

**The Exposition Light Rail Line Study:
“Before-After” Opening Travel Impacts and New Resident Sample Preliminary Analysis**

Marlon G. Boarnet, Doug Houston, and Steven Spears

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Abstract

Transit has become central to the Los Angeles region's plans for air quality attainment, greenhouse gas emission reduction, community quality of life, and the promotion of increased physical activity. However, limited information exists about how rail transit investments reduce driving, increase transit use and non-motorized travel, and how transit investment links to environmental sustainability and community quality of life goals. In order to better understand the impact of this transportation policy shift, the University of California, Irvine and University of Southern California undertook a multi-year, multiple objective study of the Exposition light rail line west of downtown Los Angeles. Approximately six months before and after the opening of the line, we collected a comprehensive set of demographic and travel data from 204 households. Approximately half of these were in "experimental" neighborhoods located ½ mile or less from new Expo Line Stations. The remaining "control" households were located from ½ to 3 miles from these stations. In addition, we obtained data from 89 households that had moved into the Expo Line study area since January of 2012, for comparison with our "core" sample of established residents and to understanding the factors that affected residential selection.

Our analysis indicates that the Expo Line has had a significant impact on the travel of our core sample households. In particular, households in our experimental neighborhoods, which lie within ½ mile of an Expo Line station, reduced their daily household vehicle miles traveled (VMT) by approximately 10 miles per day compared to control households that were more than ½ mile from a station. Households in the experimental neighborhoods also took significantly more train and walking trips than they did before the opening of the line. However, this change in the number of daily walking and train trips was not significantly different from that of the control households.

New resident households had the highest VMT of any of our study groups. VMT of new resident households in our experimental neighborhoods was 11 miles per day higher than that of core households. This difference was statistically significant. There was no difference in VMT between new resident households within ½ mile of Expo stations and those further away. New residents tended to be considerably younger than those in our core sample of established households and were more likely to rent their residence. Low housing cost, low crime, and housing quality were most important reasons cited in residential choice, followed by commute time and access to shops and services. Overall, new residents indicated that car accessibility was the most important travel mode consideration in their household location decision. However, more than 60% indicated that being able to walk to shops and services was an important factor in their decision.

About the Authors

Marlon G. Boarnet is Professor of Public Policy and director of graduate programs in urban planning and development in the Sol Price School of Public Policy at the University of Southern California. His research focuses on land use and transportation; links between land use and travel behavior; urban growth patterns; and the economic impacts of transportation infrastructure. He currently serves on the governing board of the Association of Collegiate Schools of Planning. Since 2002, Boarnet has coedited the *Journal of Regional Science*, a leading international journal at the intersection of economics and quantitative geography. Boarnet also serves as an associate editor of the *Journal of the American Planning Association* and is on the editorial boards of several other academic journals.

Douglas Houston (BA, University of Texas, Austin; MA, PhD, University of California, Los Angeles) is an Assistant Professor of Planning, Policy, and Design at the University of California, Irvine. His research focuses on the environmental and health implications of urban development and transportation systems. His recent work has appeared in the *Journal of Transport Geography*, *Environment and Planning A*, and the *American Journal of Public Health* and assesses the environmental and land use implications of vehicle-related air pollution for residents of goods movement corridors and evaluates the implications of compact development and transit investments on travel behavior and activity patterns. This work uses travel surveys and real-time location and pollution tracking techniques to inform policies seeking to make neighborhoods more compact, mixed-use, and transit accessible in hopes of reducing vehicle travel and associated air pollution.

Steven Spears is a doctoral candidate in the Department of Planning, Policy, and Design at the University of California, Irvine.

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**The Exposition Light Rail Line Study:
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Executive Summary

During the next ten years, the Los Angeles Metropolitan Transportation Authority will commit funds to six new rail transit lines, an expansion that will create a network longer than the current Washington Metro. Transit has become central to the Los Angeles region’s plans for air quality attainment, greenhouse gas emission reduction, community quality of life and the promotion of increased physical activity. However, limited information exists about how rail transit investments reduce driving, increase transit use and non-motorized travel, and how transit investment links to environmental sustainability and community quality of life goals.

In order to better understand the impact of this transportation policy shift, the University of California, Irvine and University of Southern California have undertaken a multi-year, multiple objective study of the Exposition light rail line west of downtown Los Angeles, which opened at the end of April, 2012. During the fall and winter of 2011–12, prior to the opening of the line, we collected a comprehensive set of demographic and travel data from 284 households. Approximately half of these were in “experimental” neighborhoods located ½ mile or less from new Expo Line Stations. The remaining “control” households were located from ½ to 3 miles from these stations.

In the fall of 2012, approximately 4–6 months after the Expo Line began operation, we administered the same study protocol to 204 households that had participated in the before-opening phase of the study. In addition, we obtained data from 89 households that had moved into the Expo Line study area since January of 2012, with a goal of capturing their travel behavior (for comparison to the established before-after households) and understanding the factors that affected the selection of their new residential location.

Our preliminary analysis indicates that 4–6 months after opening the Expo Line has had a significant impact on the travel of our core sample households. In particular, households in our experimental neighborhoods, which lie within ½ mile of an Expo Line station, reduced their daily household vehicle miles traveled (VMT) by approximately 10 miles per day compared to control households that were more than ½ mile from a station. Households in the experimental neighborhoods also took significantly more train and walking trips than they did before the opening of the line. However, this change in the number of daily walking and train trips was not significantly different from that of the control households.

The new resident sample obtained during this phase of the Expo Line study provided several insights into the characteristics of this group. First, new residents tended to be considerably younger than those in our core sample of established households. They were more likely to rent their residence, and though fewer had very low (less than \$15,000/year) incomes, their incomes and other demographic characteristics did not differ substantially from the core households.

In terms of the their decision to move to their current address, low housing cost, low crime, and housing quality were most important, followed by commute time and access to shops and services. The

least important factors were school quality and access to child care services. Overall, new residents indicated that car accessibility was the most important travel mode consideration in their household location decision. However, more than 60% indicated that being able to walk to shops and services was an important factor in their decision.

New resident households had the highest VMT of any of our study groups. VMT of new resident households in our experimental neighborhoods was 11 miles per day higher than that of core households. This difference was statistically significant. There was no difference in VMT between new resident households within ½ mile of Expo stations and those further away.

Over the next year, we will continue research into the travel behavior effects of the Expo Line. We will return to both our core and new resident samples in the fall and winter of 2013 using the same survey protocol. This will enable us to analyze the effects of the line over the longer term for the core sample and new residents. We will also evaluate the feasibility of recruiting a supplemental, more recent new resident sample of households to add to our understanding of housing selection and behavior change in the project area.

Background and Research Objectives

Los Angeles is pursuing possibly the most ambitious rail transit investment program in the nation. Eighty percent of Los Angeles County's transportation sales tax revenues (from Propositions A and C, passed in 1980 and 1992, and Measure R, passed in 2008) are dedicated to transit, either by bus or rail. During the next ten years, the Los Angeles Metropolitan Transportation Authority will commit funds to six new rail transit lines, an expansion that will create a network longer than the current Washington Metro. Transit-oriented development (TOD), and transit more generally, will be central to the Los Angeles region's plans for air quality attainment, greenhouse gas emission reduction, and co-benefits such as community quality of life and the promotion of increased physical activity. Against that backdrop, we have limited information about how rail transit investments reduce driving, increase transit use and non-motorized travel, and link to environmental sustainability and community quality of life goals. The nation's first truly automobile city is rapidly transforming its transportation system—a transition from an almost complete reliance on the automobile and busses to a retrofitting of alternative modes that has not been seen anywhere else. This paradigm shift in transportation policy and investment creates new requirements for understanding and policy research.

In order to better understand the impact of this change, the University of California, Irvine and University of Southern California have undertaken a multi-year, multiple objective study of the impact of light rail investment in Los Angeles. The first objective is to evaluate the impact of light rail on travel behavior, physical activity, and vehicle miles traveled (VMT) (as a proxy for associated vehicle greenhouse gas emissions). In particular, we examine the impact of the Exposition light rail line west of downtown Los Angeles.

Previous research indicates travel behavior impacts up to 2 miles from rail stations, but knowledge of how travel behavior changes over time in response to new rail investment is almost completely

lacking.¹ The results of this study will help illuminate how the Expo light rail line is associated with changes in driving, walking, and bicycling in ways that can enhance the quality of life for residents in the vicinity of the line. They will also help us understand how the beneficial impacts of the Expo Line can be enhanced. Beyond the Expo Line itself, this work is necessary to pioneer evaluation methods that will be essential for Los Angeles and California to implement bottom-up, neighborhood based transportation investments that can enhance local quality of life while meeting state-mandated environmental goals.

The second objective of this research is to better understand of the process by which individuals and households select housing locations, and to examine differences in travel behavior between new and established residents within the same neighborhood. The new resident study represents an exceptional opportunity to gain insight into questions of residential selection and travel behavior. By comparing the travel behavior of residents who lived in the study area before the Expo Line opened with the travel behavior of new in-migrants into the neighborhood, it will be possible to assess how new light rail affects two groups of persons—those who lived in the study area before the light rail opened and persons who moved into the study area.

This paper details the work that has been completed through the before and after opening phase of the Expo line, including study area selection, participant recruitment, data collection, and preliminary descriptive analysis.

Policy Context—California SB 375 and Transportation-Related Greenhouse Gas Emission Reduction

The context for regional transportation and land use planning in California has changed dramatically in the past few years. State Senate Bill (SB) 375 brings new, and still evolving, requirements for metropolitan planning organizations to align transportation and land use in ways that meet greenhouse gas (GHG) emission reduction targets from the transport sector. The targets have been set by the California Air Resources Board (ARB), and the greater Los Angeles region's first plan to comply with those targets has been published in draft form, as the Southern California Association of Government's (SCAG's) draft Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS). By 2020, the ARB target requires that the SCAG region reduce GHG from the ground transport sector by 8%, and the target requires a 13% reduction by 2035. Both targets are from a 2005 per capita baseline. The draft SCAG RTP/SCS anticipates meeting and even exceeding the targets. Yet compliance with targets is based almost entirely on transportation forecasting models, potentially limiting the evolution and flexibility of the SB 375 policy framework in ways discussed below.

¹The literature shows that persons that live two miles from a rail transit station have no measurable difference in vehicle travel when compared with persons who have no rail transit access (Tal, Handy, and Boarnet, 2010; Bailey, Mokhtarian, and Little, 2008.) Stated equivalently, at a distance of two miles from a transit station the rail transit has no effect on driving behavior (Tal, Handy, and Boarnet, 2010; Bailey, Mokhtarian, and Little, 2008), hence the fact that 13 percent of our households are at least two miles from a rail transit station provides a strong control group. Yet the effect of rail transit on travel behavior dampens with distance—persons closer to rail transit stations drive less and use transit more, and that effect appears to be approximately linear in distance from transit (Ewing and Cervero, 2010; Pushkar, Hollingworth, and Miller, 2000; Tal, Handy, and Boarnet, 2010), hence our decision to sample households in a range of distances, from less than ¼ mile from a new station to farther than two miles from the station.

Metropolitan Planning Organizations (MPOs) must develop transportation investment plans that, when combined with affordable housing allocation plans and projected growth patterns, comply with ARB GHG targets for the ground transport sector. Yet MPOs do not have authority to regulate land use—land use regulations are still virtually the exclusive province of municipal governments. Instead, the MPO acts in part as an aggregator of local plans, in part as a trend setter, and in part as a collaborator, and the regional transportation investments can in many cases have impacts on travel and development patterns. Yet the relationship between local policies and regional compliance will be important for SB 375, and that relationship remains informal.

In the SCAG region, under SB 375 the plans of the region's 195 local governments must now be reconciled with a multi-decade transportation investment program to demonstrate that the SCAG region will attain greenhouse gas emission reduction targets. There are, broadly speaking, two ways that compliance can be measured, and each implies a different approach to policy development. The traditional transportation approach is model-based. Complex computer models forecast the travel impacts of the regional transportation plan, and those models then forecast compliance with greenhouse gas emission reduction targets. This approach is inherently top-down, and has only limited room for local innovation. The policies forecast in the models must be anticipated in advance by the modelers. Modelers constantly work to improve their models, and SCAG's model is among the most sophisticated in the U.S., but it is difficult to model unanticipated innovations. What if a local government sought to create a pedestrian mall, or pursue a local bicycle-sharing program, or promote neighborhood electric vehicles? These programs, or close analogs, are being pursued in the SCAG region now, but each of these is outside of the fidelity of regional travel forecasting models. Programs that are innovative, or that affect a small area, will often be outside of the scope of what forecasting models can accurately predict. This makes it difficult to intimately and effectively tie transportation planning to neighborhood development and limits the ability to understand and respond to local concerns.

A preferable alternative is to foster a bottom-up, locally innovative transportation policy. In a region as vast and varied as the greater Los Angeles area, allowing and inviting local innovation will be a necessary component of transportation planning going forward. Local governments zealously guard their land use authority and within cities neighborhoods actively organize around issues that are specific to their community, creating a circumstance where the most viable way forward for SB 375, or for the regional planning that it fosters and requires, is to encourage local innovation that fits the local context. That local experimentation cannot exist without a credible way to evaluate the results.

SB 375 requires that metropolitan planning organizations be able to quantify the greenhouse gas (GHG) emission impact of various transportation policies, and the state Air Resources Board must certify compliance with targets. For the first time ever, even small transportation programs will be subject to assessments of the way those programs influence greenhouse gas emissions, and hence travel. Transportation has long been a top-down policy endeavor, and the evaluation tools needed to assess the travel and emission impacts of, for example, local bicycle sharing programs, or innovations in parking pricing, or other programs not yet anticipated have not been carefully applied.

This research, by demonstrating how new technology combined with classic social scientific program evaluation techniques can be used to evaluate a broad range of travel impacts from a major infrastructure project, will provide an early proof-of-concept for evaluation methods in transportation.

The results will document how driving, transit use, walking, bicycling, and physical activity change after the construction of the Expo Line corridor.

Expo Line Background

The Exposition (Expo) Line is a light rail line in the Los Angeles metropolitan area that extends south and west from downtown Los Angeles. Phase I of the line, which opened April 28, 2012, runs 8.7 miles from downtown Los Angeles westward to Culver City, near the junction of the 405 and 10 Freeways. Construction of Phase II, which will extend the line into downtown Santa Monica, began during the summer of 2012 and is scheduled to be completed in 2015. Figure 1 shows a diagram of the Phase I portion of the line and its location within the LA metro area.

Figure 1: Expo Line Phase 1 Location and Stations



Source: LACMTA

Phase 1 of the Expo line stops at a total of 12 stations, 10 of which were newly constructed. It shares track with the Metro Blue light rail line over 1.2 miles near downtown Los Angeles, and also runs on the same route as the Metro Silver rapid bus and other Metro bus lines line over 2.7 miles between the 7th Street/Metro Center station in downtown LA and the Expo Park/USC station. The Expo Line operates from 5 AM to 12:30 AM, with approximate headways of 12 minutes during the day and 20 minutes at other times. The system could run at headways as low as 6 minutes depending on demand and system capacity (LACMTA, 2012).

In addition to downtown LA and Culver City, the Expo line serves the area south and west of the University of Southern California campus as well as the neighborhoods of Exposition Park, Leimert Park, Crenshaw, Jefferson Park, Baldwin Hills and West Adams. The neighborhoods served by the Expo line are predominantly minority and lower income, with more moderate income in the Culver City area.

Study Area Selection

In order to study the effect of the Expo Line on travel behavior and physical activity, we selected experimental neighborhoods in the immediate vicinity of the new stations, and comparison neighborhoods with similar built environment and socio-demographic characteristics at varying distances from the line. The experimental neighborhoods were chosen around the six westernmost Expo Line Phase 1 stations. The six easternmost stations were not chosen because they were also served by either the Blue Line light rail or the Silver Line rapid bus, which provide service of similar characteristics in conjunction with the new Expo Line service. In addition, the Jefferson/USC, Expo Park/USC, and Expo/Vermont stations were excluded because of their proximity to the University of Southern California campus, which has a very different socio-demographic profile than the neighborhoods to the west. Because this area has a high proportion of university students, any travel behavior change, though interesting in its own right, may not be as generalizable as that of residents in other neighborhoods.

Comparison neighborhoods were selected at varying distance from the new stations, ranging from ½ to more than 2 miles in distance. They were chosen from areas with similar characteristics to the experimental areas, but they were also located along corridors that have been identified for future light rail lines by the Los Angeles Metropolitan Transit Authority (LAMTA). By doing this, we hoped to lay the groundwork for future longitudinal studies of travel behavior in these corridors as well. The first set of comparison neighborhoods used in the study extended south from the Expo/Crenshaw station along the proposed Crenshaw light rail line. The second set was chosen within a ½ mile radius of the Expo Line National/Palms station, which is the easternmost station of Expo Line Phase 2, and the first stop beyond the Expo Line Phase I Culver City station. Figure 2 shows the approximate limits of the experimental and control neighborhoods. Figure 3 shows the relationship of the project area to the LA Metro Transit System in South Los Angeles.

We chose the study corridor and control neighborhoods to be demographically similar, to approximate a treatment—control group design where the treatment group, within ½ mile of new stations, gets an improvement in access to light rail, and the control group, being more distant, does not benefit as much from the new Expo Line. The control households are drawn from locations over a half-mile from an Expo Line Phase I station, and 38 of our households (13 percent) live two miles or farther from one of the Phase I stations.

Characteristics of the treatment and control group neighborhoods are shown in Table 1. The treatment and control areas are similar in terms of population density, age and income distribution. The only apparent difference between the two is that the control neighborhoods have a higher proportion of African-American residents, and a larger proportion of Hispanics live in the experimental neighborhoods.

Table 1: Census Data for Expo Line Experimental and Control Areas

| | Experimental | Control | Source |
|---|--------------|---------|--------------------------|
| Land Area (acres) | 3590 | 5011 | 2010 Census SF1 Data |
| Population Density* | 21.1 | 18.1 | 2010 Census SF1 Data |
| Housing Unit Density* | 7.8 | 7.2 | 2010 Census SF1 Data |
| Race and Ethnicity: | | | |
| Hispanic | 51.8% | 32.7% | 2010 Census SF1 Data |
| African American | 27.7% | 46.4% | 2010 Census SF1 Data |
| White | 11.5% | 12.5% | 2010 Census SF1 Data |
| Asian | 5.8% | 5.3% | 2010 Census SF1 Data |
| Other | 1.0% | 0.8% | 2010 Census SF1 Data |
| Multiple Races | 2.1% | 2.3% | 2010 Census SF1 Data |
| Age: | | | 2010 Census SF1 Data |
| Under 20 Years Old | 27.5% | 25.4% | 2010 Census SF1 Data |
| 65 Years Old and Older | 9.2% | 12.0% | 2010 Census SF1 Data |
| Household Income and Benefits (2010 Inflation-adjusted Dollars): | | | |
| Less than \$25,000 | 29.8% | 31.9% | ACS 2010 5-year Estimate |
| \$25,000 to \$50,000 | 26.4% | 27.8% | ACS 2010 5-year Estimate |
| \$50,000 to \$74,999 | 18.5% | 17.5% | ACS 2010 5-year Estimate |
| \$75,000 to \$99,999 | 11.9% | 8.1% | ACS 2010 5-year Estimate |
| \$100,000 or more | 13.5% | 14.6% | ACS 2010 5-year Estimate |

Participant Recruitment and Data Collection

Expo Core Sample—Before Opening (September 2011–February 2012)

The Before Opening Core sample, which is comprised of experimental and control households that were resident in the study area before the Expo Line opened, was recruited in two phases. During the first phase, from September to November of 2011, we obtained addresses for a total of 27,275 households in the vicinity of three Expo stations (Crenshaw, Farmdale, and La Brea) and control neighborhoods to the south, including Crenshaw, Leimert Park, Harvard Park and Chesterfield Square. Each household was mailed a letter inviting them to take part in the study.

The study recruitment letter, which was provided in English and Spanish, directed potential participants to visit the project website and/or call a telephone number to contact us. In either case, the respondent was asked to complete an introductory questionnaire that consisted of basic questions about household composition and travel behavior. These included the number of members in the household in three different age groups (over 18, 12 to 17, and under 12), number of vehicles, and whether anyone in the household had used transit in the past month. We also asked whether the participant would be willing to carry a GPS logger and physical activity monitor, and whether they would be willing to use a smartphone-based survey application. Participants were not informed of the study’s objectives regarding effects of the Expo Line. They were informed in study materials that “the purpose of this

study is to examine the effects of local employment, shopping, transportation and neighborhood design on the distance people travel and the types of transportation they use”.

Based on responses to the introductory questionnaire, potential participants were separated into three groups: web-based (participants who completed survey components online), paper-based (participants who completed survey components using hard copy materials), and mobile tracking (participants who completed survey components using hard copy materials and also participated in GPS and activity monitoring).

All participants except those interested in carrying the GPS and activity monitor were mailed a packet that contained all of the materials necessary to complete the study. Those who agreed to carry the GPS and activity monitor (the mobile tracking group) met with a trained researcher and were provided the materials in person during training on how to use and charge tracking devices. The survey instrument included instructions, a 7-day travel log for each household member 12 years old or older, and a mileage log for each household vehicle. Appendix A contains the materials that each participating household completed for all household members 12 years of age or older.

For participants who indicated they preferred to complete the study using the website (the web-based group), a password and username were provided. Participants were instructed to log in on the website using the username and password to complete the baseline survey and 7-day travel logs. Responses were captured using a survey form developed with the SurveyGizmo web application. Responses were stored on the SurveyGizmo servers and subsequently downloaded to project computers.

Those who either did not have access to the internet, or preferred to mail the materials to us, received a paper version of the surveys along with the instructions and 7-day travel log (the paper-based group). A self-addressed postage-paid envelope was provided to facilitate return of the survey instruments and logs. The survey materials included in the paper group packet were identical in content to those available on the web-based survey.

Households in the mobile tracking group were contacted to schedule a convenient time to meet with a trained researcher. At this meeting, the respondent was given instructions, survey materials, travel logs, and vehicle logs. These materials were identical to those received by the paper and the web groups. Participants were also given the two monitoring devices and personalized instruction on how to properly use them. Only the main respondent in each household carried the GPS and physical activity monitor during the survey period. However, the remainder of the survey protocol was the same as the web and paper groups. Each household member 12 years old or older completed a travel log that included daily counts of trips by mode and minutes walked and cycled. Daily vehicle mileage was tracked using an odometer log for each household vehicle. This allowed the computation of household-level trip counts, walk/bicycle minutes, and vehicle miles travelled (VMT). At the end of the 7-day survey period, participants again met with one of our researchers, who collected all of the survey materials along with the GPS and activity monitors. The responses to the survey were checked by the researcher to ensure they were complete at the time of pick up.

During October, it became apparent that the Expo Line would not open before early 2012. This gave us sufficient time to expand the project area beyond the original boundaries and to include three stations adjacent to the original study stations (Culver City, La Cienega/Jefferson, and Expo/Western). In addition, we selected an area in the vicinity of the Expo Phase 2 National/Palms station as a new

control area. A final mailing went out to these, as well as any remaining households in the original project area, during the second week of November. Approximately 12,000 households received letters in this final wave.

A total of 304 responses were received during the Before Opening study. Of these 284 were complete and usable: 146 (51.4%) in control neighborhoods and 138 (48.6%) in experimental neighborhoods.

Expo Core Sample—After Opening (September 2012–November 2012)

In September, 2012, approximately five months after the opening of the Expo Line, we began re-contacting households that completed the Before Opening study. Participants were mailed a letter asking them to reply by phone or email if they were willing to participate in the after opening study. As before, in order to not affect participant behavior, no mention was made of the Expo Line in the recruitment materials. To encourage households to participate, study compensation was substantially increased. In the Before Opening study, each household that completed the survey materials received a supermarket gift card with a value of \$15 or \$30. For the After Opening study, paper and web respondents were offered \$50 gift cards, while mobile tracking group households received \$75 cards. Households that did not respond to the initial letter were also contacted by telephone or email using information obtained during the before opening study. Overall, return rate for the after opening study was quite good. A total of 204 households out of 284 (71.8%) returned a usable set of study materials.

Households completed the after opening study between September and November of 2012. The survey protocol was the same as the before opening, and the study was administered in the same way as before, with respondents completing the study by one of three methods (web, paper, or mobile tracking). Mobile tracking households from the before study were once again enrolled in the mobile tracking group of the after study to allow analysis of physical activity and travel pattern changes.

Expo New Resident Sample (October 2012–April 2013)

In order to compare new resident travel behavior to that of established households, we targeted between 100 and 200 travel diary surveys in areas previously surveyed for the Expo Line before and after opening study. In early October, 2012, we purchased an address list of 3,212 residents who had moved to the study area between January and September of 2012. The address list was supplied by InfoUSA, a commercial provider of residential and business marketing information. The total number was lower than our original estimate of 8,000 new residents in the study area, which was based on preliminary information we received from InfoUSA. We mailed these 3,212 new residents an invitation postcard (see Appendix B) in late October 2012, and 110 (or about 3%) of these new residents went to our study website or called to express interest in participation. We mailed a survey packet to each of these participants during the week of November 26, with instructions that they should log their trips and vehicle mileage from Tuesday–Thursday, December 4–6, 2013. Participants who completed all survey materials were mailed compensation in the form of a \$30 supermarket gift card. From this initial recruitment, we received a total of 29 completed surveys (26.3% of packets mailed), well below our target of 100 to 200 households.

In order to improve response, we conducted a second mailing in early February of 2013. The mailing list for this wave was created from two sources. First, we again purchased a “new mover” address list from InfoUSA that covered the period from October to December of 2012. Second, we purchased a full

address list from InfoUSA for all project areas that were included in the first phase of the Expo Line study in 2011. The address list from fall 2011 and the address list from January 2013 were then compared to identify potential new residents. Addresses that matched between 2011 and 2013 but had different names listed were identified as potential new residents. Combining the October–December new mover list from InfoUSA, and the potential new mover households we identified from our previous list resulted in 11,213 possible contacts. Each of these households was mailed a recruitment postcard (Figure 1) in early February of 2013. In order to boost response, we increased the incentive compensation to \$50 for each household. As before, compensation was offered in the form of a supermarket gift card.

The February mailing resulted in 151 responses from potential new resident participants. As before, each household was mailed a full set of survey materials, asking them to complete their travel diaries Tuesday through Thursday during either March 5–7 or March 19–21. Of the 151 packets mailed, 84 (55.6%) were completed and returned to us. The total number of usable study responses was 124. Table 1 gives a summary of recruiting and survey materials mailed and travel diary dates.

The survey instrument used for the new resident sample included the same socio-demographic and travel data as the core before and after samples with several notable modifications. First, the travel diary and vehicle odometer logs were altered to reduce burden on respondents. Each household in the new resident survey was requested to track their travel for three weekdays (Tuesday–Thursday) instead of the full 7-day diary in the Core survey. Second, participants were asked for details about the time and distance of their move, including the zip code of their previous address. Finally, the main respondent in each new resident household was asked to answer 16 questions about various housing and neighborhood characteristics and 4 questions about which modes of travel were important in the choice of their current residence. The full set of survey materials can be found in Appendix B.

Unlike the core sample, all new resident surveys were completed in paper form only and were returned in a postage paid return envelope. Other than the initial screening questionnaire, no survey materials were completed online, and mobile tracking devices were not used for the new resident survey.

A total of 124 responses were received in the new resident study. However, a number of the households included on InfoUSA's recent mover list were found to have not moved after our cutoff date of January 1, 2012. Excluding those who moved into the study area before the cutoff left 89 usable responses.

Data Processing and Preparation

Participants in the paper group (including all new residents) and mobile tracking groups completed their survey materials on the paper forms that were provided to them and returned them to us via mail (paper-based group) or directly to research staff (mobile tracking group). All paper surveys were entered by research staff into the same web-based forms that were used by the web group. All completed survey responses were then downloaded for further processing and quality control checks.

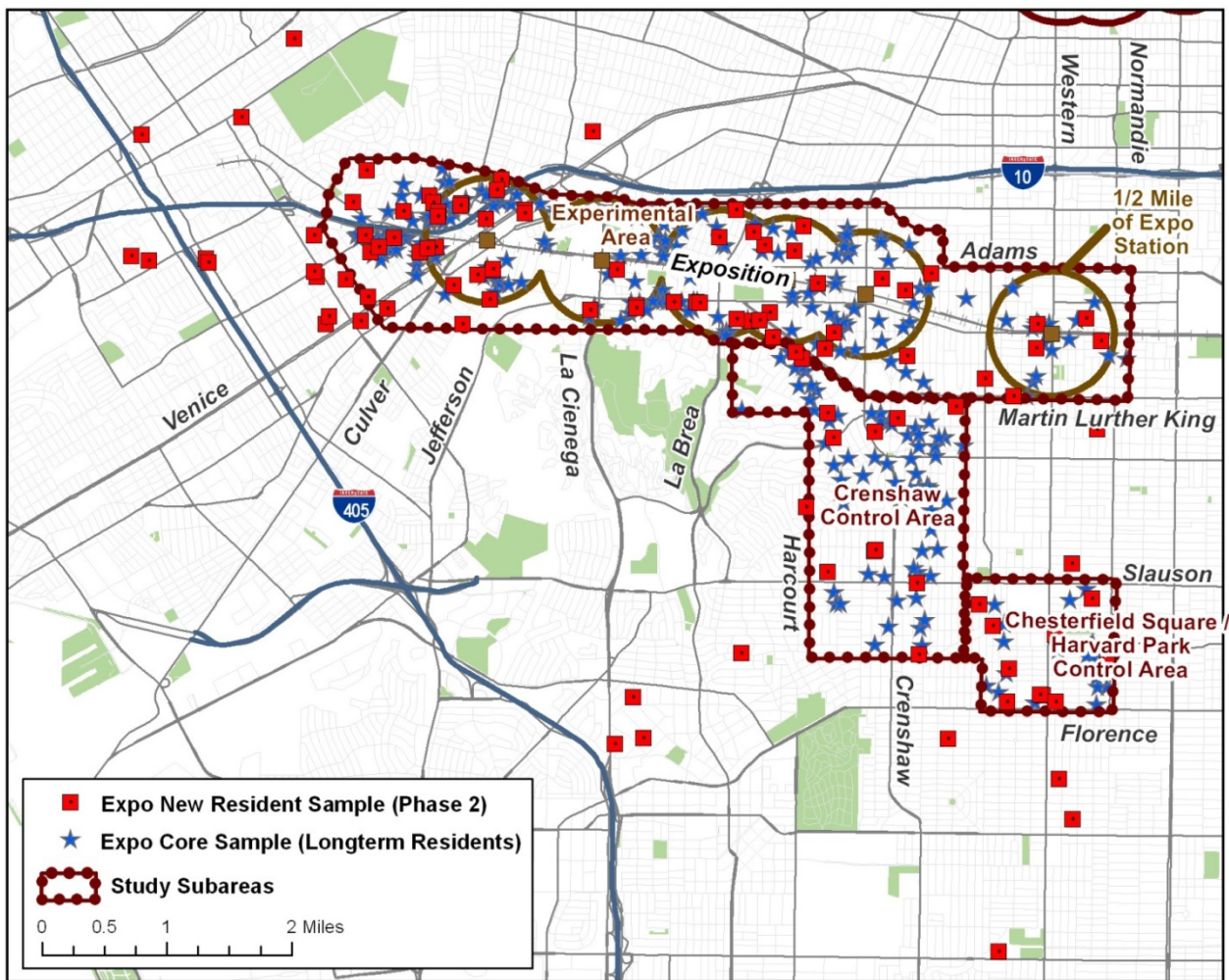
Quality control checks were performed on all Travel Log and Vehicle Mileage Log data to ensure that responses were complete and reasonable. Records with missing data or that were outside of reasonable ranges were flagged so they could be identified and appropriately handled in our analysis. In a few

cases where responses appeared to be unreasonable due to input error (for example, odometer readings with transposed digits), research staff attempted to correct the values and flagged them as corrected.

Sample Comparisons—Descriptive Statistics

Between the core (before-after Opening), and new resident Samples, we obtained travel, socio-demographic, and attitude/preference data from 373 households. Figure 2 shows the approximate location of the responses and their geographic location within the study area.

Figure 2: Core and New Resident Household Approximate Locations



Socio-Demographics

Table 2 contains descriptive statistics for the households in each of the three samples, including the number of households in the experimental and control groups, household income, homeownership status, and age structure. While the core sample is comprised of a nearly even split between

experimental (within ½ mile of an Expo station) and control areas, only 1/3 of the new mover sample were located in experimental neighborhoods.

Household incomes were similar between the three samples, although the new residents included fewer very low income (less than \$15,000 per year) households. Approximately 10 percent of new resident households were in the lowest income category, compared to 17 and 16 percent for the before and after samples respectively. Households that recently moved into the study area were also more likely to be renters. More than 70 percent of new residents rented their housing compared to less than 55 percent of longer-term residents in the core sample.

Differences are also apparent in the age structure of core and new resident households. More than 47 percent of the household members in core households were 45 years old or older, compared to 23 percent of new residents. In contrast, 64 percent of new residents were in the 18–44 age range, compared to just over a third of those in core households. The core and new residents were similar in terms of household size, vehicle ownership, and number of household members with driving licenses.

Table 2: Expo Line Core and New Resident Sample Socio-demographic Descriptive Statistics

| Study Area | Core Before Opening | | Core After Opening | | New Resident | |
|-------------------------|---------------------|---------|--------------------|---------|--------------|---------|
| | N | percent | N | percent | N | percent |
| Control | 146 | 51.4 | 101 | 49.5 | 61 | 68.5 |
| Experimental | 138 | 48.6 | 103 | 50.5 | 28 | 31.5 |
| Total | 284 | 100.0 | 204 | 100.0 | 89 | 100.0 |
| Household Income | | | | | | |
| less than \$15k | 46 | 17.0 | 32 | 15.9 | 9 | 10.5 |
| \$15k to \$35k | 60 | 22.2 | 43 | 21.4 | 22 | 25.6 |
| \$35k to \$55k | 50 | 18.5 | 44 | 21.9 | 19 | 22.1 |
| \$55k to \$75k | 43 | 15.9 | 29 | 14.4 | 13 | 15.1 |
| \$75k to \$100k | 38 | 14.1 | 27 | 13.4 | 11 | 12.8 |
| more than \$100k | 33 | 12.2 | 26 | 12.9 | 12 | 14.0 |
| Total | 270 | 100.0 | 201 | 100.0 | 86 | 100.0 |
| Home Ownership | | | | | | |
| Rent | 147 | 53.3 | 109 | 54.2 | 63 | 70.8 |
| Own | 124 | 44.9 | 89 | 44.3 | 24 | 27.0 |
| Other | 5 | 1.8 | 3 | 1.5 | 2 | 2.2 |
| Total | 276 | 100.0 | 201 | 100.0 | 89 | 100.0 |
| Age | | | | | | |
| Under 12 | 70 | 12.6 | 48 | 12.3 | 24 | 10.4 |
| 12 to 17 | 35 | 6.3 | 18 | 4.6 | 7 | 3.0 |
| 18 to 29 | 70 | 12.6 | 53 | 13.6 | 66 | 28.6 |
| 30 to 44 | 121 | 21.8 | 81 | 20.8 | 81 | 35.1 |
| 45 to 64 | 185 | 33.3 | 144 | 36.9 | 42 | 18.2 |
| 65 and Older | 75 | 13.5 | 46 | 11.8 | 11 | 4.8 |
| Total | 556 | 100.0 | 390 | 100.0 | 231 | 100.0 |

| | Core Before Opening | | Core After Opening | | New Resident | |
|----------------------------|---------------------|-------|--------------------|-------|--------------|-------|
| | mean | S.D. | mean | S.D. | mean | S.D. |
| Household Size | 2.160 | 1.340 | 1.890 | 1.178 | 2.040 | 1.021 |
| Number of Vehicles | 1.360 | 0.874 | 1.300 | 0.796 | 1.340 | 0.693 |
| Number of Driving Licenses | 1.630 | 0.809 | 1.520 | 0.694 | 1.530 | 0.606 |

Travel Outcomes

For all samples, we obtained a comprehensive set of travel outcomes from travel diaries and vehicle odometer logs. Household vehicle miles traveled (VMT) was calculated by computing the miles driven each day from the odometer logs for each vehicle. Because mileage was reported on a daily rather than per trip basis, we could not evaluate the effect of individual long trips on household VMT. All entries were quality control checked for reasonableness, but individual days with high mileage totals were not excluded from the analysis. For the core sample, diaries and logs were completed for seven consecutive days, though the participants’ start and end day of the week varied. For the new resident sample, we collected the same data, but over a three day period. New resident households always recorded their

travel between Tuesday and Thursday. Therefore, new resident data reflect weekday travel only, whereas core household data include weekend travel as well. Table 3 summarizes the mean number of trips taken by mode for each sample group. Summary data from the 2012 California Household Travel Survey (CHTS) is listed for comparison.

The CHTS data include all of Los Angeles County, California, which contains not only the dense urban core of the city of Los Angeles, but also smaller cities, suburban neighborhoods, and a considerable rural area. Therefore, it is not surprising that the samples from the Expo study area, which is moderately dense and urban, show higher transit usage, lower daily personal vehicle trips, and slightly higher active travel (walk and bicycle) usage. It is notable however, that despite lower vehicle trip counts, overall vehicle miles traveled (VMT) are almost identical between the core and NHTS sample. In addition, the new resident sample VMT was higher than any other group. At an average of nearly 35 miles per day, new mover households traveled approximately eight miles further each day than the core or NHTS sample households. In addition, the standard deviation of the new resident sample, while nearly identical to the CHTS sample, is considerably higher than either of the core samples. The new resident data includes two outliers with daily household VMT in excess of 150 miles. Removing these two outliers reduces the mean VMT for this group to 30.51 (S.D. = 25.76). However, removing outliers over 150 VMT per day from each of the core samples results in before and after opening means of 26.69 (S.D. = 25.34) and 25.10 (S.D. = 24.32) respectively.

Table 3: Mean Daily Trip Counts and VMT for Expo Samples and CHTS

| | LA County CHTS (n = 8,219) | | Expo Core Before-opening (n = 276) | | Expo Core After-opening (n = 204) | | Expo New Residents (n = 89) | |
|------------------|----------------------------|-------|------------------------------------|-------|-----------------------------------|-------|-----------------------------|-------|
| | Mean | S.D. | Mean | S.D. | Mean | S.D. | Mean | S.D. |
| Walk | 1.36 | 3.24 | 1.49 | 1.97 | 1.59 | 1.93 | 1.78 | 2.03 |
| Bike | 0.11 | 0.72 | 0.16 | 0.56 | 0.27 | 0.93 | 0.08 | 0.26 |
| Personal Vehicle | 6.39 | 6.61 | 4.53 | 3.96 | 4.29 | 3.84 | 3.78 | 2.44 |
| Bus | 0.33 | 1.43 | 0.60 | 1.31 | 0.56 | 1.10 | 0.50 | 1.23 |
| Rail transit | 0.07 | 0.59 | 0.07 | 0.29 | 0.19 | 0.54 | 0.28 | 0.72 |
| Other | 0.11 | 0.63 | 0.34 | 3.32 | 0.07 | 0.71 | 0.02 | 0.14 |
| Total trips | 8.37 | 7.88 | 7.20 | 6.38 | 7.18 | 6.10 | 6.43 | 3.20 |
| VMT | 26.68 | 36.93 | 27.19 | 26.56 | 26.76 | 29.41 | 34.77 | 37.29 |

Table 4 shows transportation mode choice split in each of the samples. Personal vehicle use was lower for all Expo samples compared to the CHTS sample, with the after-opening and new resident samples approximately 7 percentage points lower than the before-opening group. Bus use was nearly twice the LA County rate for all Expo samples. Although the before-opening rail use rate of 1.0% was nearly equal to LA County as a whole (0.8%), the after-opening rate for the core and new residents were 3 to 4 times higher. Bus use remained essentially unchanged in the core sample before and after the Expo Line opening.

Table 4: Mode Split Comparison for Expo Samples and CHTS

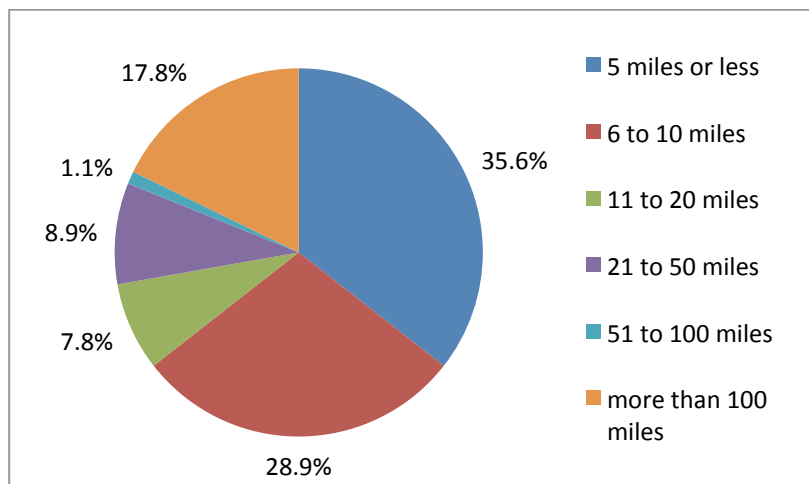
| | LA County CHTS | | Expo Core Before-opening | | Expo Core After-opening | | Expo New Residents | |
|------------------|----------------|-------|--------------------------|-------|-------------------------|-------|--------------------|-------|
| | n | (%) | n | (%) | n | (%) | n | (%) |
| Walk | 11,137 | 16.2 | 2,820 | 21.5 | 2,294 | 22.3 | 483 | 28.4 |
| Bike | 898 | 1.3 | 325 | 2.5 | 380 | 3.7 | 20 | 1.2 |
| Personal Vehicle | 52,526 | 76.4 | 8,721 | 66.4 | 6,132 | 59.5 | 994 | 58.5 |
| Bus | 2,714 | 4.0 | 1,110 | 8.4 | 860 | 8.3 | 128 | 7.5 |
| Rail transit | 580 | 0.8 | 128 | 1.0 | 275 | 2.7 | 71 | 4.2 |
| Other | 900 | 1.3 | 38 | 0.3 | 91 | 0.9 | 4 | 0.2 |
| Total | 68,755 | 100.0 | 13,142 | 100.0 | 10,032 | 100.0 | 1,700 | 100.0 |

New Resident Housing Preferences and Move Characteristics

In addition to the socio-demographic items from the core sample survey, new residents were asked a series of questions about the move to their current address. These included the distance between their old and current residence, and the housing, transportation, and neighborhood characteristics that were important factors in their choice of where to live.

Figure 3 shows move distance for the 89 households that comprise the new resident sample. More than 60 percent of households moved less than 10 miles to their current address and more than 1/3 moved 5 miles or less. Approximately 18 percent moved from locations more than 100 miles from their current address.

Figure 3: Move Distance for Expo New Resident Sample



The main respondent in each new resident household was asked to rank the importance of a number of factors related to the decision to move to their current residence. Each item was rated on a scale of 1 (not important at all) to 7 (extremely important). Table 5 shows the results. The dominant attribute was

housing affordability (6.54 out of 7.00). Low crime (5.57) was next in importance, followed by housing quality (5.27), neighborhood visual attractiveness (5.17), commute time (5.12), and access to shops and services (5.10). Least important attributes were generally related to amenities for children, including school quality (2.87), distance to school or daycare (2.20), and child care access (1.97). Access to transit, both generally (4.29) and rail specifically (3.91) ranked in the lower half in importance, and both were rated below highway access (4.64) in importance.

Table 5: Housing Characteristic Importance Ranking for New Residents

| Neighborhood Attribute | N | Mean | S.D. |
|--|----------|-------------|-------------|
| Housing affordability | 89 | 6.54 | .840 |
| Low crime | 87 | 5.57 | 1.369 |
| A particular type or quality of housing | 89 | 5.27 | 1.601 |
| Visual attractiveness of the neighborhood | 89 | 5.17 | 1.290 |
| Short commute (self) | 90 | 5.12 | 2.049 |
| Access to shops and services | 90 | 5.10 | 1.656 |
| Access to open space | 88 | 4.70 | 1.696 |
| Access to highways, generally | 66 | 4.64 | 1.845 |
| Lower traffic noise or safety from traffic | 89 | 4.49 | 1.700 |
| Access to public transit, generally | 89 | 4.29 | 2.217 |
| Near to family and friends | 89 | 4.11 | 2.145 |
| Short commute (other hh members) | 88 | 4.09 | 2.462 |
| Access to the rail transit systems | 89 | 3.91 | 2.239 |
| Wanted to live near certain kinds of people (other families with children, ethnic or cultural group) | 89 | 3.60 | 2.066 |
| Familiarity with the neighborhood | 88 | 3.56 | 2.050 |
| Quality of the public schools | 89 | 2.87 | 2.375 |
| Short trip to school or daycare for children | 85 | 2.20 | 2.240 |
| Access to child care | 88 | 1.97 | 2.031 |

All items measured on a scale of 1 (not important at all) to 7 (extremely important)

Main respondents in the new resident survey were also asked to indicate which travel modes were important in the decision to move to their current residential location. Respondents indicated as many travel modes as they wished for the following purposes:

- Their personal commute
- Commute of others in the household
- Trips to school or day care
- Access to shops and services

Table 6 shows the percentage of respondents that indicated a given travel mode as important for each purpose. For each journey type, personal vehicle was selected as important more often than any other travel mode. Bus and train were more often listed as important for commute trips than for school or shopping trips. Interestingly, more than 60 percent of respondents listed walking as an important mode for access to shops and services, and nearly 30 percent indicated walking was important for their personal commute. This could indicate a preference among new residents for living within walking distance to a mix of land uses, despite the high importance placed on car accessibility.

Table 6: Modes Indicated as Important in the Choice of Housing by Purpose (%)

| | Personal Commute | Other HH Member Commute | School/Day Care | Access to Shops/Services |
|------------------|-----------------------------|--|----------------------------|-------------------------------------|
| Walk | 28.9 | 18.9 | 6.7 | 63.3 |
| Bike | 15.6 | 10 | 2.2 | 22.2 |
| Bus | 31.1 | 35.6 | 7.8 | 21.1 |
| Train | 27.8 | 25.6 | 4.4 | 17.8 |
| Personal Vehicle | 74.4 | 51.1 | 18.9 | 85.6 |
| None / NA | 12.2 | 33.3 | 72.2 | 2.2 |

Expo Before—After Opening Travel Behavior Change

The primary goal of the Expo Line Study is to evaluate the travel behavior impacts of a major light rail project on travel behavior. To our knowledge, there are only two previous studies that have attempted a similar before-after evaluation of travel behavior change near a new light rail line, and both studies found that approximately half of the households that completed the “before opening” surveys also participated in “after opening” data collection approximately a year later (Brown, et al., 2008; McDonald et al., 2010). In our sample, more than 70% of households returned for the after opening portion of the study. In addition, we retained a nearly 50/50 split between experimental households (within ½ mile of Expo stations) and control households (beyond ½ mile) in the after opening sample. The following sections detail preliminary analysis of the Expo before-after samples, and provide some insight into the short-term (4–6 months) travel impacts of the new light rail system on existing residents.

Core Sample Travel Outcome Comparisons—Group Means

In order to quantify the impact of the Expo Line on travel behavior, we conducted a series of analyses that compare differences in travel outcomes between the experimental and control households, as well as the change that occurred within these groups over time. Table 7 shows mean daily VMT and trips by travel mode for experimental households that reside within ½ mile of an Expo station and control households that live more than ½ mile away. Independent sample t-tests of the differences in means were computed to evaluate statistical significance between the two groups’ travel outcomes.

In the before opening sample, no significant differences existed between the experimental and control households for mean daily VMT, car driver trips, transit trips, active travel trips, or total trips. However, in the after opening sample significant differences do exist. Households within ½ mile of the Expo Line stations traveled 10.15 fewer vehicle miles per day, and took a significantly higher number of daily train and walking trips.

Table 7: Expo Core Sample Between Groups Travel Outcome Means Difference Tests

| Core Before Opening Means Comparison (Between Groups) | | | | | | | |
|--|--------------|-----|-------|-----------|---------------------|------|------|
| | Sample | N | Mean | Std. Dev. | Difference in Means | t | Sig. |
| Vehicle Miles Traveled | control | 98 | 27.41 | 24.38 | 2.30 | .57 | |
| | experimental | 100 | 29.71 | 31.40 | | | |
| Car Driver Trips | control | 99 | 3.55 | 3.26 | -.11 | -.26 | |
| | experimental | 106 | 3.44 | 2.84 | | | |
| Bus Trips | control | 99 | .58 | 1.11 | .15 | .75 | |
| | experimental | 106 | .72 | 1.63 | | | |
| Train Trips | control | 99 | .05 | .16 | .04 | 1.14 | |
| | experimental | 106 | .09 | .35 | | | |
| Walk Trips | control | 99 | 1.29 | 1.79 | .44 | 1.50 | |
| | experimental | 106 | 1.73 | 2.34 | | | |
| Bicycle Trips | control | 99 | .17 | .60 | .01 | .13 | |
| | experimental | 106 | .18 | .62 | | | |
| Total Trips | control | 99 | 6.82 | 5.24 | .66 | .82 | |
| | experimental | 106 | 7.48 | 6.18 | | | |

Significance codes: *** 0.001, ** 0.01, * 0.05, ° 0.10

| Core After Opening Means Comparison (Between Groups) | | | | | | | |
|---|--------------|-----|-------|----------------|---------------------|-------|------|
| | Study Group | N | Mean | Std. Deviation | Difference in Means | t | Sig. |
| Vehicle Miles Traveled | control | 98 | 31.91 | 35.60 | -10.15 | -2.46 | * |
| | experimental | 101 | 21.76 | 20.79 | | | |
| Car Driver Trips | control | 100 | 3.42 | 2.93 | -.24 | -.61 | |
| | experimental | 103 | 3.17 | 2.78 | | | |
| Bus Trips | control | 100 | .56 | 1.09 | -.01 | -.03 | |
| | experimental | 103 | .56 | 1.13 | | | |
| Train Trips | control | 100 | .12 | .47 | .15 | 2.05 | * |
| | experimental | 103 | .27 | .59 | | | |
| Walk Trips | control | 100 | 1.31 | 1.61 | .55 | 2.03 | * |
| | experimental | 102 | 1.86 | 2.18 | | | |
| Bicycle Trips | control | 100 | .23 | .87 | .08 | .64 | |
| | experimental | 103 | .31 | .98 | | | |
| Total Trips | control | 100 | 6.60 | 4.55 | 1.13 | 1.32 | |
| | experimental | 102 | 7.74 | 7.29 | | | |

Significance codes: *** 0.001, ** 0.01, * 0.05, ° 0.10

Table 8 shows travel outcome means, differences, and significance levels within each group before and after the Expo Line opening. For the control group, no significant change in travel behavior is evident after the opening of the line. In contrast, at the 0.05 level of significance, experimental households reduced their daily VMT by 7.8 miles and tripled their number of rail trips from 0.9 to 2.7 per day. The results provide evidence that Expo Line experimental households changed travel behavior, while households not in close proximity to the line were not significantly influenced by the new service.

Table 8: Expo Core Sample within Groups Before-After Means Difference Tests

| Control Group Before-After Opening Comparison | | | | | | | |
|---|----------------|----|-------|-----------|---------------------|------|------|
| | Study Group | N | Mean | Std. Dev. | Difference in Means | t | Sig. |
| Vehicle Miles Traveled | before opening | 94 | 26.24 | 21.06 | 5.16 | 1.50 | |
| | after opening | 94 | 31.40 | 34.19 | | | |
| Car Driver Trips | before opening | 98 | 3.56 | 3.27 | -.12 | -.58 | |
| | after opening | 98 | 3.44 | 2.95 | | | |
| Bus Trips | before opening | 98 | .56 | 1.11 | -.01 | -.16 | |
| | after opening | 98 | .55 | 1.08 | | | |
| Train Trips | before opening | 98 | .05 | .17 | .07 | 1.43 | |
| | after opening | 98 | .12 | .47 | | | |
| Walk Trips | before opening | 98 | 1.28 | 1.80 | .03 | .19 | |
| | after opening | 98 | 1.32 | 1.62 | | | |
| Bicycle Trips | before opening | 98 | .17 | .60 | .06 | .57 | |
| | after opening | 98 | .23 | .88 | | | |
| Total Trips | before opening | 98 | 6.83 | 5.27 | -.19 | -.69 | |
| | after opening | 98 | 6.63 | 4.58 | | | |

Significance codes: *** 0.001, ** 0.01, * 0.05, ° 0.10

| Experimental Group Before-After Opening Comparison | | | | | | | |
|--|----------------|-----|-------|----------------|---------------------|-------|------|
| | Study Group | N | Mean | Std. Deviation | Difference in Means | t | Sig. |
| Vehicle Miles Traveled | before opening | 96 | 29.71 | 31.81 | -7.79 | -2.57 | * |
| | after opening | 96 | 21.93 | 21.18 | | | |
| Car Driver Trips | before opening | 103 | 3.40 | 2.85 | -.22 | -1.06 | |
| | after opening | 103 | 3.17 | 2.78 | | | |
| Bus Trips | before opening | 103 | .70 | 1.59 | -.14 | -1.43 | |
| | after opening | 103 | .56 | 1.13 | | | |
| Train Trips | before opening | 103 | .09 | .36 | .18 | 2.88 | ** |
| | after opening | 103 | .27 | .59 | | | |
| Walk Trips | before opening | 102 | 1.74 | 2.38 | .12 | .45 | |
| | after opening | 102 | 1.86 | 2.18 | | | |
| Bicycle Trips | before opening | 103 | .19 | .63 | .12 | 1.89 | ° |
| | after opening | 103 | .31 | .98 | | | |
| Total Trips | before opening | 102 | 7.38 | 6.20 | .35 | .58 | |
| | after opening | 102 | 7.74 | 7.29 | | | |

Significance codes: *** 0.001, ** 0.01, * 0.05, ° 0.10

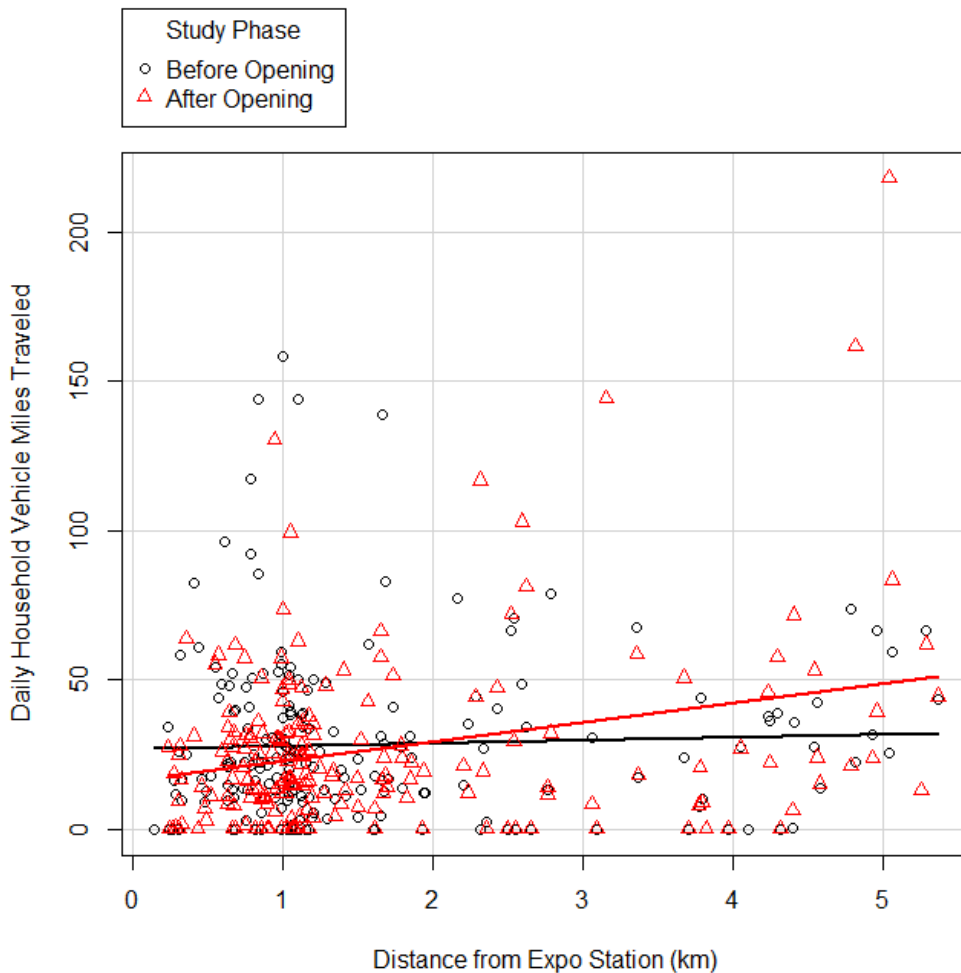
Change Analysis—VMT and Active Travel

The two main objectives of the Expo Line light rail study are to evaluate the neighborhood-level impact of a major transportation investment on VMT (as a proxy for associated GHG emissions from vehicles) and physical activity of residents. These outcomes are particularly important, as two of the main goals of transportation and land use policy in the Los Angeles region are to reduce urban greenhouse

emissions and improve public health through increased use of physically active forms of travel. In order to quantify the impact of the Expo Line over its first 4–6 months of operation, we examine household-level changes in VMT and active (walk and bicycle) trips.

Figure 4 shows a scatterplot of VMT versus distance from Expo Line stations for the core before and after samples. The solid lines represent linear models of the relationship between VMT and distance from the nearest Expo station.

Figure 4: Scatterplot of Daily VMT versus Distance to the Nearest Expo Station



As the analysis of group means in section 8a indicate, in the before opening VMT was relatively constant as distance from the Expo Line Stations increased. This is the expected relationship, as the control and experimental neighborhoods were chosen to be very similar in terms of socio-demographics, land use mix, street design, and transit service level. In contrast, the after-opening sample exhibits a positive relationship between distance from Expo stations and VMT.

To evaluate the statistical significance of changes in VMT before and after the Expo Line opening, we performed two analyses. In the first, we computed the change in VMT (Δ VMT) for each household that completed both the before and after study. We then compared the means of the change in VMT for

the control and experimental groups. This difference in means reflects the differential effect of the Expo Line opening on those within ½ mile compared to those further away. The results are shown in Table 9. Overall, daily household VMT increased by 5.2 miles in the control group and decreased by 7.8 miles in the experimental group. The difference in the means of 12.9 miles is significant at less than the 0.01 level, indicating that the Opening of the Expo Line reduced VMT of experimental households by 12.9 miles per day compared to control households.

Table 9: Test of Equality for Before-After Opening Change in VMT Means

| | | t-test for Equality of Means | | | | | | | | |
|-------|--------------|------------------------------|--------|----------------|-----------------|---|---------|--------|--------|----|
| | | | | | | 95% Confidence Interval of the Difference | | t | Sig. | |
| | | N | Mean | Std. Deviation | Mean Difference | Std. Error Difference | Lower | Upper | | |
| Δ VMT | control | 94 | 5.157 | 33.272 | -12.944 | 4.571 | -21.960 | -3.928 | -2.832 | ** |
| | experimental | 96 | -7.787 | 29.661 | | | | | | |

Significance codes: *** 0.001, ** 0.01, * 0.05, ° 0.10

As a second test of the impact of the Expo Line opening on VMT, we conducted a difference in differences (DID) analysis. DID is an econometric technique commonly used with quasi-experimental panel data to evaluate the effect of a treatment over time. DID analysis assumes that the differences that arise in the control and experimental groups are due only to the treatment—in this case, the opening of the new line. Defining μ_{it} as the mean of the outcome for group i at time t , the DID estimator is $(\mu_{11} - \mu_{01}) - (\mu_{01} - \mu_{00})$. This estimator can be evaluated using the following regression model:

$$y_{it} = b_0 + b_1X_i + b_2T_t + b_3 X_i * T_t + e_{it}$$

where y_{it} is the outcome for individual i at time t , X_i is a dummy variable where 0 represents the control group and 1 the experimental group, and T_t is a dummy variable that takes the value 0 in the before treatment period and 1 for the after treatment period. The coefficient β_3 on the interaction between X_i and T_t represents the DID estimator. Note that $X_i * T_t$ takes a value of 1 only for experimental households in the after opening time period.

Table 10 shows the result of the DID analysis for the 193 households that had usable daily mean VMT values in both the before and after opening periods. The estimate of the coefficient of the time*experimental interaction is -14.44, $p=0.027$. At the 0.05 significance level, the opening of the Expo Line reduced household VMT within the experimental group by approximately 14 miles per day.

Table 10: Difference in Differences Regression for VMT Change

| Parameter | B | Std. Error | Sig. |
|---------------------|--------|------------|------|
| (Intercept) | 23.47 | 3.32 | .000 |
| time | 6.53 | 4.67 | .162 |
| experimental | 3.55 | 4.60 | .441 |
| time * experimental | -14.44 | 6.54 | .027 |

On the question of VMT change, the answer appears to be that the new line has had a significant impact—at least in the short term period 6 months after the line opened. However, there are reasons to be cautious about the results—particularly because obvious outliers exist in the VMT data. Looking at Figure 4, two households are distinct VMT outliers in the after-opening period. One of these had a daily total of more than 200 miles per day, the other more than 150. In addition, one household in the before opening period had a daily VMT of more than 150 miles. In order to evaluate the impact of these outliers on the DID parameter estimates, these three outlier households were eliminated and the model was re-estimated. In the revised model, the time x experimental parameter estimate remained was -10.07 (S.E. = 5.83, p=0.084) remained significant at the 0.10 level. These results provide more confidence in the basic findings of the analysis, which indicate that the opening of the Expo Line has had a significant and sizeable impact on the VMT of households in the vicinity of the new light rail stations.

The same analyses were carried out to examine the question of whether the opening of the Expo Line had an impact on active travel. Figure 5 is a scatterplot of the before and values of daily mean active travel trips versus distance from the nearest Expo station. The linear relationships between active travel and distance, represented by the solid lines, show a slight increase in active trips for households closer to the new stations after the opening.

Figure 5: Scatterplot of Daily Active (Bike/Walk) Trips versus Distance to the Nearest Expo Station

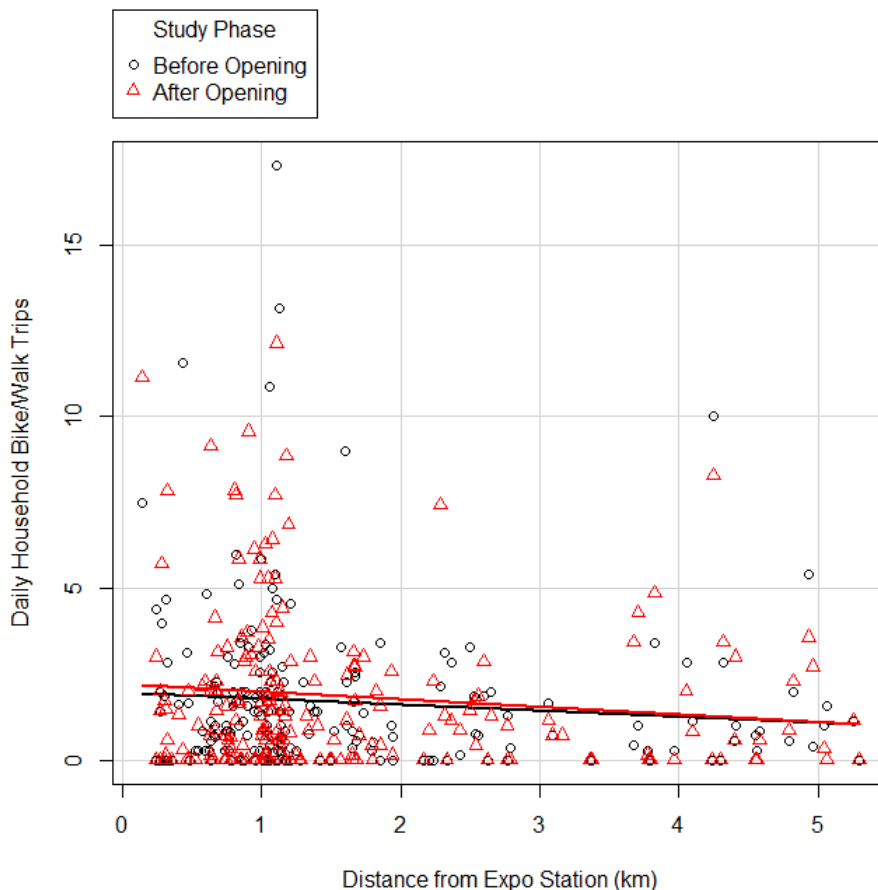


Table 11 shows a comparison of means for the change in walking trips, bicycling trips, and overall active travel trips (bicycle + walk) and the results of the independent samples t-test for the difference in means between the experimental and control households. The results show that although the mean change in bicycle, walk, and overall active trips was greater for the experimental group, none of the differences in means were significant at the 0.10 level.

Table 11: Test of Equality for Before-After Opening Change in Bike, Walk and Active Travel Means

| | | t-test for Equality of Means | | | | | | | | |
|-----------------|--------------|------------------------------|------|----------------|-----------------|---|-------|-------|------|--|
| | | | | | | 95% Confidence Interval of the Difference | | t | Sig. | |
| | | N | Mean | Std. Deviation | Mean Difference | Std. Error Difference | Lower | Upper | | |
| Δ Walk Trips | control | 98 | .031 | 1.627 | .086 | .308 | -.521 | .694 | .280 | |
| | experimental | 102 | .117 | 2.627 | | | | | | |
| Δ Bicycle Trips | control | 98 | .055 | .959 | .067 | .115 | -.161 | .294 | .580 | |
| | experimental | 103 | .122 | .655 | | | | | | |
| Δ Active Trips | control | 97 | .094 | 2.022 | .147 | .333 | -.511 | .804 | .440 | |
| | experimental | 102 | .241 | 2.626 | | | | | | |

Significance codes: *** 0.001, ** 0.01, * 0.05, ° 0.10

Finally, we conducted a DID regression analysis to examine the effect of the Expo Line opening on active travel. The results, shown in Table 12, indicate that the DID estimator (the coefficient of the interaction of the time experimental dummy variables) was not statistically significant (DID = 0.254, p=0.527).

Table 12: Difference in Differences Regression for Active Trips Change

| Parameter | B | Std. Error | Sig. |
|---------------------|-------|------------|------|
| (Intercept) | 1.469 | .183 | .000 |
| time | .085 | .284 | .765 |
| experimental | .241 | .262 | .357 |
| time * experimental | .254 | .401 | .527 |

The results of the preceding analyses show that no statistically significant change in active travel occurred between the experimental and control groups before and after the opening of the Expo Line. However, this paper does not include data obtained from physical activity monitoring devices carried by mobile tracking households in the before and after opening studies. That data, obtained through GPS and accelerometers, provides a more accurate measure of the change in physical activity as well as the duration and location where physical activity occurred. Detailed analysis of this data is currently ongoing.

Core After-Opening and New Mover Travel Behavior Comparison

In addition to evaluating the impact of the Expo Line opening on existing residents, in the second wave of this research we attempted to lay the groundwork for understanding residential selection and travel behavior differences between new and established households. To begin to examine these differences, we conducted basic statistical tests on the means for the travel outcomes for both the after opening core and new resident samples. Note that for all comparisons of after-opening core sample and new resident household travel behavior, only weekday means are used. The mean values shown reflect 5-day (Monday–Friday) averages for core households and 3-day (Tuesday–Thursday) averages for new resident households.

Descriptive statistics, presented in Section 7 above, indicate that the new resident sample has the highest VMT of any group. This could possibly be attributable to the fact that the new resident sample is considerably younger than our core sample, and therefore more mobile. More than 47 percent of the household members in core households were 45 years old or older, compared to 23 percent of new residents. In contrast, 64 percent of new residents were in the 18–44 age range, compared to just over a third of those in core households. This age difference may account for some of the difference in the overall household VMT between the samples, but we still hypothesized that households that recently moved into experimental neighborhoods would exhibit similar behavior to the core sample. That is, they would travel fewer miles by private vehicle than those in control neighborhoods and make more use of transit and active travel modes. To test this hypothesis, we computed independent sample t-tests on the means of travel outcomes for the core after opening and new resident households. The results are shown in Table 13.

For control households, no significant differences exist between the core and new resident samples in the after-opening period. However, in the experimental households new residents have significantly higher mean daily household VMT ($\Delta\mu_{\text{vmt}} = 11.24$, $p < 0.05$) and take fewer daily bicycle trips on average ($\Delta\mu_{\text{bike}} = -0.28$, $p < 0.05$). However, the small size of the new resident experimental group ($N=26$) makes it more difficult to draw conclusions about whether these differences are representative of the population of new movers into the area.

Table 13: Means and Independent Sample t-tests for After Opening Core and New Resident Households

| Core After Opening and New Resident Means Comparison—Experimental Households | | | | | | | |
|--|--------------------|-----|-------|-----------|---------------------|-------|------|
| | Sample | N | Mean | Std. Dev. | Difference in Means | t | Sig. |
| Vehicle Miles Traveled | Core After Opening | 101 | 21.28 | 22.07 | -11.24 | -2.27 | * |
| | New Resident | 26 | 32.52 | 24.02 | | | |
| Car Driver Trips | Core After Opening | 103 | 3.31 | 3.04 | 0.37 | 0.75 | |
| | New Resident | 26 | 2.94 | 2.00 | | | |
| Bus Trips | Core After Opening | 103 | 0.59 | 1.28 | 0.31 | 1.17 | |
| | New Resident | 26 | 0.28 | 0.83 | | | |
| Train Trips | Core After Opening | 103 | 0.27 | 0.62 | -0.17 | -0.86 | |
| | New Resident | 26 | 0.44 | 0.96 | | | |
| Walk Trips | Core After Opening | 102 | 1.79 | 2.05 | -0.26 | -0.58 | |
| | New Resident | 26 | 2.05 | 2.21 | | | |
| Bicycle Trips | Core After Opening | 103 | 0.33 | 1.20 | 0.28 | 2.24 | * |
| | New Resident | 26 | 0.05 | 0.18 | | | |
| Total Trips | Core After Opening | 102 | 7.58 | 7.73 | 1.44 | 0.93 | |
| | New Resident | 26 | 6.14 | 2.95 | | | |
| Vehicle Miles Traveled | Core After Opening | 95 | 33.99 | 41.86 | -0.25 | -0.04 | |
| | New Resident | 62 | 34.24 | 40.83 | | | |
| Car Driver Trips | Core After Opening | 100 | 3.55 | 3.15 | 0.35 | 0.83 | |
| | New Resident | 64 | 3.19 | 2.29 | | | |
| Bus Trips | Core After Opening | 100 | 0.59 | 1.20 | 0.02 | 0.12 | |
| | New Resident | 64 | 0.56 | 1.32 | | | |
| Train Trips | Core After Opening | 100 | 0.12 | 0.44 | -0.10 | -1.19 | |
| | New Resident | 64 | 0.22 | 0.61 | | | |
| Walk Trips | Core After Opening | 100 | 1.32 | 1.64 | -0.29 | -1.03 | |
| | New Resident | 64 | 1.61 | 1.90 | | | |
| Bicycle Trips | Core After Opening | 100 | 0.22 | 0.95 | 0.10 | 0.79 | |
| | New Resident | 64 | 0.12 | 0.40 | | | |
| Total Trips | Core After Opening | 100 | 6.51 | 4.18 | 0.10 | 0.18 | |
| | New Resident | 64 | 6.41 | 3.33 | | | |

Significance codes: *** 0.001, ** 0.01, * 0.05, ° 0.10

In order to further examine the differences between all groups, we developed regression models of VMT for each sample (before opening, after opening, and new residents) that included household-level socio-demographic controls, built environment characteristics, and transit service levels.

Data on the built environment and transit service were obtained from the following sources:

- Roadway, freeway, and intersection locations derived from United States Census 2010 Topologically Integrated Geographic Encoding and Referencing (TIGER) line data.

- Parcel-level land use and firm information for 2011, obtained from the Southern California Association of Governments (SCAG) and InfoUSA.
- Transit stop information for 2012 from SCAG and Los Angeles Metropolitan Transit Authority

Each regression model includes a basic set of socio-economic variables:

- number of household members in each of three age categories
- annual household income (3 categories with *Under \$35,000* as the reference category)
- number of vehicles available in the household

Built environment variables include:

- Distance to nearest Expo Line station in kilometers
- Commercial, industrial and residential acres within ¼ mile of the respondent's residence
- The number of intersections within ½ mile
- Total employment within ½ mile
- Population density of the census block group for the residence
- Number of transit stops within ¼ mile
- Transit service level (headway index, where higher values indicate more frequent service)

Table 14 shows results of the tobit regression on mean daily VMT. As expected, distance from an Expo station was not significant before the line opened for the core sample, but is significant after opening. For the after opening households, increasing distance to a station by 1 kilometer (0.62 miles) results in 6.6 mile increase in VMT. Distance to Expo is not significant for the new resident sample.

Among the demographic controls, household age composition had a significant impact on VMT for the core sample, though the significant age categories change between time periods. Household age composition was not significant for the new residents. This is a somewhat surprising result, since surveys have shown that VMT begins to decline for drivers beyond the age of 45². Based on this, it might be expected that the difference in age composition between the older core and younger new resident households could at least partially explain VMT differences between these groups. Similarly, household income is significant for the core households, with higher income residents having higher VMT. Again, household income level was not significant for new residents.

The one independent variable that is significant in all three groups is number of cars available to the household. The effect size for adding a car, while holding all other variables in the model constant, is similar in magnitude for the core sample in each time period (17.5 miles before, 14.3 miles after). For new residents, however, the effect of adding a car is 35.1 miles—more than double that for the core.

No built environment or transit service level factors have a significant effect on VMT in this model, with the exception of distance to an Expo station.

² For example, 1994 data from the U.S. Department of Energy's Household Vehicle Energy Consumption survey (1997) found that VMT declines for households with primary drivers over the age of 49, while no statistically significant difference existed between drivers in any of the four age groups between the ages of 18 and 49.

Table 14: Tobit Regression on Mean Daily Household VMT

| | Core Before Opening | | | Core After Opening | | | New Residents | | |
|---|---------------------|-------|------|--------------------|-------|------|---------------|-------|------|
| | Estimate | S.E. | Sig. | Estimate | S.E. | Sig. | Estimate | S.E. | Sig. |
| Intercept | -31.74 | 27.66 | | -40.94 | 30.44 | | -70.89 | 62.19 | |
| Distance from Expo Station (km) | -0.27 | 1.74 | | 6.80 | 1.81 | *** | 2.23 | 4.16 | |
| Household Members Under 12 y.o. | 1.43 | 3.62 | | 7.88 | 3.94 | * | -2.75 | 7.04 | |
| Household Members 12 to 17 y.o. | 8.16 | 5.16 | | 5.41 | 6.28 | | -18.59 | 17.07 | |
| Households Members 18 to 44 y.o. | 6.71 | 2.93 | * | 5.07 | 3.30 | | -5.57 | 8.27 | |
| Households Members over 44 y.o. | 4.94 | 3.05 | | -1.14 | 3.64 | | -5.84 | 10.25 | |
| Household Income \$35k to \$75k | 7.11 | 4.60 | | 12.25 | 4.94 | * | -2.75 | 7.04 | |
| Household Income over \$75k | 8.94 | 5.45 | | 13.60 | 5.84 | * | 2.86 | 13.83 | |
| Number of Cars in Household | 17.46 | 2.84 | *** | 14.33 | 3.32 | *** | 35.12 | 8.38 | *** |
| Commercial Acres within ¼ mi. | 0.22 | 0.34 | | 0.54 | 0.37 | | 0.14 | 0.64 | |
| Industrial Acres within ¼ mi | 0.21 | 0.28 | | 0.17 | 0.30 | | 0.05 | 0.57 | |
| Residential Acres within ¼ mi | 0.25 | 0.28 | | 0.30 | 0.31 | | 0.61 | 0.55 | |
| Intersection Count ½ mi | 0.02 | 0.07 | | 0.01 | 0.07 | | 0.11 | 0.16 | |
| Total Employment within ½ mi | 0.67 | 0.76 | | -0.29 | 0.80 | | 0.00 | 1.53 | |
| Block Group Pop. Dens. (1000s / sq. mi) | -0.30 | 0.26 | | -0.27 | 0.26 | | 0.21 | 0.47 | |
| Number of Transit Stops within ¼ mi | -0.33 | 0.80 | | -0.24 | 0.87 | | 1.31 | 2.18 | |
| Transit Service Level (Headway Index) | 0.14 | 1.06 | | 0.24 | 1.16 | | -0.42 | 2.58 | |
| logSigma | 3.19 | 0.06 | *** | 3.29 | 0.06 | *** | 3.54 | 0.09 | *** |

Significance codes: *** 0.001, ** 0.01, * 0.05, ° 0.10

Summary of Preliminary Findings

Phase II of the Expo Line study, which is detailed in this paper, was designed to achieve two main research objectives. The first was to evaluate the impact of the Expo Line on the travel behavior of our core sample, for whom we collected a full set of travel and demographic data both before and after the opening of the Expo Line on April 28, 2012. In particular, we were interested in the impact of this major infrastructure investment on vehicle miles traveled (VMT) and the use of active travel modes (walking and bicycling).

The second objective was to obtain a sample of households who moved into the Expo Line neighborhoods during and after the Expo Line opening period. The purpose of obtaining this sample was to better understand how the presence of major investments like light rail enter into the residential selection process of households who are relocating, and how new resident travel patterns and demographics compare to those of established residents.

Core Sample Before-After Analysis

Our preliminary analysis indicates that 4–6 months after opening the Expo Line has had a significant impact on the travel of our core sample households. In particular, households in our experimental neighborhoods, which lie within ½ mile of an Expo Line station, reduced their daily household VMT by approximately 14 miles per day compared to control households that were more than ½ mile from a station.

The picture for the impact of Expo on physical activity is a bit less clear. Although comparisons of daily mean walk and bicycle trips indicate some increased active travel among experimental households, this increase does not appear to be statistically significant. However, during both the before and after opening data collection, a subsample of our households carried physical activity monitors comprised of GPS devices and accelerometers. Together, these devices are capable of recording physical activity intensity and the geographic location where the physical activity takes place. We are currently analyzing this data, which should provide a more complete picture of how physical activity patterns changed in response to the opening of the Expo Line.

New Resident Analysis

The new resident sample obtained during this phase of the Expo Line study provided several insights into the characteristics of this group. First, new residents tended to be considerably younger than those in our core sample of established households. They were more likely to rent their residence, and though fewer had very low (less than \$15,000/year) incomes, they did not otherwise differ substantially in from the core households.

In terms of the their decision to move to their current address, low housing cost, low crime, and housing quality were most important, followed by commute time and access to shops and services. The least important factors were school quality and access to child care services. Overall, new residents indicated that car accessibility was the most important travel mode consideration in their household location decision. However, more than 60% indicated that being able to walk to shops and services was an important factor in their decision.

In terms of travel behavior, new resident households had the highest VMT of any of our study groups. VMT of new resident households in our experimental neighborhoods was 11 miles per day higher than that of core households. This difference was statistically significant.

Future Research

Over the next year, we will continue research into the travel behavior effects of the Expo Line. We have obtained funding from the California Air Resources Board (ARB) that will allow us to return to both our core and new resident samples in the fall and winter of 2013 using the same survey protocol. This will enable us to analyze the effects of the line over the longer term for the core sample as well as behavior change for new residents. Pending additional funding for outreach, recruitment and coordination, we will evaluate the feasibility of recruiting a supplemental, more recent new mover sample of households. By doing so, we hope to add to our understanding of the residential selection process and behavior change in the project area.

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Appendix A—Expo Line Core Study Survey Materials

Appendix A-1: Expo Line Study—Baseline Survey

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Neighborhood Travel and Activity Study

Neighborhood Travel and Activity Study Study Information Sheet

You are being asked to participate in a research study about household travel. The purpose of this study is to examine the effects of local employment, shopping, transportation and neighborhood design on the distance people travel and the types of transportation they use.

The research procedures involve the following:

- ✧ Survey - After you review this information sheet, you will begin the study's baseline survey which will ask you to answer questions about your household composition, transportation resources, and about your neighborhood. This section should take less than 30 minutes to complete.
- ✧ One Week Travel Log - Next, we ask that your household keep a trip log for everyone over 12 years old for one week starting **on the designated day on your instruction letter**. On the log, you will count the number of trips you take by each travel mode (car, bus, train, etc.) and the number of minutes you spend walking or bicycling each day. We will also ask you to record the mileage for each of your vehicles from the vehicle's odometer at the beginning and end of each day.
- ✧ Log Entry and Final Survey - At the end of the seven-day collection period, we will ask one adult from your household to enter the Trip and Vehicle Log information on our website and to answer a few additional questions about each person and vehicle. This step will take less than 30 minutes to complete.
- ✧ Activity and location tracking - If you choose to carry a lightweight Global Positioning Systems (GPS) device and a lightweight activity monitor during the seven-day collection period, the research manager will drop off the device, explain how it works, and answer any questions. At the end of the seven-day period, the research manager will pick up the device.

We do not anticipate that you will experience any physical or emotional discomfort as a result of this study. However, we will ask you for personal information about you and other members of your household. We realize the release of your personal and travel information could make you uncomfortable. We will minimize the risk of disclosure through secure data collection, storage, and analysis procedures that protect sensitive information and participant privacy.

There are no direct benefits to you from participation in the study. However, this study may provide insights about the impacts of urban design and planning policies on travel. These insights could help guide policies designed to reduce transportation-related air pollution and energy use in urban areas.

Participation in this study is voluntary and there is no cost to you for participating. You may refuse to participate or discontinue your involvement at any time without penalty. You may choose to skip a question or a study procedure.

As an incentive to participate, you will receive a local supermarket gift card worth \$15 after you complete the study. Households which also carry two lightweight devices which measure activity and locations will receive an additional \$15 (a total gift card value of \$30). We will repeat data collection in early 2012. Households which also participate in phase 2 will receive a second gift card upon completion.

If you are interested in participating, we will ask you to complete an initial questionnaire which asks eight questions about your household which we will use to select 600 households that are representative of your neighborhood as a whole.

All research data collected will be stored securely and confidentially. The household identification number (HID) provided on your invitation postcard will be used to track your information in a way that cannot be readily associated with you. The link between your identifying information (name, phone number, and residential address) and your HID will be stored in the UCI research facility in a restricted-access locked cabinet that is separate from the cabinet where the research data are stored. Data with subject identifiers will not be released. All research data will be maintained in a secure location at UCI. Only authorized researchers will have access to the data for research purposes.

The research team and authorized UCI personnel may have access to your study records to protect your safety and welfare. Any information derived from this research project that personally identifies you will not be voluntarily released or disclosed by these entities without your separate consent, except as specifically required by law.

If you have any comments, concerns, or questions regarding the conduct of this research please contact us:

- ⤴ If you prefer English, please contact Steve Spears, Research Field Manager
University of California, Irvine, 323-364-4824 or ntas@uci.edu
- ⤴ If you prefer Spanish, please contact Carolina Sarmiento, Research Field Manager
University of California, Irvine, 323-570-4824 or ntas@uci.edu

In addition, you may contact Dr. Douglas Houston, Principal Investigator, Department of Planning, Policy and Design, University of California, Irvine. Phone: 949-824-1870. Email: houston@uci.edu

If you are unable to reach the researchers listed at the top of the form and have general questions, or you have concerns or complaints about the research, or questions about your rights as a research subject, please contact UCI's Office of Research Administration by phone, (949) 824-6662, by e-mail at IRB@rgs.uci.edu or at University Tower - 4199 Campus Drive, Suite 300, Irvine, CA 92697-7600.

Do all members of your household over 12 years old understand the study goals and agree to participate? Yes No

If you agree to participate, please enter the Household Identification Number (HID) from your invitation letter:

Information About Your Household

How long have you lived in your current home?

- less than 1 year
- 1 to 5 years
- 6 to 10 years
- more than 10 years
- all of my life

Do you own or rent your residence?

- Own
- Rent
- Don't know
- Other

If other, please describe:

Is your housing unit provided to you at a reduced rent through a government or non-profit program?

- Yes
- No
- Don't know

If you receive assistance, which best describes the rent assistance you currently receive?

- I receive a housing voucher which pays all or part of my rent (e.g., through a section 8 or a housing voucher program)
- I reside in a unit provided at reduced rent in a building owned or financially assisted by the government
- I reside in a unit provided at reduced rent in a building owned or managed by a non-profit organization
- Other

What is your average annual household income?

- Less than \$15,000
- \$15,001 to \$35,000
- \$35,001 to \$55,000
- \$55,001 to \$75,000
- \$75,001 to \$100,000
- More than \$100,000

What is your race or ethnicity?

- Asian/Pacific Islander
- Black/African-American
- White/Caucasian
- Hispanic
- Native American/Alaska Native
- Other/Multi-Racial

How long have you lived in the United States?

- less than 1 year
- 1 to 5 years
- 6 to 10 years
- more than 10 years
- all of my life

Information About Your Household's Vehicles

Section Two: Information about the cars and other vehicles that you or other household members have in your home.

Number of cars that are available to persons living in my home, including me, on most days:

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- more than 7

Number of motorcycles in your household:

- none
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- more than 7

Number of bicycles in your household:

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- more than 7

How many members of your household have a driver's license?

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- more than 7

About Your Typical Weekday Travel

Now think about your travel on a typical weekday (Monday through Friday). Please answer the following questions about how you travel to your work on a typical weekday:

On a typical workday, I travel to work by (check all that apply):

- Car
- Bus
- Train
- Bicycle
- Walking
- Other
- I work at home
- I am not employed

If you drive to work, where do you park your car while at work?

- On the street
- Parking lot or parking garage at my workplace
- Parking lot or parking garage not part of my workplace, but nearby
- Other
- I do not drive to work

On a typical workday, do you carpool to work with other people?

- Yes
- No

During a typical work week, do you work at home?

- Yes
- No

How many days per week do you usually work at home?

- 1
- 2
- 3
- 4
- 5
- 6
- 7

On the days that you work at home, do you work part of the day or a full day?

- All day
- Part of the day

Your Thoughts About Transportation and Your Neighborhood

In this section, you will be asked your opinion on a range to transportation topics. Please select the answer that most closely reflects your feeling or experience.

Please read each of the following statements and indicate how much you agree or disagree with each of them.

| | Strongly disagree | Moderately disagree | Slightly disagree | Neither agree nor disagree | Slightly agree | Moderately agree | Strongly agree |
|--|-----------------------|-----------------------|-----------------------|----------------------------|-----------------------|-----------------------|-----------------------|
| I can get things done while riding the bus or train that I can't do in my car. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Driving is stressful for me. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Traffic makes walking and bicycling in my neighborhood difficult. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Reducing car use is beneficial to the environment. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| My friends and family would support me if I decided to use my car less. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Much of my travel is done to meet the needs of others in my household. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I feel restricted because I don't have access to a car often enough. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| The bus and train schedules are convenient for me. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| There are plenty of places to shop within walking distance of my home. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I am uncomfortable on a crowded bus or train. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I don't like to waste natural resources or energy. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| My car is an important part of who I am. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| My life keeps me on the move all of the time. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| To protect the environment, I try to use my car as little as possible. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I have physical limitations that make getting around difficult. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Increasing use of public transit is beneficial to the environment. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

| | Strongly disagree | Moderately disagree | Slightly disagree | Neither agree nor disagree | Slightly agree | Moderately agree | Strongly agree |
|---|-----------------------|-----------------------|-----------------------|----------------------------|-----------------------|-----------------------|-----------------------|
| I don't know enough about public transit in my neighborhood to use it. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| There are enough places in my neighborhood where I can go for recreation or entertainment. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Using the bus or train takes too long compared to going by car. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Protecting the environment is important to me. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| The bus and train take me where I need to go. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I like the privacy of riding in a car compared to other ways of traveling. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Taking the bus or train could save me money compared to driving a car. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I enjoy walking or bicycling near my home. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| My family and friends would support me if I used public transit for environmental reasons. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I feel pressed for time in my daily travels. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I can get most of my personal business (like banking, laundry, etc.) done within walking distance of my home. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I try to minimize my impact on the environment by taking the bus or train whenever I can. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Privacy is a problem on the bus or train. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| It is/would be difficult to get everything done without a car. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| My close friends and family are concerned about the environment. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Noise and pollution from cars and trucks is a problem in my neighborhood. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| There are good restaurants within walking distance of my home. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| People who are important to me worry about my safety when I use public transit. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Your Thoughts About Safety and Transportation

The following section includes questions about safety and security concerns you might have in your neighborhood and when you use transit. Please select only one answer for each of the questions below.

Please indicate how safe you feel when...

| | completely unafraid | unafraid | somewhat unafraid | neither | somewhat afraid | afraid | extremely afraid |
|---|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| walking in your neighborhood during the day. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| walking in your neighborhood at night. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| where you get on and off of the train/bus during the day. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| where you get on and off of the train/bus at night. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| while riding on the train/bus during the day. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| while riding on the train/bus at night. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Have you ever had a problem with personal safety while walking in your neighborhood?

- No
- Yes, during the day only
- Yes, at night only
- Yes, during the day and at night

Have you ever had a problem with personal safety where you get on and off the bus or train?

- No
- Yes, during the day only
- Yes, at night only
- Yes, during the day and at night

Have you ever had a problem with personal safety while riding the bus or train?

- No
- Yes, during the day only
- Yes, at night only
- Yes, during the day and at night

If you have had a personal safety problem when using public transit, what was it?

- none
- harassment
- robbery
- physical attack
- more than one of the above

How often do you use public transit?

- hardly ever
- few times a year
- few times a month
- few time a week
- almost every day

| | very unlikely | unlikely | somewhat unlikely | neither | somewhat likely | likely | very likely |
|---|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| How likely are you to reduce or avoid using public transit because of safety and security concerns? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| How likely are you to change the time or route of a trip by public transit because of safety and security concerns? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| How likely are you to drive a car as often as possible because of safety and security concerns? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Thank You!

Thank you for completing this portion of the study. Your response is very important to us. If you have not already done so, the next step is to fill out the one-week travel and mileage logs for your household. Please try to be as accurate as possible with your responses. The quality of this study depends on the getting the best possible information from you and your neighbors. You are an important member of the study team!

Appendix A-2: Individual Demographic Survey and 7-Day Travel Log

Please enter the following information for the person whose trips are recorded on this log.

First Name: _____

What is this person's gender?

- Male Female

How old is this person?

_____ years

Is this person employed?

- No Yes, part time Yes, full time

Is this person a student?

- No.
 Yes, in a college or university.
 Yes, in high school.
 Yes, in another type of school.

If they are a student, do they attend school full time or part time?

- Part time Full time

What is the highest level of education this person has completed?

- 12th grade or less
 Graduated high school or equivalent
 Some college, no degree
 Associate degree
 Bachelor's degree
 Post-graduate degree

What is this person's height? _____ feet _____ inches

What is this person's weight? _____ pounds

Overall, how would you describe this person's current health?

- Excellent
 Good
 Fair
 Poor

Neighborhood Travel and Activity Study

Travel Log

Person Name:

| | Car Driver | Car Passenger | Motor-cycle/ Scooter | Bus | Train | Bicycle | | Walk | | Other | Notes? Problems? Please describe below. |
|------------------|------------|---------------|----------------------|-----|-------|------------|---------------|------------|---------------|-------|---|
| | | | | | | # of Trips | Total Minutes | # of Trips | Total Minutes | | |
| Monday | | | | | | | | | | | |
| Tuesday | | | | | | | | | | | |
| Wednesday | | | | | | | | | | | |
| Thursday | | | | | | | | | | | |
| Friday | | | | | | | | | | | |
| Saturday | | | | | | | | | | | |
| Sunday | | | | | | | | | | | |

Instructions

- Count each trip you take during each day
- Include walk/bike trips over 5 minutes
- Count trips you take for recreation or exercise
- Log the total minutes you walk or bicycle each day
- Count each trip mode as a separate trip (car, walk, etc)

Suggestions

- Carry and complete the log as you travel
- Or you can complete the log at the end of each day
- Note any problems each day (forgot to fill out one day)
- See the back of this log for examples

Appendix A3: Vehicle Mileage Log

Neighborhood Travel and Activity Study

Vehicle Mileage Log

Vehicle Year: _____

Make (Ford, Honda, etc): _____

Model (Focus, Accord, etc): _____

| | Start | End |
|-----------|-------|-----|
| Monday | | |
| Tuesday | | |
| Wednesday | | |
| Thursday | | |
| Friday | | |
| Saturday | | |
| Sunday | | |

Instructions

- Place one log in each vehicle in a visible location
- Enter vehicle year, make, and model
- Log mileage at the start and end of each day
- Obtain mileage from the *odometer* near the speedometer

Appendix B—Expo Line New Resident Study Survey Materials

Neighborhood Travel and Activity Study

University of California, Irvine

Study Information Sheet

You are being asked to participate in a research study about household travel. The purpose of this study is to examine the effects of local employment, shopping, transportation and neighborhood design on the distance people travel and the types of transportation they use.

The research procedures involve the following:

Survey – After you review this information sheet, you will begin the study’s baseline survey which will ask you to answer questions about your household composition, transportation resources, and about your neighborhood. This section should take less than 30 minutes to complete.

Three Day Travel Logs – Next, we ask that your household keep a trip log for everyone over 18 years old for three days **starting on Tuesday**. On the log, you will count the number of trips you take by each travel mode (car, bus, train, etc.) and the number of minutes you spend walking or bicycling each day. We will also ask you to record the mileage for each of your vehicles from the vehicle's odometer at the beginning and end of each day.

We do not anticipate that you will experience any physical or emotional discomfort as a result of this study. However, we will ask you for personal information about you and other members of your household. We realize the release of your personal and travel information could make you uncomfortable. We will minimize the risk of disclosure through secure data collection, storage, and analysis procedures that protect sensitive information and participant privacy.

There are no direct benefits to you from participation in the study. However, this study may provide insights about the impacts of urban design and planning policies on travel. These insights could help guide policies designed to reduce transportation-related air pollution and energy use in urban areas.

Participation in this study is voluntary and there is no cost to you for participating. You may refuse to participate or discontinue your involvement at any time without penalty. You may choose to skip a question or a study procedure.

As an incentive to participate, you will receive a local supermarket gift card worth \$50 after you complete the study. One gift card will be given per household.

All research data collected will be stored securely and confidentially. The household identification number (HID) provided on your invitation postcard will be used to track your information in a way that cannot be readily associated with you. The link between your identifying information (name, phone number, and residential address) and your HID will be stored in the UCI research facility in a restricted-access locked cabinet that is separate from the cabinet where the research data are stored. Data with subject identifiers will not be released. All research data will be maintained in a secure location at UCI. Only authorized researchers will have access to the data for research purposes.

The research team and authorized UCI personnel may have access to your study records to protect your safety and welfare. Any information derived from this research project that personally identifies you will not be voluntarily released or disclosed by these entities without your separate consent, except as specifically required by law.

If you have any comments, concerns, or questions regarding the conduct of this research please contact:

- a) Steven Spears Research Field Manager
University of California, Irvine, 323-364-4824 or ntas@uci.edu

In addition, you may contact Dr. Douglas Houston, Principal Investigator, Department of Planning, Policy and Design, University of California, Irvine. Phone: 949-824-1870. Email: houston@uci.edu.

If you are unable to reach the researchers listed at the top of the form and have general questions, or you have concerns or complaints about the research, or questions about your rights as a research subject, please contact UCI's Office of Research Administration by phone, (949) 824-6662, by e-mail at IRB@rgs.uci.edu or at University Tower, 4199 Campus Drive, Suite 300, Irvine, CA 92697-7600.

Neighborhood Travel and Activity Study - Baseline Survey

Part 1 - Information About Your Household

Housing and Neighborhood Preferences

1. When did you move to your current address?

Month _____

Year _____

1a. In what city was your previous residence? _____

1b. What was your previous zip code? _____

1c. About how far away is your new home from your old home?

- 5 miles or less
- From 6 to 10 miles
- From 11 to 20 miles
- From 21 to 50 miles
- From 51 to 100 miles
- More than 100 miles

1d. When people move, they choose a new house or apartment and also choose a new neighborhood. Please think back to when you lived in your previous home. When you starting looking for a new place to live, how important were the following factors to you?

| | 1 Not Important at all | 2 | 3 | 4 | 5 | 6 | 7 Extremely Important |
|--|---------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------------|
| Housing affordability | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Short commute to <i>your</i> workplace or school | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Short commute to work or school for <i>other adult household members</i> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Short trip to school or daycare for <i>children in your household</i> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Access to shops and services (grocery stores, shopping malls, etc.) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

| | 1 Not Important at all | 2 | 3 | 4 | 5 | 6 | 7 Extremely Important |
|---|---------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------------|
| Access to highways, generally | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Access to public transit, generally | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Access to the rail transit systems (Metro subway or light rail) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| A particular type or quality of housing available in the neighborhood | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Quality of the public schools | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Wanted to live near certain kinds of people/households (other families with children, ethnic or cultural group, etc) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Visual attractiveness of the neighborhood | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Low crime | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Access to open space (parks, beaches, mountains, etc) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Lower traffic noise or safety from traffic | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Near to family and friends | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Wanted to move in with someone already living in the neighborhood | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Familiarity with the neighborhood | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Access to child care | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

1e. For your personal commute to school or work, which transportation modes were important considerations in deciding where to live? (Please select all that apply)
 Walking Bicycle Bus Train Personal Vehicle (Car, Truck, etc) None/Not Applicable

1f. For the commute of other adult household members to school or work, which transportation modes were important considerations in deciding where to live? (Please select all that apply)
 Walking Bicycle Bus Train Car None/Not Applicable

1g. For the trip to school or day care for children in your household, which transportation modes were important considerations in deciding where to live? (Please select all that apply)
 Walking Bicycle Bus Train Car None/Not Applicable

1h. For access to shops or services, which transportation modes were important considerations in deciding where to live? (Please select all that apply)
 Walking Bicycle Bus Train Car None/Not Applicable

Current Housing and Household Characteristics

2. Do you own or rent your current residence?

- Own
- Rent
- Don't know
- Other. If other, please describe: _____

3. If you RENT the current home:

a) Is your housing unit provided to you at a reduced rent through a government or non-profit program?

- Yes No Don't know

b) If you receive assistance, which best describes the rent assistance you currently receive?

- I receive a housing voucher which pays all or part of my rent (e.g., through a section 8 or a housing voucher program)
- I reside in a unit provided at reduced rent in a building owned or financially assisted by the government
- I reside in a unit provided at reduced rent in a building owned or managed by a non-profit organization
- Other

4. What is the housing type of your current home?

- Detached single family house
- Duplex or triplex
- Row-house or townhouse
- Apartment or condominium
- Mobile home or trailer
- Other (Specify) _____

5. What is your average annual household income?

- Less than \$15,000
- \$15,001 to \$35,000
- \$35,001 to \$55,000
- \$55,001 to \$75,000
- \$75,001 to \$100,000
- More than \$100,000

6. How many people in your household are in the following age groups ?

- 0 to 5 years old _____
- 6 to 11 years old _____
- 12 to 15 years old _____
- 16 to 17 years old _____
- 18 years old or older _____

Information About Your Household's Vehicles

7. Number of cars that are available to persons living in my home, including me, on most days:

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- more than 6

8. Number of motorcycles in your household:

- none
- 1
- 2
- 3
- 4
- 5
- 6
- more than 6

9. How many members of your household have a driver's license?

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- more than 6

Part 2 - About Your Typical Weekday Travel

Now think about your travel on a typical weekday (Monday through Friday). Please answer the following questions about how you travel to your work on a typical weekday:

10. On a typical workday, I travel to work by (check all that apply):

- Car
- Bus
- Train
- Bicycle
- Walking
- Other
- I work at home
- I am not employed (*please skip to Question 12*)

10. During a typical work week, do you work at home?

- Yes
- No (*please skip to question 12*)

10a. How many days per week do you usually work at home?

- 1
- 2
- 3
- 4
- 5
- 6
- 7

10b. On the days that you work at home, do you work part of the day or a full day?

- All day
- Part of the day

11. How often do you use public transit?

- hardly ever
- few times a year
- few times a month
- few time a week
- almost every day

12a. During the past 2 weeks, how many days did you use public transit (bus or rail)?

- 0 days
- 1-3 days
- 4-6 days
- 7-9 days
- 10 days or more

12b. Please estimate the average time it takes to walk from your home to the nearest public transit stop (bus or rail):

- Less than 5 minutes
- 5 to 10 minutes
- 10 to 15 minutes
- 15 to 30 minutes
- More than 30 minutes

Part 3 - Your Thoughts About Transportation and Your Neighborhood

In this section, you will be asked your opinion on a range to transportation topics. Please select the answer that most closely reflects your feeling or experience.

Please read each of the following statements and indicate how much you agree or disagree with each of them.

| | Strongly disagree | Moderately disagree | Slightly disagree | Neither agree nor disagree | Slightly agree | Moderately agree | Strongly agree |
|--|-----------------------|-----------------------|-----------------------|----------------------------|-----------------------|-----------------------|-----------------------|
| I can get things done while riding the bus or train that I can't do in my car. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Driving is stressful for me. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Traffic makes walking and bicycling in my neighborhood difficult. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Reducing car use is beneficial to the environment. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| My friends and family would support me if I decided to use my car less. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Much of my travel is done to meet the needs of others in my household. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I feel restricted because I don't have access to a car often enough. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| The bus and train schedules are convenient for me. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| There are plenty of places to shop within walking distance of my home. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I am uncomfortable on a crowded bus or train. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I don't like to waste natural resources or energy. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| My car is an important part of who I am. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| My life keeps me on the move all of the time. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| To protect the environment, I try to use my car as little as possible. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I have physical limitations that make getting around difficult. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Increasing use of public transit is beneficial to the environment. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

| | Strongly disagree | Moderately disagree | Slightly disagree | Neither agree nor disagree | Slightly agree | Moderately agree | Strongly agree |
|---|-----------------------|-----------------------|-----------------------|----------------------------|-----------------------|-----------------------|-----------------------|
| I don't know enough about public transit in my neighborhood to use it. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| There are enough places in my neighborhood where I can go for recreation or entertainment. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Using the bus or train takes too long compared to going by car. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Protecting the environment is important to me. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| The bus and train take me where I need to go. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I like the privacy of riding in a car compared to other ways of traveling. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Taking the bus or train could save me money compared to driving a car. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I enjoy walking or bicycling near my home. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| My family and friends would support me if I used public transit for environmental reasons. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I feel pressed for time in my daily travels. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I can get most of my personal business (like banking, laundry, etc.) done within walking distance of my home. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I try to minimize my impact on the environment by taking the bus or train whenever I can. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Privacy is a problem on the bus or train. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| It is/would be difficult to get everything done without a car. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| My close friends and family are concerned about the environment. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Noise and pollution from cars and trucks is a problem in my neighborhood. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| There are good restaurants within walking distance of my home. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| People who are important to me worry about my safety when I use public transit. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Part 4 - Your Thoughts About Safety and Transportation

The following section includes questions about safety and security concerns you might have in your neighborhood and when you use transit. Please select only one answer for each of the questions below.

Please indicate how safe you feel when...

| | completely unafraid | unafraid | somewhat unafraid | neither | somewhat afraid | afraid | extremely afraid |
|---|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| walking in your neighborhood during the day. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| walking in your neighborhood at night. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| where you get on and off of the train/bus during the day. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| where you get on and off of the train/bus at night. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| while riding on the train/bus during the day. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| while riding on the train/bus at night. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Thank You!

Thank you for completing this portion of the study. Your response is very important to us.

If you have not already done so, the next step is to fill out the three day travel and mileage logs for your household. Please try to be as accurate as possible with your responses. The quality of this study depends on the getting the best possible information from you and your neighbors. You are an important member of the study team!

Neighborhood Travel and Activity Study

Travel Log

Person Name: _____

| | Car Driver | Car Passenger | Motor-cycle/ Scooter | Bus | Train | Bicycle | | Walk | | Other | Notes? Problems? Please describe below. |
|-----------|------------|---------------|----------------------|-----|-------|------------|---------------|------------|---------------|-------|---|
| | | | | | | # of Trips | Total Minutes | # of Trips | Total Minutes | | |
| Tuesday | | | | | | | | | | | |
| Wednesday | | | | | | | | | | | |
| Thursday | | | | | | | | | | | |

Instructions

- Count each trip you take during each day
- Include walk/bike trips over 5 minutes
- Count trips you take for recreation or exercise
- Log the total minutes you walk or bicycle each day
- Count each trip mode as a separate trip (car, walk, etc)

Suggestions

- Carry and complete the log as you travel
- Or you can complete the log at the end of each day
- Note any problems each day (forgot to fill out one day)
- See the back of this log for examples

Neighborhood Travel and Activity Study

Vehicle Mileage Log

Vehicle Year: _____

Make (Ford, Honda, etc): _____

Model (Focus, Accord, etc): _____

| | Start | End |
|-----------|-------|-----|
| Tuesday | | |
| Wednesday | | |
| Thursday | | |

Instructions

- Place one log in each vehicle in a visible location
- Enter vehicle year, make, and model
- Log mileage at the start and end of each day
- Obtain mileage from the *odometer* near the speedometer on the instrument panel

Please enter the following information for the person whose trips are recorded on this log.

First Name: _____

What is this person's gender?

Male Female

How old is this person?

_____ years

Is this person employed?

No Yes, part time Yes, full time

Is this person a student?

No.

Yes, in a college or university.

Yes, in high school.

Yes, in another type of school.

If they are a student, do they attend school full time or part time?

Part time Full time

What is the highest level of education this person has completed?

12th grade or less

Graduated high school or equivalent

Some college, no degree

Associate degree

Bachelor's degree

Post-graduate degree

What is this person's height? _____ feet _____ inches

What is this person's weight? _____ pounds

(continued on reverse side)

Overall, how would you describe this person's current health?

- Excellent
- Good
- Fair
- Poor

What is this person's race or ethnicity?

- Asian/Pacific Islander
- Black/African-American
- White/Caucasian
- Hispanic
- Native American/Alaska Native
- Other/Multi-Racial

How long has this person lived in the United States?

- less than 1 year
- 1 to 5 years
- 6 to 10 years
- more than 10 years
- all of his/her life