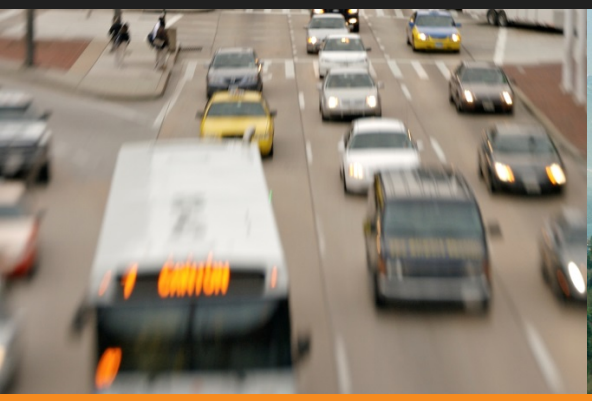
REPORT: SPRING 2014 HOUSEHOLD TRAVEL SURVEY

PUGET SOUND REGIONAL TRAVEL STUDY

RSG
the science of insight

8.18.2014



PREPARED FOR:
PUGET SOUND REGIONAL COUNCIL (PSRC)

SUBMITTED BY:
RSG, INC.

IN COOPERATION WITH:
ETC INSTITUTE AND TTI

55 Railroad Row
White River Junction, VT 05001
802.295.4999
www.rsginc.com

PUGET SOUND REGIONAL TRAVEL STUDY
REPORT: SPRING 2014 HOUSEHOLD TRAVEL SURVEY

PREPARED FOR:
PUGET SOUND REGIONAL COUNCIL (PSRC)

CONTENTS

1.0 INTRODUCTION 2
1.1 | Study Overview 2
1.2 | Study Objectives 2
1.3 | Spring 2014 Data Collection Overview 4
2.0 SURVEY SAMPLING 5
2.1 | Goal of Sample Plan 5
2.2 | Sample Method 5
Primary Sample Stratification 5
City of Seattle Supplemental Sample 7
2.3 | Monitoring During Data Collection 9
Snohomish County: Adjustment Due to Natural Disaster 10
King County: Adjustment Due to High Response 10
Pierce County: Adjustment due to Low Response 11
3.0 QUESTIONNAIRE DESIGN 13
3.1 | Overview 13
3.2 | Recruit Survey 13
Travel Date Assignment 14
3.3 | Retrieval Survey 15
3.4 | General Travel Behavior and Attitude Questions 19
4.0 PUBLIC OUTREACH 21
4.1 | Branding 21
4.2 | PSRC's Outreach Efforts 22

5.0 PILOT SURVEY 24
5.1 | Overview 24
5.2 | Approach 24
5.3 | Pilot Results 25
Demographics 25
Trip Rates 26
5.4 | Changes Made 26
5.5 | Conclusion 27
6.0 SURVEY ADMINISTRATION 28
6.1 | Invitation Materials 28
6.2 | Participation Methods 28
Online Survey Methods 29
Phone Survey Methods 29
6.3 | Communication Protocol 29
Phone Recruitment 29
Email and Phone Reminders 30
Email and Phone Inquiries 31
Mailings 32
6.4 | Survey Incentives 32
6.5 | Monitoring During Data Collection 33
7.0 DATA PREPARATION 34
7.1 | rSurvey™ Data Checks 34
7.2 | Dataset Preparation 35
Exclusion Criteria 35
Geographic Data Checks 35
Derived and Calculated Variables 36
Income Imputation 36
8.0 RESPONSE RATES 39
8.1 | Final Response Rates 39
9.0 EXPANSION AND WEIGHTING 43
9.1 | The Role of Weighting 43
9.2 | First stage expansion based only on sampling probabilities 43

9.3 | Establishing targets for re-weighting 45
9.4 | Use iterative proportional fitting to adjust the expansion weights to match the ACS targets 51
10.0 2014 SURVEY COMPARISON TO 2006 53
10.1 | Trip-Level Data 54
11.0 APPENDICES 58
11.1 | Questionnaire (in PowerPoint) 58
11.2 | Survey Screenshots 58
11.3 | Print Materials 58
11.4 | Example Email Reminders 58
11.5 | Open-ended Survey Comments 58
11.6 | Dataset Guide 58
11.7 | Unweighted tabulations 58
11.8 | Weighted tabulations 58

LIST OF FIGURES

FIGURE 1: PUGET SOUND REGIONAL TRAVEL STUDY AREA (FROM PSRC'S WEBSITE) 3
FIGURE 2: TRAVEL DIARY DASHBOARD 14
FIGURE 3: TRIP ROSTER 16
FIGURE 4: TRIP GEOCODER ADDRESS SEARCH 17
FIGURE 5: TRIP DETAILS (WALK TRIP) 17
FIGURE 6: TRANSIT SYSTEM USED ON TRIP 18
FIGURE 7: TRIP TRAPPER PROMPT 18
FIGURE 8: COPY TRIPS FEATURE 19
FIGURE 10: PUGET SOUND REGIONAL TRAVEL STUDY LOGO 21
FIGURE 11: STUDY WEBSITE 22
FIGURE 12: NEWS ARTICLES ABOUT THE PUGET SOUND REGIONAL TRAVEL STUDY 23
FIGURE 12: EMAIL INQUIRIES 31
FIGURE 14: RESPONSE RATES BY SEGMENT 42

LIST OF TABLES

TABLE 1: SPRING 2014 SURVEY COMPLETION OVERVIEW 4
TABLE 2: SAMPLE PLAN TARGETS BY SAMPLING SEGMENT 6
TABLE 3: SAMPLE TARGETS BY COUNTY 7
TABLE 4: CITY OF SEATTLE URBAN VILLAGE (UV) SAMPLE GROUPS AND TARGETS 8
TABLE 5: KING COUNTY INVITATION REDUCTIONS BY SAMPLE SEGMENT 10
TABLE 6: PIERCE COUNTY SAMPLE INCREASES BY SAMPLE SEGMENT 11

TABLE 7: PILOT SAMPLING RATES 24
TABLE 8: PILOT RESPONSE RATE 25
TABLE 9: PILOT STUDY VEHICLE OWNERSHIP 25
TABLE 10: PILOT STUDY HOUSEHOLD INCOME 26
TABLE 11: PILOT STUDY TRIP RATES 26
TABLE 12: GIFT CARD TYPE AND AMOUNT 33
TABLE 14: FINAL (IMPUTED) INCOME CATEGORY VERSUS REPORTED INCOME FOR ALL HHS 37
TABLE 15: RESPONSE RATES BY SAMPLE GROUPS 39
TABLE 16: ORIGINAL SAMPLING PLAN - RESPONSE RATES BY COUNTY 40
TABLE 17: ADJUSTED RESPONSE RATES BY COUNTY 40
TABLE 18: RESPONSE RATES BY SAMPLING SEGMENT 41
TABLE 19: FIRST STAGE EXPANSION FACTORS BY SAMPLING SEGMENT 44
TABLE 20: DIFFERENCE BETWEEN HOUSEHOLD SIZE TARGETS AT THE COUNTY LEVEL FOR 2012 1-YEAR ACS COMPARED TO 2008-12 5-YEAR ACS 45
TABLE 21: PUMA-LEVEL TARGETS BASED ON ACS 2012, AND DIFFERENCE FROM INITIAL EXPANDED SAMPLE 46
TABLE 22: SURVEY DIFFERENCE FROM ACS TARGET AFTER INITIAL EXPANSION: HH SIZE 48
TABLE 23: SURVEY DIFFERENCE FROM ACS TARGET AFTER INITIAL EXPANSION: HH WORKERS 49
TABLE 24: SURVEY DIFFERENCE FROM ACS TARGET AFTER INITIAL EXPANSION: HH INCOME 49
TABLE 25: SURVEY DIFFERENCE FROM ACS TARGET AFTER INITIAL EXPANSION: HH VEHICLES 50
TABLE 26: SURVEY DIFFERENCE FROM ACS TARGET AFTER INITIAL EXPANSION: HH LIFECYCLE STAGE 50
TABLE 27: MEAN VALUES OF FINAL EXPANSION FACTOR BY SAMPLING SEGMENT 51
TABLE 28: NUMBERS OF HOUSEHOLDS, PERSONS AND TRIPS, UNWEIGHTED 53
TABLE 29: NUMBERS OF HOUSEHOLDS, PERSONS AND TRIPS, WEIGHTED 53

ACKNOWLEDGEMENTS

The Puget Sound Regional Travel Study was supported by the efforts and advice of many regional partners. The Puget Sound Regional Council (PSRC) offers their thanks and appreciation to these agencies and their staff for their input on this study.

PSRC

Neil Kilgren, Project Manager and Senior Planner
Billy Charlton, Program Manager
Suzanne Childress, Senior Modeler
Michael Jensen, Senior Planner
Chris Johnson, Principal Modeler
Mark Simonson, Principal Planner

OTHER AGENCIES/ ORGANIZATIONS

City of Bellevue
City of Seattle
Washington State Department of Transportation
King County
Kitsap County
Pierce County
Snohomish County
Members and attendees of PSRC's Regional Technical Forum
Members and attendees of PSRC's Model Users Group
PSRC's Government Relations & Communications Department

CONSULTANT TEAM

RSG, Inc. (RSG)
ETC Institute (ETC)
Texas A&M Transportation Institute (TTI)

1.0 INTRODUCTION

1.1 | STUDY OVERVIEW

In spring of 2014, the Puget Sound Regional Council (PSRC) initiated the Puget Sound Regional Travel Study, which began with a Household Travel Study (HTS) conducted to collect current information about household and individual travel patterns for residents throughout the PSRC four-county region. PSRC will use the results of this study to update the region's travel and land use models and to calibrate local traffic and travel models. The study can also help PSRC and its regional partners develop plans that accommodate the diverse travel needs and preferences of residents. The results of this study can potentially also be compared to the results of similar studies conducted in 1999 and 2006 to understand changing trends in travel behavior over time.

The primary goals of the study were to collect complete travel information for a 24-hour weekday period from a representative sample of households from the region, as well as collecting a sufficient sample of households that may be more difficult to reach but are important to transportation policies and plans. This includes (but is not limited to) low-income households, low- or no-vehicle households, households in policy-relevant neighborhoods (such as regional growth or transit-oriented development areas), and households that frequently make transit or non-motorized trips. The study collected information from households across the four counties in the PSRC region (King, Kitsap, Pierce and Snohomish), including households from 82 cities and towns as well as rural areas (as shown in Figure 1).

In addition to the spring 2014 household data collection effort, the Puget Sound Regional Travel Study will subsequently also include a college population travel survey in fall of 2014, as the region's university students are unlikely to be sufficiently represented in a household study. Then in spring of 2015, a second household data collection effort will be conducted as part of an effort to collect data more frequently, to collect GPS data, and to collect a sample of longitudinal data from households that had also completed the 2014 HTS.

This report presents the methodology and results of the spring 2014 HTS.

1.2 | STUDY OBJECTIVES

The following key objectives were identified in the scope of work.

- Build better urban system models (land use and travel models) that predict what
- impacts changes in land uses, policies, demographic or economic standing, etc. will have on travel behavior
- Develop a more complete assessment of current travel times and costs, both actual and perceived, facing users in the region
- Improve the "predictive" ability of planners in evaluating the impacts of future actions on travel patterns and facility usage

- Support both long-term (such as household location choice) and short-run (such as destination and mode) choice models;
- Establish a continuous survey program for ongoing collection of travel behavior

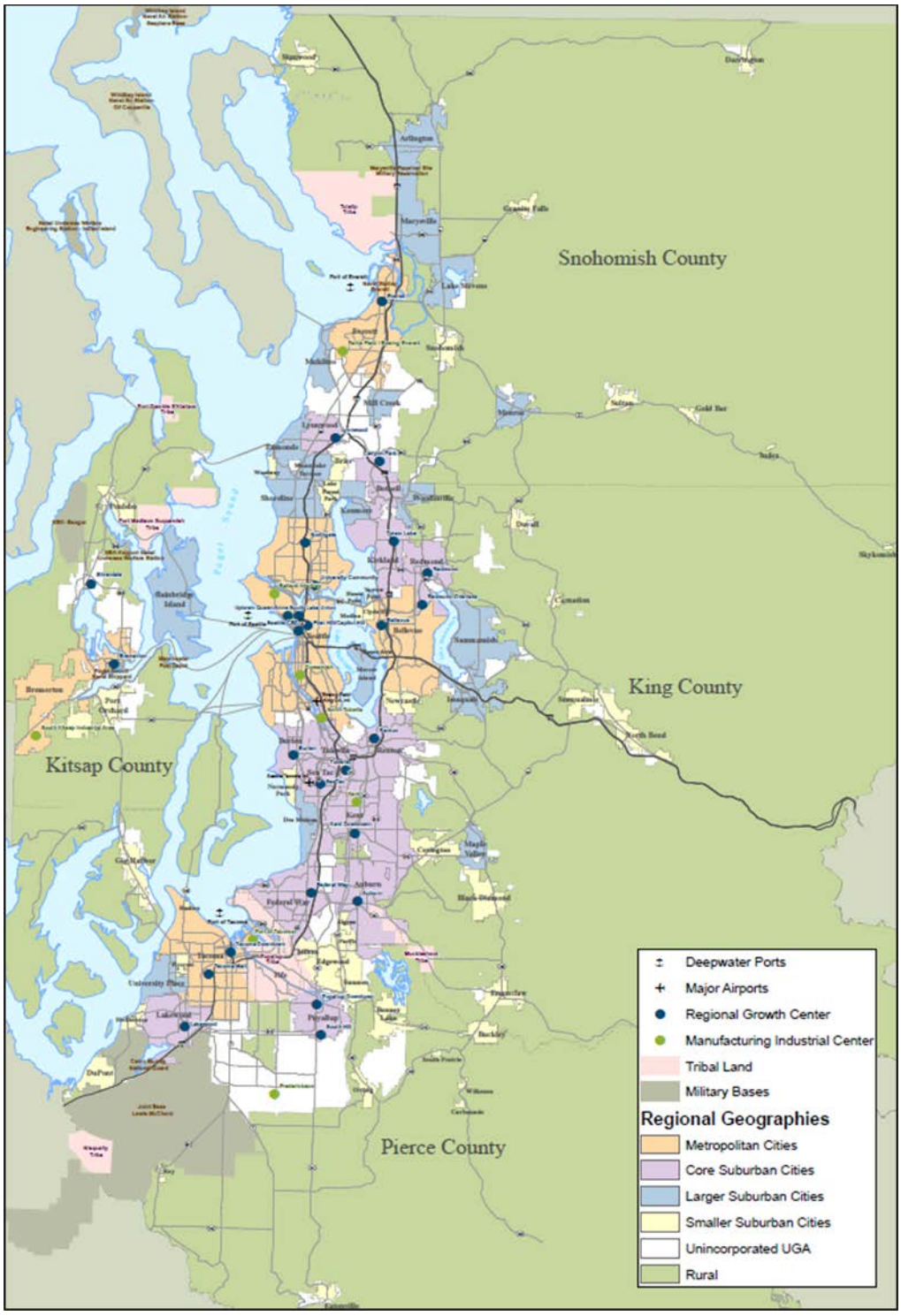


FIGURE 1: PUGET SOUND REGIONAL TRAVEL STUDY AREA (FROM PSRC'S WEBSITE)

1.3 | SPRING 2014 DATA COLLECTION OVERVIEW

The initial goal for the spring 2014 data collection was to collect data from a minimum of 4,700 households in region. In addition to the PSRC funded households, the City of Bellevue funded collection of 300 additional households, and the City of Seattle funded collection of 150 additional households. Data collection took place between April 8 and June 12, 2014. Table 1 is an overview on the spring 2014 data collection effort.

In the spring of 2015 a booster sample of 1,200 households, including a panel of 600 households from the 2014 survey will be surveyed using the same methodology and materials. In addition, a subsample of 250 households (also drawn from the 2014 survey) will use a smartphone application to collect GPS paths for travel over a 24-hour period.

TABLE 1: SPRING 2014 SURVEY COMPLETION OVERVIEW

Sample Area	Recruited	Completed	Retention Percentage	Target HHs	Percent Target
King County	3,615	2,993	82.8%	2,625	114.0%
Kitsap County	442	369	83.5%	311	118.3%
Pierce County	1,247	1020	81.8%	926	110.8%
Snohomish County	984	798	81.0%	756	105.0%
PSRC Sub-Total	**6,288**	**5,180**	**82.4%**	**4,618**	**112.2%**
City of Bellevue Supplement	403	337	83.6%	299	112.7%
City of Seattle Supplement	670	577	86.1%	150	384.7%
Grand Total	**7,361**	**6,094**	**82.8%**	**5,067**	**120.3%**

2.0 SURVEY SAMPLING

2.1 | GOAL OF SAMPLE PLAN

The primary goal of the PSRC Spring 2014 sample plan was to yield data that is reflective of the demographic and travel behavior characteristics of study area residents in order to ensure that representative parameters can be generated for the PSRC travel demand model. To meet this goal, the address-based sampling plan for the PSRC Spring 2014 household travel survey included a combination of simple geographic proportional sampling, along with targeted "oversampling" (higher sampling rates) in selected geographic areas. For this analysis, the main geographic unit used was Census block groups. Block groups are the smallest areas for which the desired variables are available from the American Community Survey (ACS). Because there are often small ACS sample sizes within individual block groups, the block group data are only available using five years of aggregated data (in this case 2007-2011).

It would have been possible to use larger areas such as Census tracts or counties for this analysis in order to rely on fewer years of data and focus more on the most recent years. However, there is typically greater demographic variation across block groups within the same tract than there is across recent years within the same block group. Therefore, the approach was to use the maximum geographic detail that is available. Using block group geography allowed for oversampling to take place at a more refined level than the most recent survey effort in 2006, which used transit maps to define 'high transit areas' at the ZIP+2 level.

2.2 | SAMPLE METHOD

The spring 2014 HTS recruited households using a stratified address-based sampling method. Addresses were obtained from Marketing Systems Group (MSG), a data vendor that maintains the US Post Office's Computerized Delivery Sequence File (CDSF). The CDSF is a regularly list of all mailing addresses in the US, providing coverage for approximately 97% of all households.

PRIMARY SAMPLE STRATIFICATION

The sampling frame for the spring 2014 HTS included all Census block groups in the four-county study area. This study's primary sample was stratified to increase the data collected from particular types of households. To define the stratification plan, the block groups were grouped into "proportional" and "oversample" sampling areas based on the sampling and analysis goals. The "oversample areas" were defined as block groups that either were located in PSRC's Regional Growth Centers (RGCs), defined by PSRC and its member agencies as target areas for implementing urban growth policies, or which contained high proportions of household types or behaviors of interest (i.e. low-income, 0-vehicle, young non-family, or non-car commuting). Higher sampling rates were used for these areas in order to provide sufficient data to analyze these areas, household types, and behaviors of interest.

In addition to identifying and applying higher sampling rates to "oversample areas" with households and behaviors of interest, the final number of households invited to the study was increased in areas with lower incomes due to expected lower response rates. For example, in the 2013 South Sound Travel Study (conducted in Thurston and Pierce Counties just south of the PSRC study area), approximately 4% of households in low-income areas (i.e., where more than 30% of households had incomes less than $25,000) responded to the survey on average. In comparison, approximately 7% of households from higher income areas responded to that same survey. Increasing the number of invitations in low-income areas helps mitigate the impact of the lower response rates so that the benefit of oversampling is not "undone".

While the majority of the PSRC study area was given a uniform set of sampling targets, the block groups within the City of Bellevue were grouped separately because Bellevue contributed additional funds to increase the total number of samples within their City. However, the Bellevue stratification methods were the same as the rest of the region; the final sampling rates were simply increased uniformly to meet the Bellevue targets.

Table 2 summarizes the sampling rates, expected response rates, and quantity of invitations planned for each of the sample groups described above. It is important to note that this summary table does NOT include additional samples obtained for the City of Seattle after the PSRC sampling plan had been finalized. The City of Seattle sample targets overlap with all of the sample areas listed below, but this sample was allocated separately, as discussed in the next section.

TABLE 2: SAMPLE PLAN TARGETS BY SAMPLING SEGMENT

SAMPLE AREA DESCRIPTION	TOTAL # HHS IN AREA	TARGET SAMPLING RATE	TARGET # COMPLETE HHS	EXPECTED RESPONSE RATE	TOTAL # PLANNED INVITATIONS
Regular Higher Income	694,578	0.24%	1,677	7.0%	24,700
Regular Medium Income	323,513	0.24%	781	5.5%	14,700
Regular Lower Income	47,003	0.24%	113	4.0%	3,000
Oversample Higher Income	78,316	0.62%	482	7.0%	7,100
Oversample Medium Income	94,483	0.62%	581	5.5%	10,900
Oversample Lower Income	159,445	0.62%	984	4.0%	25400
Bellevue Regular Higher Income	29,936	0.39%	118	7.0%	1,800
Bellevue Regular Medium Income	9,150	0.40%	37	5.5%	700

SAMPLE AREA DESCRIPTION	TOTAL # HHS IN AREA	TARGET SAMPLING RATE	TARGET # COMPLETE HHS	EXPECTED RESPONSE RATE	TOTAL # PLANNED INVITATIONS
Bellevue Oversample Higher Income	7,238	0.94%	68	7.0%	1,000
Bellevue Oversample Medium Income	7,261	1.05%	76	5.5%	1,500
TOTAL	**1,450,923**	**0.34%**	**4,917**	**5.6%**	**90,800**

(1) # HHs in sample area Census block groups from the ACS 2007-2011 5-year data

(2) Target Sampling Rate = % of total HHs in sampling area desired in the final dataset

*(3) Target # Complete HHs = Target sampling rate * Total # HHs*

(4) Total # HHs Invited = Target # Complete HHs / Expected Response Rate (rounded up to account for bad addresses). These numbers from the sample plan include addresses that were discarded before mailing due to incomplete address information or that the name / address matched PSRC staff.

The sample targets for each sample area described above were further divided across the four counties in the region. The sampling targets for the counties are summarized in Table 3. Again, the King County sample target and invitation quantity shown do not include the additional City of Seattle sample.

TABLE 3: SAMPLE TARGETS BY COUNTY

COUNTY	TOTAL # HHS IN REGION	TARGET SAMPLING RATE	TARGET # COMPLETE HHS	TOTAL # MAILED INVITATIONS
King	790,070	0.39%	2,924	43,308
Kitsap	96,683	0.32%	311	5,500
Pierce	297,839	0.31%	926	20,322
Snohomish	266,331	0.28%	756	12,663
Total	**1,450,923**	**0.34%**	**4,917**	**81,793**

(1) # HHs in sample area Census block groups from the ACS 2007-2011 5-year data

(2) Target Sampling Rate = % of total HHs in sampling area desired in the final dataset

*(3) Target # Complete HHs = Target sampling rate * Total # HHs*

(4) Total # HHs Invited (mailed to) = Target # Complete HHs / Expected Response Rate (rounded up to account for bad addresses)

CITY OF SEATTLE SUPPLEMENTAL SAMPLE

The City of Seattle, like the City of Bellevue, contributed additional funds to increase the sample sizes in Seattle's "Urban Villages" (key planning areas in the City). The City of Seattle sample targets were not included in the primary stratification calculation used for the PSRC and Bellevue due to the timing associated with the contracting process. Instead, City of Seattle sample targets were calculated and tracked independently.

PSRC, RSG, and the City of Seattle worked together to consolidate the 41 Urban Village areas into 18 sample groups (villages were grouped primarily by geographic proximity). This grouping, shown in Table 4, was done because the several of the urban villages were too small in population to set reasonable individual sample targets.

The City of Seattle add-on sample also used Census block groups for the sampling frame, and sample addresses were obtained from MSG along with the primary sample described above. As previously noted, the Urban Village areas overlap with the primary sample areas; however, the targets shown below only describe the number of complete household records desired for the City of Seattle add-on sample.

At the time that the sample addresses had to be obtained, the City of Seattle targets had not yet been finalized. In order to remain efficient and stay on schedule, PSRC elected to spend additional funds and purchase a large sample (10,000 addresses) spread across all of the Urban Villages. This was many more addresses than were required to meet the targets, but as discussed later in this report, many of these addresses were ultimately removed from the sample before the end of the study. In all, invitations were mailed to 6,617 households as part of the City of Seattle add-on subsample funded by both the City and PSRC. The completion targets and number of invited households by Urban Village group are shown in Table 4.

TABLE 4: CITY OF SEATTLE URBAN VILLAGE (UV) SAMPLE GROUPS AND TARGETS

UV GROUPS	URBAN VILLAGE NAMES	TARGET # COMPLETE HHS	TOTAL # HHS INVITED
1	Bitter Lake Village Lake City Northgate	8	360
2	Aurora-Licton Springs Crown Hill Greenwood-Phinney Ridge	7	324
3	Green Lake Ravenna Roosevelt	6	267
4	University Campus University District Northwest	9	371
5	Fremont Wallingford	6	266
6	Ballard Ballard-Interbay-Northend	12	520
7	Eastlake	4	162

UV GROUPS	URBAN VILLAGE NAMES	TARGET # COMPLETE HHS	TOTAL # HHS INVITED
8	Upper Queen Anne Uptown	12	510
9	Capitol Hill South Lake Union	18	757
10	Pike/Pine	7	301
11	12th Avenue First Hill	18	779
12	Belltown Denny Triangle	7	310
13	Chinatown-International District Commercial Core Pioneer Square	5	212
14	23rd & Union-Jackson Madison-Miller	7	292
15	Admiral Greater Duwamish West Seattle Junction	7	294
16	Morgan Junction South Park Westwood-Highland Park	5	192
17	North Beacon Hill North Rainier	5	228
18	Columbia City Othello Rainier Beach	7	301
	TOTAL	**150**	**6,617**

2.3 | MONITORING DURING DATA COLLECTION

The sample targets and invitation quantities shown in Table 2 describe the first step to recruiting households for the study. Households that agreed to participate in the study (i.e. recruited HHs) and that reported their travel (i.e. retrieved) were monitored daily (using both the real-time tracking website and other means) throughout the study to help estimate how closely the final dataset was likely to match the target sample targets in each segment. Adjustments were made at multiple points during the survey period to ensure that the final

sampling targets would be met and maximized as best possible. The significant sample adjustments that were made during 2014 data collection are detailed below.

SNOHOMISH COUNTY: ADJUSTMENT DUE TO NATURAL DISASTER

The first sample adjustment was not made due to response rates or other internal study factors, but was implemented due to a natural disaster that occurred in the study area immediately prior to the start of data collection. In late March 2014, a mudslide on State Road 530 in northern Snohomish County destroyed numerous homes and affected many more households in the surrounding area. In recognition of this disaster, 678 households in the area and in nearby communities that were in the original invitation list were removed.

The sample targets for Snohomish County were not adjusted (i.e. lowered) even though fewer households were invited, and therefore the final number of Snohomish records was slightly lower than the survey target. This shortfall was made up for by including the 173 responses from the pilot survey (including 74 households from Snohomish County) to the dataset. For additional details about combining the pilot survey data to the main survey dataset, see Section 7.0 of this report.

KING COUNTY: ADJUSTMENT DUE TO HIGH RESPONSE

After several weeks of data collection were complete, it was determined that as designed, the expected final dataset would significantly exceed the sample targets in the King County segments. This was partially because the initial City of Seattle sample was larger than required (as previously discussed). It was also due to higher than expected response rates from very engaged survey respondents (in certain areas response rates averaged between 8-11%). In order to counteract this and avoid budget overruns (due to the additional incentive payments that would be required), 14,173 King County invitations originally scheduled to be mailed during the last three weeks of data collection were cancelled. Table 5 shows number of cancelled invitations per segment in King County.

TABLE 5: KING COUNTY INVITATION REDUCTIONS BY SAMPLE SEGMENT

SAMPLE AREA NAME	# ORIGINAL INVITES	# INVITES CANCELLED	FINAL # INVITES
Regular - Higher Income	12,635	1,393	11,242
Regular - Medium Income	6,128	1,097	5,031
Regular - Lower Income	1,319	0	1,319
Oversample – Higher Income	5,677	1,560	4,117
Oversample – Medium Income	8,263	2,280	5,983
Oversample – Lower Income	15,000	4,135	10,865
Bellevue Regular – Higher Income	1,800	248	1,552
Bellevue Regular - Medium Income	700	0	700
Bellevue Oversample - Higher Income	999	0	999
Bellevue Oversample - Medium Income	1,500	0	1,500

SAMPLE AREA NAME	# ORIGINAL INVITES	# INVITES CANCELLED	FINAL # INVITES
City of Seattle Urban Villages	10,000	3,460	6,540
TOTAL	**64,021**	**14,173**	**49,848**

Concurrently, all households assigned to travel dates in the last week of May (the week of Memorial Day) were re-assigned to travel dates in June. This schedule adjustment allowed for a week without any data collection while the sample size adjustments were being finalized, retained a substantive sample collected in June, and also minimized any potential impact on 'typical travel' from the Memorial Day holiday.

PIERCE COUNTY: ADJUSTMENT DUE TO LOW RESPONSE

In contrast to King County, response rates in Pierce County over the first several weeks of data collection were lower than expected for all segments within the county (between 3-5% on average). Therefore, at the same time that the King County sample sizes were reduced, 2,297 additional addresses were obtained for Pierce County. These addresses were added to the last two weeks of the study. This increase was expected to result in approximately 100 more complete household records, ensuring that the Pierce County targets were met.

In addition to obtaining more address-based samples, 99 Pierce County households that had completed the 2013 South Sound Travel Study and had volunteered for future studies were also invited to participate in the PSRC study. An advantage to inviting the South Sound households was that the response from these volunteers would provide a proxy estimate for how panel households re-invited to the 2015 PSRC study might respond.

Table 6 summarizes the additional sample addresses obtained from the sample vendor (MSG) and from South Sound volunteers for sample areas in Pierce County.

TABLE 6: PIERCE COUNTY SAMPLE INCREASES BY SAMPLE SEGMENT

SAMPLE AREA NAME	# ORIGINAL INVITES	# EXTRA INVITATIONS MSG	# EXTRA INVITATIONS SOUTH SOUND	FINAL # INVITES
Regular – Higher Income	5,309	1,180	26	6,515
Regular – Medium Income	3,679	629	26	4,334
Regular – Lower Income	812	92	7	911
Oversample - Higher Income	144	10	4	158
Oversample - Medium Income	1,306	81	10	1,397
Oversample - Lower Income	6,676	305	26	7,007

SAMPLE AREA NAME	# ORIGINAL INVITES	# EXTRA INVITATIONS MSG	# EXTRA INVITATIONS SOUTH SOUND	FINAL # INVITES
TOTAL	**17,926**	**2,297**	**99**	**20,322**

3.0 QUESTIONNAIRE DESIGN

3.1 | OVERVIEW

In fall 2013 RSG was commissioned by PSRC to assist in scoping the 4-county region's next household travel survey, to be carried out starting in 2014. The main tasks RSG performed included:

- Assessing PSRC's potential modeling needs and subsequently describing options for addressing those modeling needs in future surveys.
- Providing background, methodology, and recent examples on the different options for designing the core features of the next household travel survey.
- Providing a more focused "menu" of relevant survey design options for PSRC to rank and select from when planning the next PSRC household travel survey.
- Providing examples of questions to be included in the survey and ranking them as essential or "nice-to-have" questions.

At each of these stages, RSG obtained PSRC staff feedback about priorities for each of the various options, and that feedback was used to provide more focused options and examples for the next task. As noted, the final task was focused on data variables for the questionnaire. As part of the task, RSG and PSRC reviewed potential data variables from recent U.S. studies including the 2006 PSRC survey, the California statewide study, and the neighboring region (TRPC) survey. Ultimately, a master list of data variables were ranked and prioritized and the list was used to draft a questionnaire in December 2013.

In February 2014, the questionnaire was updated. There are three primary sections in the questionnaire:

- Recruit survey with information about the household and its members and vehicles
- One-day (24-hour) travel diary for each person over age 5 (Retrieval Survey)
- Person-level travel behavior and attitude questions

The questions included in each section of the survey are described below. The full wording and design of each survey question along with all survey screenshots are provided in a separate appendix.

3.2 | RECRUIT SURVEY

The recruit survey was designed as a separate survey that households completed prior to starting their travel diaries. Households could complete the recruit survey prior to their travel date, on, or immediately after their travel date. If completed after their travel date, they could then proceed directly to the travel diary (trip reporting) portion of the survey.

The recruit survey focuses primarily on household-level demographics, basic person-level demographics, and administrative questions such as contact information and incentive preferences to aid in the diary administration. Data obtained included the following variables:

- Household composition (number of members and relationships to householder)
- Household demographics (e.g. income)
- Number and type of household vehicles (e.g. make, model, year of vehicle, and year obtained vehicle)
- Person-level demographics (e.g. age, gender, employment, education status)
- Person-level behaviors used to dynamically design certain diary questions (e.g. toll road use, smartphone ownership)
- Current home location, type and tenure (ownership status and duration)
- Factors influencing current home location choice
- Previous home information (if moved in past 5 years)
- Administrative data (e.g. contact information, incentive preferences and willingness to participate in future studies)

Only one (adult) household member was required to complete the recruit survey. Once this section was complete, respondents were shown (or read) a survey dashboard with further instructions about logging their travel day trips and completing the diary (Figure 2). Household members returned to this dashboard after their travel date to access and complete the individual travel diaries.

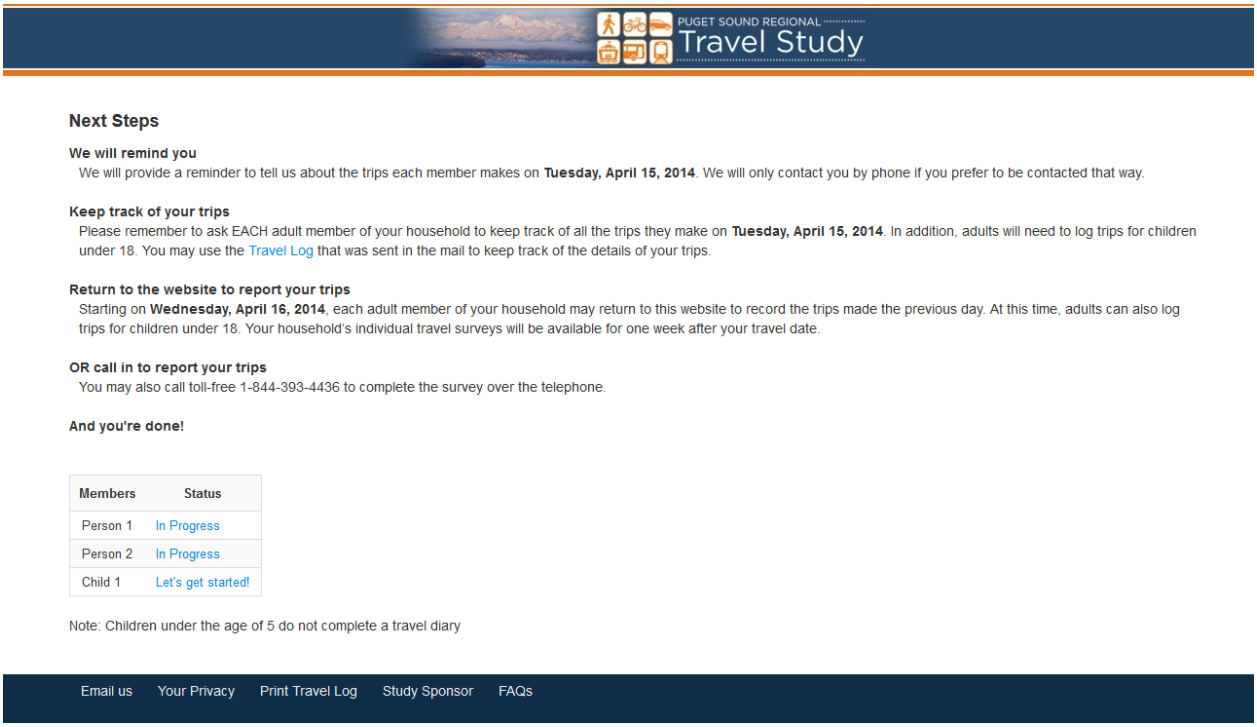


FIGURE 2: TRAVEL DIARY DASHBOARD

TRAVEL DATE ASSIGNMENT

The households invited to the survey were assigned to one of 29 "travel dates" during ten weeks in April, May or June 2014. All members of each household were asked to report all the trips they made during their pre-assigned 24-hour travel date. All travel dates were on a

Tuesday, Wednesday or Thursday (households were not sampled on the Tuesday after Memorial Day). This is a common approach for household travel surveys because travel on these days is more frequently expected to represent "typical" household travel patterns.

Travel dates were pre-assigned and invitations were spread over 10 weeks so that the recruitment and survey retrieval process could be easily managed. In particular, this allowed responses to be tracked over time so that adjustments to the process could be made as needed (e.g.; sample sizes, recruitment methods, or other adjustments). More details about sample monitoring and adjustments are available in the next section of the report.

3.3 | RETRIEVAL SURVEY

The retrieval survey included a 24-hour travel diary, as well as questions about general travel behavior and attitudes. The diary collected trip-making behavior for every household member (age 5+) on a single pre-assigned Tuesday, Wednesday or Thursday (the household's travel date). The retrieval survey was made available to respondents at the conclusion of the assigned travel date.

The first question was a proxy reporting question to determine whether the respondent was filling out his or her own survey, was present while another household member filled out the survey, or was not present while the survey was filled out by another household member. This question was used to skip certain questions (explained later in this section) for respondents who were not present while another household member filled out the survey for them.

The diary questions included the following for each person:

- Where they started and ended their travel day (defined as 24-hours beginning at 3AM on the travel date)
- A full list of all of the places they went during the travel day (Figure 3).
  - If respondents did not go anywhere, they were asked to select one or more reasons why they did not travel
- The exact location of each place they went on their travel day (geocoded on a map, see Figure 4)
- For the trip to each destination, respondents were asked:
  - When they traveled (when they started traveling and when they arrived)
  - The primary purpose of their trip (e.g. go to work, personal errands, etc.)
  - How they traveled (e.g. driving, carpooling, riding transit, walking, etc.)
  - Whom they traveled with (other household members and non-household members) (asked unless it was a drive-alone trip). See Figure 5 for an example of a walk/bike trip.
- Additionally, for driving trips, respondents were asked about:
  - Toll road use (if they typically used a toll road at least once per week)

  - Type and cost of parking location
  - Park and Ride lot location (if applicable)

- Additionally, for carpool or vanpool trips (including family-only as well as traditional carpool trips), respondents were asked:
  - Where the carpool started
  - Whether they were the driver or passenger
- Additionally, for transit trips, respondents were asked:
  - How they got to and from the transit stop
  - Which specific transit systems and routes were used (Figure 6).
- Additionally, for taxi trips, respondents were asked:
  - The total cost of the taxi fare for the trip
  - The type of taxi (e.g. Uber or a traditional taxi)

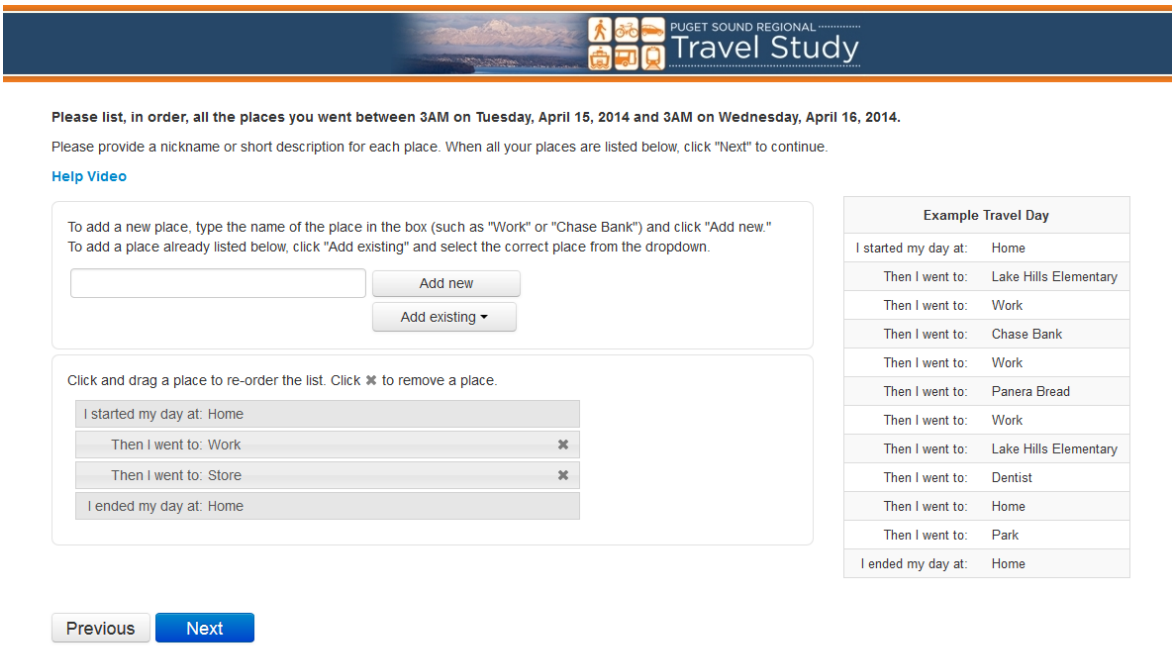


FIGURE 3: TRIP ROSTER

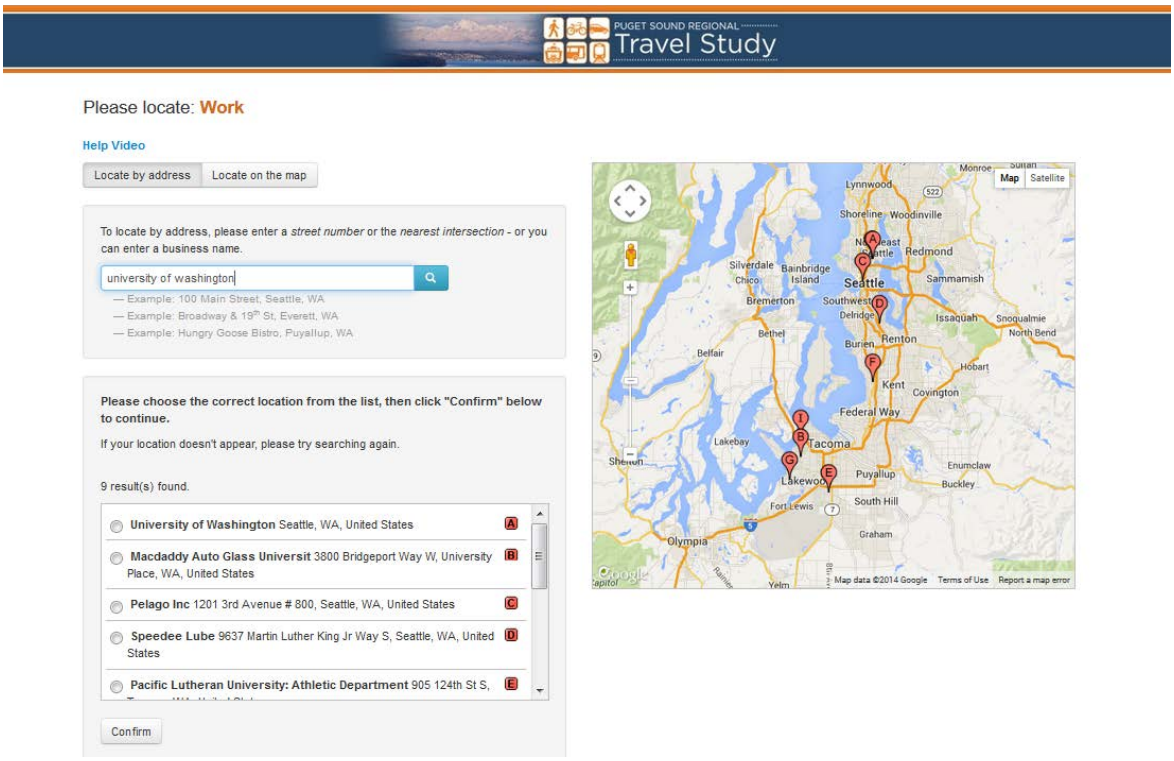


FIGURE 4: TRIP GEOCODER ADDRESS SEARCH

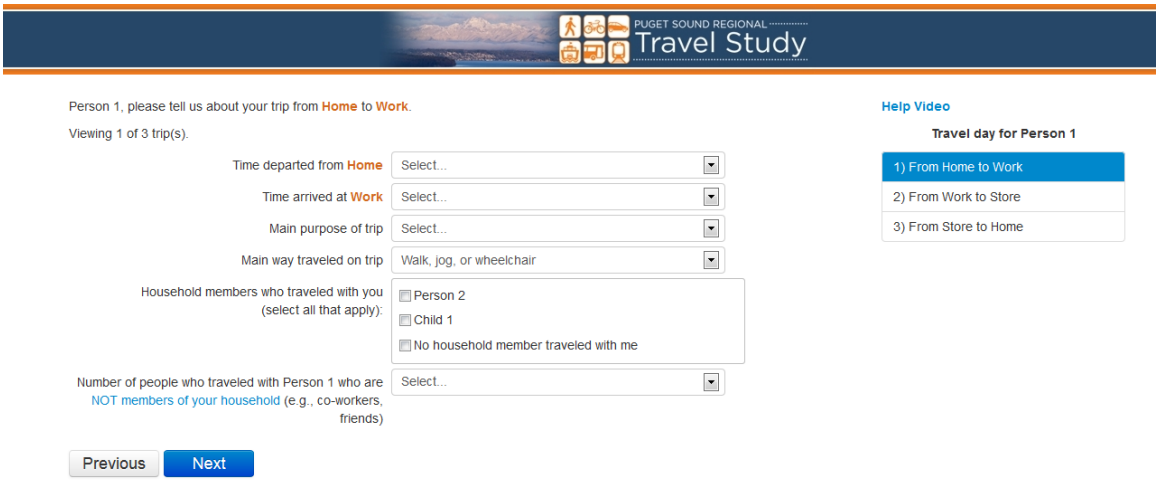


FIGURE 5: TRIP DETAILS (WALK TRIP)

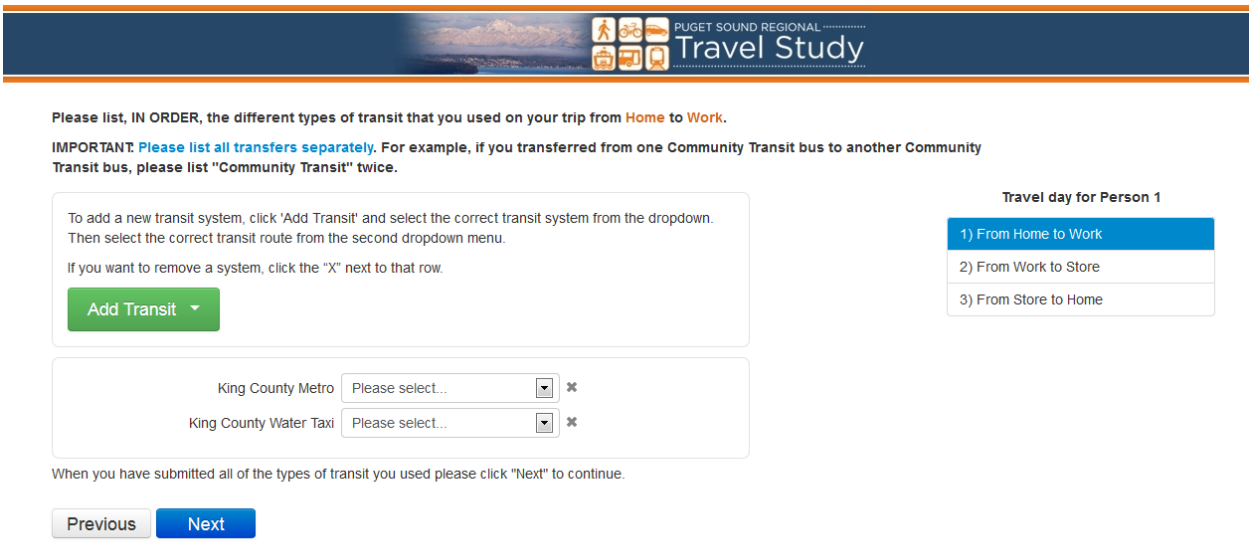


FIGURE 6: TRANSIT SYSTEM USED ON TRIP

At the end of the trip details questions, a prompt question (the Trip Trapper page) verified that respondents had reported all of their trips by listing the type of trips that are commonly forgotten, and gave respondents an opportunity to add any trips they may have forgotten to report. See Figure 7. Commonly under-reported trips include short trips, such as stops for gas or running a short errand on a lunch break, and loop trips (i.e. walk the dog, go for a run, etc.). There were specific instructions provided for loop trips, including a demonstration video on how those trips should be reported.

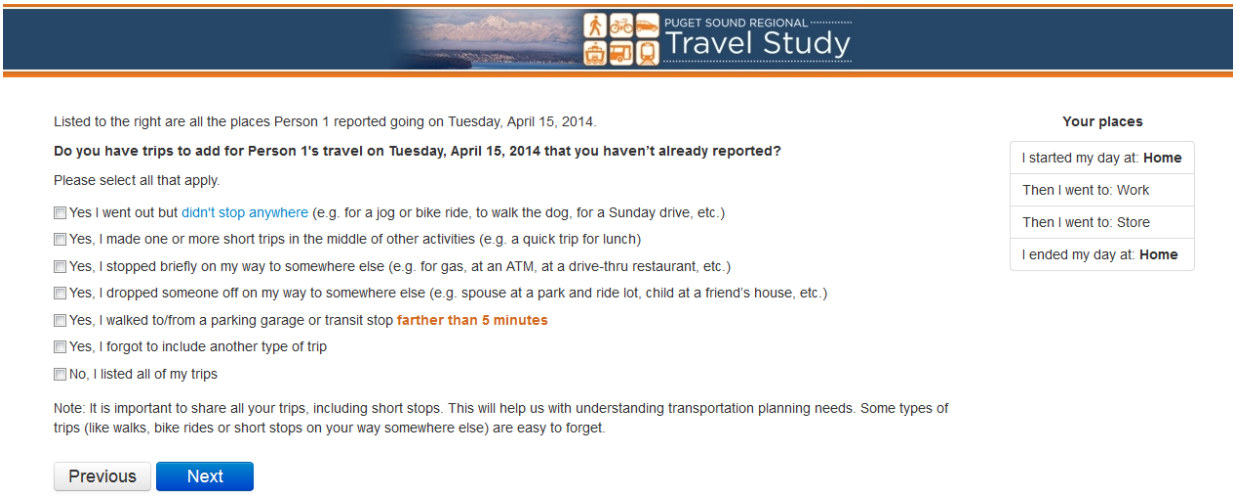


FIGURE 7: TRIP TRAPPER PROMPT

Lastly, respondents could use a feature of rSurvey™ to easily "copy" trips across household members. When a respondent reported joint travel with another household member, that trip was then made available to household members who were reported on the trip to

"copy" to their own travel diary. Subsequent household members had to verify that they took the joint trip. These members then skipped the geocoding and time-reporting steps and were only asked about the purpose of the trip, due to the possibility of household members having different purposes on the same trip. For example, if a parent reported driving a child to school in his or her diary, they could copy that trip into the child's diary instead of having to re-enter all of the details. The copy trip functionality saved time, reduced respondent burden, and created built-in data consistency for intra-household travel.

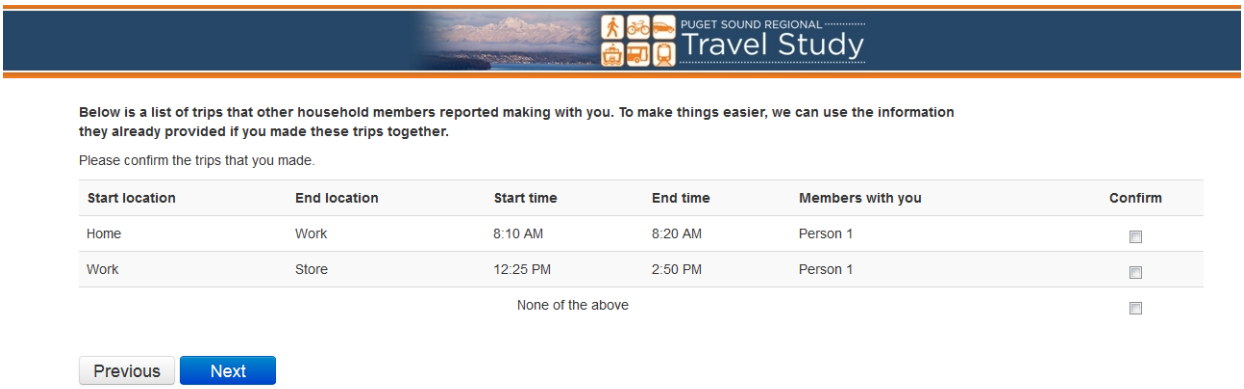


FIGURE 8: COPY TRIPS FEATURE

Following the trip details for the day, respondents were asked for a few more details about their travel day, including:

- If the pre-assigned travel day was "typical" (and reasons why if it was not)
- If they had telecommuted for part or all of their travel day instead of going to their workplace (if employed)
- If they had purchased anything online for delivery at a later time

3.4 | GENERAL TRAVEL BEHAVIOR AND ATTITUDE QUESTIONS

Following the 24-hour diary portion of the retrieval survey, respondents were asked a series of questions about their typical transportation behaviors. These questions provided additional context about people's typical travel behaviors (such as travel to work), even if the trips or the travel day were not "typical" for the individual. Other questions in this section collected preferences or attitudes about transportation alternatives intended to assist PSRC planners in evaluating potential project impacts. The questions in this section included:

- Typical work behaviors (e.g. commuting frequency, work-related trips, work location, etc.)
- Current work location
- Previous work location if commuted to current work for less than five years
- Availability and use of employer-provided commuter benefits (e.g. flextime, commuting subsidies, etc.)

- Typical frequency of trips to school and current school location (if a student)
- Typical frequency of travel by transit, biking, or walking
- Transit pass ownership and employer or school subsidies
- The effect of various factors on transit, biking and walking behaviors (e.g. increases in frequency due to hypothetical improvements)
- Factors influencing the use of shared-ride trips
- Awareness, use, and impact of real-time traveler information
- Type of smartphone owned

At the end of the retrieval survey, respondents were also invited to provide open-end comments about transportation issues in the PSRC region.

4.0 PUBLIC OUTREACH

A thoughtful and appropriate public outreach process was critical for increasing awareness of the project. The public outreach goals were to:

- Increase the public's confidence in the legitimacy of the project and therefore their likelihood in participating
- Provide information to alleviate concerns about the survey or how the data would be collected, processed, secured, and handled by PSRC
- Inform the public that PSRC will use the data for both updating travel demand models and to inform future transportation planning decisions

4.1 | BRANDING

Branding of the project serves to provide continuity among the outreach and survey materials and to legitimize the study with the public and key stakeholders. A study logo and color scheme for the project were developed with input from PSRC. The study website, invitation materials, and online survey all incorporated this branding scheme into their design. Figure 10 shows the study logo.

FIGURE 9: PUGET SOUND REGIONAL TRAVEL STUDY LOGO

PSRC hosted the project website, https://survey.psrc.org, which was maintained and updated by RSG. The website included information about the study and the region, a link to the online survey, FAQs, links to news stories about the study, and contact information. Figure 11 shows the front page of the study website. It should be noted that the project website was intended to both specifically be branded to the survey project and to be branded with the look and feel of PSRC's "parent" agency website.

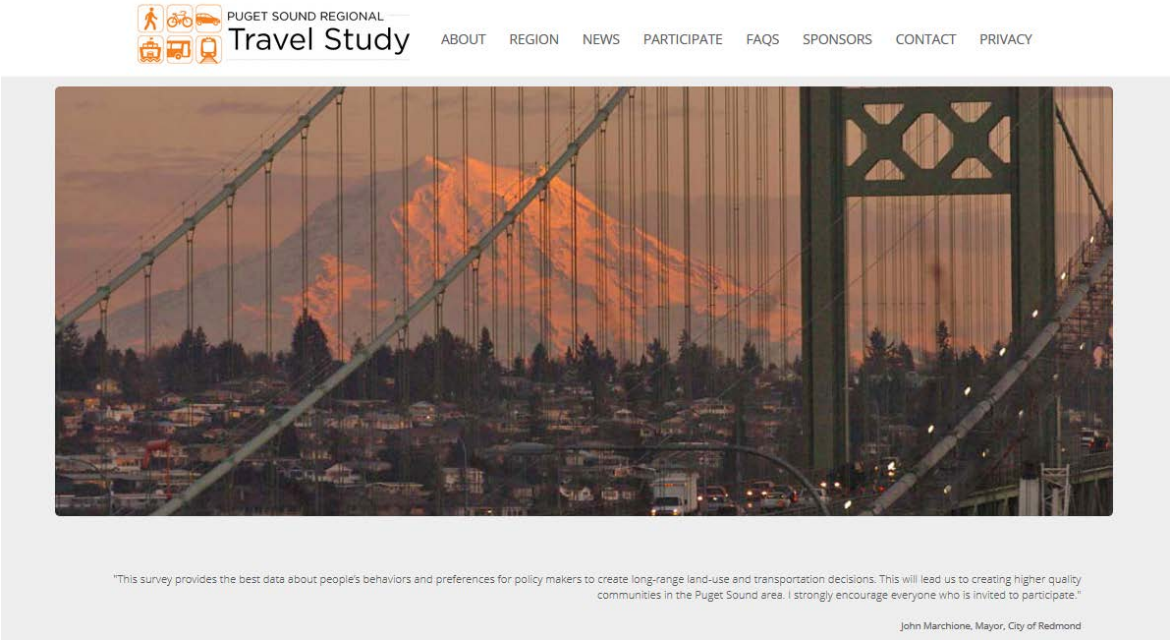


FIGURE 10: STUDY WEBSITE

4.2 | PSRC'S OUTREACH EFFORTS

PSRC distributed press releases to news outlets in the region and conducted additional public outreach efforts through its website and social media sites. Several regional news websites posted articles about the study, primarily drawing upon content from PSRC's press release. RSG provided PSRC with content to share through its blog and Twitter feed, such as survey response rates. Figure 12 shows a sample of news articles about the study (including PSRC's own blog post about the study), which were listed on the survey project website.

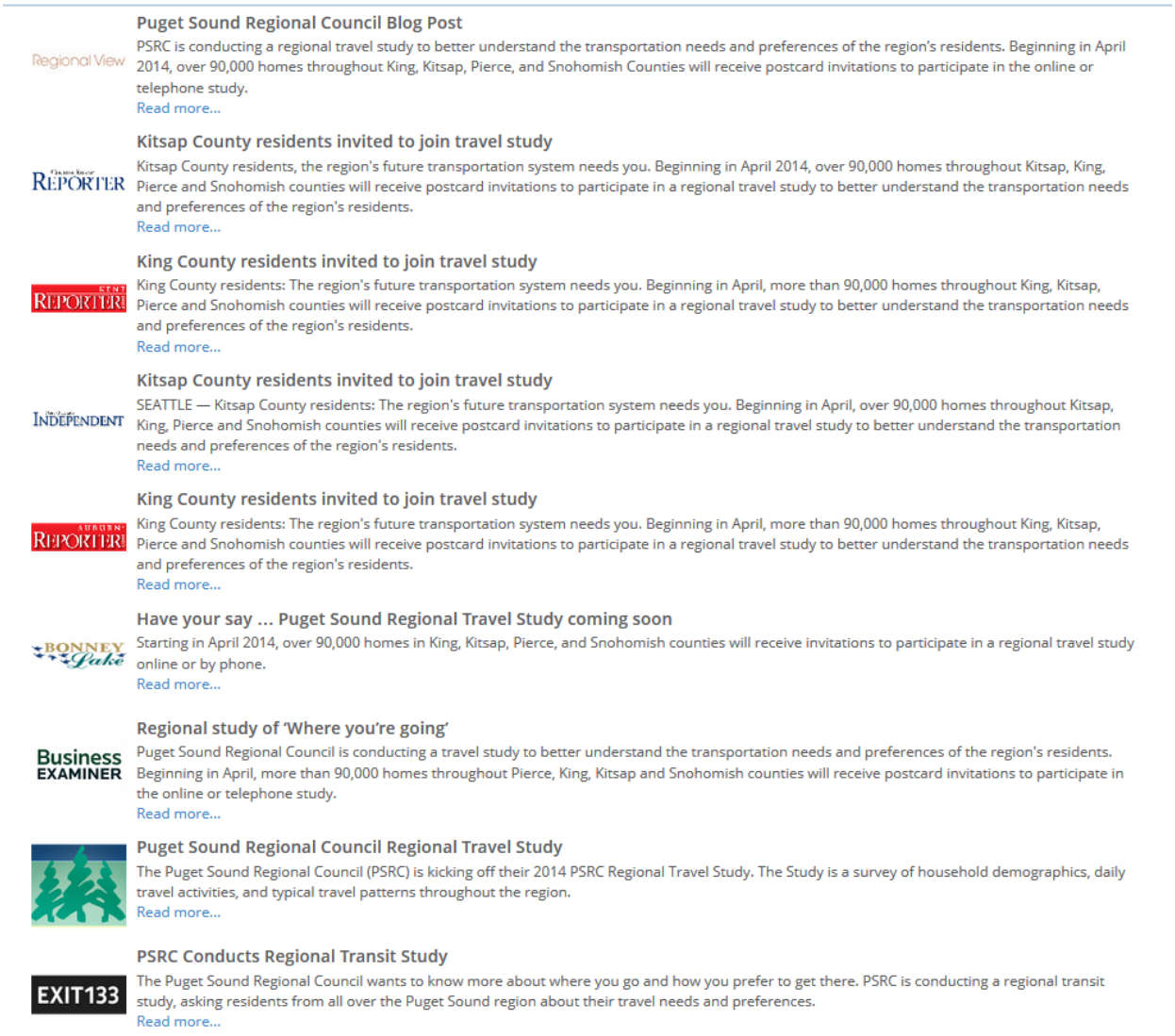


FIGURE 11: NEWS ARTICLES ABOUT THE PUGET SOUND REGIONAL TRAVEL STUDY

5.0 PILOT SURVEY

5.1 | OVERVIEW

The goal for the pilot was to collect data from 100 households in order to properly evaluate the effectiveness and accuracy of the survey questionnaire design and the overall study methodology for PSRC's model development needs. The project kick-off was in February 2014 and the pilot study took place during the first week of March 2014. Two geographic segments were selected for pilot survey sampling: downtown Seattle and Snohomish County. The pilot study resulted in 173 complete households, which were later combined with the data from the main study.

5.2 | APPROACH

RSG worked with the client and determined that targeting two unique areas in the region for the pilot study effort would be wise, as it would serve to inform potential response rates in areas where typically hard-to-reach populations reside. Four Regional Growth Centers (RGCs) in downtown Seattle were selected as pilot area one. The demographic characteristics in these RGCs tend to have higher numbers of young non-family households (householders under age 35), households without children, and households without personal vehicles. These characteristics are of interest to the PSRC and have not been adequately represented in previous travel surveys.

The second pilot study target area was Snohomish County. Based on RSG's experience in other surveys, specifically the 2013 South Sound Travel Study in nearby Thurston County, response rates tend to be lower for counties that are more rural. RSG and PSRC agreed that sampling Snohomish County in the pilot study would allow for a good assessment of response rates from the more rural areas of the PSRC study region.

Table 7 shows the sampling rates in each of the pilot segments. The total households in area are based on ACS estimates from 2007-2011.

TABLE 7: PILOT SAMPLING RATES

GEOGRAPHIC AREA	TARGET SAMPLE	% OF SAMPLE	TOTAL HHS IN AREA	SAMPLING RATE
Downtown Seattle in King County	50	50%	43,137	0.12%
Snohomish County	50	50%	266,331	0.02%
TOTAL	**100**	**100%**	**309,468**	**0.03%**

RSG projected a conservative 4% response rate when calculating the number of invitations needed to obtain the final sample size. Based on this estimate, RSG mailed 1,250 invitations to each pilot segment for a total of 2,500 invited households

The recruitment and administration process for the pilot study closely resembled the approach taken for the main study (Section 6.0). Households could take the study either online or over the phone. Pilot households were offered a base incentive of $10 in the form of an Amazon or Walmart gift card if they completed the survey. Households with zero vehicles, large households, and households with incomes below $25,000 were offered a $20 incentive.

During the pilot, 8.5% of households (15 total) completed the survey over the phone. The remainder completed the survey online.

5.3 | PILOT RESULTS

Table 8 shows the total number of responses for each segment. The overall response rate was 6.9%.

TABLE 8: PILOT RESPONSE RATE

GEOGRAPHIC AREA	SAMPLE TARGET	RECRUITED HHS	COMPLETE HHS	RETENTION RATE	RESPONSE RATE
Downtown Seattle in King County	50	126	99	78.6%	7.9%
Snohomish County	50	97	74	76.2%	5.9%
TOTAL	**100**	**223**	**173**	**77.6%**	**6.9%**

DEMOGRAPHICS

Demographic results from the pilot showed strong representation from zero-vehicle households in the downtown Seattle area, as seen in Table 9. This trend continued during the main study, which informed a decision to cease offering the higher $20 incentive to higher-income zero-vehicle households (see section 6.0).

TABLE 9: PILOT STUDY VEHICLE OWNERSHIP

VEHICLE COUNT	DOWNTOWN SEATTLE		SNOHOMISH		TOTAL	
	COUNT	%	COUNT	%	COUNT	%
0	33	33.3%	2	2.7%	35	20.2%
1	60	60.6%	20	27.0%	80	46.2%
2	5	5.1%	33	44.6%	38	22.0%
3	0	0.0%	13	17.6%	13	7.5%
4	1	1.0%	3	4.1%	4	2.3%
5+	0	0.0%	3	4.1%	3	1.7%
Total	**99**	**100.0%**	**74**	**100.0%**	**173**	**100.0%**

Table 10 shows the reported household incomes during the pilot study by sample segment. The downtown Seattle segment included a higher concentration of households with incomes

below $50,000 compared to the Snohomish segment. In both segments, nearly a third of participating households reported incomes over $100,000.

TABLE 10: PILOT STUDY HOUSEHOLD INCOME

2013 INCOME	DOWNTOWN SEATTLE		SNOHOMISH		TOTAL	
	COUNT	%	COUNT	%	COUNT	%
Under $25,000	12	12.1%	11	14.9%	23	13.3%
$25,000-$49,999	27	27.3%	12	16.2%	39	22.5%
$50,000-$74,999	16	16.2%	11	14.9%	27	15.6%
$75,000-$99,999	11	11.1%	10	13.5%	21	12.1%
$100,000 or more	28	28.3%	24	32.4%	52	30.1%
Prefer not to answer	5	5.1%	6	8.1%	11	6.4%
Total	**99**	**100.0%**	**74**	**100.0%**	**173**	**100.0%**

TRIP RATES

Table 11 shows the raw person- and household-level trip rates from the pilot study. The average trip rates account for every household member even if no travel was reported. Trips were derived for children under 5 years old based on whether they were reported on trips with other household members.

TABLE 11: PILOT STUDY TRIP RATES

TRIP RATES	DOWNTOWN SEATTLE	SNOHOMISH	TOTAL
Average trips per person*	4.80	3.87	4.27
Average trips per HH	6.86	9.94	8.18
Total trips	**680**	**736**	**1415**

**Includes people who did not travel and children under 5*

5.4 | CHANGES MADE

The pilot process was evaluated for areas of improvement prior to the main study. The following enhancements were implemented for the main study:

Survey Administration and Outreach

- The study website was designed and launched to share information about the project (there was not adequate time to do so prior to the pilot)
- The study logo was altered to emphasize the words "Travel Study"
- Starbucks gift cards were offered in place of Walmart gift cards

Survey Design

- Several travel attitude questions were added to the retrieval survey based on input from transportation planning staff at PSRC:
  - Real-time travel information sources and use
  - Frequency of walking, biking, and taking transit
  - Factors that would increase frequency of walking and biking

  - Factors that would increase frequency of carpool or transit as a commute mode

- Transit pass questions were revised based on pilot survey responses and comments
- Commute-related questions were revised based on pilot survey comments

Sample Plan

- The expected response rate for the main survey was adjusted based on the pilot response rate

5.5 | CONCLUSION

Given that the changes implemented for the main survey did not significantly alter the survey instrument, PSRC decided to add the pilot data to the main survey dataset. The pilot data was subject to the same data checks and preparation as the main dataset, the process of which is described in Section 7.0. Pilot segments were re-coded to match the main study sample segments based on the block group location. In instances where questions were added between the pilot and main surveys, pilot data was coded accordingly as missing. The supplemental reference guide to reviewing the datasets, delivered with the data, provides further detail on the process of combining pilot and main study data.

6.0 SURVEY ADMINISTRATION

The main survey administration began with mailed invitations to households, and communication with participating households continued through phone and online channels. Invitations were mailed out by first-class mail in late March for arrival prior to the first travel date of April 8, 2014. This section describes the invitation process, household participation methods, and how communication was maintained with invited households during the study.

6.1 | INVITATION MATERIALS

Initial contact with all households was carried out through first-class mailings. Households received a pre-notice postcard informing them of the study, then an invitation packet inviting them to participate in the study, followed by two reminder postcards. Below are more details about the first-class mailings.

- **Pre-Notification Postcard**
  - Delivered approximately seven days before the assigned travel date.
  - Provided an introduction to the study and a link to the study website.
- **Invitation Packet**
  - Delivered approximately four days before the assigned travel date
  - This packet included:
    - A large envelope branded with the study logo and PSRC's logo to help it stand out from other mail received by the household.
    - A letter signed by PSRC's executive director, Josh Brown, with information about the study, the survey link, and the household's unique password and assigned travel date. The household could begin participating (the recruitment survey) immediately.
    - A FAQ sheet (on the back of the letter) with more information about the study's purpose and how to track and report trips.
    - Travel logs for recording the household's travel day trips.
- **Reminder Postcards**
  - The first was delivered on the travel date (approximately).
  - The second was delivered two days after the travel date (approximately).
  - All households received these postcards regardless of whether they had completed their travel diaries, as they were printed and mailed prior to the travel date.

6.2 | PARTICIPATION METHODS

Households had the option to participate online or over the phone. ETC Institute (ETC) conducted the phone recruitment and completion efforts. Both the online and phone

surveys were identical, with ETC utilizing the online survey for input while speaking to participants on the telephone. Details about survey content are provided above in Section 3.0.

ONLINE SURVEY METHODS

The online survey was hosted by PSRC and implemented using RSG's proprietary survey software, rSurvey™. The rSurvey architecture includes rigorous Web 3.0 protocol to protect data during and after data collection (e.g., encryption of all submitted data over the Internet) to ensure proper consideration of all data privacy concerns and continuous "uptime" of all technology. Households invited to take the survey were able to enter their unique password and complete the survey through the online survey portal, which was accessible from the project website. rSurvey has several features that ensure data quality and minimize respondent burden. One feature of rSurvey is that participants who stop midway through the survey arrive at the question they last answered when they return to the survey (with all previously provided data saved). Other functionalities to ensure data consistency and minimize respondent burden include:

- Validation and logic checking, such as real-time geocoding of addresses, intersections, businesses, and utilizing points on a Google map
- "Copy trips" functionality allowing household members to report other household members on a trip and "copy" the trip details to that member's diary to reduce respondent burden of repeating trip details

In addition, administrative data (also known as metadata) are collected, including browser language, browser type, use of a mobile device, and survey duration. A majority of households (86%) took the entire survey online. The median time spent on the recruit survey was nine minutes, and the median time spend on the diary survey was 14 minutes.

PHONE SURVEY METHODS

The toll-free phone number was listed on all the invitation materials to allow households to participate over the phone. ETC fielded incoming calls and made outbound calls to households with a known phone number. The phone survey was conducted by the ETC operator using the same online survey that was used by online participants. For the main survey effort, 14% of participating households took the recruit or retrieval survey over the phone.

6.3 | COMMUNICATION PROTOCOL

PHONE RECRUITMENT

The address-based sample included a landline telephone number associated with the address for approximately 28% of all invited households. In addition to the printed invitation materials, these households received telephone calls encouraging them to participate in the study. Contacted household could complete the recruit survey over the telephone, or

through the survey website. RSG sent a prioritized recruit call list to ETC each weekday during data collection.

The recruitment phone calls prioritized households based on their designation as a "target" or hard-to-reach household. Recruitment phone calls began once households received their pre-notice postcard and continued until the day prior to the travel date.

"Target" recruitment households were designated based on estimated income and geography. The sample provider included income estimates for 83.7% of households. Households with an estimated income of lower than $25,000 were given first recruitment call priority. Geographic priority was determined in the midst of the study based on response, as described later in this section.

EMAIL AND PHONE REMINDERS

Once recruited, households received telephone and email reminders encouraging them to complete the steps to finish the study. Reminders to households were conducted based on the household's indicated communication preference (provided in the recruit survey). Households that indicated a preference for phone call reminders received phone calls; similarly, households that indicated a preference for email reminders received emails. A small number (1.3%) of households received both phone call and email reminders after indicating a preference for receiving both.

Telephone Reminders

For households that preferred receiving reminders via telephone, ETC conducted reminders through the following process:

- A telephone call was placed to the household on the day before their travel date to remind the household to track their travel the following day.
- Additional calls were placed (for up to seven days after the travel day) to the households to remind them to complete the survey online or over the telephone. The timing and frequency of telephone calls varied based on the households' previously expressed preference for a "call back" and the ease of reaching the household.
- After seven days from the travel date passed, no additional phone calls were placed to that household.

ETC ensured that all reminder phone calls were placed on time and that scripted messages were left on voicemail if a voice mailbox was available. Reminder phone calls were prioritized similar to recruit call prioritization, with low-income households as the first call priority, followed by geographic and demographic targets based on survey response (see the end of this section). Approximately 15% of recruited households received telephone reminders.

Email Reminders

RSG sent email reminders to households that preferred email contact requesting that they log and report trips on their assigned travel date and describing the reporting process. Reminders included a link to the survey website, the household password, and the toll-free

telephone number should the household prefer to report travel over the telephone, or have difficulty completing the survey online.

Reminder emails were sent to households:

- The day before the assigned travel date (reminder to log travel the following day).
- The morning after the assigned travel date (reminder to report travel from the previous day).
- Saturday morning after the travel date (only if travel had not yet been reported).
- Monday morning after the travel date (only if travel had not yet been reported).

If a household had not reported travel after seven days passed the assigned travel date, no further email reminders were sent to the household. Examples of the email reminders are included Appendix 4. Approximately 86% of households received email reminders.

EMAIL AND PHONE INQUIRIES

RSG monitored and maintained the study email account hosted by PSRC, help@psrc.org. Several households asked questions about the survey via email. RSG responded to emails within 24 hours of receiving the message or on the next business day. Inquiries sent by email typically involved households asking for their password before they received the invitation letter, questions about the gift card, and questions about the survey itself. Occasionally households also emailed with comments about regional transportation issues, which were forwarded to PSRC. Figure 13 shows a tally of emails sent to the project email account. Messages categorized as "other" include emails from participants saying they completed the survey, questions about the invitation materials, and other miscellaneous questions.

EMAIL TYPE	COUNT	%
Amazon thank-you	205	36%
Technical issues	68	12%
Password/log-in help	56	10%
Other	53	9%
Survey question issues	41	7%
Issue now resolved	33	6%
Request to participate	31	5%
Gift card questions	26	5%
Reassignment	20	3%
General comments	18	3%
Unsubscribe request	14	2%
Website questions	11	2%
TOTAL	**576**	**100%**

FIGURE 12: EMAIL INQUIRIES

ETC operators handed questions over the phone. If an operator did not know the answer to a question or needed more information, the ETC supervisor contacted RSG for guidance.

ETC kept record of all interactions with respondents, and received 310 inquiries during the course of the survey effort, excluding calls to take the survey. In cases where a participant was having trouble completing the survey, ETC would help them complete over the phone. Calls from households who wanted to report their travel on their travel date (rather than on the day after) were scheduled for callback. Calls to ask about the household's gift card were forwarded to RSG for resolution.

PSRC also received several phone calls about the project from the general public and participating households. Fifteen inquiries were received from the general public to PSRC by phone or email, and 32 phone calls or emails were received from invited households. The PSRC contact information was provided on the project website and it is expected that this was the source of most of the incoming inquiries.

MAILINGS

The vast majority of communication with invited households occurred through phone or email. The survey invitation materials specified that mailed travel logs would not be accepted, and emphasized phone and email as contact methods. Despite this, 15 mailings were received to the project's P.O. Box, including several written travel logs and requests to be removed from the mailing list.

Undeliverable mail was also returned to the project's P.O. Box and subsequently forwarded to RSG. In total, 9,183 invitation letters were returned. The returned letters were counted separately from post cards, so the total accounts for unique addresses. These 9,183 addresses can be included or excluded when calculating final response rates. This report provides response rates based on both these methods in Section 8.1.

6.4 | SURVEY INCENTIVES

Incentives were offered as encouragement and compensation for households that completed the survey. The printed survey invitation materials and survey reminders notified households that they would receive their choice of a $10 Amazon.com or Starbucks gift card upon completion of the travel diary.

Incentives were sent approximately once per week for households that had completed their travel diaries the previous week. Respondents who chose to receive survey reminders by email during the recruit survey were emailed an Amazon or Starbucks gift card (depending on their card preference). Respondents who only chose phone call reminders were given the option of receiving an emailed gift card or a physical mailed gift card.

Some "hard-to-reach" households were selected for a higher incentive ($20) to encourage a higher completion rate. Initially, higher incentives were offered to households with more than four adults, zero vehicles, or low incomes (under $25,000).

Over the course of the study, incentive amounts offered to households was modified based on response rates. For example, zero-vehicle households were more common in King County than anticipated, particularly in the Seattle area therefore, households with zero vehicles and annual income higher than $50,000 were not offered the higher incentive during

the last several weeks of the study. Additionally, for a short period at the end of the study, households in Pierce, Snohomish, and Kitsap counties were offered the $20 incentive regardless of household demographics to increase retention of households in these counties, ensuring that targets were met.

In total, 30% of households qualified for the $20 gift card. Table 9 shows the number of gift cards sent by type and amount.

TABLE 12: GIFT CARD TYPE AND AMOUNT

	AMAZON		STARBUCKS	
	COUNT	PERCENT	COUNT	PERCENT
$10	2,251	70.2%	1,973	70.8%
$20	957	29.8%	815	29.2%
TOTAL	**3,208**	**100.0%**	**2,788**	**100.0%**

6.5 | MONITORING DURING DATA COLLECTION

Throughout data collection, demographic and geographic response rates were monitored, as mentioned in Section 2.0. In addition to the adjustments to the sampling plan between the pilot and main surveys, administrative procedures were adjusted to meet demographic and county targets.

Revisions to administrative procedures included varying the time of day and day of week for recruitment and retrieval calls, especially calls to "target" households. Midway through the study, RSG determined that household completion rates for Pierce, Snohomish, and Kitsap counties were just slightly behind the target (while response for King County was well ahead of target). Households from these counties took second priority in the recruitment call lists after the below-$25,000 income households. As completion rates increased in some counties, geographic priorities were regularly adjusted accordingly.

7.0 DATA PREPARATION

Data quality assurance and quality checks happen during all stages of the project, from questionnaire and sample design to final deliverables. This report section discusses the data preparation process and summarizes steps taken to prepare the data deliverables.

Dataset preparation focuses on review of frequency tabulations and mapping of location data, a set of flags, corrections and exclusions, quality checks of the prepared core datasets, and finally deriving key variables for downstream data uses.

The data deliverable includes four distinct datasets, which can be joined using a combination of household ID, person number and trip number.

1. Household-level data
2. Person-level data
3. Trip-level data
4. Vehicle-level data

7.1 | rSURVEY™ DATA CHECKS

rSurvey includes built-in data and consistency checks that facilitate dataset preparation and reduce the amount of data cleaning and up coding required. A few examples include:

- Web respondents and ETC telephone operators both use rSurvey to ensure that all data undergo the same logic, validation, and real-time checks.
- Validation logic to ensure respondents answer all questions.
- Logic checking, such as real-time geocoding of addresses, intersections, businesses, and utilizing points on a Google map.
- Filters to automatically determine which questions were shown to each person based on their previous responses (for example, non-employed persons were not asked commuting questions).
- Predefined acceptable ranges for text entry questions.
- Metadata collection permitted passive collection of data such as survey duration (in total and by each question), browser type, default language of web-browser, and more. These metadata are used to trouble-shoot survey errors and to assist a household that calls or emails asking for help.
- The copy trips feature in rSurvey allows a household member to select and copy information already reported by another household members if that household member reported that they traveled together. This "copy trips" feature, described in more detail in Section 3.0, ensures that jointly made household trips were reported with the same geocodes and trip times.
- Reported trip sequences were required to be logical, so that one trip's end location matched the next trip's starting location.
- A trip's end time had to be later than that trip's start time, and the next trip's start time was required to fall after the previous trip ended.

7.2 | DATASET PREPARATION

The first step in the dataset preparation for spring 2014 was combining the pilot and main survey datasets. Including the pilot data in the main dataset was feasible because the changes between the pilot and main survey were relatively minor. Preparation steps involved clearing data for those questions asked in the pilot but not in the main, and recoding variables (to a value of -99) not asked in the pilot survey, but asked in the main survey. A flag was included in the deliverable datasets to easily determine whether the record is from the pilot or main survey.

EXCLUSION CRITERIA

Once the pilot and main datasets were combined, frequency tabulations were generated and location data were mapped to highlight potential data errors. Households with potential data errors were flagged and reviewed with PSRC. After review it was decided that 77 previously 'complete' households (~1% of households) would be excluded from the final dataset for the following reasons.

1. Household not located in the four-county study area: One household. This is possible based on the mail forwarding and an invitation to a household could have been forwarded to their new home address now outside the study area.
2. Households flagged during data collection as having multiple data issues, typically call center operator errors or isolated online survey technical issues: Five households.
3. Household participated more than once under different passwords. Identified via checking for duplicates in email address and home address checking: Four households
4. Households who reported a home address at an intersection more than .25 miles from their sample address, where upon review it was determined that the cross-street was not a valid home or residential location: 56 households.
5. Households who reported a home location as an organization or institution rather than a valid home address likely due to privacy concerns: 11 households.

GEOGRAPHIC DATA CHECKS

Finalizing Home Location

Every household has two sources of home location data: 1) the sample provider (MSG) home latitude/longitude provided with the address file and 2) the survey self-reported home latitude/longitude from the Google Maps API. Home location is an essential variable for the analysis of household travel survey datasets, but the two sources of addresses do not always match perfectly. For this reason, data preparation included comparing the two sources and recommending the 'final' home location for each household (coordinates and address). This final home location was used in all downstream data tasks. For 90% of households, the respondent self-reported address was the 'final home location' used for analysis, however three sets of home address variables are provided with the household-level dataset:

1. The sample provider (MSG) address and coordinates used for mailing of the invitation materials
2. The home address (and coordinates) self-reported by the household in the recruit survey,
3. The final home address, which is either the reported address (in 90%) of the cases, or the sample provider address.

Estimating Travel Time and Duration

Estimated travel time and trip duration between a trip's origin and destination points were passively recorded and calculated by the Google Maps API Distance Matrix Service embedded in rSurvey, and are included in the data deliverable. These estimates indicate the distance and duration of a trip under "standard driving directions using the road network"[1] and do not account for traffic, thus representing "free flow" conditions on the roadway. These values are collected in addition to the user-reported travel time and allow for comparison between the two values. All but a few ferry and airplane trips were coded and provided and could be used for future trip validation to detect trip records with potential issues.

DERIVED AND CALCULATED VARIABLES

In addition to the core variables reported by respondents, a set of derived variables are necessary for downstream data, weighting and analysis. Approximately 40 variables were derived or added during data preparation. A final round of quality checks was conducted on the derived and added variables.

Deriving trips for children under five

Children under the age of five were not required to complete a diary, but could be reported on trips made by household members age five or older. After deriving all other trip-level variables, trip records were created for the children under five by copying trip records from other household members and editing relevant details. Edits included identifying and removing duplicate trips, such as all trip records that were copy-trips, sorting the remaining trips in ascending order, creating unique trip ids, and recoding instances of 'driver' to 'passenger' for vehicle trips. This exercise added 2,000 trip records to the dataset, all of which were identified with a flag. The original tripID (from another household member) was also attached to each record, to ensure the ability for tracing back.

INCOME IMPUTATION

Households had the option of reporting income in ten categories or select "prefer not to answer". A follow up question offered the option of reporting a broad income category for those that selected "prefer not to answer". Knowing that detailed income category was a key variable in weighting, household income was imputed for the 11.5% of households that preferred not to report detailed income. This was done using a multinomial logit model

[1] https://developers.google.com/maps/documentation/javascript/distancematrix

(MNL) of income category, using the 5,390 (out of 6,094) households that did answer the detailed income question.

The model includes attributes of the household, as well as the income distribution in the residence block group, based on the 2008-2012 5 year ACS. The MNL model was estimated using SPSS, which also has a feature to write out the predicted probabilities for each choice alternative, and to predict a choice as the alternative with the highest probability. Because a logit model is a probabilistic model and not a deterministic one, a more appropriate way of using it to predict a single alternative for each household is to use "Monte Carlo" simulation, drawing a random number between 0 and 1 for each household and using that to select one of the chosen alternatives. This method was also applied in SPSS, however, the overall distribution of the predictions across the alternatives in the "Monte Carlo" simulation was very similar to the observed distribution, and the number of cases in cells far away from the diagonal remains very low.

The final income variable was created using the following rules:

- If a person answered the detailed income question, the reported detailed category is used.
- If a person did not answer the detailed income question but did answer the broad income follow up question, the Monte Carlo method is used to impute a choice only among the detailed categories within the reported broad categories.
- If a person neither answered the detailed nor the broad category income question, the Monte Carlo method is used to impute a choice from among all ten income categories.

The resulting final income category is shown in Table 14 versus the reported detailed income. The shaded column shows the income categories imputed for the 704 respondents who did not answer the detailed income question, which is the outcome of this step. This "final income" variable was used for all of the weighting steps described in Section 9.0.

TABLE 13: FINAL (IMPUTED) INCOME CATEGORY VERSUS REPORTED INCOME FOR ALL HHS

	REPORTED HOUSEHOLD INCOME 2013: DETAILED CATEGORIES											
FINAL INCOME CATEGORY	UNDER $10,000	$10,000-$24,999	$25,000-$34,999	$35,000-$49,999	$50,000-$74,999	$75,000-$99,999	$100,000-$149,999	$150,000-$199,999	$200,000-$249,999	$250,000 OR MORE	PREFER NOT TO ANSWER	TOTAL
Under $10,000	233	0	0	0	0	0	0	0	0	0	27	260
$10,000-$24,999	0	519	0	0	0	0	0	0	0	0	45	564
$25,000-$34,999	0	0	459	0	0	0	0	0	0	0	63	522
$35,000-$49,999	0	0	0	645	0	0	0	0	0	0	71	716
$50,000-$74,999	0	0	0	0	1,006	0	0	0	0	0	113	1,119
$75,000-$99,999	0	0	0	0	0	835	0	0	0	0	109	944

REPORTED HOUSEHOLD INCOME 2013: DETAILED CATEGORIES												
FINAL INCOME CATEGORY	UNDER $10,000	$10,000-$24,999	$25,000-$34,999	$35,000-$49,999	$50,000-$74,999	$75,000-$99,999	$100,000-$149,999	$150,000-$199,999	$200,000-$249,999	$250,000 OR MORE	PREFER NOT TO ANSWER	TOTAL
$100,000-$149,999	0	0	0	0	0	0	999	0	0	0	159	1,158
$150,000-$199,999	0	0	0	0	0	0	0	376	0	0	59	435
$200,000-$249,999	0	0	0	0	0	0	0	0	160	0	25	185
$250,000 or more	0	0	0	0	0	0	0	0	0	158	33	191
	233	519	459	645	1006	835	999	376	160	158	704	6,094

8.0 RESPONSE RATES

8.1 | FINAL RESPONSE RATES

The response rates presented in this section are based on the final number of completes after data cleaning from the main survey administration.

Starting with a high-level overview, Table 15 has the target number of complete survey households, final number of invited households and final response rates by the four counties, with the supplemental sample purchases by Bellevue and City of Seattle (with support from PSRC) listed separately. Retention rates (retrieval / recruited) were consistent – above 80% in all sample groups. Response and retention was particularly high in the City of Seattle Urban Villages.

TABLE 14: RESPONSE RATES BY SAMPLE GROUPS

SAMPLE GROUP	TARGET # COMPLETE HHS	TARGET RESPONSE RATE	# HHS INVITED	RECRUITS (#HHS)	RETRIEVAL (#HHS)	RETENTION RATE	RESPONSE RATE
King County	2,625	6.8%	38,557	3,519	2,894	82.2%	7.5%
Kitsap County	311	5.7%	5,500	448	369	83.5%	6.7%
Pierce County	926	4.6%	20,322	1,264	1,020	81.8%	5.0%
Snohomish County	756	6.0%	12,663	900	724	80.4%	5.7%
PSRC Sub-Total	**4,618**	6.0%	**77,042**	**6,131**	**5,007**	**82.0%**	**6.5%**
City of Bellevue Supplemental	299	-	4,751	408	337	83.6%	7.1%
City of Seattle Supplemental (Urban Villages)	150	-	6,538	673	577	86.1%	8.8%
Grand Total	**5,067**		**88,331**	**7,212**	**5,921**	**82.5%**	**6.7%**

Table 16 has summary administration numbers by county for the original sampling plan, where the City of Bellevue is included in King County. The City of Seattle sample (which was added after the original sampling plan) is not included in this table. At 0.37%, the actual overall sampling rate (target complete households divided by 2007-2011 ACS estimate of number of households) exceeded the target 0.34%. Response was particularly strong in King and Kitsap counties. Response rates in King County were moderated by adjustments during the survey administration to curb response. Pierce County exceeded the target after adjustments made during the survey administration (described in the Sampling Section).

The sample targets for Snohomish County were not adjusted (i.e. lowered) even though fewer households were invited in response to the natural disaster (see Sampling Section), and therefore the final number of Snohomish completes was slightly lower than the survey target. This shortfall was made up for by including the 173 households from the pilot survey (including 74 households from Snohomish County) to the final dataset. The pilot households are not provided below in Table 16

TABLE 15: ORIGINAL SAMPLING PLAN - RESPONSE RATES BY COUNTY

COUNTY	TARGET # COMPLETE HHS	TARGET SAMPLING RATE	# HHS INVITED	RECRUITS (#HHS)	RETRIEVAL (#HHS)	RETENTION RATE	RESPONSE RATE	ACTUAL SAMPLING RATE
King County	2,924	0.39%	43,308	3,927	3,230	82.3%	7.5%	0.41%
Kitsap County	311	0.32%	5500	448	369	82.4%	6.7%	0.38%
Pierce County	926	0.31%	20,322	1264	1,020	80.7%	5.0%	0.34%
Snohomish County	756	0.28%	12,663	900	725	80.6%	5.7%	0.27%
TOTAL	4,917	0.34%	81,793	6,539	5,344	81.7%	6.5%	0.37%

The response rates presented in this section do not account for the 10% of mailings that were returned undeliverable, thus the actual response rates are somewhat higher. The fraction of undeliverable mail was approximately equal in all four counties. Table 17 shows the total invited households and undeliverable mail (including City of Seattle). Accounting for undeliverable mail adjusts all response rates upward.

TABLE 16: ADJUSTED RESPONSE RATES BY COUNTY

COUNTY	#HHS INVITED	UNDELIVERED MAIL %	DELIVERED MAIL	ADJUSTED RESPONSE RATE
King County	49,846	10.0%	44,860	8.5%
Kitsap County	5,500	10.3%	4,932	7.5%
Pierce County	20,322	11.8%	17,934	5.7%
Snohomish County	12,663	9.8%	11,418	6.3%
TOTAL	88,331	10.4%	79,144	7.5%

Table 18 has the target response rates, final number of invited households and final response rates for the original ten sampling segments described in the sampling plan. As with Table 16, the additional City of Seattle sample is not included. This finer resolution shows the differences in target and actual sampling rates and response rates in the study area.

TABLE 17: RESPONSE RATES BY SAMPLING SEGMENT

SAMPLING SEGMENT	HHS	TARGET SAMPLING RATE	TARGET # COMPLETES	EXPECTED RESPONSE RATE	COMPLETE HHS	RESPONSE RATE	SAMPLING RATE
Regular – Higher Income	694,578	0.24%	1,677	7.0%	1,732	7.2%	0.25%
Regular – Medium Income	323,513	0.24%	781	5.5%	829	5.9%	0.26%
Regular – Lower Income	47,003	0.24%	113	4.0%	142	4.7%	0.30%
Oversample - Higher Income	78,316	0.62%	482	7.0%	513	9.2%	0.66%
Oversample - Medium Income	94,483	0.62%	581	5.5%	691	7.9%	0.73%
Oversample - Lower Income	159,445	0.62%	984	4.0%	1,103	5.1%	0.69%
Bellevue Regular - Higher Income	29,936	0.39%	118	7.0%	134	8.6%	0.45%
Bellevue Regular - Medium Income	9,150	0.40%	37	5.5%	59	8.4%	0.64%
Bellevue Oversample - Higher Income	7,238	0.94%	68	7.0%	63	6.3%	0.87%
Bellevue Oversample - Medium Income	7,261	1.05%	76	5.5%	78	5.2%	1.07%
TOTAL	1,450,923	0.34%	4,917	5.6%	5,344	6.5%	0.37%

(1) # HHs in sample area Census block groups from the ACS 2007-2011 5-year data

Figure 14 illustrates the different expected response rates from Table 18 by sampling segment income group. As described in the sampling plan section, an average 7% response rate was expected in higher income areas, 5.5% in medium income areas, and 4% in lower income areas. In the 'regular' (proportional) sampling segments, the actual response rates closely followed expectations. The oversample (higher sampling rates) segments were either in PSRC's Regional Growth Centers (RGCs), or contained high proportions of household types or behaviors of interest (i.e. low-income, 0-vehicle, young non-family, or non-car commuting). These segments, typically more urban in character, performed much above expectations. For example, the higher income oversample response rate was 9.2% compared to the expected 7%. Interestingly, even the lower income oversample exceeded its expected response rate by one percentage point. In the Bellevue sampling segments, response was strong overall, but the pattern was different: the regular sampling segments exceeded expected response the most, whereas the oversample areas were closer to expectations. It should also be noted that in general, we have observed higher response rates to transportation surveys in the greater Seattle region than in many parts of the United States.

FIGURE 13: RESPONSE RATES BY SEGMENT

9.0 EXPANSION AND WEIGHTING

9.1 | THE ROLE OF WEIGHTING

Household travel surveys cover a fraction of the population, yet the resulting datasets are used to analyze and make inferences about the population at large. Weighting is the process of comparing selected demographics in the survey to external control data such as Census or ACS (American Community Survey), and adjusting the profile of the survey dataset to improve the representativeness of the population in the study area.

The final demographic and geographic distribution of households and persons in a survey dataset is a result of several factors:

- The sampling plan: The study area is divided into geographies with separate targets or expected number of complete surveys. Geographies with certain demographic characteristics may be oversampled, either because the area is of special interest (e.g. a growth area), or because low response rates are expected (e.g. low-income areas, or areas further from the center).
- Adjustments made after pilot administration and throughout survey administration to reach sampling targets.
- Final sampling rates: Some households are more or less likely than others to participate, despite efforts in sampling plan and adjustments during administration. For example, a dataset may have a larger proportion of senior households and lower proportion of young households than the study area. Typical "hard-to-reach" groups include young households, very low-income households, and zero-vehicle households.

Depending on the outcome of the three factors above, the resulting data are not necessarily fully representative of the population in a region in terms of demographic or geographic characteristics– there is some bias related to non-response. By assigning lower weights to households and person types that were over-represented in the survey, and higher weights to combinations that were under-represented, these differences are mitigated.

9.2 | FIRST STAGE EXPANSION BASED ONLY ON SAMPLING PROBABILITIES

Weights were developed for the combined pilot and main PSRC 2014 dataset (6,094 households), in a two-step process. In the first step, the number of survey households was expanded to the number of households in each sampling segment, by assigning an expansion factor to each household based on the sampling rate.

This step is based only on the calculated sampling rates for the different sampling groups. These are groups that had equal sampling probabilities for all households within each group. The groups used in this step were the ten original sampling segments, but with the households located in Urban Villages (from both the PSRC sample and the City of Seattle sample) broken out separately, forming 13 groups as shown in Table 19. The other data

source for this step is the most recent estimate of the number of households at the block group level from the 5-year 2008-2012 ACS. The ratio of number of ACS 2008-2012 households to the number of households in the sample is the initial expansion factor.

TABLE 18: FIRST STAGE EXPANSION FACTORS BY SAMPLING SEGMENT

BLOCK GROUP TYPE	KING	KITSAP	PIERCE	SNOHOMISH	TOTAL SAMPLE HH	PERCENT	# HHS ACS 2008-2012
Regular - Lower Income	57	10	38	36	141	2.3%	46,129
Regular - Medium Income	316	82	222	216	836	13.7%	319,084
Regular - Higher Income	906	104	393	386	1,789	29.4%	695,084
Oversample - Lower Income	308	64	286	88	746	12.2%	119,814
Oversample - Medium Income	207	52	72	42	373	6.1%	56,562
Oversample - Higher Income	316	57	10	30	413	6.8%	59,654
Urban Village Oversample - Low Income	573	0	0	0	573	9.4%	44,241
Urban Village Oversample - Medium Income	621	0	0	0	621	10.2%	44,139
Urban Village Oversample - High Income	268	0	0	0	268	4.4%	23,380
Bellevue Regular - Medium Income	59	0	0	0	59	1.0%	9,362
Bellevue Regular - Higher Income	134	0	0	0	134	2.2%	30,148
Bellevue Oversample - Medium Income	78	0	0	0	78	1.3%	7,348
Bellevue Oversample - Higher Income	63	0	0	0	63	1.0%	7,158
Total	3,906	369	1,021	798	6,094	100%	1,462,103

The highest expansion factors are for the regular block groups, which were not oversampled. The factors are around 350, which corresponds to about a 0.3% sampling rate of all households. The next highest factors are for the oversample block groups, with factors around 150 (roughly a 0.7% sampling rate). Next highest are the Bellevue oversample segments, which are at about 200 (0.5% sampling rate) for the block groups that were originally from the regular segments, and around 100 (1.0% sampling rate) for the segments that were originally from the oversample segments. As expected, the lowest expansion factors are the Urban Village block groups, with a weight of about 75 (a 1.3% sampling rate). This means that the Urban Village oversampling resulted in roughly a doubling of the sample rate compared to the other oversample segments.

9.3 | ESTABLISHING TARGETS FOR RE-WEIGHTING

In the second step, target demographic variables and weighting geographies were established. The initial expansion weights were adjusted to match demographic control data targets from the ACS PUMS (Public Use Microdata Sample) 2008-2012 for the following target dimensions, which were intentionally kept similar to those used in PSRC 2006 weighting:

- Household size (1, 2, 3, 4, 5+)
- Number of workers (0, 1, 2, 3+)
- Income group (9 categories, generally the same as in the detailed income question)
- Number of vehicles (0, 1, 2, 3+)
- Lifecycle (8 categories, a combination of presence of children age 0-4, presence of children age 5-17, number of adults 1 or 2+, and age of householder-under 35, 35-64, 65 or older)

In PSRC 2006, the targets were set at the county level, but with King County split into the City of Seattle and Other. For PSRC 2014, it was decided to set the targets at the 4-county level, but to add a sixth target dimension within each county:

- 2012 PUMA geography (16 PUMAs in King County, 2 in Kitsap, 7 in Pierce and 6 in Snohomish)

The final question for setting targets is which ACS sample to use to establish the targets. The two best options were the 2008-2012 5-year ACS PUMS or the 2012 1-year ACS PUMS. The 1-year 2012 ACS PUMS is more recent, but based on only 14,000 households in the PSRC region, which is only about twice the size of the sample for this survey. Therefore, targets based on the 1-year ACS PUMS will have quite a bit of measurement error compared to the 5-year ACS. If the two ACS versions provided roughly the same target values, then the accuracy would not be a major issue and we would use only the most recent data. However, a comparison of targets based on the two showed a large difference, with over 25% difference in some of the target values.

As an example, Table 20 shows the comparison for the household size targets, with fairly large discrepancies for 4 person and 5+ person households. Comparisons for the other dimensions (not shown here) showed similar discrepancies. Believing that the discrepancies are due more to measurement error than to actual shifts in the county demographics between 2008 and 2012, the decision was to use targets based on the 5-year 2008-2012 sample. The exception is the target based on PUMA – because the Census Bureau shifted to a new PUMA system in 2012 that is consistent with the 2010 block group geography, only the 1-year 2012 sample is used to set the PUMA targets. Because all PUMAs are of similar, substantial size with about 40,000 households, small-cell measurement error is not a major issue for this dimension.

TABLE 19: DIFFERENCE BETWEEN HOUSEHOLD SIZE TARGETS AT THE COUNTY LEVEL FOR 2012 1-YEAR ACS COMPARED TO 2008-12 5-YEAR ACS

HOUSEHOLD SIZE	KING	KITSAP	PIERCE	SNOHOMISH	TOTAL

1 person	3.1%	3.9%	3.4%	-0.5%	2.6%
2 people	-1.8%	5.3%	0.3%	2.2%	-0.1%
3 people	0.6%	1.8%	2.7%	0.0%	1.0%
4 people	2.7%	-14.8%	-4.1%	-9.4%	-2.4%
5 or more people	1.8%	-25.2%	-5.1%	16.8%	1.5%
Total	0.9%	-0.7%	0.4%	0.8%	0.7%

Table 21 shows the ACS-based target values for the 31 PUMAs, compared to the expanded number of households from the first stage expansion. Some of the differences are quite large. It appears that response rates in the City of Seattle were much higher than in the rest of King County, even after the initial expansion factors which adjusted for the higher sampling rates in much of the City. The southern portions of the county are particularly under-expanded. The same pattern appears in Pierce County, with Tacoma over-represented compared to the more rural parts of the county, and in Snohomish, with the Everett PUMA over-represented. These discrepancies show the need for re-weighting at a finer level of geography than was used for the previous survey (PSRC 2006).

TABLE 20: PUMA-LEVEL TARGETS BASED ON ACS 2012, AND DIFFERENCE FROM INITIAL EXPANDED SAMPLE

PUMA 2012	EXPANDED SAMPLE	ACS 2012 TOTAL	% DIFFERENCE
Seattle City (Northeast)	91,141	67,666	34.7%
Seattle City (Northwest)	71,592	49,210	45.5%
Seattle City (Downtown)--Queen Anne Magnolia	80,071	69,367	15.4%
Seattle City (Southeast)--Capitol Hill	54,102	49,456	9.4%
Seattle City (West)--Duwamish Beacon Hill	59,371	54,055	9.8%
King County (Northwest)--Shoreline, Kenmore Bothell (South) Cities	44,777	46,108	-2.9%
King County (Northwest)--Redmond, Kirkland Cities, Inglewood Finn Hill	55,558	55,211	0.6%
King County (Northwest Central)--Greater Bellevue City	52,022	56,826	-8.5%
King County (Central)--Sammamish, Issaquah, Mercer Island, Newcastle	58,424	49,062	19.1%
King County (Central)--Renton City, Fairwood, Bryn Mawr, Skyway	39,703	51,018	-22.2%
King County (West Central)--Burien, SeaTac,	30,063	48,126	-37.5%

Tukwila Cities White Center			
King County (Far Southwest)--Federal Way, Des Moines Cities, Vashon Island	36,718	47,812	-23.2%
King County (Southwest Central)--Kent City	25,132	41,951	-40.1%
King County (Southwest)--Auburn City Lakeland	24,683	36,191	-31.8%
King County (Southeast)--Maple Valley, Covington Enumclaw Cities	25,552	43,113	-40.7%
King County (Northeast)--Snoqualmie City, Cottage Lake, Union Hill Novelty Hill	34,634	38,885	-10.9%
Kitsap County (North)--Bainbridge Island City Silverdale	54,037	47,791	13.1%
Kitsap County (South)--Bremerton Port Orchard Cities	47,337	49,235	-3.9%
Pierce County (Central)--Tacoma City (Central)	68,393	46,311	47.7%
Pierce County (Northwest)--Peninsula Region Tacoma City (West)	52,941	44,909	17.9%
Pierce County (West Central)--Lakewood City Joint Base Lewis-McChord	36,166	42,582	-15.1%
Pierce County (South Central)--Tacoma City (South), Parkland Spanaway	39,700	43,579	-8.9%
Pierce County (North Central)--Tacoma (Port) Bonney Lake (Northwest) Cities	42,331	43,499	-2.7%
Pierce County (East Central)--Puyallup City South Hill	37,019	44,197	-16.2%
Pierce County (Southeast)--Graham, Elk Plain Prairie Ridge	31,603	35,475	-10.9%
Snohomish County (Southwest)--Edmonds, Lynnwood Mountlake Terrace Cities	58,824	47,103	24.9%
Snohomish County (West Central)--Mukilteo Everett (Southwest) Cities	43,215	45,100	-4.2%
Snohomish County (Central)--Everett City (Central & East) Eastmont	47,588	45,428	4.8%
Snohomish County (South Central)--Bothell (North), Mill Creek Cities Silver Firs	47,429	40,333	17.6%

Snohomish County (Central & Southeast)--Lake Stevens Monroe Cities	42,237	44,545	-5.2%
Snohomish County (North)--Marysville Arlington Cities	29,736	48,059	-38.1%
Total	1,462,103	1,472,203	-0.7%

Comparisons between the ACS (2008-2012) PUMS data and the initial expanded sample were made for the five demographic household dimensions aggregated to county-level (Table 22 through Table 26). The values in the columns labeled "Initial Expanded Survey" are the percent difference in the expanded survey sample cell size to the ACS estimate. For example, after initial expansion, the King County survey sample had 13% fewer 3-person households than the ACS target for 3 person households in King County.

Summarizing these five tables, the groups that appear to be under-represented due to lower response rates were:

- Larger households: Two-person households were over-represented, and households of size 4 and 5+ were under-represented in all counties.
- 3+ worker households: These were underrepresented in all counties, which is likely related to the relationship with household size. Zero-worker households were over-represented in all counties, which may be related to a higher response rate among retired households.
- Low-income households: The lower income categories tend to be under-weighted in all counties.
- Zero-vehicle households: These were somewhat underweighted, particularly in the more rural counties. Households with 3+ vehicles were also somewhat underrepresented, probably due to the relationship with large household size.
- Households with children and young single households: The former is related to the large household size, and the latter is typically due to the lack of a phone match for cell-only households and the fact that young single people tend to be transient and harder to contact.

Note that some of these households types – low-income, zero vehicle, and young single households – were targeted in the geographic oversampling. While that oversampling was successful, as indicated by the lower expansion factors for the oversample segments, it does not eliminate the fact that these types of households have higher non-response rates, and therefore need to be re-weighted. In effect, just like lower response rates were anticipated by using higher sampling rates (and more invitations) for those groups, the higher re-weighting factors will compensate for the lower initial expansion factors.

TABLE 21: SURVEY DIFFERENCE FROM ACS TARGET AFTER INITIAL EXPANSION: HH SIZE

	KING	KITSAP	PIERCE	SNOHOMISH	TOTAL

HH SIZE	ACS	INITIAL EXPAN-DED SURVEY	ACS	INITIAL EXPAN-DED SURVEY	ACS	INITIAL EXPAN-DED SURVEY	ACS	INITIAL EXPAN-DED SURVEY	ACS	INITIAL EXPAN-DED SURVEY
1 person	32%	1.4%	26%	1.2%	26%	6.6%	25%	-1.8%	29%	1.9%
2 people	33%	21.7%	38%	28.1%	34%	32.3%	33%	21.4%	34%	24.3%
3 people	15%	-13.4%	15%	5.8%	16%	-19.2%	18%	-6.5%	16%	-12.0%
4 people	12%	-18.5%	13%	-38.4%	14%	-22.5%	15%	-16.9%	13%	-20.3%
5 or more people	7%	-66.7%	8%	-37.3%	10%	-36.8%	9%	-29.9%	8%	-50.1%
Total	100%	-1.6%	100%	3.8%	100%	2.9%	100%	0.2%	100%	0.0%

TABLE 22: SURVEY DIFFERENCE FROM ACS TARGET AFTER INITIAL EXPANSION: HH WORKERS

	KING		KITSAP		PIERCE		SNOHOMISH		TOTAL	
HH WORKERS	ACS	INITIAL EXPAN-DED SURVEY	ACS	INITIAL EXPAN-DED SURVEY	ACS	INITIAL EXPAN-DED SURVEY	ACS	INITIAL EXPAN-DED SURVEY	ACS	INITIAL EXPAN-DED SURVEY
0 workers	19%	10.1%	24%	36.3%	22%	39.3%	18%	15.0%	20%	19.8%
1 worker	41%	-0.9%	40%	-1.5%	40%	3.1%	39%	0.9%	41%	0.2%
2 workers	33%	3.2%	30%	-9.4%	32%	-13.4%	34%	4.1%	33%	-0.7%
3 or more workers	7%	-60.2%	6%	-26.7%	6%	-41.7%	8%	-51.5%	7%	-53.0%
Total	100%	-1.6%	100%	3.8%	100%	2.9%	100%	0.2%	100%	0.0%

TABLE 23: SURVEY DIFFERENCE FROM ACS TARGET AFTER INITIAL EXPANSION: HH INCOME

	KING		KITSAP		PIERCE		SNOHOMISH		TOTAL	
HH INCOME	ACS	INITIAL EXPAN-DED SURVEY	ACS	INITIAL EXPAN-DED SURVEY	ACS	INITIAL EXPAN-DED SURVEY	ACS	INITIAL EXPAN-DED SURVEY	ACS	INITIAL EXPAN-DED SURVEY
Under $10,000	6%	-49.8%	5%	-39.4%	6%	-27.6%	5%	-48.3%	6%	-44.1%
$10,000-$24,999	11%	-42.2%	12%	-20.8%	14%	-21.4%	11%	-22.5%	12%	-32.5%
$25,000-$34,999	8%	-16.0%	10%	-23.1%	10%	11.8%	8%	-19.7%	9%	-10.9%
$35,000-$49,999	12%	-19.5%	15%	1.2%	15%	-12.9%	14%	-19.8%	13%	-16.5%
$50,000-$74,999	18%	-2.6%	21%	20.0%	21%	5.0%	20%	-14.3%	19%	-1.5%
$75,000-$99,999	13%	9.0%	14%	9.2%	14%	31.7%	16%	36.9%	14%	19.3%
$100,000-$149,999	17%	34.5%	15%	26.3%	14%	16.5%	17%	32.9%	16%	30.4%

$150,000-$199,999	7%	27.6%	5%	32.1%	4%	39.7%	6%	10.9%	6%	26.6%
$200,000 or more	8%	13.0%	4%	-11.0%	3%	-38.7%	4%	2.0%	6%	5.5%
Total	100%	-1.6%	100%	3.8%	100%	2.9%	100%	0.2%	100%	0.0%

TABLE 24: SURVEY DIFFERENCE FROM ACS TARGET AFTER INITIAL EXPANSION: HH VEHICLES

	KING		KITSAP		PIERCE		SNOHOMISH		TOTAL	
HH VEHICLES	ACS	INITIAL EXPAN-DED SURVEY	ACS	INITIAL EXPAN-DED SURVEY	ACS	INITIAL EXPAN-DED SURVEY	ACS	INITIAL EXPAN-DED SURVEY	ACS	INITIAL EXPAN-DED SURVEY
0 vehicles	9%	-11.5%	5%	-17.5%	6%	-25.0%	5%	-36.0%	7%	-16.8%
1 vehicle	35%	11.2%	29%	4.9%	30%	10.3%	29%	-2.8%	33%	8.4%
2 vehicles	37%	-1.5%	40%	3.9%	39%	4.1%	39%	20.6%	38%	4.2%
3 or more vehicles	19%	-21.1%	26%	6.5%	25%	-1.6%	28%	-18.8%	22%	-13.9%
Total	100%	-1.6%	100%	3.8%	100%	2.9%	100%	0.2%	100%	0.0%

TABLE 25: SURVEY DIFFERENCE FROM ACS TARGET AFTER INITIAL EXPANSION: HH LIFECYCLE STAGE

	KING		KITSAP		PIERCE		SNOHOMISH		TOTAL	
HH LIFECYCLE	ACS	INITIAL EXPAN-DED SURVEY	ACS	INITIAL EXPAN-DED SURVEY	ACS	INITIAL EXPAN-DED SURVEY	ACS	INITIAL EXPAN-DED SURVEY	ACS	INITIAL EXPAN-DED SURVEY
Children age 0-4	12%	-16.3%	12%	-18.1%	14%	-23.2%	13%	4.9%	12%	-13.8%
Children age 5-17 only	18%	-35.3%	20%	-38.1%	21%	-37.3%	21%	-22.8%	19%	-33.4%
No children, hhsize 1, householder under 35	7%	-20.7%	4%	-18.7%	5%	-41.4%	4%	-38.2%	6%	-26.1%
No children, hhsize 1, householder 35-64	16%	6.8%	13%	6.2%	14%	13.6%	14%	-4.7%	15%	6.1%
No children, hhsize 1, householder 65+	8%	10.6%	9%	3.8%	8%	23.1%	7%	24.7%	8%	15.0%
No children, hhsize 2+, householder	10%	1.8%	6%	29.4%	6%	20.4%	7%	-12.3%	8%	3.8%

under 35										
No children, hhsize 2+, householder 35-64	21%	14.3%	25%	9.2%	22%	20.0%	24%	17.0%	22%	15.6%
No children, hhsize 2+, householder 65+	8%	34.9%	12%	78.9%	10%	66.6%	9%	16.7%	9%	42.3%
Total	100%	-1.6%	100%	3.8%	100%	2.9%	100%	0.2%	100%	0.0%

The one type of area/household where this compensating relationship does not hold is for households in more urban areas that tend to use transit or other non-auto modes (not shown here). Not only were those types of areas oversampled, but households in those types of areas appear to have higher response rates as well. This is likely one cause of the overrepresentation of the more urban PUMAs, as seen in Table 21.

Finally, while some substantial re-weighting is necessary, the discrepancies were not as large as those reported for the 2006 survey re-weighting. This indicates that the use of address-based sampling, the choice of online or telephone interviewing, and the uses of an attractive online platform appear to reduce the amount of selective non-response bias compared to the previous survey.

9.4 | USE ITERATIVE PROPORTIONAL FITTING TO ADJUST THE EXPANSION WEIGHTS TO MATCH THE ACS TARGETS

An iterative proportional fitting (IPF) procedure looped over the five demographic target dimensions (created from 2008-2012 PUMS data) and the sixth PUMA target (created from 2012 PUMS data), and the survey data with initial expansion weights, and gradually adjusted the weights to match the target values.

The program was run for 25 IPF iterations so that each target cell value is matched within 0.1%.

The resulting expansion factors are roughly in the range of 15 to 1,500 (a maximum expansion weight of 1,500 was used in the program, but was never exceeded), but with the large majority remaining in the range of the initial expansion weights. Table 27 shows the resulting mean and standard deviation of the final expansion weights by weighting group. The mean within each group tends to stay fairly close to the initial expansion weight.

TABLE 26: MEAN VALUES OF FINAL EXPANSION FACTOR BY SAMPLING SEGMENT

BLOCK GROUP TYPE	SAMPLE HHS	INITIAL EXPANSION FACTOR	FINAL EXPANSION FACTOR-MEAN	FINAL EXPANSION FACTOR - STANDARD DEVIATION

Regular - Lower Income	141	327.156	382.1015	195.593
Regular - Medium Income	836	381.6794	392.443	229.8381
Regular - Higher Income	1,789	388.5321	378.4408	217.9455
Oversample - Lower Income	746	160.6086	189.7926	132.2615
Oversample - Medium Income	373	151.6408	148.3417	112.1266
Oversample - Higher Income	413	144.4407	117.6285	62.1784
Urban Village Oversample - Low Income	59	158.678	205.7835	174.0679
Urban Village Oversample - Medium Income	134	224.9851	236.109	169.9533
Urban Village Oversample - High Income	78	94.2051	84.2113	49.4611
Bellevue Regular - Medium Income	63	113.619	121.4712	76.8233
Bellevue Regular - Higher Income	573	77.2094	72.5309	40.2419
Bellevue Oversample - Medium Income	621	71.0773	61.4843	55.633
Bellevue Oversample - Higher Income	268	87.2388	74.17	43.315
Total	6,094	239.925	239.9257	213.2328

As a check on the reweighting process, the re-weighted survey distributions were compared to the target distributions for the six demographic dimensions. All cell differences were 0.0%, so the tables are not included here. The exception is for the PUMA dimension, where the total number of households from the 2012 ACS is slightly different from the 2008-2012 ACS. For that dimension, all cell values were matched within 0.7%.

10.0 2014 SURVEY COMPARISON TO 2006

The PSRC 2014 dataset was compared to the PSRC 2006 dataset; both weighted and unweighted distributions. As in the weighting, the PSRC 2014 dataset in this section is the final dataset of 6,094 households.

First, we just compared the overall number of records in the data, unweighted and then weighted. Table 28 shows that the unweighted average household size (person records/household records) is somewhat lower in 2014, mainly resulting from higher oversampling for young, single households and in the Urban Village areas. Although the 2006 survey was a 2-day diary survey, we only compare to the trips from Day 1 of that survey, since we know that there were somewhat fewer trips reported per household on Day 2 of that survey. The 2014 survey obtained a somewhat higher number of trips per person (4.11 vs. 3.86), but a slightly lower number of trips per household, due to the smaller average household size. When we look at the percent of households and persons that reported no trips at all on the travel day, the 2014 household contains fewer households reporting no travel at all (3.6% vs. 5.5%), although a somewhat higher percentage of persons reporting no trips at all. This result suggests that there may be more children with 0 trips in the 2014 data.

TABLE 278: NUMBERS OF HOUSEHOLDS, PERSONS AND TRIPS, UNWEIGHTED

	2006 SURVEY	2014 SURVEY
Households	4,741	6,094
Persons	10,510	12,370
Persons/HH	2.22	2.03
Trips (day 1)	40,522	50,856
Trips/household	8.55	8.35
Trips/person	3.86	4.11
HH with no trips	5.5%	3.6%
Persons with no trips	10.1%	11.2%

TABLE 289: NUMBERS OF HOUSEHOLDS, PERSONS AND TRIPS, WEIGHTED

	2006 SURVEY	2014 SURVEY	2006 WITH GPS-BASED ADJUSTMENT
Households	1,375,702	1,462,107	1,375,702
Persons	3,267,043	3,537,800	3,267,043
Persons/HH	2,37	2.42	2.37

Trips (day 1)	12,273,532	13,782,059	14,762,567
Trips/household	8.92	9.43	10.73
Trips/person	3.76	3.90	4.52
HH with no trips	6.0%	3.6%	
Persons with no trips	10.7%	12.2%	

The weighted numbers in Table 29 show a similar picture. Now, however, the discrepancy in average household size has been adjusted for in the weighting, and the average household size is around 2.4 in both years. Now, the average trips per household and trips per person are both somewhat higher in the 2014 data compared to the 2006 data.

Table 29 includes an extra column showing the results with adjusted trip rates for 2006 based on an analysis that was done for that survey using GPS trace data from a small subset of households. So, although the trips per household and per person for 2014 are higher than in the raw survey data for 2006, they are still a fair bit below the GPS-adjusted trip rates. This suggests that the 2014 survey has gone some ways toward avoiding non-reporting of actual trips that inevitably occurs as part of active self-reporting, but has not completely avoided the issue of non-reported trips. The Spring 2015 PSRC surveys, which will use both active diary-based reporting very similar to the current 2014 survey, and passive smartphone-based reporting, will provide further insight into any remaining trip non-reporting biases.

10.1 | TRIP-LEVEL DATA

Table 30 shows a breakdown of trip destination purposes for 2014 compared to 2006 (Day 1 trips only). The differences can be attributed mainly to some processing that PSRC did on the 2006 data that remains to be done for the 2006 data. Specifically:

- Most the of the "Change mode" trips will be linked as composite transit trips. For example, this may be a trip where a person transferred from bus to light rail, which can be linked together with the next trip as a single transit trip.
- There is a discrepancy in the "escort/serve passenger trips". A preliminary analysis of the 2014 data show that there are a fairly large number of auto trips with very short stays at the destination and a change in auto occupancy for the following trip where it appears that the car driver reported the passenger's trip purpose (for example, a parent dropping off a child at school and reporting "school" as the trip purpose). Simple rules can be used to recode the purposes of such trips, which will increase the percentage of escort/serve passenger trips to be closer to the 2006 percentage, at the same time decreasing the percentage of School/daycare trips to also be closer to the 2006 percentage.
- About 4.5% of the 2014 trips have the destination purpose "Other". When these are grouped with the "Personal business/Other" trips, the percentage is similar to the 2006 survey. However, it may be possible to more accurately code the destination

purpose for many of the "other" trips using the information in the text label for the destination that was provided by the respondent, using a similar process as was performed by PSRC staff following the 2006 survey. For example, there was no explicit "Medical" purpose category in the 2006 survey, but many respondents gave "doctor's appointment" or the name of a specific doctor's office, clinic or hospital as the name of their destination, and it was subsequently possible to create a "medical" purpose category for the 2006 data (not included in Table 30).

TABLE 30: TRIP PURPOSE DISTRIBUTION, WEIGHTED

PURPOSE CATEGORY	2006 SURVEY %	2014 SURVEY %
Home	35.0	32.8
Work	14.1	15.4
School/daycare	5.8	7.2
Shopping	9.2	11.3
Eat out	5.1	4.5
Social	2.7	2.3
Recreation	6.1	6.9
Medical	0.0	2.2
Escort/serve passenger	11.1	5.2
Personal business/other	10.9	10.5
Change mode	0.0	1.8
Total	100.0	100.0

Tables 31 and 32 shows a breakdown of mode shares for the 2014 trips compared to 2006 (Day 1) trips. The most notable differences are that the transit walk-access, walk, and bike mode shares are all twice as high in the 2014 data compared to the 2006 data. This was intentional, for the most part, as we oversampled in areas where non-auto trips were likely to be most predominant, in order to be able to better model the use of the less-commonly used modes. Even after weighting, however, in Table 32, the mode shares for walk, walk-to-transit and bike all remain about 50% higher than in the 2006 data. It is likely that the shares for those modes actually increased somewhat during the period, especially for walk and bike, but a 50% increase in mode share is unlikely to be realistic. We suspect that the main reason for the difference is that people who use alternative modes were more interested and motivated to participate in the survey, and thus there was a higher response rate among survey persons and households that was not completely corrected for in the weighting procedure. It is likely that a similar response bias also occurred in the 2006 survey, but probably to a lesser extent than in the current survey. It would be possible to use the ACS

data on commuter mode share to further modify the weighting procedure, but this has at least three aspects that are somewhat problematic:

- We did not ask a question for "usual commute mode" in the same way that the ACS survey does, and we did not observe work trips for all commuters.
- The ACS data is only for commuters, and does not included data for non-commuters.
- No corresponding variable was used in weighting the 2006 survey, so it would still not be possible to make an "apples to apples" comparison between the 2006 and 2014 mode shares.

As a result, this is an aspect of the survey where we have been very successful in obtaining information about the use of alternative modes, but where the use of the data in comparison to the 2006 data will need to be done with some caveats.

TABLE 31: TRIP MODE SHARES, UNWEIGHTED

MODE	2006 SURVEY %	2014 SURVEY %
SOV	45.8	39.5
Auto-2	20.3	19.1
Auto-3	16.7	9.6
Vanpool	1.0	0.3
Transit walk-access	3.1	6.6
Transit auto-access	1.1	0.5
Walk	8.4	20.3
Bicycle	1.0	1.9
Other	2.7	2.2
Total	100.0	100.0

TABLE 31: TRIP MODE SHARES, WEIGHTED

MODE	2006 SURVEY %	2014 SURVEY %
SOV	43.1	41.4
Auto-2	20.5	21.0
Auto-3	18.8	13.9
Vanpool	1.3	0.3
Transit walk-access	3.2	4.6

Transit auto-access	0.9	0.6
Walk	7.8	13.9
Bicycle	0.9	1.4
Other	3.4	3.0
Total	100.0	100.0

11.0 APPENDICES

11.1 | QUESTIONNAIRE (IN POWERPOINT)

11.2 | SURVEY SCREENSHOTS

11.3 | PRINT MATERIALS

11.4 | EXAMPLE EMAIL REMINDERS

11.5 | OPEN-ENDED SURVEY COMMENTS

11.6 | DATASET GUIDE

11.7 | UNWEIGHTED TABULATIONS

11.8 | WEIGHTED TABULATIONS