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Session 302

Innovative Analyses of National Household Transportation Survey

Monday, January 12, 2015   10:45AM - 12:30PM   *Convention Center, Hall E*
Poster Session

Data and Information Technology, Planning and Forecasting, Policy

Thera Black, Thurston Regional Planning Council, presiding

Sponsored By:

Task Force on Understanding New Directions for the National Household Travel Survey (ABJ45T)

The goal of this session is to share and learn about innovative applications of the National Household Travel Survey with a focus on studies that use the NHTS with other large, publically available data sets; analyze travel patterns using visualization; characterize long-distance and rural trips; help understan broad public health topics related to transportation and disaster management; analyze transit or active modes; examine environmental issues; or answer questions important to MPOs.

Abstracts: Show   Hide

Title	Presentation Number	Board Numb
Combining NHTS Travel and Electric Load Data to Evaluate Plug-in Electric Vehicle Charging Impacts	P15-6328	A22

Jonathan R. Dowds, University of Vermont
Paul Hines, University of Vermont

Growing electricity demand for plug-in electric vehicle (PEV) charging has the potential to impact all aspects of the electric power system from the lifespan of distribution transformers through power plant dispatch decisions and electricity prices. The magnitude of these impacts depends crucially on the timing of vehicle charging. While many early studies on the impact of PEVs assumed simplistic, evening and nighttime charging scenarios, it is likely that many PEV drivers will charge their vehicles whenever the PEV is at home and the battery is low. Using NHTS trip data, including trip time, trip length, trip destination, and vehicle type, the authors derived time-varying PEV charging profiles that were consistent with observed travel patterns. Charging demand (the energy required to charge a vehicle) was derived based on trip length, vehicle type, and PEV performance characteristics. Charging start times and durations were determined based on the time that travelers returned to and left from home and the charging demand. Charging profiles were created separately for weekends and weekdays. These individual, NHTS-derived PEV charging profiles were combined with publicly available household level load data from the Energy Information Administration's National Energy Modeling System to study the impact of PEV charging on transformer aging and in aggregate with regional load data from several Independent System Operators to study on the impact of PEV charging on the generating portfolio, overall generating fuel mix, and the costs of electricity generation.

Impact of Urban Form and Gasoline Prices on Vehicle Usage: Evidence from 2009 National Household Travel Survey	P15-6331	A24

Harya Dillon, University of California, Irvine
Jean-Daniel Maurice Saphores, University of California, Irvine
Marlon G. Boarnet, University of Southern California, Los Angeles

The goal of this paper is to tease out the relationship between land use, gasoline prices and travel behavior by analyzing data from the Southern California subsample of the 2009 National Household Travel Survey (NHTS), which has a quasi-experimental nature thanks to large gasoline price variations during the administration of the NHTS (March 2008-April 2009). Using Structural Equation Modeling (SEM), we specify joint models of residential urban form, vehicle efficiency choice, and vehicle use that account for self-selection and endogeneity in order to explain vehicle miles traveled (VMT) for both work and non-work trips. Our structural models capture the causal influences of household socio-economic status on residential urban form and on driving behavior, where residential urban form is treated as a latent construct that reflects observed variables such as population density, land use diversity and distance to employment centers. Our results suggest that in the short run households drive 0.27% less for non-work trips when gas prices increase by 1%, while work trips are not responsive to gasoline price changes. The direct effect of residential urban form on driving is statistically significant but small: an increase in population density of 1,000 persons per square mile decreases non-work VMT by 1.27% but it has no impact on work trips. Standardized estimates suggest that the impact of gas prices on non-work VMT is twice the size of the impact of population density. We also find that owners of more fuel efficient vehicles tend to be more educated, Asian and younger (under 30). Heads of households in low density neighborhoods tend to have a higher household income, to be older than 45 and white; these households tend to own more vehicles per driver. Our results suggest that urban form has a limited impact on short term driving behavior.

Freight Deliveries Directly Generated by Residential Units: Analysis with 2009 NHTS Data	P15-6337	A26

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As a result of the rapid growth of online shopping, more goods and services are delivered directly to residential units. The door-to-door deliveries improve residents' accessibility to retailing sector, and at the same time create truck delivery trips. However, partially due to the data limitation, most existing freight research focuses on freight trips generated by business establishments, little is known about freight trips generated by residential units. As more and more urban areas are pushing for dense and mixed development, it is necessary to understand the pattern of truck freight trips directly generated by residential units. For this paper, dataset from NHTS is used to investigate the freight trips generated by residential units. NHTS 2009 provides accurate, comprehensive and timely information on trips, land use, household characteristics and social economic factors. It is the first time NHTS data is used to estimate freight trips. A set of right censored negative binomial models are used to identify the impacts of influential factors such as housing density, type of house and

house ownership. A case study for the Capital District in New York State is then presented. The predicted freight trips generated by residential units are also compared to freight trips generated by business establishments. Such a study will supplement city logistics studies that traditionally focus on business behaviors, help reconstruct the complete picture of freight activities in urban areas.

Variations in Americans' Day-to-Day Travel Patterns

P15-6341   B21

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Travel patterns (vehicle-miles traveled [VMT], trip length, vehicle occupancy, and congestion etc.) vary by day of week, month of year and location or region, due to holidays, region-specific events, weather, and various other factors. Quantifying travel-pattern variations is important in deciding transportation system expansion and modification, investments and policies, whether for highways, transit, non-motorized modes, air travel, or other options. Typically, such variations are ignored, with models run and decisions made for a single average workday's demand, which contributes to underperformance of our transportation systems (though it should be noted that some traffic studies base design considerations using a year's 30th highest hour). This study analyses variations in daily VMT, trip lengths, and occupancy of light-duty vehicles (LDVs) using the 2009 National Household Travel Survey (NHTS) data. Survey data were analyzed from May 1, 2008 to April 30, 2009, with an average of 1913 respondents per day (and varying from 142 to 3454 respondents across all 365 days). While publicly available NHTS data do not carry survey dates, such details can be made available by the FHWA's Office of Policy (upon special request). The study's key conclusions of analysis are as follows: while overall averages (across all NHTS vehicle-trips) of daily VMT, vehicle-trip lengths, and vehicle occupancy levels (per LDV used) are 37.30 miles per vehicle, 9.14 miles, and 1.51 persons, respectively, day-to-day and month-tomonth departures from the average can be dramatic. For example, July 5, 2008 (a Saturday) and March 1, 2009 (a Sunday) had the biggest departures from the average: with 37.3% higher VMT and 25.2% lower VMT, respectively. More generally, the average Friday in April and Sunday in January exhibited the highest and lowest VMT per LDV, with 17.8% higher and 11.9% lower daily values than the overall average. Vehicle-trip lengths and occupancies were highest on Sundays in April (22.6% higher) and May (21.1% higher), and lowest on Tuesdays in May (12.3% lower) and Mondays in November (11.18% lower). Among all days of the week, Sundays offer the highest vehicle occupancies, on average (17.8% higher), and trip lengths (9.2% higher), but the lowest (2.7% lower) daily VMT (per vehicle). Among seasons, winter carries the lowest daily VMT (just 2.9% lower than the average) and trip length (3.2% lower). The U.S.'s 13 top holidays were evaluated separately, and exhibit 2.3%, 15.3%, and 11.3% higher daily VMT, vehicle-trip lengths, and occupancies (on average) as compared to nonholidays. These statistics may enlighten the policy-makers' vision and they may find a way to account for travel-pattern-uncertainties in future planning decisions.

Examining Travel Patterns and Characteristics of Transit Users in New York State

P15-6364   B22

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This study, conducted by Oak Ridge National Laboratory researchers in support of the New York State Department of Transportation, aimed at using the 2009 National Household Travel Survey (NHTS) data, in conjunction with related spatial data sets, to examine characteristics and travel patterns of transit users within New York State (NYS). The study also intended to identify any specific differences between transit users and non-users. Along with NHTS data, this study utilized NYS transit system General Transit Feed Specification (GTFS) data, which was converted by the research team from its native format into a Geographic Information System for analysis and visualization purposes. To measure the significance of transit systems within NYS, available GTFS data were spatially analyzed against the LandScan population dataset to determine the proportion of NYS population within selected distances from available transit stations. Note that LandScan contains the finest population distribution data available at about 1 km (30-meter x 30-meter) resolution, allowing more precise estimates of population within selected radii of transit stations. This effort led to the creation of several NYS transit sheds (e.g., 1-mile). Specific issues addressed include: Are there demographic differences between travelers who used/did not use transit? How does transit usage compare with the population at large? What are the regional or spatial differences (e.g., living in or outside of a specific transit shed)? Are there any unique travel characteristics or patterns that exist for transit users? Potential influence of New York City transit systems and population on statewide analysis, and results, was also considered in this study.

Using NHTS 2001 and 2009 to Analyze Intrapersonal Variability in Travel Behavior

P15-6346   B23

Ralph Buehler, Virginia Polytechnic Institute and State University
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According to national statistics 87% of all trips in the U.S. are by automobile and 90% of commuters typically get to work by car. Statistics for individual trips or the main mode of commuting do not capture variability in individual travel behavior over time. This poster uses the 2001 and 2009 National Household Travel Surveys to analyze recent trends in the share of multimodal motorists who use a car and also walk, bicycle, or ride public transport during a day or week. The goals of this paper are to identify trends of multimodal behavior among car users in the U.S. and provide profiles of these multimodal motorists. This analysis relied on data from the daily trip and person data files. The mode of transport used (foot, bicycle, transit, car) for individual trips was aggregated and matched to the trip maker and then added to the person data set. The person file also included data about the number of trips made by walking, cycling, or public transport during the previous week(s). During a typical day about 15% of American car users make at least one trip by foot, bicycle, or public transport, while during a typical week almost 70% of motorists are multimodal. Additionally, 12.5% of motorists make at least 2 trips by foot, bicycle or public transport per day and 25.0% of American car users make at least 7 trips per week by means of transport other than the car. Trends over time suggest a significant shift toward multimodal behavior among motorists between 2001 and 2009. Multimodal motorists tend to be younger, educated beyond high school, and have higher incomes. They live in households without cars, in high-density neighborhoods, and in metropolitan areas with a rail system. Results suggest that planning for walking, cycling, and public transport benefits a larger proportion of the U.S. population than suggested by traditional trip based analysis.

Using NHTS to Estimate Transportation Needs of People with Medical Conditions During Disasters in Hawaii

P15-6366   B24

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Transportation systems play a crucial role during disasters. A functional and operational transport system is vital for response and recovery in disaster stricken areas. At-risk vulnerable populations, including those with medical conditions, may need to be evacuated before the onset of hazards and threats. Disaster risk mapping and vulnerability assessments have been conducted and many states have developed mitigation plans. State, tribal, and local governments are required to develop hazard mitigation plans as a condition for receiving non-emergency disaster assistance. A total of 23,033 communities and 121 tribal governments, comprising about 78% of the nation's population, have FEMA-approved or approvable-pending-adoption local multi-hazard mitigation plans. While, multi-hazard mitigation plans provide a starting point for planning resilient communities, but they typically do not include specific evacuation and sheltering needs assessments. HAZUS-MH, a multi-hazard regional assessment and mitigation planning tool is used to produce estimates of hazard-related damages before or after disaster. HAZUS-MH provides information about the economic and social impacts, including estimates of sheltering requirements, displaced households, and population exposed to floods, earthquakes and hurricanes. HAZUS-MH does not include assessments for evacuation or sheltering needs of people with medical conditions. NHTS contains rich socio-demographic information and detailed inventories of travel behavior. NHTS data can be used to assess medical conditions of travelers. Figure 1, "A Framework for Assessing Demand and Routing during Hazard Events," illustrates how NHTS data can be used to estimate evacuation needs of those with medical conditions. The approach includes three analyses: (i) cluster and factor analysis of 9 medical conditions related to travel behavior using a national NHTS data sample; (ii) analysis of para-transit travel data for a particular study area to establish

demand for assisted travel during "normal conditions;" and, (iii) overlay of hazard conditions and imputation of the demand and routing needs during hazardous events. People with mobility limiting medical conditions are most vulnerable during disasters. They may require assistance to evacuate to a shelter. Health workers may need to provide home-based visits to residents who are unable to leave their homes. Evacuation or transportation routing for health services providers and recipients for hazard scenarios are essential to protect vulnerable populations. This research provides "a proof of concept" for estimating the demand and routing of people with medical conditions using the national NHTS dataset.

Using National Travel Surveys to Advance Public Health: Healthy People Objectives for Active Transportation   P15-6349   B25

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Healthy People provides science-based, 10-year national objectives for improving the health of all Americans. They were first developed in 1979 and updated for 2000, 2010 and 2020. Each health objective includes a baseline measure, a target and a national surveillance system for tracking progress. Four active transportation objectives are included in Healthy People 2010 and 2020. The four objectives on Healthy People 2010 were tracked with the National Household Travel Survey (NHTS); the 1995 National Personal Travel Survey was used for baseline measures. The Healthy People 2020 active transportation objectives---identical to the 2010 objectives---are categorized as developmental because they did not meet the Healthy People requirement of baseline data from 2006 or later when they were drafted. An ongoing midterm review of the Healthy People 2020 objectives will reconsider the status of the four active transportation objectives given the availability of data from the 2009 National Household Travel Survey for baseline measures (Table). The poster will examine how National Travel Surveys have been used to support Healthy People active transportation objectives.

Urban Mobility Modeling Using Volunteered Geographic Information and High-Resolution Population Data   P15-6367   B26

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Mobility has been an important measure to evaluate the efficiency and livability in urban areas. With the increasing amount of volunteered geographic information, such as OpenStreetMap, we can build applications to study urban mobility and dynamics at national and even global level. By taking advantage of the LandScan high-resolution population distribution data (30m by 30m in United States and 1 km by 1 km in other counties), we developed the TUMS (Toolbox for Urban Mobility Simulations) system, a microsimulaiton approach to address transportation problems at global level. The TUMS integrates the National Household Travel Survey (NHTS) data and Census Transportation Planning Products (CTPP) special tabulation for travel demand modeling in US case studies. To demonstrate the system capability and performance, two kinds of traffic scenarios in Alexandria, Virginia are modeled: daily normal traffic scenario and emergency evacuation scenario. The first scenario is modeled with selected NHTS data and simulated with microscopic traffic models in the TUMS. The second scenario is modeled based on the no-notice emergency evacuation assumption – everyone leaves the affected area with shortest paths. Through the comparison study and vehicle-based microscopic visualization, users can easily find the urban mobility patterns under different scenarios. This can help transportation planners to identify system bottlenecks and to test different operation strategies for special events, such as game-day traffic operation and disaster management. The TUMS system is easily scaled to any geographic locations with its unique GIS data resources. With proper analysis and process of NHTS data, it is fairly fast to simulation traffic mobility in a multiple-county megaregion area.

Analyzing How Sociodemographic Characteristics Associate Public Transit Usage: Comparison Between Southern and Northern California   P15-6368   C21

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California needs transit systems that are as smart and diverse as its residents; however, research about its transit riders' characteristics and how they affect transit usage still is lacking. This study investigates the differences in transit usage between people in Southern and Northern California, using the National Household Travel Survey, collected by the Federal Highway Administration in 2009. Transit riders' socio-demographic and travel attitudes are accounted for in the comparison between the regions, which previously have not been examined extensively. Los Angeles-Long Beach-Santa Ana in the South and San Francisco-Oakland-Fremont in the North are used in this research as representatives for each region. The results show that most of the determining socio-demographic variables—including race, education, employment status, age, household income—are significantly different between the Northern and the Southern transit riders, while gender showed no significant difference. Additionally, transit riders in the South cared about price of travel the most, followed by highway congestion, while the Northern transit riders cared about public transit availability and accessibility the most, and then by the price of travel. A series of multivariate regressions were performed to identify the characteristics of those who would prefer to take transit more often in each region. The results show that there are some socio-demographic factors associated with frequency of taking transit that vary conversely between the regions. For example, Hispanic respondents took over 3 transit trips more than those who are not Hispanic in the South, while Hispanic respondents took over 3 transit trips fewer than non-Hispanic responders in the North, controlling for all other factors in the models. We conclude that the model and results can assist in improving transit supply performance and urban planning in order to provide a sustainable and high quality of living environment.