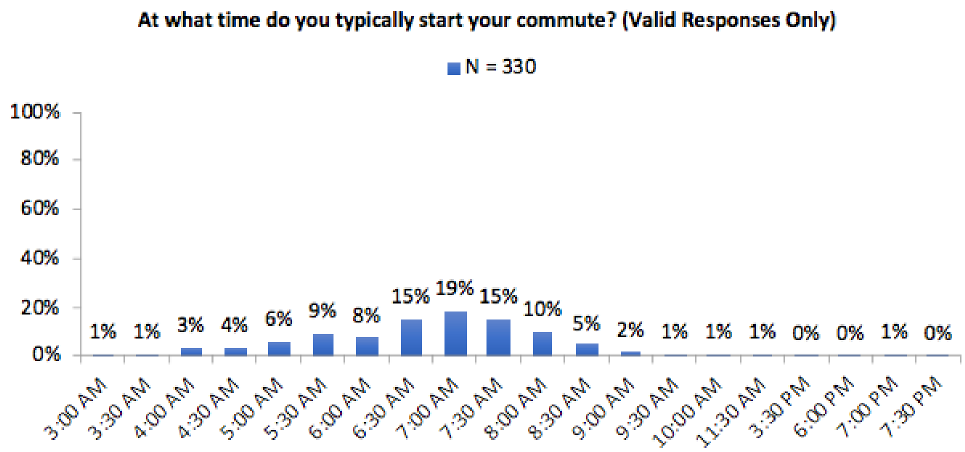


Figure A-101 *"After" Survey – Group 3 – Morning Commute Days*

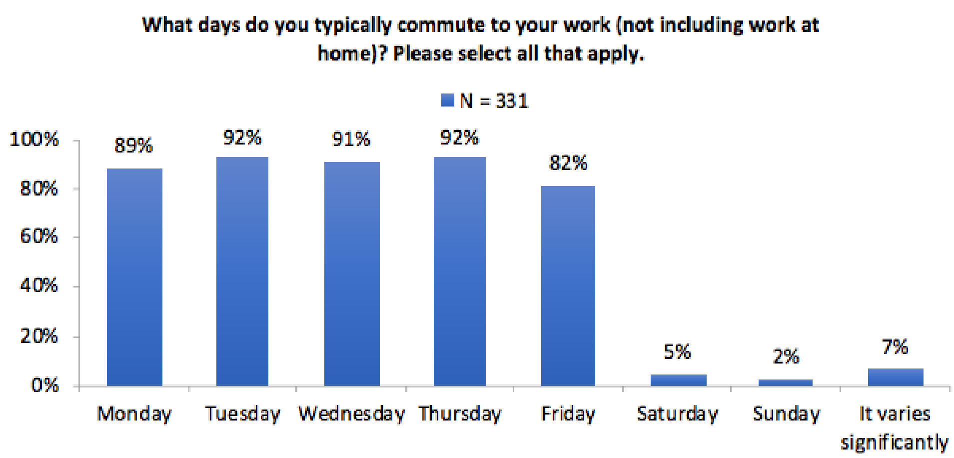


Figure A-102 *"After" Survey – Group 3 – Child During Morning Commute*

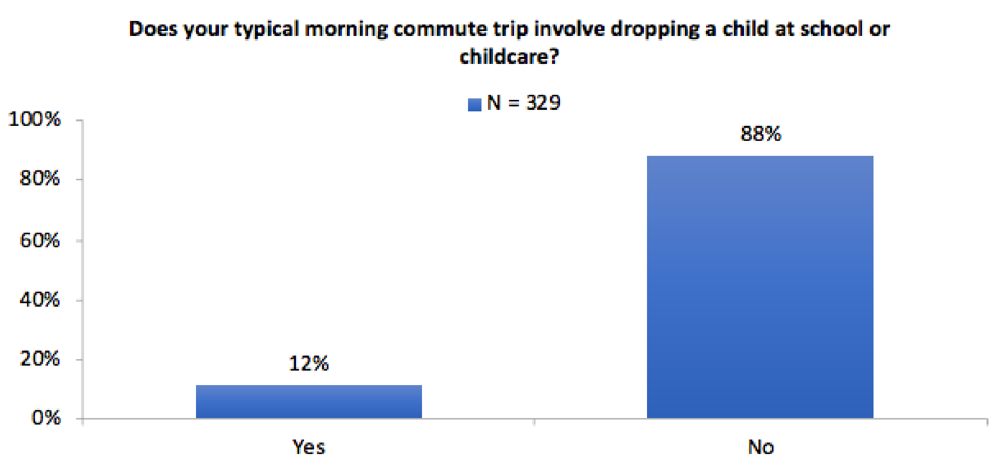


Figure A-103 *"After" Survey – Group 3 – Parking Cost*

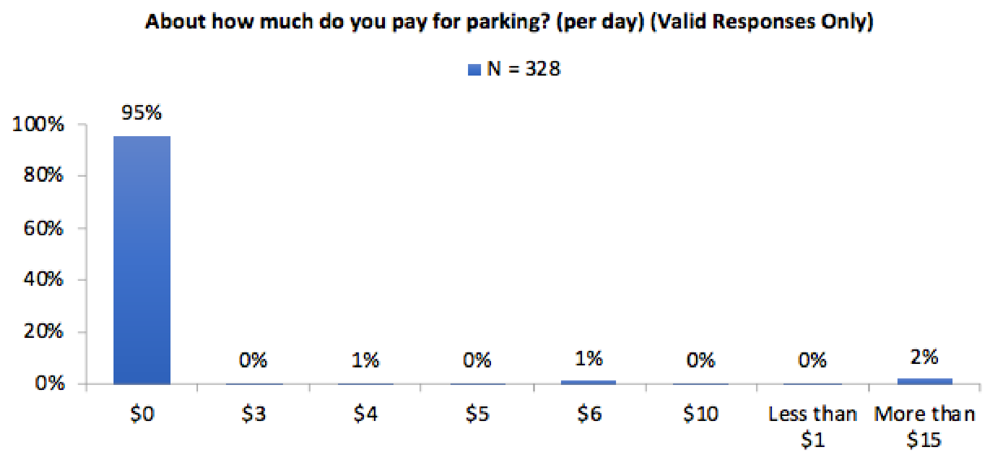


Figure A-104 *"After" Survey – Group 3 – Tolls Cost*

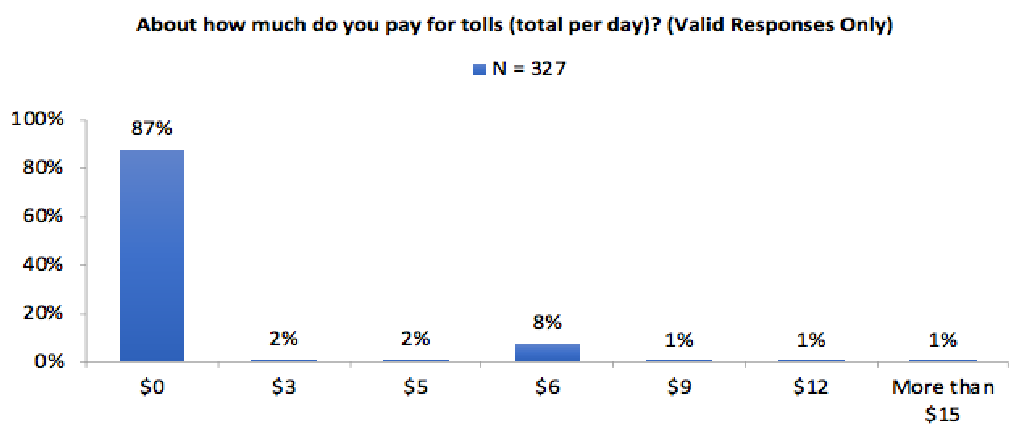


Figure A-105 *"After" Survey – Group 3 – Alternative Mode to Get to Work*

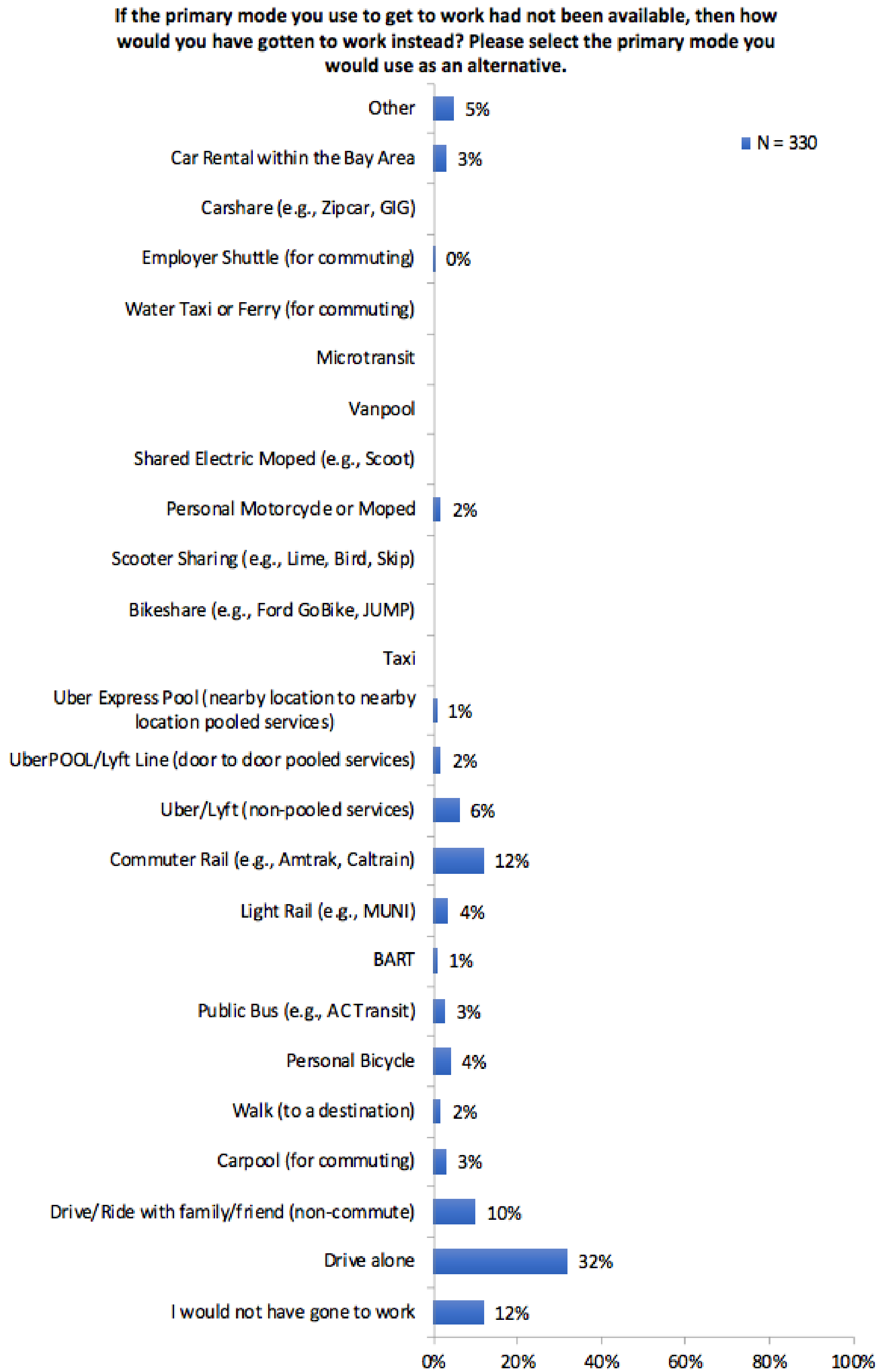


Figure A-106 *"After" Survey – Group 3 – Evening Commute Start Time*

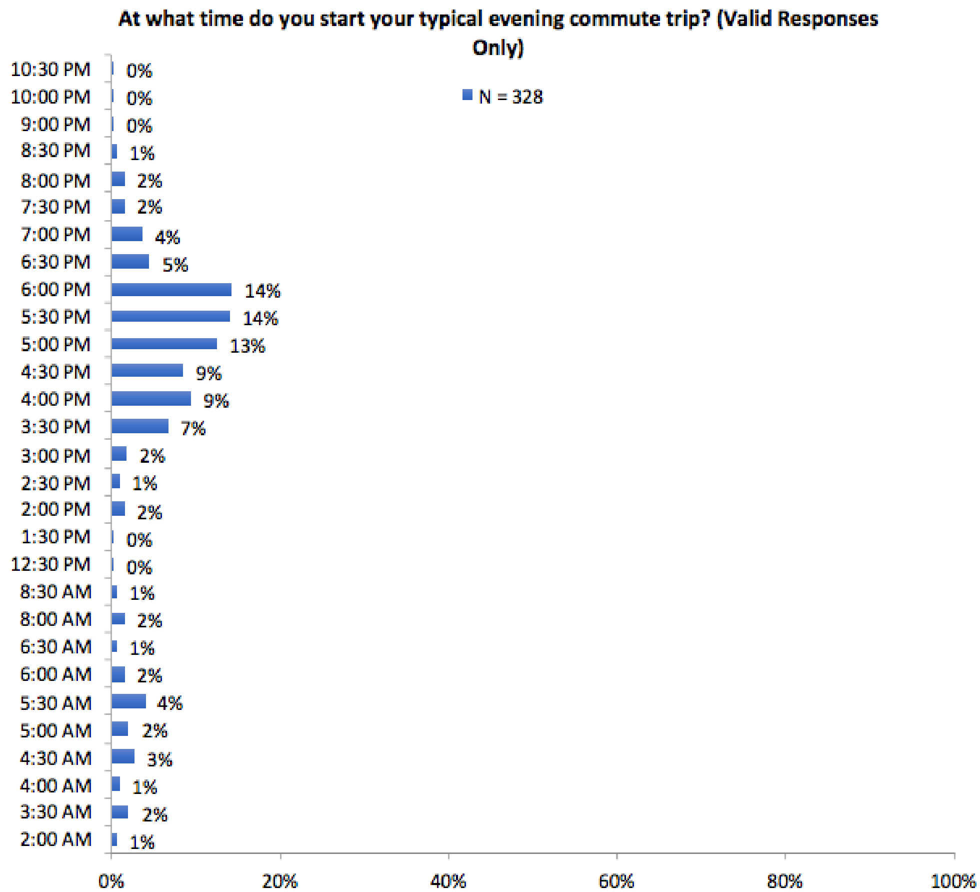


Figure A-107 *"After" Survey – Group 3 – Alternative Mode to Get from Work*

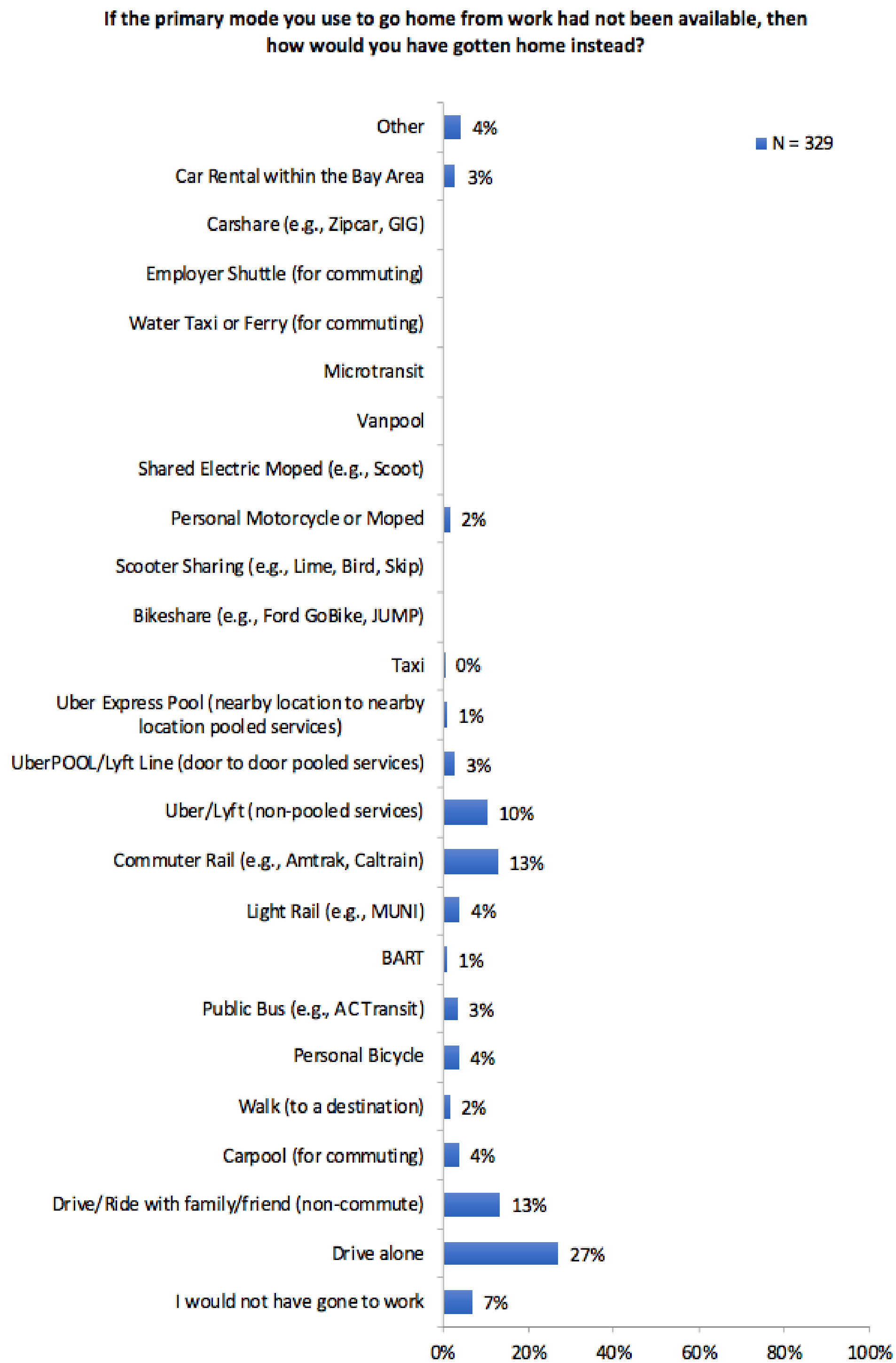


Figure A-108 *"After" Survey – Group 3 – Child During Evening Commute*

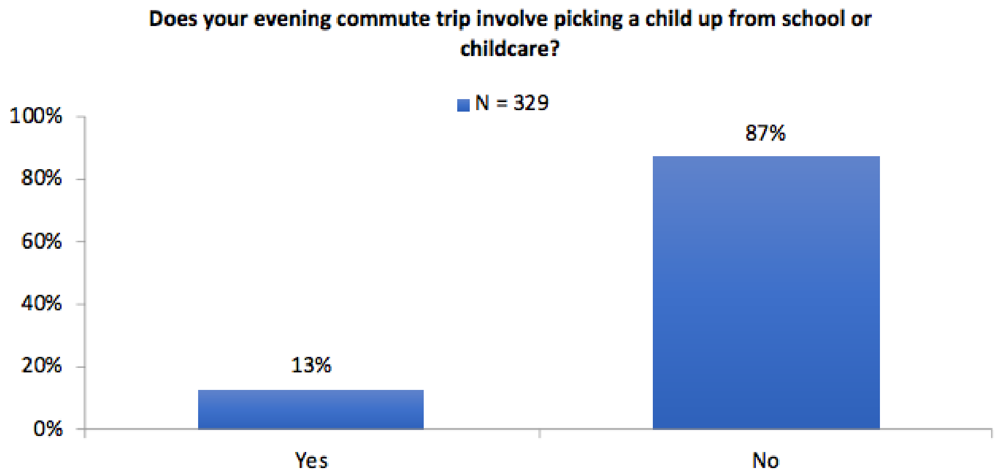


Figure A-109 *"After" Survey – Group 3 – Commuter Benefits Received (1) – Cupertino & Palo Alto*

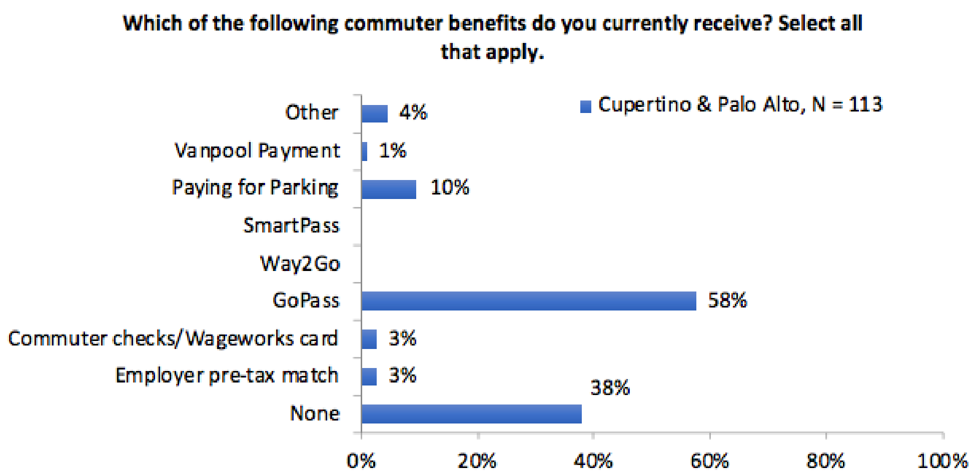


Figure A-110 *"After" Survey – Group 3 – Commuter Benefits Received (1) – Menlo Park*

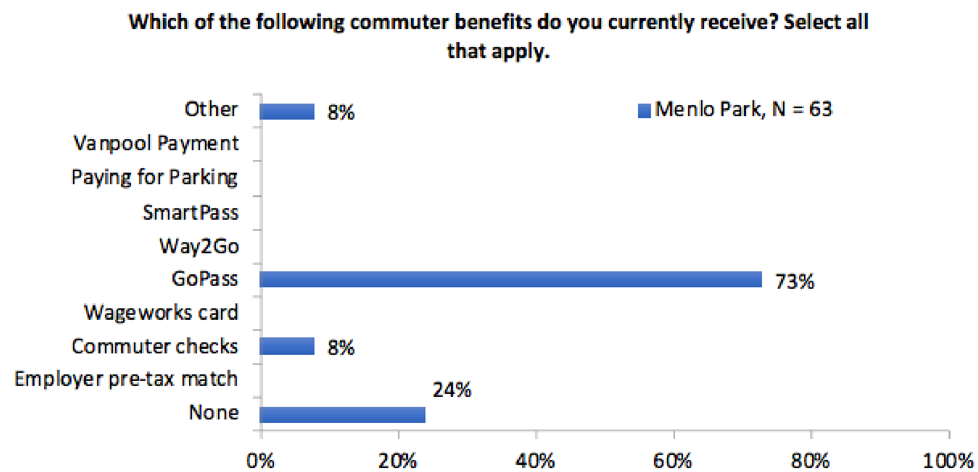


Figure A-111 *"After" Survey – Group 3 – Commuter Benefits Received (2) – Mountain View*

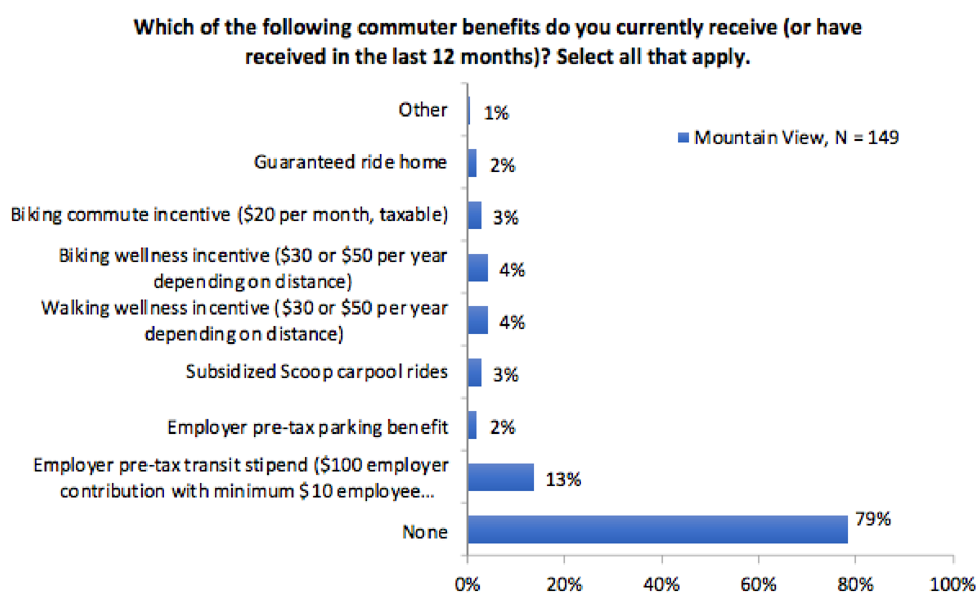


Figure A-112 *"After" Survey – Group 3 – Cost of Commuter Benefits (1) – Menlo Park*

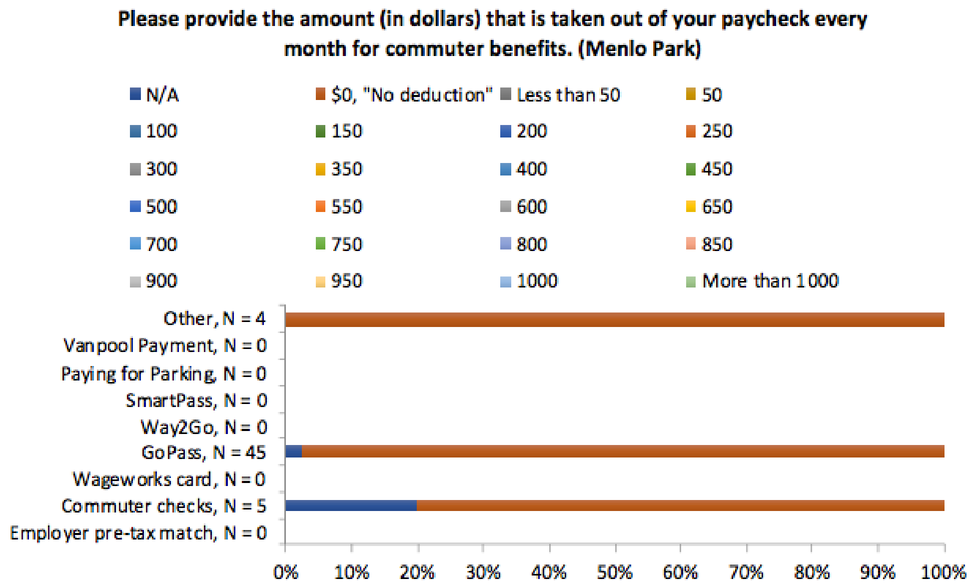


Figure A-113 *"After" Survey – Group 3 – Cost of Commuter Benefits (1) – Palo Alto*

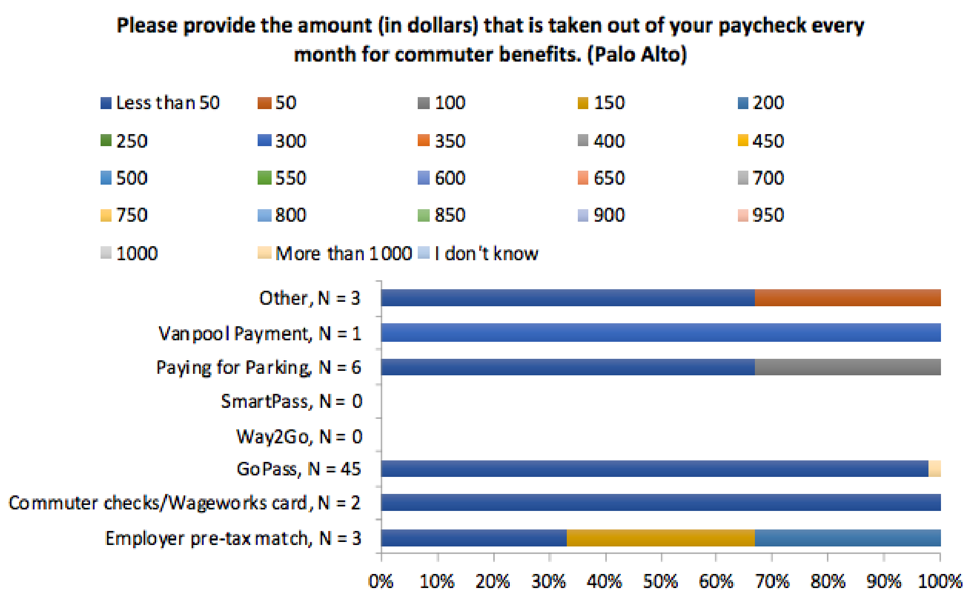


Figure A-114 *"After" Survey – Group 3 – Cost of Commuter Benefits (2) – Mountain View*

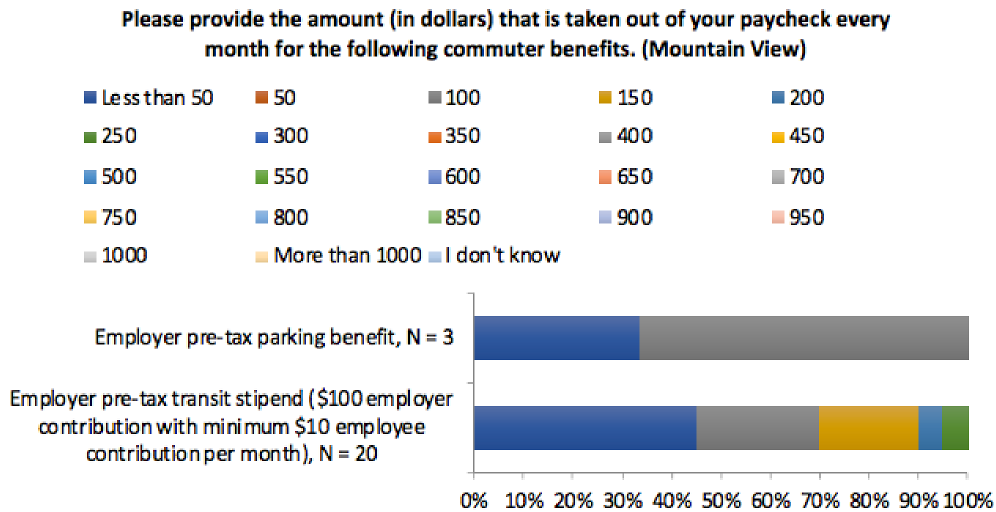
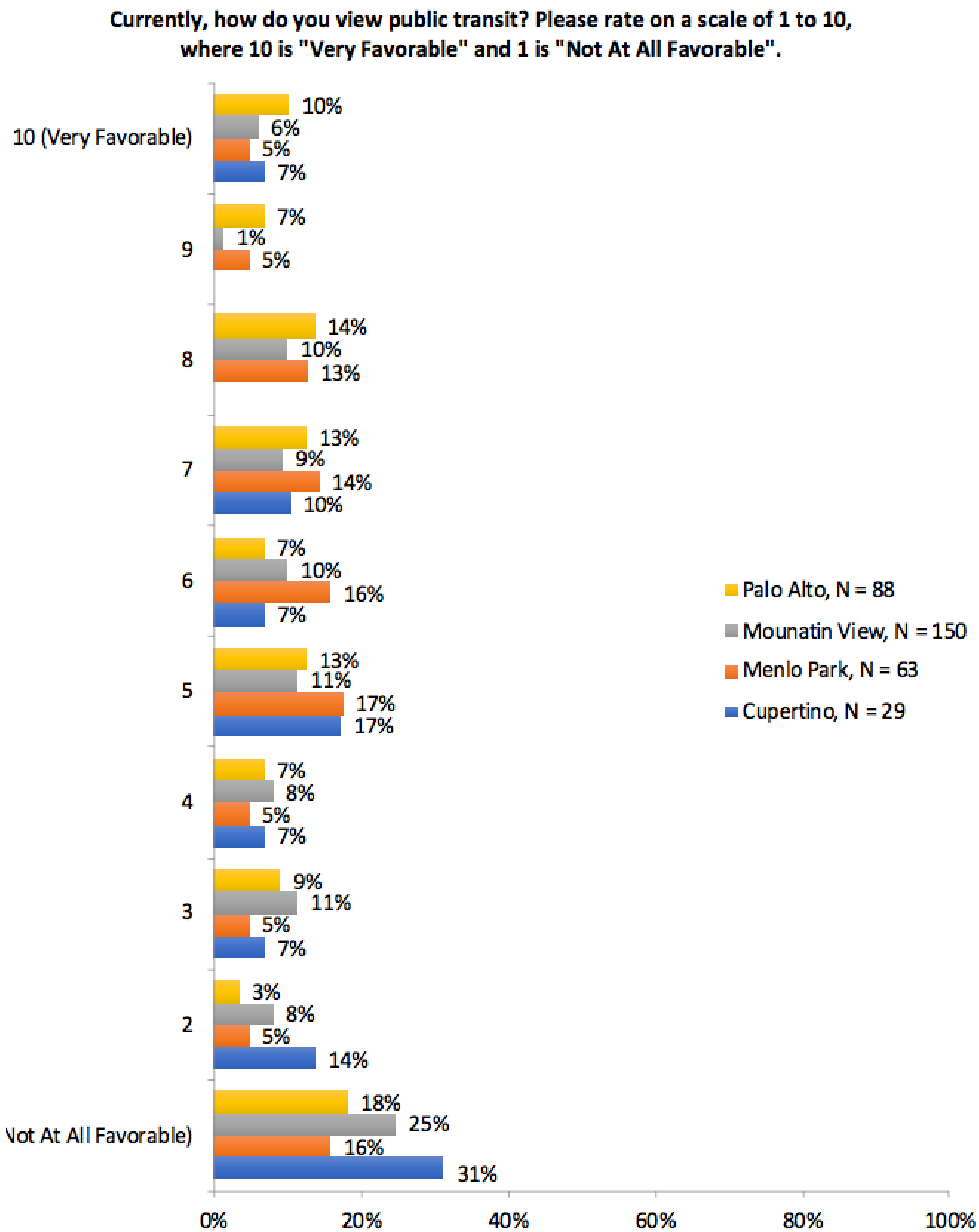


Figure A-115 *"After" Survey – Group 3 – Perception of Public Transit – City Level*



All Groups

Figure A-116 *"After" Survey – All Groups – Commute by E-Bikes or Scooters – Cupertino & Mountain View*

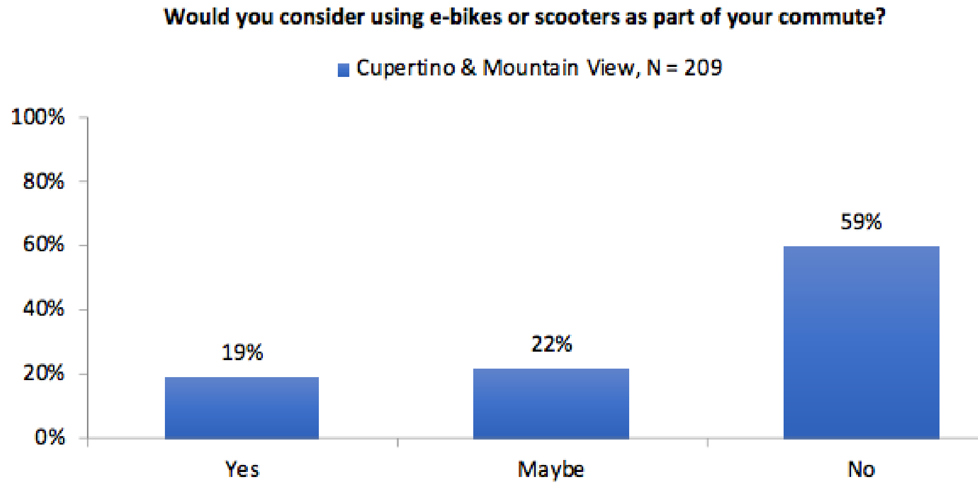


Figure A-117 *"After" Survey – All Groups – Fair Value Commuting Pilot Prgram– Mountain View*

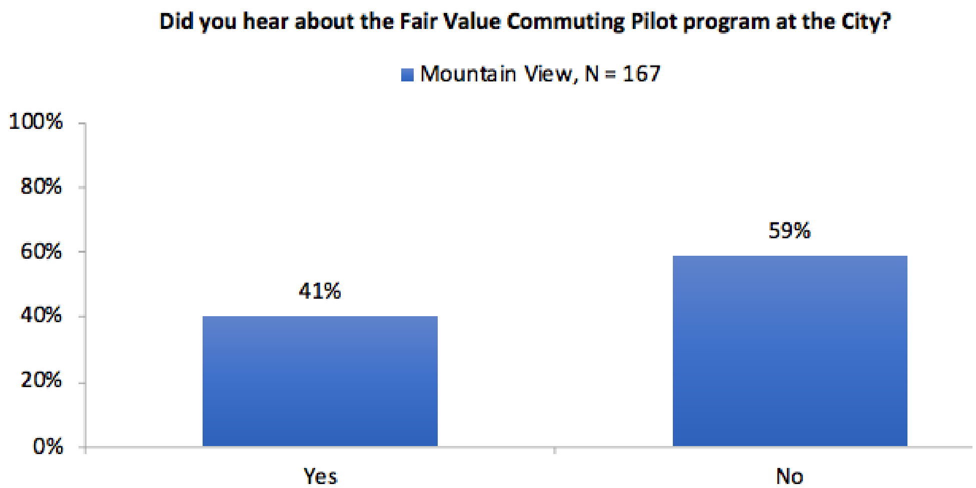


Figure A-118 *"After" Survey – All Groups – Gender*

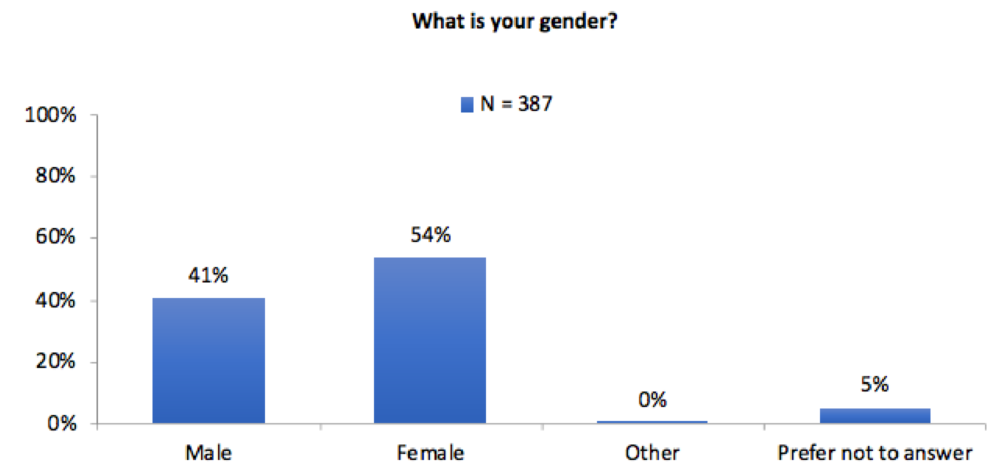


Figure A-119 *"After" Survey – All Groups – Wheelchair Use*

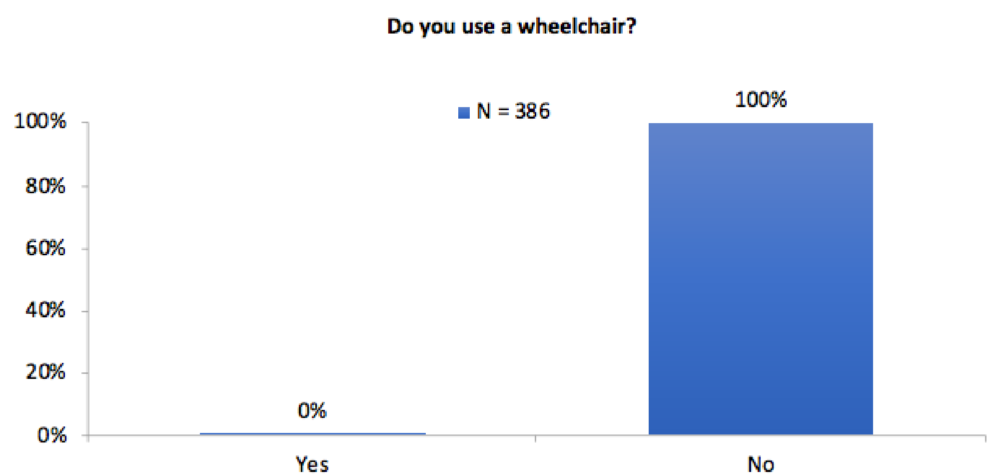


Figure A-120 *"After" Survey – All Groups – Transportation Specialized Accommodations*

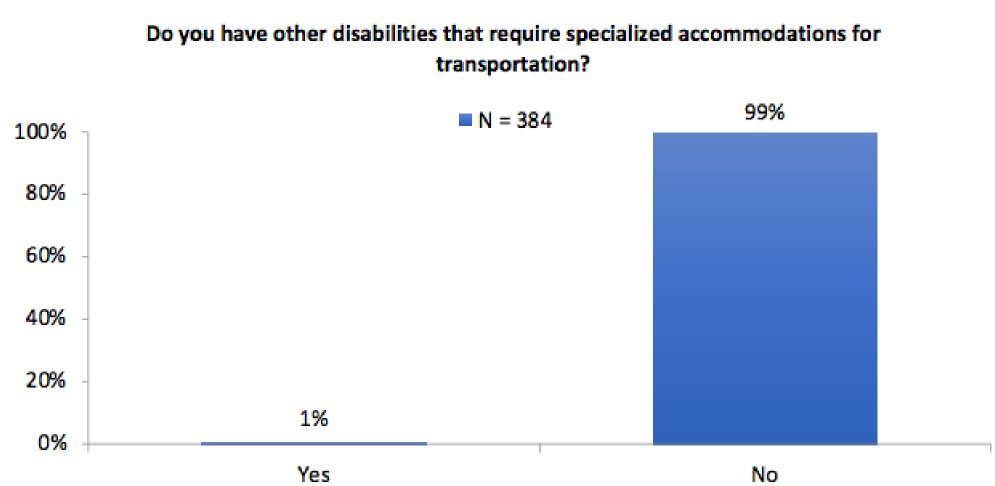


Figure A-121 *"After" Survey – All Groups – Need for ADA-Compliant Transportation*

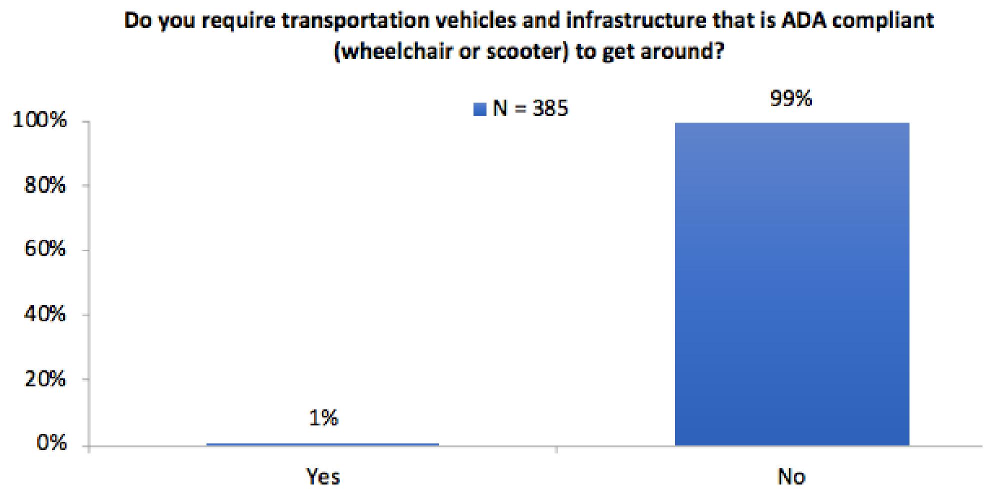


Figure A-122 *"After" Survey – All Groups – Education Level*

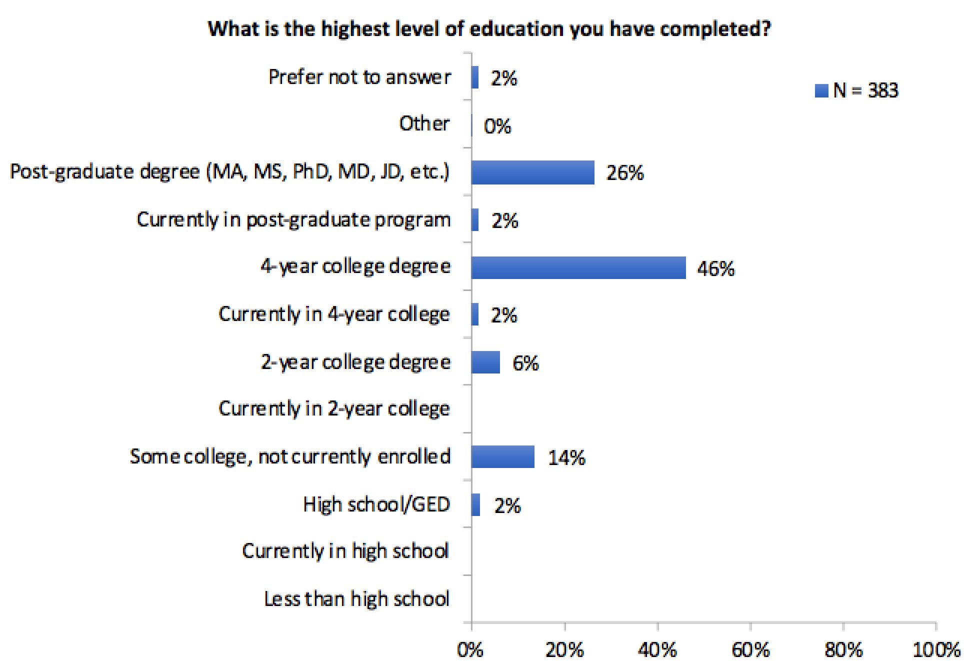


Figure A-123 *"After" Survey – All Groups – Race or Ethnic Identification*

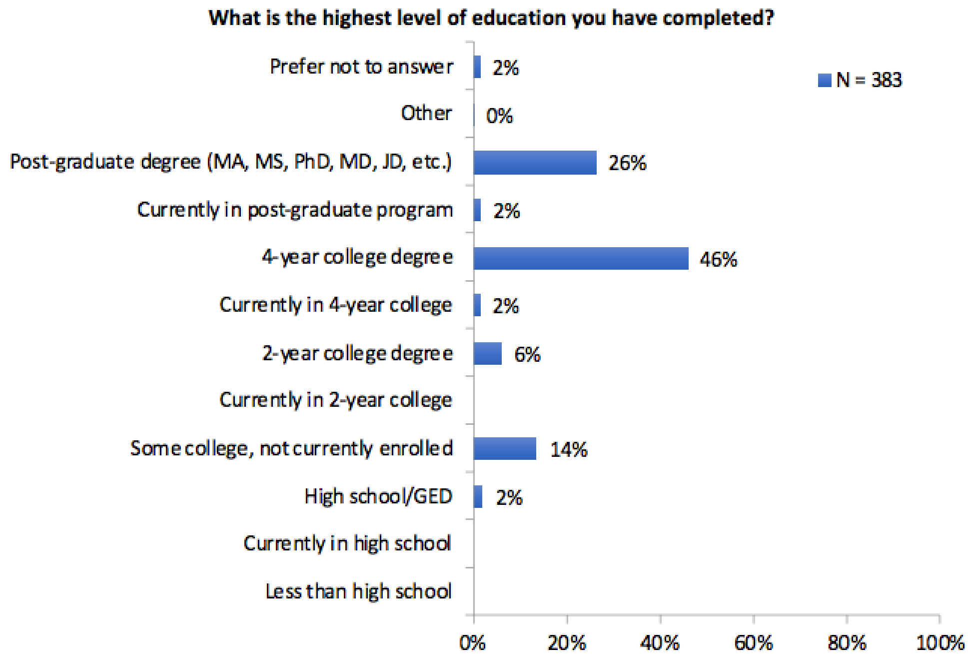
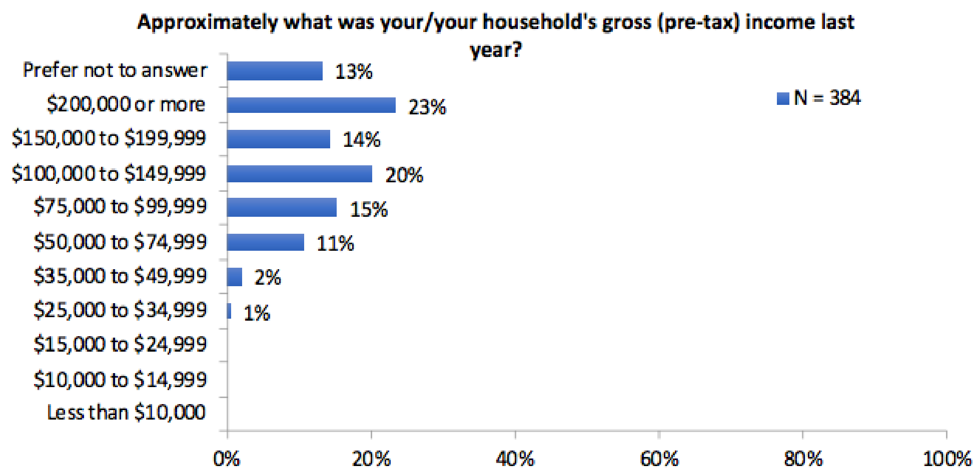


Figure A-124 *"After" Survey – All Groups – Household Income*



Appendix B Additional Activity Data Results

The following plots show additional activity data results. Trip activity data, recorded by RideAmigos, was used to generate time series distributions for mode share in each of the four participating cities—Cupertino, Menlo Park, Mountain View, and Palo Alto. The dataset did not include any trips by non-participants for the cities of Mountain View and Palo Alto.

Figure B-1 *Trip Mode Share Distribution for Cupertino – Pilot Participants*

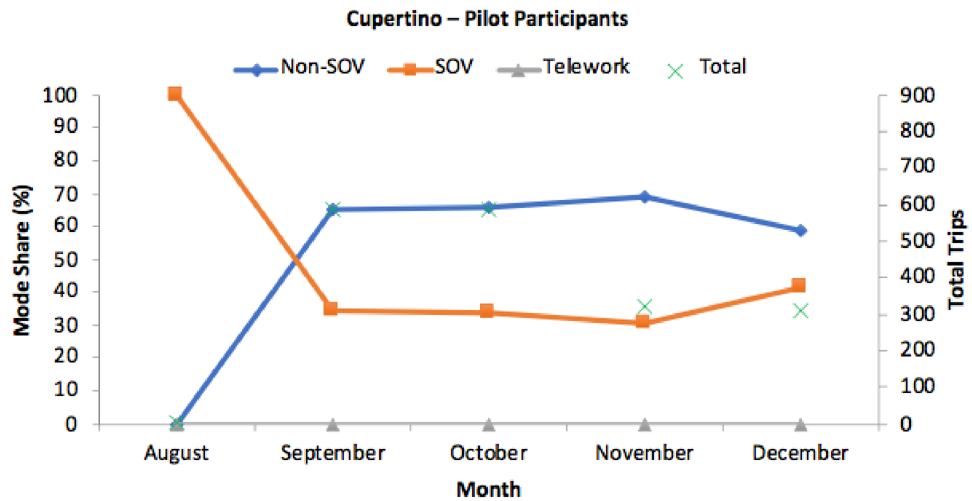


Figure B-2 *Trip Mode Share Distribution for Cupertino – Non-Participants*

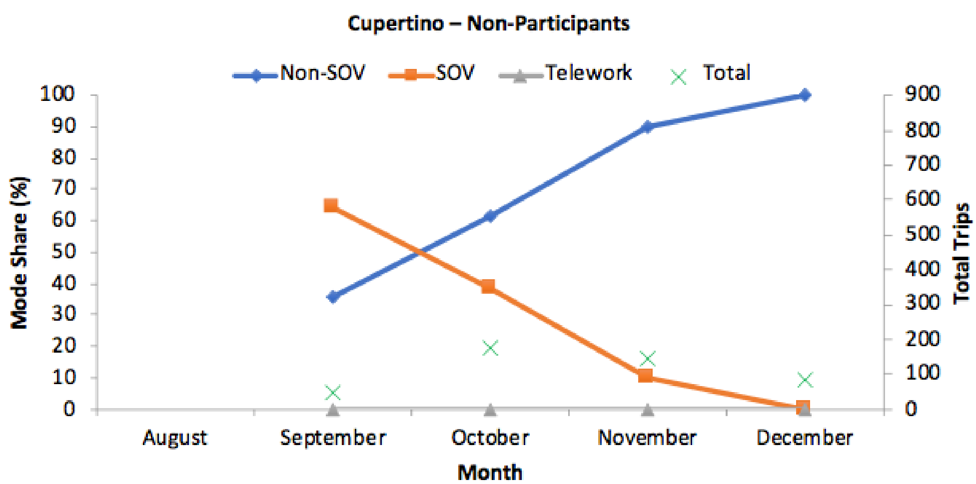


Figure B-3 *Trip Mode Share Distribution for Cupertino – TDM Managers*

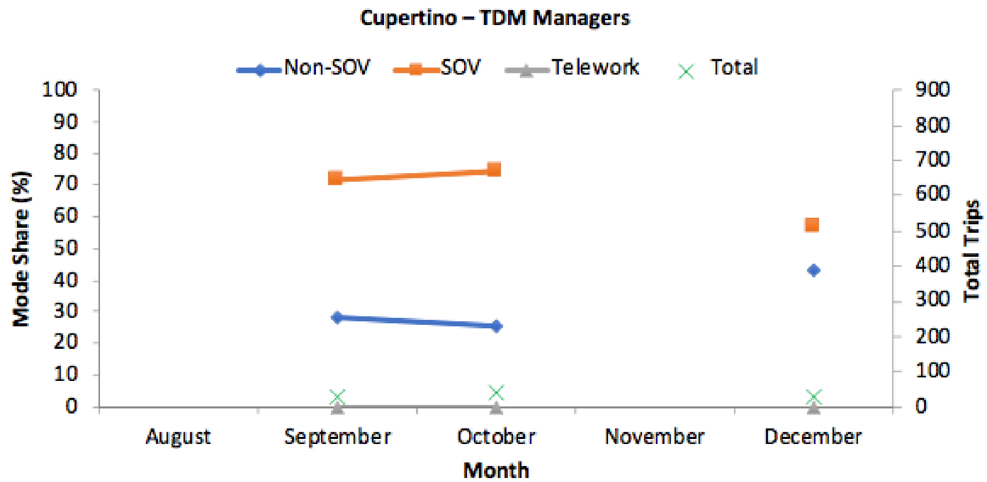


Figure B-4 *Trip Mode Share Distribution for Menlo Park – Pilot Participants*

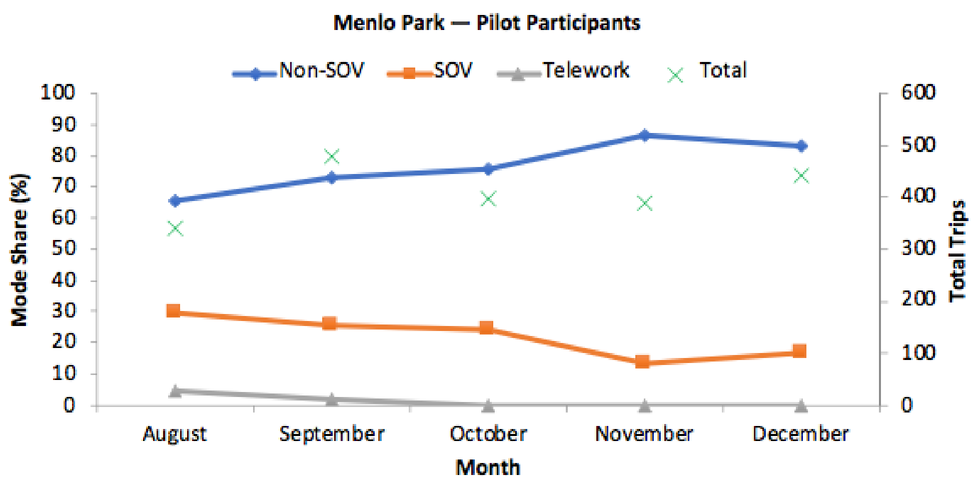


Figure B-5 *Trip Mode Share Distribution for Menlo Park – Non-Participants*

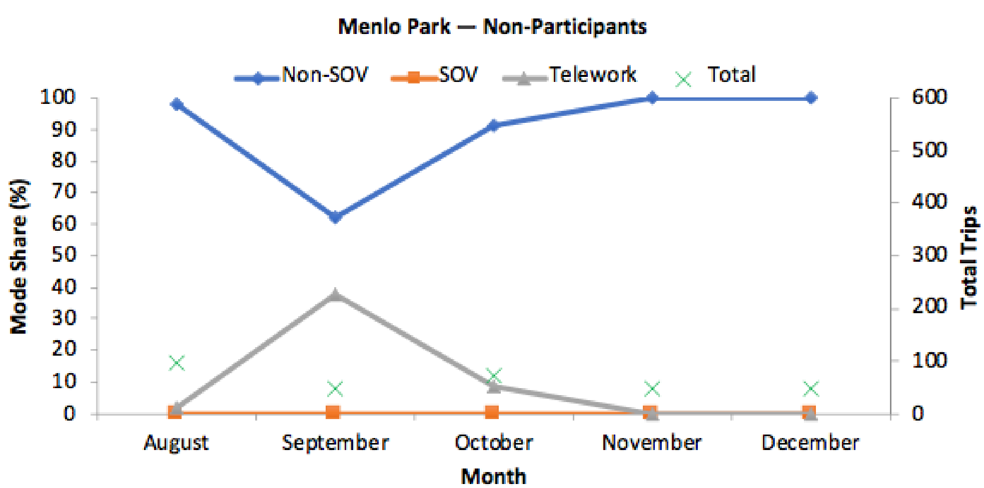


Figure B-6 *Trip Mode Share Distribution for Menlo Park – TDM Managers*

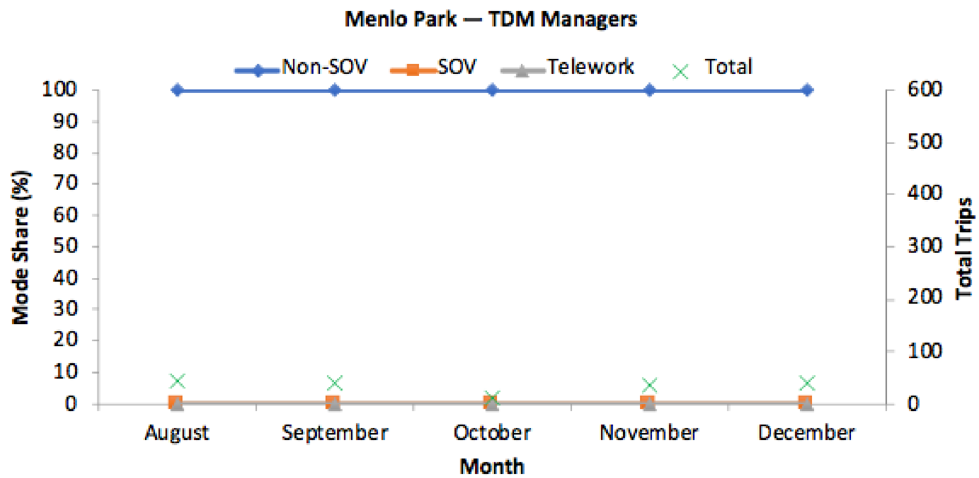


Figure B-7 *Trip Mode Share Distribution for Mountain View – Pilot Participants*

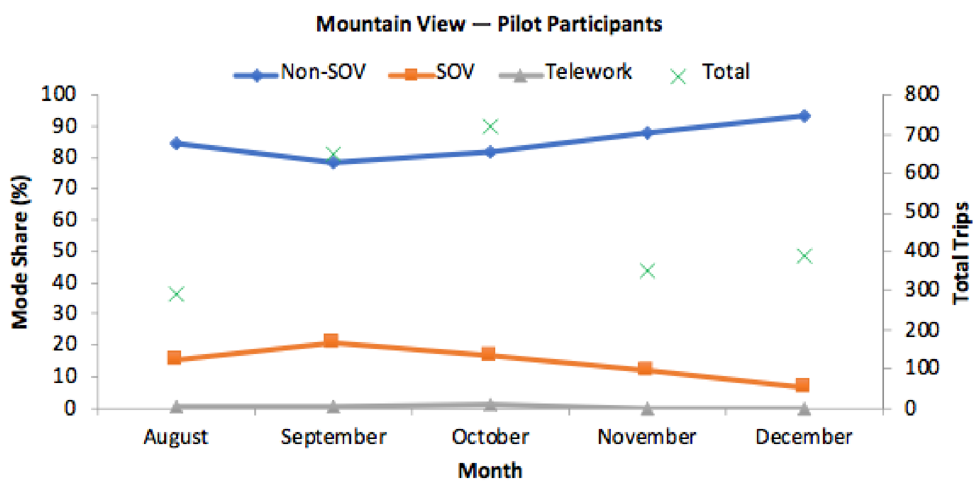


Figure B-8 *Trip Mode Share Distribution for Mountain View – TDM Managers*

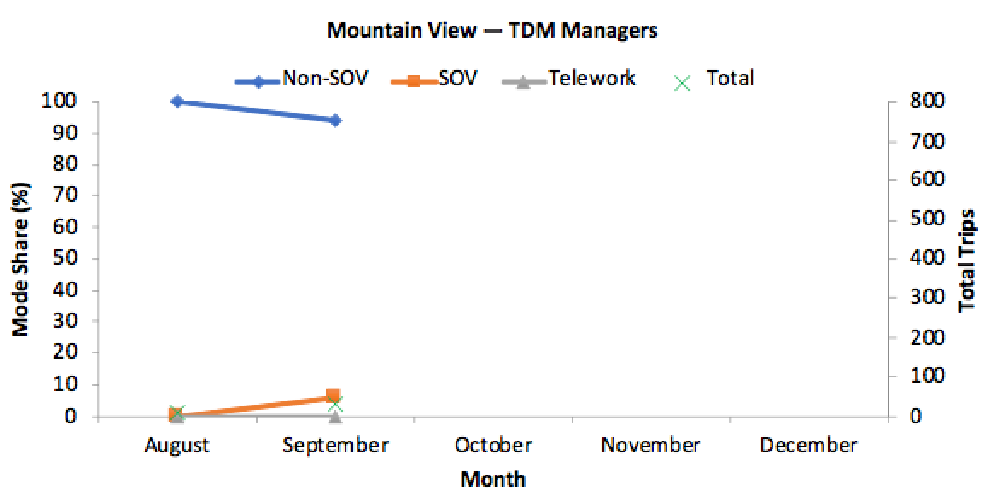


Figure B-9 *Trip Mode Share Distribution for Palo Alto – Pilot Participants*

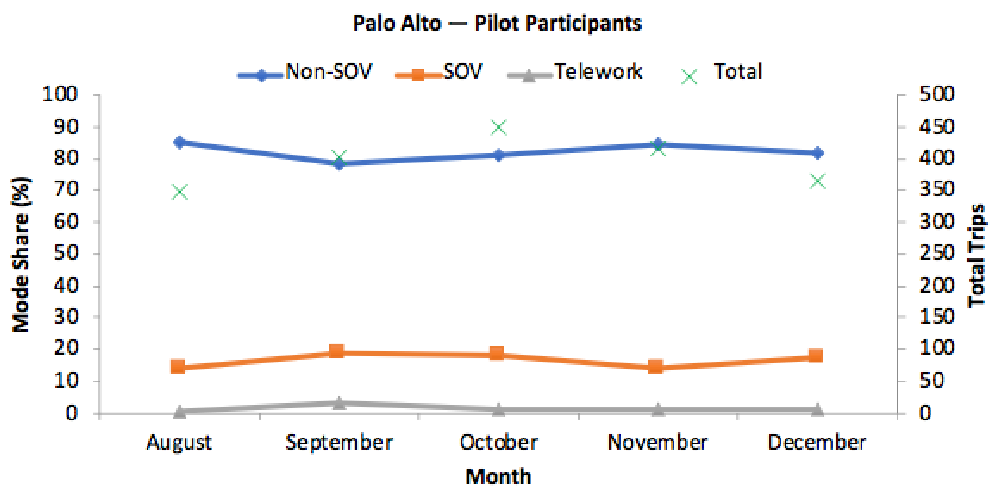
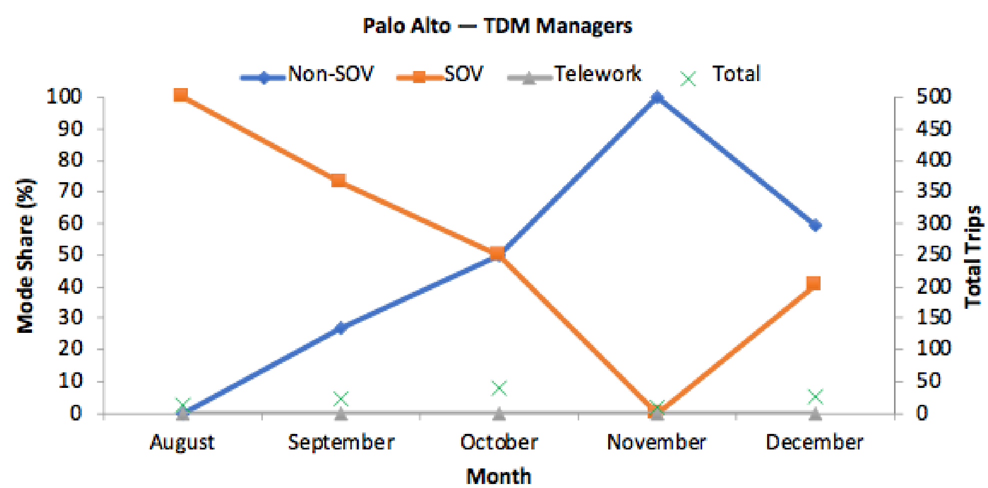


Figure B-10 *Trip Mode Share Distribution for Palo Alto – TDM Managers*



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