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Conducting a Longitudinal Survey of Overnight Travel: Methods and Preliminary Findings

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Disclaimer

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1. Introduction

The majority of transportation planning research and data collection focuses on *daily* activity patterns, usually within one's home region. Consequently, the *non-routine long-distance* activity patterns (describing the bulk of tourism and some types of business travel as well as the trips of interest in air travel and rail studies) are understudied and are often treated as external trips in regional forecasting models. Our understanding of long distance travel remains less developed in part due to data limitations.

This report summarizes the implementation and initial results of the Longitudinal Study of Overnight Travel (LSOT), conducted monthly between February 2013 and February 2014 using an online survey instrument developed by researchers at the University of Vermont and Auburn University and implemented by Resource Systems Group, Inc. (RSG). Respondents were residents of the United States and Canada, predominantly in Vermont, Alabama, and California. The overall goal of the study was to pilot the innovative survey method while collecting sufficient observations to analyze attributes of planned and executed overnight trips for all purposes by individuals aged 25 years and older over a 12-month period. The deliberate focus on overnight travel was intended to evaluate this definition as a potential improvement for data collection. Existing household travel surveys typically use a one-day collection window and focus on daily travel regardless of distance. Such survey methods under-represent overnight travel, which overlaps substantially with long distance travel.

This report summarizes the survey process and initial modeling results with reference to existing research papers or reports that provide more detail. This report also describes data tabulation and contains initial descriptive statistics of the overnight travel data measured.

2. An internet-based Longitudinal Survey of Overnight Travel

This section summarizes work from the following references:

Resource Systems Group. (2014). *Methodology Report: Overnight Trip Study*. Prepared for the University of Vermont Transportation Research Center.

Aultman-Hall, L., Harvey, C., LaMondia, and J. J., Ritter, C. (in press). Design and Response Quality in a One-Year Longitudinal Survey of Overnight and Long-distance Travel. *The 10th International Conference on Transport Survey Methods.*

Dr. Lisa Aultman-Hall (University of Vermont) and Dr. Jeff LaMondia (Auburn University) partnered with Resource Systems Group, Inc. (RSG) to design and implement an internet-based Longitudinal Survey of Overnight Travel (LSOT) that could be administered to a large number of respondents each month throughout a full year. The survey was designed to shed new light on long distance trip planning and making, while examining the effectiveness of innovative survey approaches such as monthly, internet-based questions and an overnight (rather than distance-based) threshold for collecting non-routine travel data. The survey design was informed by potential research questions relating to (1) the geographic distribution of planned and completed travel destinations, (2) the temporal distribution of trip-planning and trip-making, (3) the temporal relationships between trip planning and execution, and (4) the flexibility in trip destinations, mode choices, and duration.

Survey respondents were recruited by a variety of methods, including mass emails sent to large corporate, university, and personal groups; posting to social media; posting to email newsletters; and word of mouth. Recruitment from various sources is summarized in Table 2-1. Personal recruitment methods, such as word of mouth to friends and family and Facebook yielded the highest response rates. Posting to email newsletters (e.g., Front Porch Forum) and mass emailing large groups (e.g., Caltrans) yielded the lowest response rates, though these methods demanded relatively little effort or social capital on the part of investigators.

Table 2-1. Groups Recruited

Group	Date Invited (2013)	Estimated Size	Recruits	Response Rate
Front Porch Forum	Jan 13	50,000	151	0.3%
Friends and family	Jan 23-26	493	277	56.2%
UVM newsletter	Jan 28	15,000	125	0.8%
VTrans	Jan 24	750	80	10.7%
VEIC	Jan 24	300	60	20.0%
CCRPC	Jan 24	18	30	166.7%
Caltrans	Jan 24	23,000	117	0.5%
Facebook messages	Jan 24	60	21	35.0%
Auburn faculty and staff email	Feb 1	4,695	496	10.6%
Green Mountain Power	Jan 24	300	47	15.7%
Miscellaneous	Jan 31	11	11	100.0%
CA Transportation Research Centers	Feb 3	159	39	24.5%
Project team members	Feb 4	5	5	100.0%

(1) "Miscellaneous" recruits primarily consist of staff at RSG Inc.

The survey collected information about overnight trips that were both planned and completed. Three distinct survey instruments were used to gather information about demographics, trip plans, and completed trips before and during the one-year survey period (Table 2-2). Prior to the survey period, a recruitment survey was used to gather key demographic information about potential respondents. A baseline survey in February of 2013 marked the start of the one-year period. It gathered demographic information about respondents and their households. It also gathered information about future trips that were currently being planned. Subsequent surveys on approximately one-month intervals collected information about new trip plans and completed trips, including detailed records about stop locations, travel modes, travel party, and trip duration. The last "monthly" survey, in February of 2014, marked the end of the survey period. Table 2-3 shows the schedule of the monthly surveys and the associated number of responses. Of the 1,440 respondents who completed the recruitment survey, 1,220 completed the baseline survey and 628 completed the full, year-long panel.

Table 2-2. Overview of the LSOT Panel Process

Recruitment Survey (N=1440)	• Faculty, staff or student at University • Employed by transportation or planning agency • Year of Birth (filter for >25 years old)
Baseline Survey (N=1220)	• Gender, education, household income • Household members' age, worker status, and vehicles • Home location via interactive map • Work days/week, commute mode and time • Travel plans for the coming year (destination type, primary purpose, travel party) • Frequencies and modes of overnight travel for work and leisure
Monthly Survey (months 2-12)	• Updates to household members, workers, vehicles, or location • Overnight trips completed since last survey o Dates, stop locations, stop purpose(s), mode(s) between stops, travel party • New travel plans and updates to previously recorded plans o Dates, type of destination, purpose, travel party • Number of work or leisure day-trips greater than 50 miles since the last survey

Table 2-3. Survey Schedule, Panel Response, And Panel Attrition

Survey Month	Launch Date	Close Date	Invites	Completes	Dropped*
1- Feb 2013	02/06/2013	02/24/2013	1,440	1,220 (84.7%)	220
2- Mar 2013	03/14/2013	03/29/2013	1,220	1,001 (82.0%)	0
3- Apr 2013	04/22/2013	04/30/2013	1,213	952 (78.5%)	0
4- May 2013	05/23/2013	06/03/2013	1,079	868 (80.4%)	140
5- June 2013	06/24/2013	07/03/2013	1,005	816 (81.2%)	71
6- July 2013	07/22/2013	07/31/2013	930	781 (84.0%)	79
7- Aug 2013	08/23/2013	08/31/2013	869	732 (84.2%)	58
8- Sept 2013	09/23/2013	09/30/2013	832	698 (83.9%)	42
9- Oct 2013	10/24/2013	11/04/2013	788	697 (88.5%)	45
10- Nov 2013	12/02/2013	12/09/2013	753	656 (87.7%)	37
11- Dec 2013	01/02/2014	01/10/2014	729	660 (90.5%)	25
12- Jan 2014	02/03/2014	02/10/2014	708	628 (88.7%)	23
Total			**11,566**	**9,709**	**740**

**People who did not complete the first month's survey were no longer invited; beginning in Month 4, people who missed two months in a row were also dropped from the panel.*

The monthly repeating survey instrument, which respondents completed up to eleven times throughout the panel, was central to the survey process. It collected information about planned and completed trips, as well as updated personal and household demographics. Information collected about planned trips included departure and return dates, purpose, approximate range of destination, modes, and travel party. Planned trips entered in previous months could be updated, marked as

completed, or canceled. Respondents could also record completed trips that had not been planned. More detailed information was collected about completed trips, including the number of unique overnight stops, the location of each stop, duration of each stop, purpose of each stop, and primary travel mode for each leg (between stops).

The online interface allowed the survey to make use of interactive design features, improving user experience and reducing input errors. Most notably, a map-based interface was used to identify home and stop locations (Figure 2-1). Respondents could search for an address with a minimum specificity of city and state, though some entered locations as precisely as street addresses. They could verify these locations using an integrated webmap. The locations were automatically converted into longitude and latitude before being saved to the database. Other features made possible by the web interface included automatic referencing of previous trips plans and logic to minimize irrelevant or redundant questions.

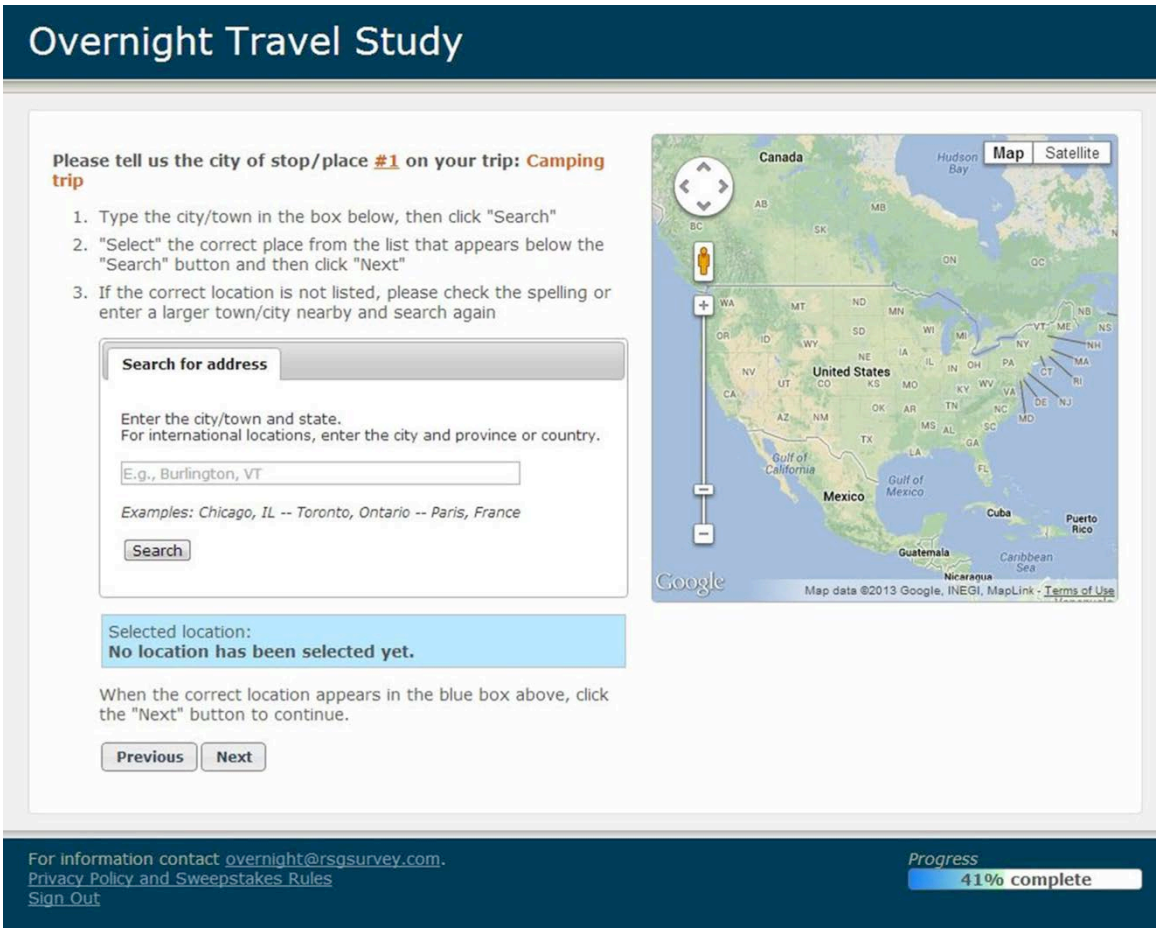

Figure 2-1. Screen Shot of Geolocation Interface for LSOT Survey

Administration of the survey, facilitated by RSG Inc., involved sending monthly emails to each respondent inviting them to complete the most recent survey, sending email reminders several days later, distributing incentives for survey

completion, monitoring the performance of survey technology, and compiling results. Emails sent to respondents included personalized hyperlinks to surveys that were pre-linked to their personal identifiers, eliminating the need for user account services. Respondents who had missed the past two months of surveys were no longer invited to participate. As an incentive for participation, each respondent completing a survey each month was entered in a raffle to win an iPod or iPad. Discussion of the raffle featured prominently in each month's invitation and reminder emails. The large proportion of initial respondents who completed the full twelve-month panel of surveys, more than 50%, is a testament to the effectiveness of the online method and incentive structure used to retain participation.

3. Structuring overnight and long distance tour data

Raw data from the Longitudinal Survey of Overnight Travel (LSOT) were reported by Resource Systems Group, Inc. (RSG), who were contracted to design and administer the survey, in five tables:

Original RSG Tables

1. Baseline – Demographic records from the baseline survey
2. Monthly_demogs – Demographic records from the baseline survey and subsequent monthly surveys
3. Final_demogs – Demographic records from the last survey completed by each respondent
4. Monthly_planstrips – Planned and completed trip records collected in the baseline survey and subsequent monthly surveys
5. Completed_planstrips – Completed trip records collected in the monthly surveys

These tables fully represented information collected by the LSOT, but their organization reflected how the data were collected rather than how it might be used to understand trip-making behavior. To improve accessibility and interpretability of the data for researchers, and to screen and correct errors in the survey data, staff at the University of Vermont Transportation Research Center prepared a new series of tables organized by the units of people, tours[1], legs, and stops. This organization further normalized the data structure while providing the opportunity to include additional summary fields, such as maximum distance from home for each completed tour. Of the new tables, seven included raw and summarized survey data, while an eighth logged substantial edits made to completed tour records to correct errors and inconsistencies. Minor edits made in other tables were logged in fields at the end of each table.

New TRC Tables

1. PersonTable – Demographic records from the baseline survey
2. MonthlyPersonTable – Demographic records for each month that each person completed a survey
3. CompletedTourTable – Completed tour records
4. LegTable – Records for each leg of each completed tour
5. StopTable – Records for each stop of each completed tour
6. PlannedTourTable – Aggregated records for each tour plan
7. MonthlyPlannedTourTable – Monthly records for each tour plan
8. CompletedTourEditLog – Log of edits to records in the CompletedTourTable

[1] The term "tour" was deemed to more accurately describe the potential for multiple stops, though "tour" and "trip" describe the same travel unit throughout this report.

Figure 3-1 outlines the general flow of data between RSG and TRC tables. RSG's Monthly_planstrips and Completed_planstrips tables were expanded into multiple tables to facilitate rotation and normalization of completed trip records and associated legs and stops, or aggregation among planned trip records. The Final_demogs table, which included a subset of records from the Monthly_demogs, was considered unnecessary and did not contribute to the new data structure.

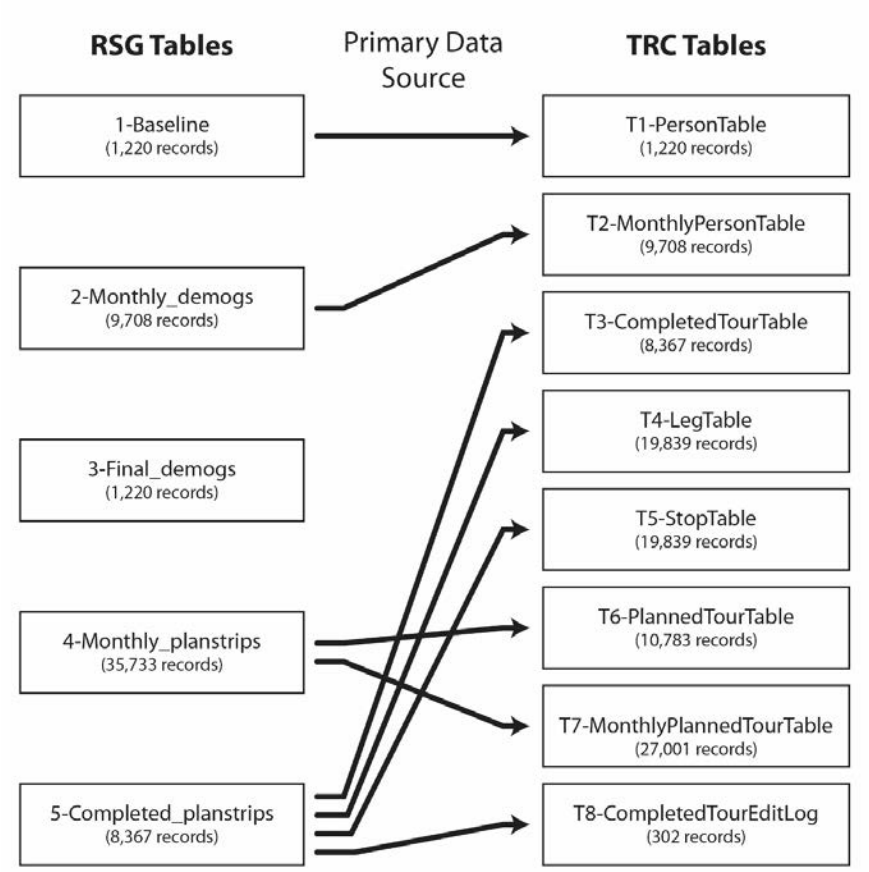

Figure 3-1. Relationships between RSG and TRC Tables

As part of the data restructuring process, completed tour records, which were prone to internal inconsistencies, were systematically checked for errors and corrected where appropriate. Fifteen tours were identified and flagged as one-way, representing home base moves. Extra stops were removed from 135 tours, where it was obvious that multiple stops represented repeat overnights in the same location. Modes were edited where it was reasonable to assume reporting error, such as a rail leg between New York, New York and London, England. Stop locations were edited where text descriptions did not align with reported stops, such as a tour named "NYC," made by a respondent from Burlington, VT, with a single stop in Burlington, VT. This stop location was edited to "New York, NY." In total, 302 tour records were edited for errors; these edits were reflected in associated leg and stop records. All place names, including home and stop locations, were also systematically edited to remove detailed address information to protect the privacy of respondents.

4. Design considerations and response quality for a longitudinal travel survey

This section summarizes work from the following references:

Aultman-Hall, L., Harvey, C., LaMondia, and J. J., Ritter, C. (in press). Design and Response Quality in a One-Year Longitudinal Survey of Overnight and Long-distance Travel. *The 10th International Conference on Transport Survey Methods.*

The Longitudinal Survey of Overnight Travel (LSOT) was successful in capturing a detailed account of respondents' long distance and overnight travel behavior over an entire year. Nonetheless, the survey posed important questions about how future surveys might better capture travel information, retain participants throughout longitudinal panels, and recruit respondents who are more representative of the general population.

Several strategies were used to recruit LSOT respondents, allowing analysis of which strategies were most effective for recruiting diverse and dedicated participation. Nearly 95,000 invitations were made by email, posting to social media, advertising in neighborhood newsletters, and word of mouth (Table 2-1), resulting in 1,220 respondents to the baseline survey in Month 1. Of these, 628 completed the entire, year-long panel. It was hypothesized that personal connections with the researchers or professional connections to the transportation field would result in the highest rates of recruitment and panel completion. This was partly confirmed—the response rate for personal emails to friends and family of the researchers was nearly 50%. However, responses from group emails sent to employees in Transportation Agencies were less than 1%, similar in magnitude to responses from posting in neighborhood and university e-newsletters. Retention throughout the survey, however, was not substantially influenced by recruitment method (Figure 4-1).

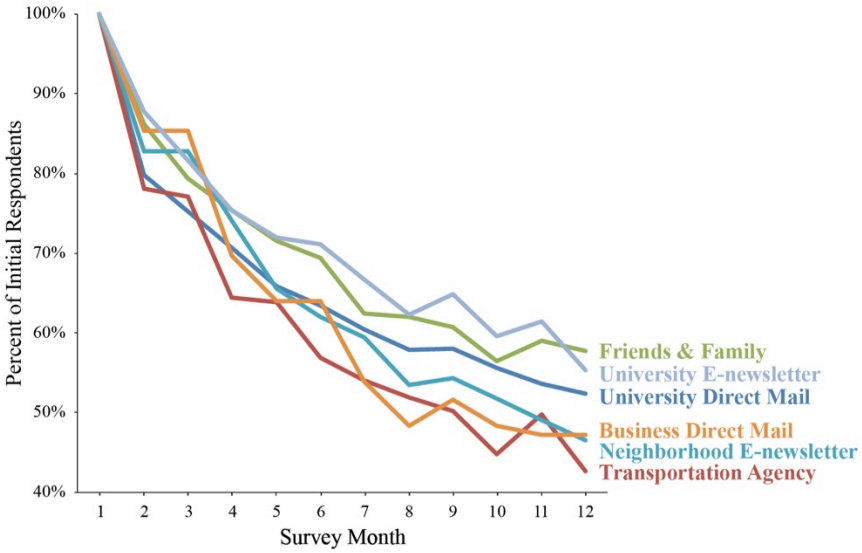

Figure 4-1. Monthly Retention by Recruit Method

None of the strategies used to recruit respondents used randomized techniques intended to capture a sample representative of the U.S. population at-large. Recruiting was geographically focused on areas in Vermont, Alabama, and California (Figure 4-2). Respondents from other areas in the U.S. and Canada were recruited mostly through direct personal and professional connections with the investigators. Recruiting within university and professional networks yielded extremely well educated and relatively affluent respondents. Nearly 90% had college-level education, and 46% had annual household incomes greater than $100,000. Approximately 80% of respondents worked full-time, and 62% were female. Given the direct relationship between long distance travel demand and affluence observed by existing research (Limatanakool et al., 2006; Steiner and Cho, 2006), data from the LSOT is problematic for estimating long distance travel demand across a more general population.

Figure 4-2. Baseline Home Locations of LSOT Respondents

Respondent burden was a key consideration affecting survey design, and was central to recommendations for improving future surveys. The interface and questions were intended to minimize effort for respondents each month. However, travel surveys pose substantially more burden for heavy travelers because they must report more trip information. Comments and follow-up focus groups did reveal that some heavy travelers dropped the survey prematurely, and analysis of last months of participation showed that respondents often had a spike in travel immediately prior to dropping the survey, suggesting that fatigue played a role in attrition (Figure 4-3). Nonetheless, modeling results indicated that overall volume of travel did not significantly affect the likelihood of respondents completing the full panel. Further reducing respondent burden in future surveys may be advantageous for maintaining the heaviest travelers, who make important contributions to overall travel volume, while making the survey more attractive for all participants.

Comments within the monthly surveys suggested that some very light travelers may have dropped the survey because they did not feel it was relevant to them. Technology such as cell phones may make it possible to design future surveys that are extremely "lightweight" for users, requiring minimal interaction, while gathering precise information about travel locations and scheduling.

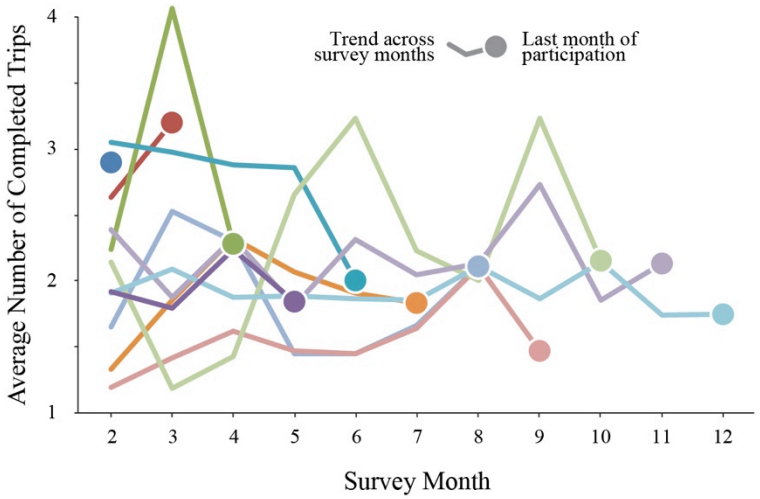

Figure 4-3. Trip Making by LSOT Dropout Cohorts

5. Defining, surveying, and forecasting long distance travel

This section summarizes work from the following references:

LaMondia, J. J., Aultman-Hall, L., and Greene, E. (2014). Long Distance Work and Leisure Travel Frequencies: Ordered Probit Analysis Across Non-Distance-Based Definitions. *Transportation Research Record*. No. 2413, 1-12.

A significant challenge to forecasting long distance travel is appropriately defining different types of trips. It is unrealistic to lump all long distance trips into a single category based on popular distance thresholds of greater than 40 to 100 mi from home (RSG Inc. 2013, Steiner and Cho 2013, Zhang et al. 2012). Instead, long distance trips with different purposes, modes, and distances are likely to have unique influences. This study examined how the frequency of several common types of long distance travel may be affected by personal and household characteristics of the travelers. It used data from the baseline survey of the LSOT, where respondents were asked to estimate how frequently, on five-point ordinal scales, they traveled overnight, by various modes, and to international destinations for both personal and work purposes (Figure 5-1).

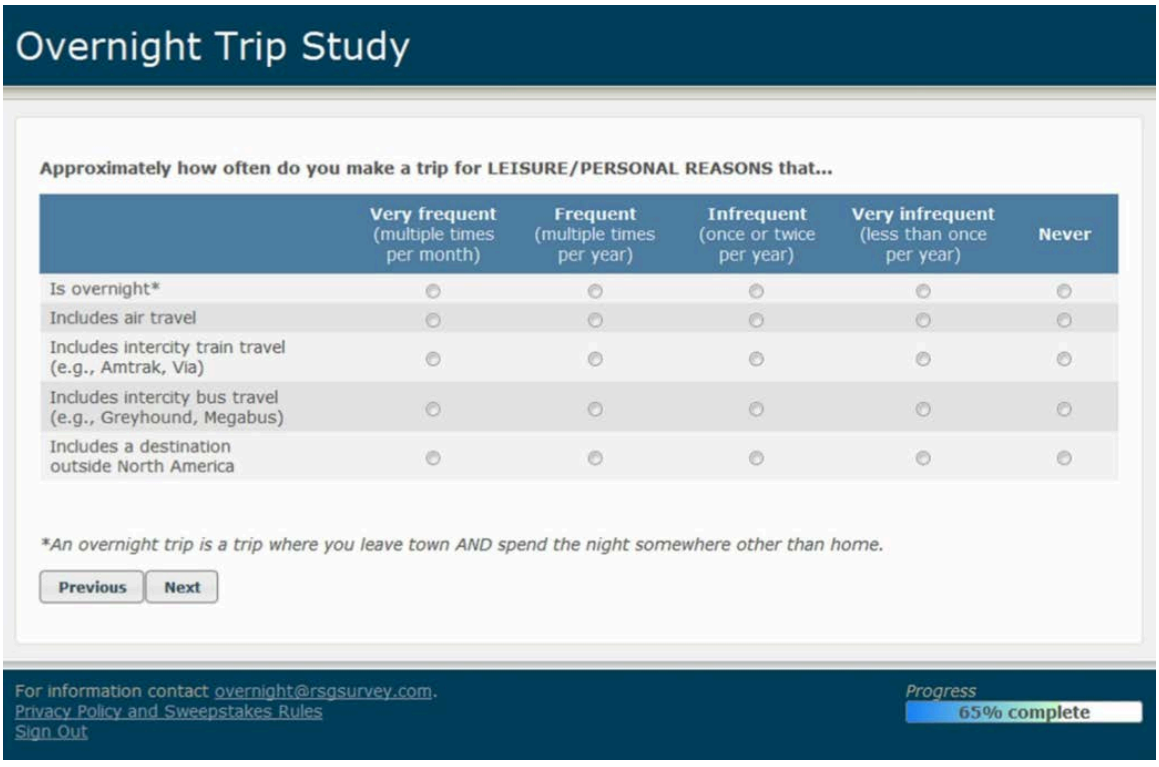

Figure 5-1. Screen Shot of Trip Frequency Questioner from Baseline LSOT Survey

Ordered Probit models were used to identify factors with a significant effect on travel frequency within each type. A total of ten models were estimated, one for each of the personal and work trip types: overnight, air, train, bus, and international. This allowed comparison of effects based on purpose, duration, mode, and distance.

Table 5-1 shows which factors were significant at the 0.05 level and were therefore included each final model. It also shows the sign of each coefficient. Very few factors have a similar effect on all types of long distance trips, indicating the necessity of modeling the different types separately.

Several factors did increase trip frequency across most types. Attainment of a bachelors or graduate degree had a positive effect on overnight and air trips for both work and leisure, and a graduate degree positively effected most other trip types. Higher income also generally increased frequency of trip making, though not by rail for leisure or by bus for either leisure or work. Bus trip making, especially for leisure, was increased by not working full-time. These results should, however, be interpreted in the context of the LSOT sample, which was highly skewed toward the well-educated, upper-middle class, and full time employed.

Daily activity patterns, such as commuting, also impacted long distance trip making for both work and leisure. Commuting by transit increased frequency of trips by air, rail, and bus, but not overnight, perhaps suggesting that transit riders are comfortable making trips that combine multiple modes. Increased international leisure trips among those who commute by walk, bike, or transit suggests that those living in more central places, where these commute options are available, may have more disposable income. It makes sense that those with longer commute durations, who conceivably have less free time, make fewer overnight and air leisure trips. It is similarly logical that those who telework make more overnight, air, and rail work trips.

Household factors also affected trip making. Having a spouse reduced trip frequency among most types, and having children reduced several types of leisure trip making. Differences in trip making based on household age and composition indicates different travel needs depending on stage of life. For instance, young adults who have not yet started their own families may need to visit family more frequently. Greater numbers of household vehicles increased overnight trip frequency for both leisure and work, unsurprising given that vehicles reduce logistical burden and marginal costs for trip making. Private vehicles also reduced leisure trip frequency by other surface modes, and to international destinations. Geographic characteristics of households, such as distance to airport and downtown areas, had little influence on most trip types. Overnight leisure trips, however, were less frequent among those in more central areas, conceivably because they had less need to leave the immediate area for cultural, recreational, or visiting opportunities.

This study's key finding was that long distance travel models must account differently for factors influencing different types of trips. Very few factors had the same effects across the ten trip types modeled. These trip types, however, are not meant to suggest a correct or particularly useful trip typology. Rather, they simply demonstrate the heterogeneity of factors affecting trips with different characteristics. Further research should use segmentation techniques to identify trips with similar characteristics, providing an efficient structure for long distance

trip prediction. These trip types will likely be based on cross-categorization of trip purpose, mode, distance, duration, party, and other characteristics.

Table 5-1. Comparison of Factors Between Ordered Probit Models

		Overnight		Airline		Intercity Rail		Intercity Bus		International	
		Work	Leisure	Work	Leisure	Work	Leisure	Work	Leisure	Work	Leisure
DEMOGRAPHIC	Age in 30s								-		
	Age in 40s		-						-		
	Age in 50s						-		-		
	Age in 60s	-							-	+	+
	Age in 70s	-									
	Some college		+			-		+			+
	A bachelor's degree	+	+	+	+			+			+
	A graduate degree	+	+	+	+	+	+		+	+	+
	Respondent is male	+	-	+	-					+	
	Current home 1 – 5 years					+		+			+
	Current home 6 - 10 years				-	+					
	Current home > 10 years		-		-	+					
EMPLOYMENT ATTRIBUTES	Employed part time	-		-			+		+	-	
	Self employed				+			+	+		+
	Unemployed student								+		
	Employed student	+	-					+	+		+
	Homemaker				+		+				+
	Income $25k - 49.9k			-	-						-
	Income $50k – 74.9k				-						-
	Income $75k – 99.9k	+	+								-
	Income $100k - 149.9k	+		+	+	+				+	
	Income > $150k	+	+	+	+	+				+	+
	Works out of home > 5 days a week		-		+				+		
	Works out of home 1 - 4 days a week	+	+	+			+	+			
	Works from home one day a week		-								
	Works from home 1 – 3X / month		-	-							
	Works from home < 1 per month		-								
	Works in the transportation field			+		+	+				-
	Works as university faculty		-		-		-		-		
	Works as university staff				-		-		-		-
COMMUTE	Typical commute: dropped off	-					+	-			
	Typical commute: car/vanpooling			+					+		
	Typical commute: public transit			+	+	+	+	+	+		+
	Typical commute: cycling		+		+	+	+		+		+
	Typical commute: walking		+				+		+		+
	Typical commute: teleworking	+		+		+					
	Duration of commute (minutes)		-		-				+		
	Day trips over 50 miles in last month	-									
	Work day trips >50 mi last month	+									
HOUSEHOLD	People under 6 years old		-								-
	People between 6 and 17 years old		-		-						-
	People between 18 and 24 years old				-						-
	People between 25 and 50 years old		-								
	People older than 50 years old		-	-			+				
	People that work > 20 hours per week						+	+	+		
	Number of household vehicles	+	+				-		-		-
	Participant has spouse	-		-	-	-	-			-	-
	Household has children									-	
	Household has extended family		-						+		
	Household includes roommates				+				+		
	Household includes “others”				-						
GEOGRAPHIC	Middle Atlantic Census division										-
	South Atlantic Census division		+								
	West North Central Census division						+				
	Straightline dist home – RUCA 1		+	-						-	-
	Straightline dist home - airport		-								
	Road-distance home – RUCA 1		-	+						+	+
	Road distance home - airport		+		-						
	Pop (in millions) within 100 mi		-								+

6. Modeling time intervals between long distance trips

This section summarizes work from the following references:

LaMondia, J. J., Moore, M. and Aultman-Hall, L. (In Press). Modeling Inter-Trip Time Intervals Between Individuals' Overnight Long-Distance Trips. *Transportation Research Record.*

A critical aspect of simulating long distance travel demand is understanding how trips are scheduled through time. Long distance trips, especially those that span multiple days, pose substantial time constraints on each other and on daily activities. Opportunities for overnight travel may be impacted by the time that has passed since the last trip, or until the next one, and these impacts may be different depending on individual and household factors. This study aimed to be better understand what demographic and adjacent trip factors contribute to *inter-trip* intervals. The year-long timeframe of the LSOT was particularly conducive to this research, as each respondent reported between 2 and 37 overnight trips, and inter-trip intervals could be evaluated for each consecutive pair.

It is logical to assume that trips might be distributed evenly throughout a given year, and that the more trips someone takes the smaller their average inter-trip interval will be. As shown by Figure 6-1, those who took many trips necessarily had a small average inter-trip interval. There is limited time in a year, and if one is traveling frequently those trips must be closely spaced. However, those who went on fewer trips had more variance in their inter-trip intervals, clustering their trips within just a few days of each other or spreading them out by nearly a full year. Close analysis showed that trip clusters were more common in the winter and summer seasons. Even those who made many overnight trips were likely to have clusters scheduled within close proximity of each other.

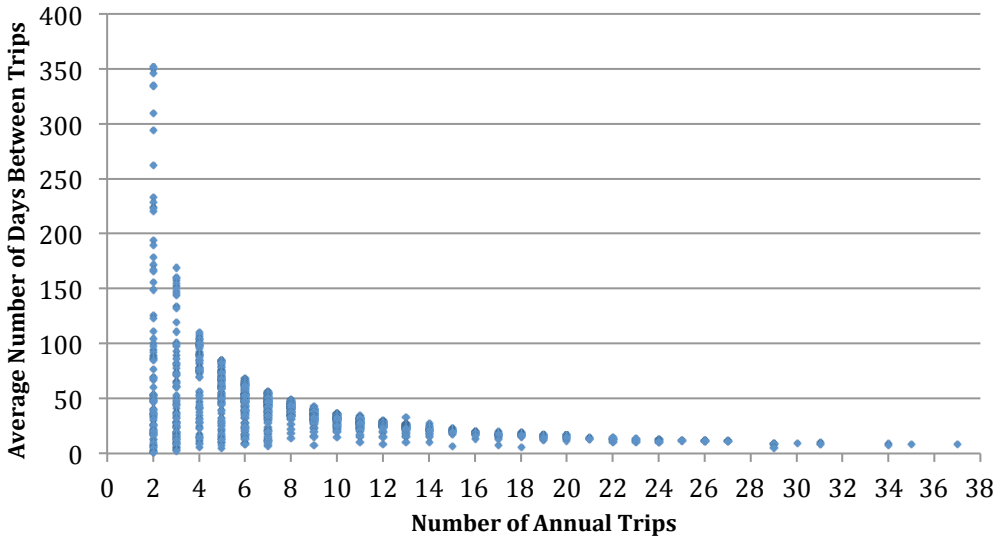

Figure 6-1. Average Inter-Trip Intervals by Total Number of Annual Trips

Negative binomial regression was used to estimate the length of inter-trip intervals based on characteristics of previous and upcoming trips and traveler demographics. Seasonality of upcoming trips was significant, with relatively large inter-trip intervals in the winter suggesting long intervals without trips before and after closely-spaced holiday travel. Trip making was estimated to be most closely and regularly spaced throughout the summer.

The investigators also calculated variables for conditional probability of upcoming trips being for either work or leisure. These variables were calculated as the proportion of previous trips that were for the same purpose (work or leisure) as the upcoming trip, thus describing the effects of repeating trip purposes. Both work and leisure conditional probability variables were significant in the model, though their effects had different signs. The leisure coefficient was positive, suggesting larger inter-trip intervals when respondents' schedules were dominated by leisure trips. A negative work coefficient suggested that schedules dominated by work trips would result in smaller inter-trip intervals. This supports the premise that work travel is more frequent and regularly scheduled than leisure travel.

Several characteristics of previous trips were significant in the model. Not surprisingly, the more trips a traveler had made already in the year, the smaller the predicted gap until the next one. Distance and duration or previous trips were also significant, with greater average distances and durations increasing inter-trip intervals. However, larger maximum distance and duration in a traveler's annual history *decreased* inter-trip intervals. This suggests that fatigue and the necessity for greater inter-trip spacing stems from repeated long-distance or -duration trips, not single, potentially anomalous trips.

Demographics affected inter-trip intervals in several ways. Households with children had increased time intervals between trips, likely due to higher costs and complexity of traveling with children. Full time workers tended to make more, closely-spaced trips, potentially due to greater disposable income or heavy travel for work. Those with graduate degrees generally have shorter intervals between trips, but University-level faculty had larger intervals, potentially due to constraints imposed academic calendar. Income was not a significant factor, though this may have been due to high correlations with education and work status variables.

This study shows that inter-trip time intervals are feasible to estimate and may potentially be incorporated into annual activity models predicting overnight travel schedules. Microsimulations of annual activity will need to be able to estimate not only how much overnight travel will occur, but *when* it will occur. Predicting inter-trip intervals will be crucial for appropriately scheduling trips throughout the year, and showing how long distance, overnight trips compete for time with daily activities in a traveler's home region.

7. Preliminary Overnight Tour Characteristics based on the LSOT

The last comprehensive national survey of long distance travel, the American Travel Survey, was undertaken in 1995. Long-distance trips were estimated to account for 25% of all person miles of travel (Zhang et al. 2012). There were an estimated 1.3 billion long-distance trips in the United States in 2001, a 155% increase from 1977 (Henderson and Trani 2008). Long-distance travel, based on a distance threshold, and overnight travel, distinguished by an overnight stay away from home, are closely but not exactly related. The relationship between these types of travel is difficult to quantify due to lack of data.

Figure 7-1 shows estimated overlap between overnight and long distance trips over a one-year period. It is based on the overnight and daily long distance activity recorded for the 628 LSOT full panel members, along with average daily trips rates and distances for residents of Vermont, Alabama, and California from the 2009 National Household Travel Survey (NHTS). Relatively few trips are overnight. However, these overnight trips account for similar number of person miles traveled compared with daily trips. This finding suggests a need for greater emphasize on measuring long distance and overnight trips especially for energy and environmental policy questions.

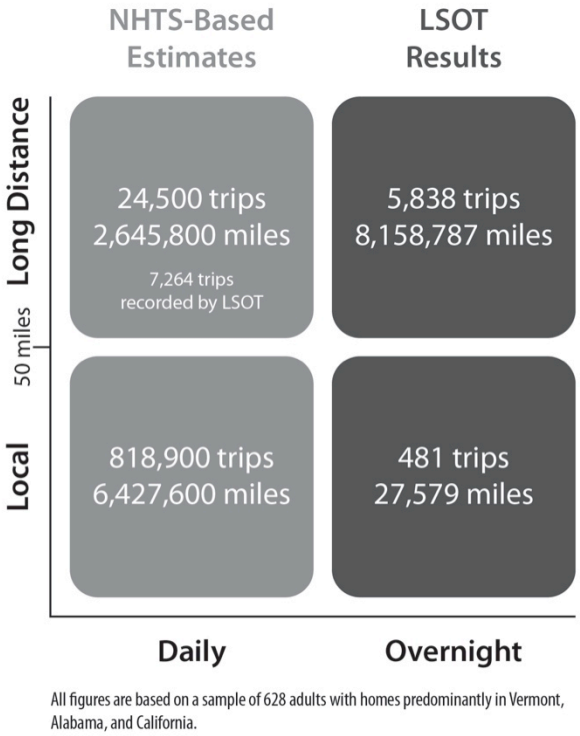

Figure 7-1. Overlap between distance-based and time-based trip types

This section provides some initial descriptive statistics from analysis and modeling of LSOT data that is ongoing at the University of Vermont and Auburn University. Note that the sample is not random and contains a disproportionate number of

people who travel for work and are relatively educated and affluent (Table 7-1). The sample also contains an unrepresentative proportion of households made up of couples and two-adult families, who do substantially more traveling than one-adult families (which can include any number of children) (Table 7-2). Tours, miles and nights away are not highly correlated, suggesting the need to measure all three depending on the policy question. Figure 7-2 illustrates the number of overnight tours per person throughout the one-year survey. Most participants reported 10 or fewer overnight tours. However, some reported substantially more.

Table 7-1. Demographics of Vermont, Alabama, and California LSOT Respondents

	Vermont	**Alabama**	**California**
N	229	222	62
Age			
20s	18 (8%)	13 (6%)	1 (2%)
30s	51 (22%)	61 (27%)	10 (16%
40s	40 (17%)	51 (23%)	9 (15%)
50s	67 (29%)	70 (32%)	38 (61%)
60s	42 (18%	27 (12%)	4 (6%)
70s	11 (5%)	0 (0%)	0 (0%)
Education			
High School	5 (2%)	6 (3%)	1 (2%)
Some College	19 (8%)	12 (5%)	4 (6%)
Assoc. Deg.	11 (5%)	6 (3%)	2 (3%)
Bach. Deg.	90 (39%)	48 (22%)	28 (45%)
Grad. Deg.	104 (45%)	150 (68%)	27 (44%)
Income			
<$25K	12 (5%)	5 (2%)	0 (0%)
$25-50K	25 (11%)	28 (13%)	1 (2%)
$50-75K	44 (19%)	56 (25%)	6 (10%)
$75-100K	44 (19%)	33 (15%)	10 (16%)
$100-150K	59 (26%)	58 (26%)	19 (31%)
$150-200K	15 (7%)	23 (10%)	6 (10%)
$200-250K	7 (3%)	4 (2%)	8 (13%)
>$250K	0 (0%)	2 (1%)	3 (5%)
Unspecified	23 (10%)	13 (6%)	9 (15%)

Table 7-2. LSOT Travel by Household Type

Household Type	**N**	**Average Number of Tours**	**Average Miles Traveled**	**Average Traveling Days**
Single	153	10.2	1,637	44
Couple	276	10.4	1,518	42
One-adult family*	18	8.3	945	22
Two-adult family*	181	9.6	1,361	34

* Including any number of children

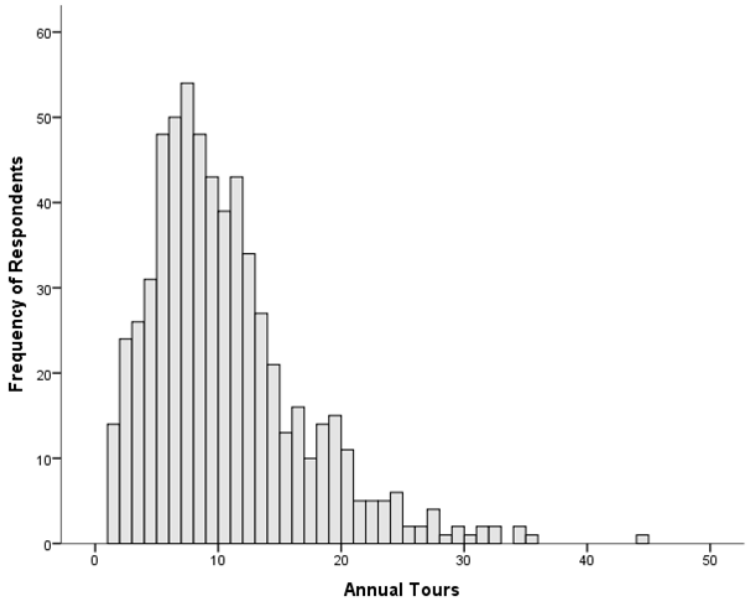

Figure 7-2. Frequency Distribution of Overnight Tours Made By LSOT Respondents

Figure 7-3 illustrates the frequency distribution of overnight tour lengths for tours with and without use of air on at least one leg. Only 8% of the overnight tours were within 50 miles of home, but 23% were within 100 miles of home. Distance was clearly a determinant of choice between air and surface modes, however there was a range of distance for which both were used. Note that the x-axis on this figure is truncated as some tours in the dataset were as long as 10,000 miles, and these tours all included air legs. Clear relationships between trip distance and mode indicate that it is not necessarily appropriate to use a single distance threshold of 40 to 200 miles as the delineator between local and long distance trips. Other definitions, based on a combination of travel duration, mode, and spatial factors may be more appropriate for both data collection and analysis depending on the research or policy context.

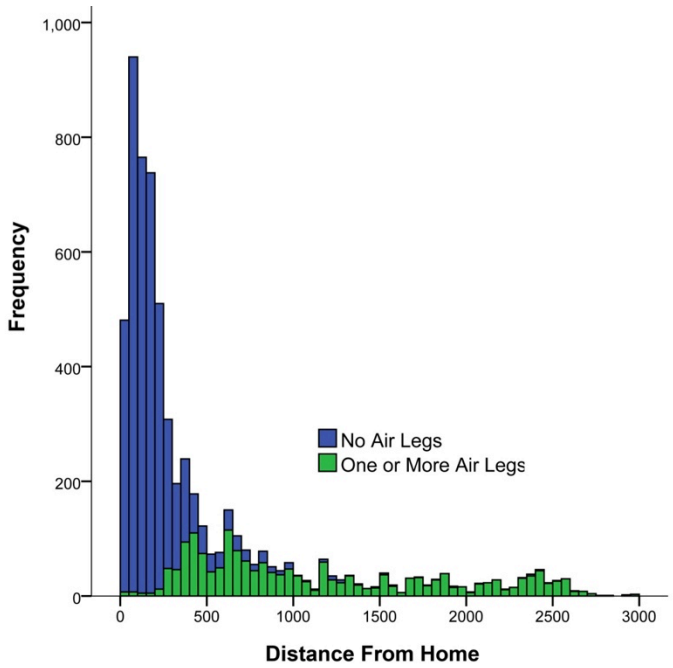

Figure 7-3. Use of Air Mode by Length of Tour

The LSOT collected the geolocation of every overnight stop location throughout overnight tours (Appendices A – C contain maps of stops for residents of the three primary states where participants lived). As such, tours could be classified by spatial patterns and distance from home, as demonstrated in Figure 7-4. Although certain types and lengths were more or less common, the broad-ranging spatial types represented even within the limited LSOT dataset attests to the complexity of a large portion of overnight and long distance travel, and the need to pursue more meaningful frameworks for understanding and forecasting such tours.

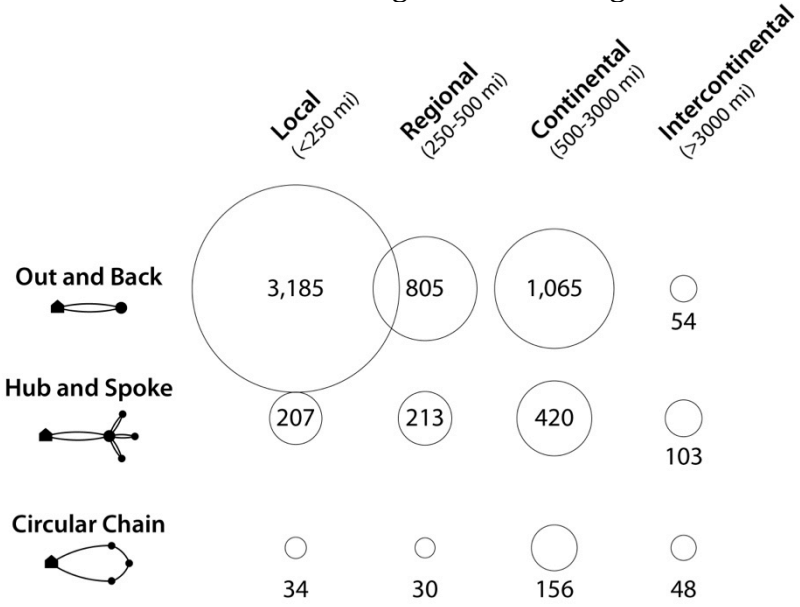

Figure 7-4. LSOT Tours by Distance and Spatial Pattern

Conclusions

Quantifying travel activity and associated motivations is increasingly important for planning effective transportation systems at nested geographic scales: regional, national, and global. While many countries have robust daily travel surveys, few have established methods for collecting data over multiple days, especially for long-distance travel. The successful pilot of the Longitudinal Study of Overnight Travel (LSOT) provides support for use of an online longitudinal approach. Moreover, the LSOT provides many insights related to survey design that stimulate a wider discussion about how to collect overnight travel data in a way that is understandable by respondents and useful for planning. The complexity of factors influencing overnight travel behavior suggests that, while passive data collection from cell phones and other devices may be used to observe spatial patterns of travel, surveys will still be needed to capture complementary details about the planning processes, motivations, trip details, and demographics.

Developing more robust methods for measuring and modeling long distance travel will challenge the travel survey methods and modeling communities to:

- Develop a common language for long-distance and overnight travel surveys;
- Integrate models for surface and air modes;
- Expand study areas to a global landscape for parts of the modeling process; and
- Integrate traditional surveys with passive technology to collect data from all segments of the population.

The global scale and complexity of long distance and overnight travel is daunting. Several other countries routinely collect long distance travel data, recognizing its importance to myriad policy issues. Long distance and overnight travel is central to infrastructure and level of service planning, equity and quality of life issues, economic development and the environmental impacts of transportation. The successful execution of the LSOT, as well as the lessons learned and initial findings, provides a solid base from which to design more frequent and robust long distance travel data collection efforts.

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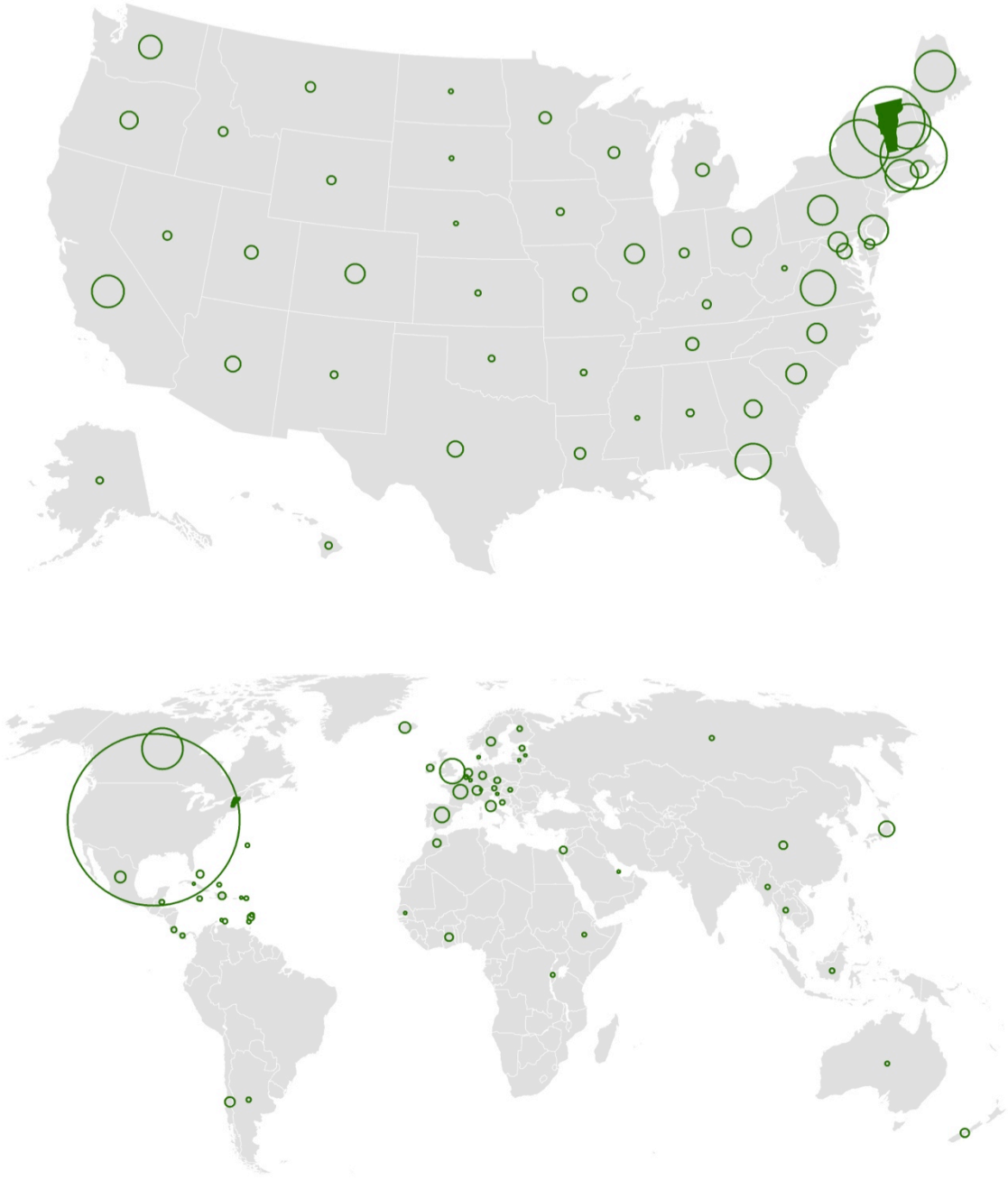
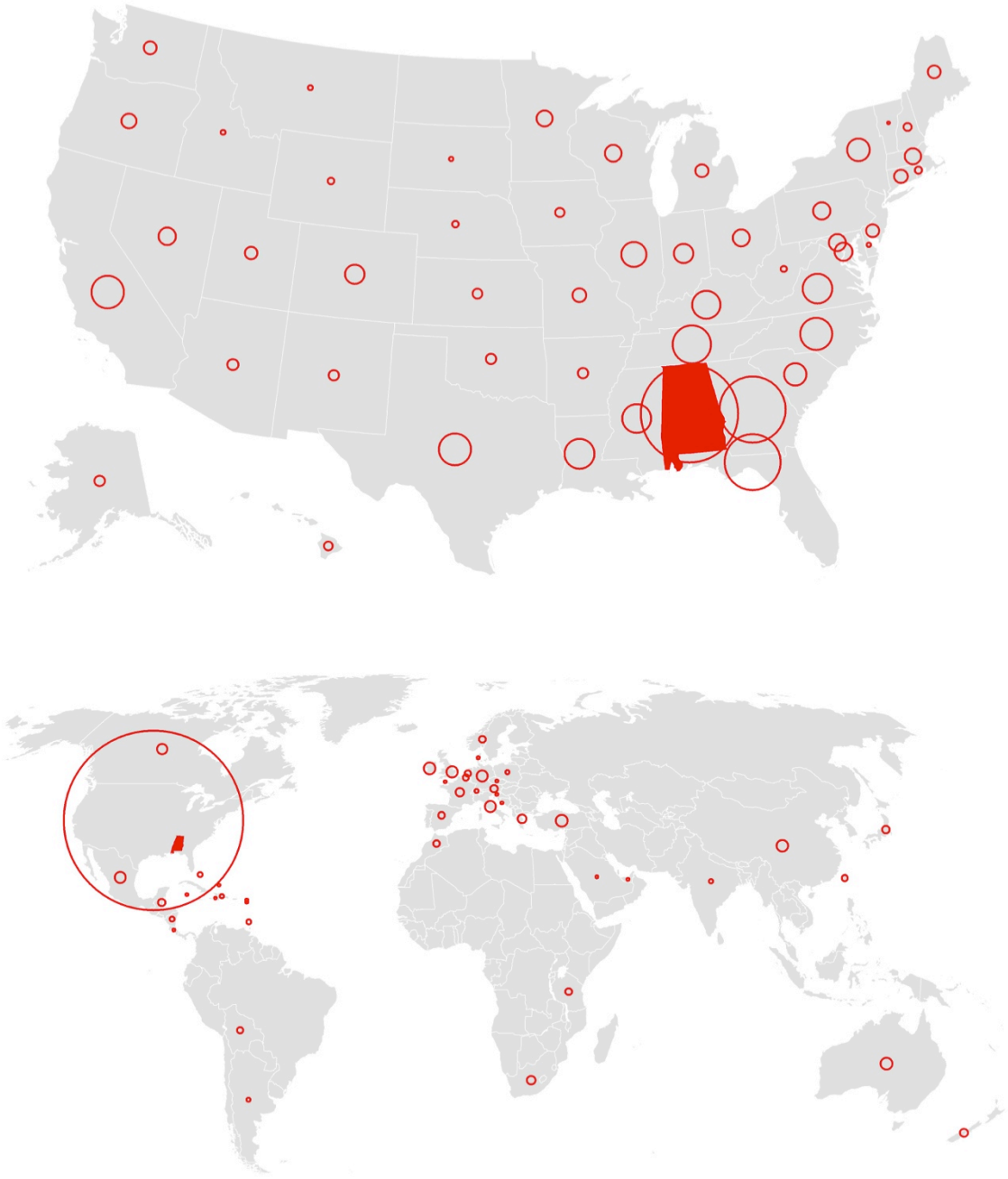
Appendix A: Overnight Tour Stops for Vermonters



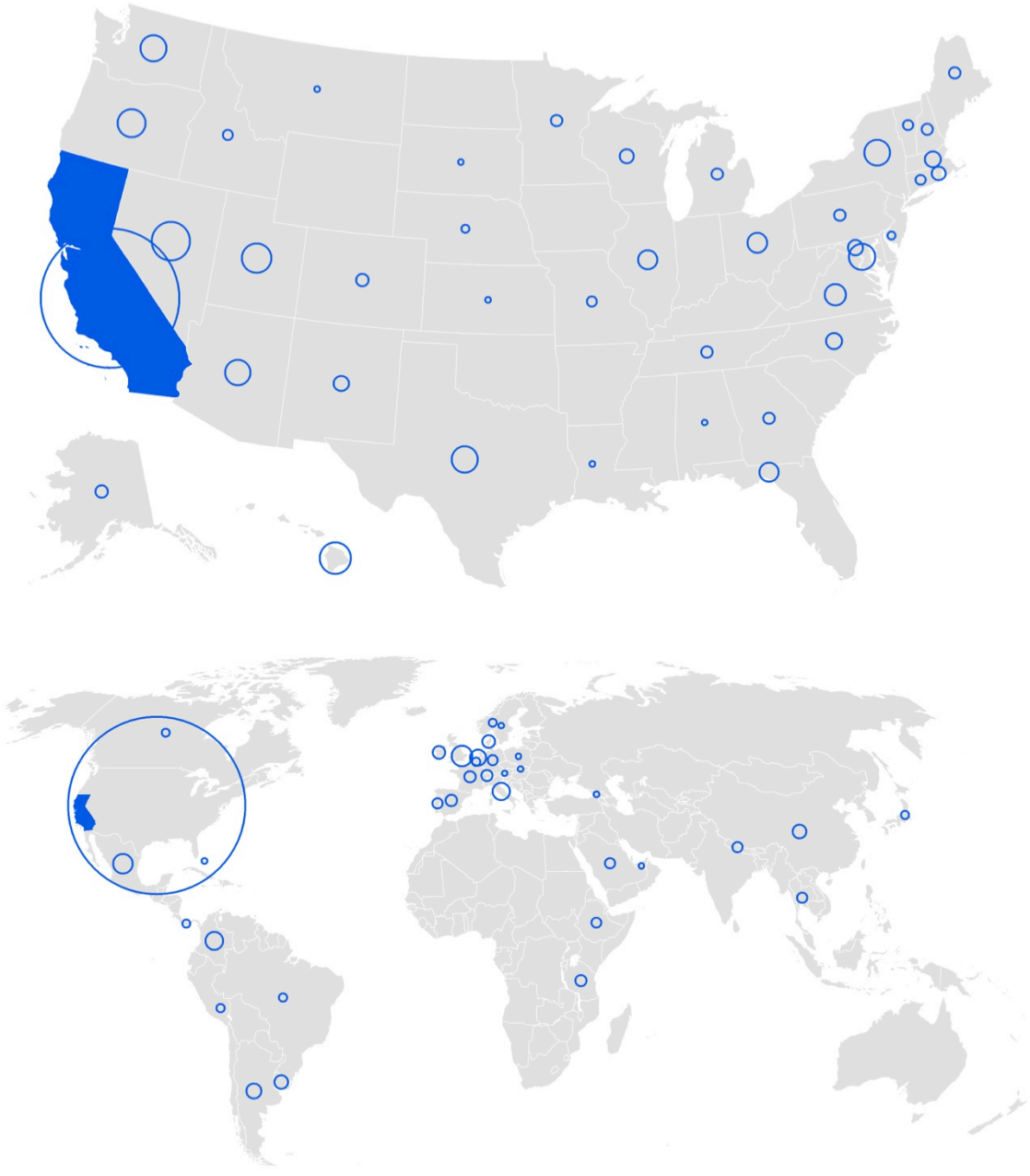
Areas of circles are scaled proportional to the number of stops made by LSOT respondents with Vermont home addresses. Circles are drawn at the same scale on the United States and international maps, and also the maps in Appendices B and C.

Appendix B: Overnight Tour Stops for Alabamers



Areas of circles are scaled proportional to the number of stops made by LSOT respondents with Alabama home addresses. Circles are drawn at the same scale on both United States and international maps, and also the maps in Appendices A and C.

Appendix C: Overnight Tour Stops for Californians



Areas of circles are scaled proportional to the number of stops made by LSOT respondents with California home addresses. Circles are drawn at the same scale on both United States and international maps, and also the maps in Appendices A and B.