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SACRAMENTO AREA COUNCIL OF GOVERNMENTS (SACOG)

SACRAMENTO REGIONAL TRANSPORTATION STUDY

Analysis Report | November 16, 2018

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1.0 EXECUTIVE SUMMARY

The Sacramento Regional Transportation Study collected a rich set of demographic and travel behavior data from a representative set of 4,010 households in the six-county SACOG planning area. The study collected data from 8,321 persons, representing 146,000 (linked) trips across 34,000 complete person-days during all days from April 10 to May 21, 2018.

The study used innovative and representative sampling methods to provide a quality dataset, decreasing the nonresponse bias from low-income households and roughly doubling the number of Uber/Lyft users captured to 350 people. The study also used innovative data collection methods, leveraging smartphones to capture most travel data, resulting in higher and more accurate trip rates and more precise trip times, distances and person-miles traveled.

This report summarizes response for the study, focusing on evaluating the success of the sample plan and providing descriptive statistics for key questions in the survey and key travel behaviors from the travel diaries. Future work at SACOG will focus on incorporating this dataset into regional modeling, analysis, and planning. To facilitate that effort, RSG provided a version of the survey files already coded to the meet the DaySim/SacSim travel demand model format.

Three of these analyses are highlighted here, as they reflect the important and diverse data collected. These include overall trip rates and mode; basic Uber and Lyft usage; and a summary of the questions on roadside assistances and highway callboxes.

Overall Trip Rates and Mode Shares

The overall trip rate in the region was 3.7 trips per day on an average weekday (Monday-Thursday). This overall rate can be broken out by many categories, including age. Those age 18 and under take the fewest trips per day, at 2.7, those 18-34 take 4.1 trips per day, those 35-64 take the most trips per day, at 4.5, and those over 65 make about 3.1 trips per day.

Looking at mode shares, vehicle trips account for 85% of all trips and 75% of all person-miles. Walk has a 9.7% mode share, bike has a relatively high 2.2% mode share. Yolo County, led by the City of Davis, has the highest bike and walk activity by far, with nearly 0.4 bike trips per day and a 10% bike mode share, while walking is 0.7 trips per day and a 16% mode share. The total *person*-miles traveled by car (~53,000,000 per weekday) is higher than *vehicle*-miles traveled (VMT) for the region. This dataset will support the model-based estimate of regional VMT.

About two-thirds of trips are for residents of Sacramento County. Sutter and Yuba travel the fewest miles per day, around 25, while El Dorado and Placer travel the most at 35 to 37.

Looking at the trip activity by urban-rural geography, people living in urban areas tend to make more trips, at 3.8 vs 3.0 trips per day, but those trips are slightly shorter (8.5 vs 9.6 miles), leaving to only 12% more person-miles traveled per day (32.5 vs 29.1). Urban residents spend more time traveling per day than rural residents, at 85 minutes vs 67 minutes, however that is purely a function or taking more trips, as the average trip times are the same (22 minutes).

TABLE 1 TRAVEL BEHAVIOR FOR A "TYPICAL WEEKDAY" FOR URBAN-RURAL, COUNTY, AGE, AND TRAVEL MODE (WEIGHTED)[1]

Category	Person-Days of Travel[2]	Person Trips	Percent of Trips	Person Trip Rate	Person-Miles Traveled (PMT) (Miles)	Distance Per Person-Day (Miles)	Distance Per Trip (Miles)	Travel Time Per Person-Day (Minutes)	Travel Time Per Trip (Minutes)
Urban	1,928,759	7,414,135	**89%**	**3.84**	62,656,982	32.5	8.5	85.1	22.1
Rural[3]	301,034	908,809	**11%**	**3.02**	8,745,798	29.1	9.6	68.6	22.7
El Dorado[4]	144,106	506,683	**6.1%**	**3.52**	5,082,292	35.3	10.0	78.4	22.3
Placer	335,268	1,313,384	**15.8%**	**3.92**	12,541,901	37.4	9.5	86.3	22.0
Sacramento	1,428,315	5,299,962	**63.7%**	**3.71**	45,109,332	31.6	8.5	84.7	22.8
Sutter	69,015	235,894	**2.8%**	**3.42**	1,670,280	24.2	7.1	54.3	15.9
Yolo	186,939	794,430	**9.5%**	**4.25**	5,331,082	28.5	6.7	81.2	19.1
Yuba	66,150	172,591	**2.1%**	**2.61**	1,667,894	25.2	9.7	69.4	26.6
Under 18	553,203	1,475,171	**17.7%**	**2.67**	8,212,434	14.8	5.6	49.2	18.4
18-34	445,187	1,815,045	**21.8%**	**4.08**	13,835,809	31.1	7.6	87.5	21.5
35-64	891,534	3,970,743	**47.7%**	**4.45**	41,001,494	46.0	10.3	106.7	23.9
65 and over	339,871	1,061,985	**12.8%**	**3.13**	8,353,043	24.6	7.9	69.3	22.2
Walk	2,229,793	807,160	**9.7%**	**0.36**	797,042	0.4	1.0	6.5	18.0
Bike	2,229,793	181,593	**2.2%**	**0.08**	404,904	0.2	2.2	1.6	19.6
Car	2,229,793	7,058,299	**84.8%**	**3.17**	53,343,202	23.9	7.6	67.9	21.4
Taxi	2,229,793	3,908	**0.0%**	**0.00**	38,510	0.0	9.9	0.1	47.2
TNC	2,229,793	19,139	**0.2%**	**0.01**	188,681	0.1	9.9	0.2	20.7
Transit	2,229,793	102,754	**1.2%**	**0.05**	1,000,861	0.4	9.7	2.8	59.9
School bus	2,229,793	23,920	**0.3%**	**0.01**	129,128	0.1	5.4	0.4	40.2
Other[5]	2,229,793	122,720	**1.5%**	**0.06**	15,473,234	6.9	126.1	3.3	60.9
Total	**2,229,793**	**8,322,944**	**100%**	**3.73**	**71,432,508**	**32.0**	**8.6**	**83.8**	**22.5**

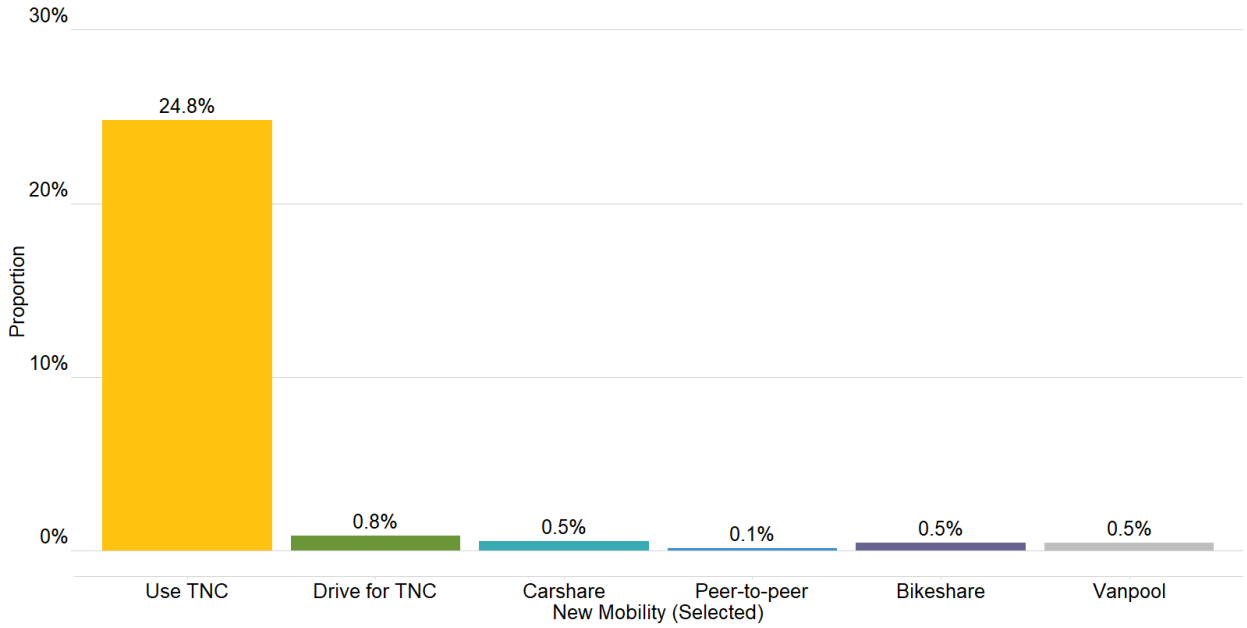
[1] This table represents all trips on complete weekdays, regardless of trip location. In-region trip rates and shares may vary slightly.
[2] Person-days represent all persons living in households in the region, which equates to the regional population excluding group quarters residents.
[3] Rural is defined by the "Rural" sample segment from the study sample plan, mostly based on SACOG's community types of "Ag/Other" or "Rural Res."
[4] El Dorado and Placer counties exclude the Tahoe Basin, in accordance with the SACOG planning area.
[5] The largest class of trips identified within 'Other' is air travel, and the resulting estimates for travel distances are heavily skewed towards long trips.

Uber/Lyft Usage and Trip Characteristics

Roughly one-quarter of respondents said they use Uber or Lyft (i.e., transportation network companies, or TNCs) at least periodically. Around 4% of participants actually recorded at least one trip by a TNC. Another 0.8% of persons report driving for TNCs. These levels of use are higher than all other “new mobility” or shared modes, which hover at 0.5% or less (Figure 1).

The TNC mode share is quite small for the region overall at 0.23%, however it is nearly 0.9% for persons in the TNC oversample segment, which was composed of Census block groups with an expected higher share of TNC activity. (Figure 1) Looking at all seven days of travel for smartphone owners, nearly half (47%) of TNC trips occurred after 5PM, and nearly half (48%) occur on Friday to Sunday, a time period outside of most travel surveys.

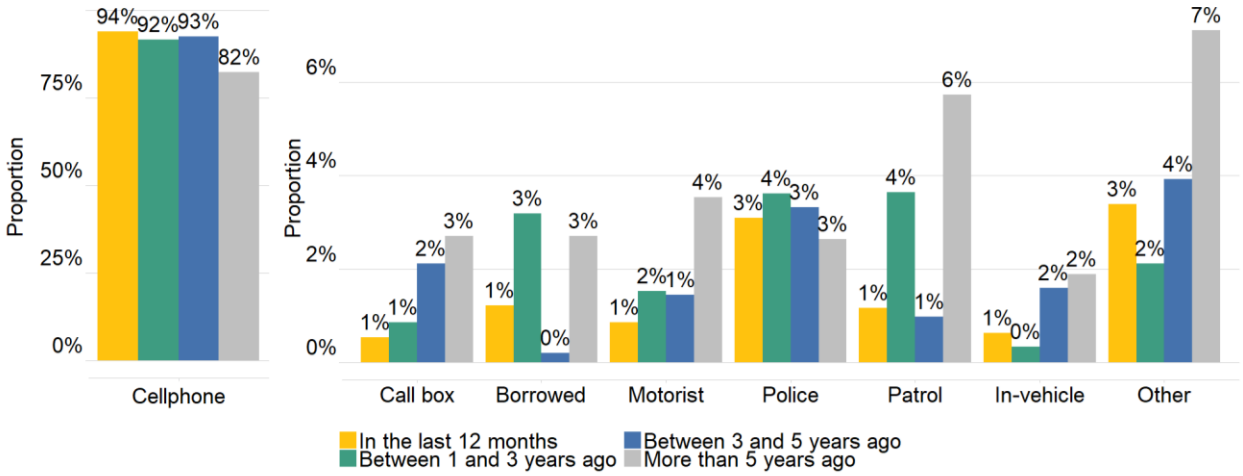
FIGURE 1: NEW MOBILITY SUMMARY OF SELF-REPORTED USAGE % OF ADULTS (18+)



Roadside Assistance and Highway Callbox Questions

Roughly 80% of people have ever requested roadside assistance for themselves, with 30% requesting it in the last 12 months and another 20% requesting it in the 12-36 months. 90% of people said they used a cell phone the last time the requested roadside assistance, while only 1% of people said they used a highway call box. Looking at the trend over time, we see that using cell phones has grown from 82% among people who requested assistance over five years ago to 94% of persons who requested assistance in the last 12 months. Conversely, the share of people using the call boxes has dropped from 3% to less than 1% for those same time periods (Figure 2). Over 90% of households reported being aware of roadside call boxes in the region, however, signaling that people know that they are available.

FIGURE 2: ROADSIDE REQUEST METHOD BY LAST REQUESTED (N = 3,413 HHS)



Remainder of This Document

The remainder of this document evaluates the performance of the sample plan, describes the demographics of the persons in the dataset, describes the key travel behaviors that were captured, including sections on TNC use, and summarizes the results of the questions on roadside assistance and highway callboxes.

Finally, with a sample size of 4,000 households, the results and distributions of this dataset generally have a 95% confidence interval of +/- 1.5% *or less*, however that can vary depending on the exact universe of analysis and reported share of the distribution. A chart showing that 25% of people regularly use Uber/Lyft is technically 25% +/- 1.3%, for example.

2.0 SAMPLE PLAN EVALUATION

This section briefly evaluates the performance of the sample plan, both in terms of the quantity of data collected and whether the oversampling approaches accomplished their objectives. Overall, this study targeted at least 3,600 households with complete travel surveys but obtained 4,010 households. The address-based sample (ABS) plan used compensatory oversampling to overcome low response among low-income and rural households and targeted oversampling to gather a higher volume of data among groups of particular interest (frequent TNC- and walk/bike/transit-users). These different oversampling methods resulted in the following sample segments:

- General population (no oversampling)
- Rural population (1.3x compensatory oversampling)
- Medium-frequency walk/bike/transit population (2.0x targeted oversampling)
- TNC-users or high-frequency walk/bike/transit population (3.0x targeted oversampling)

The income-based compensatory oversampling was split among these geographic sample segments. The sections below analyze the overall effectiveness of this sample plan.

Overall Response

This study exceeded the target household size by nearly 14%, with an overall sample rate for this region to 0.47% (4,010 complete households / 846,899 total households in the region). The general and targeted oversample segments exceeded their household targets while the rural segment met its household target almost exactly.

Compensatory Oversample Evaluation

The pilot study in early 2018 demonstrated that both low-income and rural households in the region respond at lower rates than the general population, so both characteristics were prioritized for oversampling. The rural oversample strategy used geographic oversampling while the low-income strategy used estimated household incomes from the sample data provider. The full details of both strategies are included in the study sample memo, provided separately.

As expected, the rural segment had 30% lower *response rates* than the general population (Figure 3), but the rural *sample rate* was equal to the general population, indicating that the compensatory sampling strategy achieved its goal (Figure 4).

The income-based oversampling strategy was also effective, as evidenced by the initial household weights among income groups within each segment. These weights are calculated based on the probability of a household being sampled (e.g., a 1 in 300 chance). The final count of sampled households includes all households that completed at least one travel day on Monday to Thursday. The general population segment, which was the largest segment, has relatively consistent initial weights, all near ~325. This reflects how the estimated income-based oversampling mostly corrected the nonresponse bias across income groups. The full weighting process is detailed in the weighting memo, provided separately.

Targeted Oversample Evaluation

Frequent TNC and walk/bike/transit-users responded as typical rates during the pilot study but were still of high interest in the final dataset. RSG identified key geographic areas to oversample these behaviors, based on available evidence and prior research in the San Diego region. RSG then split these areas into two segments – 1) Medium-frequency of walk/bike/transit use and 2) TNC or High-frequency or walk/bike/transit use. The estimated final sample rates for these segments were 0.62% and 0.94%, respectively. The combination of high response rates and initial oversampling efforts (i.e., high initial invitation rates) resulted in both segments surpassing their targets (See Figure 3 and Figure 4).

FIGURE 3: RESPONSE RATE BY SAMPLE SEGMENT (UNWEIGHTED)

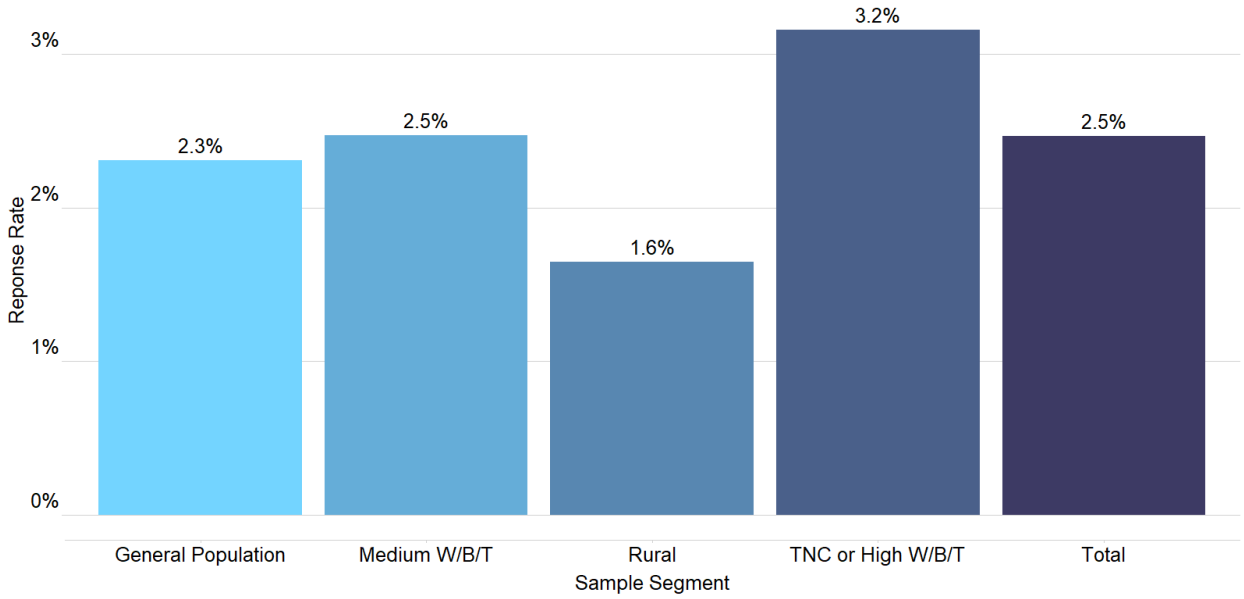
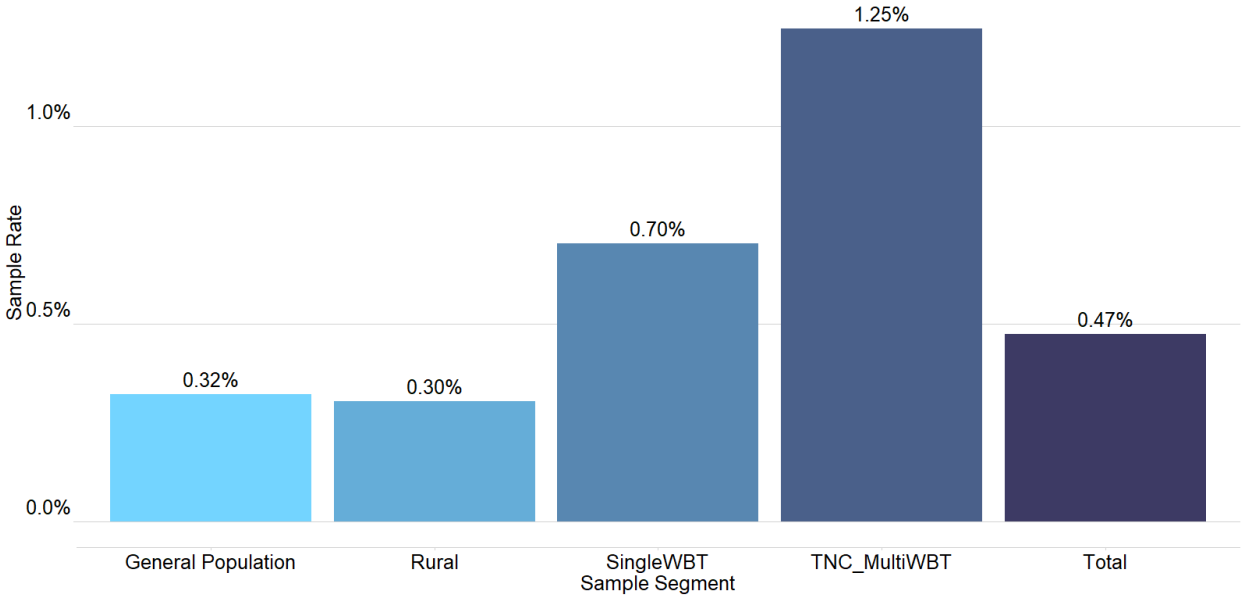


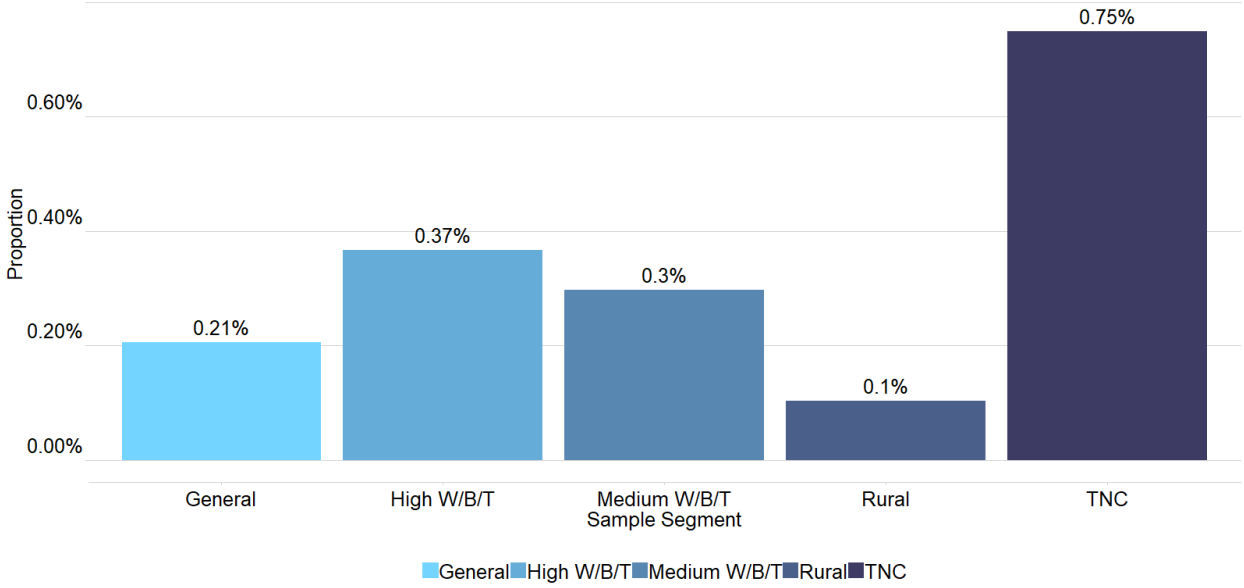
FIGURE 4: SAMPLE RATE BY SAMPLE SEGMENT (UNWEIGHTED)



TNC Trip Oversample Evaluation

The goal behind oversampling likely TNC-users was to collect a higher number of TNC trips. Figure 5 below shows the TNC mode share among the sample segments, with the TNC and walk/bike/transit portions of the "TNC or High W/B/T" split out separately. Given that many TNC trips occur on weekends, this analysis uses all seven days of travel, instead of restricting it to Monday to Thursday like most weighted analyses in this report. Overall, the block groups that RSG identified as more likely to take TNC trips took nearly three-times the TNC trips than the other segments. The dataset includes 713 TNC trips on complete household days, more than one-third of which can be attributed to oversampling efforts. Nearly half (48%) of TNC trips were collected Friday-Sunday, which can be attributed to the study design collecting data for up to seven days.

FIGURE 5: TNC MODE SHARE BY EXPANDED SAMPLE SEGMENT (WEIGHTED ACROSS ALL DAYS OF THE WEEK)



Summary

Overall, the sample plan was effective in reaching (and exceeding) the study targets by nearly 14%. Both the compensatory income-based and targeted TNC usage oversampling methods were researched and tested prior to the study, but this study was innovative in its use of these approaches.

3.0 DEMOGRAPHIC SUMMARY

This section analyzes the demographic composition of the final sample. Unless otherwise noted, all analyses use weighted data, meaning the totals and overall proportions align closely with American Community Survey (ACS) data for the region. For an evaluation of how closely the *unweighted* dataset matched the ACS data for the region, please see the memo on the data weighting approach.

Demographics by Participation Group

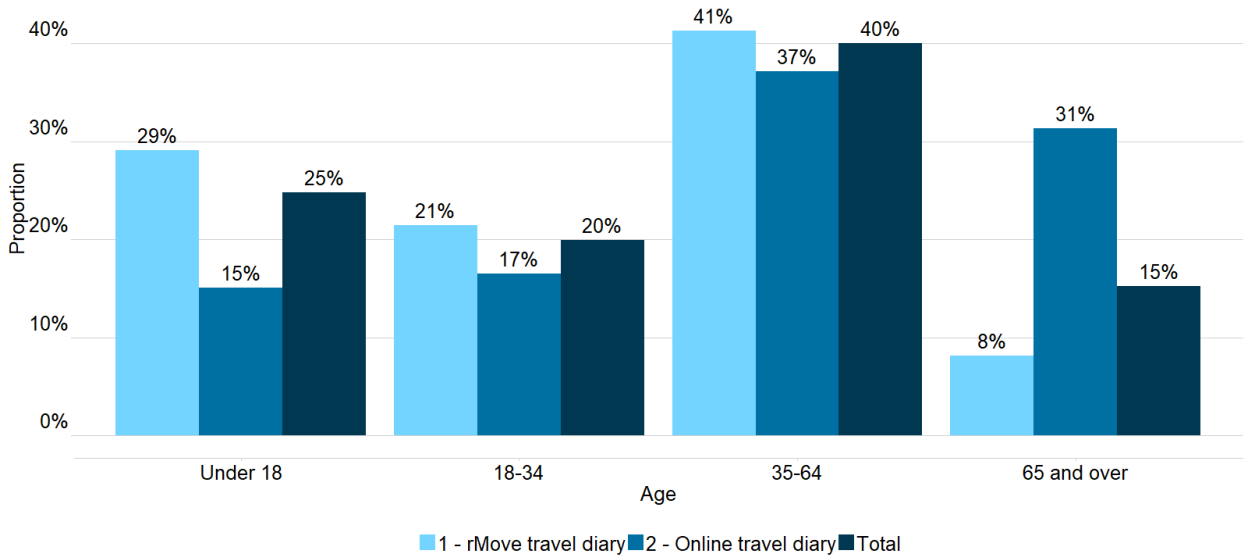
Given the design and methods used in this study, it is important to understand the demographic differences between smartphone-users and non-smartphone-users and how this shaped the response and the resulting dataset. (Using smartphones for the travel diary was determined at the household level; all adults were required to own their own smartphones to use the rMove™ smartphone app for travel surveys.)

Approximately 73% of the unweighted households used the rMove smartphone app to complete their travel diaries, and the remaining 26% of households completed their travel diaries online. Given the high share of households that used rMove to complete the study, the resulting dataset is both high quality and high quantity. On average, rMove households completed 5.4 travel days with a person trip rate of 4.3 trips per day, whereas online diary households completed only one travel day with an average person trip rate of 2.6 (Figure 27). The most noticeable difference between groups is that online diary participants have four times the share of persons over 65 (31% vs 8%) compared to rMove households, which leads to noticeable differences in demographics correlated with age, including employment and student status. Household income is far less predictive of smartphone ownership (and thus group assignment) than age, especially after controlling for age.

Person Age

As mentioned above, online diary participants are much older, with nearly four times the share of persons over 65 (31% vs 8%) (Figure 6). Similarly, households using rMove have twice the share of those under 18 (29% vs 15%), and slightly more persons age 18-34 (21% vs 17%). This difference in age leads to differences in other demographics correlated with age (e.g., employment status) and resulting trip behaviors (e.g., distribution of trip purposes). The effects of this difference in age are detailed more extensively in the sections below.

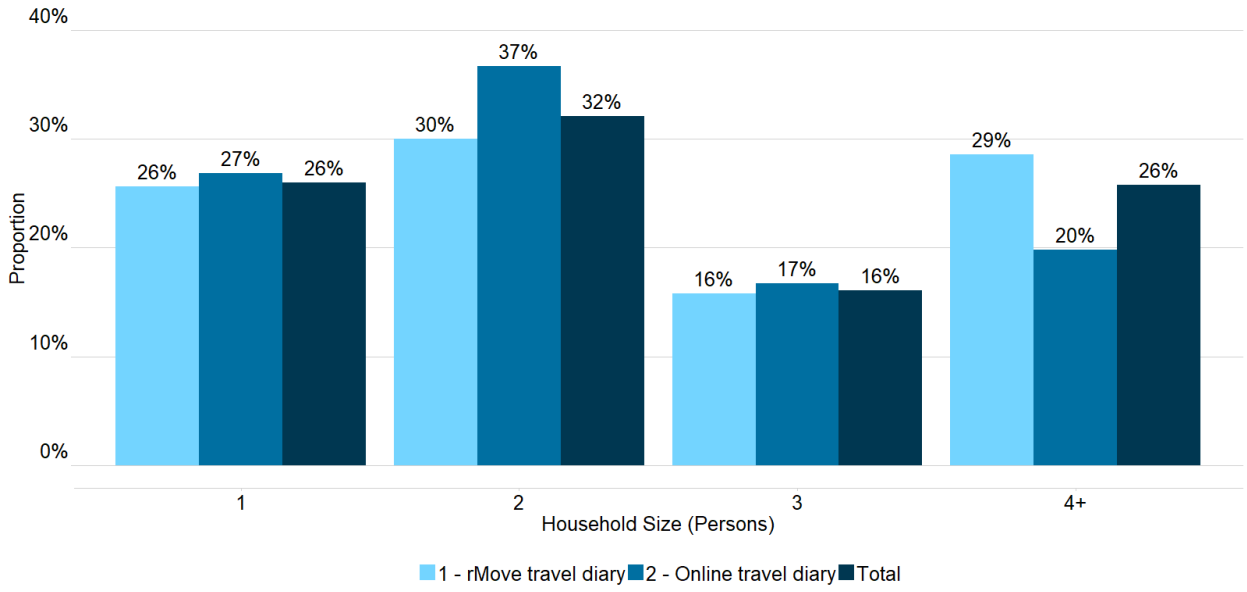
FIGURE 6: PERSON AGE BY PARTICIPATION GROUP



Household Size

The distribution of household sizes between participation groups is fairly similar for 1- and 3-person households, but noticeably different for 2 and 4+ person households (see Figure 7). The online diary participants have a higher share of 2-person households due to the slightly older demographic overall – many of these households are older couples without children at home. The lower share of 4+ person households is the inverse of this pattern.

FIGURE 7: HOUSEHOLD SIZE BY PARTICIPATION GROUP



Household Income

In general, households using rMove had higher household incomes (Figure 8). They also have larger household sizes (Figure 7) and higher shares of employed persons (Figure 12), both correlates of higher incomes. About 75% of adults (age 18+) with reported incomes below $25k reported smartphone ownership compared to 90%+ smartphone ownership among households with higher reported incomes (Figure 9), however once again, this trend of smartphone ownership by income is almost nonexistent after controlling for age.

FIGURE 8: HOUSEHOLD INCOME BY PARTICIPATION GROUP

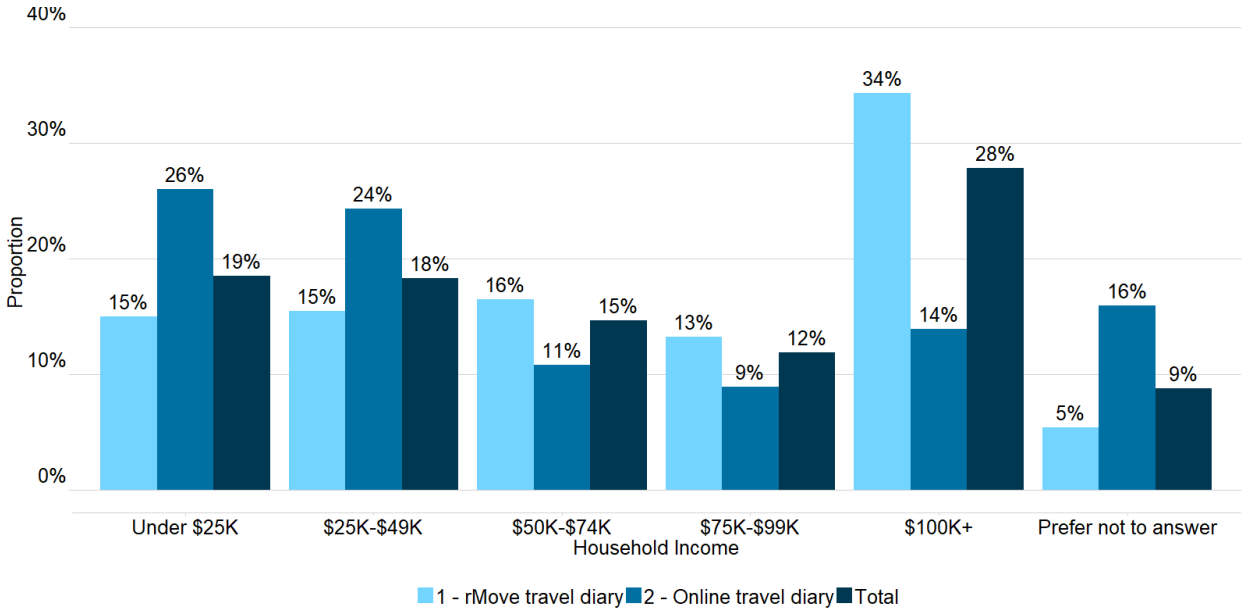
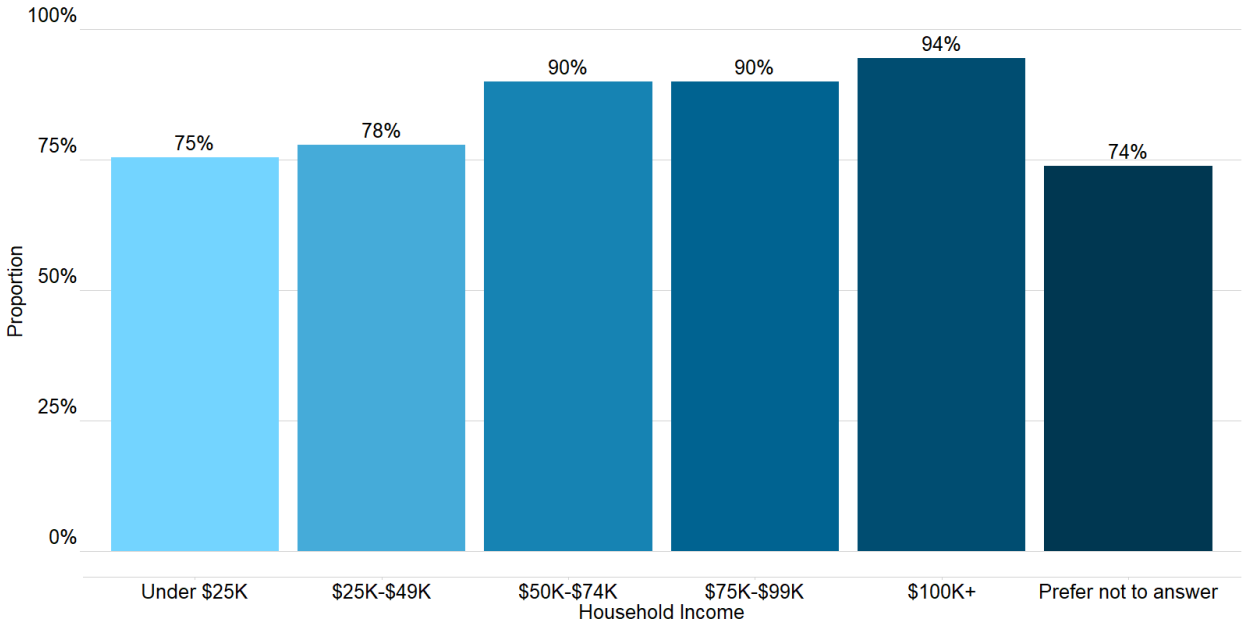
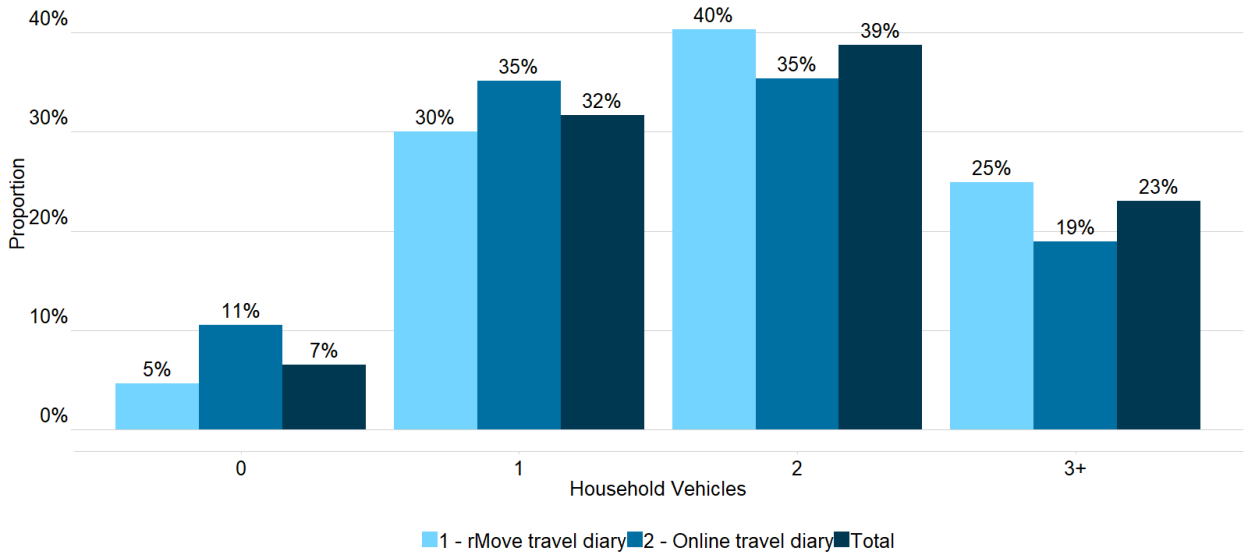


FIGURE 9: SMARTPHONE OWNERSHIP BY REPORTED HOUSEHOLD INCOME



Household Vehicles

On average, rMove households have more cars than online diary households (2.0 vs 1.7 cars, respectively). The total weighted average for all households in the study was about 1.9 cars per household. Online diary households are twice as likely as rMove households to not have a car, but the proportion is still small (11% vs 5%).



Household Dwelling Type

The share of single-family homes between the two participation groups is extremely similar at 71-72%. Online diary users were about six-times as likely to live in a mobile home or trailer (6% vs 1%), and twice as likely to live in retirement or senior housing (2% vs 1%). The higher share

Figure 11 shows the distribution of dwelling types among residents age 65+. This distribution is similar to the total distribution, although with slightly more participants living in single-family and retirement/senior homes, and fewer living in multifamily homes.[6]

[6] Dorms, barracks, and “other” household types are excluded from both figures – and subsequent dwelling type figures – due to the low number of observations in this study (11 households total). Given how this study focused on residents of households, and not group quarters residents, this is not unexpected.

FIGURE 10: HOUSEHOLD DWELLING TYPE BY PARTICIPATION GROUP (EXCL. DORM/BARRACKS/OTHER)

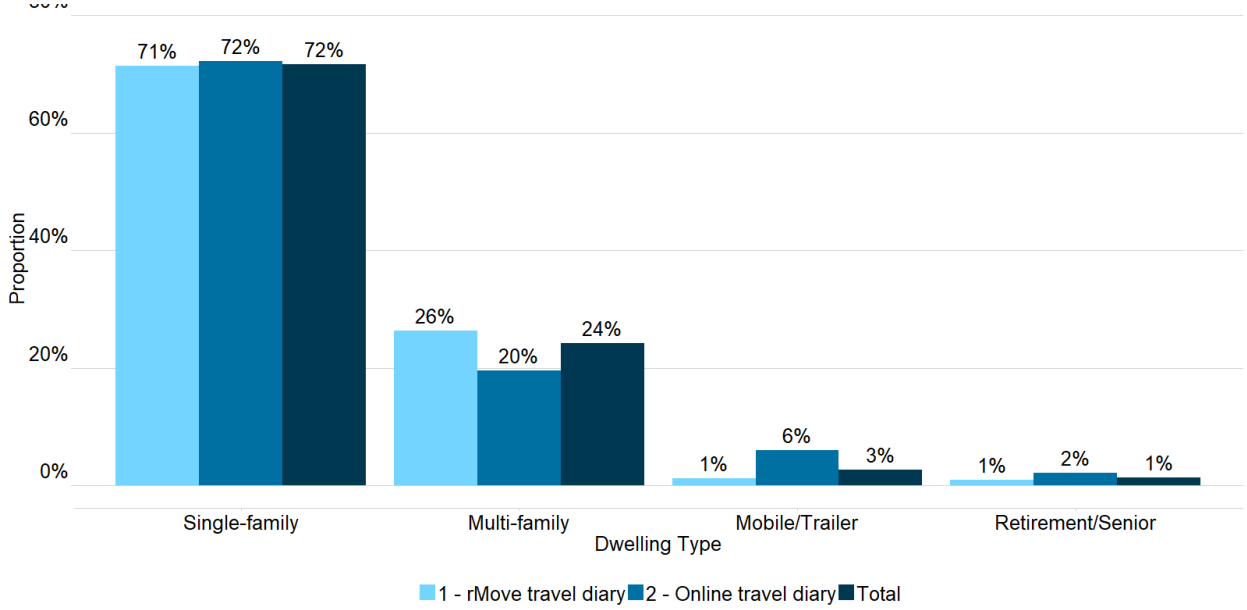
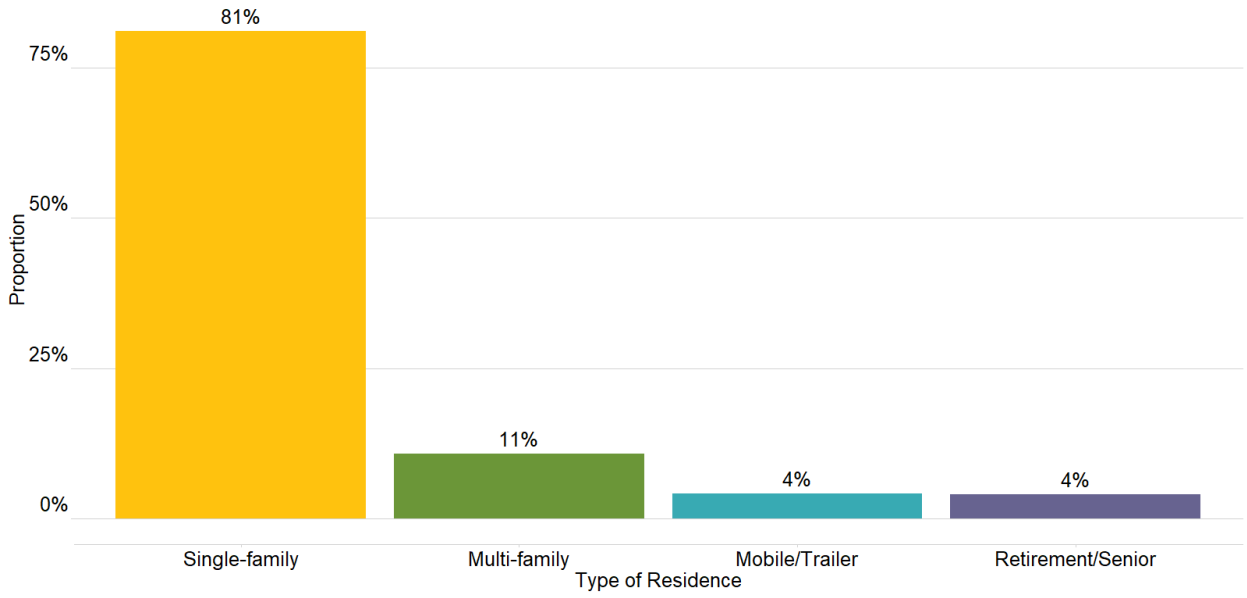


FIGURE 11: DWELLING TYPE AMONG AGE 65+



Person Employment Status by Participation Group

As mentioned earlier, online travel diary users contain four times as many participants over age 65 as the rMove segment, resulting in twice the share of rMove users who are employed full-time (48% vs 24%) and half the share who are unemployed (31% vs 62%) (Figure 12).

Figure 13 shows the person employment status by age, which confirms the primary cause for the employment differences between participation groups. Approximately 80% of adults age 65+

are not currently employed, compared to about 30% of adults age 18-64. This is consistent with unemployment rates among 65+ adults in California, as shown in Table 2.

FIGURE 12: PERSON EMPLOYMENT BY PARTICIPATION GROUP

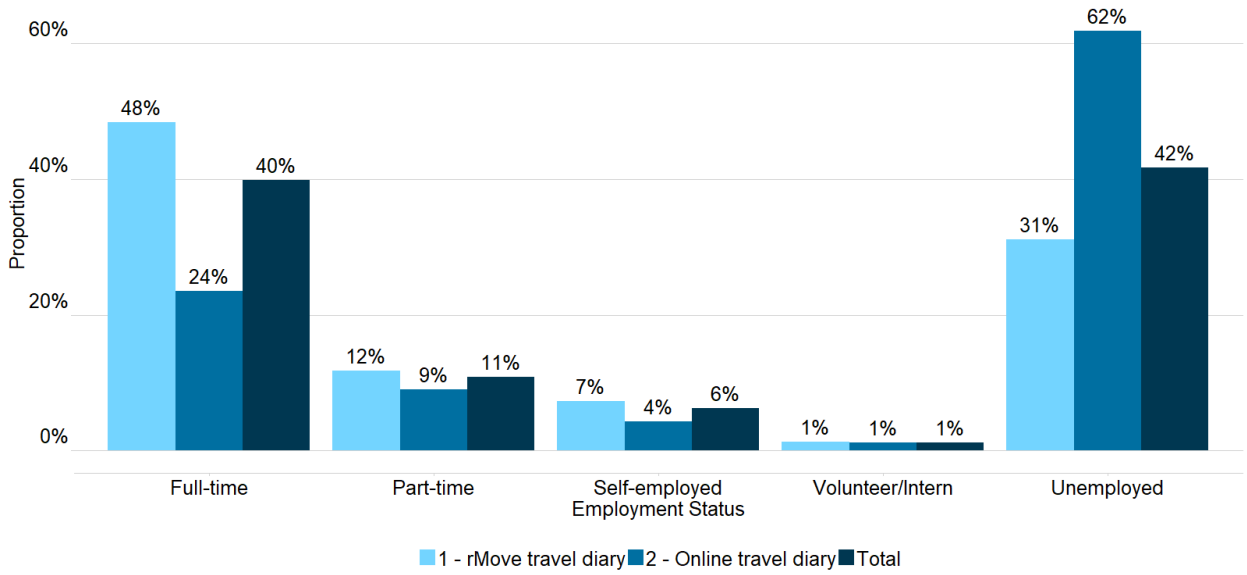


FIGURE 13: PERSON EMPLOYMENT BY AGE

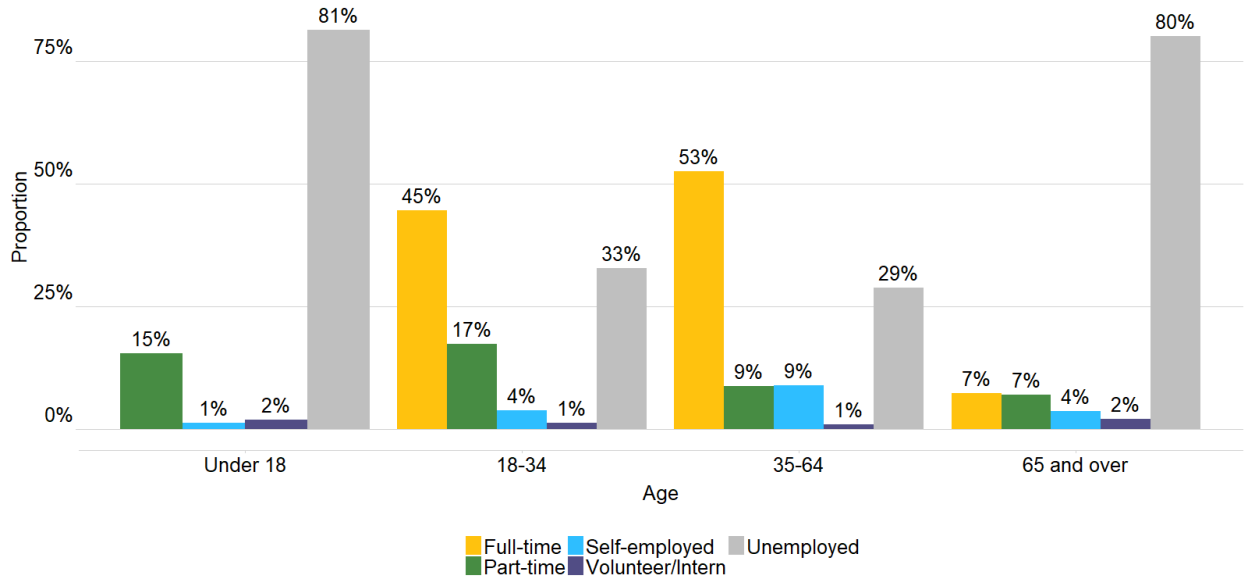


TABLE 2: CALIFORNIA WORK STATUS IN THE PAST 12 MONTHS (65 YEARS AND OVER) [7]

WORK STATUS IN THE PAST 12 MONTHS	Study Region	California
Worked full-time, year-round	7.3%	8.6%

[7] This data was taken from ACS table B23027: *Full-time, year-round work status in the past 12 months by age for the population 16 years and over.*

Worked less than full-time, year-round	12.6%	11.3%
Did not work in the past 12 months	80.1%	80.1%

Although there is a large difference between the employment rates of age 65+ participants and younger participants, the travel behavior by employment status is relatively similar across the two age categories (Figure 14 vs Figure 15).

FIGURE 14: DISTRIBUTION OF TRIP PURPOSE BY EMPLOYMENT STATUS (AGE 64 AND UNDER)

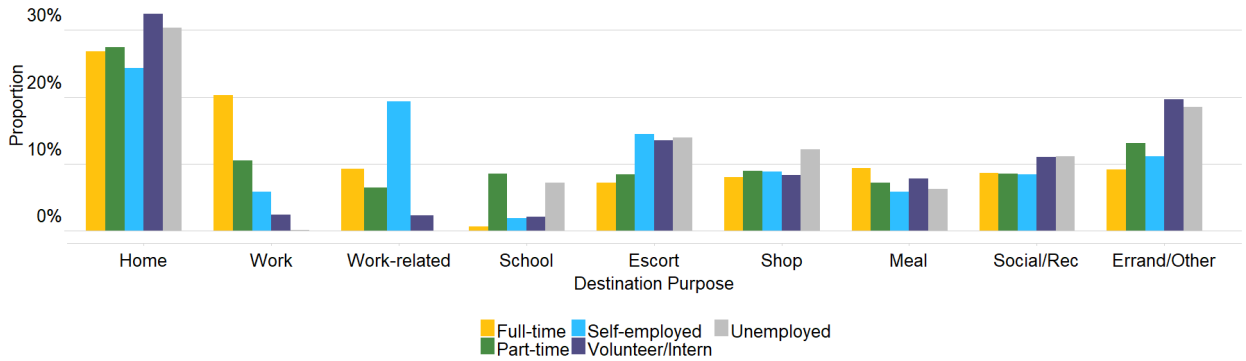
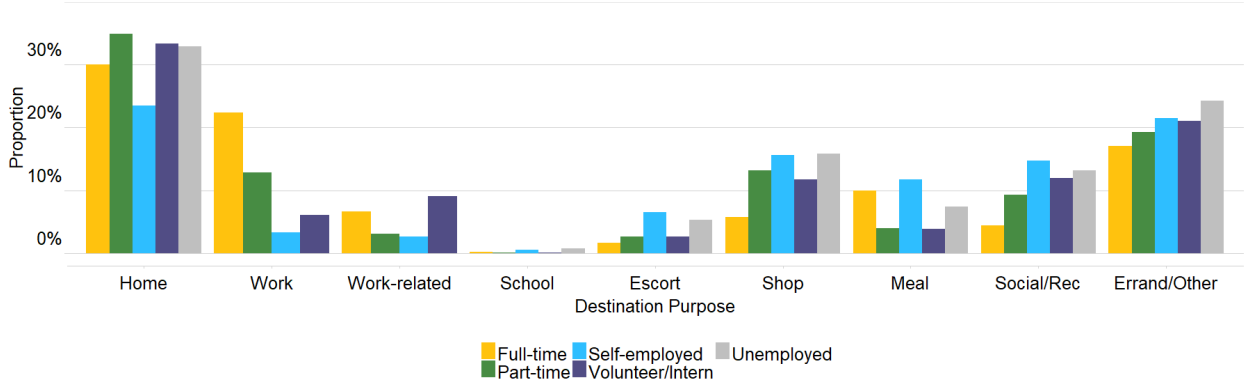


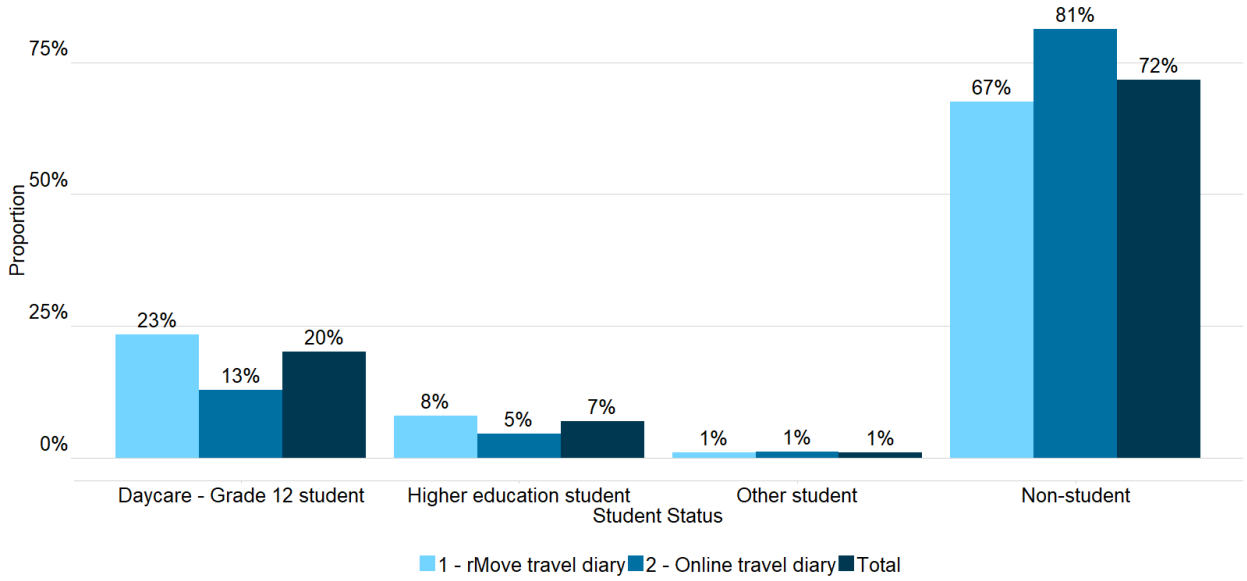
FIGURE 15: DISTRIBUTION OF TRIP PURPOSE BY EMPLOYMENT STATUS (AGE 65 AND OVER)



Person Employment Status by Participation Group

rMove households have a higher share of students than the online diary households (Figure 16), which includes both primary and second students 23% vs 13%) and those in higher education (8% vs 5%). Accurate and complete child trip rate reporting is a longstanding difficulty for household travel surveys.

FIGURE 16: PERSON STUDENT STATUS BY PARTICIPATION GROUP



Household Vehicles

Household vehicle ownership is impacted by many factors, including income and housing type, while also heavily impacting travel behavior. Lower income households have fewer cars per household, with one-quarter of households earning less than $25,000 per year not owning a car, while less than 1% of households earning $50,000 or more are car-free. (Figure 17)

When looking at vehicle ownership by dwelling type, three-quarters of single-family homes have two or more cars, while two-thirds of those in multifamily housing have zero or one vehicle. At the extreme, 97% of those in retirement/senior living have zero or one vehicle. (Figure 18) The impact of this vehicle distribution is shown in Figure 19, which displays trip modes by dwelling type. Multi-family and retirement/senior households have the highest share of zero-vehicle ownership (19% and 27%, respectively). These households also have the lowest share of car trips (77% and 83%, respectively). Still, car trips make up the vast majority of trips among all dwelling types.

Around 92% of household vehicles in the region are gas-powered (including flex fuel), but 5.5% are hybrid or electric. The remaining 3% use either Diesel or another fuel. (Figure 20)

FIGURE 17: HOUSEHOLD VEHICLES BY HOUSEHOLD INCOME

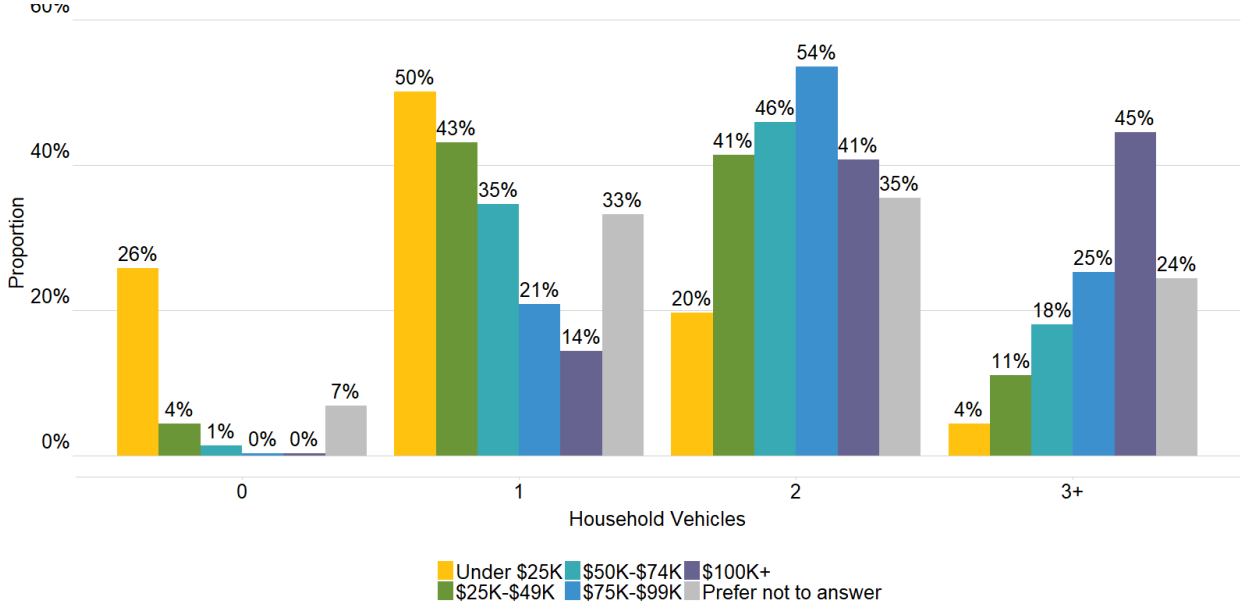


FIGURE 18: HOUSEHOLD VEHICLES BY DWELLING TYPE

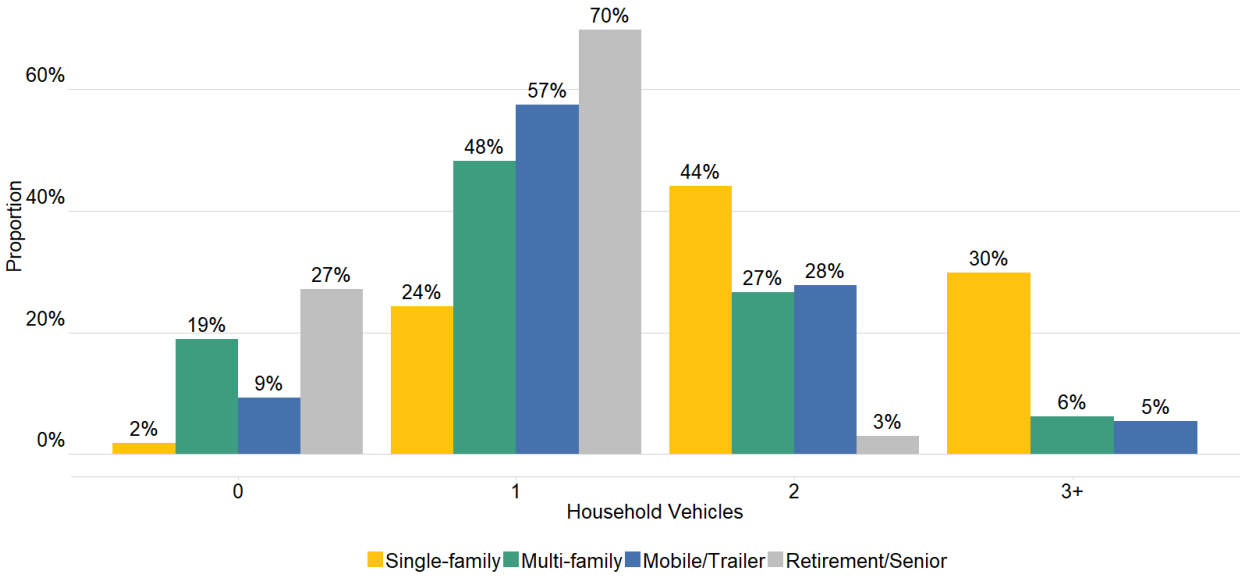


FIGURE 19: TRAVEL MODE BY DWELLING TYPE

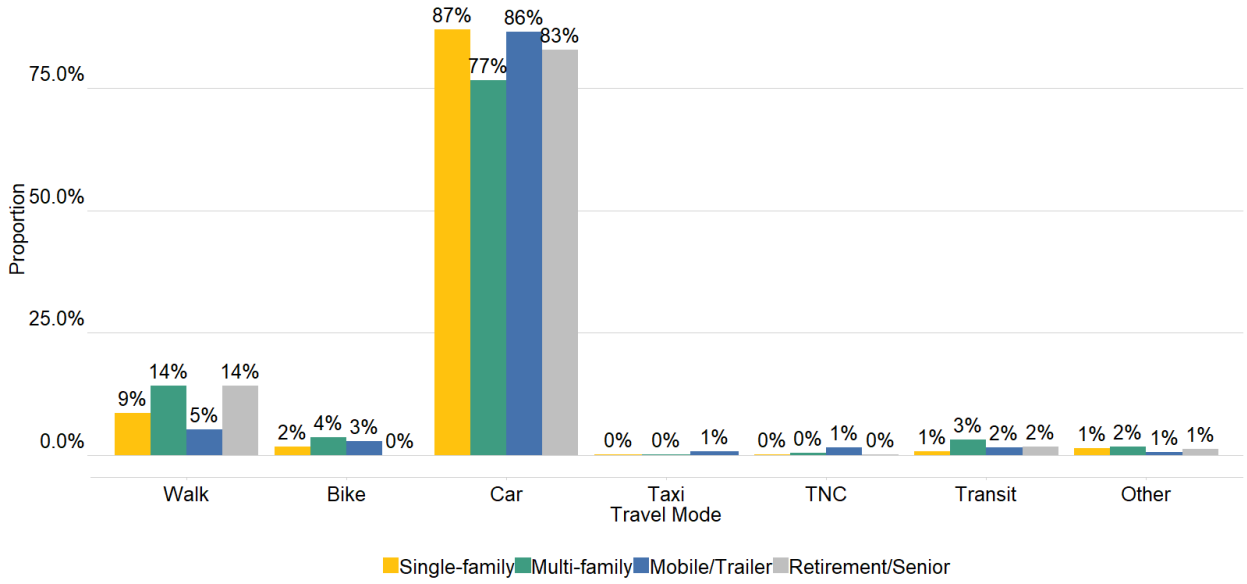
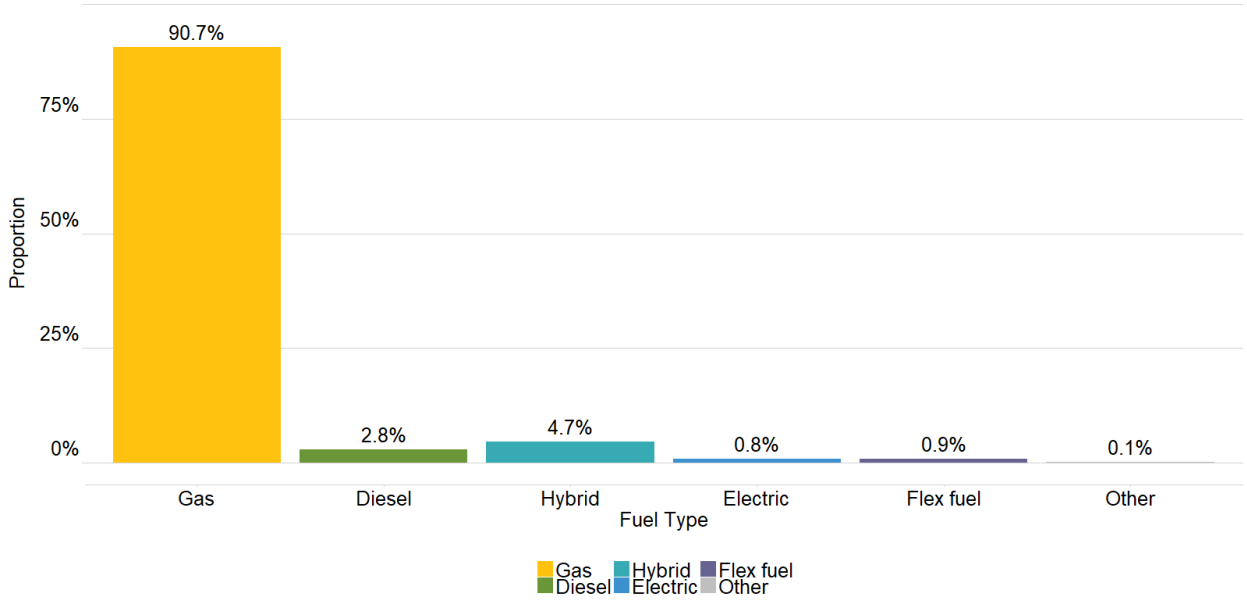


FIGURE 20: HOUSEHOLD VEHICLES BY FUEL TYPE



4.0 REGIONAL QUESTION RESPONSE SUMMARY

The study included several questions specific to the Sacramento region to help SACOG understand roadside assistance, highway call box awareness and use, and general transportation planning/information tools. The following analyses show the overall weighted results of these questions.

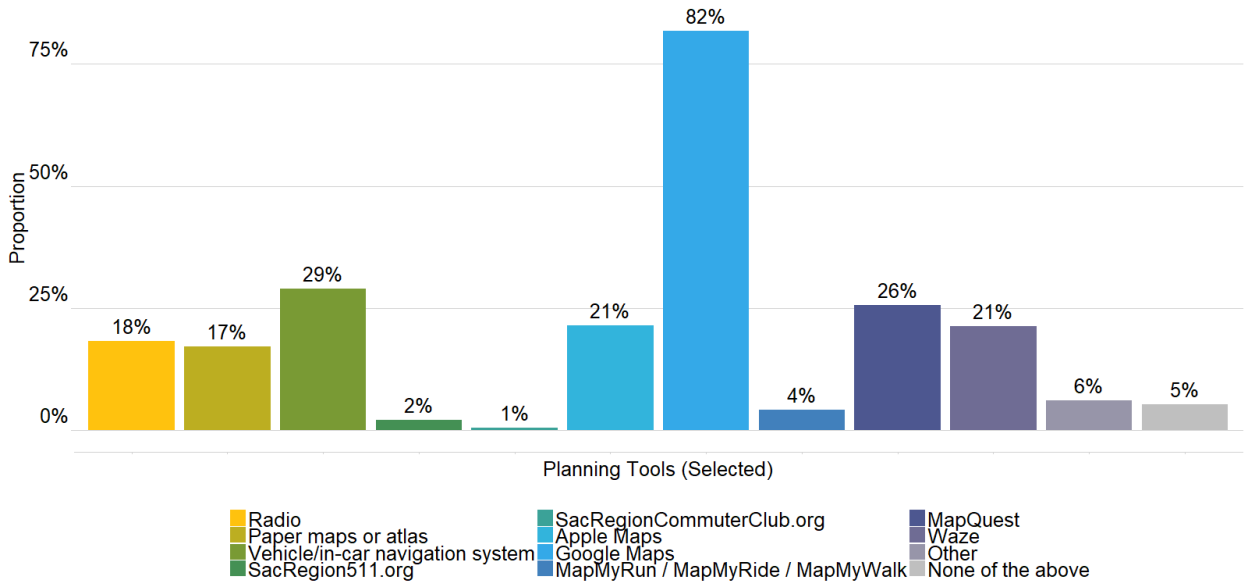
Planning Tools

The survey included the following question about transportation planning tools:

> ***Which of the following tools, apps, or websites does your household use to help plan your transportation decisions?*** *Please select all that apply.*

Figure 21 shows the percent of households that selected each option listed. (Households could select as many options as were relevant, unless they selected "none.") Over 80% of households use Google maps, the most popular service. In-car navigation, MapQuest, Apple Maps, and Waze all have approximately similar popularity, with 20-30% of households using those services. The local services *SacRegion511.org* and *SacRegionCommuterClub.org* had the smallest shares, at 2% and 1%, respectively. Five percent of people said they used none of these tools.

FIGURE 21: NAVIGATION PLANNING TOOLS SUMMARY (SELECT ALL THAT APPLY)



Roadside Assistance

The survey also included questions about the last time someone in the household requested roadside assistance for a stranger or for themselves. Overall, 64% of households reported that no household member had ever requested roadside assistance for a stranger (Figure 22), but

about 80% had requested roadside assistance for themselves (Figure 23). Nearly 30% of households requested assistance in the past year.

FIGURE 22: REQUESTED ROADSIDE ASSISTANCE FOR A STRANGER – SUMMARY

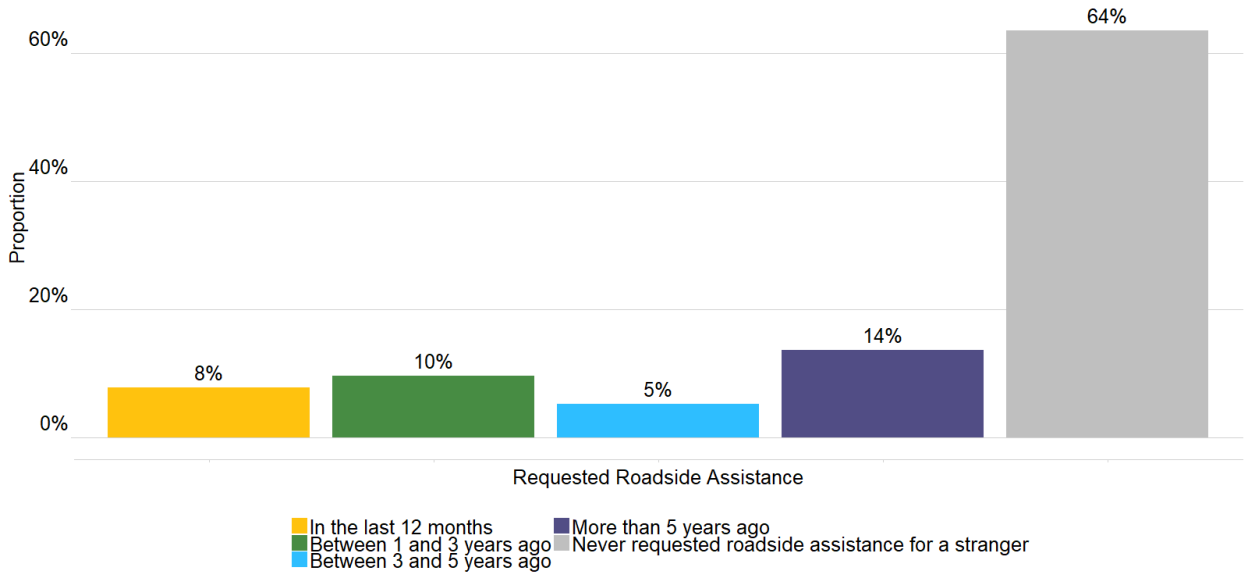
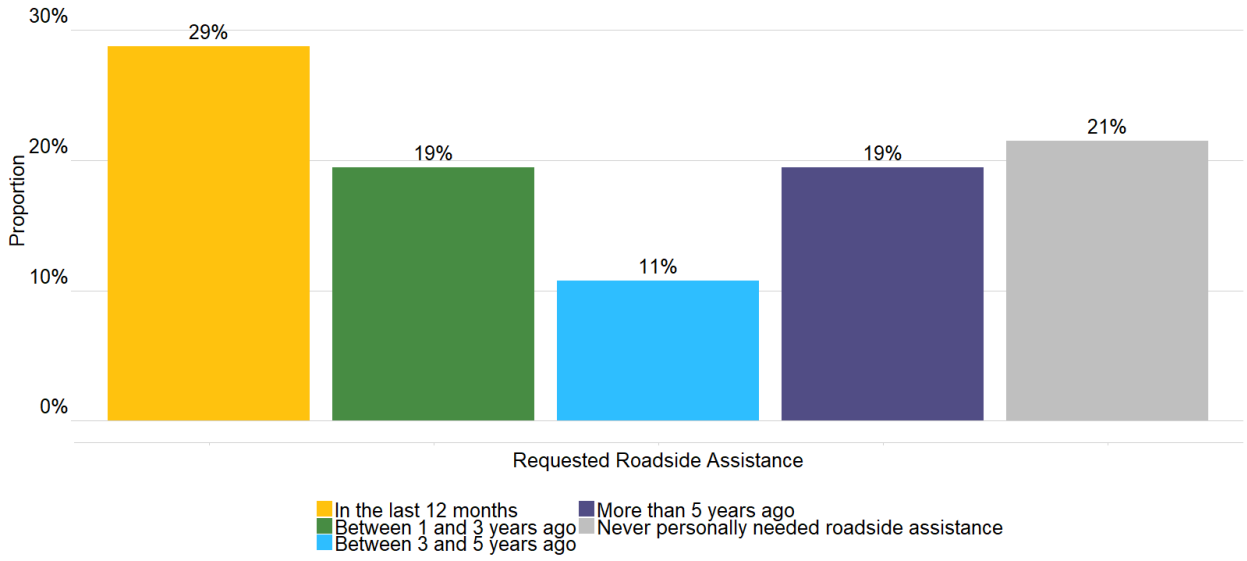


FIGURE 23: REQUESTED ROADSIDE ASSISTANCE FOR MYSELF – SUMMARY



Those who had requested roadside assistance for themselves were asked a follow-up question about the way they requested roadside assistance (Figure 24). By far the most common method of requesting roadside assistance is by personal cellphone (90% of responses). About 1% of households used a call box the last time they requested roadside assistance. When looking at the request method by the time the request was made, we can see that cellphone requests have become more common while call box requests have declined in popularity. (Figure 25)

Among households that requested assistance in the past year, less than 1% used a call box (compared to 3% among households that requested assistance more than 5 years ago).

FIGURE 24: LAST METHOD OF ROADSIDE ASSISTANCE SUMMARY

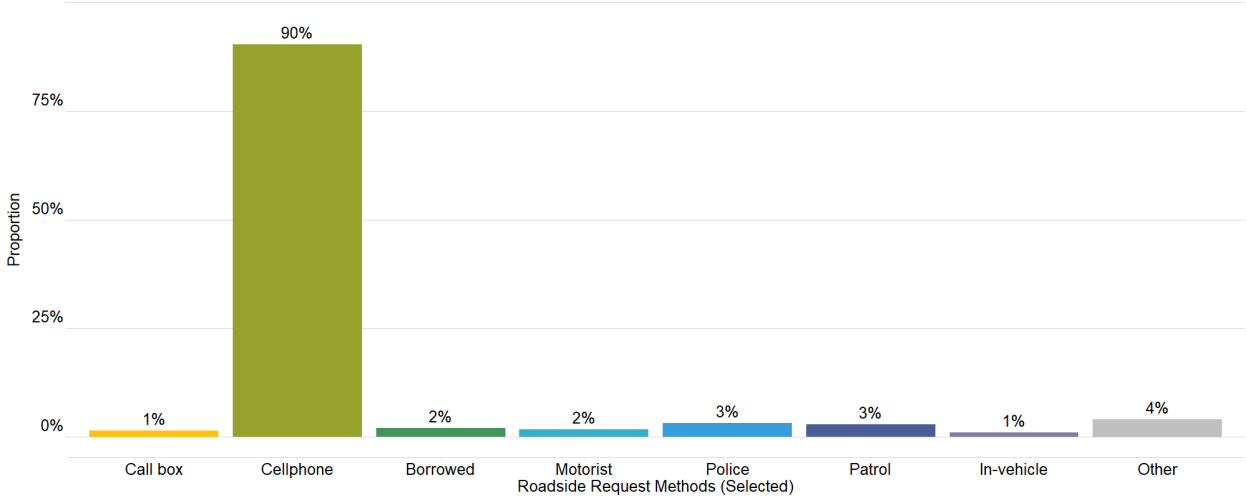
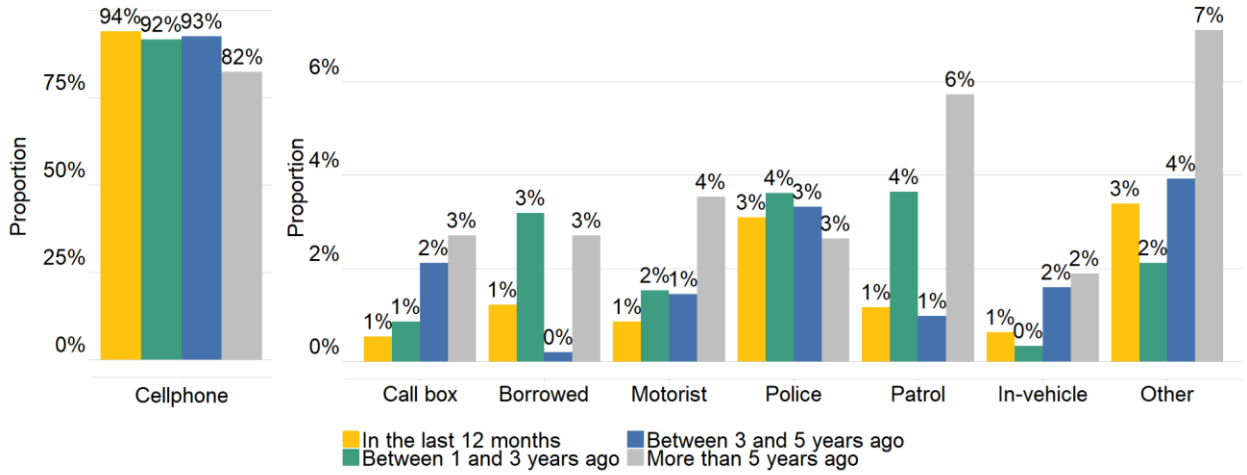


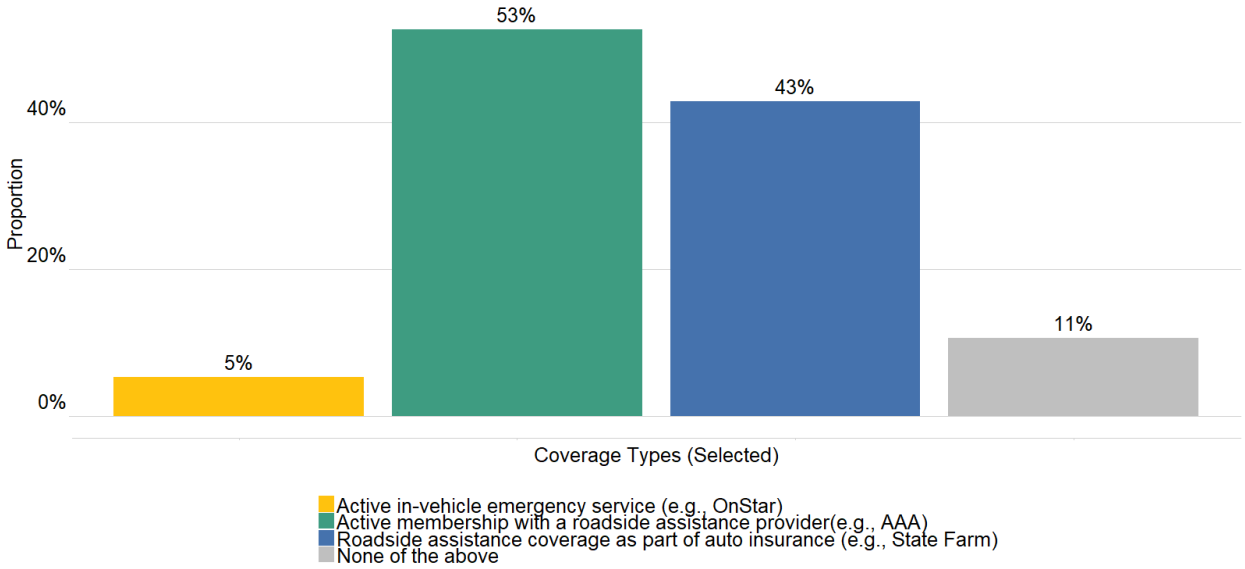
FIGURE 25: ROADSIDE ASSISTANCE REQUEST METHOD BY LAST REQUESTED (N = 3,413 HOUSEHOLDS)



Based on household responses to questions about call box awareness, the low share using call boxes is likely not due to lack of awareness. Over 90% of households reported being aware of roadside call boxes in the region prior to starting the survey. By comparison, only 16% of households knew that they could call 511 toll-free for roadside assistance prior to starting the survey.

A final question asked about roadside assistance coverage, summarized in Figure 26. The majority of households (53%) reported an active membership with a roadside assistance provider. A significant portion (43%) reported coverage as part of their auto insurance. These categories are not mutually exclusive, but only 11% of households reported no coverage at all.

FIGURE 26: SUMMARY OF HOUSEHOLD ROADSIDE ASSISTANCE SERVICE COVERAGE (SELECT ALL THAT APPLY)



5.0 TRIP ANALYSIS

This section describes the travel data collected during this study. The metrics used below include distributions (e.g., mode share, trip purpose share), trip rates (e.g., 3.7 trips per person-day), and maps. These metrics are often broken out by important variables, such as household income, age, or employment status. Additionally, these travel metrics are frequently broken out by whether a household used rMove versus the online travel diary, as the method of data collection can affect the data collected (smartphone-based data collected generally has higher and more accurate trip rates).

Trip Rates and Counts

One of the most notable differences between participation groups is the difference in volume of trips reported or collected. Figure 27 and Figure 28 below show the person- and household-level trip rates on complete household days (Monday – Thursday). The rMove household trip rate is nearly double the online household trip rate (11.2 vs 6.4), although a portion of that can be attributed to the larger average household size for households using rMove. Still, the rMove person trip rate is about 65% higher than the online diary person trip rate (4.3 vs 2.6).

FIGURE 27: PERSON TRIP RATE BY PARTICIPATION GROUP

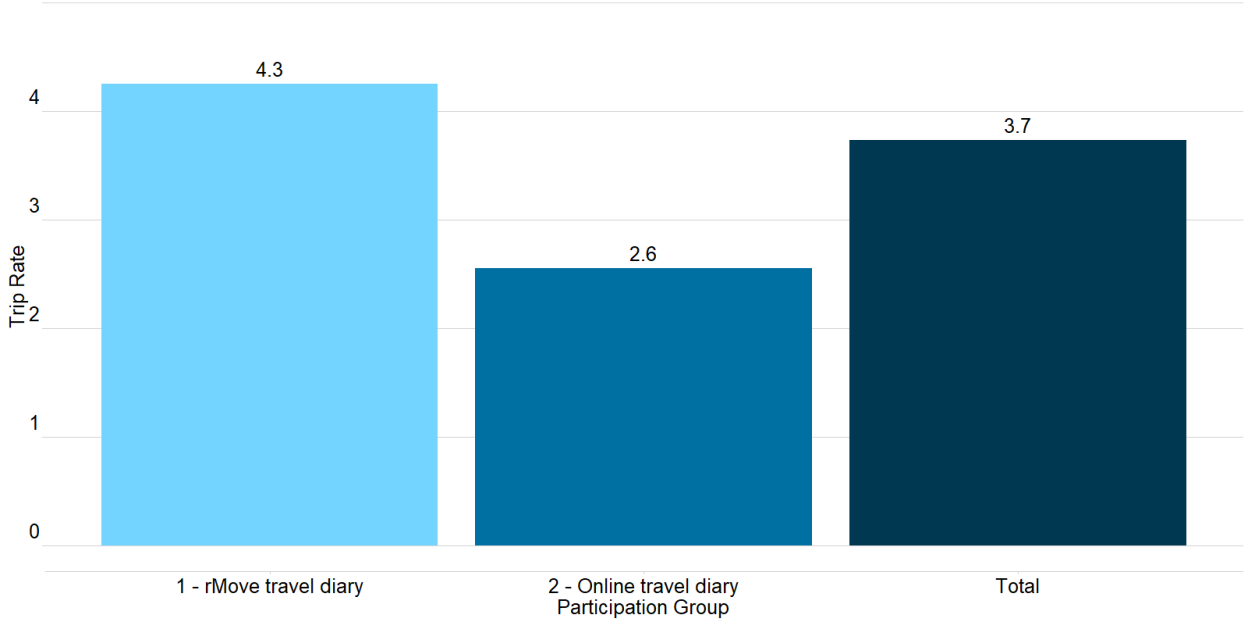
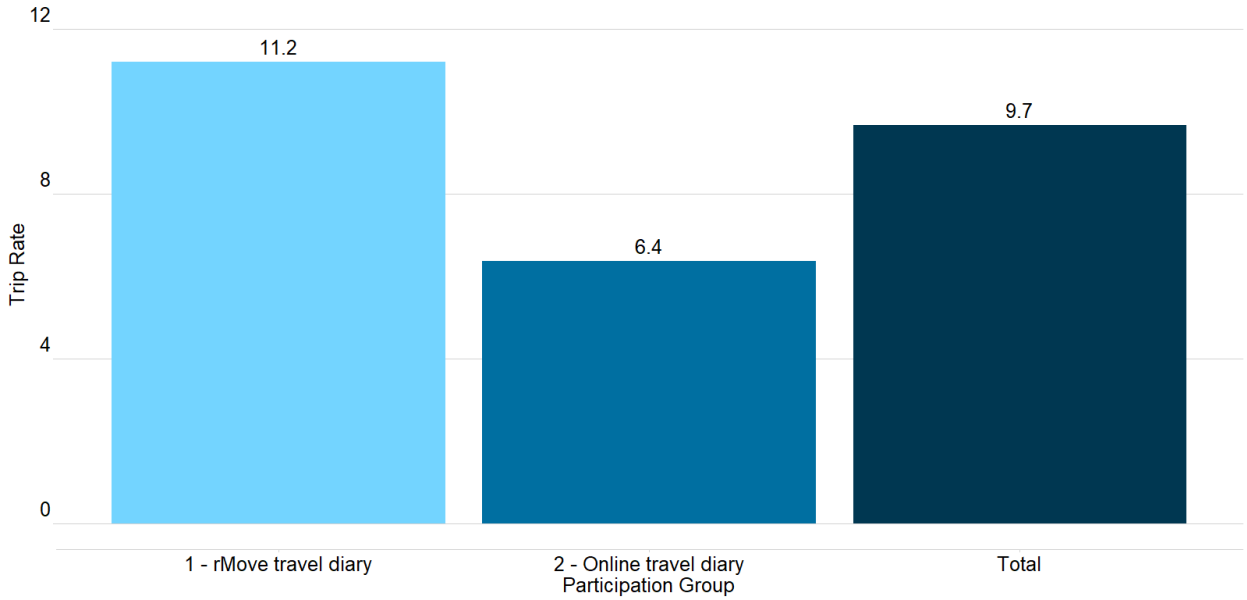


FIGURE 28: HOUSEHOLD TRIP RATE BY PARTICIPATION GROUP



While demographic differences account for some of the trip rate gap between groups, online diary nonresponse is also a factor. Figure 29 shows the difference in number of trips per day by participation group. The online diary participants (who recalled their travel) reported significantly more 0- and 2-trip days than rMove participants (whose phones collected their travel in real time). Online diary participants also likely underreported short-distance trips compared to rMove participants. Trips under two miles comprised 40% of rMove trips compared to 34% of online diary trips (Figure 30).

FIGURE 29: COUNT OF PERSON TRIPS ON COMPLETE WEEKDAYS BY PARTICIPATION GROUP (UNWEIGHTED)

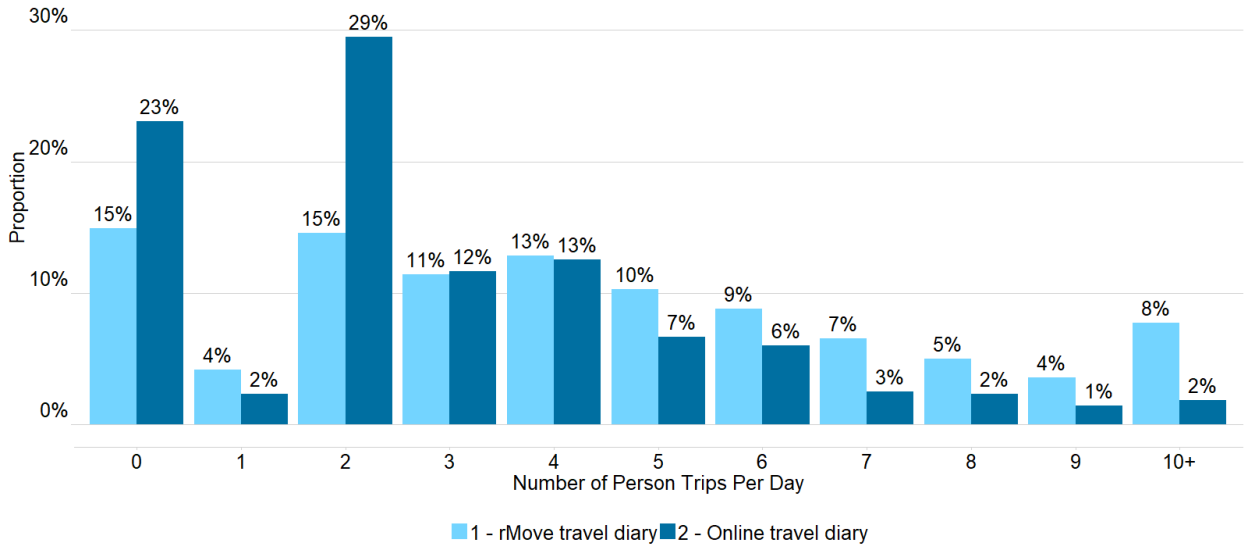
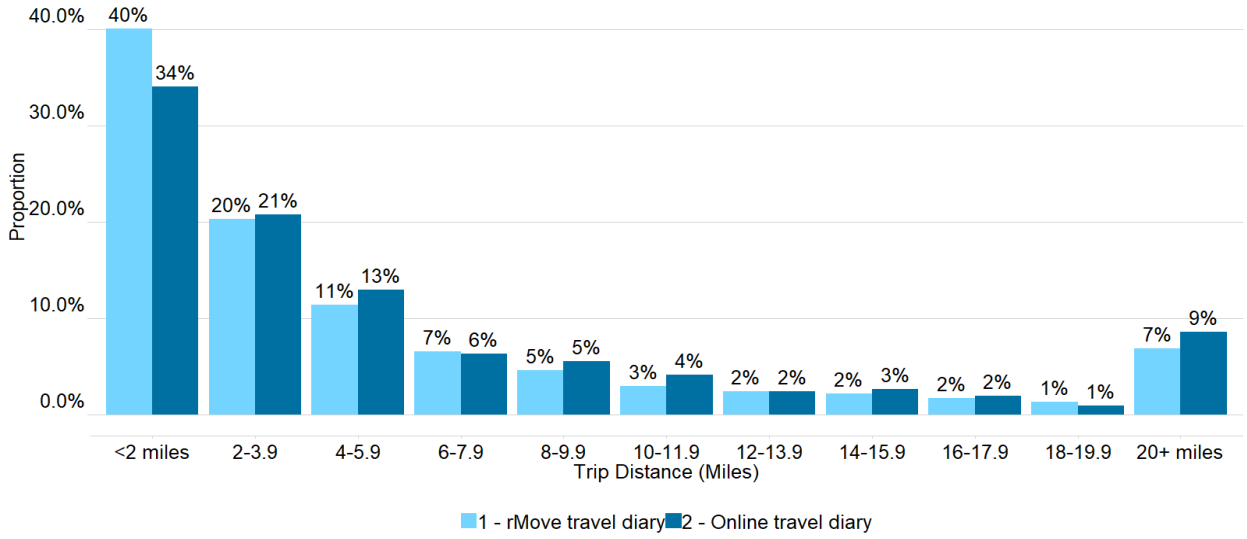


FIGURE 30: TRIP DISTANCE BY PARTICIPATION GROUP



Trip rates vary considerably by age, as shown in Figure 31. The younger (under 18) and older (over 65) age groups make around three trips per weekday, while those in the 18-64 age range make closer to four trips per weekday. It's important to note that trip reporting for children is often imperfect, even with smartphone-based data collection. This is a known issue among household travel surveys of all types and designs.

Trip rates also vary by income, as shown in Figure 33. Persons with reported household incomes below $50,000 had low trip rates by about 16% compared to persons with reported household incomes at or above $50,000. Similar to employment, lower incomes are highly correlated with online diary reporting, which results in lower trip rates for a number of demographic and survey response reasons (e.g., rMove is better at capturing short trips).

FIGURE 31: PERSON TRIP RATE BY AGE

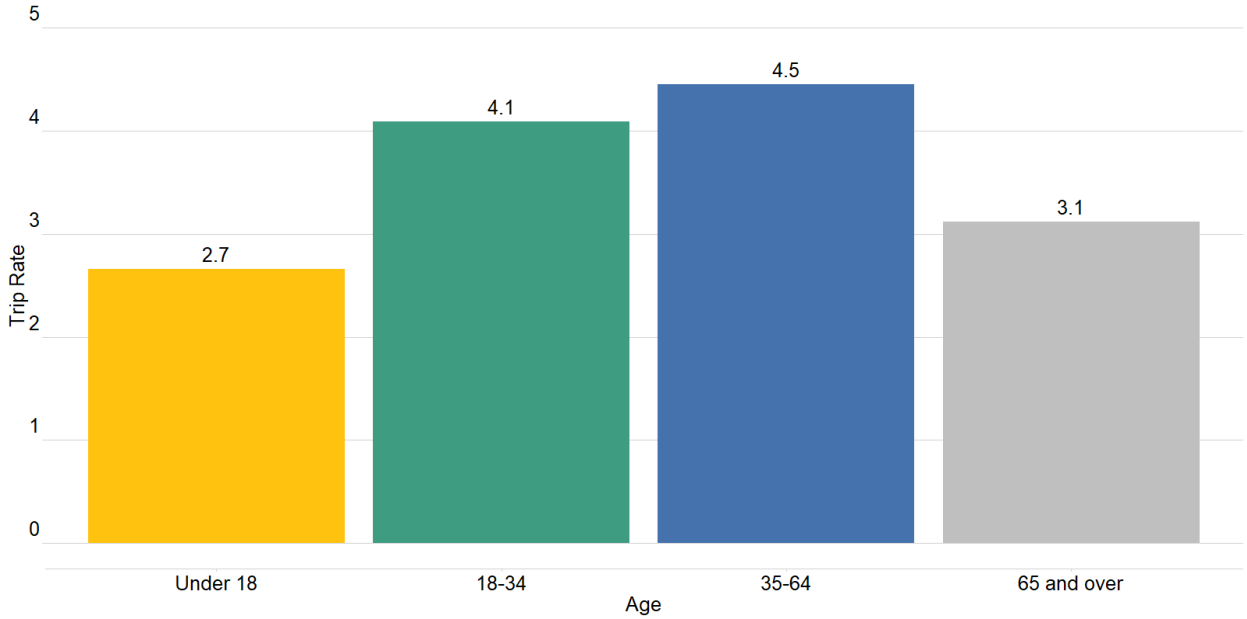


FIGURE 32: PERSON TRIP RATE BY EMPLOYMENT STATUS FOR THOSE AGE 65+

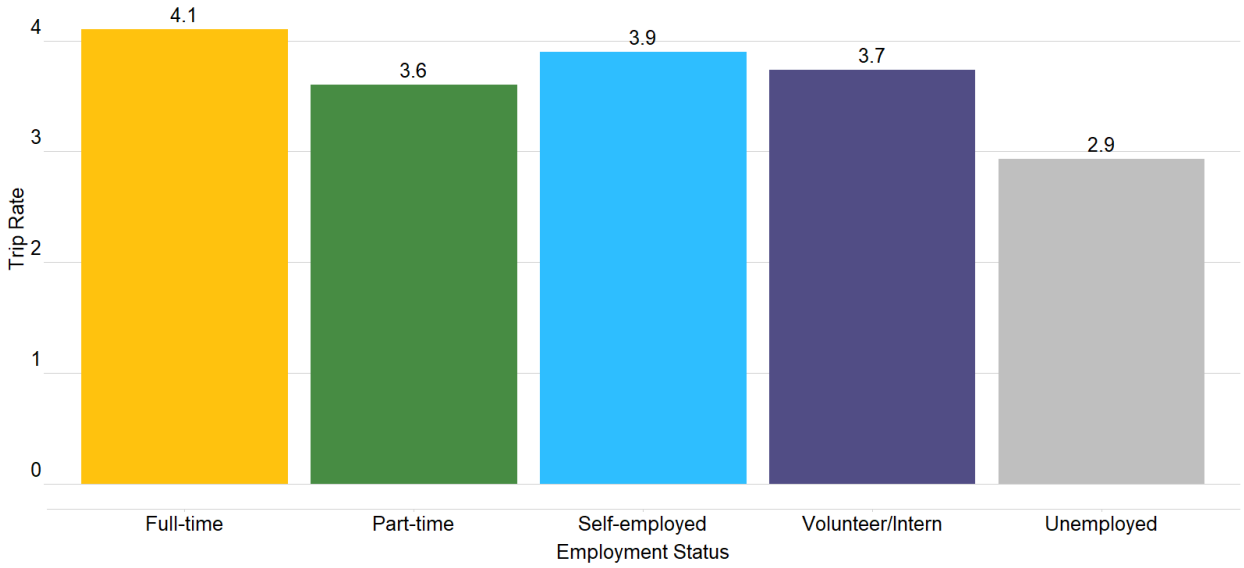
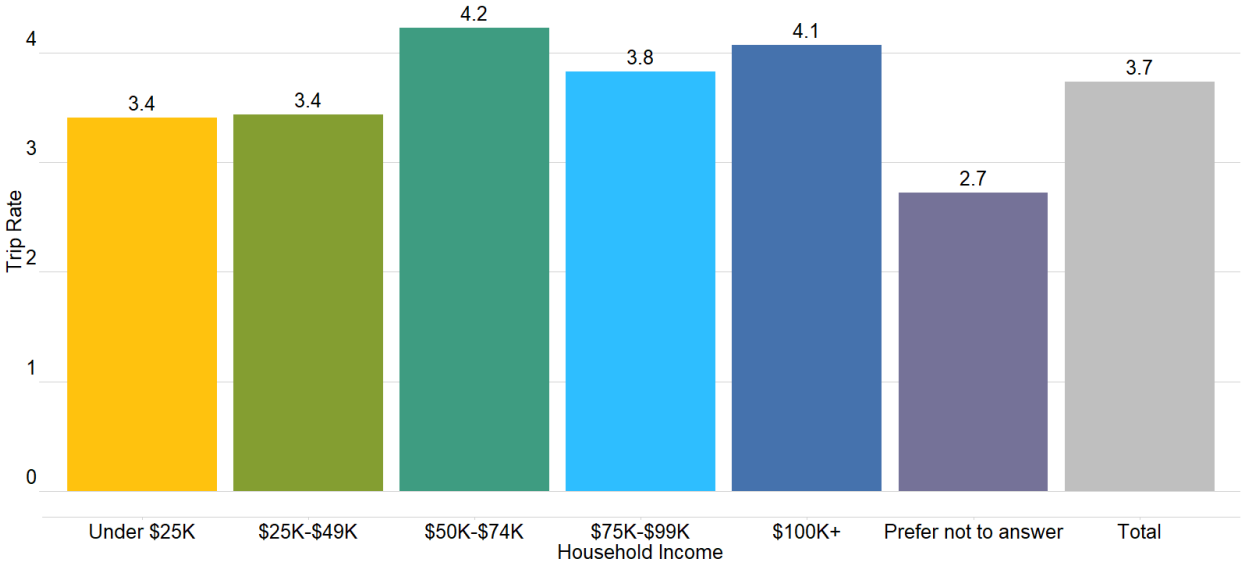


FIGURE 33: PERSON TRIP RATE BY HOUSEHOLD INCOME



In looking at trip rates by travel mode (Figure 34) and destination purpose (Figure 35), 85% of trips are by car (equal to 3.17 trips per day), followed by walk trips at 10% (0.36 trips per day). On average, participants make about one trip home per day and while running an errand, shopping, going to work, and going to a social/recreational event all have 0.4 to 0.5 trips per day.

FIGURE 34: PERSON TRIP RATE BY TRIP MODE (EXCL. TAXI)

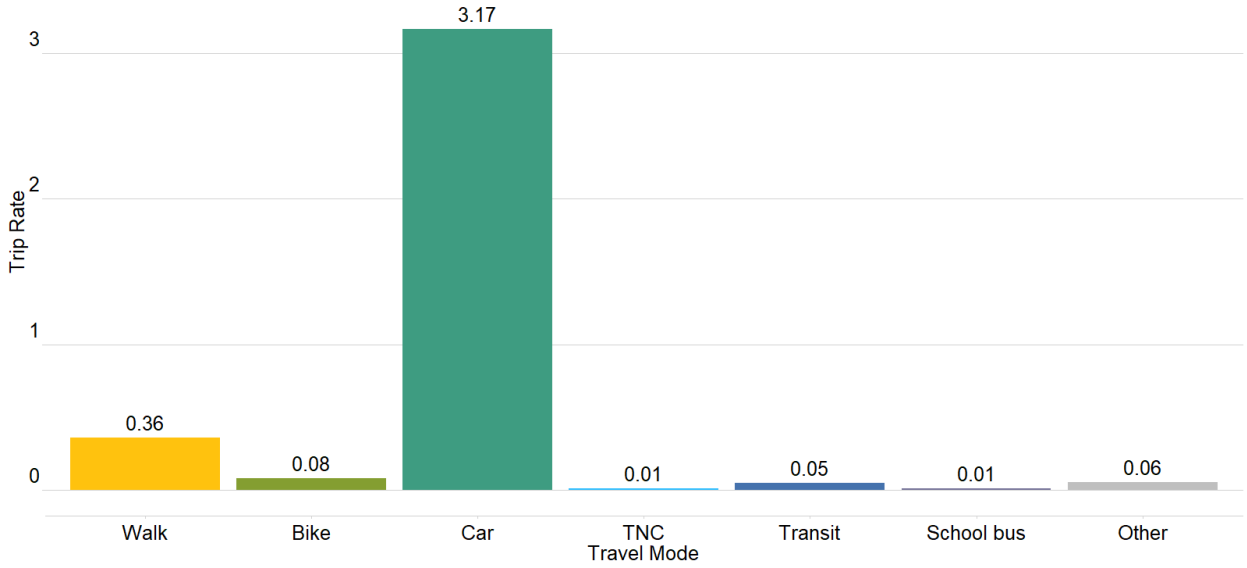
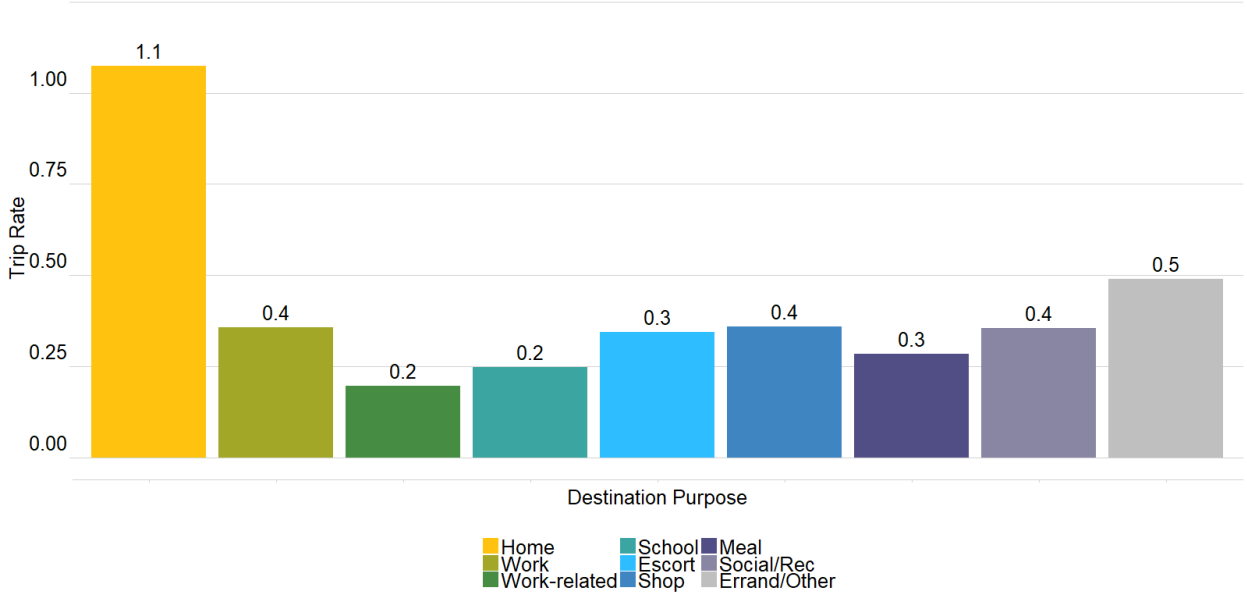
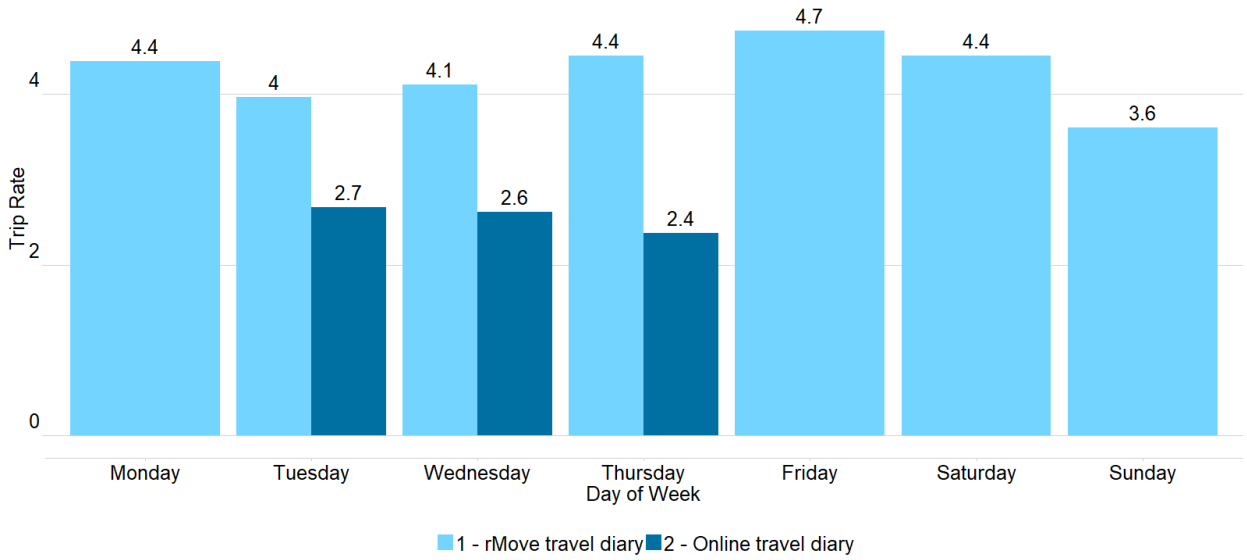


FIGURE 35: PERSON TRIP RATE BY TRIP PURPOSE



Although the trip rate is relatively consistent throughout the week, Fridays tend to include more trips while Sundays include fewer trips. The difference in trip rates by participation group is again large for each day of the week. (Figure 36)

FIGURE 36: PERSON TRIP RATE BY DAY OF WEEK BY DIARY GROUP (USING 7-DAY WEIGHT)



The lower trip rate for adults age 65 and older (shown earlier) is correlated with the lower trip rate (2.9 trips per day) among unemployed adults (Figure 32). Approximately 80% of adults age 65 and over are not currently employed. The trip rates among the elderly are also highly correlated with their greater use of the online diary, where short trips in particular are more likely to be forgotten or not reported.

A full comparison of trip rates by age group is shown in Table 3 below. Adults age 65 years and older showed consistently lower trip rates in all employment and income categories, which suggests that age (and correlated online diary use) are bigger predictions of trip rate than employment status or income. Trip purposes vary somewhat by age with adults age 65 years and older making more trips on average with shop, social/recreation, and errand/other purposes than those age 64 years and younger.

TABLE 3: TRIP RATES BY COMBINED AGE GROUP

AGE GROUP	CATEGORY	PERSON TRIP RATE	% OF TRIPS (WHERE APPLICABLE)
TRIPS BY EMPLOYMENT STATUS			
Under 65	Full-time	4.63	
	Part-time	4.72	
	Self-employed	4.49	
	Unemployed	3.36	
	Volunteer/Intern	4.77	
65 and over	Full-time	4.09	
	Part-time	3.61	
	Self-employed	3.91	
	Unemployed	2.94	
	Volunteer/Intern	3.73	
TRIPS BY INCOME			
Under 65	Under $25K	3.42	
	$25K-$49K	3.54	
	$50K-$74K	4.45	
	$75K-$99K	3.89	
	$100K+	4.19	
	Prefer not to answer	2.70	
65 and over	Under $25K	3.06	
	$25K-$49K	3.03	
	$50K-$74K	3.00	
	$75K-$99K	3.56	
	$100K+	3.25	
	Prefer not to answer	2.77	
TRIPS BY DESTINATION PURPOSE			
Under 65	Home	1.08	28%
	Work	0.40	10%
	Work-related	0.23	6%
	School	0.29	8%
	Escort	0.38	10%
	Shop	0.35	9%
	Meal	0.30	8%
	Social/Recreation	0.35	9%
	Errand/Other	0.45	12%
	Change mode	0.02	0%
65 and over	Home	1.01	32%
	Work	0.11	3%
	Work-related	0.04	1%
	School	0.02	1%
	Escort	0.15	5%
	Shop	0.45	15%
	Meal	0.24	8%
	Social/Recreation	0.38	12%
	Errand/Other	0.72	23%
	Change mode	0.01	0%

Trips by Trip Mode

Analyzing trip mode is an important way to understand regional travel behavior. The study captured over 40 unique mode types, which are summarized in Table 4. This detailed list of modes was recoded to eight primary categories (mode type) for ease of understanding and analysis, as shown in Figure 37 and in most charts. Note: While some charts in this report show all eight primary categories, Figure 37 excludes the Taxi and TNC categories, which comprise about 0.2% of all weighted trips in the region.

The vast majority of trips in the region are made by car (85% mode share). The next most frequent mode is walking, at nearly 10% of trips (Figure 37). The overall distribution is similar by participation group, although rMove households take about 7% more car trips on average than online diary households. Some of this difference may be tied to income differences between groups. Online diary households had lower incomes on average (Figure 8), and lower income households tend to make higher shares of non-car (e.g., walk, bike, transit) trips than higher income households (Figure 38). Households with incomes below $25,000 make 78% more walk trips (mode share of 15.7% vs. 8.8%) and more than four times as many transit trips as households with incomes of $25,000 or greater. Both walk and bike trips show some higher mode shares among the highest income group (>$100,000), while the $25-100,000 range show the lowest levels of walk and bike usage.

FIGURE 37: TRIP MODE BY PARTICIPATION GROUP (EXCL. TAXI/TNC)

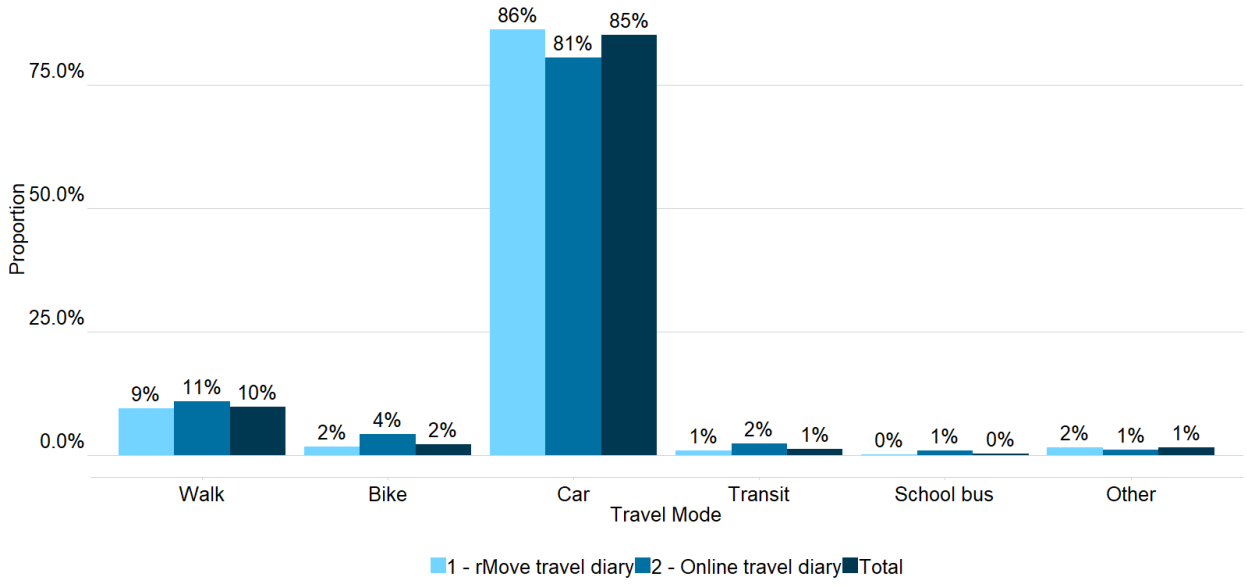
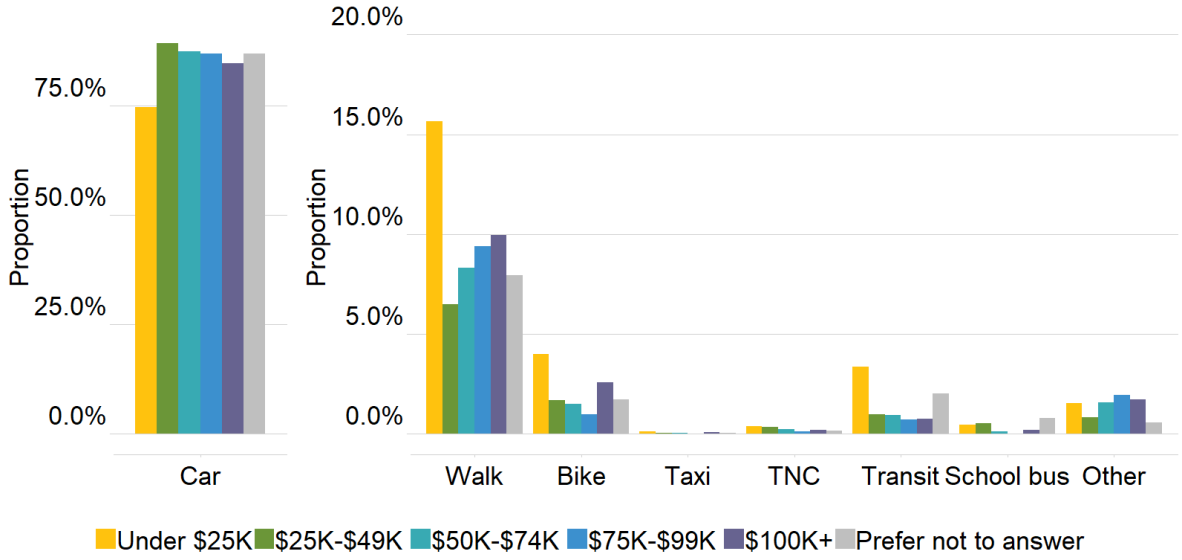


TABLE 4: DETAILED REPORTED MODE BREAKOUT (LINKED TRIPS)[8]

Reported mode	Unweighted count	Weighted count	Unweighted share	Weighted share
Airplane/helicopter	352	14,569	0.2%	0.2%
ATV or snowmobile	14	2,487	0.0%	0.0%
Bicycle owned by my household	5,095	180,447	2.6%	2.2%
Boat/ferry/water taxi	60	1,028	0.0%	0.0%
Borrowed bicycle (e.g., from friend)	19	182	0.0%	0.0%
Bus Rapid Transit (BRT)	85	1,714	0.0%	0.0%
Car from work	3,421	203,922	1.8%	2.5%
Carshare service (e.g., Car2Go, Zipcar, Turo, Maven)	41	1,737	0.0%	0.0%
Employer shuttle/bus	60	2,474	0.0%	0.0%
Express bus	206	4,686	0.1%	0.1%
Friend/colleague's car	5,816	215,365	3.0%	2.6%
Golf cart	252	11,959	0.1%	0.1%
Household vehicle 1	88,826	3,863,887	45.8%	46.4%
Household vehicle 2	41,111	2,011,430	21.2%	24.2%
Household vehicle 3	5,715	388,066	2.9%	4.7%
Household vehicle 4	1,622	84,229	0.8%	1.0%
Household vehicle 5	268	16,307	0.1%	0.2%
Household vehicle 6	79	6,375	0.0%	0.1%
Intercity bus (e.g., Greyhound, Megabus)	28	938	0.0%	0.0%
Intercity rail (e.g., Amtrak)	286	3,916	0.1%	0.0%
Local bus	1,036	55,464	0.5%	0.7%
Local rail/light rail	822	23,627	0.4%	0.3%
Other	1,199	63,465	0.6%	0.8%
Other bus	120	5,511	0.1%	0.1%
Other hired car service (e.g., black car, limo)	35	2,437	0.0%	0.0%
Other motorcycle/moped/scooter	286	6,084	0.1%	0.1%
Other private shuttle/bus (e.g., a hotel's, an airport's)	149	4,625	0.1%	0.1%
Other rail	37	407	0.0%	0.0%
Other vehicle	908	41,610	0.5%	0.5%
Other vehicle in household	3,752	141,606	1.9%	1.7%
Peer-to-peer car rental (e.g., Turo, Getaround)	2	0	0.0%	0.0%
Regular taxi (e.g., Yellow Cab)	61	1,461	0.0%	0.0%
Rental car	2,009	80,492	1.0%	1.0%
Rental or bike-share bicycle	28	1,601	0.0%	0.0%
School bus	152	23,920	0.1%	0.3%
Skateboard/hoverboard	32	9,203	0.0%	0.1%
Subway	45	1,367	0.0%	0.0%
Uber, Lyft, Via, or other smartphone-app car service	899	17,578	0.5%	0.2%
uberPOOL, Lyft Line, or other matched shared-ride	36	1,430	0.0%	0.0%
University shuttle/bus	249	5,928	0.1%	0.1%
Vanpool	30	2,272	0.0%	0.0%
Walk (or jog/wheelchair)	21,143	813,690	10.9%	9.8%
Missing: Nonresponse	*7,471*	*3,451*	*3.9%*	*0.0%*

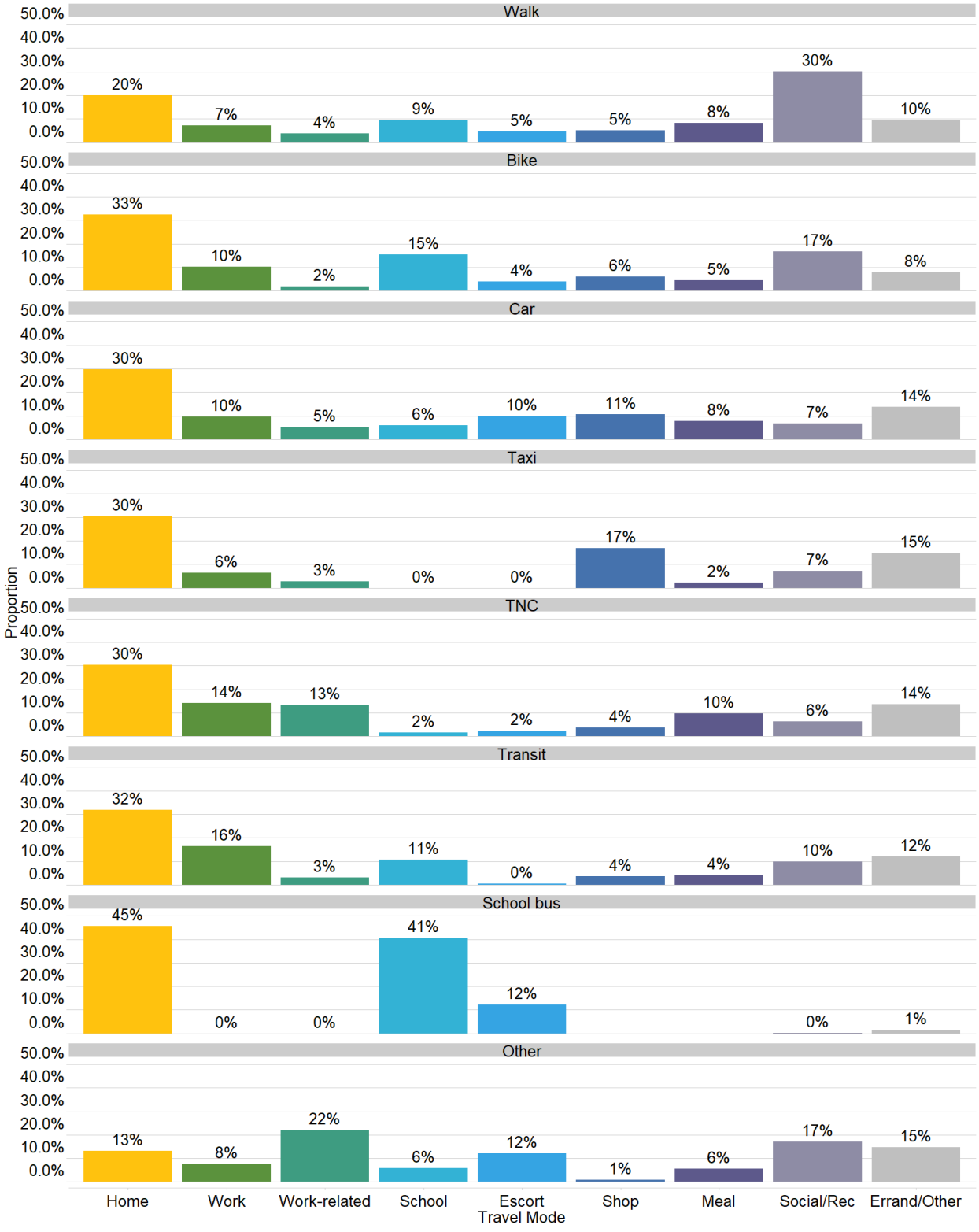
[8] rMove users could report multiple modes for each trip, but less than 1% of completed trip surveys provided more than one mode. This table shows the counts and mode shares for only the first provided mode. The unweighted trip count is for all trips across all days, regardless of whether the day is complete for all household members.

FIGURE 38: TRIP MODE BY HOUSEHOLD INCOME



Looking at trip modes by trip purpose highlights the different ways people travel depending on their trip purposes (Figure 39). For almost all modes, the most common trip purpose is going home (Figure 35). Walk trips are the exception, for which the most common trip purpose is social or recreation. Transit has higher than average shares of trips to work (16%) and school (11%). Biking shows relatively high rates of social/recreation (17%) and going to school (15%). The most frequently identified ‘Other’ mode was air travel, which explains the high rates of work-related (22%) and social/recreation (17%) travel. The mode with the most concentrated purposes is school bus, where “home” or “school” are over 40% of all school bus trips.

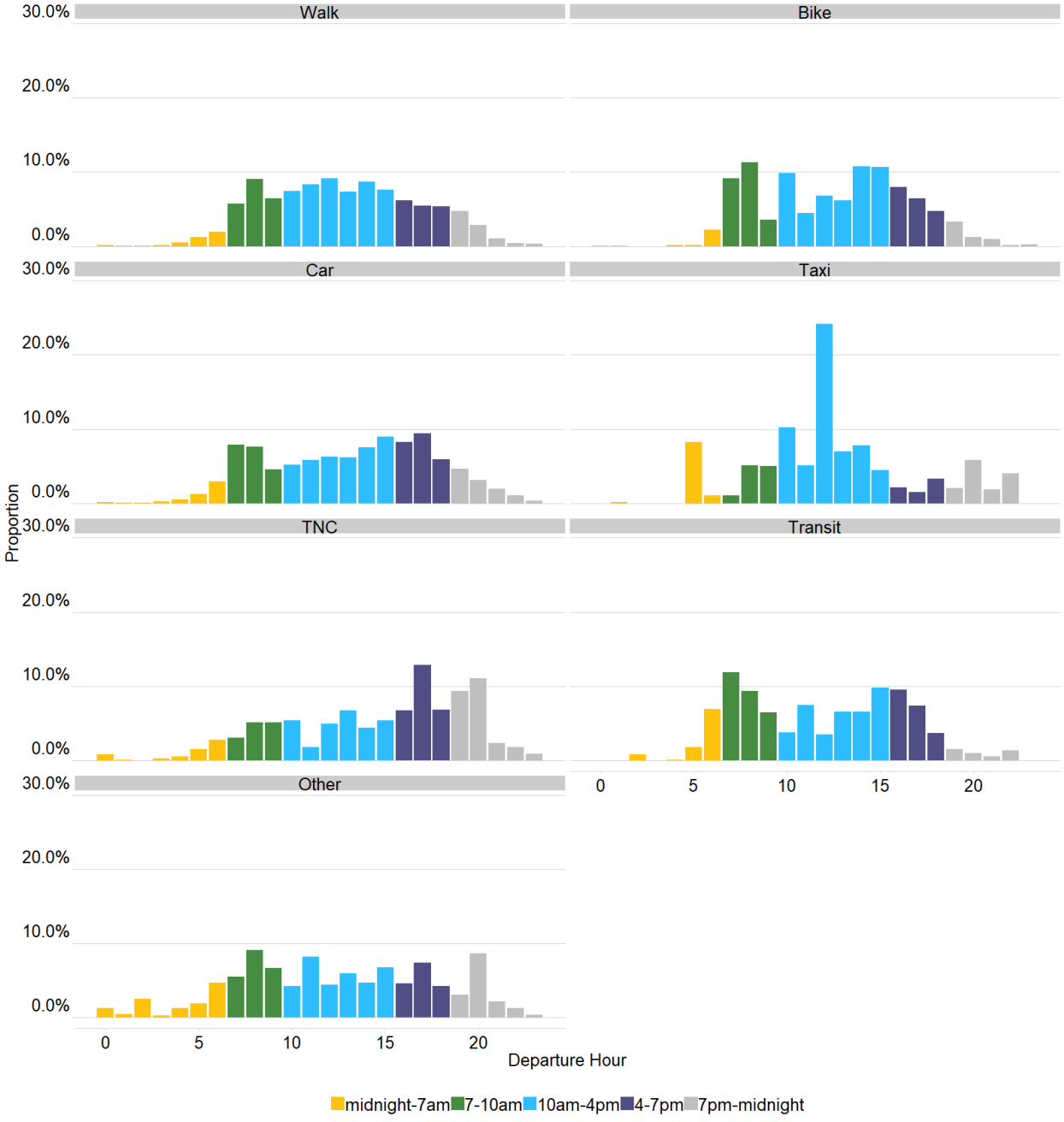
FIGURE 39: TRIP MODE BY TRIP PURPOSE (EXCL. "CHANGE MODE")[9]



[9] This analysis uses linked trip records. For this reason, "change mode" purposes are excluded from trip most purpose analyses because the share of these trips after linking is very low.

Looking at travel by travel mode by time of day, two peaks occur during typical work commute hours, but the distribution of trips throughout the day varies greatly by mode. Transit trips see steeper a.m. and p.m. peaks. School bus trips (not shown) are the most peaked, around 7-8 a.m. and again during the 3 p.m. hour. Bike trips show the narrowest range of hours during which people use that mode, likely given the safety concerns around bicycle travel in the dark. Walk travel is relatively evenly distributed across the day. TNC travel is unique in how it builds during the day and peaks in the evenings. 'Other' travel modes spread widely throughout the day and into the night or early morning, which more likely reflects travel out of town or extended trips via airplane.

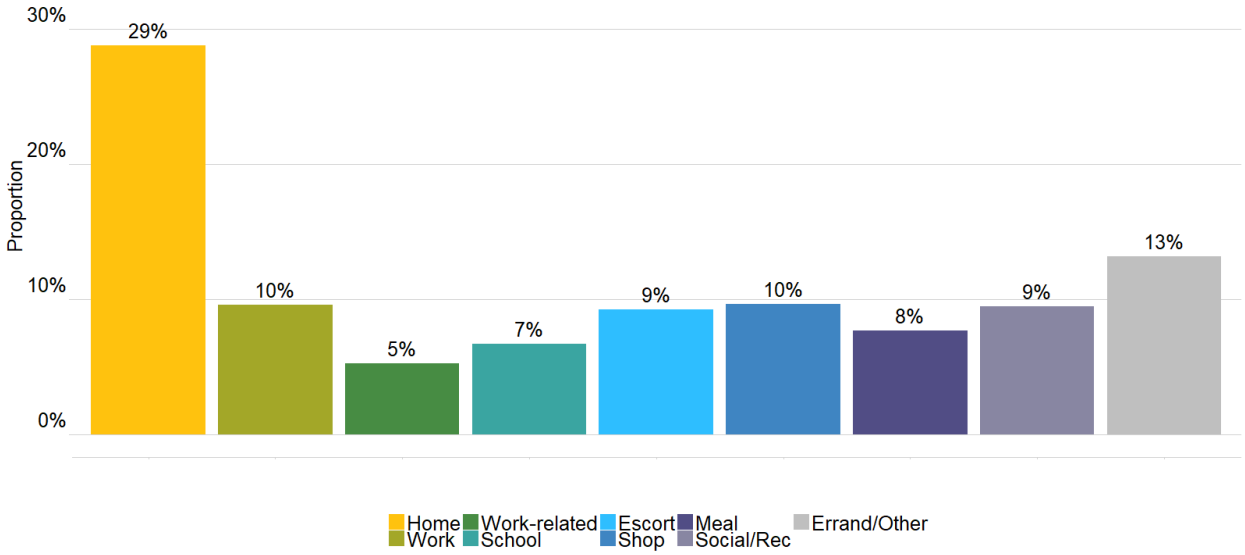
FIGURE 40: TRIP MODE BY TIME OF DAY



Trips by Trip Purpose

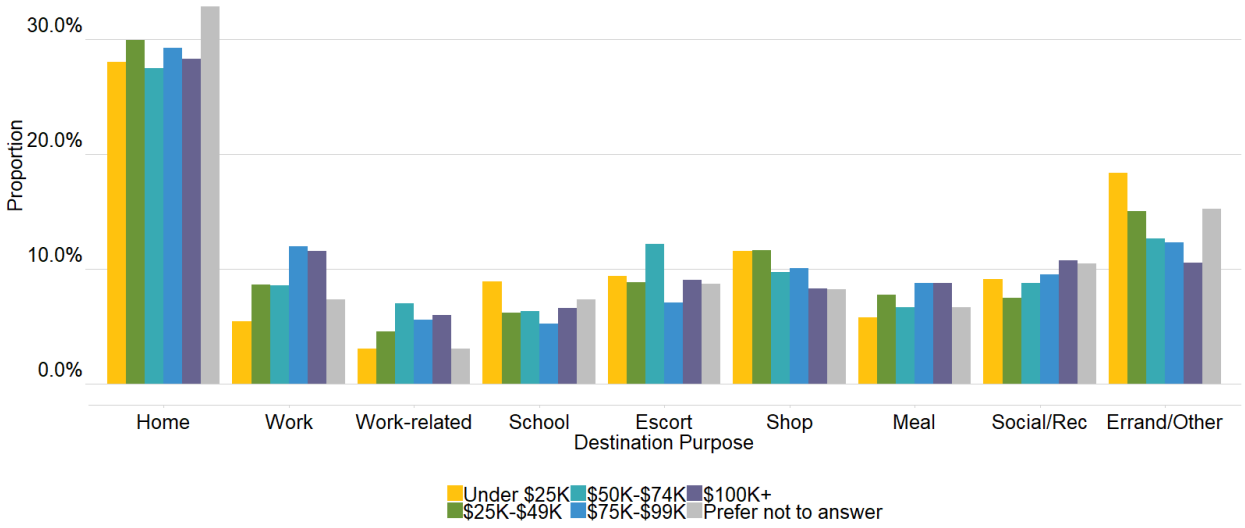
As shown earlier, the most common trip purpose is going home at 29% of all trips (Figure 41). Work and work-related travel combine for 15% of all trips and errands/other purposes are 13%. All other modes breakout relatively evenly between 7% and 10%.

FIGURE 41: DISTRIBUTION OF TRIP PURPOSE



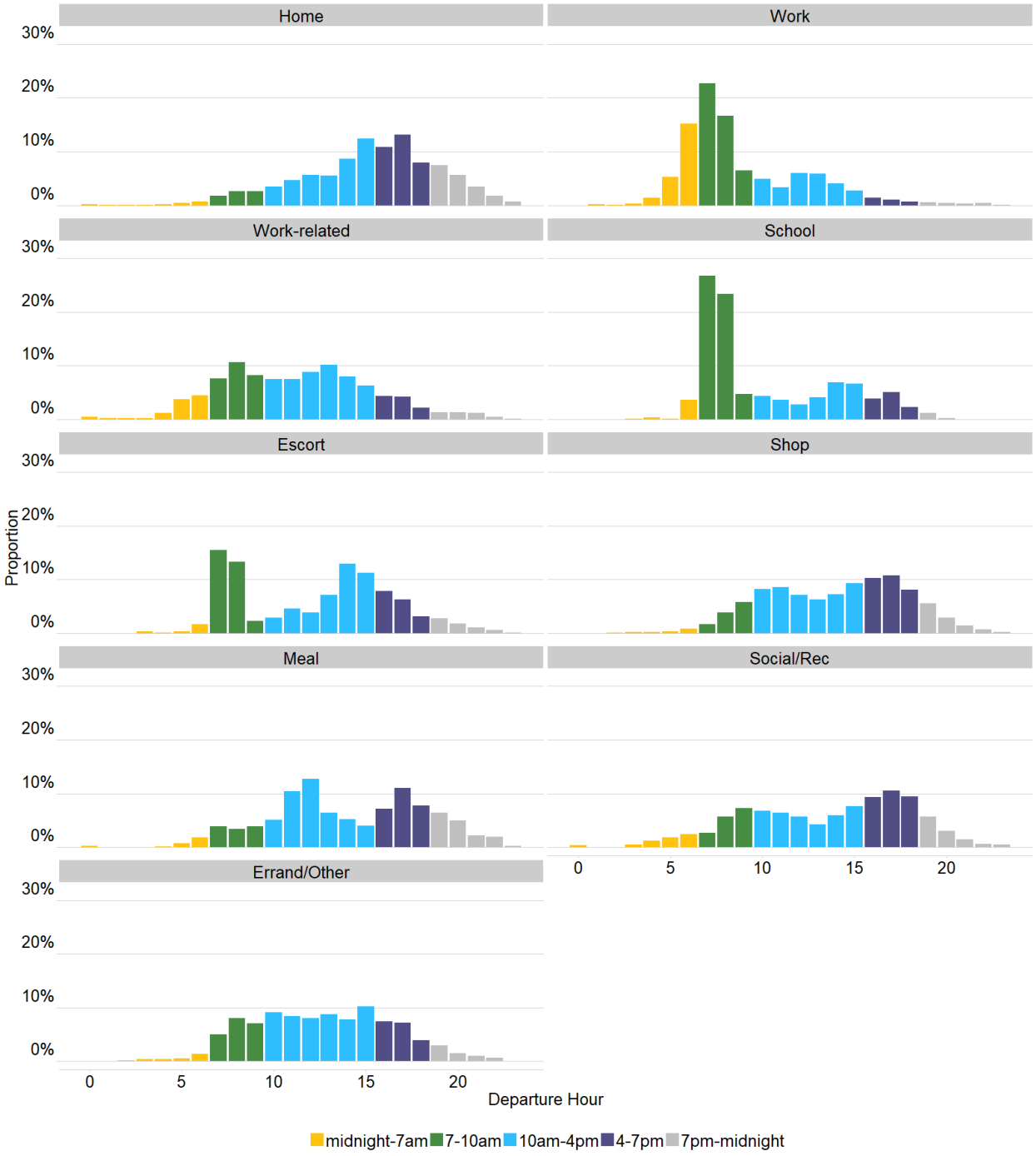
Although the distribution of trip purposes is mostly consistent by income, lower income households tend to take fewer work/work-related trips and more school, shop, and errand/other purpose trips than higher income households. For example, households with incomes below $75k took about 28% fewer work/work-related trips and 28% more shopping/errand/other trips than households with incomes of $75k or more.

FIGURE 42: TRIP PURPOSE BY HOUSEHOLD INCOME



Looking at trip purposes by time of day highlights the patterns in when we make certain types of trips (Figure 43). Trips to work and school are heavily skewed toward the morning hours while trips home occur more in the afternoon and evening. Errand/Other purpose trips are relatively uniform across the day, without any distinct peaks. All other trip purposes show some level of bimodal distributions. Escort trips peak during both the morning and afternoon hours when parents are dropping kids off at school and after-school activities. Shopping and social/recreation trips have similar distributions with peaks in the late morning and late afternoon. Meal trips peak midday for lunch and the evening for dinner.

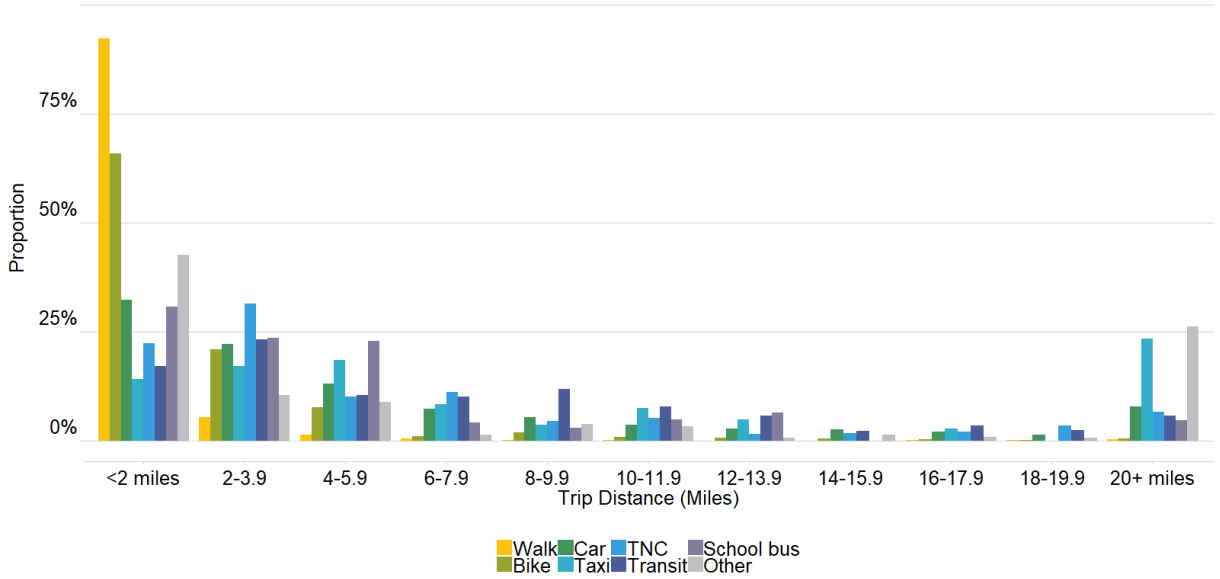
FIGURE 43: TRIP PURPOSE BY TIME OF DAY



Trips by Trip Distance

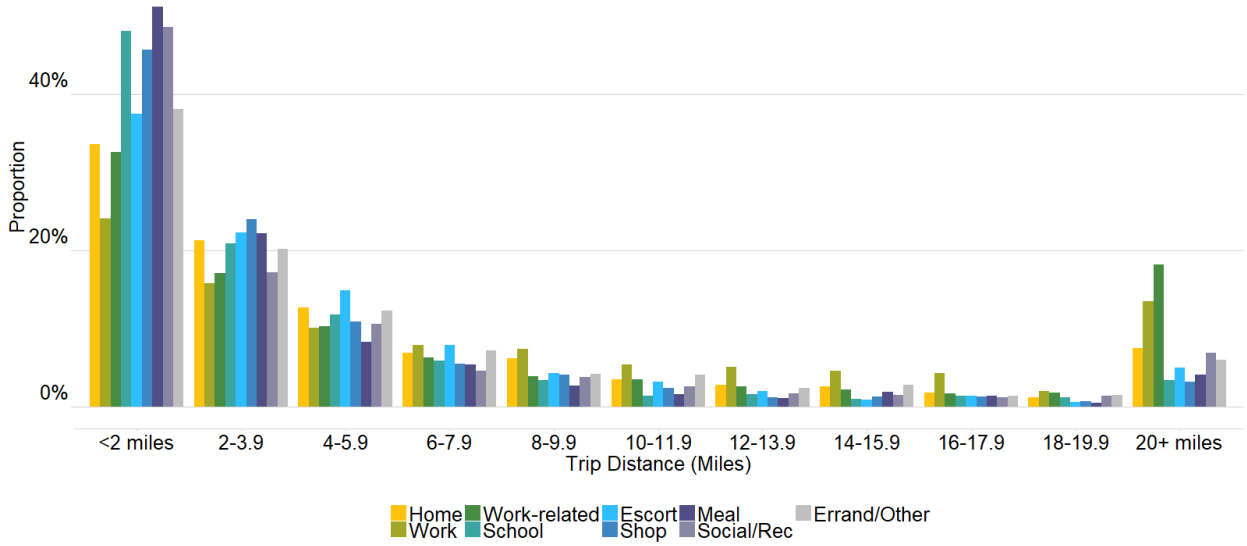
Just as trips vary by mode, purpose, and time of day, the distribution of trip distances varies along several important dimensions. Looking at trip distances by mode (Figure 44) shows that most walk and bike trips (92% and 66%, respectively) are under 2 miles long. Over 50% of car trips are less than 4 miles. Roughly a quarter of 'Other' trips are more than 20 miles, indicative of the high share of air travel in that category.

FIGURE 44: TRIP DISTANCE BY MODE



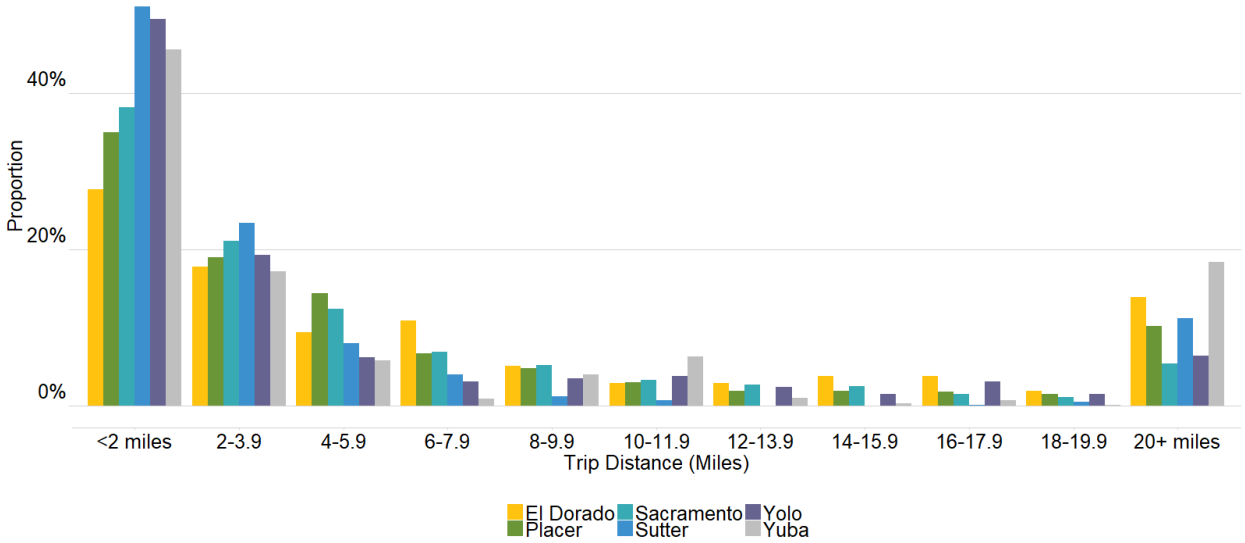
Looking at trip distance by purpose, school, escort, meals, and social recreation trips all shown high levels of short trips (~65% of trips under 4 miles). Work and work-related trips show the longest trips, with one-third of trips over 10 miles. However, many work and work-related trips are short as well, with nearly half (48%) of trips under four miles.

FIGURE 45: TRIP DISTANCE BY PURPOSE



On average, participants in the Western part of the study region (Sutter, Yolo, and Yuba counties) made about 33% more trips under 2 miles than those living in the central and Eastern parts of the county (El Dorado, Placer, and Sacramento counties). However, the inverse is not necessarily true for long-distance trips (over 20 miles) – participants in Yuba county made the most 20+ mile trips (18% of all trips), followed by El Dorado (14%). (Figure 46)

FIGURE 46: TRIP DISTANCE BY COUNTY OF RESIDENCE

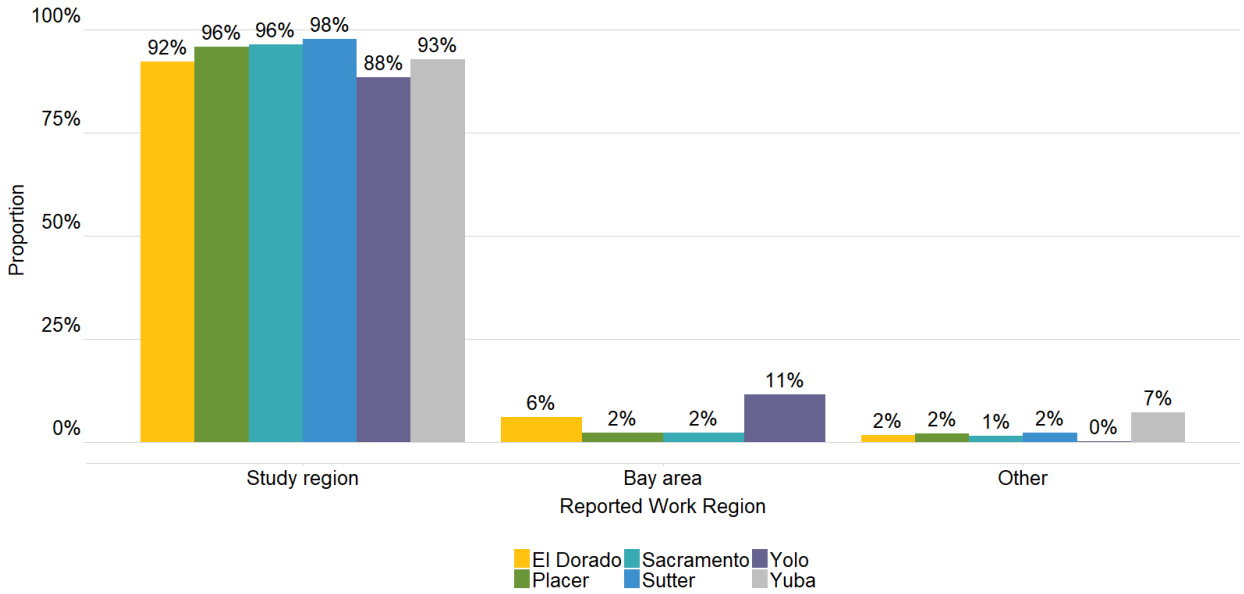


While there are many other possible breakouts for trip distances, including income, employment status, and age, these alternatives did not display any notable or interesting patterns and are thus excluded from this report.

Work-related Trips

Around 95% of reported work addresses fell within the SACOG planning area. Another 3% were located among the nine Bay Area counties (Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma). Figure 47 below shows the distribution of reported work address by county of residence. Yolo county workers were most likely to work outside the study region (12%), almost all of which were in the Bay Area. El Dorado had, perhaps surprisingly, 6% of workers with work in the Bay Area. Yuba counties had the next highest share outside the region 7%, none of which were in the Bay Area.

FIGURE 47: REPORTED WORK REGION BY REPORTED COUNTY OF RESIDENCE



Looking at work and work-related trips by modes, 87% of work or work-related trips in the study region are by car, compared to 78% outside the study region (Figure 48). Bay Area work and work-related trips are twice as likely to be walking trips (13% vs 7%) and slightly more likely to use transit (4% vs 2%) (Figure 49).

The trip lengths for these work and work-related trips varies significantly depending on if the trip is in the SACOG region or outside of it (as expected). Work and work-related trips outside of the study region are typically 20 miles or longer, with about 45% of commute trips with destinations outside the study region fell into this category. A high share (25-30%) of short trips are under two miles as well, mostly representing walk trips in the areas near their workplaces.

FIGURE 48: WORK AND WORK-RELATED TRIPS BY MODE BY REGION (EXCL. SCHOOL BUS & TAXI)

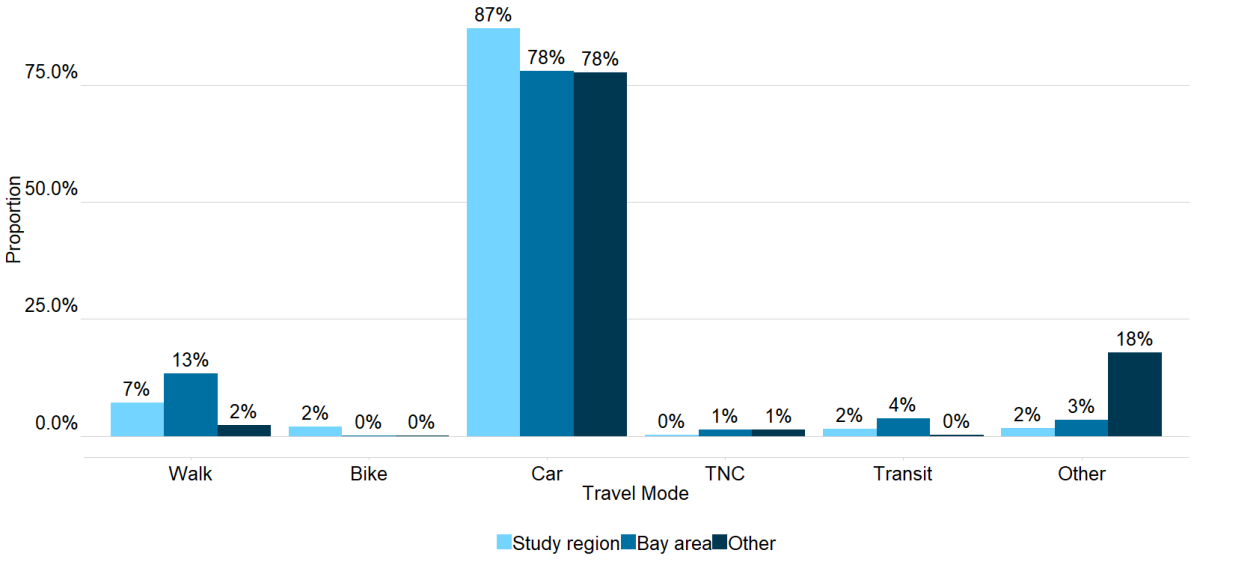
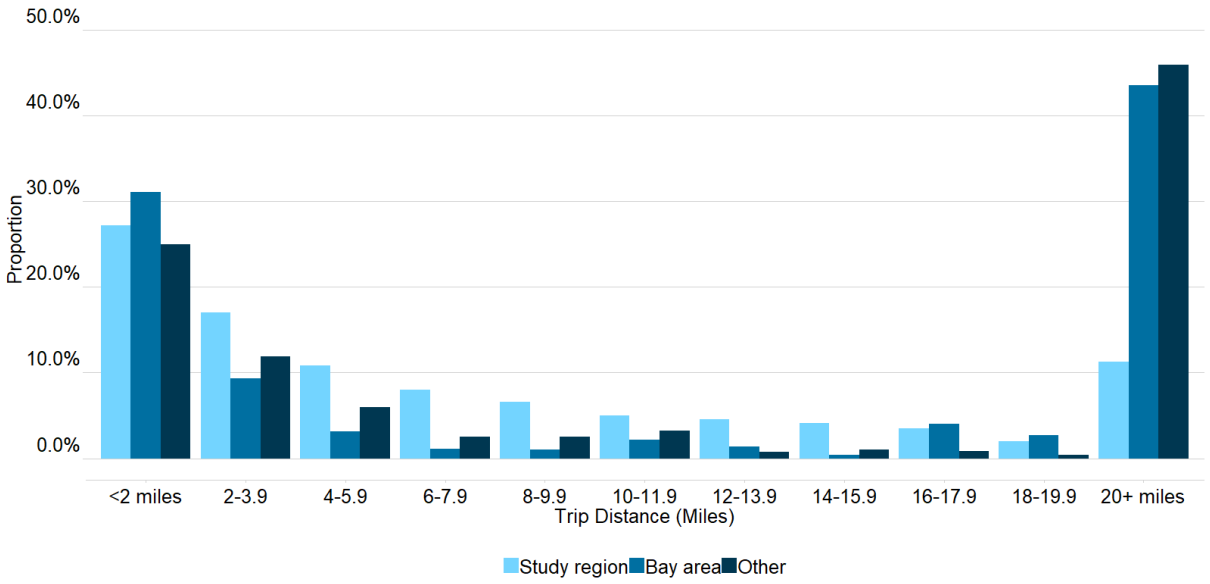


FIGURE 49: WORK AND WORK-RELATED TRIP DISTANCES BY REGION



Geographic Coverage

The study captured households, persons, and trips across and beyond the six-county SACOG planning area. Below are four maps showing the coverage of the home locations, work trip locations, and trips by mode for downtown Sacramento and Davis.[10]

Figure 50 shows the home locations of participants in the study. All 4,010 households live within the SACOG planning area (planning area block groups are shown in gray). As shown in Table 1, roughly two-thirds live in Sacramento County, while one-third live in the other five counties.

[10] Each of these maps has "jittered" the location points to help protect the privacy of participants (jittering adds random noise while still maintaining the overall trends and relationships within the data).

FIGURE 50: MAP OF REPORTED HOME LOCATIONS

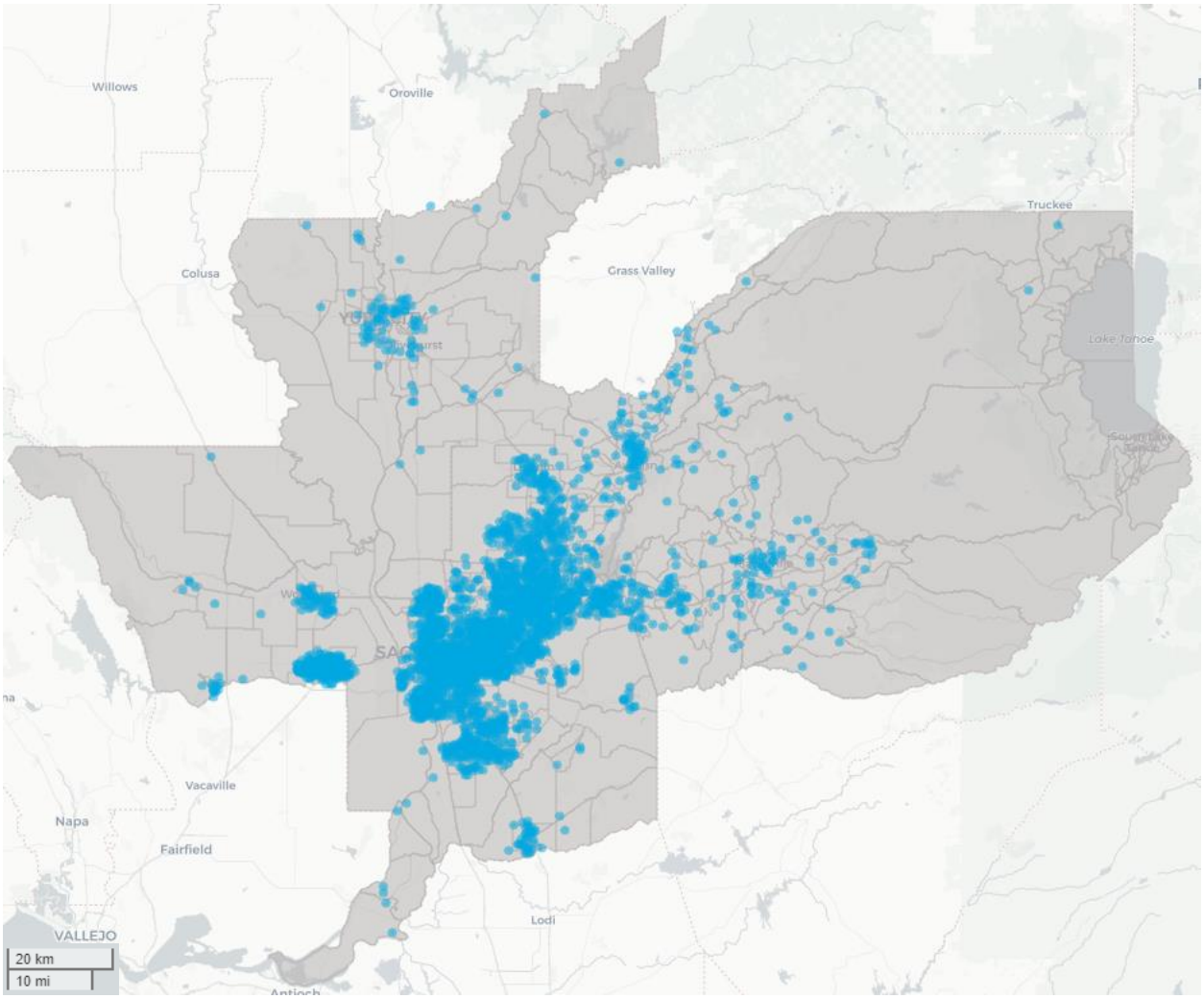


Figure 51 shows the map of all work and work-related trips from complete travel days. The trip ends are colored by region, with blue representing all trips in the study area, yellow all trips in the Bay Area, and purple all work and work-related trips to other areas. While only about 5% of workers reported work locations outside of the study area (Figure 47), about 12% of work and work-related trips occurred outside the study area.

FIGURE 51: MAP OF WORK TRIPS ON COMPLETE TRAVEL DAYS (TRIP DESTINATION PURPOSE OF "WORK" OR "WORK-RELATED")

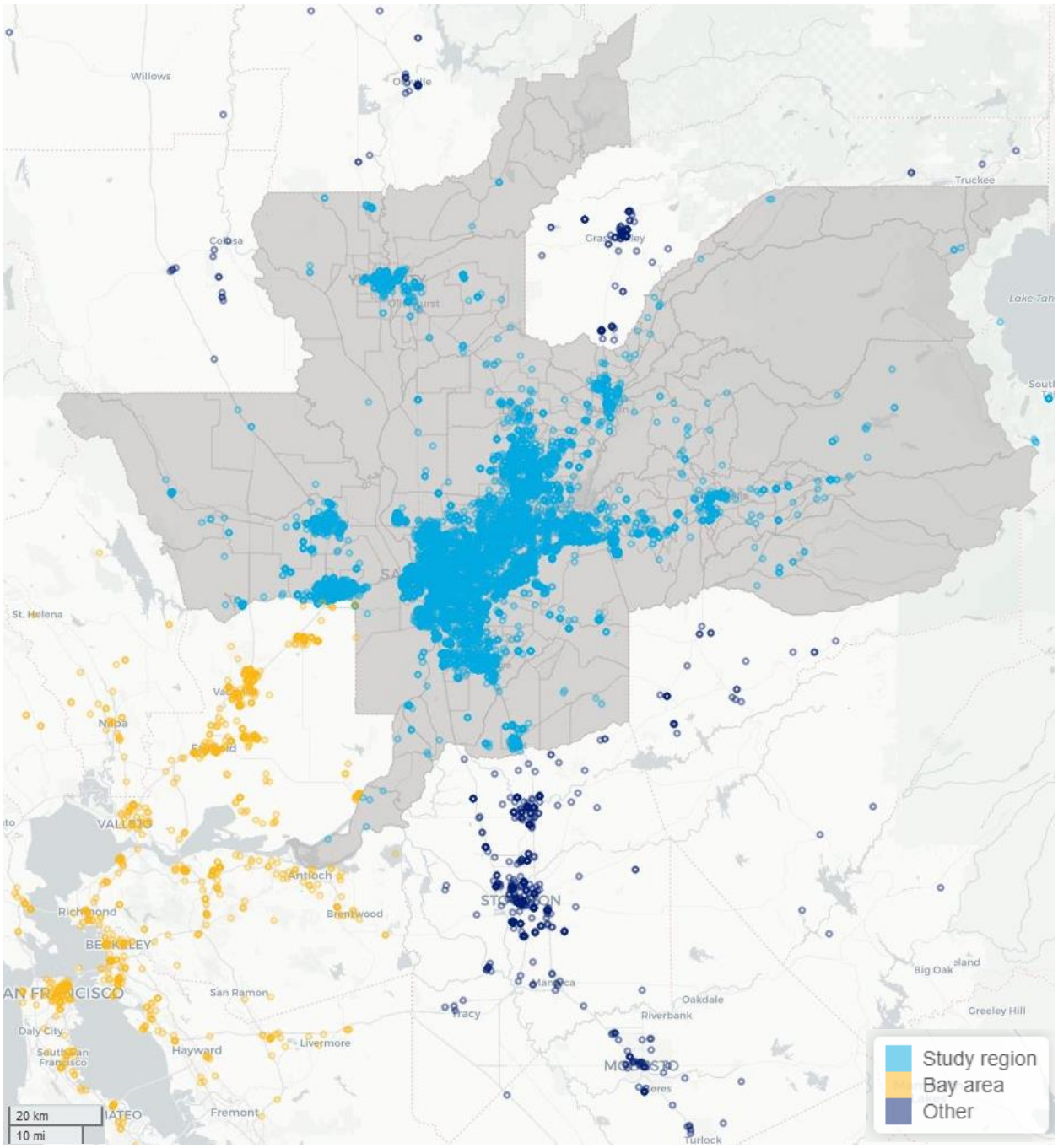


Figure 52 and Figure 53 show zoomed in maps of all trip ends (jittered) for Downtown Sacramento and Davis for a single day of the week (Wednesday). These maps show the relative concentration of travel modes, with walk and bike activity in yellow and orange. Davis stands out for its high share of bike trips, with additional pockets of walk activity in and around UC Davis.

FIGURE 52: TRIP END POINTS BY MODE ON COMPLETE WEDNESDAYS (DOWNTOWN SACRAMENTO, JITTERED)

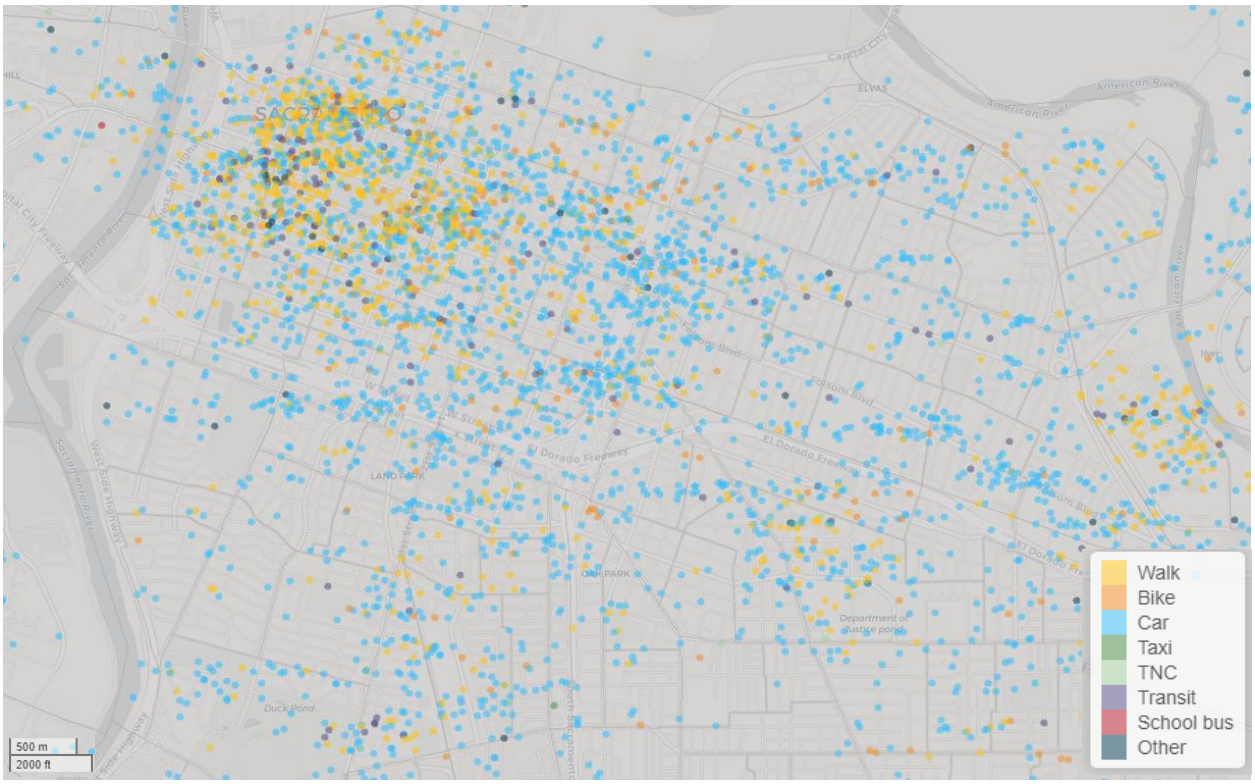
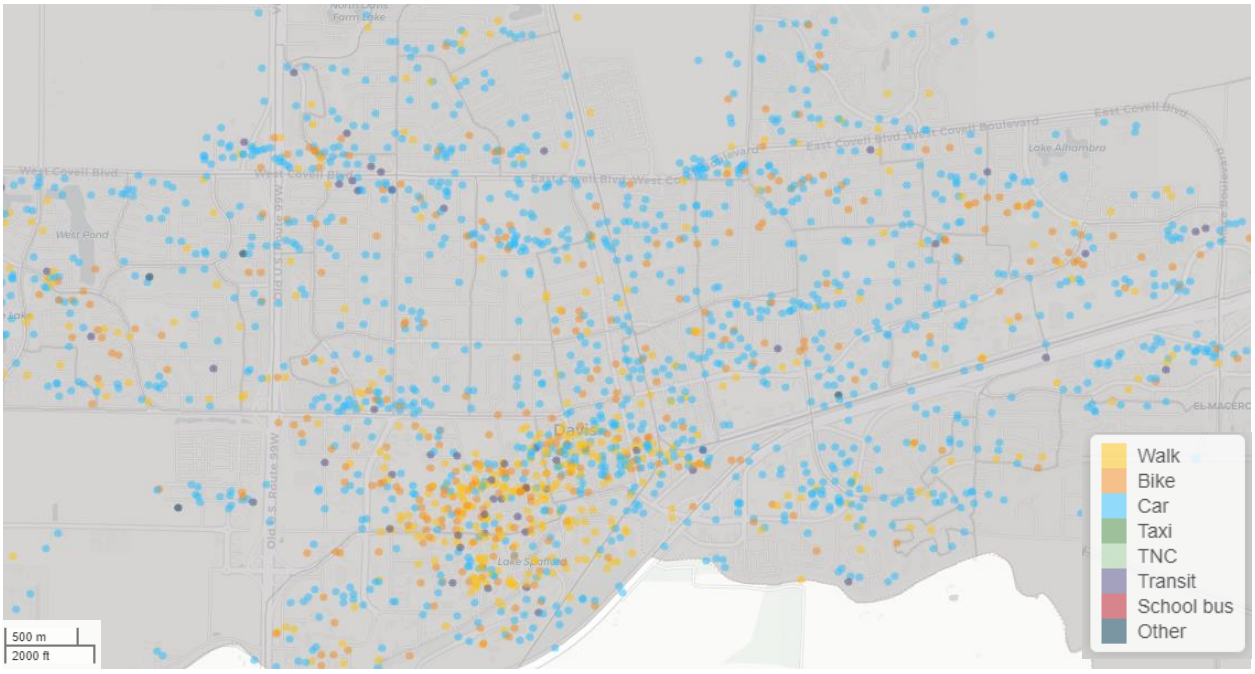


FIGURE 53: TRIP END POINTS BY MODE ON COMPLETE WEDNESDAYS (DAVIS, JITTERED)



6.0 TRAVEL DAY ANALYSIS

A portion of the travel diary was devoted to travel day summary information, including travel replacement activities such as shopping online and teleworking.

The survey asked employed participants to report the frequency with which they telework. One-sixth of respondents reported working from home one or more days per week. Among those 17%, about 70% reported working from home for 15 minutes or more on at least one travel day. Among the 83% who reported teleworking *less* than one day per week, 27% worked at least 15 minutes on at least one travel day. Figure 54 shows the total distribution of self-reported and observed telework frequency on all household-complete travel days.

Participants reported personally purchasing something online on about 10% of days with complete survey data. Related, 79% of participants did not report any package deliveries on their travel days (Figure 55). Among those who did report deliveries, deliveries at home were reported most frequently (on 17% of all complete travel days).

FIGURE 54: REPORTED TELEWORK FREQUENCY (MORE OR LESS THAN 1 DAY PER WEEK) BY OBSERVED TELEWORK FREQUENCY (X AND Y AXES)

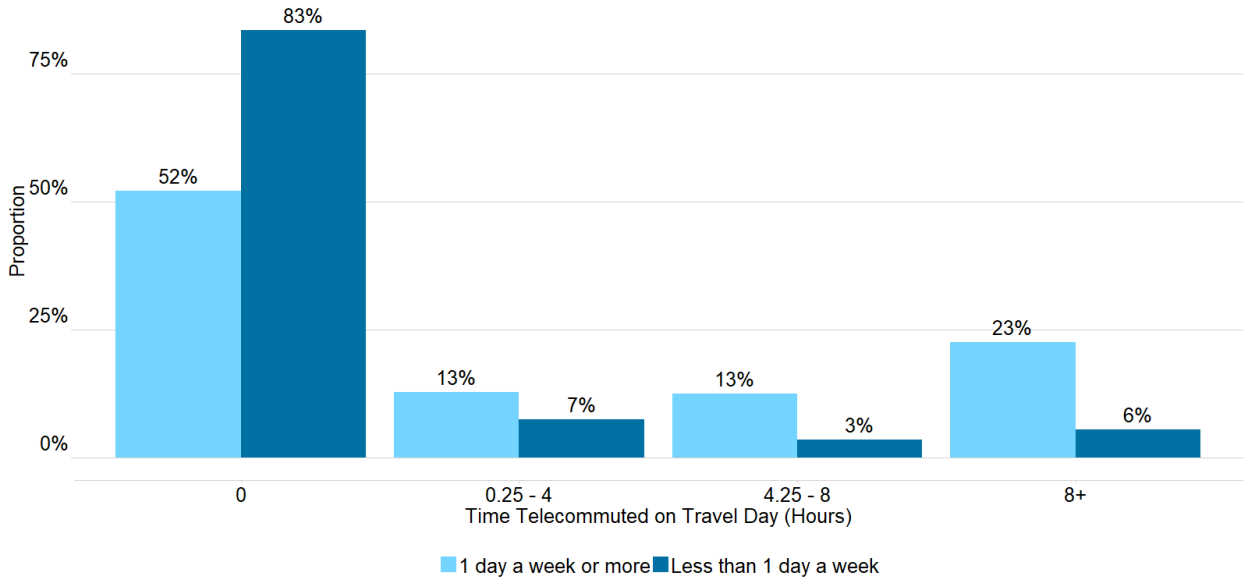
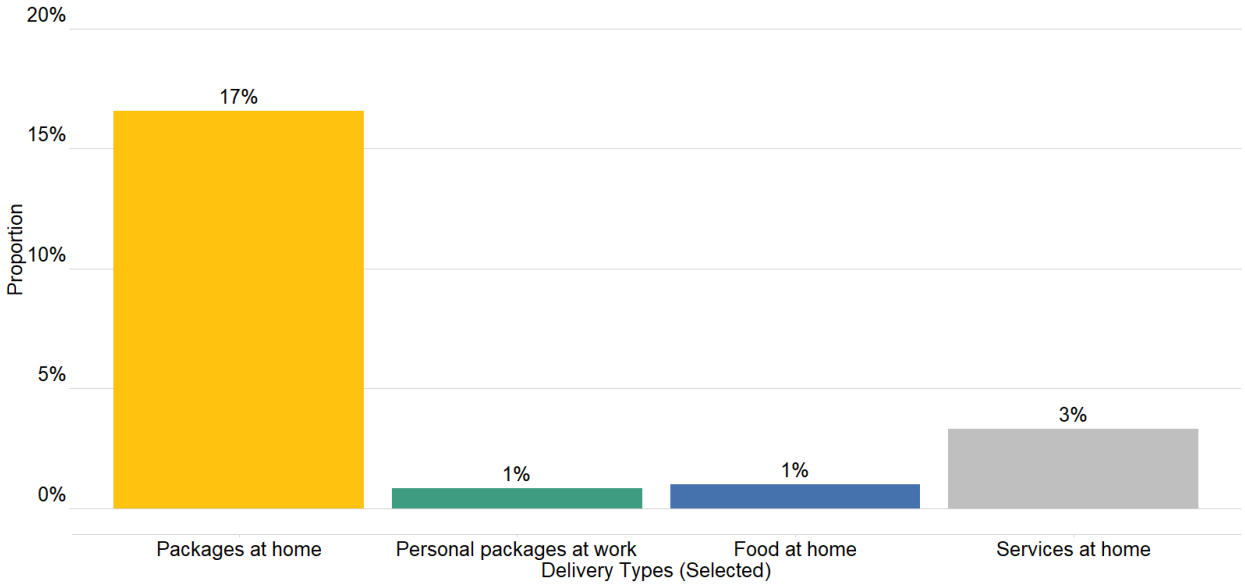


FIGURE 55: DELIVERY SUMMARY: % OF ADULTS WHO REPORTED DELIVERIES ON TRAVEL DAY



7.0 SELF-REPORTED VS. OBSERVED TNC TRAVEL BEHAVIORS

The survey asked participants to report aspects of their typical travel behaviors prior to completing the travel diary. This section of the survey included several questions about TNC and new mobility usage. Figure 56 below summarizes participants' responses to the initial new mobility question ("Which of the following do you use?"). About one-quarter of all participants age 18 and over reported using Uber, Lyft, or other smartphone-app car services. Figure 57 shows that, of those who use TNC, most (15.6%) reported using it less than monthly.

FIGURE 56: NEW MOBILITY SUMMARY: % OF ADULTS (18+) WHO REPORTED USAGE

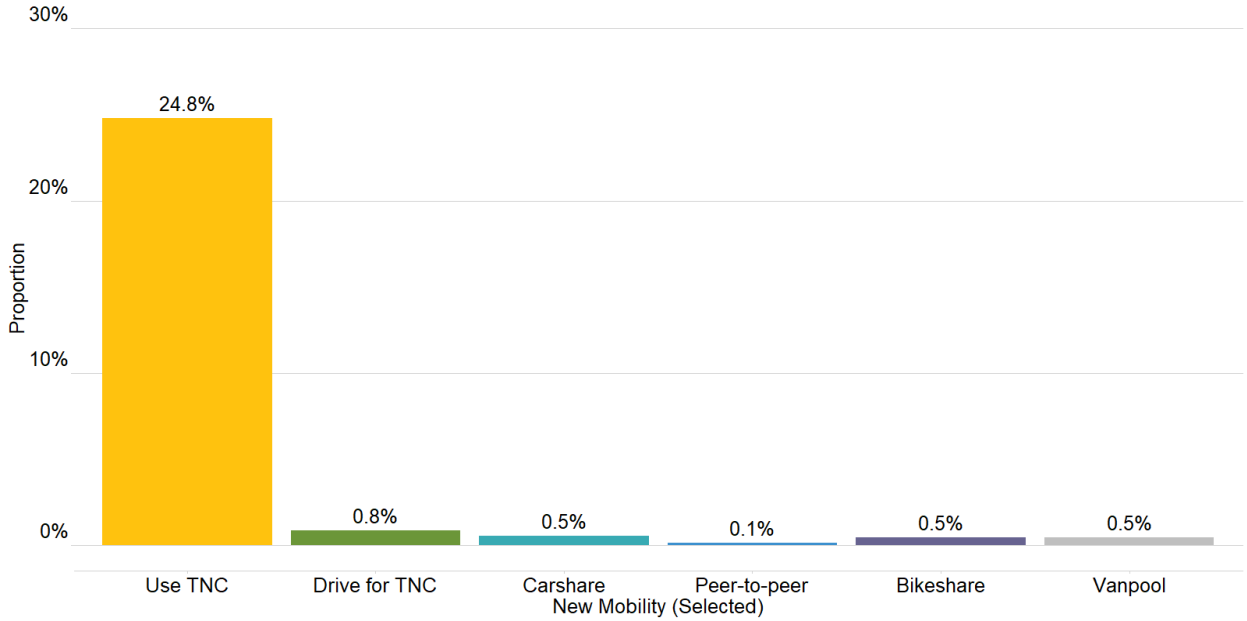


FIGURE 57: REPORTED TNC FREQUENCY (AMONG THOSE WHO USE TNC)

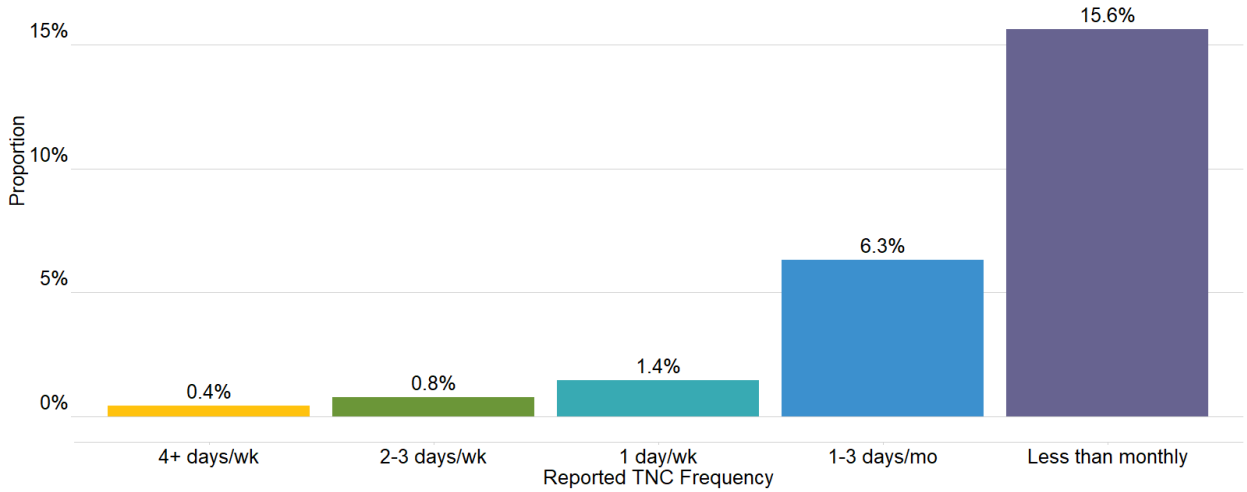
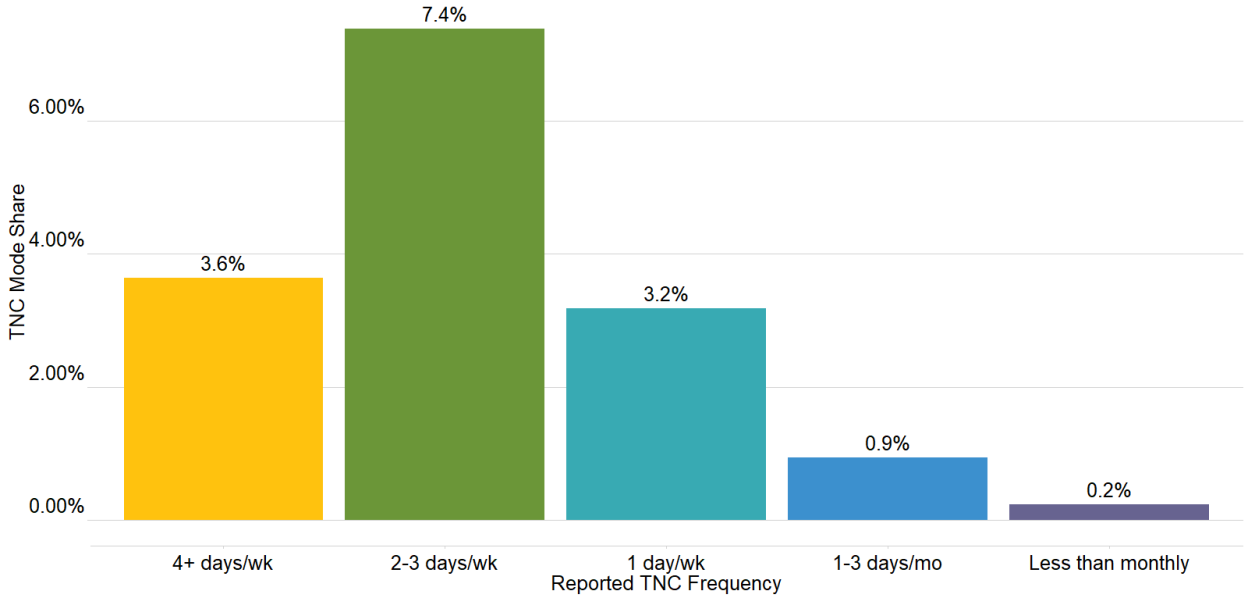


Figure 58 shows participant's reported TNC usage by observed TNC mode share during their travel periods. In general, participants with more frequent reported use *did* use TNC more often during their travel periods. The average TNC mode share among participants who reported TNC use at least one day per week was 4.4% compared to 0.4% among those who reported TNC use less than one day per week (but more often than "never"). However, it's worth noting that the more frequent reported TNC use categories have very small sample sizes (see Figure 57), so these figures may vary in a larger sample.

FIGURE 58: REPORTED TNC FREQUENCY BY OBSERVED TNC MODE SHARE (USING 7-DAY WEIGHT)



8.0 CONCLUSION

The Sacramento Regional Transportation Study used innovative methods to provide a high-quality and representative dataset. The combined compensatory and targeted oversampling methods decreased the nonresponse bias from low-income households, roughly doubled the number of Uber/Lyft users captured to 350 people, and increased the number of transit, walk, and bicycle trips captured. By including several regionally-relevant survey questions (e.g., questions about roadside call boxes), the survey collected qualitative data that may help inform future planning decisions. The study used advanced data collection methods, leveraging smartphones to capture most travel data (96% of all trips), resulting in more accurate (and higher) trip rates and more precise trip times, distances, and person-miles traveled.

Overall, this study achieved and surpassed its goal of generating a high-quality, representative dataset from households throughout the greater Sacramento region.