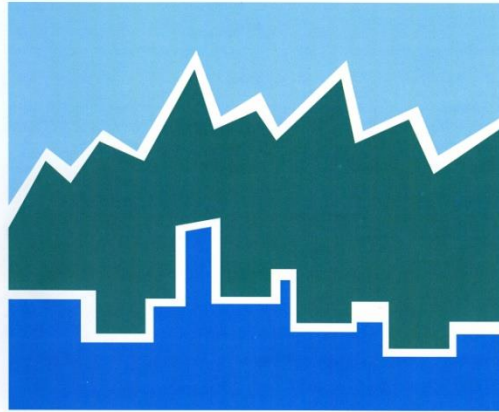


NHTS



# **NATIONAL HOUSEHOLD TRAVEL SURVEY**

Compendium of Uses

January 2014 - December 2014

## Introduction

This compendium contains various uses and applications of the National Household Travel Survey (NHTS) data used in transportation planning and research from January 2014 to December 2014. Published journal articles and reports that cite the use of NHTS data were selected using the Transportation Research Board (TRB) Annual Meeting Online Portal <http://amonline.trb.org/> and Google Alerts, notification emails sent by Google when new search results matched predetermined search terms pertaining to NHTS data. The key word and search engine terms used in both online sources were the **National Household Travel Survey** and **NHTS**.

The research papers were grouped into 11 categories that were created based on the **Subject Areas** and index terms identified in each abstract as well as category titles used in previous NHTS compendium databases. The categories are as follows:

1. Bicycle and Pedestrian Studies
2. Demographic Trends
3. Energy Consumption
4. Environment
5. Policy and Mobility
6. Special Population Groups
7. Survey, Data Synthesis, and Other Applications
8. Traffic Safety
9. Transit Planning
10. Travel Behavior
11. Trend Analysis and Market Segmentation

A one-page description of each paper is provided which includes the **Title, Authors, Abstract, Subject Areas, and Availability**.

Research articles and reports in this document cover a diverse range of topics in the areas of transportation, health, safety, environment, and engineering and were published in various journals including, but not limited to, the American Journal of Public Health, the International Journal of Behavioral Nutrition and Physical Activity, and the National Center for Transit Research. Several papers were also submitted by researchers and graduate students for presentation and publication to the Transportation Research Board 93rd Annual Meeting and can be found in the 2014 TRB Annual Meeting Compendium of Papers.

Please note that this 2014 compendium consists of approximately 322 research papers and articles. This document was updated on an on-going basis with newly published papers that cite NHTS data. For information about adding a research paper to the NHTS compendium, please contact Adella Santos at [adella.santos@dot.gov](mailto:adella.santos@dot.gov).

Search and documentation support was provided Jasmy Methipara (MacroSys) who also categorized and formatted the paper abstracts.

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# 1. BIKE AND PEDESTRIAN STUDIES

**Evaluation of Bike Accessibility in an Urban Network.** *Mahmoud Mesbah and Neema Nassir*

**Abstract:** Encouraging active and sustainable modes of transport has been an important goal for all transport authorities in developed countries. In many cities, cycling as an active transport mode is only directly investigated within the limited scope of separate road development projects. Efficient moves towards urban transport networks that favour sustainable modes can only be possible by accurate, realistic, and robust evaluation techniques to measure existing facilities, and to assess future network development scenarios. As a result, there is a need for tools and techniques to generate a comprehensive network perspective with regards to cycling facilities. This paper aims to introduce a method to evaluate bike accessibility between given origins and destinations. Considering an urban trip all the way from an origin (O) to a destination (D), the proposed evaluation method is capable of incorporating the key concerns of cyclists by applying route choice coefficients of a cycling trip into a path generation process. Moreover, the proposed method takes into account multiple route options available to ride between an origin destination (OD) pair. The method is applied to the network of Brisbane, Australia. The network includes all levels of road hierarchy suitable for bikes (arterials, collectors, and access roads) and covers the effect of available bike facilities on road (bike paths, bike lanes, wide curb side lanes, and general traffic lanes). Indicative results are provided on bike accessibility to the Central Business District (CBD) from the suburbs.

**Subject Area:** bicycle accessibility; central business district; suburbs; active transport;

**Availability:** MESBAH, Mahmoud, and Neema NASSIR. "Evaluation of Bike Accessibility in an Urban Network." JOURNEYS (2014).

[http://www.lta.gov.sg/Itaacademy/doc/Journeys\\_Issue\\_12\\_Nov\\_2014.pdf#page=46](http://www.lta.gov.sg/Itaacademy/doc/Journeys_Issue_12_Nov_2014.pdf#page=46)

## **Cycling Is Creating More Jobs in Europe Than Automakers Are in the U.S.** *Taylor Hill*

**Abstract:** On just two wheels, the industry is creating more jobs than Europe's high-fashion footwear industry (388,000 jobs), its well-established steel sector (410,000), and the United States' Big Three automobile companies (Ford, General Motors, and Chrysler) combined (510,000).

**Subject Area:** Cycling industry; jobs

**Availability:** McDonald, Noreen C., et al. "Costs of school transportation: quantifying the fiscal impacts of encouraging walking and bicycling for school travel." *Transportation* (2014): 1-17.  
<http://link.springer.com/article/10.1007/s11116-014-9569-7>

**Costs of school transportation: quantifying the fiscal impacts of encouraging walking and bicycling for school travel** *Noreen C. McDonald, Ruth L. Steiner, W. Mathew Palmer, Allison N. Bullock, Virginia P. Sisiopiku, & Benjamin F. Lytle*

**Abstract:** National governments have provided subsidies for investments in increasing the safety and attractiveness of walking and biking to school. Evaluations of Safe Routes to School initiatives have found that they have been effective at changing behavior and reducing injuries. However, there has been little attention to the impacts of these programs on pupil transportation costs. This analysis assesses the potential economic benefits of Safe Routes to School programs in the US context by estimating the annual costs of using motorized transport for short trips to schools, examining real-world examples of the costs savings of SRTS programs, and evaluating land use impacts on school transportation costs using a simulation analysis of school bus routes. We find that there is potential for school districts and families to reduce transport expenditures through public sector investments in walking and biking infrastructure near schools. We also find that land use context matters and the most cost-effective investments would benefit schools where large numbers of children live within walking distance.

**Subject Area:** School transport, Safe routes to school, Costs, School bus, Hazard busing

**Availability:** McDonald, Noreen C., et al. "Costs of school transportation: quantifying the fiscal impacts of encouraging walking and bicycling for school travel." *Transportation* (2014): 1-17. <http://link.springer.com/article/10.1007/s11116-014-9569-7>

## **Generation Y's Travel Behavior and Perceptions of Walkability Constraints**

*Maria Kamargianni, & Amalia Polydoropoulou*

**Abstract:** The aim of this study was to investigate the interrelationship between urban environment and walking to school and how teenagers' perceptions of walkability (i.e., how friendly an area is to walking) constraints affected their mode choice. An advanced hybrid mode choice model was developed in which the utilities of the alternative modes depended on the mode characteristics, teenagers' socioeconomic characteristics, weather conditions, and built environment characteristics, as well as a latent variable referring to walking constraints. The indicators of the latent variable included perceptions regarding the existence of stray animals, poor lighting, narrow sidewalks, parked cars that obscure visibility, unsignalized intersections, and probability of attack and safety en route. A questionnaire survey that took place at high schools of three distinct geographic areas in Greece (an urban area, a rural area, and an insular area) during 2011-2012 was the basis for a case study; 1,988 high school students aged 12 and 18 years old participated in the survey. Adolescents in rural areas walked a greater distance than did urban and insular adolescents. Model estimation results showed that teenagers from each geographical area were affected in different ways by weather conditions and they also perceived the built environment in different ways; this perception indicates how significant the sense of place is. The incorporation of the latent variable enhanced the explanatory power of the model, and the results of the study provide insights on policies that may help Generation Y to keep walking.

**Subject Area:** walkability; teenagers; generation Y

**Availability:** Kamargianni, Maria, and Amalia Polydoropoulou. "Generation Y's Travel Behavior and Perceptions of Walkability Constraints." *Transportation Research Record: Journal of the Transportation Research Board* 2430.1 (2014): 59-71.

<http://trb.metapress.com/index/KM2551767750423R.pdf>



## **Institutional Barriers To College Bicycle Program Development** *Matthew S. McCluney*

**Abstract:** College communities are increasingly finding bicycles to be the answer to greater mobility for their active lifestyles, while on a budget, and with the future of the environment in mind. The cost of parking, growth of bicycle commuting (over 50% mode split at some universities), and its acceptance as a sustainable practice has led to the establishment of campus programs. As of fall 2013, the League of American Bicyclists has recognized 75 schools as Bicycle Friendly Universities.

Several previous studies have examined the physical attributes that determine college bicycling behaviors, including infrastructure and weather preferences. However, there has been little research into the organizational structures that support bicycle services. If bicycling is growing, and it is generally accepted as a clean and cost-efficient alternative, then why haven't more colleges made the modal shift away from single occupancy vehicles through the establishment of comprehensive bicycle programs? What are the institutional barriers to college campus bicycle program development?

This research involved interviewing bicycle program coordinators at universities across the country recognized for their bicycle services, to give voice to their triumphs and challenges. The findings from these interviews help explain the institutional culture that may inhibit further programmatic growth, as well as the strategies that have met with success. Together, these insights from current bicycle program coordinators could contribute to the dialogue surrounding organizational credibility for alternative and sustainable practices, such as campus bicycling.

**Subject Area:** college campus bicycle programs

**Availability:** McCluney, Matthew. "Institutional Barriers to College Bicycle Program Development." University of Oregon. Masters Thesis (2014).  
<https://scholarsbank.uoregon.edu/xmlui/handle/1794/18233>

## **Analyzing Bicycle Sharing System User Destination Choice Preferences: An Investigation of Chicago's Divvy System** *Ahmadreza Faghih-Imani & Naveen Eluru*

**Abstract:** In recent years, there has been increasing attention on bicycle-sharing systems (BSS) as a viable and sustainable mode of transportation for short trips. However, due to relatively recent adoption of BSS there is very little research exploring how people consider these systems within the existing transportation alternatives. Given the recent growth of BSS across the world, there is substantial interest in identifying contributing factors that encourage individuals to use these systems. The current study contributes to the growing literature by examining BSS behavior at a trip level to analyze bicyclists' destination preferences. Specifically, we study the decision process involved in identifying destination locations after picking up a bicycle at a BSS station using a random utility maximization approach in the form of a multinomial logit model (MNL). The quantitative frameworks developed have been estimated using data from Chicago's Divvy system for 2013. In our modeling effort, we distinguish between BSS users with annual membership and short-term customers with daily passes. The developed model will allow bicycle-sharing system operators to better plan their services by examining the impact of travel distance, land use, built environment and access to public transportation infrastructure on users' destination preferences. Using the estimated model we generate utility profiles as a function of distance and various other attributes allowing us to visually represent the trade-offs that individuals make in their decision process. To further illustrate the applicability of the proposed framework for planning purposes, destination station choice probability prediction is undertaken.

**Subject Area:** bicycle sharing systems, Divvy Chicago, destination choice, location choice, Multinomial logit model, bicycle infrastructure, land use and built environment

**Availability:** Faghih-Imani, Ahmadreza, and Naveen Eluru. "Analyzing Bicycle Sharing System User Destination Choice Preferences: An Investigation of Chicago's Divvy System."  
[http://stmm.mcgill.ca/Papers/Chicago\\_FinalVersion.pdf](http://stmm.mcgill.ca/Papers/Chicago_FinalVersion.pdf)

**Non-motorized transport and university populations: an analysis of connectivity and network perceptions** *Benjamin Lundberg, & Joe Weber*

**Abstract:** This research examines local bicycle and pedestrian networks in the vicinity of the University of Alabama campus to assess the utility of these networks for travel to the university by students and employees. Network connectivity is examined using Geographic Information Systems (GIS) and the results compared to a survey of 3731 university students and employees. Results indicate that areas within one mile of the University of Alabama's campus have the highest levels of bicycle and pedestrian network connectivity and accessibility. The survey results show that an individual's positive perception of the bicycle and pedestrian networks is related to their travel behavior, and that this knowledge decreases within an increase in commute distance to campus. Increases in connectivity can be expected to lead to an increase in non-motorized travel, but it is also clear that lack of knowledge of driving and cycling laws is a deterrent to many.

**Subject Area:** Walking; Cycling; Non-motorized travel; Connectivity

**Availability:** Lundberg, Benjamin, and Joe Weber. "Non-motorized transport and university populations: an analysis of connectivity and network perceptions." *Journal of Transport Geography* 39 (2014): 165-178.

<http://www.sciencedirect.com/science/article/pii/S0966692314001501>

## **Physical Environment and Women's Physical Activity Behaviors** *Beth Ann Brisky*

**Abstract:** This study was developed using the Ecological Model (Stokols, 1992). The purpose of this study was to determine women's perceptions of the physical environment and the relationship between perceptions and physical activity behaviors. The study also analyzed women's non-motorized transportation behaviors, including walking and cycling to get from place to place. An email was sent to 526 female Minnesota State University, Mankato employees to ask them to participate in an electronic survey. The survey was developed using two of Sallis's (2013a, 2013b) instruments, Neighborhood Quality of Life Study survey and Neighborhood Environment Walkability Scale- Confirmatory Factor Analysis survey. The survey consisted of 51 questions addressing general information, perceptions of the physical environment, and physical activity behaviors. There were a total of 200 responses; however, 23 were eliminated as a result of unverified age or incomplete surveys. The data was analyzed with 177 completed surveys. The participants' had positive perceptions regarding the safety and aesthetics of their perceptions of their physical activity environments. Their perceptions regarding the accessibility and convenience of the environments, however, were not favorable. Very few relationships were found between the women's perceptions of the physical environment and physical activity behaviors. About half of the women reported that they walked as a mode of transportation. A small proportion of women reported that they cycled as a mode of transportation. Future research recommendations include conducting this study during warmer weather months to identify how their perceptions of their physical activity environments and their physical activity behaviors are associated when the weather is more suitable for physical activity.

**Subject Area:** physical activity; women; biking; walking

**Availability:** Brisky, Beth Ann. Physical Environment and Women's Physical Activity Behaviors. Diss. MINNESOTA STATE UNIVERSITY, MANKATO, 2014.  
<http://cornerstone.lib.mnsu.edu/cgi/viewcontent.cgi?article=1291&context=etds>

## **Design Treatments For Right-Turns At Intersections With Bicycle Traffic** *David Hurwitz, Mafruhatul Jannat & Christopher Monsere*

**Abstract:** With public interest seemingly increasing in sustainable transportation solutions—in part motivated by rising fuel prices and other concerns—bicycling has gradually become a more integral component of the multimodal transportation system in the US. As cities have made investments in the non-motorized transportation infrastructure, bicycling has become a meaningful alternative mode of transportation for commuting to activities such as school, work, shopping, and recreation. According to the National Personal Transportation Surveys of 1977 through 1995 and the National Household Travel Surveys of 2001 and 2009, the number of trips made by bicycle in the US has more than tripled from 1977 to 2009 while the bike share of total trips almost doubled, rising from 0.6% to 1.0%. Bicycle sales in the US have also increased from \$15 million (projected) in 1973 to \$6 billion in 2009.

Clearly, increased levels of cycling has the potential to improve overall levels of public health, reduce emissions, parking as well as enhancing the livability of the community by providing an alternative to driving and mitigate other transportation-related externalities. Since 50% of trips made by all modes in US cities are shorter than 3 miles and 40% are shorter than 2 miles, there is tremendous potential for replacing those trips with bicycling. From the context of health benefits, studies found that, adults who bike to work have healthier weight, blood pressure, and insulin levels and adolescents who bike are 48% less likely to be overweight as adults. According to the Bureau of Transportation Statistics (2010), the annual cost of owning and driving a car for an average American household is estimated to be \$7,179. Compared to that, for a round-trip commute of 10 miles, bicyclists save around \$10 daily, or \$3,650 annually (Bikes Belong, 2013). It has also been found that by replacing 1 mile of driving with 1 mile of bicycling can prevent the production of nearly 1 pound of CO<sub>2</sub> (0.88 lbs).

Still, much research has shown that safety is primary concern for many people when considering transportation by bicycle. For the most recent year available (2011), the National Highway Traffic Safety Administration (NHTSA) reports that there were 677 fatal bicycle-related crashes in 2011 which accounted for 2 percent of transportation related fatalities in the United States. As shown in the Table 1-1, the largest number of bicyclist fatalities were recorded in 2005 (786 persons).

**Subject Area:** sustainable transportation; public health, bicycle safety

**Availability:** Hurwitz, David, Mafruhatul Jannat, and Christopher Monsere. "Design Treatments For Right-Turns At Intersections With Bicycle Traffic." (2014).

[ftp://ftp.cs.pdx.edu/pub/users/monserec/spr767/SPR\\_767\\_LiteratureReview\\_V14.pdf](ftp://ftp.cs.pdx.edu/pub/users/monserec/spr767/SPR_767_LiteratureReview_V14.pdf)

**The influence of residential dissonance on physical activity and walking: evidence from the Montgomery County, MD, and Twin Cities, MN, areas** *Gi-Hyong Cho & Daniel A. Rodríguez*

**Abstract:** This study investigates to what extent a mismatch between residential preferences and actual residential locations is associated with residents' physical activity and walking. The residents of Montgomery County, MD, and Twin Cities, MN, were classified into four residential subgroups, and their walking and physical activity outcomes were compared. The results showed that, for transport activity and walking outcomes, participants living in a urban location and preferring a urban environment were more likely to be active than those who lived in a suburban location and preferred a suburban environment. In a highly dense region, the influence of preferences might be overridden by the characteristics of neighborhood locations. With respect to recreation activity, no significant associations were found regarding neighborhood locations or preference for neighborhood environment.

**Subject Area:** Travel behavior; Physical activity; Residential dissonance; Neighborhood locations

**Availability:** Cho, Gi-Hyong, and Daniel A. Rodríguez. "The influence of residential dissonance on physical activity and walking: evidence from the Montgomery County, MD, and Twin Cities, MN, areas." *Journal of Transport Geography* (2014).

<http://www.sciencedirect.com/science/article/pii/S0966692314001215>

## **A Multimedia Pedestrian Safety Program And School Infrastructure: Finding The Connection To Child Pedestrian Risk-Taking Attitudes And Risk Perceptions Of Pedestrian Behavior** *Diana Dawn Scott*

**Abstract:** Approximately 47,700 pedestrians were killed between the years of 2000 - 2009. School buses are one of the safest modes of transportation (National Highway Traffic Safety Administration, 2004). However, the Central Florida school district eliminated bus transportation within the 2-mile radius from schools just last year. Children must prepare for an alternative mode of transportation; walking and biking. The purpose of this research was two-fold. First to develop an online safety training program for elementary school children; and second, a self-report questionnaire was constructed and piloted to measure how safety training and school infrastructure affects students' pedestrian risk-taking attitudes and risk perceptions to avoid the dangers of walking and biking to and from school.

A 2x2 Factorial Multivariate Analysis of Variance (MANOVA) was used to test two categorical independent variables (safety awareness training, school infrastructure) for each of the two continuous dependent variables (pedestrian risk-taking attitudes and risk perceptions of pedestrian behavior). Using data from the pilot study, the researcher developed, self-reported questionnaires demonstrated that there was a significant difference between schools. Those receiving the training had lower mean scores in risk-taking attitudes than those who did not receive the training. Regardless of intervention, School 2 (complete infrastructure) takes fewer risks than School 1 (incomplete infrastructure). The mean difference between groups was not statistically significant.

**Subject Area:** School; safety training; walking; fatalities; MANOVA; risk

**Availability:** Scott, Diana Dawn. A Multimedia Pedestrian Safety Program And School Infrastructure: Finding The Connection To Child Pedestrian Risk-Taking Attitudes And Risk Perceptions Of Pedestrian Behavior. Diss. University Of Central Florida Orlando, Florida, 2014. [http://etd.fcla.edu/CF/CFE0005248/DIANA\\_DAWN\\_SCOTTs\\_2014\\_Thesis\\_for\\_final\\_submission.pdf](http://etd.fcla.edu/CF/CFE0005248/DIANA_DAWN_SCOTTs_2014_Thesis_for_final_submission.pdf)

**Physical activity mediates the relationship between perceived crime safety and obesity** *Barbara B. Brown, Carol M. Werner, Ken R. Smith, Calvin P. Tribby, & Harvey J. Miller*

**Abstract:** Objective: The current cross-sectional study tests whether low perceived crime safety is associated with body mass index (BMI) and obesity risk and whether less moderate-to-vigorous physical activity (MVPA) accounts for part of this relationship. Method: Adults (n = 864) from a relatively low-income and ethnically mixed neighborhood in Salt Lake City UT (2012) were assessed for perceived crime safety, objective physical activity, and BMI measures. Results: This neighborhood had lower perceived safety than for other published studies utilizing this safety measure. In a mediation test, lower perceived crime safety was significantly associated with higher BMI and greater risk of obesity, net of control variables. Residents with lower perceived safety had less MVPA. Lower MVPA partially explained the relationship between less safety and both elevated BMI and higher obesity risk, suggesting that perceiving less crime safety limits MVPA which, in turn, increases weight. Conclusion: In this neighborhood, with relatively low perceived safety from crime, residents' low perceived safety is related to more obesity and higher BMI; lower MVPA among residents explained part of this relationship. If residents are to become more active in their neighborhood it may be important to address perceived crime safety as part of broader efforts to enhance active living.

**Subject Area:** Physical activity; Body mass index; Obesity; Fear; Perceived safety; Walking

**Availability:** Brown, Barbara B., et al. "Physical activity mediates the relationship between perceived crime safety and obesity." *Preventive medicine* (2014).  
<http://www.sciencedirect.com/science/article/pii/S0091743514002229>



## **Location or design? Associations between neighbourhood location, built environment and walking** *Gi-Hyoug Cho & Daniel Rodriguez*

**Abstract:** In examining the association between environmental exposures and walking, conducting research on a neighbourhood scale has been the dominant approach whereas the association of the regional-scale environment with behaviours has rarely been explored. Because regional location and neighbourhood built environment attributes are likely to be correlated, the findings in neighbourhood-scale studies may be biased. In contrast to existing literature, this study is based on the assumption that a neighbourhood's location may be associated with walking or physical activity and that this association may be separately identifiable from the influence of the neighbourhood built environment on behaviours. The findings indicated that residing in a highly urban location had a consistently positive association with walking and transportation-purpose physical activity when the neighbourhood built environment and individuals' socio-demographic factors were controlled. Meanwhile the inclusion of the neighbourhood location variable did not result in significant changes to the models for recreation-purpose activity.

**Subject Area:** neighbourhood location; obesity; physical activity; transport; walking

**Availability:** Cho, Gi-Hyoug, and Daniel Rodriguez. "Location or design? Associations between neighbourhood location, built environment and walking." *Urban Studies* (2014): 0042098014537691.

<http://usj.sagepub.com/content/early/2014/06/16/0042098014537691.abstract>

## **Methods for Estimating Bicycling and Walking in Washington State** *Krista Nordback & Michael Sellinger*

**Abstract:** This report presents the work performed in the first and second phases in the process of creating a method to calculate Bicycle and Pedestrian Miles Traveled (BMT/PMT) for the state of Washington. First, we recommend improvements to the existing Washington State Bicycle and Pedestrian Documentation Program to provide data for BMT/PMT estimates, including expanding the program geographically and installing permanent automated bicycle and pedestrian counters to complement the short duration count program. The method to estimate BMT/PMT relies on the assumption of a stratified random sample drawn from the set of all roads and paths divided into 16 groups. These groups are based on three spatial attributes, which were gathered from a review of the literature:

- Level of urbanism (2 categories): Urban and Rural
- Facility type (2 categories): Highway/Arterial and Other
- Geographic/climatic regions (4 regions): Coast Range, Puget Lowland, Cascades, Eastern Washington

This report describes the first steps being taken toward the goal of computing this metric. Count data from Seattle, Olympia, and the State's Count Program have been gathered. To account for temporal variation, seasonal, daily and hourly adjustment factors have been computed based on one year of count data collected from the Fremont Bridge in Seattle. The short duration count sites have been grouped by the attributes described above, though most fall into just two groups: Puget Lowland Urban Arterial/Highway and Puget Lowland Urban Local/Collector/Path. Little or no data are available in most of the other groups. The roads in the state have also been divided into these 16 groups in order to compute total centerline miles for each group. This report outlines a sample-based method that could be used to compute BMT/PMT for the state and identifies both the data available for such a computation as well as the data gaps. It also suggests other methods that could also be used to estimate BMT/PMT to compare to the count-based method.

**Subject Area:** Walking, Bicycling, VMT, Transportation planning, Bicycle Miles Traveled, Pedestrian Miles Traveled

**Availability:** Sellinger, Michael. "Methods for Estimating Bicycling and Walking in Washington State." <http://www.wsdot.wa.gov/research/reports/fullreports/828.1.pdf>

## **Sidestepping Equity? A Case Study on the Provision and Quality of Sidewalks in Fremont, California** *Joel Manning*

**Abstract:** The sidewalk is the starting place for walkability. It should then be of concern to policy makers that numerous studies have found decreasing levels of access to public transportation infrastructure, including pedestrian facilities, as neighborhood incomes decrease. Land use has also been found to affect the provision and quality of transportation infrastructure. Furthermore, a vast amount of research has demonstrated some variation in the travel patterns and mode choice among poor and non-poor individuals, whether the mode is walking, transit, or personal vehicle. In order to examine these patterns of variability by income and land use, this research investigates existing conditions in the San Francisco Bay Area suburb of Fremont, California. This was done through an audit of sidewalk provision and quality on 100 public street segments in Fremont (50 from residential areas and 50 from nonresidential areas).

Audit findings show that Fremont sidewalks may be fairly uniform when looking at income, while more stark contrasts occur when investigating land use. Overall, findings are consistent with literature demonstrating variability in transportation infrastructure depending on land use, but mostly inconclusive regarding the effect of income. Additional research would be required to draw definitive conclusions yet findings from this case study seem to support such an assertion. Due to its small sample size and non-random selection, audit findings should only be taken as a preliminary overview of current conditions in Fremont. Some regional and local recommendations can be made nonetheless. The Metropolitan Transportation Commission may be right in supporting Fremont's policy of first targeting commercial areas for improvement in pedestrian infrastructure and would likely do well to continue assisting the City in the build-up of its downtown. However, it may also need to encourage the City to address the older, narrower sidewalks in its large, established residential areas. In light of audit findings, three possible recommendations for the City of Fremont emerged: Emphasize the importance of bringing residential sidewalks up to a higher level of quality rather than focusing almost exclusively on improving commercial areas; Incentivize or fund the widening and set-back of sidewalks, particularly in residential areas; Encourage non-residential property owners to improve sidewalks abutting their property through creative incentives.

**Subject Area:** sidewalk quality;

**Availability:** Manning, Joel. "Sidestepping Equity? A Case Study on the Provision and Quality of Sidewalks in Fremont, California." (2014).

[http://scholarworks.sjsu.edu/cgi/viewcontent.cgi?article=1369&context=etd\\_projects](http://scholarworks.sjsu.edu/cgi/viewcontent.cgi?article=1369&context=etd_projects)

**Multi-modal transportation optimization of a local corridor** *McMahon, Britton; Draeger, Mallory; Ferguson, Nicholas; Moberg, Haley & Barrella, Elise*

**Abstract:** The objective of this project is to redesign a one-mile section of the South Main Street Corridor in Harrisonburg, Virginia into a multimodal one that feasibly and safely integrates motor vehicles, bicyclists, and pedestrian traffic. Traditional traffic engineering practices emphasize optimizing vehicular traffic movement while treating pedestrian and bicyclist traffic movements as constraints. The focus of this research is to develop a way to maximize the capacity of existing right-of-way for all three traffic movements simultaneously, using a common metric of person-trips. Starting with standard equations from the Highway Capacity Manual for modal capacity of an intersection approach, the objective function for an optimization problem is developed. The objective function is the sum of capacity for each traffic movement measured in person-trips/hour, which normalizes the metrics. The input variables are flow rates for each movement that can vary based on scenario but cannot exceed their respective saturation flow rates. The outputs, or key design variables, are number of sublanes, which are unique to each traffic movement and define the geometry of the travel way. Combining all the sublane-widths results in the total width of the travel way that is constrained by the existing width of right-of-way. Therefore, through varying the flow rate per mode, different scenarios are evaluated that represent status quo, and shifts in corridor use. All other variables in the capacity equation are held constant. Based on the constraints, the objective function will yield a feasible region for which maximization of intersection efficiency will be found. The resultant combination of sublanes for each mode of transportation can then be implemented into the redesign model. This will allow for the most efficient flow of people through the intersection, regardless of mode choice, and could help promote policies and street design that prioritize alternatives to vehicular travel.

**Subject Area:** Corridor; Modal capacity; Optimization & Transportation

**Availability:** McMahon, Britton, et al. "Multi-modal transportation optimization of a local corridor." Systems and Information Engineering Design Symposium (SIEDS), 2014. IEEE, 2014. [http://ieeexplore.ieee.org/xpls/abs\\_all.jsp?arnumber=6829926](http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6829926)

## **Using Latent Class Models to Explore the Heterogeneous Impact of Accessibility by Mode on Residential Location Choice** *Fletcher Foti & Paul Waddell*

**Abstract:** The preferences of households making location decisions and how they change over time is one of the most important areas of research for travel modeling, as these decisions can have impacts on traffic congestion, social equity considerations, and environmental impacts. To date, residential location choice is typically treated as a discrete choice model in which the alternatives are a large aggregate geography in the city, for instance census tracts or transportation analysis zones. This makes analysis of the impacts of local-scale land use difficult, as the built environment can change significantly within these large geographies. Additionally, standard discrete choice techniques find one set of coefficients for the entire estimation dataset, which results in the “average” behavior for the set of choices that are observed. In the case of residential location choice, where variables of interest to modelers might include access by walking, driving, and transit, the question is not “does the average person value walking?” but rather, “what is the relative size of the population that values walking highly enough for it to affect the home buying decision?” This work adds to previous research by applying latent class choice methodology to a residential location choice model where alternatives are small geographies. This methodology allows for multiple sets of coefficients for the residential location choice, based on an endogenously estimated set of “classes” where membership in classes is regressed on available demographic variables. Although there are a small number of studies which apply latent class models to the residential choice, this is the first to incorporate walking-scale accessibility.

**Subject Area:** latent class choice methodology; walking-scale accessibility

**Availability:** Waddell, Paul. "Paper Author (s) Fletcher Foti (corresponding), University of California, Berkeley (ffoti@berkeley.edu)."

<http://onlinepubs.trb.org/onlinepubs/conferences/2014/ITM/Resources/18.pdf>

**Using an Activity Based Travel Demand Model to Estimate Health Co-Benefits of Land Use and Transportation Plans** *Nicholas J. Linesch, Caroline Jane Rodier & Richard Lee*

**Abstract:** There is increasing evidence that improved health outcomes may be a significant co-benefit of land use plans and transport policies that increase active transport (or walking and biking for purposeful travel) and reduce greenhouse gas emissions (GHGs). A greater understanding of these benefits may broaden the constituency for regional planning that supports local and national GHG reduction goals. In this study, California's activity based travel demand model (ABM) is linked with the Integrated Travel and Health Impact Model (ITHIM) to demonstrate how the next generation of travel models can be used to produce the active travel data required for running a comparative risk assessment model to estimate health outcomes for regional land use and transport plans. Further, the study illustrates possible growth strategies that achieve increased levels of walking and biking and does so by highlighting results from San Diego County. Finally, the ABM outputs in conjunction with ITHIM produce quantitative health cobenefits results and an estimate of the CO<sub>2</sub> reductions achieved from densification, enhanced transit, and vehicle pricing scenarios in California for a future 2035 time horizon.

**Subject Area:** land use; active transport; GHGs; Activity based travel demand model

**Availability:** Rodier, Caroline Jane. "Using an Activity Based Travel Demand Model to Estimate Health Co-Benefits of Land Use and Transportation Plans"  
<http://onlinepubs.trb.org/onlinepubs/conferences/2014/ITM/Resources/100.pdf>

## **Biking Distance: Exploring Gender, Race, and Climate** *Haleh Dolati*

**Abstract:** Today's urban life requires different types of transportation, such as private cars, public transit, and non-motorized transportation, each selected by people based on location and individual characteristics. Non-motorized transportation such as biking is a healthier option that is environmentally friendly and more flexible than motorized modes. Several studies have examined the importance of biking, ways to encourage more individuals to biking, and factors that influence an individual's decision to bike. An understudied research area lies in determining, once an individual is open to biking as a means of transportation, the factors that encourage or discourage her/him to bike longer distances.

This research contributes to the limited body of research on biking distance by examining four major questions: (1) Does biking distance vary by gender? (2) Does biking distance vary for different races? (3) To what degree do weather conditions affect longer distances?

I created a database using a number of different data sources. First, I used the National Household Travel Survey to identify the distance and number of trips individuals made by bicycle during 2009. This includes a total of 9,443 trips. I also used the National Household Travel Survey to identify individual who made the trip and household characteristics of them. More specifically, I included data related to race, gender, and income for bikers who made the trips. In addition to household and individual characteristics, I included a second source of data related to weather from the National Oceanic and Atmospheric Administration (NOAA). Overall, the database I created includes a matrix of 19 variables by 8636 cases. Using these data, I conducted a regression analysis. I run regression for five different scenarios: for female bikers, for male bikers, for African Americans bikers, for white bikers, and finally for all groups of bikers. Consistent with existing literature, gender plays an influential role in the decision to bike longer distances, with women generally biking shorter distances than men. In contrast, race, precipitation, and temperature do not affect biking distance. I found that age plays significant role in distance biked for each trip.

Despite the limitations to the analysis due to the size of the database and unavailable or inadequate data for some factors, the findings offer an increased understanding of biking distance. The results show race and climate do not affect biking distance. However, women bike shorter distances compare to men. Based on these findings, policymakers wishing to increase bicycle use in cities, may want to target women and low- income families and encourage these two groups, which are less likely to bike longer distances.

**Subject Area:** biking; gender; race; weather; distance

**Availability:** Dolati, Haleh. *Biking Distance: Exploring Gender, Race, and Climate*. Diss. The Ohio State University, 2014.

[https://etd.ohiolink.edu/!etd.send\\_file?accession=osu1388725654&disposition=attachment](https://etd.ohiolink.edu/!etd.send_file?accession=osu1388725654&disposition=attachment)

**Parent safety perceptions of child walking routes** *Cody Evers, Shawn Boles, Deb Johnson-Shelton, Marc Schlossberg, David Richey,*

**Abstract:** Walking rates to school remain low for U.S. children in large part due to parent concern for child safety. Little research exists that identifies which features of streets and intersection lead parents to feel that walking is unsafe for their children. In this study, parent volunteers conducted an audit of streets and intersections leading to seven elementary schools in a suburban school district. Parents were most likely to feel concern about streets that lacked sidewalks or had sidewalks with obstructions. Wheelchair-accessible routes were seen as appropriate for walking children. Parents expressed concern over safety at intersections, particularly those involving large streets; traffic controls did not mollify their concern. These results support the use of appropriate behavior models for assessing walking choices, highlight the importance of well-maintained sidewalks and age-appropriate crossings for young families, and demonstrate the importance of including the public in street audits.

**Subject Area:** Safe routes to school; Child physical activity; Environmental psychology; Public participatory GIS

**Availability:** Evers, Cody, et al. "Parent safety perceptions of child walking routes." *Journal of Transport & Health* (2014).

<http://www.sciencedirect.com/science/article/pii/S2214140514000322>



## **The Case for Crowdsourcing in Bicycle Planning: An Exploratory Study** *Jennifer Molina*

**Abstract:** In an effort to make broader mode shifts by attracting users of all abilities to bike, research needs to focus on understanding cyclists' behaviors at the local level and collecting real time travel data. Crowdsourcing is an online problem solving and production model that presents great potential in the area of bicycle planning by tapping into the collective intelligence of networked communities to support local policies and programs, as well as improve community engagement. This model has benefited both the private and public sectors, but has yet to be fully realized as a method for improving bicycling planning. A mixed-methods approach was employed, using a literature review, document and media research, and interviews with a subset of program managers and software developers. Through this exploratory case study, existing practices and limitations of crowdsourcing for bicycle planning projects in various metropolitan communities are discussed. The document also provides planners with recommendations as they look to this data collection and public participation method for bicycle planning projects, specifically bicycle facility demand, network planning, suitability modeling, and route choice modeling.

**Subject Area:** Crowdsourcing, Bicycle Planning, Web 2.0, Mobile, Public Participation, Civic Technology

**Availability:** Molina, Jennifer. *The Case for Crowdsourcing in Bicycle Planning: An Exploratory Study*. Diss. Tufts University, 2014.

[http://sites.tufts.edu/MaryDavis/files/2014/04/MastersThesisUEP\\_Final\\_JMolina.pdf](http://sites.tufts.edu/MaryDavis/files/2014/04/MastersThesisUEP_Final_JMolina.pdf)

## **Understanding the Underutilization of Urban Bicycle Commuting: A Behavioral Reasoning Perspective** *Marius C. Claudy & Mark Peterson*

**Abstract:** In an effort to make urban transportation more sustainable, bicycling has received growing attention from policy makers and social marketers. This study applies behavioral reasoning theory (BRT) to investigate consumers' mental processing of bicycle commuting in order to better understand why such an active mode of transportation is underutilized in many urban areas. Using a large-scale sample of commuters in Dublin, Ireland, the study offers knowledge about the psychological antecedents of bicycling adoption. The structural equation modeling results confirm BRT's main premise in that reasons serve as important linkages between individuals' values and their attitudes and behavior. In particular, findings suggest that commuters have reasons not to engage in bicycling, such as inconvenience or perceived danger, which account for most of the variance in bicycle-commuting behavior. The findings challenge interventions, which emphasize the role of information campaigns and one-off infrastructural changes in encouraging voluntary change in travel behavior. Instead, findings suggest that transportation planners and social marketers would do better to address consumers' reasons for and reasons against bicycling via community-based initiatives.

**Subject Area:** Bicycling, Sustainable Transportation, Behavioral Reasoning Theory, Social Marketing

**Availability:** Claudy, Marius C., and Mark Peterson. "Understanding the Underutilization of Urban Bicycle Commuting: A Behavioral Reasoning Perspective." *Journal of Public Policy & Marketing* (2014). <http://journals.ama.org/doi/abs/10.1509/jppm.13.087>

**Shifting short motorized trips to walking: The potential of active transportation for physical activity in Montreal** *Catherine Morency, Marie Demers & Eric Poliquin*

**Abstract:** Objectives: To estimate the number of walking steps resulting from shifting short motorized trips to walking at a population level and determine the weight gain from not operating this transfer. Methods: Analyses are based on data from the 2008 Origin-Destination Survey carried out in the Greater Montreal Area (Canada). This survey collects geocoded information on all trips (motorized or not) made by 5% of the population during a typical weekday. Using appropriate stride lengths for various population segments, short motorized trips were converted into steps to see how many steps per day could be performed by transferring these trips to walking. Until they are performed, these steps are accounted for “steps in reserve”. Results: During a typical 2008 weekday, 7.72% of daily motorized trips were flagged as walkable. These trips account for 608 million steps, an average of 2380 daily steps per person. Shifting short motorized trips to walking would allow 8.33% of the population to increase its level of daily physical activity. Conclusions: Shifting short motorized trips to walking offers a valuable opportunity for increasing daily physical activity and might also help reduce weight gain at a population level.

**Subject Area:** Active transport; Physical activity; Walking; Commuting; Modal choice

**Availability:** Morency, Catherine, Marie Demers, and Eric Poliquin. "Shifting short motorized trips to walking: The potential of active transportation for physical activity in Montreal." *Journal of Transport & Health* (2014).

<http://www.sciencedirect.com/science/article/pii/S2214140514000310>

## **Public Opinion towards Bicycle Lanes: The Case of New York** *Wil Fisher*

**Abstract:** As bicycles gradually become an established form of transportation in the United States, planners and policymakers need new evidence to determine how best to expand bicycle infrastructure. Using logistic regression analysis of 2012 public opinion data from New York City, this article explores the demographics behind support of bicycle lanes. Due to an absence of literature on public opinion toward bike lanes, it examines a breadth of variables in order to provide a basis for future research, answering the question: What personal characteristics are important in one's support for bike lanes? This study also demonstrates the distinction between demographics of bicycle ridership and demographics of supporters of bicycle infrastructure.

**Subject Area:** Public opinion, bike lanes, transportation policy, urban planning, demographics

**Availability:** Fisher, Wil. "Public Opinion towards Bicycle Lanes: The Case of New York." (2014). <http://digitalcommons.pepperdine.edu/sturesearch/87/>

**Problems and Suggestions of Walking in the Resident Trip Survey** *K. Wang, X. Guo, & N. Zhang*

**Abstract:** n/a

**Subject Area:** walking

**Availability:** WANG, Kai, Xiucheng GUO, and Ning ZHANG. "Problems and Suggestions of Walking in the Resident Trip Survey."

## **The health benefits of walking: a Nigerian reflection** *Franz Atare*

**Abstract:** A ban on the use of motorcycles for public transportation in major cities in Nigeria along with the increased awareness of the contributions of leisure activity to health is prompting many citizens to engage in walking. This paper provides a foundation for establishing the health benefits of walking as leisure and uses exploratory data to examine the perceptions that Nigerians have about walking. The majority of the participants claim that walking for leisure contributes to physical health, reduces the risk of chronic obesity and improves their immune system. They also agree that leisure walking enhances mental or psychological health by relieving stress and enhancing self-esteem and positive image. Although walking is sometimes a necessity, it also can be enjoyable and can promote people's general well-being in Nigeria, just as it can in other countries.

**Subject Area:** health outcomes, obesity, walking, well-being

**Availability:** Atare, Franz. "The health benefits of walking: a Nigerian reflection." *World Leisure Journal* ahead-of-print (2014): 1-4.

<http://www.tandfonline.com/doi/abs/10.1080/16078055.2014.903731>

## **Simulating bicycle wayfinding mechanisms in an urban environment** *Greg Rybarczyk*

**Abstract:** With the increased recognition that bicycling is a sustainable transportation mode choice, there is a continued interest in understanding how the built environment affects bicyclist travel behavior. Research on the influence of small-scale built form elements, such as street characteristics, on bicyclist wayfinding is limited. wayfinding is defined as a purposeful way of reaching from point A to point B; it is comprised of decision-making and subsequent movement. This research uses an agent-based model to investigate how small-scale urban design affects bicyclist wayfinding. Using geographic information systems and statistical analysis, different types of simulated bicycle agents were compared to observed bicycle volumes. Statistically significant positive relationships between bicycle agent types and observational data existed. The largest correspondence between agents and field observations occurred along central routes that were accessible from other streets ( $R^2 = .377$ ) and that had fewer decision-making junctions ( $R^2 = .352$ ). Bicyclists selected streets that were wider and with fewer obstructions to one's forward view. The results support the need to design streetscapes that offer a high level of visibility and reduced stops to promote bicycling. The study also describes a modeling approach that can be replicated by urban planners to understand bicyclist travel patterns.

**Subject Area:** agent-based model, urban design, bicyclist wayfinding, space syntax, visibility graph analysis, geographic information systems

**Availability:** Rybarczyk, Greg. "Simulating bicycle wayfinding mechanisms in an urban environment." *Urban, Planning and Transport Research* ahead-of-print (2014): 1-16.  
<http://www.tandfonline.com/doi/abs/10.1080/21650020.2014.906909>

**Active transport between home and school assessed with GPS: a cross-sectional study among Dutch elementary school children** *Dirk Dessing, Sanne I de Vries, Jamie MA Graham and Frank H Pierik*

**Abstract:** Background: Active transport to school is associated with higher levels of physical activity in children. Promotion of active transport has therefore gained attention as a potential target to increase children's physical activity levels. Recent studies have recognized that the distance between home and school is an important predictor for active travel among children. These studies did not yet use the promising global positioning system (GPS) methods to objectively assess active transport. This study aims to explore active transport to school in relation to the distance between home and school among a sample of Dutch elementary school children, using GPS. Methods: Seventy-nine children, aged 6-11 years, were recruited in six schools that were located in five cities in the Netherlands. All children were asked to wear a GPS receiver for one week. All measurements were conducted between December 2008 and April 2009. Based on GPS recordings, the distance of the trips between home and school were calculated. In addition, the mode of transport (i.e., walking, cycling, motorized transport) was determined using the average and maximum speed of the GPS tracks. Then, proportion of walking and cycling trips to school was determined in relation to the distance between home and school. Results: Out of all school trips that were recorded (n = 812), 79.2% were classified as active transport. On average, active commuting trips were of a distance of 422 meters with an average speed of 5.2 km/hour. The proportion of walking trips declined significantly at increased school trip distance, whereas the proportion of cycling trips ( $\beta = 1.23$ ,  $p < 0.01$ ) and motorized transport ( $\beta = 3.61$ ,  $p < 0.01$ ) increased. Almost all GPS tracks less than 300 meters were actively commuted, while of the tracks above 900 meters, more than half was passively commuted. Conclusions: In the current research setting, active transport between home and school was the most frequently used mode of travel. Increasing distance seems to be associated with higher levels of passive transport. These results are relevant for those involved in decisions on where to site schools and residences, as it may affect healthy behavior among children.

**Subject Area:** Elementary school, Children, Global positioning system (GPS), Mode of transport, Walking, Cycling

**Availability:** Dessing, Dirk, et al. "Active transport between home and school assessed with GPS: a cross-sectional study among Dutch elementary school children." *BMC Public Health* 14.1 (2014): 227. <http://www.biomedcentral.com/1471-2458/14/227/>



## **Final Report for Phase II Study: Prototyping the Sketch Planning Visualization Tool for Non-Motorized Travel** *Ho-Ling Hwang, Daniel Wilson, Timothy Reuscher, Shih-Miao Chin, Rob Taylor*

**Abstract:** The idea of livable communities suggests that people should have the option to utilize non-motorized travel (NMT), specifically walking and bicycling, to conduct their daily tasks. Forecasting personal travel by walk and bike is necessary as part of regional transportation planning, and requires fine detail not only about individual travel, but also on transportation and neighborhood infrastructure.

This project was funded by the Office of Planning, Federal Highway Administration (FHWA), and was carried out in two phases. Phase I of this project was completed in 2012, which focused on using data collected under the 2009 National Household Travel Survey (NHTS) and supplemented with data from the American Community Survey (ACS), as well as several other public and private databases, to characterize the “market” potential for NMT under a national perspective. The final report documenting the effort and findings of Phase I research can be found at this website: <http://info.ornl.gov/sites/publications/Files/Pub36798.pdf>.

The Phase I NMT research exercise revealed that developing estimates on the propensity to travel non-motorized was, unfortunately, too large a task on a national scale. Although the reduction of geography to nine add-on areas with better NHTS data coverage did produce a relatively reasonable overall model performance under Phase I, the NHTS sampling limitation indeed impacted the model’s ability to accurately estimate characteristics in certain areas, specifically in the City of Alexandria, Virginia.

To further examine how factors such as those identified from the Phase I NMT study, and the modeling framework developed under that effort could be applied to local/regional level planning activities, FHWA decided to pursue a Phase II study. It was determined that a small geographic area with more detailed local data would be necessary. Although Washington D.C. was not one of the 2009 NHTS add-ons, it did conduct a household travel survey of 11,000 households in 2007-2008. The National Capital Region Transportation Planning Board at the Metropolitan Washington Council of Governments (MWCOC) conducted the household travel survey. The data coverage under the MWCOC survey is much higher than that of the NHTS. As a part of the Phase II study, a prototype of a Geographic Information System (GIS)-based sketch planning visualization tool was also to be developed. The intent was to use a neighborhood in the Washington D.C. region as a case study for this prototype application.

**Subject Area:** walking, biking, livable communities,

**Availability:** Hwang, Ho-Ling, et al. "Final Report for Phase II Study: Prototyping the Sketch Planning Visualization Tool for Non-Motorized Travel." (2014).  
<https://wiki.ornl.gov/sites/publications/Files/Pub48559.pdf>

## **Exploring the Characteristics of Short Trips: Implications for Walk Mode**

**Choice** *Sanjay Paul, Kathryn Born, Kelsey McElduff, Ram M. Pendyala, & Chandra R. Bhat*

**Abstract:** People undertake many short trips, which may be defined as those under five miles, or under two miles, or even under one mile in length. Although these trips have lengths that make them candidates for bicycling or walking, i.e., the use of sustainable non-motorized modes of transport, it is found that a substantial share of these short trips are undertaken by car. Although there has been some research into the reasons why short trips are not largely undertaken by walk and bicycle, much remains to be learned about the nature of short trips and the potential constraints that limit the ability of travelers to use non-motorized modes for these trips. This paper offers a detailed examination of short trips, with a view to exploring the potential factors inhibiting the use of walk and bicycle modes for these trips. The paper offers a detailed descriptive analysis of short trips in two major metropolitan regions using data from the most recent 2008-2009 National Household Travel Survey in the United States. It is found that trip chaining patterns may be playing a significant role in preventing more walking and bicycling. Based on a characterization of short trips in the survey data sets, the paper offers planning and policy strategies that may help bolster the share of walking and bicycling for short trips.

**Subject Area:** walking, short trips, travel analysis, pedestrians, mode choice, trip chaining

**Availability:** Paul, Sanjay, et al. "Exploring the Characteristics of Short Trips: Implications for Walk Mode Choice." Transportation Research Board 93rd Annual Meeting. No. 14-5211. 2014. <http://www.ce.utexas.edu/prof/bhat/ABSTRACTS/ShortTripsAnalysisWalkDrive.pdf>

## **The process of crafting bicycle and pedestrian policy: A discussion of cost-benefit analysis and the multiple streams framework** *Johann Weber*

**Abstract:** Existing literature on bicycling policies and infrastructure in the United States is still somewhat limited in number and scope, with the majority of research framed by a cost-benefit analysis (CBA) framework of decision making; this has led studies to focus on the potential benefits of bicycle and pedestrian facilities, factors affecting the use of bicycles as a mode of transit, and the improvement of CBA analysis with regards to bike/ped programs. While the CBA framework may be accurately matched to the practical process of specific policy implementation for some governing organizations, and provide valid evidence for application under other frameworks, it does not account for the role of policy windows and policy entrepreneurs in policy decision making, or for the role of effective advocacy. After a review of the existing literature, I suggest the multiple streams framework as a more suitable framework for understanding decision making with regard to non-motorized transportation policies, and provides a useful structure for future research (particularly on the role of advocacy groups and policy entrepreneurs in the planning and policy process).

**Subject Area:** cost-benefit analysis; bicycle and pedestrian infrastructure;

**Availability:** Weber, Johann. "The process of crafting bicycle and pedestrian policy: A discussion of cost-benefit analysis and the multiple streams framework." *Transport Policy* 32 (2014): 132-138. <http://www.sciencedirect.com/science/article/pii/S0967070X14000237>

## **An energy expenditure approach for estimating walking distance** *Chaug-Ing Hsu, Yau-Ching Tsai*

**Abstract:** A walking distance of approximately a quarter mile is normally used as an estimate of willingness to walk when planning a pedestrian-related infrastructure. However, there are variations in walking distance across pedestrian environments, yet there is scant empirical literature on the subject. In this study we propose an energy-based approach to aid the planner in establishing reasonable walking distances while taking into account the effect of pedestrian environment quality. The Pandolf et al model (Pandolf et al, 1977 *Journal of Applied Physiology* 44 577–581) is used to analyze the walking energy expenditure (WEE). The terrain factor is adjusted using the calibrated regression function to fit the urban street space in the experiment. A goodness-of-fit test for the 385 WEEs surveyed suggests a gamma distribution. Using the isoenergy curves, walking distances are shown according to energy level, street type, and gender in order to improve the traditional single measure. The results of this study suggest that, instead of a concentric pattern, the pattern of accessible walking distance around a service facility should be designed based on the service contour lines which take into account the different pedestrian environments.

**Subject Area:** walking accessibility, energy expenditure, pedestrian environment

**Availability:** Hsu, Chaug-Ing, and Yau-Ching Tsai. "An energy expenditure approach for estimating walking distance." *Environment and Planning B: Planning and Design* 41 (2014): 000-000. <http://www.envplan.com/abstract.cgi?id=b37169>

## **Chapter 38 Transportation Policies and Obesity** *David R. Bassett Jr.*

**Abstract:** Transportation policies have been shown to impact population levels of physical activity and obesity. Governments make many decisions that influence people's choice of transportation modes. In most places there is a wide array of transportation options, but simple behavior economics may cause people to favor certain modes of transportation over others. In places where governments have invested heavily in public transit and in building cities and towns that are conducive to walking and bicycling, obesity rates are lower than in places that are more car dependent. Active transportation has a host of other benefits, including economic savings, energy conservation, reduced vehicle emissions and decreased requirements for roads and parking lots.

**Subject Area:** obesity; policy; biking, walking, transit; active transportation; health

**Availability:** Bassett Jr, David R. "38 Transportation Policies and Obesity." *Handbook of Obesity: Epidemiology, Etiology, and Physiopathology* 1 (2014): 427.

<http://books.google.com/books?hl=en&lr=&id=86WNAgAAQBAJ&oi=fnd&pg=PA427&dq=38+Transportation+Policies+and+Obesity+&ots=dFmU-LljUs&sig=rOuik1o3XWrTwQ4AfFKiy7aqLE>

**E-Bikes in the North America: Results from an online survey** *John MacArthur, Jennifer Dill and Mark Person*

**Abstract:** This research aims in part to understand if different bicycling technology, in this case electric assist bicycles or e-bikes, can reduce barriers to bicycling, including trip distance, topography, time, and rider effort. Doing so may result in more bike trips and longer bike trips, and increase the diversity of people bicycling, including people with a disability or chronic injury. E-bikes typically resemble a standard pedal bicycle with the addition of a rechargeable battery and electric motor to assist the rider with propulsion. To address these aims, we conducted an online survey of existing e-bike users on their purchase and use decisions. Responses from 553 e-bike users across North America are analyzed here. Results suggest that e-bikes are enabling users to bike more often, to more distant locations, and to carry more cargo with them. Additionally, e-bikes allow people who would otherwise not be able to bike because of physical limitations or proximity to locations, the ability to bike with electric assist.

**Subject Area:** electric bicycle; electric assist; e-bike

**Availability:** MacArthur, John, Jennifer Dill, and Mark Person. "E-Bikes in the North America: Results from an online survey." (2014).

[http://www.urop.uci.edu/journal/journal11/03\\_naviaux.pdf](http://www.urop.uci.edu/journal/journal11/03_naviaux.pdf)

## 2. DEMOGRAPHIC TRENDS

**Socioeconomics of Urban Travel: Evidence from the 2009 National Household Travel Survey with Implications for Sustainability** *John L. Renne and Peter Bennett*

**Abstract:** This article summarizes patterns of mobility for urban travel across the United States based on the 2009 National Household Travel Survey (NHTS). It examines how patterns vary by socioeconomics and highlights policy implications of current mobility patterns for creating a more sustainable society. Key findings include the reaffirmation that over 80 percent of trips in America are made by automobiles. While vehicle ownership is the most significant factor in variations in mode use, income, trip purpose, regional variation, race/ethnicity, gender and age are all factors examined for variation in travel behavior. The paper concludes with recommendations for promoting a sustainable society through shifting transportation priorities.

**Subject Area:** mode share; socioeconomic variations; travel behavior

**Availability:** John L. Renne and Peter Bennett. "Socioeconomics of Urban Travel: Evidence from the 2009 National Household Travel Survey with Implications for Sustainability" *World Transport Policy and Practice* 20.4 (2014): 7-27. <http://www.eco-logica.co.uk/pdf/wtpp20.4.pdf>

## **Promoting Biking among Low-Income Chinese Immigrants in San Francisco**

*Kenji Wada*

**Abstract:** There are some bike related projects to reach out to Chinese communities using multi--language in San Francisco, such as the Green Infrastructure Projects—managing watershed and improving other infrastructures on streets, like public space, bike lanes and vegetations (PUC, 2013) by Public Utility Commons (PUC). However, the author insists that the underlying problem for the low bicycle participation among Chinese immigrants is the language barrier. Although the study focuses on youth Chinese immigrants, Yeh et al. states “the loss of opportunities to communicate in one’s native language contributes to feelings of insecurity and fear when interacting with the majority culture or engaging in daily living activities” (2008). San Francisco Municipal Transportation Agency (SFMTA) is in the process of expanding biking’s share in commuting from 8 to 10 percent by 2018, which is double to triple the 2010 figure of 3.5 percent (SFMTA, 2013). Regardless of SFMTA’s effort, language barrier may contribute greatly to the low participation in biking by Chinese immigrants, since most of SFMTA’s communication is done by English. ACS 2007–2011 census data show 65 percent of the Chinese population in San Francisco has language barriers. This accounts for 14 percent of the total population of San Francisco—797,983 by ACS 2007–2011. Therefore, over 110,900 of the Chinese populations may have problems receiving information correctly or to accessing information about biking.

**Subject Area:** Chinese immigrant; San Francisco; Green Infrastructure; bicycle

**Availability:** Bassett Jr, David R. "38 Transportation Policies and Obesity." *Handbook of Obesity: Epidemiology, Etiology, and Physiopathology* 1 (2014): 427.

<http://books.google.com/books?hl=en&lr=&id=86WNAgAAQBAJ&oi=fnd&pg=PA427&dq=38+Transportation+Policies+and+Obesity+&ots=dFmU-LjUs&sig=rOuik1o3XWrTwQ4AfFKiy7aqLE>



**A cross-sectional study of demographic, environmental and parental barriers to active school travel among children in the United States** *Palma Chillón, Derek Hales, Amber Vaughn, Ziya Gizlice, Andy Ni, & Dianne S Ward*

**Abstract:** Background: Promoting daily routine physical activities, such as active travel to school, may have important health implications. Practitioners and policy makers must understand the variety of factors that influence whether or not a child uses active school travel. Several reviews have identified both inhibitors and promoters of active school travel, but few studies have combined these putative characteristics in one analysis. The purpose of this study is to examine associations between elementary school children's active school travel and variables hypothesized as correlates (demographics, physical environment, perceived barriers and norms). Methods: The current project uses the dataset from the National Evaluation of Walk to School (WTS) Project, which includes data from 4th and 5th grade children and their parents from 18 schools across the US. Measures included monthly child report of mode of school travel during the previous week ( $n = 10,809$ ) and perceived barriers and social norms around active school travel by parents ( $n = 1,007$ ) and children ( $n = 1,219$ ). Generalized linear mixed models (GLMM) with log-link functions were used to assess bivariate and multivariate associations between hypothesized correlates and frequency of active school travel, assuming random school effect and controlling for the distance to school. Results: The final model showed that the most relevant significant predictors of active school travel were parent's perceived barriers, specifically child resistance (Estimate =  $-0.438$ ,  $p < 0.0001$ ) and safety and weather (Estimate =  $-0.0245$ ,  $p < 0.001$ ), as well as the school's percentage of Hispanic students (Estimate =  $0.0059$ ,  $p < 0.001$ ), after adjusting for distance and including time within school cluster as a random effect. Conclusions: Parental concerns may be impacting children's use of active school travel, and therefore, future interventions to promote active school travel should more actively engage parents and address these concerns. Programs like the Walk to School program, which are organized by the schools and can engage community resources such as public safety officials, could help overcome many of these perceived barriers to active transport.

**Subject Area:** Correlates, Active travel, Barriers, Children, Walk to school

**Availability:** Chillón, Palma, et al. "A cross-sectional study of demographic, environmental and parental barriers to active school travel among children in the United States." *International Journal of Behavioral Nutrition and Physical Activity* 11.1 (2014): 61.

<http://www.ijbnpa.org/content/11/1/61/abstract>

### 3. ENERGY CONSUMPTION

#### **Optimal Energy Management for SmartGrids Considering Thermal Load and Dynamic Pricing** *Duong Tung Nguyen*

**Abstract:** n/a (in French)

**Subject Area:** thermal load; dynamic pricing

**Availability:** Nguyen, Duong Tung. Optimal Energy Management for SmartGrids Considering Thermal Load and Dynamic Pricing. Diss. McGill University, 2014.

<http://espace.inrs.ca/2427/1/Nguyen,%20Duong%20Tung.pdf>

## **Performance and energy efficiency testing of a lightweight FCEV Hybrid Vehicle** *Dylan Ryan, Jinlei Shang, Christophe Quillivic, & Bernard Porter*

**Abstract:** The Microcab H2EV is a 4 seat lightweight niche vehicle, which with a top speed of under 90 km/h and a kerb weight of 750 kg's, is primarily intended for urban use. It is a plugin series hybrid powered by an air-cooled PEM type fuel cell. As part of ongoing development of the Microcab H2EV a series of tests were conducted to determine the power consumption and energy efficiency of the vehicle operating under urban traffic conditions. This included extensive testing of the vehicle both under battery power and fuel cell power operating in active traffic conditions and steady speed tests at a range of different speeds. The Microcab has also been subjected to rolling road tests in accordance with the UDC cycle. This paper will provide a review of the testing methods undertaken, the results of this study and how it has feedback into future improvements of the vehicle as well as providing data to support vehicle modelling. The observed energy performance, TTW, WTW and Wh/km of the vehicle under both fuel cell and pure EV power, will be discussed for a variety of conditions, as well as the factors influencing this performance. The differences in vehicle performance between those observed under real traffic conditions and the UDC cycle testing will also be discussed in context of the suitability of the UDC cycle as a measure of urban vehicle performance.

**Subject Area:** FCEV, fuel economy, vehicle testing

**Availability:** Ryan, Dylan, et al. "Performance and energy efficiency testing of a lightweight FCEV Hybrid Vehicle." European Electric Vehicle Congress Brussels, Belgium, 3rd – 5th December 2014 <http://www.microcab.co.uk/wp-content/uploads/eevc2014.pdf>

## **Rapid estimation of electric vehicle acceptance using a general description of driving patterns** *Michael A. Tamor, Paul E. Moraal, Briana Reprogle, & Miloš Milačić*

**Abstract:** A reliable estimate of the potential for electrification of personal automobiles in a given region is dependent on detailed understanding of vehicle usage in that region. While broad measures of driving behavior, such as annual miles traveled or the ensemble distribution of daily travel distances are widely available, they cannot be predictors of the range needs or fuel-saving potential that influence an individual purchase decision. Studies that record details of individual vehicle usage over a sufficient time period are available for only a few regions in the US. In this paper we compare statistical characterization of four such studies (three in the US, one in Germany) and find remarkable similarities between them, and that they can be described quite accurately by properly chosen set of distributions. This commonality gives high confidence that ensemble data can be used to predict the spectrum of usage and acceptance of alternative vehicles in general. This generalized representation of vehicle usage may also be a powerful tool in estimating real-world fuel consumption and emissions.

**Subject Area:** Electric vehicle; Hybrid electric vehicles; Plug-in hybrid; Electric range; Acceptance

**Availability:** Tamor, Michael A., et al. "Rapid estimation of electric vehicle acceptance using a general description of driving patterns." *Transportation Research Part C: Emerging Technologies* 51 (2015): 136-148. <http://www.sciencedirect.com/science/article/pii/S0968090X1400309X>

## **Optimal Coordination and Scheduling of Demand Response via Monetary Incentives** *Sarker, M.R.; Ortega-Vazquez, M.A.; & Kirschen, D.S.*

**Abstract:** Without demand-side management, an increase in the number of electric vehicles (EVs) could result in overloads on distribution feeders. Aggregators could optimally manage the charging/discharging of the EVs, to not only maximize the consumers' welfare in response to real-time prices and accommodate their needs for transportation, but also to keep the distribution network within its operating limits. This paper proposes a decentralized framework in which the aggregator seeks to maximize its profits while the consumers minimize their costs in response to time-varying prices, and additional incentives provided to mitigate potential overloads in the distribution system. Test results show that a large penetration of EV penetration can then be managed without violating the capacity of the distribution network.

**Subject Area:** Aggregator; demand response; demand-side management (DSM); electric vehicles (EVs); incentives

**Availability:** Sarker, Mushfiqur R., Miguel A. Ortega-Vazquez, and Daniel S. Kirschen. "Optimal Coordination and Scheduling of Demand Response via Monetary Incentives."

[http://ieeexplore.ieee.org/xpls/abs\\_all.jsp?arnumber=6980133](http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6980133)

## **Control and Management of PV Integrated Charging Facilities for PEVs**

*Preetham Goli, & Wajiha Shireen*

**Abstract:** The ongoing research in the field of plug-in electric vehicles (PEVs) and the growing global awareness for a pollution free environment, will lead to an increase in the number of PEVs in the near future. The proliferation of these PEVs will add stress to the already overloaded power grid creating new challenges for the distribution network. To mitigate this issue several researchers have proposed the idea of charging PEVs using renewables coupled with smart charging strategies. This chapter reviews the current literature on the state of the art infrastructure proposed for PEV charging facilities integrated with photovoltaic system. The proposed control algorithms, various smart charging techniques and different power electronic topologies for photovoltaic charging facilities (PCFs) are reviewed. Studies assessing the ability of photovoltaic charging stations to minimize the loading on distribution transformers are assessed. Finally, a simple and unique energy management algorithm for a PV based workplace charging facility based on dc link voltage sensing is presented. The power needed to charge the plug-in electric vehicles comes from grid-connected photovoltaic (PV) generation or the utility or both. The efficacy of the proposed algorithm is validated through simulation and experimental results.

**Subject Area:** Plug-in electric vehicles (PEVs); Photovoltaic charging facility (PCF); Distribution network

**Availability:** Goli, Preetham, and Wajiha Shireen. "Control and Management of PV Integrated Charging Facilities for PEVs." *Plug In Electric Vehicles in Smart Grids*. Springer Singapore, 2015. 23-53. [http://link.springer.com/chapter/10.1007/978-981-287-317-0\\_2](http://link.springer.com/chapter/10.1007/978-981-287-317-0_2)

## **Testbed Design and Co-simulation of PEV Coordination Schemes Over Integrated Fiber-Wireless Smart Grid Communications Infrastructures** *Intissar Harrabi, Taycir Louati, Martin Lévesque, & Martin Maier*

**Abstract:** It is of great importance to smart grids to build a communications network that can support the future power utility growth, customer connections, and new applications. One significant main concern is the integration of plug-in electric vehicles (PEVs) within smart grids. This chapter provides a comprehensive performance evaluation of PEV coordination strategies over integrated Fiber-Wireless (FiWi) smart grid communications infrastructures using a scaled-down testbed and advanced co-simulator. As the coordination of PEVs was not experimentally demonstrated previously, this chapter describes a smart grid testbed based on a real-world distribution network in Denmark by scaling a 250 kVA, 0.4 kV real low-voltage distribution feeder down to 1 kVA, 0.22 kV. The obtained experimental results show that the proposed hybrid centralized and decentralized control approach for PEV charging simultaneously takes into account the charging cost, network congestion, and local voltage. Moreover, the coordination between distribution management system (DMS) and sensors is realized in real-time using the developed smart grid testbed (SGT) by the synchronized exchange of power and control signals via a heterogeneous Ethernet-based mesh network. The developed SGT is a step forward to (i) identify practical problems and (ii) validate and test new smart grid mechanisms under realistic physical conditions. However, building such a testbed is time and space consuming. To evaluate large-scale smart grid systems, co- and multi-simulation experiments may be carried out instead. Therefore, the chapter next presents the co-simulation of a power distribution system combined with a smart grid communications infrastructure in order to enable real-time exchange of information between PEVs and utilities for the coordination of charging algorithms, which allow PEVs to intelligently consume or send stored power back to the grid (Vehicle-To-Grid capability). Different types of coordinated PEV charging algorithms in a multidisciplinary approach by means of co-simulation of both power and communication perspectives are implemented. A comparison of both centralized and decentralized PEV charging algorithms is drawn in terms of power and communication performance. The integration of photovoltaic solar panels to locally charge PEVs, which plays a major role in limiting the impact of PEV charging on the utility grid and thereby minimizing peak energy demand as well as effectively achieving load balancing, is also investigated.

**Subject Area:** Centralized scheduling; Decentralized scheduling; Grid-to-vehicle; Plug-in electric vehicle; Smart grid; Testbed; Vehicle-to-grid

**Availability:** Harrabi, Intissar, et al. "Testbed Design and Co-simulation of PEV Coordination Schemes Over Integrated Fiber-Wireless Smart Grid Communications Infrastructures." *Plug In Electric Vehicles in Smart Grids*. Springer Singapore, 2015. 99-128.  
[http://link.springer.com/chapter/10.1007/978-981-287-299-9\\_4](http://link.springer.com/chapter/10.1007/978-981-287-299-9_4)

**Optimal In-Home Charge Scheduling of Plug-in Electric Vehicles Incorporating Customer's Payment and Inconvenience Costs** *Mahmud Fotuhi-Firuzabad, Soroush Shafiee & Mohammad Rastegar*

**Abstract:** Plug-in electric vehicles (PEVs) are identified as one of the motivating technologies in smart grid era. However, if their highly disruptive impacts on the distribution system are left unaddressed, it may obstruct both smart grid development and PEV adoption. This chapter develops a novel in-home PEV charging control (PCC) algorithm that schedules both the time and level of charging PEVs incorporating customer's desired comfort level. This optimization-based problem attempts to achieve a trade-off between minimizing the electricity payment and minimizing the waiting time to fully charge the PEVs in presence of a time of use (TOU) pricing tariff combined with inclining block rates (IBRs). The projected algorithm is online in which each PEV is scheduled at its plug-in time, and the charge scheduling of plugged-in PEVs are updated when the next PEV is plugged-into the home outlet. The proposed method is applied to a smart home with different number of PEVs and various levels of customer's comfort. In addition, the impacts of solving PCC problems on the specifications of the IEEE 34-bus residential test feeder with different PEV penetration levels are investigated. The simulation results are presented to demonstrate the effectiveness and applicability of the proposed PEV charge scheduling scheme.

**Subject Area:** Charging strategy; PEV; smart grid;

**Availability:** Fotuhi-Firuzabad, Mahmud, Soroush Shafiee, and Mohammad Rastegar. "Optimal In-Home Charge Scheduling of Plug-in Electric Vehicles Incorporating Customer's Payment and Inconvenience Costs." *Plug In Electric Vehicles in Smart Grids*. Springer Singapore, 2015. 301-326. [http://link.springer.com/chapter/10.1007/978-981-287-317-0\\_10](http://link.springer.com/chapter/10.1007/978-981-287-317-0_10)



**PHEV charging strategy via user preferences and its impacts on power system network** *Ahmad, Mohd Redzuan; Musirin, Ismail; Othman, Muhammad Murtadha & Rahmat, Nur Azzammudin*

**Abstract:** Uncontrolled PHEVs charging will cause severe impacts on a power system network, especially on the distribution system; i.e. feeders, cables and transformers overload hence shortened its life. In this paper, PHEV charging strategy namely SOC-based charging has been proposed. This charging strategy focused on user needs, i.e. full charged the battery within plugged-in time frame considering maximum charging rate from the standard outlet. Moreover, it will reduce the peak loads as well as improving the load factor on a power system network. Real vehicle travel data from National Household Travel Survey (NHTS) is used to represent PHEV types, miles driven and its final arriving times. This proposed technique also comprehensively used to present the impact of charging PHEV on power system networks considering PHEV battery sizes and maximum charging levels. Vehicles Charging Load Profile (VCLP) is developed and implemented in IEEE 30-bus test system that represents a portion of American Electric Power System (Midwestern US). Normalization technique is used to represent real time loads of IEEE 30-bus test system. Comparative study has been performed with respect to uncontrolled charging technique. Results indicated that the proposed charging strategy not only achieved the required battery capacity but also has improved peak load and load factor thus reduces impacts on power system networks.

**Subject Area:** Plug-in Hybrid-Electric Vehicle; electricity demands profile; impact of PHEV charging; load profile; transportation electrification

**Availability:** Ahmad, Mohd Redzuan, et al. "PHEV charging strategy via user preferences and its impacts on power system network." Energy Conversion (CENCON), 2014 IEEE Conference on. IEEE, 2014. [http://ieeexplore.ieee.org/xpls/abs\\_all.jsp?arnumber=6967470](http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6967470)

## **Vehicle Fuel Economy And Vehicle Miles Traveled: An Empirical Investigation Of Jevons' Paradox** *Vincent Vinola Munyon*

**Abstract:** There has been, in recent decades, a concerted effort to promote energy efficiency as a means to reduce energy consumption, along the supply and demand sides. The general thesis is that, *ceteris paribus*, an increase in energy efficiency would lead to a decrease in the consumption of the good or service rendered efficient. This is in opposition to Jevons' Paradox which states that "It is wholly a confusion of ideas to suppose that the economical use of fuel is equivalent to a diminished consumption. The very contrary is the truth..." (Jevons, 1865). While many studies have applied Jevons' Paradox to various sectors to estimate rebound effects, few have examined if Jevons' Paradox holds when all available factors that could affect consumption of an efficient good/service are controlled for. This study hoped to fill that gap in literature. The study looked at vehicle fuel economy and vehicle miles travelled (VMT) and examined if, all else being equal, a vehicle that was more fuel efficient accrued greater VMT. Using data from the National Household Travel Survey (NHTS, 2009), a multivariate regression model was built (N = 82,485) controlling for driver, household and vehicle attributes. The findings indicated that, at the microlevel, Jevons' Paradox does hold true; a 1% increase in fuel efficiency was associated with a 1.2% increase in VMT.

**Subject Area:** Jevons Paradox; Energy efficiency; Fuel economy; Vehicle Miles Traveled; Rebound

**Availability:** Munyon, Vincent. Vehicle Fuel Economy And Vehicle Miles Traveled: An Empirical Investigation Of Jevons' paradox. Diss. Cleveland State University, 2014.  
[https://etd.ohiolink.edu/ap/10?0::NO:10:P10\\_ACCESSION\\_NUM:csu1415710122](https://etd.ohiolink.edu/ap/10?0::NO:10:P10_ACCESSION_NUM:csu1415710122)

## **Study on orderly charging management of EVs based on demand response**

*Huiying Zhang; Xin Ai; Zili Gao; & Lei Yan*

**Abstract:** Large-scale electric vehicles (EVs) connected to the power system would bring extensive negative impacts on power system operation and control. Based on this situation, this paper puts forward a coordinated schedule strategy about the charging and discharging of electric vehicles both at the scale charging station and smart residential area. The strategy adopts the demand response (DR) scheme, namely, the charging and discharging behavior of the electric vehicles are controlled by the time-of-use price (TOU). With the electricity price as a level, in order to smooth the fluctuation of load and enhance the profit of users, this paper builds a scheduling strategy model and solved by adaptive mutation particle swarm optimization to reduce the influence of premature of standard particle swarm algorithm on optimization result. Finally, through examples, the reasonable pricing mechanism for peak-valley charging and discharging as proposed in the paper has proved to be effective in smoothing the system load, and the users' economic benefits are satisfied at the same time. Meanwhile, the performance contrast between traditional PSO algorithm and improved PSO algorithm, it is proved that the latter is more effective for dealing with high-dimensional problems.

**Subject Area:** EV (electric vehicle); charging schedule; demand response

**Availability:** Zhang, Huiying, et al. "Study on orderly charging management of EVs based on demand response." *Transportation Electrification Asia-Pacific (ITEC Asia-Pacific)*, 2014 IEEE Conference and Expo. IEEE, 2014.

[http://ieeexplore.ieee.org/xpls/abs\\_all.jsp?arnumber=6940709](http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6940709)

**Economic evaluation for EVCS with ancillary service provision capability** *Yu Rongrong; Yao Chen; Xing Huang; & De La Parra, H.Z.*

**Abstract:** In this paper, a generic methodology was proposed to evaluate economic performance of EVCS (electric vehicle charging station) with ancillary service provision capability, considering EV (electric vehicle) arrival/leave distribution, EV battery degradation and compensation subsidy for EV owner. EVCS at office parking site was exemplified for illustrative case study. Ancillary service market data in NYISO (New York Independent System Operator) was adopted to generate evaluation results. The results show that ancillary service provision can bring considerable benefits (measured by NPV, net present value) for EVCS owner under acceptable payback even though the capital cost and operation cost may be increased.

**Subject Area:** Batteries; Charging stations; Degradation; Economics; Frequency control; Resource management; Vehicles

**Availability:** Yu, Rongrong, et al. "Economic evaluation for EVCS with ancillary service provision capability." *Transportation Electrification Asia-Pacific (ITEC Asia-Pacific)*, 2014 IEEE Conference and Expo. IEEE, 2014. [http://ieeexplore.ieee.org/xpls/abs\\_all.jsp?arnumber=6940932](http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6940932)

## **Impacts of electric vehicles on power grid considering time series of TOU** *Lei Yan; Xin Ai; Yao Wang; & Huiying Zhang*

**Abstract:** As large amounts of EVs connect to power grid, in the future, this paper proposes the optional mode of TOU (Time-of-use) shift the load of EVs to relief the burden of power grid. Analyzing the users' habits without control, this paper establishes single-user and multiple-users charging mode. Simulated by Monte Carlo method, the load with EV and the peak-valley difference will be aggregated. Therefore, EVs' charge-discharge load model considering TOU is proposed. To minimize the peak-valley difference, the paper introduce genetic algorithm to achieve the optimal time series of TOU strategy. Lastly, the numerical example demonstrates the molds in this paper.

**Subject Area:** EV (electric vehicle); TOU (Time-of-use); genetic algorithm

**Availability:** Yan, Lei, et al. "Impacts of electric vehicles on power grid considering time series of TOU." *Transportation Electrification Asia-Pacific (ITEC Asia-Pacific)*, 2014 IEEE Conference and Expo. IEEE, 2014. [http://ieeexplore.ieee.org/xpls/abs\\_all.jsp?arnumber=6940711](http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6940711)

## **A Comprehensive System of Energy Intensity Indicators for the U.S.: Methods, Data and Key Trends** *DB Belzer*

**Abstract:** This report describes a comprehensive system of energy intensity indicators for the United States that has been developed for the Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE) over the past decade. This system of indicators is hierarchical in nature, beginning with detailed indexes of energy intensity for various sectors of the economy, which are ultimately aggregated to an overall energy intensity index for the economy as a whole. The aggregation of energy intensity indexes to higher levels in the hierarchy is performed with a version of the Log Mean Divisia index (LMDI) method. Based upon the data and methods in the system of indicators, the economy-wide energy intensity index shows a decline of about 14% in 2011 relative to a 1985 base year. Discussion of energy intensity indicators for each of the broad end-use sectors of the economy—residential, commercial, industrial, and transportation—is presented in the report. An analysis of recent changes in the efficiency of electricity generation in the U.S. is also included. A detailed appendix describes the data sources and methodology behind the energy intensity indicators for each sector.

**Subject Area:** Energy intensity indicators; electricity generation efficiency; Log Mean Divisia

**Availability:** Belzer, David B. A Comprehensive System of Energy Intensity Indicators for the US: Methods, Data and Key Trends. No. PNNL-22267. Pacific Northwest National Laboratory (PNNL), Richland, WA (US), 2014.

[http://www.pnnl.gov/main/publications/external/technical\\_reports/PNNL-22267.pdf](http://www.pnnl.gov/main/publications/external/technical_reports/PNNL-22267.pdf)

## **On the Objectives of Industrial Engineering from the Perspectives of the Energy Efficiency** *Chen Zhou*

**Abstract:** The focus of Industrial engineering has always been efficiency. While industrial engineering has contributed significantly to the improvement of productivity and quality of life, the objective function in the models used in industrial engineering normally measures of efficiency of products or processes. However, the efficiencies of products or services are normally indirect measures of quality of life. Therefore, this paper will illustrate some discrepancies between what we measure and what we need in some aspects of energy efficiency. In manufacturing, transportation, and services, energy efficiency has improved tremendously using the current measures in food processing, in fuel efficiency of cars and trucks, or in heating and air conditioning. However, the total energy consumption per capita in developed countries remains high. The improvement in products and processes may not be reflected in serving human needs. For example, while car fuel efficiency has improved many times in the last 100 years, commuting times become longer and longer. Commuting time is directly related to our livelihood in modern cities, as measured in some basic elements of Maslow's hierarchy of human needs. This paper intends to draw attention to the measure or objective function in optimizations through the perspectives of energy efficiency. We first gather information on improvements in energy efficiency in cars, food supply chains, and heating and air conditioning systems in commonly accepted measures. We will then contrast them with the improvements in satisfying human needs. The evidence reveals interesting food for thought for industrial engineering and for engineering and science in general. In addition, we developed an energy efficiency measure for commuting that is directly linked to our needs, demonstrated its usage with some examples, and provided ideas for future research. We hope our measure on energy efficiency in commuting would lead to new measures or objectives for industrial engineers in product design, manufacturing, transportation, process design, and city planning.

**Subject Area:** Energy efficiency, human needs, commute, industrial engineering, energy consumption, commuting time

**Availability:** Zhou, Chen. "On the Objectives of Industrial Engineering from the Perspectives of the Energy Efficiency." *Journal of Industrial Engineering and Management Innovation* 1.1 (2014): 39-51. [http://www.atlantis-press.com/php/download\\_paper.php?id=14483](http://www.atlantis-press.com/php/download_paper.php?id=14483)

## **Uncertainties of EV Charging and Effects on Well-Being Analysis of Generating Systems** *Xu, N. Z., & Chung, C. Y.*

**Abstract:** Power systems can make use of electric vehicle (EV) charging to improve system reliability. EV charging can serve the grid with charging interruption and vehicle-to-grid (V2G) capacity—injecting energy back into the system during the outage. However, the contribution of EVs is uncertain because they serve both the power system and the transportation sector. Scheduled EV charging can be affected either by failures of components such as charging facilities, or by human errors such as punctuality, rounding of time and errors in forecast of energy consumption. Moreover, with the introduction of the aggregator, the realization of EVs' grid services also plays an important role. This paper examines uncertainties of EV charging that can affect the EVs' capability to improve the system reliability. Methods are proposed to incorporate these uncertainties into generating system well-being analysis. Results show that the uncertainties identified directly affect EVs' contribution in the system well-being enhancement.

**Subject Area:** Aggregator, electric vehicle (EV) charging, risk assessment, uncertainty, vehicle-to-grid (V2G), & well-being

**Availability:** Xu, N. Z., and C. Y. Chung. "Uncertainties of EV Charging and Effects on Well-Being Analysis of Generating Systems. [http://ieeexplore.ieee.org/xpls/abs\\_all.jsp?arnumber=6933954](http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6933954)



**Impact of Wind-Based Distributed Generation on Electric Energy in Distribution Systems Embedded With Electric Vehicles** *Abdelsamad, S., Morsi, W. & Sidhu, T.*

**Abstract:** In this paper, the synergy between wind-based distributed generation (DG) and plug-in electric vehicles (PEVs) is studied. Monte Carlo is used to address the uncertainties associated with wind speed variations and charging of PEVs hence simulating their impact at the distribution system (DS) level considering different DG penetration (up to 35%) and different PEV penetration (up to 50%). The excess in active/reactive power, energy exceeding normal (EEN), unserved energy (UE), and energy losses are investigated in this study. Forty-eight penetration scenarios involving DGs and PEVs are studied in this work and simulated in the IEEE 123-bus radial power distribution test system after modeling its secondary circuit in OpenDSS. The results of the simulation show that 30% wind-based DG penetration may be adequate to supply the active energy needed to charge PEVs. However, this might result in a reverse reactive power flow back to the substation.

**Subject Area:** Batteries, Clustering algorithms, Electric vehicles, Indexes, Reactive power, Wind speed

**Availability:** Abdelsamad, S., W. Morsi, and T. Sidhu. "Impact of Wind-Based Distributed Generation on Electric Energy in Distribution Systems Embedded With Electric Vehicles." [http://ieeexplore.ieee.org/xpls/abs\\_all.jsp?arnumber=6922582](http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6922582)

## **Centralized and Decentralized Optimal Scheduling for Charging Electric Vehicles** *Liang Zhang, Zheng Yan, Donghan Feng, Gang Wang, Shaolun Xu, Naihu Li, and Lei Jing*

**Abstract:** Uncoordinated charging of large-scale electric vehicles (EVs) will have a negative impact on the secure and economic operation of the power system. Given that the charging load of EVs can be controlled to some extent, research on the optimal charging control of EVs has been extensively carried out. In this paper, two possible smart charging scenarios in China are studied: centralized optimal charging operated by an aggregator and decentralized optimal charging managed by individual users. Under the assumption that the aggregators and individual users only concern the economic benefits, new load peaks will arise under time of use (TOU) pricing which is extensively employed in China. To solve this problem, a simple incentive mechanism is proposed for centralized optimal charging while a rolling-update pricing scheme is devised for decentralized optimal charging. The original optimal charging models are modified to account for the developed schemes. Simulated tests corroborate the efficacy of optimal scheduling for charging EVs in various scenarios.

**Subject Area:** Centralized optimal charging, decentralized optimal charging, electric vehicles, incentive, rolling-update price.

**Availability:** Zhang, Liang, et al. "Centralized and Decentralized Optimal Scheduling for Charging Electric Vehicles." arXiv preprint arXiv:1410.3899 (2014).  
<http://arxiv.org/ftp/arxiv/papers/1410/1410.3899.pdf>

**A new intelligent method for optimal coordination of vehicle-to-grid plug-in electric vehicles in power systems** *Mohammad-Reza Akbari-Zadeh, Farzaneh Kavousi-Fard, Rasool Hoseinzadeh, Aliasghar Baziar, & Sadreddin Saleh*

**Abstract:** Plug-in Electric Vehicles (PEVs) will play significant role in the future smart grids. In this regard, the increasing appearance of PEVs can create new challenges in the optimal operation of these devices. In this way, this paper suggests a new method for optimal coordination of PEVs for reducing the total cost of the system during the day. The proposed method makes use of the idea of vehicle-to-grid (V2G) for shifting the energy demand in the grid. The problem is then formulated in an intelligent framework based on bat algorithm (BA) and Monte Carlo method to be solved optimally. Meanwhile, we suggest a new modification method for BA to improve its search ability for optimal coordination of PEVs. The proposed problem is examined on the IEEE test system with five PEV fleets.

**Subject Area:** Plug-in Electric Vehicle (PEV), Vehicle-to-Grid (V2G), Modified Bat Algorithm (MBA)

**Availability:** Akbari-Zadeh, Mohammad-Reza, et al. "A new intelligent method for optimal coordination of vehicle-to-grid plug-in electric vehicles in power systems." *Journal of Intelligent and Fuzzy Systems*. <http://iospress.metapress.com/index/K30801162Q204444.pdf>

## **Layered and Distributed Charge Load Dispatch of Considerable Electric Vehicles** *Shao, C.; Wang, X.; Wang, X.; & Du, C.*

**Abstract:** Cooperation between controllable loads such as electrical vehicles (EVs) and wind power is regarded as a promising way to promote the integration of wind power. A novel layered and distributed charging load dispatch mechanism is proposed for the control of thousands of EVs in this paper. Based on the Lagrangian Relaxation and Auxiliary Problem Principle, the dispatch framework is developed, consisting of layers of system operator, generation units/EV aggregators, and EVs, and the cooperation between the generation and EVs is considered. Furthermore, the necessity of EV aggregators is analyzed, and the function of them is stressed. Compared with existing distributed methods, the proposed method is proper for large populations of EVs and gains an advantage in reducing generation cost directly. In addition, it is with a wider application scope such as problems with coupled constraints. The case study on IEEE-RTS verifies the method is feasible and valid and the charge load dispatch based on it reduces generation cost and wind power spillage.

**Subject Area:** Auxiliary Problem Principle; EV charge control; Lagrangian Relaxation; electric vehicle (EV) aggregators; layered and distributed charge load dispatch

**Availability:** Shao, Chengcheng, Xifan Wang, and C. Du. "Layered and Distributed Charge Load Dispatch of Considerable Electric Vehicles."

[http://ieeexplore.ieee.org/xpls/abs\\_all.jsp?arnumber=6917215](http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6917215)

## **Forecast of Performance Parameters of Automotive Fuel Cell Systems – Delphi Study Results** *M. Thoennes, A. Busse, & L. Eckstein*

**Abstract:** Fuel cells are a promising propulsion technology option in sustainable and zero-emission drivetrain strategies as they offer a high potential to significantly reduce well-to-wheel greenhouse gas emissions and the dependency on fossil energy resources. At the same time, the current technological performance of automotive fuel cell systems is not yet sufficient to meet market demands. Therefore, the technical development of fuel cells is a critical factor for a successful market introduction of fuel cell electric vehicles (FCEV). This paper describes the methodology and results of a two-round Delphi Survey conducted by the Institut für Kraftfahrzeuge of RWTH Aachen University to assess the technological potential of polymer electrolyte membrane fuel cell (PEMFC) systems in automotive applications by 2030. The analysis of the current and future performance level of key performance indicators (KPI) of automotive fuel cell systems helps to identify critical performance parameters and to prioritize research and development demands. KPI analyzed in the Delphi Survey as forecast parameters include system efficiency, durability, power density, and specific power.

**Subject Area:** Delphi Study; Durability; Fuel Cell Electric Vehicle; Fuel Cell System; Fuel Cells; Hydrogen; PEMFC; Power Density; System Efficiency; Specific Power

**Availability:** Thoennes, M., A. Busse, and L. Eckstein. "Forecast of Performance Parameters of Automotive Fuel Cell Systems–Delphi Study Results." *Fuel Cells* (2014).  
<http://onlinelibrary.wiley.com/doi/10.1002/face.201400035/full>

## **Utility Factors Derived From Beijing Passenger Car Travel Survey** *Xiaobin Zhang & Hewu Wang*

**Abstract:** This study is aimed to reveal the high sensitivity of PHEVs and BEVs utilization to real using and charging conditions in a specific region (Beijing, China). GPS loggers are adopted to collect driving data of near 10,000 km travel distance for about 4,892 trips in 2003 travel days. UFs of PHEV and BEV under various charging patterns are studied and compared. The results show that the utilization of PHEVs as well as BEVs are intensively affected by charging patterns, and constant public place charging brings more benefit compared with deploying charging infrastructures everywhere. If the CD range exceeds 100 km or AER reaches 150 km, only night charging is necessary. Cost and benefit analysis of BEV based on UF indicates AER less than 200 km is a cost-effective choice for the current Beijing passenger car travel pattern.

**Subject Area:** utility factor; plug-in hybrid vehicle; driving pattern; GPS logger; charging pattern

**Availability:** Zhang, Xiaobin, and Hewu Wang. "Utility Factors Derived From Beijing Passenger Car Travel Survey."

[http://www.dae.tsinghua.edu.cn/publish/dae/4364/20101220102833065470806/2\)%20Utility%20factors%20derived%20from%20Beijing%20Passenger%20car%20travel%20survey.pdf](http://www.dae.tsinghua.edu.cn/publish/dae/4364/20101220102833065470806/2)%20Utility%20factors%20derived%20from%20Beijing%20Passenger%20car%20travel%20survey.pdf)

## **Dynamic Control and Optimization of Distributed Energy Resources in a Microgrid** *Trudie Wang, Dan O'Neill, & Haresh Kamath*

**Abstract:** As we transition towards a power grid that is increasingly based on energy from renewable resources like solar and wind, the intelligent control of distributed energy resources (DER) including photovoltaic (PV) arrays, controllable loads, energy storage and plug-in electric vehicles (EVs) will be critical to realizing a power grid that can handle both the variability and unpredictability of renewable energy sources as well as increasing system complexity. In addition to providing added system reliability, DERs acting in coordination can be leveraged to address supply and demand imbalances through demand response (DR) and/or price signals on the electric power grid by enabling continuous bidirectional load balancing. Intelligent control and integration has the capability to reduce or shift demand peaks and improve grid efficiency by displacing the amount of backup generation needed and offsetting the need for spinning reserves and peaking power plants. Because of the intractable scale of the optimization problem with variables and constraints for every DER, load and generator online at each time period, we use an iterative decentralized method to operate each DER independently and autonomously within this environment. This method was developed in [1] using a distributed algorithm referred to as the Alternating Direction Method of Multipliers (ADMM). The site operates as a small microgrid that can participate in the wholesale market on the power grid or operate off-grid in an islanded state. The ADMM algorithm is deployed within a Model Predictive Control (MPC) framework to allow the microgrid to distribute the optimization among the individual DERs and dynamically adapt to changes in the operating environment while responding to external real-time wholesale prices and potential contingency situations. At each time step, embedded controllers model their own DERs as optimization problems with local objectives subject to individual constraints and forecasts. They then use the ADMM algorithm to solve the problem and obtain a control schedule across the MPC horizon. The local objectives are augmented with a regularization term that includes a simple exchanged message between neighbors in the microgrid. This is the only communication required between DERs. Through the exchange of these messages, the decentralized method rapidly converges to an optimal solution for the entire microgrid when each DER is able to locally solve its own problem efficiently in parallel. Once solved, the controllers execute the first step of the schedule and await the next time step at which point they re-solve the problem using any new information that arrives to augment their forecasts over the planning horizon and account for changes in operating state. This iterative optimization process is repeated for every time step thereafter, ensuring a robust and flexible framework that dynamically adapts to changes in the operating environment.

**Subject Area:** energy grid

**Availability:** Wang, Trudie, Dan O'Neill, and Haresh Kamath. "Dynamic Control and Optimization of Distributed Energy Resources in a Microgrid." arXiv preprint arXiv:1410.0054 (2014). <http://arxiv.org/abs/1410.0054>

## **Evaluating Charging Service Reliability for Plug-In EVs From the Distribution Network Aspect** *Cheng, L. Chang, Y. Wu, Q. & Lin, W*

**Abstract:** The demands for reducing city pollutant emissions and for reducing fossil fuel consumption have stimulated the development of plug-in electric vehicles (EVs). From the perspective of distribution systems, evaluating the reliability of their charging services for EVs should be essential because reliable charging services would help to encourage the use of EVs and accelerate their deployment. However, the existing literature does not fully explore the fact that the charging processes of EVs can be considered interruptible. Modeling the charging demands as interruptible loads, this paper proposes a systematic charging service reliability evaluation algorithm for distribution systems. First, novel indices specialized for describing the reliability of charging services are proposed. Then, a method for extracting EV integration patterns is proposed. The method features the capability of describing the geographical dispersion of EV integrations, enabling careful inspection of the reliability at each load point in a distribution system. Third, the algorithm considers how charging profiles under uncoordinated and coordinated charging strategies will be affected by electric supply interruptions, as charging strategies would have an effect on the reliability. Finally, a case study is carried out on an existing distribution system in Guizhou Province, China, providing a reference for the planning and operations of distribution systems.

**Subject Area:** Electric vehicles; Power distribution; Power supplies; Power system reliability

**Availability:** Cheng, Lin, et al. "Evaluating Charging Service Reliability for Plug-In EVs From the Distribution Network Aspect." *Sustainable Energy, IEEE Transactions on* 5.4 (2014): 1287-1296. [http://ieeexplore.ieee.org/xpls/abs\\_all.jsp?arnumber=6895147](http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6895147)



## **Harnessing Demand Flexibility to Minimize Cost, Facilitate Renewable Integration, and Provide Ancillary Services** *Mahdi Kefayati*

**Abstract:** In this thesis, we focus on harnessing demand flexibility as a key to enabling more renewable integration and cost reduction. We start with a data driven analysis of the potential of flexible demands. We first show that, if left unmanaged, these loads can jeopardize grid reliability by exacerbating the peaks in the load profile and increasing the negative correlation of demand with wind energy production. Then, we propose a simple local policy with very limited information and minimal coordination that besides avoiding undesired effects, has the positive side-effect of substantially increasing the correlation of flexible demand with wind energy production. We then propose improved localized charging policies that counter balance intermittency. Next, we consider the case where real-time prices are employed to provide incentives for demand response. We consider a flexible load under such a pricing scheme and obtain the optimal policy for responding to stochastic price signals to minimize the expected cost of energy. We show that this optimal policy follows a multi-threshold form and propose a recursive method to obtain these thresholds. We then extend our results to obtain optimal policies for simultaneous energy consumption and ancillary service provision by flexible loads as well as optimal policies for operation of storage assets under similar real-time stochastic prices. We prove that the optimal policy in all these cases admits a computationally efficient form. Moreover, we show that while optimal response to prices reduces energy costs, it will result in increased volatility in the aggregate demand which is undesirable. We then discuss how aggregation of flexible loads can take us a step further by transforming the loads to controllable assets that help maintain grid reliability by counterbalancing the intermittency due to renewables. We explore the value of load flexibility in the context of a restructured electricity market. To this end, we introduce a model that economically incentivizes the load to reveal its flexibility and provides cost-comfort trade-offs to the consumers. We establish the performance of our proposed model through evaluation of the price reductions that can be provided to the users compared to uncontrolled and uncoordinated consumption. We show that a key advantage of aggregation and coordination is provision of regulation" to the system by load, which can account for a considerable price reduction. The proposed scheme is also capable of preventing distribution network overloads. Finally, we extend our flexible load coordination problem to a multi-settlement market setup and propose a stochastic programming approach in obtaining day-ahead market energy purchases and ancillary service sales. Our work demonstrates the potential of flexible loads in harnessing renewables by affecting the load patterns and providing mechanisms to mitigate the inherent intermittency of renewables in an economically efficient manner.

**Subject Area:** PHEV; demand flexibility; renewable energy; pricing scheme

**Availability:** Kefayati, Mahdi. Harnessing demand flexibility to minimize cost, facilitate renewable integration, and provide ancillary services. University of Texas at Austin Diss. 2014. <http://repositories.lib.utexas.edu/handle/2152/25987>

## **Modeling of electric vehicle charging load and its optimal control strategy**

*Chen, Lidan & Zhang, Yao*

**Abstract:** Electric vehicle charging behavior is random, a disorderly charging load access to network will impact the power grid planning and operation largely. Firstly, by the analysis of vehicles' day trip chains, the normal and lognormal distribution are used to fitting the single trip's ending time and driving distance, respectively. Then, the charging frequency are considered and the charging load is calculated by Monte Carol method, the impact of electric vehicles charging load under different penetration on the original power load will be analyzed subsequently. Followed by this section, the optimal control strategy based on AMPSO method is developed to solve the minimization of load variance problem. Finally, a residential is selected as an example, the results illustrate that electric vehicle charging disorderly will cause peak load, and the optimal control strategy will not only stabilize the load fluctuation and peak load shifting, but also meet the needs of electric vehicle users.

**Subject Area:** Educational institutions, Electric vehicles, Electronic mail, Load modeling, Optimal control, System-on-chip

**Availability:** Chen, Lidan, and Yao Zhang. "Modeling of electric vehicle charging load and its optimal control strategy." Control Conference (CCC), 2014 33rd Chinese. IEEE, 2014.  
[http://ieeexplore.ieee.org/xpls/abs\\_all.jsp?arnumber=6896375](http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6896375)

## **Model design and realization of multi-EVSE-level electric vehicle recharging station** *Li, Yan; Wang, Jin-kuan; Han, Peng; & Han, Ying-hua*

**Abstract:** Based on the EV possession, EV customer requirements, recharging-station scales, service levels, etc., this paper constructs a high-adaptive EV recharging station model, and then builds an impact model of recharging station control method to the grid load. Simulation denotes this model can well reflect the EV recharging demand, recharging station service ability, and operation process of a certain area, moreover, it can reveal the different service level recharging strategies' influence to the distribution grid. The proposed model is beneficial for providing improved service to the EV customers with different requirements, getting a precise assessment to the recharging station construction in areas with different EV possession ratios, and also assisting the decision making of recharging station scheduling optimization.

**Subject Area:** EV; Load Control; Modelling Technology; Recharging Station

**Availability:** Li, Yan, et al. "Model design and realization of multi-EVSE-level electric vehicle recharging station." Control Conference (CCC), 2014 33rd Chinese. IEEE, 2014.

[http://ieeexplore.ieee.org/xpls/abs\\_all.jsp?arnumber=6896002](http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6896002)

## **Energy management of plug-in hybrid electric vehicles with unknown trip length** *Cong Hou, Liangfei Xu, Hewu Wang, Mingguo Ouyang, and Huei Peng*

**Abstract:** This paper proposes a novel control strategy for plug-in hybrid electric vehicles (PHEV). The minimization of the utility factor weighted fuel consumption (FCUFW), which represents the average fuel consumption in numerous trips, is firstly proposed as the objective of the energy management. In previous studies, the trip length is usually assumed to be known. Then, if it is shorter than the all-electric range (AER), a Charge Depleting–Charge Sustaining (CDCS) strategy leads to the minimum fuel consumption; otherwise, a blended strategy that spends down battery energy almost uniformly brings the minimum fuel consumption. Nevertheless, the trip length is not always known before trip in real life. To deal with the cases of unknown trip length, this paper proposes a Range ADaptive Optimal Control (RADOC) strategy to minimize the FCUFW, which utilizes the statistical information of the trip length. The RADOC strategy was verified by dynamic programming and was found to be somewhere in between the blended and CDCS strategies. Depending on the nature of the trips, the RADOC strategy was found to improve FCUFW between 0.10% and 4.07% compared with the CDCS strategy. The RADOC strategy is very close to the CDCS strategy when the PHEV is used in regular daily driving. On the contrary, the RADOC solution exhibits a “uniform battery discharging” behavior similar to the blended strategy for urban utility vehicles or taxis. The behavior of the RADOC strategy is also studied for different battery sizes and driving cycles.

**Subject Area:** PHEV energy management; AECS; CDCS; RADOC; AER

**Availability:** Hou, Cong, et al. "Energy Management of Plug-in Hybrid Electric Vehicles with Unknown Trip Length." *Journal of the Franklin Institute* (2014).

<http://www.sciencedirect.com/science/article/pii/S0016003214002002>

## **Impact of Plug-In Electric Vehicles on the Distribution Grid** *Anna, Ravi, and D. K. Jain*

**Abstract:** Pollution due to greenhouse gas emissions in urban areas and excessive dependence fossil fuel has been a huge threat in the sustainable development of the transportation sector. So, there is a need for a solution that can tackle this situation. Electric vehicles can be one of the most promising remedies to tackle this problem. They provide energy conservation and environmental protection. Electric vehicles are propelled by an electric motor powered by rechargeable battery packs. They have both positive and negative impact on the power grid. For instance, in order to evaluate the impact on electric vehicles on demand profile, one needs to know about 1)charging process of electric vehicles, 2) amount of electrical energy required, 3) amount of power required, 4)state of charge of the battery. This paper extracts the comparison between the load profile of the distribution system without EV's and with EV's connected. Also it shows the voltage unbalance caused by EV's interconnection with the grid.

**Subject Area:** Electric vehicles; load profile; charging process; voltage unbalance

**Availability:** Anna, Ravi, and D. K. Jain. "Impact of Plug-In Electric Vehicles on the Distribution Grid." [http://www.ieeejournal.com/Vol\\_5\\_No\\_7/Impact%20of%20Plug-In%20Electric%20Vehicles%20on%20the%20Distribution%20Grid.pdf](http://www.ieeejournal.com/Vol_5_No_7/Impact%20of%20Plug-In%20Electric%20Vehicles%20on%20the%20Distribution%20Grid.pdf)

## **Energy management of plug-in hybrid electric vehicles with unknown trip length** *Cong Hou, Liangfei Xu, Hewu Wang, Minggao Ouyang, and Hwei Peng*

**Abstract:** This paper proposes a novel control strategy for plug-in hybrid electric vehicles (PHEV). The minimization of the utility factor weighted fuel consumption (FCUFW), which represents the average fuel consumption in numerous trips, is firstly proposed as the objective of the energy management. In previous studies, the trip length is usually assumed to be known. Then, if it is shorter than the all-electric range (AER), a Charge Depleting–Charge Sustaining (CDCS) strategy leads to the minimum fuel consumption; otherwise, a blended strategy that spends down battery energy almost uniformly brings the minimum fuel consumption. Nevertheless, the trip length is not always known before trip in real life. To deal with the cases of unknown trip length, this paper proposes a Range ADaptive Optimal Control (RADOC) strategy to minimize the FCUFW, which utilizes the statistical information of the trip length. The RADOC strategy was verified by dynamic programming and was found to be somewhere in between the blended and CDCS strategies. Depending on the nature of the trips, the RADOC strategy was found to improve FCUFW between 0.10% and 4.07% compared with the CDCS strategy. The RADOC strategy is very close to the CDCS strategy when the PHEV is used in regular daily driving. On the contrary, the RADOC solution exhibits a “uniform battery discharging” behavior similar to the blended strategy for urban utility vehicles or taxis. The behavior of the RADOC strategy is also studied for different battery sizes and driving cycles.

**Subject Area:** PHEV energy management;

**Availability:** Anna, Ravi, and D. K. Jain. "Impact of Plug-In Electric Vehicles on the Distribution Grid." [http://www.ieeejournal.com/Vol\\_5\\_No\\_7/Impact%20of%20Plug-In%20Electric%20Vehicles%20on%20the%20Distribution%20Grid.pdf](http://www.ieeejournal.com/Vol_5_No_7/Impact%20of%20Plug-In%20Electric%20Vehicles%20on%20the%20Distribution%20Grid.pdf)

**Analysis of the Impact of Different PEV Battery Chargers during Faults** *Andrew D. Clarke, Himanshu A. Bihani, Elham B. Makram, Keith A. Corzine*

**Abstract:** With a high penetration of Plug-In Electric Vehicles (PEVs) in the electric grid, utilities will have to face the challenges related to them. Considerable research is being done to study and mitigate the impact of PEVs on the electric grid and devise methodologies to utilize them for energy storage and distributed generation. In this paper, the impact of PEVs in a smart car park, placed in an unbalanced distribution system, during a single line to ground fault with auto-recloser operation is studied. Level-2, bidirectional battery chargers with current-controlled and voltage-controlled voltage source converters are modeled for the battery charging systems of the PEVs. A smart car park, with 16 vehicles connected to each of the three phases is simulated at one of the buses in the IEEE 13 Bus Test Feeder. The impacts observed during the fault are analyzed and a method to mitigate them is suggested.

**Subject Area:** Electric Vehicles, Battery Chargers, Voltage Source Converters, Current Control, Voltage Control, Power Distribution Faults

**Availability:** Clarke, Andrew D., et al. "Analysis of the Impact of Different PEV Battery Chargers during Faults." *Journal of Power and Energy Engineering* 2.08 (2014): 31.  
<http://www.scirp.org/journal/PaperInformation.aspx?paperID=48742>

# Optimizing and Diversifying Electric Vehicle Driving Range for U.S. Drivers

Zhenhong Lin

**Abstract:** Properly determining the driving range is critical for accurately predicting the sales and social benefits of battery electric vehicles (BEVs). This study proposes a framework for optimizing the driving range by minimizing the sum of battery price, electricity cost, and range limitation cost—referred to as the “range-related cost”—as a measurement of range anxiety. The objective function is linked to policy-relevant parameters, including battery cost and price markup, battery utilization, charging infrastructure availability, vehicle efficiency, electricity and gasoline prices, household vehicle ownership, daily driving patterns, discount rate, and perceived vehicle lifetime. Qualitative discussion of the framework and its empirical application to a sample (N = 36,664) representing new car drivers in the United States is included. The quantitative results strongly suggest that ranges of less than 100 miles are likely to be more popular in the BEV market for a long period of time. The average optimal range among U.S. drivers is found to be largely inelastic. Still, battery cost reduction significantly drives BEV demand toward longer ranges, whereas improvement in the charging infrastructure is found to significantly drive BEV demand toward shorter ranges. The bias of a single-range assumption and the effects of range optimization and diversification in reducing such biases are both found to be significant.

**Subject Area:** electric vehicle; range anxiety; optimal design; transportation energy; alternative fuel infrastructure

**Availability:** Lin, Zhenhong. "Optimizing and Diversifying Electric Vehicle Driving Range for US Drivers." *Transportation Science* (2014).

<http://pubsonline.informs.org/doi/abs/10.1287/trsc.2013.0516>



## **Coordinated Bidding of Ancillary Services for Vehicle-to-Grid Using Fuzzy Optimization** *Ansari, M.; Al-Awami, A.T.; Sortomme, E.; & Abido, M.A.*

**Abstract:** Electric vehicles (EVs) can be effectively integrated with the power grid through vehicle-to-grid (V2G). V2G has been proven to reduce the EV owner cost, support the power grid, and generate revenues for the EV owner. Due to regulatory and physical considerations, aggregators are necessary for EVs to participate in electricity markets. The aggregator combines the capacities of many EVs and bids their aggregated capacity into electricity markets. In this paper, an optimal bidding of ancillary services coordinated across different markets, namely regulation and spinning reserves, is proposed. This coordinated bidding considers electricity market uncertainties using fuzzy optimization. The electricity market parameters are forecasted using autoregressive integrated moving average (ARIMA) models. The fuzzy set theory is used to model the uncertainties in the forecasted data of the electricity market, such as ancillary service prices and their deployment signals. Simulations are performed on a hypothetical group of 10 000 EVs in the electric reliability council of Texas electricity markets. The results show the benefit of the proposed fuzzy algorithm compared with previously proposed deterministic algorithms that do not consider market uncertainties.

**Subject Area:** Electric vehicles (EVs); electricity market; fuzzy set theory; regulation service; smart grid; vehicle-to-grid (V2G)

**Availability:** Ansari, Muhammad, et al. "Coordinated Bidding of Ancillary Services for Vehicle-to-Grid Using Fuzzy Optimization."

[http://ieeexplore.ieee.org/xpls/abs\\_all.jsp?arnumber=6872593](http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6872593)

**Analysis of fluid-dynamic guidelines in diesel particulate filter sizing for fuel consumption reduction in post-turbo and pre-turbo placement** *J.R. Serrano, H. Climent, P. Piqueras, & E. Angiolini*

**Abstract:** Wall-flow particulate filters are in the present days a standard aftertreatment system widely used in diesel engines to reduce particle emissions and meet emission regulations. This paper deals with the analysis of the macro- and meso-geometry definition of the DPF monoliths from a fluid-dynamic modelling approach. Focus is driven to the analysis of the influence on pressure drop and hence on engine fuel economy.

The influence of the DPF volume on the engine performance is analysed with a gas dynamic software including both post-turbo and pre-turbo placement under clean and soot loading conditions. A swept in cell density is also considered for different thermal integrity factors. This approach allows analysing the trends in pressure drop and cell unit geometric parameters defining the monolith thermal and mechanical performance. A discussion considering constant specific filtration area and constant filtration area is performed providing a comprehensive understanding of the DPF and engine response as volume and cellular geometry are changed. Results are leading to rigorously justify known but usually empirical guidelines for DPF design in post-turbo applications. A discussion on the potential for monolith volume reduction in pre-turbo applications with respect to the post-turbo baseline is addressed. This is based on the very low sensitivity of fuel consumption and pressure drop both to volume reduction and soot and ash loading with pre-turbo DPF configuration.

**Subject Area:** Diesel engine; DPF sizing; Pressure-drop; Fuel consumption; Pre-turbo aftertreatment

**Availability:** Serrano, J. R., et al. "Analysis of fluid-dynamic guidelines in diesel particulate filter sizing for fuel consumption reduction in post-turbo and pre-turbo placement." *Applied Energy* 132 (2014): 507-523. <http://www.sciencedirect.com/science/article/pii/S0306261914007259>

## **Adaptive Electric Vehicle Charging Coordination on Distribution Network** *Hua, L; Wang, J; & Zhou, C*

**Abstract:** Electric vehicles (EVs) with large battery charging demands may cause detrimental impact on distribution grid stability without EV charging coordination. This paper proposes an on-line adaptive EV charging scheduling (OACS) framework to optimize EV charging schedules and reduce flow limit, voltage magnitude limit, 3-phase voltage imbalance limit, and transformer capacity violations. EV user convenience is considered and EV charging cost is optimized. DC power flow based optimizations is proposed for EV charging scheduling approximation and parallel ac power flow verification is used to verify the scheduling results. Incremental feasibility improvement procedure is further proposed to correct the scheduling discrepancy between dc linear model and the ac model. Experiments are performed on a modified IEEE 34 14.7 kV distribution system with different EV penetration levels to demonstrate performance comparisons between different scheduling schemes. The result shows that our proposed OACS framework optimizes the EV charging coordination problem efficiently.

**Subject Area:** Demand coordination; distribution grid; electric vehicle (EV); optimization model; smart grid

**Availability:** Hua, Lunci, Jia Wang, and Chi Zhou. "Adaptive Electric Vehicle Charging Coordination on Distribution Network."

[http://ieeexplore.ieee.org/xpls/abs\\_all.jsp?arnumber=6863680](http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6863680)

**Plug-in electric vehicles in electric distribution networks: A review of smart charging approaches** *J. García-Villalobos, I. Zamora, J.I. San Martín, F.J. Asensio, & V. Aperribay*

**Abstract:** Plug-in electric vehicles (PEV) are emerging as an efficient and sustainable alternative for private and public road transportation. From the point of view of electric grids, PEVs are currently considered as simple loads due to their low market penetration. However, as the PEV fleet grows, implementation of an intelligent management system will be necessary in order to avoid large capital expenditures in network reinforcements and negative effects on electric distribution networks, such as: voltage deviations, transformers and lines saturations, increase of electrical losses, etc. These issues may jeopardize the safety and reliability of the grid. As a consequence, this topic has been researched in many papers where a wide range of solutions have been proposed. This paper presents a review of different strategies, algorithms and methods to implement a smart charging control system. Also significant projects around the world about PEVs integration are presented. Finally, on the basis of this review, main findings and some recommendations are presented.

**Subject Area:** Plug-in electric vehicles; Smart charging; Distribution networks

**Availability:** García-Villalobos, J., et al. "Plug-in electric vehicles in electric distribution networks: A review of smart charging approaches." *Renewable and Sustainable Energy Reviews* 38 (2014): 717-731. <http://www.sciencedirect.com/science/article/pii/S1364032114004924>

**Finite Action-Set Learning Automata for Economic Dispatch Considering Electric Vehicles and Renewable Energy Sources** *Junpeng Zhu, Ping Jiang, Wei Gu, Wanxing Sheng, Xiaoli Meng and Jun Gao*

**Abstract:** The coming interaction between a growing electrified vehicle fleet and the desired growth in renewable energy provides new insights into the economic dispatch (ED) problem. This paper presents an economic dispatch model that considers electric vehicle charging, battery exchange stations, and wind farms. This ED model is a high-dimensional, non-linear, and stochastic problem and its solution requires powerful methods. A new finite action-set learning automata (FALA)-based approach that has the ability to adapt to a stochastic environment is proposed. The feasibility of the proposed approach is demonstrated in a modified IEEE 30 bus system. It is compared with continuous action-set learning automata and particle swarm optimization-based approaches in terms of convergence characteristics, computational efficiency, and solution quality. Simulation results show that the proposed FALA-based approach was indeed capable of more efficiently obtaining the approximately optimal solution. In addition, by using an optimal dispatch schedule for the interaction between electric vehicle stations and power systems, it is possible to reduce the gap between demand and power generation at different times of the day.

**Subject Area:** economic dispatch; stochastic optimization; electric vehicles; wind power; learning automata

**Availability:** Zhu, Junpeng, et al. "Finite Action-Set Learning Automata for Economic Dispatch Considering Electric Vehicles and Renewable Energy Sources." *Energies* 7.7 (2014): 4629-4647. <http://www.mdpi.com/1996-1073/7/7/4629/htm>

## **Aggregate modeling and control of plug-in electric vehicles for renewable power tracking** *Ebrahimi, B & Mohammadpour, J.*

**Abstract:** A robust strategy is proposed in this paper to control the aggregate charging power of plug-in electric vehicles (PEVs). The charging flexibility of PEVs provides the intermittent renewable power sources with control authority to cope with load fluctuations caused by the variation of grid-connected PEVs population and their instantaneous power demand. In this paper, we consider an aggregate model of PEVs power in the form of a partial differential equation (PDE). A sliding mode control is then developed for the derived PDE load model with no discretization in the spatial domain. The developed sliding mode controller operates on the real-time measurable imbalance between source and demand power. To evaluate the closed-loop response and demonstrate the controller's robustness against PEVs population variations, a Monte Carlo simulation is performed for real driving conditions and using renewable power data.

**Subject Area:** Aggregates, Load modeling, Mathematical model, Sociology, Statistics, Switches, Wind power generation

**Availability:** Ebrahimi, Behrouz, and Javad Mohammadpour. "Aggregate modeling and control of plug-in electric vehicles for renewable power tracking." American Control Conference (ACC), 2014. IEEE, 2014. [http://ieeexplore.ieee.org/xpls/abs\\_all.jsp?arnumber=6859169](http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6859169)

## **Optimal Operation and Services Scheduling for an Electric Vehicle Battery Swapping Station** *Sarker, M.R., Pandzic, H., & Ortega-Vazquez, M.A.*

**Abstract:** For a successful rollout of electric vehicles (EVs), it is required to establish an adequate charging infrastructure. The adequate access to such infrastructure would help to mitigate concerns associated with limited EV range and long charging times. Battery swapping stations are poised as effective means of eliminating the long waiting times associated with charging the EV batteries. These stations are mediators between the power system and their customers. In order to successfully deploy this type of stations, a business and operating model is required, that will allow it to generate profits while offering a fast and reliable alternative to charging batteries. This paper proposes an optimization framework for the operating model of battery swapping stations. The proposed model considers the day-ahead scheduling process. Battery demand uncertainty is modeled using inventory robust optimization, while multi-band robust optimization is employed to model electricity price uncertainty. The results show the viability of the proposed model as a business case, as well as the effectiveness of the model to provide the required service.

**Subject Area:** Battery swapping station; electric vehicles; energy storage; robust optimization

**Availability:** Sarker, Mushfiqur R., H. Pandzic, and Miguel A. Ortega-Vazquez. "Optimal Operation and Services Scheduling for an Electric Vehicle Battery Swapping Station."  
[http://ieeexplore.ieee.org/xpls/abs\\_all.jsp?arnumber=6857439](http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6857439)

## **An Illustrative Look at Energy Flow through Hybrid Powertrains for Design and Analysis** *Eli Hampton White*

**Abstract:** Throughout the past several years, a major push has been made for the automotive industry to provide vehicles with lower environmental impacts while maintaining safety, performance, and overall appeal. Various legislation has been put into place to establish guidelines for these improvements and serve as a challenge for automakers all over the world. In light of these changes, hybrid technologies have been growing immensely on the market today as customers are seeing the benefits with lower fuel consumption and higher efficiency vehicles. With the need for hybrids rising, it is vital for the engineers of this age to understand the importance of advanced vehicle technologies and learn how and why these vehicles can change the world as we know it. To help in the education process, this thesis seeks to define a powertrain model created and developed to help users understand the basics behind hybrid vehicles and the effects of these advanced technologies.

One of the main goals of this research is to maintain a simplified approach to model development. There are very complex vehicle simulation models in the market today, however these can be hard to manipulate and even more difficult to understand. The 1 Hz model described within this work aims to allow energy to be simply and understandably traced through a hybrid powertrain. Through the use of a “backwards” energy tracking method, demand for a drive cycle is found using a drive cycle and vehicle parameters. This demand is then used to determine what amount of energy would be required at each component within the powertrain all the way from the wheels to the fuel source, taking into account component losses and accessory loads on the vehicle. Various energy management strategies are developed and explained including controls for regenerative braking, Battery Electric Vehicles, and Thermostatic and Load-following Series Hybrid Electric Vehicles. After validating this model, several studies are completed. First, an example of using this model to design a hybrid powertrain is conducted. This study moves from defining system requirements to component selection, and then finding the best powertrain to accomplish the given constraints. Next, a parameter known as Power Split Fraction is studied to provide insight on how it affects overall powertrain efficiency. Since the goal with advanced vehicle powertrains is to increase overall system efficiency and reduce overall energy consumption, it is important to understand how all of the factors involved affect the system as a whole. After completing these studies, this thesis moves on to discussing future work which will continue refining this model and making it more applicable for design. Overall, this work seeks to provide an educational tool and aid in the development of the automotive engineers of tomorrow.

**Subject Area:** hybrid technology; vehicle powertrain

**Availability:** White, Eli Hampton. An Illustrative Look at Energy Flow through Hybrid Powertrains for Design and Analysis. Diss. Virginia Polytechnic Institute and State University, 2014. <http://vtechworks.lib.vt.edu/handle/10919/49433>



## **Development of a Series Parallel Energy Management Strategy for Charge Sustaining PHEV Operation** *Peter Christopher Manning*

**Abstract:** The Hybrid Electric Vehicle Team of Virginia Tech (HEVT) is participating in the 2012-2014 EcoCAR 2: Plugging in to the Future Advanced Vehicle Technology Competition series organized by Argonne National Lab (ANL), and sponsored by General Motors Corporation (GM) and the U.S. Department of Energy (DOE). The goals of the competition are to reduce well-to-wheel (WTW) petroleum energy consumption (PEU), WTW greenhouse gas (GHG) and criteria emissions while maintaining vehicle performance, consumer acceptability and safety. Following the EcoCAR 2 Vehicle Development Process (VDP) of designing, building, and refining an advanced technology vehicle over the course of the three year competition using a 2013 Chevrolet Malibu donated by GM as a base vehicle, the selected powertrain is a Series-Parallel Plug-In Hybrid Electric Vehicle (PHEV) with P2 (between engine and transmission) and P4 (rear axle) motors, a lithium ion battery pack, an internal combustion engine, and an automatic transmission. Development of a charge sustaining control strategy for this vehicle involves coordination of controls for each of the main powertrain components through a distributed control strategy. For example, the algorithm accounts for a variety of system operating points and will penalize or reward certain operating points for other conditions. These conditions include but are not limited to rewards for discharging the battery when the state of charge (SOC) is above the target value or penalties for operating points with excessive emissions.

Development of diagnostics and remedial actions is an important part of controlling the powertrain safely. In order to validate the control strategy prior to in-vehicle operation, simulations are run against a plant model of the vehicle systems. This paper details the development of the controls for diagnostics, major selection algorithms, and execution of commands and its integration into the Series-Parallel PHEV through the supervisory controller. This paper also covers the plant model development and testing of the control algorithms using controller SIL and HIL methods. This paper details reasons for any changes to the control system, and describes improvements or tradeoffs that had to be made to the control system architecture for the vehicle to run reliably and meet its target specifications. Test results illustrate how changes to the plant model and control code properly affect operation of the control system in the actual vehicle. The VT Malibu is operational and projected to perform well at the final competition.

**Subject Area:** PHEV

**Availability:** Manning, Peter Christopher. Development of a Series Parallel Energy Management Strategy for Charge Sustaining PHEV Operation. Diss. Virginia Polytechnic Institute and State University, 2014. <http://vtechworks.lib.vt.edu/handle/10919/49436>

## **Study on the economic and environmental benefits of different EV powertrain topologies** *Bin Wang, Min Xu, Li Yang*

**Abstract:** Numerous feasible schemes of powertrain topology can be designed for the electric vehicles (EVs) based on the distributed configurations of the electric motors. In this study, the effects of different EV powertrain topologies on the energy efficiency, vehicle ownership cost and lifecycle greenhouse gas (GHG) emissions of EVs are investigated. Energy-based vehicle simulation model including the regenerative braking function and battery degradation prediction method is established firstly. An optimization scheme combining the energy-based vehicle simulation model is conducted to minimize the electric energy consumption under various scenarios and driving conditions. Then the vehicle ownership cost and lifecycle GHG emissions of EVs are evaluated based on Chinese EV market and electricity grid. The sensitivity analyses of EV powertrain topology are implemented based on the different vehicle weights, CO<sub>2</sub> intensities of electricity and all-electric ranges. Results show that EVs using the powertrain of wheel-hub drive with the gear reducer have lower energy consumption. Furthermore, the driving cycles with more aggressive acceleration/deceleration and frequently stop-and-go conditions can increase both the vehicle ownership cost and lifecycle GHG emissions simultaneously. Chinese city traffic conditions will help EVs to obtain more benefits in respect of the economy and environment.

**Subject Area:** Electric vehicles; EV powertrain topology; Energy economy; Lifecycle analysis

**Availability:** Wang, Bin, Min Xu, and Li Yang. "Study on the economic and environmental benefits of different EV powertrain topologies." *Energy Conversion and Management* 86 (2014): 916-926. <http://www.sciencedirect.com/science/article/pii/S0196890414004889>

**Cooperative Dispatch of Wind Generation and Electric Vehicles With Battery Storage Capacity Constraints in SCUC** *Shao, C.; Wang, X.; Wang, X.; Du, C.; Dang, C.; Liu, S.*

**Abstract:** Load dispatch such as Vehicle-to-Grid (V2G) control of electric vehicles (EVs) is taken as a promising way to promote the integration of wind power. This paper proposes a cooperation model of EVs and wind generation based on the security-constrained unit commitment (SCUC). Different from existing works, it pays special attentions to the model and constraints of EV aggregators. The distribution pattern of user trips is included and the dynamic process of stored energy is analyzed in the model. The constraints that EVs can't charge and discharge simultaneously are proved to be redundant under some conditions on theory and the necessity of battery storage constraints are explained via numerical examples. The proposed model is verified in case studies on the IEEE-RTS. The results show that V2G can not only improve the efficiency of thermal units but also promote the integration of wind power. Factors influencing storage violations are also analyzed.

**Subject Area:** Battery storage capacity constraints; EV aggregator model; SCUC; V2G control; load dispatch

**Availability:** Shao, Chengcheng, et al. "Cooperative Dispatch of Wind Generation and Electric Vehicles With Battery Storage Capacity Constraints in SCUC." 1-8.  
[http://ieeexplore.ieee.org/xpls/abs\\_all.jsp?arnumber=6837496](http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6837496)

## **The Reign of EVs? An Economic Analysis from Consumer's Perspective** *Fan, Z. & Oviedo, R.*

**Abstract:** Traditionally, petroleum (oil) has been the main source of energy for the U.S. national economy and transportation sector. In 2010, 83% of all the energy required by the United States was provided by fossil fuel sources. The energy use in the United States can be divided into four broad sectors: transportation, residential, commercial, and industrial. The transportation sector accounts for 28% of the total energy demand, and 96% of the energy used in this particular sector comes from fossil fuel. Based on records for 2011 and 2012, to satisfy these energy requirements, the United States needs to import, on average, 337,143 Mbbl (1 Mbbl = 1,000 oil barrels) of crude oil and petroleum products per month. Nearly 70% of the imported oil is allocated to the transportation sector to satisfy the fuel demands of cars, trucks, airplanes, and marine transport. Figure 1 shows the petroleum flow in the United States in millions of barrels per day. The high U.S. dependency on foreign oil together with the continually increasing price of oil and its derivatives have encouraged the national policy of reducing oil dependency by promoting carbon fuel (gasoline) displacement in the transport sector.

**Subject Area:** Batteries; Electric vehicles; Electricity supply industry; Energy management; Fuels; Petroleum; Transportation

**Availability:** Fan, Z., and R. Oviedo. "The Reign of EVs? An Economic Analysis from Consumer's Perspective." *Electrification Magazine*, IEEE 2.2 (2014): 61-71.

[http://ieeexplore.ieee.org/xpls/abs\\_all.jsp?arnumber=6841679](http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6841679)

**A review on the applications of driving data and traffic information for vehicles' energy conservation** *Abbas Fotouhi, Rubiyah Yusofa, Rasoul Rahmania, Saad Mekhilefb, & Neda Shateria*

**Abstract:** A large portion of energy consumption in the world is related to transportation. In recent decades, a variety of technologies have been innovated and applied in order to decrease vehicles energy consumption. In this paper, a comprehensive review on the use of driving data and traffic information for vehicles energy conservation is done. The main aim of this paper is the development of a framework for classification and comparative assessment of various methods and technologies, in which driving data or traffic information are utilized for vehicles energy conservation. The applications are classified into three main categories including (1) traffic monitoring and management systems, (2) intelligent energy management systems in vehicles and (3) intelligent management of charging issues. Research topics in each category are explained and their respective effectiveness in vehicles energy consumption reduction is discussed. The review concludes that the use of the driving data and traffic information leads to remarkable improvements in vehicles energy consumption reduction.

**Subject Area:** Driving data; Traffic information; Energy conservation; Vehicle

**Availability:** Fotouhi, Abbas, et al. "A review on the applications of driving data and traffic information for vehicles' energy conservation." *Renewable and Sustainable Energy Reviews* 37 (2014): 822-833. <http://www.sciencedirect.com/science/article/pii/S136403211400402X>

## **Probability Model and Simulation Method of Electric Vehicle Charging Load on Distribution Network** *Niancheng Zhou, Xicong Xiong & Qianggang Wang*

**Abstract:** This article studies the charging characteristics of different kinds of electric vehicles and, in particular, improves the sampling method of initial state-of-charge for hybrid electric vehicles. With consideration of the influences that the charging time may exert on a customer choice of charging start time, and introducing the quantity of simultaneously charging electric vehicles, a probability model of a hybrid electric vehicle charging load is built. Then an improved probability simulation method of charging demand is proposed for multiple kinds of electric vehicles connected with a distribution grid. Finally, the impact of charging electric vehicles is analyzed based on an IEEE 34-node test feeder.

**Subject Area:** pure electric vehicle, distribution network, hierarchical classification, hybrid electric vehicle, state-of-charge, charging load, Monte Carlo simulation, probability model, quick charging, battery swap

**Availability:** Zhou, Niancheng, Xicong Xiong, and Qianggang Wang. "Probability Model and Simulation Method of Electric Vehicle Charging Load on Distribution Network." *Electric Power Components and Systems* 42.9 (2014): 879-888.

<http://www.tandfonline.com/doi/abs/10.1080/15325008.2014.903537>

## **Stochastic Modeling and Forecasting of Load Demand for Electric Bus Battery-Swap Station** *Dai, Q.; Cai, T.; Duan, S.; & Zhao, F.*

**Abstract:** Electric-vehicle (EV) battery-swap stations (BSSs) have become important infrastructures for the development of EVs to extend their driving range. Due to the randomness of batteries' swapping and charging patterns, the load demand of the BSS has a stochastic nature. It is necessary to investigate the charging load characteristics of BSS to guide the coordinated battery charging for mitigating the impact of disorderly charging behaviors on the distribution network. Under the uncontrolled swapping and charging scenario, four variables are essential: 1) hourly number of EVs for battery swapping; 2) the charging start time; 3) the travel distance; and 4) the charging duration. Taking these factors into account, a novel model based on Monte Carlo simulation is presented to estimate uncontrolled energy consumption of the BSS. Then, a generic nonparametric method for the estimation of prediction uncertainty of charging load demand is introduced. Adopting an actual typical BSS as an example, the simulation results show that the proposed prediction methods of the BSS charging load and probabilistic interval are suitable for forecasting the horizon 24 h ahead.

**Subject Area:** Battery-swap station (BSS); Monte–Carlo Simulation; charging load forecasting; charging load model; electric vehicles (EVs); probability interval forecast

**Availability:** Dai, Qian, et al. "Stochastic Modeling and Forecasting of Load Demand for Electric Bus Battery-Swap Station." 1-1. [http://ieeexplore.ieee.org/xpls/abs\\_all.jsp?arnumber=6778111](http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6778111)

## **Potential power system and fuel consumption impacts of plug in hybrid vehicle charging using Australian National Electricity Market load profiles and transportation survey data** *Graham Mills & Iain MacGill*

**Abstract:** Future electric vehicle (EV) deployment raises the potential for opportunities and challenges for policy makers in both the electricity and transportation sectors. This paper describes the development of a simple, time based simulation tool for assessing plug-in hybrid EV charging load and gasoline consumption under a range of standard charging infrastructure and charge control scenarios. This tool is intended for use by power system planners and other policy makers in evaluating a range of possible load outcomes arising from EV integration. Australian vehicle trip data from the New South Wales Household Transport Survey is used with the introduced model to assess the impact of EV charging load on the 2011 Australian National Electricity Market load profile. Results are presented which address a gap in existing literature with respect to EV load profiles in the Australian context with findings which include (1) that the provision of non-residential (public) charging infrastructure is beneficial for both vehicle owners and power system load profiles, (2) that fast charging in the residential context represents a significant risk to the power system if not accompanied by charging control, (3) that inappropriate Time-of-Use electricity tariffs may lead to poor outcomes at high penetration levels, and (4) that there are trade-offs between benefits for the power system and the amount of gasoline consumed by the vehicle fleet when charging is restricted to occur overnight. Given the current focus on Time-of-Use electricity tariffs as the primary mechanism for influencing EVs recharging, the finding that inappropriate Time-of-Use electricity tariffs lead to poor outcomes at high penetration levels is significant for long term EV integration planning.

**Subject Area:** Electric vehicle; EV; Plug in hybrid electric vehicle; Australia; National Electricity Market; Demand forecasting

**Availability:** Mills, Graham, and Iain MacGill. "Potential power system and fuel consumption impacts of plug in hybrid vehicle charging using Australian National Electricity Market load profiles and transportation survey data." *Electric Power Systems Research* 116 (2014): 1-11. <http://www.sciencedirect.com/science/article/pii/S0378779614001588>



## **Transportation Systems And The Built Environment: A Life-Cycle Energy Case Study And Analysis** *Brice G. Nichols and Kara M. Kockelman*

**Abstract:** The built environment can be used to influence travel demand, but very few studies consider the relative energy savings of such policies in context of a complex urban system. This analysis quantifies the day-to-day and embodied energy consumption of four different neighborhoods in Austin, Texas, to examine how built environment variations influence various sources of urban energy consumption. A microsimulation combines models for petroleum use (from driving) and residential and commercial power and natural gas use with rigorously measured building stock and infrastructure materials quantities (to arrive at embodied energy). Results indicate that the more suburban neighborhoods, with mostly detached single-family homes, consume up to 320% more embodied energy, 150% more operational energy, and about 160% more total life-cycle energy (per capita) than a densely developed neighborhood with mostly low-rise-apartments and duplexes. Across all neighborhoods, operational energy use comprised 83 to 92% of total energy use, and transportation sources (including personal vehicles and transit, plus street, parking structure, and sidewalk infrastructure) made up 44 to 47% of the life-cycle energy demands tallied. Energy elasticity calculations across the neighborhoods suggest that increased population density and reduced residential unit size offer greatest life-cycle energy savings per capita, by reducing both operational demands from driving and home energy use, and from less embodied energy from construction. The results support the notion that transportation and the built environment are strongly linked, and improving urban energy efficiency must come from policies and designs targeting embodied sources, not just a household's travel and daily energy consumption.

**Subject Area:** Life-cycle energy use, urban systems, neighborhood design, built environment, vehicle-miles traveled, land use patterns, sustainability levers, smart growth

**Availability:** Life-Cycle Energy Implications of Different Residential Settings: Recognizing Buildings, Travel and Public Infrastructure. Brice Nichols, *Energy Policy* 68: 232-242 (2014). [http://www.caee.utexas.edu/prof/kockelman/public\\_html/TRB14neighborhoodsLCA.pdf](http://www.caee.utexas.edu/prof/kockelman/public_html/TRB14neighborhoodsLCA.pdf)

## **Urban Form And Life-Cycle Energy Consumption: Case Studies For Five U.S. Cities** *Brice G. Nichols and Kara M. Kockelman*

**Abstract:** This work estimates life-cycle energy demands for residents and workers in different built environment settings. By combining daily (operations) and embodied energy demands, the work provides a holistic analysis of energy demands by sector and usage phase, at a large scale. Pivoting off previous work to develop life-cycle analyses (LCAs) of different neighborhood types in Austin, Texas, this analysis extends these neighborhood results to fabricate five different city types, reflecting actual accessibility, resident and employment density profiles. Five residential and three commercial neighborhood types are distributed across a 10-mile circular model, and total city life-cycle energy demands are calculated. Results quantify total energy demands for these city forms (using Austin neighborhood characteristics as the basis) and provide a rare view of total annual energy demands from the urban residential and commercial sectors. Results indicate that, as expected, per-capita daily energy demands decrease with increased resident and employment density. However, results also indicate that embodied energy savings with increased density are relatively much greater, and therefore life-cycle energy savings should also be considered when evaluating efficiency benefits of density. Even though results show that embodied energy makes up only 10-20% of total life-cycle energy, per-capita energy savings with increased density suggest it may be an aspect important to include in planning analyses. Average life-cycle per-capita energy use ranges from 140 GJ/year/capita in the least dense Orlando-style setting to around 90 GJ/year/capita in the maximum-density scenario, corresponding to a 35% reduction in per-capita energy demand. Energy reductions for other neighborhood setting (relative to an Orlando-based design) increase with density, at 18, 22, and 24% per-capita demands for Phoenix, Austin, and Seattle settings, respectively. The findings suggest that urbanization can be controlled in a way that significantly reduces energy demands if resident and employment density is encouraged.

**Subject Area:** life-cycle energy demand;

**Availability:** Nichols, Brice G., and Kara M. Kockelman. "Urban Form And Life-Cycle Energy Consumption: Case Studies For Five Us Cities." Proceedings of the World Symposium on Transport and Land Use Research (WSTLUR), Delft, Netherlands (2014).

[http://www.caee.utexas.edu/prof/kockelman/public\\_html/TRB15wholecitiesLCA.pdf](http://www.caee.utexas.edu/prof/kockelman/public_html/TRB15wholecitiesLCA.pdf)

## **Research on the Performance of Cooling Module with Fuel Cell Vehicle** *He Chang, Xiumin Yu and Jing Hua Lv*

**Abstract:** Cooling-module simulation for the fuel cell car has been built according with CFD and KULI software. The simulation results are compared with the test data to verify the authenticity of the module. Based on 3D and 1D calculation of the module is done to analyze the effect on the performance of the cooling module for fuel cell car.

**Subject Area:** Cooling module, fuel cell car, performance, simulation

**Availability:** Chang, He, Y. U. Xiumin, and Jing Hua Lv. "Research on the Performance of Cooling Module with Fuel Cell Vehicle." *Open Mechanical Engineering Journal* 8 (2014): 117-120.  
<http://www.benthamscience.com/open/tomej/articles/V008/TOMEJ140501003.pdf>

## **Coordinating plug-in electric vehicle charging with electric grid: valley filling and target load following** *Li Zhang, Faryar Jabbari, Tim Brown, & Scott Samuelsen*

**Abstract:** Plug-in electric vehicles (PEVs) shift energy consumption from petroleum to electricity for the personal transportation sector. This work proposes a decentralized charging protocol for PEVs with grid operators updating the cost signal. Each PEV calculates its own optimal charging profile only once based on the cost signal, after it is plugged in, and sends the result back to the grid operators. Grid operators only need to aggregate charging profiles and update the load and cost. The existing PEV characteristics, national household travel survey (NHTS), California Independent System Operator (CAISO) demand, and estimates for future renewable generation in California are used to simulate PEV operation, PEV charging profiles, grid demand, and grid net load (demand minus renewable). Results show the proposed protocol has good performance for overnight net load valley filling if the costs to be minimized are proportional to the net load. Annual results are shown in terms of overnight load variation and comparisons are made with grid level valley filling results. Further, a target load can be approached in the same manner by using the gap between current load and the target load as the cost. The communication effort involved is quite modest.

**Subject Area:** plug-in electric vehicle; grid operation; PEV charging; decentralized control; valley filling

**Availability:** Zhang, Li, et al. "Coordinating plug-in electric vehicle charging with electric grid: valley filling and target load following." *Journal of Power Sources* (2014).  
<http://www.sciencedirect.com/science/article/pii/S0378775314005783>

## **Rapid-Charging Navigation of Electric Vehicles Based on Real-Time Power Systems and Traffic Data** *Guo, Q., Xin, S.; Sun, H.; Li, Z.; & Zhang, B*

**Abstract:** With recent changes in the availability and diversity of plug-in electric vehicles (PEVs) in the United States, there is increasing research interest in the interaction between PEVs and the electric grid. Extensive work in the literature examines these interactions with the assumption that the timing of PEV charging will be scheduled, and that charging loads can be adjusted dynamically at the behest of the utility and the system operator. While it might be technically feasible to aggregate the data on driver schedules and historical PEV use and charging decisions, it is unclear whether PEV owners will readily share these data and accept partial third-party control of their vehicle's charging. Given the uncertainty in the future relationships between electric utilities and PEV owners, this study examines the region-level effects of PEV charging in the absence of the additional data utilities would need to realize these idealized charging scenarios. In particular, this study focuses on temporally-resolved prediction of electricity demand needed to serve PEV charging loads if charge scheduling or control is not widespread. Vehicle trip data from the National Household Travel Survey (NHTS) were converted into individual vehicle charging profiles. Monte Carlo methods were then used with these profiles to simulate electricity demand for PEV charging. These simulations include accounting for the potential demographic characteristics of PEV drivers and the estimated charging behavior of those drivers. The simulation results were validated using empirical vehicle charging data collected by the Pecan Street Research Consortium from households in Austin, Texas. The simulation results compared favorably with the empirical data, estimating charging behavior to within 7% throughout most of the day. Two different simulation approaches were considered to show that a reduced-order simulation approach yields similar results. Finally, having demonstrated the stability of the simulation to assumptions about PEV owner demographics and PEV type-dependent charging patterns, the simulation results were used to determine the effect of unscheduled PEV charging on peak load in three different regions, Texas, New York, and New England, with three PEV fleet growth projections. These results indicate that for the moderate growth scenario considered, unscheduled charging will increase peak load by less than 1% by 2025 in each of the three regions.

**Subject Area:** Charge; distribution network; electric vehicle (EV); traffic control

**Availability:** Guo, Qinglai, et al. "Rapid-Charging Navigation of Electric Vehicles Based on Real-Time Power Systems and Traffic Data." 1-1.

[http://ieeexplore.ieee.org/xpl/login.jsp?tp=&arnumber=6805663&url=http%3A%2F%2Fieeexplore.ieee.org%2Fxppls%2Fabs\\_all.jsp%3Farnumber%3D6805663](http://ieeexplore.ieee.org/xpl/login.jsp?tp=&arnumber=6805663&url=http%3A%2F%2Fieeexplore.ieee.org%2Fxppls%2Fabs_all.jsp%3Farnumber%3D6805663)

## **An empirically-validated methodology to simulate electricity demand for electric vehicle charging** *Chioke B. Harris & Michael E. Webber*

**Abstract:** With recent changes in the availability and diversity of plug-in electric vehicles (PEVs) in the United States, there is increasing research interest in the interaction between PEVs and the electric grid. Extensive work in the literature examines these interactions with the assumption that the timing of PEV charging will be scheduled, and that charging loads can be adjusted dynamically at the behest of the utility and the system operator. While it might be technically feasible to aggregate the data on driver schedules and historical PEV use and charging decisions, it is unclear whether PEV owners will readily share these data and accept partial third-party control of their vehicle's charging. Given the uncertainty in the future relationships between electric utilities and PEV owners, this study examines the region-level effects of PEV charging in the absence of the additional data utilities would need to realize these idealized charging scenarios. In particular, this study focuses on temporally-resolved prediction of electricity demand needed to serve PEV charging loads if charge scheduling or control is not widespread. Vehicle trip data from the National Household Travel Survey (NHTS) were converted into individual vehicle charging profiles. Monte Carlo methods were then used with these profiles to simulate electricity demand for PEV charging. These simulations include accounting for the potential demographic characteristics of PEV drivers and the estimated charging behavior of those drivers. The simulation results were validated using empirical vehicle charging data collected by the Pecan Street Research Consortium from households in Austin, Texas. The simulation results compared favorably with the empirical data, estimating charging behavior to within 7% throughout most of the day. Two different simulation approaches were considered to show that a reduced-order simulation approach yields similar results. Finally, having demonstrated the stability of the simulation to assumptions about PEV owner demographics and PEV type-dependent charging patterns, the simulation results were used to determine the effect of unscheduled PEV charging on peak load in three different regions, Texas, New York, and New England, with three PEV fleet growth projections. These results indicate that for the moderate growth scenario considered, unscheduled charging will increase peak load by less than 1% by 2025 in each of the three regions.

**Subject Area:** Plug-in electric vehicle; Travel patterns; NHTS; PEV charging; Monte Carlo simulation

**Availability:** Harris, Chioke B., and Michael E. Webber. "An empirically-validated methodology to simulate electricity demand for electric vehicle charging." *Applied Energy* 126 (2014): 172-181. <http://www.sciencedirect.com/science/article/pii/S0306261914003183>

## **Economic Scheduling of Residential Plug-In (Hybrid) Electric Vehicle (PHEV) Charging** *Maigha and Mariesa L. Crow*

**Abstract:** In the past decade, plug-in (hybrid) electric vehicles (PHEVs) have been widely proposed as a viable alternative to internal combustion vehicles to reduce fossil fuel emissions and dependence on petroleum. Off-peak vehicle charging is frequently proposed to reduce the stress on the electric power grid by shaping the load curve. Time of use (TOU) rates have been recommended to incentivize PHEV owners to shift their charging patterns. Many utilities are not currently equipped to provide real-time use rates to their customers, but can provide two or three staggered rate levels. To date, an analysis of the optimal number of levels and rate-duration of TOU rates for a given consumer demographic versus utility generation mix has not been performed. In this paper, we propose to use the U.S. National Household Travel Survey (NHTS) database as a basis to analyze typical PHEV energy requirements. We use Monte Carlo methods to model the uncertainty inherent in battery state-of-charge and trip duration. We conclude the paper with an analysis of a different TOU rate schedule proposed by a mix of U.S. utilities. We introduce a centralized scheduling strategy for PHEV charging using a genetic algorithm to accommodate the size and complexity of the optimization.

**Subject Area:** electric vehicles; economic dispatch; energy management

**Availability:** Crow, Mariesa L. "Economic Scheduling of Residential Plug-In (Hybrid) Electric Vehicle (PHEV) Charging." *Energies* 7.4 (2014): 1876-1898. <http://www.mdpi.com/1996-1073/7/4/1876/pdf>

## **Ecodrive I-80: A Large Sample Fuel Economy Feedback Field Test** *Kenneth S. Kurani; Tai Stillwater; & Matt Jones*

**Abstract:** Energy feedback in the vehicle dashboard is one method to engage drivers in energy saving driving styles. In contrast to the occasional broadcasting of general driving tips, in-vehicle energy feedback gives drivers access to accurate information about their specific driving situation on an ongoing basis. The increasing prevalence of such feedback in new vehicles suggests a belief that the latter is effective. However, there is little reliable evidence of the effectiveness of energy feedback in real-world driving in passenger vehicles. This study begins to fill this gap. This report presents the results of a large sample eco-driving feedback study that includes 118 drivers (140 driver-vehicle combinations); the drivers reside in selected cities along the Interstate-80 corridor from San Francisco, CA to Reno and Sparks, NV. Participants are given a commercially available fuel consumption recording and display device to use in their personal vehicle for two months. The first month the display was left blank to record a baseline of driving and fuel consumption: the second month the display was switched on. The devices display one of three display designs spanning a variety of feedback modes; drivers are randomly assigned which design they will see. Using a mixed-effects linear model that controls for road grade and weather conditions, we find a statistically significant decrease of 2.7% in fuel consumption rate (grams of gasoline per meter) between the without and with-feedback months overall. We also find that drivers reduced their median trip speeds and mean acceleration rates in response to feedback. The three display designs ranged from 1.9% to 2.9% impact. Driver sex was an even greater determinant of savings with men averaging 1.9% and women 5% savings. Finally, the alignment of pre-feedback driver goals with certain designs resulted in one group achieving a 22% improvement, and we estimate that if each driver had received the optimal screen for his or her goal (rather than a random assignment) the group would have saved 9.2% overall. Analysis of households' exit interviews reveals that while many households claim that achieving good fuel economy is a goal of their driving, few can name more than three things they could do or actually do to increase fuel economy. Motivations for higher fuel economy span a range of cost savings, energy security, conservation, environmental protection, and climate change. A thematic analysis of the interview text produces a structure of four main themes, i.e., driving contexts, sense of personal control, learning, and durability over time of behaviors. Feedback can affect each of these themes and act as a bridge between them, e.g., increasing a sense of personal control over fuel economy can be accomplished by learning from feedback how personal actions affect fuel economy across driving contexts.

**Subject Area:** energy feedback; fuel economy; mixed-effects linear model

**Availability:** Kurani, Kenneth S., et al. "Ecodrive I-80: A Large Sample Fuel Economy Feedback Field Test Final Report." <http://www.fueleconomy.gov/feg/pdfs/EcoDrive%20I-80.pdf>



## **Estimating the HVAC Energy Consumption of Plug-in Electric Vehicles** *Kiran R. Kambly & Thomas H. Bradley*

**Abstract:** Plug in electric vehicles are vehicles that use energy from the electric grid to provide tractive and accessory power to the vehicle. Due to the limited specific energy of energy storage systems, the energy requirements of heating, ventilation, and air conditioning (HVAC) systems for cabin conditioning can significantly reduce their range between charges. Factors such as local ambient temperature, local solar radiation, local humidity, length of the trip and thermal soak have been identified as primary drivers of cabin conditioning loads and therefore of vehicle range. The objective of this paper is to develop a detailed systems-level approach to connect HVAC technologies and usage conditions to consumer-centric metrics of vehicle performance including energy consumption and range. This includes consideration of stochastic and transient inputs to the HVAC energy consumption model including local weather, solar loads, driving behavior, charging behavior, and regional passenger fleet population. The resulting engineering toolset is used to determine the summation of and geographical distribution of energy consumption by HVAC systems in electric vehicles, and to identify regions of US where the distributions of electric vehicle range are particularly sensitive to climate.

**Subject Area:** plug in electric vehicle; HVAC energy; cabin conditioning; electric range; thermal comfort model

**Availability:** Kambly, Kiran R., and Thomas H. Bradley. "Estimating the HVAC Energy Consumption of Plug-in Electric Vehicles." *Journal of Power Sources* (2014).  
<http://www.sciencedirect.com/science/article/pii/S037877531400216X>

## **Implementation of battery electric vehicles in 'la Mancomunidad del Sureste de Gran Canaria'** *Martijn van der Pouw*

**Abstract:** This study comprises the integration of battery-electric vehicles as means of storage in order to accommodate the increasing fluctuations in the electricity system caused by the intermittency of renewable energy sources. The study area is 'la comarca del Sureste de Gran Canaria', the southeast county of Gran Canaria. It validates the environmental benefits and the technical, business-economic and socio-economic feasibility of integrating battery-electric vehicles as a means of energy storage by comparing different scenarios for the year 2030. A technical analysis in EnergyPLAN, integrating the electric power system and transport system of the southeast, compares different battery-electric vehicle-scenarios to a conventional scenario based on gasoline- and diesel-fired vehicles. In these scenarios, as well more wind and solar power – cost-effective and abundant resources in the region – is implemented. Conclusions are drawn on the results of the renewable energy share, amount of CO<sub>2</sub>-emissions and the decrease in dependency on imported fossil fuels. A business-economic analysis compares the newest battery-electric vehicles with the newest gasoline- and diesel-fired vehicles. The investment, operation and maintenance, and fuel costs are established for the lifetime of each vehicle, based on various assumptions regarding, for example, the increase of the oil price and the discount rate. Depending on the annual driven distance, different conclusions are drawn on the cost-effectiveness of battery-electric vehicles and its fossil fired peers. A socio-economic analysis compares the different technical year 2030-scenarios in order to conclude on the regional economic development. The socio-economic consequences of the scenarios are analysed by (1), analysing the import shares of investment, operation and maintenance and fuel costs, and (2), analysing the employment effects. An analysis on the implementation of both more battery-electric vehicles and renewable energy, describes the current situation and future implications of the radical technological change as introduced in this study. Planning problems surrounding the expansion of the current wind farms are dealt with.

**Subject Area:** BEV; CO<sub>2</sub> emissions; renewable energy; wind and solar

**Availability:** van der Pouw, Martijn. "Implementation of battery-electric vehicles in 'la Mancomunidad del Sureste de Gran Canaria'."

[http://vbn.aau.dk/ws/files/72259465/Integration\\_of\\_electric\\_vehicles\\_Martijn\\_van\\_der\\_Pouw.pdf](http://vbn.aau.dk/ws/files/72259465/Integration_of_electric_vehicles_Martijn_van_der_Pouw.pdf)

## **Packetized Plug-In Electric Vehicle Charge Management** *Rezaei, P.; Frolik, J.; & Hines, P.D.H.*

**Abstract:** Plug-in electric vehicle (PEV) charging could cause significant strain on residential distribution systems, unless technologies and incentives are created to mitigate charging during times of peak residential consumption. This paper describes and evaluates a decentralized and “packetized” approach to PEV charge management, in which PEV charging is requested and approved for time-limited periods. This method, which is adapted from approaches for bandwidth sharing in communication networks, simultaneously ensures that constraints in the distribution network are satisfied, that communication bandwidth requirements are relatively small, and that each vehicle has fair access to the available power capacity. This paper compares the performance of the packetized approach to an optimization method and a first-come, first-served (FCFS) charging scheme in a test case with a constrained 500 kVA distribution feeder and time-of-use residential electricity pricing. The results show substantial advantages for the packetized approach. The algorithm provides all vehicles with equal access to constrained resources and attains near optimal travel cost performance, with low complexity and communication requirements. The proposed method does not require that vehicles report or record driving patterns, and thus provides benefits over optimization approaches by preserving privacy and reducing computation and bandwidth requirements.

**Subject Area:** Communication systems; plug-in electric vehicles; smart charging

**Availability:** Rezaei, Pooya, Jeff Frolik, and Paul Hines. "Packetized Plug-in Electric Vehicle Charge Management." [http://www.uvm.edu/~phines/publications/2014/rezaei\\_2014.pdf](http://www.uvm.edu/~phines/publications/2014/rezaei_2014.pdf)

## **Randomized PHEV Charging Under Distribution Grid Constraints** *Zhou, K.; & Cai, L.*

**Abstract:** Plug-in Hybrid Electrical Vehicles (PHEV) are promising to improve energy efficiency and environment friendliness. However, without proper control, their charging will cause harmful impact on the power distribution grid, including load congestion and voltage drop. Instead of using centralized optimization which may need accurate predictions on key parameters, in this paper, a new decentralized random access framework is introduced to schedule the PHEV charging. The proposed distributed solution does not need accurate predictions and can be executed online. Simulation on a semi-urban residential medium voltage grid shows that our algorithm can effectively provide demand response to protect the distribution grid from bus congestion and voltage drop, and also improve its efficiency. Most importantly, this algorithm is simple to deploy.

**Subject Area:** Decentralized/randomized PHEV charging; demand response; distribution grid; smart grid

**Availability:** Zhou, Kan, and Lin Cai. "Randomized PHEV charging under distribution grid constraints." IEEE Trans. Smart Grid (submitted). <http://www.ece.uvic.ca/~cai/disgrid.pdf>

## **Risk-Aware Day-Ahead Scheduling and Real-time Dispatch for Electric Vehicle Charging** *Yang, L.; Zhang, J.; & Poor, H.V.*

**Abstract:** This paper studies risk-aware day-ahead scheduling and real-time dispatch for electric vehicle (EV) charging, aiming to jointly optimize the EV charging cost and the risk of the load mismatch between the forecast and the actual EV loads, due to the random driving activities of EVs. It turns out that the consideration of the load mismatch risk in the objective function significantly complicates the risk-aware day-ahead scheduling problem (indeed it involves nonconvex optimization). A key step taken here is to utilize a hidden convexity structure to recast this problem as a two-stage stochastic linear program, and then solve it by using the L-shaped method. Since the computational complexity grows exponentially in the number of EVs, an estimation algorithm is developed based on importance sampling to mitigate the computational complexity. Further, a distributed risk-aware real-time dispatch algorithm is developed, in which the aggregator needs to compute only the shadow prices for each EV to optimize its own charging strategy in a distributed manner. It is shown, based on real data, that the proposed risk-aware day-ahead scheduling algorithm using importance sampling can significantly reduce the overall charging cost with a small number of samples.

**Subject Area:** Distributed algorithm; electric vehicles; importance sampling; smart charging; smart grids

**Availability:** Yang, Lei, Junshan Zhang, and Dajun Qian. "Risk-aware day-ahead scheduling and real-time dispatch for plug-in electric vehicles." Global Communications Conference (GLOBECOM), 2012 IEEE. IEEE, 2012.  
[http://ieeexplore.ieee.org/xpls/abs\\_all.jsp?arnumber=6503578](http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6503578)

**Plug-in Electric Vehicle Charging Demand Estimation based on Queueing Network Analysis** *Hao Liang, Isha Sharma, Weihua Zhuang, and Kankar Bhattacharya*

**Abstract:** Charging stations are critical infrastructure for the integration of plug-in electric vehicles (PEVs) in the future distribution systems. With a steadily increasing PEV penetration level, the PEV charging demands of charging stations are expected to constitute a significant portion of the total electric power demands. An accurate estimation of PEV charging demands is crucial for the planning and operation of future distribution systems. However, the estimation remains a challenging issue, as the charging demands of nearby charging stations are closely correlated to each other and depend on vehicle drivers' response to charging prices. The evaluation of charging demands is further complicated by the highly dynamic vehicle mobility, which results in random PEV arrivals and departures. In order to address these challenges, a BCMP queueing network model is presented in this paper, in which each charging station is modeled as a service center with multiple servers (chargers) and PEVs are modeled as the customers in the service centers. Based on the stationary distribution of the number of PEVs in each charging station, the statistics of PEV charging demands can be obtained. The analytical model is validated by a case study based on realistic vehicle statistics extracted from 2009 National Household Travel Survey and New York State Transportation Federation Traffic Data Viewer.

**Subject Area:** Charging station, plug-in electric vehicle, queueing network

**Availability:** Bhattacharya, Kankar. "Plug-in Electric Vehicle Charging Demand Estimation based on Queueing Network Analysis." [http://bbcr.uwaterloo.ca/~h8liang/conf\\_14\\_PESGM\\_LSZB.pdf](http://bbcr.uwaterloo.ca/~h8liang/conf_14_PESGM_LSZB.pdf)

## **A First Order Estimate of Energy Impacts of Automated Vehicles in the United States** *Don MacKenzie, Zia Wadud & Paul Leiby*

**Abstract:** A novel comprehensive calculation bounds the long-term energy implications of road vehicle automation. We combine multiple engineering estimates of the energy-efficiency benefits of vehicle automation resulting from traffic flow improvements, intelligent speed adaptation, vehicle drag reduction through platooning, and possible vehicle size and weight variations. Many of these advantages can be brought about through relatively low level of automation and are also applicable for highly automated vehicles, such as self-driving Level vehicles. However, highly-automated vehicles can have significant behavioural implications that can increase fuel consumption due to road travel. Higher speeds could offset fuel efficiency gains. Potentially lower per-mile energy costs and vehicle insurance costs (due to fewer accidents), plus a possible sharp reduction in the large cost component associated with the drivers time, can reduce total travel costs per mile. Self-driving vehicles are also hoped to enhance mobility, enabling new demographic groups travel on personal vehicles. Higher speed enabled by highly automated vehicles can also make road travel competitive with aviation (for passenger) and rail (for freight). All of these factors could increase road travel and increase energy consumption. We estimate the potential energy benefits and rebound effects using an ASIF or Kaya framework, where travel activity is endogenously determined from an economic response to estimated shifts in travel cost components, and energy intensity appears both as separate multiplicative factor and a variable contributing to the cost-based determination of activity. A wide range of potential energy outcomes highlight potentially urgent policy issues, and identify key areas for further research.

**Subject Area:** road vehicle automation; energy efficiency; ASIF; Kaya;

**Availability:** MacKenzie, Don, Zia Wadud, and Paul Leiby. "A FIRST ORDER ESTIMATE OF ENERGY IMPACTS OF AUTOMATED VEHICLES IN 1 THE UNITED STATES 2."

<http://faculty.washington.edu/dwhm/files/MacKenzie%20Wadud%20Leiby%2014-2193%20as%20submitted.pdf>

**Studying the feasibility of charging plug-in hybrid electric vehicles using photovoltaic electricity in residential distribution systems** *M.S. ElNozahy, & M.M.A. Salamaa*

**Abstract:** Recently, interest has grown in using photovoltaic (PV) electricity to charge plug-in hybrid electric vehicles (PHEVs). This paper investigates the feasibility of such a charging alternative, from a distribution system performance perspective. To achieve this goal, it is first necessary to determine the resulting aggregated impacts for both technologies when they operate in parallel. Although extensive research has explored the individual impacts of PHEVs and PV electricity on distribution networks, far too little study has been made of the interaction between these two technologies and the resulting aggregated impacts when both operate together.

This paper fills this gap by developing a probabilistic Monte Carlo (MC)-based benchmark that can be used to assess the resulting impacts when PV arrays are used to charge PHEVs. Finally, the authors compare the resulting aggregated impacts with those resulting when PHEV charging demands are met solely from the medium voltage network, in order to draw conclusions on the feasibility of such a charging alternative.

**Subject Area:** Monte Carlo simulation; Photovoltaic arrays; Plug-in hybrid electric vehicles

**Availability:** ElNozahy, M. S., and M. M. A. Salama. "Studying the feasibility of charging plug-in hybrid electric vehicles using photovoltaic electricity in residential distribution systems."

Electric Power Systems Research 110 (2014): 133-143.

<http://www.sciencedirect.com/science/article/pii/S0378779614000169>



## **Electric Vehicle Battery Swapping Station: Business Case and Optimization Model** *Mushfiqur R. Sarker, Hrvoje Pandžić, & Miguel A. Ortega-Vazquez*

**Abstract:** In order to increase the adoption rate of electric vehicles, they need to appeal to customers as much as their fossil fuel equivalents. However, major concerns include long battery charging times and range anxiety. These concerns can be mitigated if customers have access to battery swapping stations, where they can meet their motion energy requirements by swapping batteries for charged ones, in as much time as it takes to fill the gasoline reservoir of a conventional vehicle. Besides benefiting the customers, the battery swapping station is beneficial to the power system because it emulates an energy storage station capable of participating in electricity markets. In this station, the batteries can be scheduled to charge in grid-to-battery mode, inject power to the grid in battery-to-grid mode, and transfer energy between batteries in battery-to-battery mode, if there are economic advantages in doing so. This paper discusses how these various modes can be optimized and the results translated into a business case for battery swapping stations.

**Subject Area:** Battery Swapping Station, Electric Vehicles, Energy Storage, Electricity Market

**Availability:** Sarker, Mushfiqur R., Hrvoje Pandzic, and Miguel A. Ortega-Vazquez. "Electric Vehicle Battery Swapping Station: Business Case and Optimization Model."

[http://www.mushfiqsarker.com/wp-](http://www.mushfiqsarker.com/wp-content/uploads/2014/01/SarkerPandzicVazquez_BSSConferencePaper_IEEEcompatible.pdf)

[content/uploads/2014/01/SarkerPandzicVazquez\\_BSSConferencePaper\\_IEEEcompatible.pdf](http://www.mushfiqsarker.com/wp-content/uploads/2014/01/SarkerPandzicVazquez_BSSConferencePaper_IEEEcompatible.pdf)

**Daytime Charging – What is the Hierarchy of Opportunities and Customer Needs? – A Case Study Based on Atlanta Commute Data** *Danilo Santini, Yan Zhou, Vetri V. Elango, Xu Yanzi, & Randall Guensler*

**Abstract:** The charging pyramid indicates that residential charging is the foundation, with workplace charging at the next level, and public charging at the top. For intra-metro driving both PHEVs and all-electric vehicles (AEVs) can benefit from Level 1 or 2 daytime AC charging opportunities at the workplace, the house, or other locations. Many U.S. estimates of technical potential of plug-in vehicles have made use of the National Household Transportation Survey (NHTS), relying on single day vehicle samples. However, due to day-to-day variability, a similar German survey has shown that a full week sample implies a significantly smaller share of driving can be accomplished electrically by AEVs. This study uses the Commute Atlanta data base to examine a full year of data, contrasting its implications with those previously developed with NHTS single day data. Financial viability is contrasted with technical viability of plug-in electric vehicles (PEVs). Within the filtered Commute Atlanta data base used, privately held vehicles are separated into two categories — those that commute intensively (>170 days/yr.) and those that commute less or not at all. It is estimated that the daily and annual average travel of the two groups are similar. The size of the low/no commute segment of the market are larger than the intense commute market. Due to similarity of driving, it is observed that similar PHEV designs might adequately serve both markets. Opportunities to enhance financial viability via addition of daytime workplace or home charging are examined.

**Subject Area:** workplace and public charging; AEV; PHEV; commute

**Availability:** Santini, Danilo, et al. "Daytime Charging—What is the Hierarchy of Opportunities and Customer Needs?— A Case Study Based on Atlanta Commute Data 2." Transportation Research Board 93rd Annual Meeting. No. 14-5337. 2014. <http://docs.trb.org/prp/14-5337.pdf>

**Allocation of Intrahousehold Motorized Vehicles** *Richard H. Nam, Brian H. Y. Lee, Lisa Aultman-Hall, & Justine Sears*

**Abstract:** This study examines allocation of intrahousehold vehicles to drivers and trips by using data from the 2009 National Household Travel Survey and is motivated by the knowledge that reallocating household vehicles is a reasonable short-term action to reduce fuel and associated emissions. Models are developed for households in the national sample and for segmentations by population and census regions. Binomial logistic regression is used to model whether a household fleet is optimal and is a high-potential saver (HPS). Of households with two or more vehicles, 31% are classified as HPS. Linear regression is used to model the number of gallons of fuel a household can potentially save per year with vehicle reallocation. About 59% of households can reduce fuel consumption by an estimated 5.2%, or approximately 5 billion gallons of fuel nationally, if they reallocate their fleet. Household size and lifecycle, travel behavior, and fleet composition are related to allocation of intrahousehold vehicles. Similar variables are significant predictors of potential gallons of savings and whether a household is an HPS. Models are consistent across regions with minor exceptions. Rural areas had differences from more urban areas. This study has demonstrated that appreciable savings in fuel consumption and associated emissions are plausible through vehicle reallocation, and the ability to pursue this countermeasure in the short-term motivates further research to provide fuller understanding of the causal mechanisms and target households for intervention.

**Subject Area:** vehicle assignment; emissions; fuel use; binomial logistic regression

**Availability:** Bolon, Kevin M., Greg A. Keoleian, and Lidia P. Kostyniuk. "Fuel Use and Optimality of Assignments in Multivehicle Households in 2001 and 2009." *Transportation Research Record: Journal of the Transportation Research Board* 2382.1 (2013): 83-91.  
<http://trb.metapress.com/index/1V6T43L334J7R563.pdf>

## **Fuel Use and Optimality of Assignments in Multivehicle Households in 2001 and 2009** *Kevin M. Bolon, Greg A. Keoleian, & Lidia P. Kostyniuk*

**Abstract:** Multivehicle household fleets often consist of vehicles with a wide range of attributes, including passenger and cargo capacities, towing capability, and fuel consumption. Decisions for how these vehicles are assigned to trips can have a significant impact on a household's total fuel use. In this paper, actual vehicle assignments from the 2001 and 2009 National Household Travel Surveys data are compared with the decisions for minimizing fuel use by using CTRAM, a model that determines optimal vehicle-to-trip assignments while considering constraints on vehicle availability and capability. Results show that the average potential reduction in fuel use through optimal assignment for multivehicle households was 10.9% in 2001 and 10.1% in 2009. However, the corresponding increase in assignment optimality seen in this period does not appear to be the result of a greater prevalence of active, short-term vehicle assignment decisions, such as a driver's voluntary use of a nonpreferred vehicle or switching of vehicles midday. This finding provides evidence that the higher level of assignment optimality in 2009 was influenced by other, possibly longer-term, decisions such as consideration of fuel consumption in purchase decisions in accordance with the primary driver's expected usage of the vehicle (e.g., a small, efficient vehicle for long-distance work commuting). The significance of this conclusion is reinforced by the finding that increases in assignment optimality are smaller in lower-income households, possibly because of the lack of efficient vehicles in the secondary market in the years preceding the 2009 survey.

**Subject Area:** vehicle assignment; vehicle attributes; fuel use

**Availability:** Bolon, Kevin M., Greg A. Keoleian, and Lidia P. Kostyniuk. "Fuel Use and Optimality of Assignments in Multivehicle Households in 2001 and 2009." *Transportation Research Record: Journal of the Transportation Research Board* 2382.1 (2013): 83-91.  
<http://trb.metapress.com/index/1V6T43L334J7R563.pdf>

## **Cost analysis of plug-in hybrid electric vehicles using GPS-based longitudinal travel data** *Xing Wu, Jing Dong, & Zhenhong Lin*

**Abstract:** Using spatial, longitudinal travel data of 415 vehicles over 3–18 months in the Seattle metropolitan area, this paper estimates the operating costs of plug-in hybrid electric vehicles (PHEVs) of various electric ranges (10, 20, 30, and 40 miles) for 3, 5, and 10 years of payback period, considering different charging infrastructure deployment levels and gasoline prices. Some key findings were made. (1) PHEVs could help save around 60% or 40% in energy costs, compared with conventional gasoline vehicles (CGVs) or hybrid electric vehicles (HEVs), respectively. However, for motorists whose daily vehicle miles traveled (DVMT) is significant, HEVs may be even a better choice than PHEV40s, particularly in areas that lack a public charging infrastructure. (2) The incremental battery cost of large-battery PHEVs is difficult to justify based on the incremental savings of PHEVs' operating costs unless a subsidy is offered for large-battery PHEVs. (3) When the price of gasoline increases from \$4/gallon to \$5/gallon, the number of drivers who benefit from a larger battery increases significantly. (4) Although quick chargers can reduce charging time, they contribute little to energy cost savings for PHEVs, as opposed to Level-II chargers.

**Subject Area:** Plug-in hybrid electric vehicles; Operating cost; Battery cost

**Availability:** Wu, Xing, Jing Dong, and Zhenhong Lin. "Cost analysis of plug-in hybrid electric vehicles using GPS-based longitudinal travel data." *Energy Policy* (2014). <http://www.sciencedirect.com/science/article/pii/S0301421513013189>

## **Plug-In Electric Cars for Work Travel: Evaluation of Four Electric Powertrains**

*Danilo Santini, Yan Zhou, Namdoo Kim, Kevin Gallagher, & Anant D. Vyas*

**Abstract:** Vehicles with electrified powertrains such as hybrid electric vehicles, plug-in hybrid electric vehicles (PHEVs), and all-electric vehicles (AEVs, which use grid-supplied battery energy exclusively) are potentially marketable because of their low operating costs. However, each vehicle type incurs a significant initial cost penalty compared with a conventional vehicle powered by an internal combustion engine. Three PHEV cars and an AEV car are selected to assess cost-effectiveness from the consumers' perspective. Daily travel to and from work is isolated from other vehicle travel data from the U.S. National Household Travel Survey, and five daily distance categories are investigated. Three driving cycle runs are used: one developed by following cars in Los Angeles, California, in 1992, the Worldwide Harmonized Light-Duty Test Cycle, and a real driving record selected from the Kansas City metropolitan area in Kansas and Missouri. Probable charging patterns for each PHEV and the AEV are investigated for three of five daily distance categories. Overnight charging and workplace charging also are examined. The possibility for multiple charges at work is considered, as is the possibility of a charge after work, before the day's end. The degree of importance of spending a given pool of money to upgrade a residential (versus workplace) charging station is discussed. Two indicators of effectiveness of battery pack utilization are developed [a charge-depleting effectiveness factor and grid kilowatt-hours used per day per dollar of incremental vehicle expense (cost-effectiveness)], and target markets for cars used for work for each powertrain type are suggested.

**Subject Area:** PHEV; AEV; work commute; powertrain; charging station

**Availability:** Santini, Danilo, et al. "Plug-In Electric Cars for Work Travel." Transportation Research Record: Journal of the Transportation Research Board 2385.1 (2013): 53-60.  
<http://trb.metapress.com/index/H164J67237342343.pdf>

## **Charging Choices and Fuel Displacement in a Large-Scale Demonstration of Plug-In Hybrid Electric Vehicles** *Stephen Zoepf, Don MacKenzie, David Keith, & William Chernicoff*

**Abstract:** Because relatively few plug-in hybrid electric vehicles (PHEVs) have been deployed to date, existing analyses of the effects of PHEVs on gasoline and electricity demand have been based on the travel patterns of conventional vehicles and assumption-driven charging scenarios. A comprehensive analysis of a real-world fleet of 125 instrumented PHEV prototypes deployed in the United States over a 1-year period—likely the first application of a discrete choice model to the empirical analysis of plug-in vehicle charging—is presented. First, the trial is introduced, and the patterns of travel, charging behavior, and observed energy consumption are analyzed. Then, a mixed logit model of the decision to charge at the end of each trip is estimated. Results indicate that charging usually is done after the day's last trip when ending at home and when the next trip will occur in more than 3 h, even though significant heterogeneity exists between drivers. Finally, the performance of this fleet is simulated with different vehicle designs and charging patterns. Results indicate that aggressive opportunistic charging after every trip results in approximately the same fuel savings as increasing the battery size by a factor of five. However, fast charging provides only marginal changes in energy use for the observed use patterns.

**Subject Area:** PHEV; mixed logit; charging

**Availability:** Zoepf, Stephen, et al. "Charging Choices and Fuel Displacement in a Large-Scale Demonstration of Plug-In Hybrid Electric Vehicles." *Transportation Research Record: Journal of the Transportation Research Board* 2385.1 (2013): 1-10.

<http://trb.metapress.com/content/121x6h844t652155/>

## **PV Integrated Smart Charging of PHEVs Based on DC Link Voltage Sensing** Goli, P. & Shireen, W.

**Abstract:** With the proliferation in the number of PHEVs the demand on the electric grid increases appreciably. A smart charging station is proposed in which the charging of the PHEVs is controlled in such a way that the impact of charging during peak load period is not felt on the grid. The power needed to charge the plug in hybrids comes from grid-connected photovoltaic (PV) generation or the utility or both. The three way interaction between the PV, PHEVs and the grid ensures optimal usage of available power, charging time and grid stability. The system designed to achieve the desired objective consists of a photovoltaic system, DC/DC boost converter, DC/AC bi-directional converter and DC/DC buck converter. The output of DC/DC boost converter and input of DC/AC bi-directional converter share a common DC link. A unique control strategy based on DC link voltage sensing is proposed for the above system for efficient transfer of energy.

**Subject Area:** Battery management system; energy storage unit; photovoltaic; plug-in hybrid electric vehicle; smart grid

**Availability:** Goli, Preetham, and Wajiha Shireen. "PV Integrated Smart Charging of PHEVs Based on DC Link Voltage Sensing." 1-8.

[http://ieeexplore.ieee.org/xpls/abs\\_all.jsp?arnumber=6714516](http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6714516)



## **Design and Control of a Unique Hydrogen Fuel Cell Plug-In Hybrid Electric Vehicle** *Michael Giannikouris*

**Abstract:** The University of Waterloo Alternative Fuels Team (UWAFT) is a student team that designs and builds vehicles with advanced powertrains. UWAFT uses alternatives to fossil fuels because of their lower environmental impacts and the finite nature of oil resources. UWAFT participated in the EcoCAR Advanced Vehicle Technology Competition (AVTC) from 2008 to 2011. The team designed and built a Hydrogen Fuel Cell Plug-In Hybrid Electric Vehicle (FC-PHEV) and placed 3rd out of 16 universities from across North America.

UWAFT design projects offer students a unique opportunity to advance and augment their core engineering knowledge with hands-on learning in a project-based environment. The design of thermal management systems for powertrain components is a case study for design engineering which requires solving open ended problems, and is a topic that is of growing importance in undergraduate engineering courses. Students participating in this design project learn to develop strategies to overcome uncertainty and to evaluate and execute designs that are not as straightforward as those in a textbook. Electrical and control system projects require students to introduce considerations for reliability and robustness into their design processes that typically only focus on performance and function, and to make decisions that balance these considerations in an environment where these criteria impact the successful outcome of the project. The consequences of a failure or unreliable design also have serious safety implications, particularly in the implementation of powertrain controls. Students integrate safety into every step of control system design, using tools to identify and link together component failures and vehicle faults, to design detection and mitigation strategies for safety-critical failures, and to validate these strategies in real-time simulations.

Student teams have the opportunity to offer a rich learning environment for undergraduate engineering students. The design projects and resources that they provide can significantly advance student knowledge, experience, and skills in a way that complements the technical knowledge gained in the classroom. Finding ways to provide these experiences to more undergraduate students, either outside or within existing core courses, has the potential to enhance the value of program graduates.

**Subject Area:** alternative fuels, environmental impacts, safety

**Availability:** Giannikouris, Michael. "Design and Control of a Unique Hydrogen Fuel Cell Plug-In Hybrid Electric Vehicle." (2014). <https://uwspace.uwaterloo.ca/handle/10012/8144>

## **Hierarchical Agent-based Integrated Modelling Approach for Micro-grids with Adoption of EVs and HRES** *Peng Han, Jinkuan Wang, Yinghua Han, & Yan Li*

**Abstract:** The large adoption of Electric Vehicles (EVs), Hybrid Renewable Energy Systems (HRESs), and the increasing power requirements of residential, commercial and industrial loads shall bring significant challenges to the construction and operation of the micro-grid systems. The methodology to model micro-grid with high EVs and HRESs penetrations is the key to EVs adoption assessment and optimized HRESs deployment in the micro-grid. However, considering various characters, hierarchical components and complex interactions of the micro-grid containing massive EVs and HRESs, previous models built by any single modelling approaches are insufficient. Therefore in this paper, the methodology named Hierarchical Agent-based Integrated Modelling Approach (HAIMA) is proposed. With the effective integration of the agent-based modelling with other advanced modelling approaches, the proposed approach theoretically contributes to a new micro-grid model hierarchically constituted by micro-grid management layer, component layer, and event layer. In the management layer, the System Dynamics Modelling (SDM) is adopted to model the load on the micro-grid bus with multi energy inflows and outflows from the component layer, in which the object-oriented Agent-Based Modelling (ABM) is adopted to generate the main components of the micro-grid including HRES, original electricity consumers, EVs and service stations. And in the event layers, the detailed EV operation in the service stations, i.e. EV-Recharging Stations (ERS) and battery-changing stations (BCS) are modelled with the process-oriented Discrete Event Modelling (DEM) approach. Then the HAIMA further links the key parameters between models in different layers and interconnects them to achieve the interactions of the whole model while utilizing each of their features. With the combination of the hierarchical model and simulation system, the proposed HAIMA methodology will be beneficial for the study of the micro-grid and EV's operation assessment, and shall be further utilized for the energy management policy evaluation, electricity consumption prediction, the EV scheduling control, and HRES deployment optimization, assisting micro-grid utilities with a better understanding of real-time HRES generations and shall eventually help with a better short-and long-term planning of future micro-grids.

**Subject Area:** EV charging stations; HRES; agent based modelling; hierarchical agent-based integrated modelling approach (HAIMA)

**Availability:** Han, Peng, et al. "Hierarchical Agent-based Integrated Modelling Approach for Micro-grids with Adoption of EVs and HRES."

<http://downloads.hindawi.com/journals/jam/aip/808549.pdf>

## **Charging Behavior Impacts on Electric VMT: Evidence from a 2013 California Drivers Survey** *Gil Tal, Michael A. Nicholas, Jamie Davies, & Justin Woodjack*

**Abstract:** The growing plug-in electric vehicle (PEVs) market features new models of battery electric vehicles (BEVs) and Plug-in hybrid vehicles (PHEVs) with varying battery sizes and electric driving range. How are these different models being used in the real world? A common assumption in PEV impact analysis is that PEV owners will maximize their vehicle utility by appropriately sizing their battery to their driving needs and by charging their vehicles as much as possible to recover the cost of the vehicle purchase. Based on these assumptions we expect PHEV owners who drive more to plug-in more and drivers of PHEVs with small battery to plug in more than owners of vehicles with a larger battery and similar driving patterns. This paper examines the assumptions presented using a survey of more than 3,500 PEV owners conducted in California in May and June 2013. The online survey includes extensive data on driving and charging behavior using web-map questions and includes owners of all PEV models in the market including more than 600 Volts and 800 Plug-in Priuses. The results show that small battery PHEV electric vehicle miles traveled (eVMT) are lower than larger range PHEV or BEVs not only because of the battery size but also as a result of the public charging availability and charging behavior. Higher electric range PHEV drivers and BEV drivers charge more often and report more charging opportunities in the same areas that smaller battery PHEVs could not find chargers.

**Subject Area:** Plug-in hybrid electric vehicle; battery electric vehicle; eVMT; battery size

**Availability:** Tal, Gil, et al. "Charging Behavior Impacts on Electric VMT: Evidence from a 2013 California Drivers Survey." <http://assets.conferencespot.org/files/file/64258/filename/14-3556.pdf>

## **PV powered smart charging station for PHEVs** *P. Goli & W. Shireen*

**Abstract:** A huge inrush of PHEVs is envisioned in the future. There is a growing risk that, this proliferation in the number of PHEVs will trigger extreme surges in demand while charging them during rush hours. To mitigate this impact, a smart charging station is proposed in which the charging of the PHEVs is controlled in such a way that the impact of charging during peak load period is not felt on the grid. The power needed to charge the plug in hybrids comes from grid-connected photovoltaic generation or the utility or both. The three way interaction between the PV, PHEVs and the grid ensures optimal usage of available power, charging time and grid stability. The system designed to achieve the desired objective consists of a photovoltaic system, DC/DC boost converter, DC/AC bi-directional converter and DC/DC buck converter. The output of DC/DC boost converter and input of DC/AC bi-directional converter share a common DC link. A unique control strategy based on DC link voltage sensing is proposed for the above system for efficient transfer of energy.

**Subject Area:** Plug-in hybrid electric vehicle; Photovoltaic; DC link; Battery management system; Energy storage unit

**Availability:** Goli, P., and W. Shireen. "PV powered smart charging station for PHEVs." *Renewable Energy* 66 (2014): 280-287.

<http://www.sciencedirect.com/science/article/pii/S096014811300654X>

## **Battery Electric Vehicles: Range Optimization and Diversification for US Drivers** *Zhenhong Lin*

**Abstract:** Properly determining the driving range is critical for accurately predicting the sales and social benefits of battery electric vehicles (BEVs). This study proposes a framework for optimizing the driving range by minimizing the sum of battery price, electricity cost, and range limitation cost— referred to as the “range-related cost” — as a measurement of range anxiety. The objective function is linked to policy-relevant parameters, including battery cost and price markup, battery utilization, charging infrastructure availability, vehicle efficiency, electricity and gasoline prices, household vehicle ownership, daily driving patterns, discount rate, and perceived vehicle lifetime. Qualitative discussion of the framework and its empirical application to a sample (N=36664) representing new car drivers in the United States is included. The quantitative results strongly suggest that ranges of less than 100 miles are likely to be more popular in the BEV market for a long period of time. The average optimal range among US drivers is found to be largely inelastic. Still, battery cost reduction significantly drives BEV demand toward longer ranges, whereas improvement in the charging infrastructure is found to significantly drive BEV demand toward shorter ranges. The bias of a single-range assumption and the effects of range optimization and diversification in reducing such biases are both found to be significant.

**Subject Area:** electric vehicle, range optimization, transportation energy, charging infrastructure

**Availability:** Lin, Zhenhong. "Battery Electric Vehicles: Range Optimization and Diversification for the US Drivers." Transportation Research Board 91st Annual Meeting. No. 12-4477. 2012. <http://info.ornl.gov/sites/publications/files/Pub32211.pdf>

## **Probabilistic Assessment of the Impact of Plug-in Electric Vehicles on Power Quality in Electric Distribution Systems** *Matt Gray*

**Abstract:** The electrification of the transportation sector may have socio-economic benefits such as reducing greenhouse gases, lowering the soaring gas prices, and ending the reliance on imported oil. The integration of plug-in electric vehicles into the electric distribution system may pose potential power quality problems due to the uncertainties in the number of these vehicles, their charging time and locations. Several power quality phenomena such as voltage deviations, voltage imbalance, transformer overload and unbalance are investigated in this thesis. Since the problem is of a stochastic nature, a probabilistic approach using Monte Carlo simulation is adopted in this work to assess potential impact on power quality in the distribution system and hence addressing the uncertainties associated with integrating those electric vehicles. The analysis presented in this work also considers different vehicle types (i.e., plug-in hybrid and battery electric vehicles) for automobiles and pick-up trucks, vehicle penetration and vehicle charging levels. The results of Monte Carlo simulation reveal that Plug-in Battery Electric Vehicles and level 2 charging contribute most impact on undervoltage and transformer overloading, whereas level 1 charging contributes most impact to load unbalance on transformers. Recommendations are made to mitigate such impacts for future work.

**Subject Area:** plug-in electric vehicles; battery electric vehicle; undervoltage; transformer overloading

**Availability:** Gray, Matt. Probabilistic assessment of the impact of plug-in electric vehicles on power quality in electric vehicles on power quality in electric distribution systems. Diss. 2013. [https://ir.library.dc-uoit.ca/bitstream/10155/369/1/Gray\\_Matthew.pdf](https://ir.library.dc-uoit.ca/bitstream/10155/369/1/Gray_Matthew.pdf)

## 4. ENVIRONMENT

### **Development and Applications of an Emissions Micro-Simulation Tool for Transportation Infrastructure Design** *Daniel Handford*

**Abstract:** Transportation emissions constitute a significant portion of overall emissions inventories, and contribute to air quality health concerns. Reductions in transportation emissions can be achieved through efficient design of infrastructure, effective policy and regulation, and informed planning decisions. However, current transportation emissions models cannot accomplish all of these goals efficiently, and as a result such reduction opportunities are missed. This work presents a transportation micro-simulation tool that resolves emissions at the link level and efficiently models the effects of traffic congestion, traffic shifting, and mode shifting. This tool can be used for iterative design studies using conventional computing hardware. The model is described in detail, and a confidence assessment tests the model credibility. Several application studies illustrate the usefulness of the approach, and a comparison to an interaction-based microsimulation demonstrates the efficiency and limitations of the approach.

**Subject Area:** emissions; micro-simulation tool

**Availability:** Handford, Daniel. Development and Applications of an Emissions Micro-Simulation Tool for Transportation Infrastructure Design. Diss. University of Alberta, 2014.  
[https://era.library.ualberta.ca/public/view/item/uuid:482dedc4-cf8d-48bb-b1be-26ac96f46dca/DS2/Handford\\_Daniel\\_I\\_201406\\_PHD.pdf](https://era.library.ualberta.ca/public/view/item/uuid:482dedc4-cf8d-48bb-b1be-26ac96f46dca/DS2/Handford_Daniel_I_201406_PHD.pdf)

**Air Quality Impacts Of Electric Vehicle Adoption In Texas** *Brice G. Nichols, Kara M. Kockelman & Matthew Reiter*

**Abstract:** Widespread adoption of plug-in electric vehicles (PEVs) may substantially reduce emissions of greenhouse gases while improving regional air quality, increasing energy security, and taking advantage of inexpensive solar power. However, outcomes depend heavily on the electricity generation process, power plant locations, and vehicle use decisions. This paper provides a clear methodology for predicting PEV emissions impacts by anticipating battery-charging decisions and power plant energy sources across Texas. Life-cycle impacts of vehicle production and use and Texans' exposure to emissions are also computed and monetized. This study reveals to what extent PEVs are more environmentally friendly, for most pollutant species, than conventional passenger cars in Texas, after recognizing the emissions and energy impacts of battery provision and other manufacturing processes. Results indicate that PEVs on today's grid can reduce GHGs, NO<sub>x</sub>, PM<sub>10</sub>, and CO in urban areas, but generate significantly higher emissions of SO<sub>2</sub> than existing light-duty vehicles. Use of coal for electricity production is a primary concern for PEV growth, but the energy security benefits of electrified vehicle-miles endure. As conventional vehicle emissions rates improve, it appears that the power grids must follow suit (by improving emissions technologies and/or shifting toward cleaner generation sources) to compete on an emissions-monetized basis with PEVs in many locations. Moreover, while PEV pollution impacts may shift to more remote (power-plant) locations, dense urban populations remain most strongly affected by local power plant emissions in many Texas locations.

**Subject Area:** PEV; GHG; Solar power; coal; power plant emissions

**Availability:** Nichols, Brice G., Kara M. Kockelman, and Matthew Reiter. "Air quality impacts of electric vehicle adoption in Texas." *Transportation Research Part D: Transport and Environment* 34 (2015): 208-218. <http://www.sciencedirect.com/science/article/pii/S1361920914001576>



**Improving the Accuracy of Vehicle Emissions Profiles for Urban Transportation Greenhouse Gas and Air Pollution Inventories** *Janet L. Reyna, Mikhail V. Chester, Soyoung Ahn, and Andrew M. Fraser*

**Abstract:** Metropolitan greenhouse gas and air emissions inventories can better account for the variability in vehicle movement, fleet composition, and infrastructure that exists within and between regions, to develop more accurate information for environmental goals. With emerging access to high quality data, new methods are needed for informing transportation emissions assessment practitioners of the relevant vehicle and infrastructure characteristics that should be prioritized in modeling to improve the accuracy of inventories. The sensitivity of light and heavy-duty vehicle greenhouse gas (GHG) and conventional air pollutant (CAP) emissions to speed, weight, age, and roadway gradient are examined with second-by-second velocity profiles on freeway and arterial roads under free-flow and congestion scenarios. By creating upper and lower bounds for each factor, the potential variability which could exist in transportation emissions assessments is estimated. When comparing the effects of changes in these characteristics across U.S. cities against average characteristics of the U.S. fleet and infrastructure, significant variability in emissions is found to exist. GHGs from light-duty vehicles could vary by -2%–11% and CAP by -47%–228% when compared to the baseline. For heavy-duty vehicles, the variability is -21%–55% and -32%–174%, respectively. The results show that cities should more aggressively pursue the integration of emerging big data into regional transportation emissions modeling, and the integration of these data is likely to impact GHG and CAP inventories and how aggressively policies should be implemented to meet reductions. A web-tool is developed to aide cities in improving emissions uncertainty.

**Subject Area:** greenhouse gas emissions; vehicle inventories;

**Availability:** Reyna, Janet Lorel, et al. "Improving the Accuracy of Vehicle Emissions Profiles for Urban Transportation Greenhouse Gas and Air Pollution Inventories." *Environmental science & technology* (2014). <http://pubs.acs.org/doi/abs/10.1021/es5023575>

## **Fleet view of electrified transportation reveals smaller potential to reduce GHG emissions** *Christoph J. Meinrenken, & Klaus S. Lackner*

**Abstract:** Plugin and hybrid vehicles have been shown to offer possible reductions in greenhouse gas (GHG) emissions, depending on grid-carbon-intensity, range and thus life-cycle battery emissions and vehicle weight, and on trip patterns. We present a framework that enables GHG comparisons (well-to-wheel plus storage manufacturing) for three drivetrains (pure-electric, gasoline-hybrid, and plugin-hybrid), both for individual vehicles and for fleets. The framework captures effects of grid- versus vehicle-based electricity generation, grid transmission and charging losses, and manufacturing and carrying batteries. In contrast to previous work, GHG comparisons can be obtained for heterogeneous fleets of varying vehicle sizes (cars, vans, buses, trucks) and performances, without requiring forecasting of such vehicle specs and their respective market penetrations. Further, we show how a novel adaptation of the Utility Factor concept from plug-in-hybrids to mixed fleets of battery-only and gasoline-hybrids is crucial to quantifying battery-only-vehicles' impact on fleet-wide GHG. To account for regional variations and possible future technology improvements, we show scenarios over a wide spectrum of grid-carbon-intensities (50–1200 g CO<sub>2</sub>e/kW h at wall), vehicle range (~5–500 km), battery energy densities, and battery life-cycle GHG. Model uncertainties are quantified via sensitivity tests. Applying the framework to trip patterns of US passenger transportation, we find that owing to the interplay of GHG/km, battery size, all-electric range, and trip patterns, GHG reductions achievable from electrified transportation are smaller than previously considered (e.g., 55% reduction instead of 80%; scenario-dependent), even when assuming largely decarbonized grid-electricity. Optimal battery range that achieves lowest GHG for partially electrified fleets is different for plug-in hybrids versus pure electrics and furthermore varies strongly (~35 to ~200 km) with the predominant carbon-intensity of the grid.

**Subject Area:** Electrified transportation; Battery vehicle; Greenhouse gases; Range; Fleet; Life cycle assessment

**Availability:** Meinrenken, Christoph J., and Klaus S. Lackner. "Fleet view of electrified transportation reveals smaller potential to reduce GHG emissions." *Applied Energy* 138 (2015): 393-403. <http://www.sciencedirect.com/science/article/pii/S0306261914011325>

## **Who Pollutes? A Household-Level Database of America's Greenhouse Gas Footprint** *Kevin Ummel*

**Abstract:** This paper describes the creation of a database providing estimated greenhouse gas (GHG) footprints for 6 million US households over the period 2008-2012. The database allows analysis of footprints for 52 types of consumption (e.g. electricity, gasoline, apparel, beef, air travel, etc.) within and across geographic regions as small as individual census tracts. Potential research applications with respect to carbon pricing and tax policy are discussed. Preliminary analysis reveals: • The top 10% of US polluters are responsible for 25% of the country's GHG footprint. The least polluting 40% of the population accounts for only 20% of the total. The average GHG footprint of individuals in the top 2% of the income distribution is more than four times that of those in the bottom quintile. • The highest GHG footprints are found in America's suburbs, where relatively inefficient housing and transport converge with higher incomes. Rural areas exhibit moderate GHG footprints. High density urban areas generally exhibit the lowest GHG footprints, but location-specific results are highly dependent on income. • Residents of Republican-held congressional districts have slightly higher average GHG footprints than those in Democratic districts – but the difference is small (21.8 tCO<sub>2</sub>e/person/year in Republican districts; 20.6 in Democratic). There is little relationship between the strength of a district's party affiliation and average GHG footprint.

**Subject Area:** air pollution, greenhouse gases, climate change, environment

**Availability:** Ummel, Kevin. "Who Pollutes? A Household-Level Database of America's Greenhouse Gas Footprint." (2014).

<http://cgdev.org.488elwb02.blackmesh.com/sites/default/files/who-pollutes-database-greenhouse-gas-footprint.pdf>

**Passenger travel CO<sub>2</sub> emissions in US urbanized areas: Multi-sourced data, impacts of influencing factors, and policy implications** *Rabi G. Mishalani, Prem K. Goel, Andrew J. Landgraf, Ashley M. Westra, & Dunke Zhou*

**Abstract:** Policies that encourage reduced vehicle-miles traveled and the use of more efficient transportation modes are typically considered as means to reduce greenhouse gas (GHG) emissions. In support of motivating, developing, and evaluating such policies, the impacts various transportation infrastructure and use, population density, and policy variables have on passenger travel related carbon dioxide (CO<sub>2</sub>) – the primary GHG – emissions are assessed and resulting policy implications are discussed. A methodology for integrating data from multiple sources in a consistent manner is developed and implemented, producing a rich dataset consisting of 146 of the largest urbanized areas in the US. The magnitudes of the impacts that changes in certain variables have on CO<sub>2</sub> emissions in select urbanized areas are quantified. The results indicate that the variable used as a proxy for the presence of policies aimed at addressing environmental concerns and travelers' attitudes and behaviors towards such concerns influences the impacts changes in transportation characteristics and population density have on CO<sub>2</sub> emissions. Depending on these effects, the impacts of changes in average private vehicle occupancy and freeway lane-miles per capita are found to be the largest. In addition, changes in average travel time have a substantial impact on CO<sub>2</sub> emissions. While the explanatory effect of transit share is found to be statistically significant, the magnitudes of the impacts of changes in this variable are less appreciable in comparison to those of the above variables, which is understandable in light of the fairly low values of transit share and transit service utilization across most US urbanized areas. Furthermore, the impacts of changes in population density are the smallest among all the variables that are found to have statistically significant explanatory effects. However, this finding does not undermine the role land-use policies could play as increased density could have a direct or an indirect effect on reduced travel times and increased transit use, which in turn contribute to reduced CO<sub>2</sub> emissions. In addition to quantifying the impacts, several policy implications stemming from the findings are identified and discussed. Notably, the relative magnitudes of the impacts corresponding to the different variables are found to vary appreciably across urbanized areas, implying that policies aimed at reducing CO<sub>2</sub> emissions should focus on different sets of variables depending on the overall characteristics of the specific urbanized area and any existing policies aimed at reducing CO<sub>2</sub> emissions.

**Subject Area:** Urban passenger transportation; CO<sub>2</sub> emissions; Transportation supply and demand variables; Population density; Automobile emissions inspection

**Availability:** Mishalani, Rabi G., et al. "Passenger travel CO<sub>2</sub> emissions in US urbanized areas: Multi-sourced data, impacts of influencing factors, and policy implications." *Transport Policy* 36 (2014): 231-241.

<http://www.sciencedirect.com/science/article/pii/S0967070X14001450>

## **Public Health and Sustainability** *Cindy Klein-Banai*

**Abstract:** In this module, the following topics will be covered: 1) definition of public health, 2) public health impacts of non-sustainable development, 3) key public health impacts of climate change.

**Subject Area:** sustainability; public health

**Availability:** Klein-Banai, Cindy. "Public Health and Sustainability."

<http://cnx.org/exports/6084aef3-6edb-4023-8ac7-1173e5d90b24@2.pdf/public-health-and-sustainability-2.pdf>

**Potential for mitigating greenhouse gases through expanding public transport services: A case study for Gauteng Province, South Africa** *Steffen Bubeck, Jan Tomaschek, & Ulrich Fahl*

**Abstract:** South Africa's Province of Gauteng is a fast growing megacity region including the cities of Johannesburg and Tshwane. Increasing population and prosperity lead to a steadily growing energy demand and thereby increasing greenhouse gas (GHG) emissions. One third of the province's final energy consumption comes from the transport sector, dominated by motorized individual transport. Due to the limited financial resources to fund public transport initiatives, the most cost-effective means to reach the GHG mitigation targets are intended, without jeopardizing the economic growth. Recently, a bus rapid transit (BRT) system (Rea Vaya) and a rapid rail link (Gautrain) have been introduced to enforce the public transport system. In this paper, we investigate planned and possible future network expansions of the BRT and the Gautrain in terms of transport performance, costs of network expansions and GHG mitigation potential. Based on a trip rate model, we show that extensions of the current network can increase passenger numbers significantly (between 320% and 660% between 2013 and 2040 depending on the framework conditions). However, despite these expansions, the modal share of the BRT and the Gautrain in total passenger-kilometres travelled remains below 4% until 2040. This results in a decrease of cumulated GHG emissions of less than 1% until 2040 and relatively high GHG mitigation costs (4948–30045 ZAR<sub>2013</sub>/t CO<sub>2e</sub>). Nevertheless, a better integration of all public transport systems can increase the attractiveness of the services, which can result in a higher modal shift from private cars and thereby higher GHG emissions reductions at lower costs.

**Subject Area:** Public transport; Greenhouse gas emissions; Mitigation costs; BRT; Rapid rail; Megacity

**Availability:** Bubeck, Steffen, Jan Tomaschek, and Ulrich Fahl. "Potential for mitigating greenhouse gases through expanding public transport services: A case study for Gauteng Province, South Africa." *Transportation Research Part D: Transport and Environment* 32 (2014): 57-69. <http://www.sciencedirect.com/science/article/pii/S136192091400087X>

## **A geography of moral hazard: Sources and sinks of motor-vehicle commuting externalities** *Niko Yiannakoulias, Widmer Bland, & Darren M. Scott*

**Abstract:** Motor-vehicles are responsible for harms to health that are not directly experienced by individual drivers – such as air pollution and risk of injury to pedestrians. In addition to their direct effects on health, these harms also represent a moral hazard since drivers are not required to consider their effects as part of their decision to drive. We describe an approach for estimating sources of motor-vehicle commuter externalities as a means of understanding the geography of moral hazard, and in particular, the spatial displacement of negative health externalities associated with motor-vehicle commuting. This approach models motor-vehicle commuter traffic flow by trip origin for small geographic areas within the City of Toronto, Ontario. We find that most health-related externalities associated with motor-vehicle commuters are not locally generated, with a large share coming from outside Toronto. Low income is associated with externalities originating outside the municipal boundary, but not with locally sourced externalities. We discuss the impact of geographical moral hazard on the agency of citizens as well as policy options aimed at addressing motor-vehicle externalities.

**Subject Area:** Motor-vehicle commuting; Environmental externalities; Health inequality; Spatial justice

**Availability:** Yiannakoulias, Niko, Widmer Bland, and Darren M. Scott. "A geography of moral hazard: sources and sinks of motor-vehicle commuting externalities." *Health & place* 29 (2014): 161-170. <http://www.sciencedirect.com/science/article/pii/S1353829214001002>

## **The Problem Of Cold Starts: 2 A Closer Look At Mobile Source Emissions Levels**

*Matthew S. Reiter & Kara M. Kockelman*

**Abstract:** While the phenomenon of excess vehicle emissions from cold-start conditions is well known, the magnitude and duration of this phenomenon is often unclear due to the complex chemical processes involved and uncertainty in the literature on this subject. This paper synthesizes key findings regarding the influence of ambient and engine temperatures on light-duty vehicle (LDV) emissions. Results to date and analytical tools, like the U.S. Environmental Protection Agency's Motor Vehicle Emission Simulator (MOVES), indicate that vehicle-start emissions can constitute up to 80% of total LDV emissions, though they are 20% or less of the total for most species. Starting emissions are consistently found to make up a high proportion of total transportation-related methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), and volatile organic compounds (VOCs). After three to four minutes of vehicle operation, both the engine coolant and the catalytic converter have generally warmed, and emissions are significantly lower. This effect lasts roughly 45 minutes after the engine is shut off, though the cooling rate depends greatly on the emission species and ambient temperature. Electrically (pre-)heated catalysts, using the bigger batteries available on hybrid drivetrains and plug-in vehicles, may be the most cost-effective technology to bring down a big share of mobile source emissions. Trip chaining (to keep engines warm) and shifting to non-motorized modes (for shorter trips, where the cold start can dominate emissions) are also valuable tactics.

**Subject Area:** cold start; emissions; MOVES

**Availability:** trb 2015; Transportation Research Record

[http://www.cae.utexas.edu/prof/kockelman/public\\_html/TRB15coldstarts.pdf](http://www.cae.utexas.edu/prof/kockelman/public_html/TRB15coldstarts.pdf)



**Impacts of travel activity and urbanicity on exposures to ambient oxides of nitrogen and on exposure disparities** *Sashikanth Gurram, Amy Lynette Stuart, Abdul Rawoof Pinjari*

**Abstract:** Daily exposures to ambient oxides of nitrogen were estimated here for residents of Hillsborough County, FL. The 2009 National Household Travel Survey provided geocoded data on fixed activity locations during each person-day sampled. Routes between activity locations were calculated from transportation network data, assuming the quickest travel path. To estimate daily exposure concentrations for each person-day, the exposure locations were matched with diurnally and spatially varying ambient pollutant concentrations derived from CALPUFF dispersion model results. The social distribution of exposures was analyzed by comparing frequency distributions of grouped daily exposure concentrations and by regression modeling. To investigate exposure error, the activity-based exposure estimates were also compared with estimates derived using residence location alone. The mean daily activity-based exposure concentration for the study sample was 17  $\mu\text{g}/\text{m}^3$ , with values for individual person-day records ranging from 7.0 to 43  $\mu\text{g}/\text{m}^3$ . The highest mean exposure concentrations were found for the following groups: black (20  $\mu\text{g}/\text{m}^3$ ), below poverty (18  $\mu\text{g}/\text{m}^3$ ), and urban residence location (22  $\mu\text{g}/\text{m}^3$ ). Urban versus rural residence was associated with the largest increase in exposure concentration in the regression (8.3  $\mu\text{g}/\text{m}^3$ ). Time in nonresidential activities, including travel, was associated with an increase of 0.2  $\mu\text{g}/\text{m}^3$  per hour. Time spent travelling and at nonresidential locations contributed an average of 6 and 24 %, respectively, to the daily estimate. A mean error of 3.6 %, with range from -64 to 58 %, was found to result from using residence location alone. Exposure error was highest for those who travel most, but lowest for the sociodemographic subgroups with higher mean exposure concentrations (including blacks and those from below poverty households). This work indicates the importance of urbanicity to social disparities in activity-based air pollution exposures. It also suggests that exposure error due to using residence location may be smaller for more exposed groups.

**Subject Area:** Traffic pollution; Human activity patterns; Environmental inequality; Urban form; Exposure error

**Availability:** Gurram, Sashikanth, Amy Lynette Stuart, and Abdul Rawoof Pinjari. "Impacts of travel activity and urbanicity on exposures to ambient oxides of nitrogen and on exposure disparities." *Air Quality, Atmosphere & Health* (2014): 1-18.

<http://link.springer.com/article/10.1007/s11869-014-0275-6>

## **Household Carbon Emissions From Driving And Center City Quality Of Life**

*Matthew J. Holian and Matthew E. Kahn*

**Abstract:** In metropolitan areas with a vibrant center city, residents are more likely to spend time downtown for work, shopping and leisure. In the dense downtown, there are more opportunities to walk and to use public transit. We test whether households who live in metropolitan areas with more vibrant downtowns have a smaller transportation carbon footprint. We document that carbon emissions for a standardized household are lower in metropolitan areas featuring a higher concentration of college graduates living downtown. Over time, public transit use is rising more in cities featuring a higher downtown college graduate share.

**Subject Area:** carbon emissions; walking; transit; center city

**Availability:** Holian, Matthew J., and Matthew E. Kahn. "Household Carbon Emissions From Driving And Center City Quality Of Life." (2014).

<http://marroninstitute.nyu.edu/sites/default/files/Household%20Carbon%20Emissions%20from%20Driving%20and%20Center%20City%20Quality%20of%20Life.pdf>

## **The potential of carbon dioxide emission reductions in German commercial transport by electric vehicles** *T. Ketelaer, T. Kaschub, P. Jochem, & W. Fichtner*

**Abstract:** Climate change is a serious challenge of today. In order to reach the ambiguous mitigation scenarios for greenhouse gases, strong efforts are to be undertaken. Electric vehicles are seen as a potential mean to reduce emissions and energy import dependencies of most western societies. So far, the progress toward more electric vehicles in individual passenger transport is still slow. The objective to increase the share of electric vehicles of many national governments seems to be rather ambitious. In commercial transport, mileage is usually higher, trips are planned more precisely, and driving patterns are more regular than those of private vehicles. With these and other promising factors, we assume a high potential of electric vehicles in commercial transport. Therefore, we analyze in this paper the commercial transport in Germany and especially the large share of light commercial vehicles in order to make these potentials explicit. Based on German survey data, we analyze the heterogeneous German economic sectors with top-down statistical values like daily distance categories and bottom-up values like driving and parking behaviors. By way of example, German postal services are evaluated in detail, which leads to an electrification potential of between 60,750 and 105,550 vehicles. In case of “green” electricity for charging, postal services can avoid up to 882,000 t CO<sub>2</sub> /a, which is about 40–70 %.

**Subject Area:** Emission reduction potential; Electric mobility; Commercial transport in Germany; Sectoral analysis; Postal services

**Availability:** Ketelaer, T., et al. "The potential of carbon dioxide emission reductions in German commercial transport by electric vehicles." *International Journal of Environmental Science and Technology*: 1-16. <http://link.springer.com/article/10.1007/s13762-014-0631-y>

**Locating human resources to reduce the cost of managing networks of protected areas** *G Christine E. Dumoulin, Tyler Macmillan, Rob Stoneman and Paul R. Armsworth*

**Abstract:** Conservation organizations that manage networks of protected areas commonly require staff to travel to those areas for management and monitoring purposes. We examine how conservation organizations can reduce the resulting travel costs by locating human resources effectively. Specifically, we focus on the problem of siting the home offices of management staff, in a way that minimizes the travel costs involved. We illustrate the importance of travel cost using two case study applications, the Yorkshire Wildlife Trust (YWT), U.K., and the Northwest Florida Water Management District (NWF), USA. For YWT, siting an additional office effectively could save \$43,000 in annual travel costs. Optimally, siting NWF's four existing offices could save \$95,000 annually. These savings are sufficient for each organization to acquire 171–360 additional hectares of protected area or to hire an additional protected area manager. We also calculated the reduction in greenhouse gas emissions made possible by optimizing office locations.

**Subject Area:** Costs of conservation; conservation planning; location-allocation; p-median; protected areas; road network

**Availability:** Dumoulin, Christine Elise, et al. "Locating human resources to reduce the cost of managing networks of protected areas." *Conservation Letters* (2014).  
<http://onlinelibrary.wiley.com/doi/10.1111/conl.12115/abstract>

## **Cost effectiveness of introducing a new European evaporative emissions test procedure for petrol vehicles** *Gary Haq, Giorgio Martini, & Giorgos Mellios*

**Abstract:** Evaporative emissions of non-methane volatile organic compounds (NMVOCs) arise from the vehicle's fuel system due to changes in ambient and vehicle temperatures, and contribute to urban smog. This paper presents an economic analysis of the societal costs and benefits of implementing a revised European evaporative emission test procedure for petrol vehicles under four scenarios for the period 2015–2040. The paper concludes that the most cost-effective option is the implementation of an aggressive purging strategy over 48 h and improved canister durability (scenario 2+). The average net benefit of implementing this scenario is €146,709,441 at a 6% discount rate. Per vehicle benefits range from €6–9 but when fuel savings benefits are added, total benefits range from €13–18. This is compared to average additional cost per vehicle of €9.

**Subject Area:** Petrol vehicles; Non-methane volatile organic compounds; Test procedure; Cost effectiveness

**Availability:** Haq, Gary, Giorgio Martini, and Giorgos Mellios. "Cost effectiveness of introducing a new European Evaporative Emissions Test Procedure for petrol vehicles." *Atmospheric Environment* (2014). <http://www.sciencedirect.com/science/article/pii/S135223101400435X>

## **Transit-oriented smart growth can reduce life-cycle environmental impacts and household costs in Los Angeles** *Matthew J. Nahlik & Mikhail V. Chester*

**Abstract:** The environmental and economic assessment of neighborhood-scale transit-oriented urban form changes should include initial construction impacts through long-term use to fully understand the benefits and costs of smart growth policies. The long-term impacts of moving people closer to transit require the coupling of behavioral forecasting with environmental assessment. Using new light rail and bus rapid transit in Los Angeles, California as a case study, a life-cycle environmental and economic assessment is developed to assess the potential range of impacts resulting from mixed-use infill development. An integrated transportation and land use life-cycle assessment framework is developed to estimate energy consumption, air emissions, and economic (public, developer, and user) costs. Residential and commercial buildings, automobile travel, and transit operation changes are included and a 60-year forecast is developed that compares transit-oriented growth against growth in areas without close access to high-capacity transit service. The results show that commercial developments create the greatest potential for impact reductions followed by residential commute shifts to transit, both of which may be effected by access to high-capacity transit, reduced parking requirements, and developer incentives. Greenhouse gas emission reductions up to 470 Gg CO<sub>2</sub>-equivalents per year can be achieved with potential costs savings for TOD users. The potential for respiratory impacts (PM<sub>10</sub>-equivalents) and smog formation can be reduced by 28–35%. The shift from business-as-usual growth to transit-oriented development can decrease user costs by \$3100 per household per year over the building lifetime, despite higher rental costs within the mixed-use development.

**Subject Area:** Transit-oriented development; Life-cycle assessment; Transportation and land-use planning; Los Angeles; Greenhouse gas emissions; Energy and air quality

**Availability:** Nahlik, Matthew J., and Mikhail V. Chester. "Transit-oriented smart growth can reduce life-cycle environmental impacts and household costs in Los Angeles." *Transport Policy* 35 (2014): 21-30. <http://www.sciencedirect.com/science/article/pii/S0967070X14001036>

## **The impact of telecommuting on personal vehicle usage and environmental sustainability** *P. Zhu, & S. G. Mason*

**Abstract:** To understand whether telecommuting could be part of the policy solutions for greenhouse gas (GHG) reduction in the transportation sector, this study uses instrumental variable Tobit models and data from 2001 and 2009 National Household Travel Surveys to explore whether telecommuting reduces or increases the daily work and non-work vehicle miles traveled (VMT). Our findings suggest telecommuters have more VMT for both daily work and non-work trips than non-telecommuters. Adding the findings that telecommuting has no impact on other non-working household member's daily total (non-work) trips, we can possibly argue that households with telecommuter(s) tend to have higher daily total VMT. Our estimated marginal effect of telecommuting on worker's daily total trips indicates that a telecommuter on average travels 38 vehicle miles more on a daily basis in 2001 and 45 vehicle miles more in 2009 compared with a non-telecommuter. These increases in VMT translate into a rather large increase in GHG emissions in the US equivalent to adding 7,248,845 cars in 2001 and 8,808,165 in 2009 to the road. Moreover, the difference of this marginal effect between 2001 and 2009 suggests the impact of telecommuting on worker's daily total VMT had increased over time. With the emerging work arrangements to work from home, telecommuting has been welcomed in this changing environment, not only by individual workers and employers but also policymakers. But the outcomes seem to be opposite to what policy makers may have expected for GHG emission reductions.

**Subject Area:** Greenhouse gas; Sustainability; Telecommuting; Vehicle miles traveled

**Availability:** Zhu, P., and S. G. Mason. "The impact of telecommuting on personal vehicle usage and environmental sustainability." *International Journal of Environmental Science and Technology*: 1-16. <http://link.springer.com/article/10.1007/s13762-014-0556-5>

**A Transdisciplinary Perspective on Hedonomic Sustainability Design** *Stephen M. Fiore, Elizabeth Phillips, & Brittany C. Sellers*

**Abstract:** The impact of climate change should be a key concern of those in the human factors/ergonomics (HF/E) discipline. Our specialized knowledge and expertise can be applied toward mitigating the effects of climate change. In this article, we unite two perspectives to illustrate how HF/E can more productively contribute to the research and practice of sustainability. First, we describe differing forms of cross-disciplinary research, with a particular focus on the notion of transdisciplinary research and the concept of hedonomic design. Second, we unite these ideas to illustrate how they provide a set of complementary concepts that can guide HF/E sustainability research.

**Subject Area:** environmental sustainability; transdisciplinary research; sustainable design; hedonomics; environmental efficacy

**Availability:** Fiore, Stephen M., Elizabeth Phillips, and Brittany C. Sellers. "A Transdisciplinary Perspective on Hedonomic Sustainability Design." *Ergonomics in Design: The Quarterly of Human Factors Applications* 22.2 (2014): 22-29. <http://erg.sagepub.com/content/22/2/22.short>



## **Housing location in a Philadelphia metro watershed: Can profitable be green?**

*John A. Sorrentino, Mahbubur R. Meenar, Alice J. Lambert, & Donald T. Wargo*

**Abstract:** The objective of this paper was to examine the profit levels, energy use and environmental impacts of two residential development scenarios in a watershed in the Philadelphia region under two zoning assumptions. The two scenarios were based on economic suitability and environmental suitability. A key question was whether these occurred together in the Pennypack Creek Watershed. Suitability analyses in ArcGIS using criteria for profit and for local sustainability parsed out two sets of developable areas. Buildouts to satisfy 2035 population projections in these areas using CommunityViz software were based on actual municipal zoning ordinances. In a unified zoning scheme created by the authors, a density-adjusted number of housing units are placed watershed-wide without municipal restrictions. Profit data for buildings in each zip code were used to compute a Weighted Profit per Square Meter. Household units were associated with a particular type of automobile and average Vehicle Kilometers Traveled in the relevant census tracts. The GREET program was used to compute energy use, air pollution emissions and greenhouse gas emissions. A Weighted Water Quality Index and Index of Biological Integrity were used to assess water-related impacts based on recent monitoring data supplied by the Philadelphia Water Department. It was no surprise that ECON-UNI and ECON-MUNI generated higher profit than ENV-MUNI and ENV-UNI. ENV-UNI had lower energy use and environmental impacts than all others. That ECON-MUNI had the second lowest energy use and environmental impacts, and the highest water quality, was unexpected. Some policy proposals and conclusions end the paper.

**Subject Area:** Housing; Location; Profitability; Sustainability; Watershed planning

**Availability:** Sorrentino, John A., et al. "Housing location in a Philadelphia metro watershed: Can profitable be green?." *Landscape and Urban Planning* 125 (2014): 188-206.  
<http://www.sciencedirect.com/science/article/pii/S0169204614000292>

## **Multi-Pollutant Analysis and Cost Effectiveness Evaluation of Voluntary Mobile Source Measures** *Christian E. Lindhjem, Barbara Joy, Earth Matters & Hazel Barbour*

**Abstract:** H-GAC has contracted with the ENVIRON team to complete an analysis of current and potential mobile source emission programs that includes expected reductions for multiple pollutants affecting air quality. Therefore this analysis attempts to quantify the annual emission reductions of volatile organic compounds (VOC) and nitrogen oxides (NOx) that affect ozone from on-going programs and reduction potential from likely programs. In addition, emission reductions of VOC, NOx, and fine particulate matter (PM2.5) affect ambient levels of PM2.5, so we also estimate emission reductions of PM2.5 from mobile sources.

We did not include an evaluation of sulfur oxides (SOx) emissions that affect ambient levels of SO2 and PM2.5 because mobile sources based and fueled in the United States are required to use 15 ppm sulfur fuel and produce insignificant amounts of sulfur dioxide or sulfate particulate emissions.

This report is intended to provide a review of the progress of current programs, evaluate programs that may be implemented, and suggest additional programs that may have the potential to reduce emissions cost effectively. In Section 2, we evaluate current programs using participation and cost data through calendar year 2013. In Section 3, we evaluate the emission reduction potential of programs yet to be implemented using the expertise of team members and published accounts of similar programs. Finally in Section 4, we list and qualitatively evaluate programs that may have potential to reduce emissions cost effectively.

**Subject Area:** mobile source emissions reductions programs;

**Availability:** Council, Houston-Galveston Area, et al. "Multi-Pollutant Analysis and Cost Effectiveness Evaluation of Voluntary Mobile Source Measures." [https://www.h-gac.com/taq/airquality/raqpc/documents/2014/PMTF-Apr-10/HGAC\\_Mobile\\_Source\\_Control\\_Measures\\_DRAFT\\_09Apr2014.docx](https://www.h-gac.com/taq/airquality/raqpc/documents/2014/PMTF-Apr-10/HGAC_Mobile_Source_Control_Measures_DRAFT_09Apr2014.docx)

## **Transport Sector Greenhouse Gas Inventory for South Africa for the base year 2009** *Mphethe Tongwane*

**Abstract:** The transport sector is responsible for a quarter of global CO<sub>2</sub> emissions and the emissions continue to grow rapidly. The overall objective of this study was to calculate the following greenhouse gas emissions (GHG); CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O from the transport sector in South Africa in the base year 2009. However, in addition to the calculations of the emissions for this base year, emissions from road transport were recalculated since 2000. The available data allowed only Tier 1 method to calculate all the GHG emissions. Vehicles per type, province and distances they travelled were used to estimate the emissions, while fuel used at various airports in the country was used to determine aviation emissions. Emissions from other modes of the transport sector were calculated using the data from the national energy balances. It was estimated that 54,296 Giga grams (Gg) of CO<sub>2</sub> equivalent (CO<sub>2</sub>-eq) emissions were emitted in 2009. Road, off- road, aviation and rail transports accounted for 80%, 13%, 6% and 1% of the emissions, respectively. Motorcars and trucks produced more than 70% of the road transport emissions. Road transport emissions increased at approximately 2.66% per year between 2000 and 2009. Gauteng province had the highest emissions. Minibus taxis were the most efficient transport mode on the basis of load carried.

**Subject Area:** CO<sub>2</sub> emissions; GHG; South Africa

**Availability:** Tongwane, Mphethe. Transport sector greenhouse gas inventory for South Africa for the base year 2009. Diss. 2014. <http://wiredspace.wits.ac.za/handle/10539/14038>

## **Travel Emission Profile of Iskandar Malaysia Neighbourhoods from Pre-1980s to 2000s** *M. R. Majid, A. N. Nordin, F. Johar and H. Y. Tifwa*

**Abstract:** Vehicle Miles Travelled (VMT), an indicator of travel levels on the roadway system mainly by private vehicles, has been widely used in urban planning to help indicate CO<sub>2</sub> emission due to changes in built environment. Bordering Singapore to the south, neighbourhood development has been constantly happening in Johor Bahru since 1980's. These neighbourhood developments are believed to have undergone a continuous layout design evolution affecting its land use distribution, road network design, and density. Thus, this paper investigates the quiet influence of neighbourhood design, as it evolves over the decades on VMT and eventually travel carbon emission. Twenty two residential neighbourhoods representing several decades from pre-1980s to the 2010s were selected and travel diaries of their randomly selected households were recorded. Findings from this study reveal that travel carbon emission for pre-1980s residential areas is only 8.7 kilograms/household/day with a daily travel range of 40 km/day. However, the amount increases up to 21.8 kilograms/household/day for 2010s houses with daily travel range of 100 km/day. Car usage among residents in Iskandar Malaysia is undoubtedly increasing as car ownership proportion increases from 0.8 in pre-1980s to 2.37 in 2010s. Number and distance of vehicles trip can be reduced by organizing activities in compact communities rather than in auto dependent suburbs. In addition, a carbon emission reduction of up to 10 percent may result from a change in land use approach alone while additional reductions will result from employing other strategies such as transit investment, fuel pricing, and parking charges.

**Subject Area:** carbon emissions; VMT; land use; vehicle ownership; Malaysia

**Availability:** Majid, M. R., et al. "Travel Emission Profile of Iskandar Malaysia Neighbourhoods from Pre-1980s to 2000s." IOP Conference Series: Earth and Environmental Science. Vol. 18. No. 1. IOP Publishing, 2014. <http://iopscience.iop.org/1755-1315/18/1/012161>

## **The influence of urban form on GHG emissions in the U.S. household sector**

*Sungwon Lee, & Bumsoo Lee*

**Abstract:** To better understand the role of sustainable urban development in greenhouse gas (GHG) mitigation, this study examines the paths by which urban form influences an individual household's carbon dioxide emissions in the 125 largest urbanized areas in the U.S. Our multilevel SEM analyses show that doubling population-weighted density is associated with a reduction in CO<sub>2</sub> emissions from household travel and residential energy consumption by 48% and 35%, respectively. Centralized population and polycentric structures have only a moderate impact in our analyses. Given that household travel and residential energy use account for 42% of total U.S. carbon dioxide emissions, these findings highlight the importance of smart growth policies to build more compact and transit friendly cities as a crucial part of any strategic efforts to mitigate GHG emissions and to stabilize climate.

**Subject Area:** Greenhouse gas emissions; Urban form; Household sector

**Availability:** Lee, Sungwon, and Bumsoo Lee. "The influence of urban form on GHG emissions in the US household sector." *Energy Policy* (2014).

<http://www.sciencedirect.com/science/article/pii/S0301421514000299>

**Simulation-Based Approach for Analyzing the Regional and Local Impact of Transit Oriented Development on Congestion and Emissions** *Arefeh Nasri, Zheng Zhu, Kiana Roshan Zamir, Chenfeng Xiong, & Lei Zhang*

**Abstract:** The effects of transit-oriented development (TOD) on congestion reduction and its environmental benefits have not been extensively tested in the current literature. This paper proposes a mathematically rigorous definition for TOD and develops advanced tools to investigate the various benefits of TOD. A large-scale microscopic traffic simulation model and the EPA's MOVES model have been employed to evaluate TOD performance in the transportation system and investigate its environmental benefits.

Results suggest that TOD reduces total delay in the whole simulated network by 4 percent and by 35 percent for the trips originating from TOD zones. By converting the amount of travel time and fuel consumption savings into equivalent monetary values, the TOD scenario provides a total of \$20,586,800 from travel time savings (\$20 value of time) and \$604,074 savings in fuel consumption annually for the PM peak period. However, the effect of TOD on travel time and fuel savings is more significant in the local surroundings of TOD zones.

**Subject Area:** Transit-Oriented Development, Congestion Reduction, Traffic Simulation, MOVES, Environmental Emissions

**Availability:** Nasri, Arefeh, et al. "Simulation-Based Approach for Analyzing the Regional and Local Impact of Transit-Oriented Development on Congestion and Emissions 2." TRB2014 <http://assets.conferencespot.org/fileservers/file/65937/filename/14-3696.pdf>

**Should policy-makers allocate funding to vehicle electrification or end-use energy efficiency as a strategy for climate change mitigation and energy reductions? Rethinking electric utilities efficiency programs** *Brinda A. Thomas and Inês L. Azevedo*

**Abstract:** In order to reduce greenhouse gas emissions in the United States by an order of magnitude, a portfolio of mitigation strategies is needed. Currently, many utilities pursue energy efficiency programs. We study a case where utilities could choose whether to allocate their energy efficiency budget to either end-use efficiency or vehicle electrification as a means to reduce CO<sub>2</sub> emissions. We build a decision space that displays the conditions under which utilities should pursue either strategy. To build such decision space, assumptions are needed on how consumers respond to electric vehicle incentives, and what would be the baseline vehicle selected by consumers if no incentives were in place. Since these two aspects are highly uncertain, we treat them parametrically: if consumers are replacing a conventional vehicle with a PHEV, utility incentive programs to induce PHEV adoption appear to be cost-effective for a wide range of efficiency program costs and grid emissions factors.

**Subject Area:** Energy efficiency; PHEV; Cost-effectiveness

**Availability:** Thomas, Brinda A., and Inês L. Azevedo. "Should policy-makers allocate funding to vehicle electrification or end-use energy efficiency as a strategy for climate change mitigation and energy reductions? Rethinking electric utilities efficiency programs." *Energy Policy* (2014). <http://www.sciencedirect.com/science/article/pii/S0301421513011221>

**Residential Location, High Capacity Transportation Infrastructure and their Influences on Emissions and Travel Dispersal** *Zachary Patterson, Christopher Harding, Luis F. Miranda-Moreno and Seyed Amir H. Zahabi*

**Abstract:** There is a large literature on the link between transportation and the built environment. This literature has tended to concentrate on the effect of the built environment on a few transportation demand indicators. Recently, there has been some literature to look at the impact of the urban built environment on transport-related CO<sub>2</sub>. It has tended to use relatively coarse calculations for transport-related CO<sub>2</sub> and the built environment. This paper uses an approach developed by Beckman, Golob and Zahavi (1983) to analyze the effect of proximity to high capacity transport infrastructure on activity spaces and extends it to include more types of infrastructure, as well as to analyze the effect of infrastructure access on transport-related CO<sub>2</sub>. Data from the region of Montreal is used to generate activity spaces and transport-related CO<sub>2</sub> emissions for groups of households at different distances from the CBD close to different types of transport infrastructure. Results indicate that both activity spaces and CO<sub>2</sub> are related to transport infrastructure in predictable ways: emissions are on average higher for households living close to expressways, and activity spaces and emissions are smaller for those close to metros and commuter rail. We also find that emissions (and more weakly activity spaces) exhibit an inverted U-shape (for households near all infrastructure types apart from expressways)- at first increasing with distance from the CBD and then decreasing. We argue that this is related to households "falling out of the orbit" of the city.

**Subject Area:** Residential location, CO<sub>2</sub> emissions, transportation infrastructure, travel dispersal, built environment

**Availability:** Patterson, Zachary, et al. "Residential Location, High Capacity Transportation Infrastructure and their Influences on Emissions and Travel Dispersal." (2013).  
<https://www.cirreлт.ca/DocumentsTravail/CIRRELT-2013-81.pdf>



## **How Much Do Electric Drive Vehicles Matter to Future U.S. Emissions?** *Samaneh Babaee , Ajay S. Nagpure , and Joseph F. DeCarolis*

**Abstract:** Hybrid, plug-in hybrid, and battery electric vehicles—known collectively as electric drive vehicles (EDVs)—may represent a clean and affordable option to meet growing U.S. light duty vehicle (LDV) demand. The goal of this study is 2-fold: identify the conditions under which EDVs achieve high LDV market penetration in the U.S. and quantify the associated change in CO<sub>2</sub>, SO<sub>2</sub>, and NO<sub>x</sub> emissions through midcentury. We employ the Integrated MARKAL-EFOM System (TIMES), a bottom-up energy system model, along with a U.S. data set developed for this analysis. To characterize EDV deployment through 2050, varying assumptions related to crude oil and natural gas prices, a CO<sub>2</sub> policy, a federal renewable portfolio standard, and vehicle battery cost were combined to form 108 different scenarios. Across these scenarios, oil prices and battery cost have the biggest effect on EDV deployment. The model results do not demonstrate a clear and consistent trend toward lower system-wide emissions as EDV deployment increases. In addition to the trade-off between lower tailpipe and higher electric sector emissions associated with plug-in vehicles, the scenarios produce system-wide emissions effects that often mask the effect of EDV deployment.

**Subject Area:** plug-in hybrid; battery electric vehicles; emissions; electric drive vehicles; light duty vehicle demand

**Availability:** Babaee, Samaneh, Ajay Singh Nagpure, and Joseph F. DeCarolis. "How Much Do Electric Drive Vehicles Matter to Future US Emissions?." *Environmental science & technology* (2014). [http://www.urop.uci.edu/journal/journal11/03\\_naviaux.pdf](http://www.urop.uci.edu/journal/journal11/03_naviaux.pdf)

## **Smart Microgrids: Optimal Joint Scheduling for Electric Vehicles and Home Appliances** *Tushar, M.H.K., Assi, C., Maier, M. & Uddin, M.F.*

**Abstract:** The integration of renewable energy sources and electrical vehicles (EVs) into microgrids is becoming a popular green approach. To reduce greenhouse gas emissions, several incentives are given to use renewable energy sources and EVs. By using EVs as electricity storage and renewable energy sources as distributed generators (DGs), microgrids become more reliable, stable, and cost-effective. In this paper, we propose an optimal centralized scheduling method to jointly control the electricity consumption of home appliances and plug-in EVs as well as to discharge the latter ones when they have excess energy, thereby increasing the reliability and stability of microgrids and giving lower electricity prices to customers. We mathematically formulate the scheduling method as a mixed integer linear programming (MILP) problem and solve it to optimality. We compare the optimal solution to that obtained from a scheduling framework, where EVs do not have discharge capabilities, decentralized charge control using game theory and to a solution obtained from a naive scheduling framework.

**Subject Area:** distributed power generation, domestic appliances, electric vehicles, integer programming, linear programming, scheduling, & smart power grids

**Availability:** Tushar, Mosaddek Hossain Kamal, et al. "Smart Microgrids: Optimal Joint Scheduling for Electric Vehicles and Home Appliances." *Smart Grid, IEEE Transactions on* 5.1 (2014): 239-250. [http://ieeexplore.ieee.org/xpls/abs\\_all.jsp?arnumber=6693776](http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6693776)

## 5. POLICY AND MOBILITY

**Point-of-Dispensing Location and Capacity Optimization via a Decision Support System** *Adrian Ramirez-Nafarrate, Joshua D. Lyon, John W. Fowler, and Ozgur M. Araz*

**Abstract:** Dispensing of mass prophylaxis can be critical to public health during emergency situations and involves complex decisions that must be made in a short period of time. This paper presents a model and solution approach for optimizing Point-of-Dispensing (POD) location and capacity decisions. This approach is part of a Decision Support System (DSS) designed to help officials prepare for and respond to public health emergencies. The model selects PODs from a candidate set and suggests how to staff each POD so that average travel and waiting times are minimized. A genetic algorithm (GA) quickly solves the problem based on travel and queuing approximations and it has the ability to relax soft constraints when the dispensing goals cannot be met. We show that the proposed approach returns solutions comparable with other systems and it is able to evaluate alternative courses of action when the resources are not sufficient to meet the performance targets.

**Subject Area:** Emergency response; point-of-dispensing; facility location and resource allocation problems; genetic algorithms; queuing theory

**Availability:** Ramirez-Nafarrate, Adrian, et al. "Point-of-Dispensing Location and Capacity Optimization via a Decision Support System." *Production and Operations Management* (2014). <http://onlinelibrary.wiley.com/doi/10.1111/poms.12323/abstract>

**Travel Costs Associated With Flood Closures Of State Highways Near Centralia/Chehalis, Washington** *Mark E. Hallenbeck, Anne Goodchild, & Jerome Drescher*

**Abstract:** This report discusses the travel costs associated with the closure of roads in the greater Centralia/Chehalis, Washington, region due to 100-year flood conditions starting on the Chehalis River. The costs were computed for roadway closures on I-5, US 12, and SR 6, and are based on estimated road closure durations supplied by WSDOT. The computed costs are only those directly related to travel that would otherwise have occurred on the roads affected by the flooding closures. The computed costs do not include the economic losses associated with delayed delivery of goods or services, losses in economic activity attributable to travelers being unable to reach their intended destinations, or economic losses associated with the loss of goods because they could not be delivered. The reported costs do include the added costs of time and vehicle mileage associated with available detour routes. Costs were also estimated for each trip that will be abandoned. That is, this study estimated the number of trips that will not be made as a result of road closures. The researchers also conducted a sensitivity analysis of the findings for the I-5 cost computation. Sensitivity tests were conducted for the value of time, the speeds and level of congestion assumed to occur on the routes used for detours, the values associated with trips that are not made via the expected detours, the percentage of personal trips made for work/business purposes versus those being made for personal reasons, the fraction of cars and trucks willing to detour, the effects of flood closure during the weekend or the summer, and growth in traffic volumes on I-5.

**Subject Area:** Road closure impacts, flooding traffic impacts, detour costs

**Availability:** Hallenbeck, Mark E., Anne Goodchild, and Jerome Drescher. Travel Costs Associated with Flood Closures of State Highways Near Centralia/Chehalis, Washington. No. WA-RD 832.1. 2014. <http://depts.washington.edu/trac/bulkdisk/pdf/832.1.pdf>

**Smart Growth's Positive Impact on the Environment, Public Health, and Society** *Jenna Kersten*

**Abstract:** Explaining how and why mid-twentieth century American cities and their surrounding areas were organized and highlighting the damaging effects of sprawl, the student writer makes a strong case for implementing smart growth initiatives in this research-based essay.

**Subject Area:** smart growth; sprawl

**Availability:** Kersten, Jenna. "Smart Growth's Positive Impact on the Environment, Public Health, and Society." *Gleanings*: 75.

<https://www2.siena.edu/uploadedfiles/home/Gleanings%20Final.pdf#page=76>

**Effect of Smart Growth Policies on Travel Demand** *Maren Outwater, Colin Smith, Jerry Walters, Brian Welch, Robert Cervero, Kara Kockelman, and J. Richard Kuzmyak*

**Abstract:** The Smart Growth Network, a partnership of the U.S. Environmental Protection Agency and other government and business and environmental organizations, defines smart growth in terms of 10 basic principles: 1. Provide mixed land uses. 2. Take advantage of compact building design. 3. Create a range of housing opportunities and choices. 4. Create walkable neighborhoods. 5. Foster distinctive, attractive communities with a strong sense of place. 6. Preserve open space, farmland, natural beauty, and critical environmental areas. 7. Strengthen and direct development toward existing communities. 8. Provide a variety of transportation choices. 9. Make development decisions predictable, fair, and cost-effective. 10. Encourage community and stakeholder collaboration in development decisions. These characteristics of the urban form and built environment are generally associated with a variety of benefits to environmental protection, public health, and quality of life and economic and social benefits. One of the better-established benefits of smart growth is the reduction in unnecessary travel, the resulting reductions in impacts on congestion and delay and their costs to business and households and reduced infrastructure expansion, energy consumption, and greenhouse gas and other emissions. Comparisons of travel data among regions of different urban forms, among communities within those regions, and among development areas within those communities all demonstrate that smart growth development vehicle travel rates are lower than rates in conventional suburban forms. The comparisons show that the extent of reduction is proportional to the degree to which the development is compact, diverse, location efficient, served with a variety of transportation choices, and endowed with a sense of place.

**Subject Area:** smart growth; travel rates

**Availability:** Outwater, Maren, et al. Effect of Smart Growth Policies on Travel Demand. Transportation Research Board.

<http://books.google.com/books?hl=en&lr=&id=nPdxBQAAQBAJ&oi=fnd&pg=PR12&dq=Maren+Outwater,+Colin+Smith,+Jerry+Walters,+Brian+Welch,+Robert+Cervero,+Kara+Kockelman,+and+J.+Richard+Kuzmyak&ots=UScLlrHixF&sig=OQw-UwTVB3ranPdDBio8fV8dx3g>

## **Switching and Sharing: Gasoline Prices and Household Fleet Utilization**

*William Leung*

**Abstract:** I investigate the effect of gasoline prices on behaviors within the household, offering a new view of the mechanisms behind the short-run elasticity of gasoline use. I decompose the fuel use elasticity into changes in distance traveled and changes in fuel efficiency coming from the reallocation of driving within the household fleet. My approach allows me to examine the specific mix of trips and vehicles used on a particular day, considering the tendency of households to swap vehicles with others and select more fuel efficient vehicles on shared trips. I find that approximately 17% of short run changes in gasoline use come through vehicle utilization, and that trip length (as opposed to the number of trips) accounts for nearly all of the effect on miles driven. These responses have important welfare implications for gasoline policy choice and for driving-related externalities. I examine the safety implications of the short-run change in vehicle choice and the role that fleet heterogeneity played in a household's ability to adjust to gasoline price shocks during the housing crisis as two applications.

**Subject Area:** gas price; fuel use elasticity;

**Availability:** Leung, William. "Switching and Sharing: Gasoline Prices and Household Fleet Utilization." (2014).

[http://econweb.ucsd.edu/~w2leung/pdfs/leung\\_switching\\_and\\_sharing.pdf](http://econweb.ucsd.edu/~w2leung/pdfs/leung_switching_and_sharing.pdf)

## **Congestion, Gas Taxes And Vehicle Choice** *Sam Flanders And Melati Nungsari*

**Abstract:** Road congestion imposes large costs on individuals since long commutes yield significant decreases in productivity and leisure times. Congestion may also have ambiguous impacts on environmental pollution, either increasing it relative to a congestion-free regime through more frequent and longer vehicle usage, or decreasing it due to forgone travel. In this paper, we study the effects of gasoline tax policies on road congestion. To do this, we develop a model of household vehicle choice utilizing individual-level data from the 2009 National Household Travel Survey and combine it with a model of congestion, measured by average road speeds, which utilizes road-level data on traffic congestion collected by state and national-level departments of transportation. We estimate counterfactual regimes in which gas taxes are at different levels in order to answer questions regarding optimal gas taxes for a fixed geographical area.

**Subject Area:** gas tax, congestion, environmental pollution

**Availability:** Flanders, Sam, And Melati Nungsari. "Congestion, Gas Taxes And Vehicle Choice."  
[http://melatinungsari.web.unc.edu/files/2012/01/congestion\\_gas\\_taxes\\_and\\_vehicle\\_choice.pdf](http://melatinungsari.web.unc.edu/files/2012/01/congestion_gas_taxes_and_vehicle_choice.pdf)



**Even Smarter Growth? Land Use Policy Impact On Transportation And Emissions In Maryland** *Uri Avin, Timothy F. Welch, Gerrit Knaap, Fred Ducca, Sabyasachee Mishra, Yuchen Cui & Sevgi Erdogan*

**Abstract:** Urban form studies have generally used regional density vs. sprawl land use scenarios to assess travel behavior outcomes. The more nuanced but nonetheless important allocation of jobs and housing and their relationship to each other as a factor in travel behavior has received much less attention. That relationship is explored in this statewide urban form study for Maryland. This is a state where county land use has a long tradition of growth management, but one whose regional and statewide implications have not been evaluated. How does a continuation of the County level smart growth regime play out statewide compared to other scenarios of job and housing distribution that are driven by higher driving costs or transit oriented development goals or local zoning rather than local policy-driven projections? Answers are provided through the application of a statewide travel demand model, the Maryland Statewide Transportation Model (MSTM). The findings suggest that the debate should move beyond walkability, density and compact growth and towards a more productive dialog about how we organize whole cities and regions

**Subject Area:** Land use, transit oriented development, travel behavior, smart growth, greenhouse gases, VMT

**Availability:** Welch, Timothy F., et al. "Even Smarter Growth? Land Use Policy Impact On Transportation And Emissions In Maryland."

[http://smartgrowth.umd.edu/assets/documents/research/even\\_smarter\\_growth\\_dc\\_paris\\_symp.pdf](http://smartgrowth.umd.edu/assets/documents/research/even_smarter_growth_dc_paris_symp.pdf)

**Distributional and Efficiency Impacts of Gasoline Taxes: An Econometrically Based Multi-market Study** *Antonio M Bento, Lawrence H Goulder, Emeric Henry, Mark R Jacobsen, & Roger H. Von Haefen*

**Abstract:** Because of its potential to improve the environment and enhance national security, reducing automobile-related gasoline consumption has become a major U.S. public policy issue. Recently, many analysts have called for new or more stringent policies to discourage gasoline consumption. Proposals include a tightening of corporate average fuel economy (CAFE) standards and subsidies to retirements of older (gas guzzling) vehicles, as well as increments to the federal gasoline tax. This paper examines the gas tax option, employing an econometrically based multi-market simulation model to explore the policy's efficiency and distributional implications.

This study differs from earlier work in several ways. Some prior studies have investigated gasoline consumption either by employing a demand function for gasoline or by deriving this demand from households' vehicle-miles traveled (VMT).<sup>1</sup> These studies treat the composition of the automobile fleet as fixed. However, a gasoline tax can be expected to influence the fleet composition (e.g., the market share of more fuel-efficient cars) as well as the amount of driving. This study allows for both impacts. As in Steven Berry et al. (1995), Pinelopi Goldberg (1995), and Amil Petrin (2002), we account for the imperfectly competitive nature of the new-car market. However, in contrast with these studies, we consider interactions between the markets for new, used, and scrapped cars. The impacts of a gasoline tax can importantly depend on such interactions. Higher gasoline taxes could stimulate higher rates of scrapping of older, fuel-inefficient cars and could also promote shifts in demand from used cars to especially fuel-efficient new cars. Studies that ignore these adjustments could understate a gas tax's impacts on fuel consumption

**Subject Area:** Level of Service; bicycle; pedestrian;

**Availability:** Brozen, Madeline. Exploration And Implications Of Multimodal Street Performance Metrics: What's a Passing Grade?. Diss. Rutgers, the State University of New Jersey, 2014.  
<http://www.lewis.ucla.edu/wp-content/uploads/sites/2/2014/09/Exploration-And-Implications-Of-Multimodal-Street-Performance-Metrics.pdf>

## **Exploration And Implications Of Multimodal Street Performance Metrics: What's A Passing Grade?** *Madeline Brozen, Herbie Huff, Robin Liggett, Rui Wang & Michael Smart*

**Abstract:** Scholars, municipalities and federal agencies have proposed new measures for evaluating street performance for non-automobile modes including transit service, bicyclists and pedestrians. This is in response to the critique that the current street performance measure, traditional level of service (LOS), overemphasizes the free flow of automobile traffic while neglecting other users of the transportation system. We examine four often-cited multimodal level of service (LOS) metrics. We provide a literature review with an overview of each metric's development and the variables used to calculate performance scores, as well as their ease of use and threats to their validity. Finally, our literature review closes by offering our critique of the metrics, focusing on how the use of single-outcome metrics (even differentiated by mode) may skew our understanding of street performance by masking considerable variation among users. Beyond describing the tools, we analyze the scores produced by these measures to document how these metrics compare to one another. We then illustrate the contribution of specific variables to the overall score for each measure and mode to explain these scoring differences. We selected five street segments with different physical and operational characteristics and calculated the bicycle and pedestrian scores for each street segment using the three different tools (Charlotte, BEQI/PEQI, and HCM 2010). Overall, we found that if a street is performing "well" for cyclists and pedestrians, the tools produced fairly similar scores. But as the quality of the street deteriorated, the scores from each tool became increasingly different from each other. Lastly, we turned our analysis towards understanding how sensitive each tool is to on-the ground change. The level of service calculation, regardless of mode, is used both to assess current conditions and to evaluate proposed future changes. We wanted to understand how the tools score realistic changes in the built environment. We selected one street segment (from the five in the comparative analysis) and proposed five different scenarios of improvements to both the bicycle and pedestrian environment. We found that all of the scoring mechanisms recommended a road diet scenario with a painted buffer next to a bicycle lane. But we also found that newer bicycle configurations and treatments were often difficult and sometimes impossible to evaluate using these tools. Overall, the results demonstrate that these tools can evaluate changes to the street and guide future improvements. However, their ability to measure the effectiveness of innovative treatments is limited.

**Subject Area:** Level of Service; bicycle; pedestrian;

**Availability:** Brozen, Madeline. Exploration And Implications Of Multimodal Street Performance Metrics: What's a Passing Grade?. Diss. Rutgers, the State University of New Jersey, 2014.  
<http://www.lewis.ucla.edu/wp-content/uploads/sites/2/2014/09/Exploration-And-Implications-Of-Multimodal-Street-Performance-Metrics.pdf>

## **How does fuel economy of vehicles affect urban motor vehicle travel in the USA? *Qing Su***

**Abstract:** This paper applies the ordinary quantile regression approach to examine the impact of fuel economy of vehicles and gasoline prices on motor vehicle travel. The dataset used includes observations with a survey date before September 2008 from the 2009 National Household Travel Survey to avoid potential problems from the wild volatility of gasoline prices in late 2008 and early 2009. The regression results indicate that for every 10 % increase in fuel economy of vehicles, annual vehicle miles traveled increase by 0.9 to 1.7 % along its distribution. For every 10 % increase in average gasoline prices, annual vehicle miles decline by 0.86 to 2.65 % along the vehicle miles traveled (VMT) distribution.

**Subject Area:** Fuel economy of vehicles, Quantile regression, Vehicle miles traveled, Impact of gasoline prices

**Availability:** Su, Qing. "How does fuel economy of vehicles affect urban motor vehicle travel in the USA?." *Energy Efficiency* (2014): 1-13. <http://link.springer.com/article/10.1007/s12053-014-9302-6>

**Health and transportation: Small scale area association** Mehran Fasihozaman  
Langerudi, Mohammadian Abolfazl (Kouros)& P.S. Sriraj

**Abstract:** Public health, as a major factor influencing the livability and well-being of a community has been a subject of interest in many academic fields. It is postulated that public health has strong correlations with various factors including land development, urban form, and transportation system elements. However, due to scarcity of individual level and confidential health data, such analysis has been typically conducted in an aggregate level resulting in less accurate results due to aggregation bias. In this paper, a methodology is developed and applied to disaggregate an individual-level health data in county scale into smaller geography by using an iterative proportional fitting approach while maintaining the marginal distributions of the controlled variables. Then, the disaggregated data is used to estimate various models of individual health condition as a function of socio-demographic, built environment, and transportation system attributes. It is noteworthy that the proposed approach can be applied to disaggregate any aggregate data in an efficient way.

**Subject Area:** Health and transportation; Data disaggregation; Synthetic population; Choice modeling

**Availability:** Langerudi, Mehran Fasihozaman, Mohammadian Abolfazl, and P. S. Sriraj. "Health and transportation: Small scale area association." *Journal of Transport & Health* (2014).  
<http://www.sciencedirect.com/science/article/pii/S2214140514000590>

## **Comparison of Socioeconomic Impacts of Market-Based Instruments for Mobility Management** *Md Shahid Mamun, Dimitra Michalaka, Yafeng Yin & Siriphong Lawphongpanich*

**Abstract:** This paper presents a hypothetical case study built upon empirical data from Florida to compare socioeconomic impacts of three market-based instruments, i.e., gasoline tax, mileage fee and tradable mobility credits or permits, in regulating the vehicle miles traveled in Florida. Our empirical analysis shows that all three instruments are equally effective in achieving the control target, but yield different magnitudes of socioeconomic impacts. An increased gasoline tax leads to the most adverse changes in consumers' surplus and social welfare. In contrast, the changes caused by a tradable credit scheme are much minor. Meanwhile, the distributional effects of the gasoline tax and flat mileage fee are the most regressive, and a well-designed step fee structure can make the mileage fee policy less regressive. On the other hand, a tradable credit scheme is the most equitable in achieving the control target while maintaining the current level of revenue. When credits are allocated uniformly or in proportion to household size, the scheme is mostly progressive. When the credits are allocated with respect to existing household travel demands, the impacts are fairly uniform among different income groups.

**Subject Area:** distributional impacts and equity, gas tax, mileage fee, mobility management, tradable permits

**Availability:** Mamun, Md Shahid, et al. "Comparison of Socioeconomic Impacts of Market-Based Instruments for Mobility Management." *International Journal of Sustainable Transportation* just-accepted (2014).  
<http://www.tandfonline.com/doi/abs/10.1080/15568318.2013.859335>

## **Developing a Total Peak Period Travel Time Performance Measure** *Philip Lasley, Timothy J. Lomax, William L. Eisele, David L. Schrank*

**Abstract:** Transportation performance measures based on travel time quantities satisfy a range of mobility purposes. The measures can show the effect of many transportation and land use solutions, and they are relatively easy to communicate to a range of audiences. The concept of total travel time has been discussed since the early 1950s, but because of data inaccessibility, the planning community has rarely used total travel time as a measure. For the initial implementation of the total peak period travel time measure in the Urban Mobility Report, data from the report's primary data sets were combined in a new way to estimate road users' total travel time during the peak period. Data shortcomings were addressed with simplifying assumptions to create a calculation method that would offer a more refined value than would the use of raw or incomplete data. Total peak period travel time can provide additional explanatory power to a set of mobility performance measures and bridge the gap between traditional delay-based measurement and accessibility.

**Subject Area:** travel time, peak travel, delay-based measurement and accessibility

**Availability:** Lasley, Philip, et al. "Developing a Total Peak Period Travel Time Performance Measure." *Transportation Research Record: Journal of the Transportation Research Board* 2420.1 (2014): 15-22. <http://trb.metapress.com/index/B28154117511113V.pdf>

## **A framework for determining road pricing revenue use and its welfare effects**

*Timothy F. Welch, & Sabyasachee Mishra*

**Abstract:** In the last five decades, much of the focus on travel cost has been on what form pricing should take, whether it should be a direct road toll, in the form a Vehicle Miles Traveled (VMT) tax, encapsulated in the gas tax, or by some other mechanism. An area that has received much less attention, but is nonetheless important when considering any pricing change, is the impact of such mechanisms on traveler welfare and travel time savings. While an increase in the cost of travel may achieve traffic flow efficiencies, it may also unduly burden low-income travelers or unjustly benefit higher-income drivers. An important aspect of the road pricing debate is not just whether pricing will produce an efficient market, but also if such pricing is implemented, how the generated revenue will be managed. We propose a model to analyze transport equity by measuring change in traveler welfare and travel time savings as a result of a mix of road pricing, revenue recycling (tax cuts) and transit subsidies. In this paper we introduce a multimodal travel demand model to incorporate road pricing mechanisms with various subsidy options. A base case and five scenarios are developed to address various hypothetical pricing scenarios. We find the structure of the road pricing mechanism on average has a small impact on annual per capita traveler welfare. Replacing the state gas tax with a VMT tax can have a positive impact on traveler welfare, particularly for lower-income groups and rural residents. A VMT tax increase would be the least detrimental to welfare, especially for low-income groups.

**Subject Area:** Pricing; VMT tax; Traveler welfare; Travel time savings; Travel demand model

**Availability:** Welch, Timothy F., and Sabyasachee Mishra. "A framework for determining road pricing revenue use and its welfare effects." *Research in Transportation Economics* 44 (2014): 61-70. <http://www.sciencedirect.com/science/article/pii/S0739885914000079>



## **Mobility towers: Improving transportation efficiency policy by persistent evaluation of city-wide travel behavior** *Laura Schewel, Amol Phadke & Anand Gopal*

**Abstract:** Transportation from personal vehicles is the primary source of urban air pollution worldwide and is one of the fastest growing sources of greenhouse gas emissions (Metz et al. 2007). Coordinated deployment of Avoid-Shift-Improve policies to reduce personal vehicle usage (measured in vehicle kilometres travelled or VKT) is essential to mitigate the worsening impact of these emissions. In this paper, we describe an innovative, longitudinal method to measure key transportation behavioural metrics over time, and thus evaluate the impact of efficiency measures that aim to reduce VKT in cities. Urban planners seeking to implement new transport measures and infrastructure (roads, public transportation, bike lanes, etc.) find it difficult to quantify the ex-ante and ex-post effectiveness of such measures. In the Global South, policy makers frequently cannot measure the baseline, much less measure change. In this paper, we will show how analyzing archival (day old to years old) records from cellular tower networks that include robust safeguards for personal information, may allow measurement of key transportation metrics in a manner that can be updated constantly with low marginal cost. Thus, this method can allow quantification of the effectiveness of urban transport efficiency measures. Much of the existing literature describes progress in utilization of mobile devices for transportation data collection depending on more extensive supporting geospatial data. Our approach, which does not require such supporting data, has important implications for cities in the Global South. We propose that our cellular tower methodology is even more useful in such cities due to three factors: (1) these cities lack even basic data on the mobility behaviour of its residents, many of which can be calculated at reasonable accuracy with cellular data alone, (2) transportation behaviour is changing more rapidly, requiring more frequent measurement, and (3) mobile telephony infrastructure is at par or frequently superior to that found in the Global North.

**Subject Area:** urban transport, transport policies and measures, urban planning, information and communication technologies, transportation data

**Availability:** Schewel, Laura. "Mobility towers: improving transportation efficiency policy by persistent evaluation of city-wide travel behaviour."

[http://eetd.lbl.gov/sites/all/files/mobility\\_towers.pdf](http://eetd.lbl.gov/sites/all/files/mobility_towers.pdf)

**Missouri Livable Streets Advocacy Guide** *PedNet Coalition in cooperation with  
Trialnet and BikeWalkKC*

**Abstract:** n/a

**Subject Area:** livable streets; strategies for advocacy; campaign; public meetings; design; role play

**Availability:** <http://livablestreets.missouri.edu/wp-content/uploads/2014/06/advocacymanual-v2.pdf>

## **Incorporating spatial equity into interurban road network design** *Mostafa Mollanejad, & Lei Zhang*

**Abstract:** Methods for the road network design problem, typically, are based on optimization of the network efficiency measures (e.g. network-wide travel time) under a predefined budget. In these approaches, equity issues are not taken into account and, consequently, most of the road improvements are planned next to large cities. Thus, disparities between large and small cities increase, which does not conform to sustainable development objectives. In this paper, to overcome concerns associated with traditional methods, equity is incorporated into the interurban road network design problem. To this end, accessibility concepts are employed. However, unlike previous studies, instead of maximizing the total accessibility, a new definition is proposed for inaccessibility, and total inaccessibility is minimized throughout the network. Using this new definition not only is more compatible with the equity issue, but also helps to eliminate the nonlinearity of the problem. Average travel time to neighboring opportunities is utilized to propose this definition for inaccessibility, which captures the reality more effectively. With the aim of this definition, equity is incorporated into the road network design problem implicitly. This is another improvement over previous methods, where a new term in the objective function or a new constraint is added to include the equity. The proposed model is formulated as a mixed integer linear programming (MILP) problem, where the objective is to minimize the aggregate inaccessibility over all the population centers in the network. To illustrate the application of the model, the Northwest region of the United States is used as the case study. The respective exact solution of the example is found using a commercial solver (CPLEX). This new solution is also compared with the solutions from the traditional methods.

**Subject Area:** Spatial equity; Accessibility; Transportation network design; Interurban

**Availability:** Mollanejad, Mostafa, and Lei Zhang. "Incorporating spatial equity into interurban road network design." *Journal of Transport Geography* 39 (2014): 156-164.  
<http://www.sciencedirect.com/science/article/pii/S0966692314001379>

## **The Water, Energy, and Infrastructure Co-benefits of Smart Growth Planning in Phoenix, Arizona** *Matthew J. Nahlik*

**Abstract:** Phoenix, Arizona is an auto-dependent metropolitan area of close to 5 million people in 28 cities in the subtropical Sonoran desert climate of the Southwest United States. Currently, Valley Metro operates one light-rail line in the region, but additional extensions are under construction and in planning which will create a larger network of high-capacity transit. The local planning organization, Maricopa Association of Governments, has projected a demand for 485,000 households and nearly 130 million ft<sup>2</sup> of commercial space by 2040 immediately around this network of transit to partially support the projected population growth of the region.

During the Spring 2014 semester at Arizona State University, the multi-disciplinary course "Urban Infrastructure Anatomy and Sustainable Development" brought together students from engineering, sustainability, life sciences and urban planning to estimate the water, energy, and transportation changes of residents who live within walking distance of high-capacity transit in Phoenix and the potential barriers which currently oppose smart growth development. By comparing the results of this assessment to business-as-usual development, we find that the total energy consumption and greenhouse gas emissions from smart growth can be up to 42% lower than an equivalent amount of sprawl development and require nearly 70% less funding for infrastructure construction. Additionally, water consumption can be reduced by 37% and would be a major benefit to the desert region as population continues to grow adding stress on provisions from the Colorado River Basin. While water, energy, and infrastructure co-benefits of smart growth are found to be likely, institutional barriers exist that may prevent development from occurring and these barriers must be overcome to enable this type of development in the future.

**Subject Area:** land use; energy consumption; water consumption

**Availability:** Chester, Mikhail V., et al. "The Water, Energy, and Infrastructure Co-benefits of Smart Growth Planning in Phoenix, Arizona." (2014).

<http://repository.asu.edu/attachments/134588/content/asu-cobenefits-phoenix-smart-growth.pdf>

## **The effects of road user charges in the context of weak parking policies: The case of Malta** *Maria Attard, & Stephen Ison*

**Abstract:** Road user charging is often thought of as a first best travel demand management solution for dealing with the issue of congestion, when compared to the use of parking charges. The case for this is that parking charges are more likely to result in improvements in the situation rather than an optimal outcome. One of the reasons is that parking can be seen as a complement to vehicle travel impacting on the termination point of a journey as opposed to charging directly for the use of road space as in the case of road user charging. In saying this parking charges are used extensively as a demand management measure and there are still only a few road user charging schemes worldwide. One scheme that has moved from a parking charge to a road user charge is the Controlled Vehicular Access system in Valletta, Malta where a fixed annual charge (V-licence) for access and parking into the city was replaced by a time-based road user charge implemented in May 2007. The aim of this paper is to assess the effects of road user charging in the context of ineffective parking policies, using the case of Valletta. The paper is based on scheme documentation, semi-structured interviews with key stakeholders, supplemented by personal observations of one of the authors directly involved in the process of developing and implementing the road user charging system. The research concludes that the overall impacts of the road user charge in the City were positive but more effort will have to be made to strengthen the road charging scheme and parking policy to effectively manage the travel demands of the islands' population.

**Subject Area:** Road pricing; Parking; Malta

**Availability:** Attard, Maria, and Stephen Ison. "The Effects of road user charges in the context of weak parking policies: The case of Malta." *Case Studies on Transport Policy* (2014).

<http://www.sciencedirect.com/science/article/pii/S2213624X14000273>

## **Does the income elasticity of road traffic depend on the source of income?**

*Scott Le Vine, Bingqing (Emily) Chen, & John Polak*

**Abstract:** An extensive body of literature addresses the income elasticity of road traffic, in which income is typically treated as a homogenous quantity. Here we report evidence of heterogeneity in cross-sectional estimates of the elasticity of vehicle-kilometres of travel (VKT) with respect to income, when household income is disaggregated on the basis of income source.

The results are generally intuitive, and show that the cross-sectional income elasticity of road traffic is not homogeneous as is typically specified in transport planning models. We show that in a number of circumstances the cross-sectional elasticity with respect to aggregate household income is of the opposite sign in comparison to more refined estimates of elasticity disaggregated by income source. If further research confirms that the elasticities we report here are causal in nature, neglecting the elemental effects could result in misleading results affecting practical infrastructure-investment and policy decisions, particularly as the mix of income sources shifts (e.g. if, as society ages, pension income increases as a share of all income).

These results are of interest to both researchers and forecasters of travel demand, as well as designers of future travel survey instruments; the latter group must decide how to generate data about respondents' income. Current expert guidance is to collect a single estimate of aggregate income at the household level. Future travel survey design choices will bound the analyses that can be supported by the resulting survey data, and therefore methodological research to re-visit the trade-offs associated with such choices is warranted.

**Subject Area:** Income elasticity; Road traffic; Income source; Travel survey methods

**Availability:** Le Vine, Scott, Bingqing Emily Chen, and John Polak. "Does the income elasticity of road traffic depend on the source of income?." *Transportation Research Part A: Policy and Practice* 67 (2014): 15-29.

<http://www.sciencedirect.com/science/article/pii/S0965856414001438>

**Effects of Natural Gas Vehicles and Fuel Prices on Key Transportation Economic Metrics** *Kevin Heaslip, Ryan Bosworth, Ryan Barnes, Ali Soltani Sobh, Michael Thomas, Ziqi Song*

**Abstract:** The Washington State Department of Transportation (WSDOT) is responsible for planning, operating, and maintaining a highway network consisting of over 18,500 lane-miles of highway. Planning and building highways is, by nature, a long-range enterprise. It requires making many assumptions about future travel demand as well as estimating future fuel tax revenue. In recent years the growing uncertainty about oil prices and availability has made long-range transportation planning even more challenging. Rather than relying on trend extrapolation, this study uses market mechanisms to shed light on key long-range transportation planning assumptions. Although WSDOT is pursuing a variety of alternative fuels and energy sources including Electric Vehicles (EV), biofuels, propane, natural gas, etc. and their respective infrastructures, this study focuses primarily on natural gas. In particular, this study will help WSDOT assess the likelihood natural gas will substitute for petroleum fuels and estimate the impacts changes in fuel prices will have on travel demand, fuel consumption, Greenhouse Gas emissions, and fuel tax revenues.

The results of the modeling show that the potential impacts of Natural Gas Vehicles (NGV) have the potential to have effects on vehicle miles traveled (VMT), emissions, and fuel tax revenue. The effects of these vehicles are muted by the current lack of natural gas vehicles in the fleet. The usage of natural gas vehicles is limited to fleet vehicles and vehicles with high mileage usage. Challenges with widespread integration currently include the increased upfront capital costs associated with vehicles with natural gas, decreased power for heavy vehicles, and range anxiety in locations without developed natural gas fueling infrastructure. Currently the NGV market in the state of Washington is hampered by these factors. The modeling and analysis provided in the document can be used to analyze changing conditions in the NGV market and the effects on key transportation metrics.

**Subject Area:** Alternative Fuels, Transportation Economics, Vehicle Miles Travelled

**Availability:** Bosworth, Ryan, et al. "Effects of Natural Gas Vehicles and Fuel Prices on Key Transportation Economic Metrics." (2014).

<http://www.wsdot.wa.gov/research/reports/fullreports/829.1.pdf>

## **Expansive Urban Growth Boundary** *Hiramatsu, Tomoru*

**Abstract:** Intuitively, increasing the available land, which is an economic resource, should improve social welfare. However, traditional economic models of urban economy show that an urban growth boundary (UGB) policy, which restricts land availability, actually improves social welfare by reducing the negative externalities imposed by congestion. Nevertheless, recent studies have found that a UGB policy is not always welfare improving. This paper examines both expansive and restrictive UGB regimes using the Chicago metropolitan statistical area as an example. The simulation results presented herein show that an expansive UGB positively affects social welfare, while a restrictive UGB improves social welfare if open spaces are considered and vacant land outside the UGB registers a moderate fall in value. Further, the proportion of absentee landlords is an important determinant of welfare gains, since their gain (or loss) from a UGB policy in the real estate market is a drain from the urban economy. Moreover, a restrictive UGB leads to centralized land use, while an expansive UGB results in moderate suburbanization. Finally, gasoline consumption decreases under a restrictive UGB but increases under an expansive UGB because vehicle miles travelled increase as the city expands outward.

**Subject Area:** Urban Growth Boundary, Centralization and Suburbanization, Computable General Equilibrium

**Availability:** Hiramatsu, Tomoru. "Expansive Urban Growth Boundary." *Modern Economy* 2014 (2014). [http://file.scirp.org/Html/8-7200821\\_47288.htm](http://file.scirp.org/Html/8-7200821_47288.htm)



## **Automobile Path Dependence in Phoenix: Driving Sustainability by Getting Off of the Pavement and Out of the Car** *Mindy Kimball*

**Abstract:** A methodology is developed that integrates institutional analysis with Life Cycle Assessment (LCA) to identify and overcome barriers to sustainability transitions and to bridge the gap between environmental practitioners and decision makers. LCA results are rarely joined with analyses of the social systems that control or influence decision making and policies. As a result, LCA conclusions generally lack information about who or what controls different parts of the system, where and when the processes' environmental decision making happens, and what aspects of the system (i.e. a policy or regulatory requirement) would have to change to enable lower environmental impact futures.

The value of the combined institutional analysis and LCA (the IA-LCA) is demonstrated using a case study of passenger transportation in the Phoenix, Arizona metropolitan area. A retrospective LCA is developed to estimate how roadway investment has enabled personal vehicle travel and its associated energy, environmental, and economic effects. Using regional travel forecasts, a prospective life cycle inventory is developed. Alternative trajectories are modeled to reveal future "savings" from reduced roadway construction and vehicle travel. An institutional analysis matches the LCA results with the specific institutions, players, and policies that should be targeted to enable transitions to these alternative futures.

The results show that energy, economic, and environmental benefits from changes in passenger transportation systems are possible, but vary significantly depending on the timing of the interventions. Transition strategies aimed at the most optimistic benefits should include 1) significant land-use planning initiatives at the local and regional level to incentivize transit-oriented development infill and urban densification, 2) changes to state or federal gasoline taxes, 3) enacting a price on carbon, and 4) nearly doubling vehicle fuel efficiency together with greater market penetration of alternative fuel vehicles. This aggressive trajectory could decrease the 2050 energy consumption to 1995 levels, greenhouse gas emissions to 1995, particulate emissions to 2006, and smog-forming emissions to 1972. The potential benefits and costs are both private and public, and the results vary when transition strategies are applied in different spatial and temporal patterns.

**Subject Area:** transition strategy; Life Cycle Assessment

**Availability:** Kimball, Mindy. Automobile Path Dependence in Phoenix: Driving Sustainability by Getting Off of the Pavement and Out of the Car. Diss. ARIZONA STATE UNIVERSITY, 2014.  
[http://repository.asu.edu/attachments/134923/content/Kimball\\_asu\\_0010E\\_13822.pdf](http://repository.asu.edu/attachments/134923/content/Kimball_asu_0010E_13822.pdf)

**Cash for Corollas: When Stimulus Reduces Spending** *Mark Hoekstra Steven L. Puller & Jeremy West*

**Abstract:** Cash for Clunkers was an economic stimulus program aimed at increasing new vehicle spending by subsidizing the replacement of older vehicles. Using a regression discontinuity design, we show the increase in sales during the two month program was completely offset during the following seven to nine months, consistent with previous research. However, we also find the program's fuel efficiency restrictions induced households to purchase more fuel efficient but less expensive vehicles, thereby reducing industry revenues by three billion dollars over the entire nine to eleven month period. This highlights the conflict between the stimulus and environmental objectives of the policy.

**Subject Area:** Cash for Clunkers; economic stimulus; fuel efficiency

**Availability:** Hoekstra, Mark, Steven L. Puller, and Jeremy West. "Cash for Corollas: When Stimulus Reduces Spending." (2014).

[http://econweb.tamu.edu/puller/AcadDocs/HPW\\_stimulus\\_latest.pdf](http://econweb.tamu.edu/puller/AcadDocs/HPW_stimulus_latest.pdf)

## **Minnesota Cost Of Living Study 2014 Annual Report** *Steve Hine, Rachel Vilsack, & John Clay*

**Abstract:** The mission of the Cost of Living Study is to estimate a basic-needs cost of living in Minnesota and specifically the cost of basic needs for individuals and for various family sizes, by county and aggregated to regional and statewide estimates. The study examines living costs in seven cost categories: food, housing, health care, transportation, child care, other necessities, and net taxes.

Rather than constituting a description of what income families today are earning, the study estimates the cost of living which families would need to meet through full-time income in order to meet basic needs. It is assumed that the resulting estimates will represent neither a poverty-level living nor a middle-class living but rather a safe, healthy, sufficient living.

The study results will constitute an additional economic indicator which may be utilized by public and private institutions and by individuals.

Beyond providing the raw data of these cost of living estimates, the Department of Employment and Economic Development will, as mandated by the Statute, also offer analyses and recommendations, based on the cost of living study findings, to aid in the assessment of employment and economic development planning needs throughout the state.

**Subject Area:** cost of living; Minnesota;

**Availability:** Alexandra Forter Sirota, Tazra Mitchell, and Cedric Johnson -NCBudget & Tax Center . "LIVING INCOME STANDARD 2014: Boom in Low-Wage Work Means Many North Carolinians Don't Make an Adequate Income." (June 2014).

<http://www.ncjustice.org/?q=budget-and-tax/living-income-standard-2014-boom-low-wage-work-means-many-north-carolinians-dont-make>

**Living Income Standard 2014: Boom in Low-Wage Work Means Many North Carolinians Don't Make an Adequate Income** *Alexandra Forter Sirota, Tazra Mitchell, and Cedric Johnson*

**Abstract:** One in five North Carolina families earn too little to afford life's essentials and move up the economic ladder. A North Carolina family of two adults and two children must earn \$52,275 annually to afford housing, food, child care, health care, transportation, taxes and other necessities, based on the Budget & Tax Center's Living Income Standard (LIS) for 2014.

**Subject Area:** budget; living income

**Availability:** Alexandra Forter Sirota, Tazra Mitchell, and Cedric Johnson -NCBudget & Tax Center . "LIVING INCOME STANDARD 2014: Boom in Low-Wage Work Means Many North Carolinians Don't Make an Adequate Income." (June 2014).

<http://www.ncjustice.org/?q=budget-and-tax/living-income-standard-2014-boom-low-wage-work-means-many-north-carolinians-dont-make>

## **The Global Effects of Housing Policy** *Kyle Mangum*

**Abstract:** This paper studies the links between housing policies and aggregate energy use in the U.S. I connect two strands of literature on cities—that cities vary in their per capita energy use and in terms of housing supply elasticity—to measure the effects of location choice and housing consumption on aggregate energy use. I build a dynamic spatial equilibrium model of U.S. metropolitan areas, accounting for local heterogeneity in housing demand and supply. Importantly, I decompose the supply restrictions into those naturally-occurring and those policy-induced. After matching the model to data on housing prices, construction activity, and building density, I conduct policy simulations to quantify the effect of various housing policies on energy use. Results indicate that removing the federal tax subsidy for housing would result in a lower aggregate energy use, as would increasing land use regulations in high energy use locations. The primary channel is reducing the amount of housing consumed per person, and the secondary channel is in reallocating population from inefficient to more efficient locations.

**Subject Area:** land use, energy use, housing supply, dynamic spatial equilibrium

**Availability:** Mangum, Kyle. "The Global Effects of Housing Policy." (2014).

<http://www.ieb.ub.edu/files/PapersWSUE2014/Mangum.pdf>

## **Does Obesity Matter for the Environment? Evidence from Vehicle Choices and Driving** *Hocheol Jeon*

**Abstract:** The rising rate of obesity has become a prominent social concern in the U.S. and throughout the world. Several recent literature examines how obesity influences households driving or vehicle choice behavior. While the results in prior studies are compelling, the studies suffer from two shortcomings. First, the researches rely on aggregate data (national or county level), rather than individual level observations, potentially masking important factors determining individual choices on vehicles and driving. Second, while they are able to establish a link between obesity and vehicle choice or driving, linking vehicle choice in turn to overall emissions requires information regarding vehicle miles driven. The objective of this study is to address these two limitations using household observations from the Panel Study of Income Dynamics (PSID), jointly modeling the impact of obesity on the vehicle choice and vehicle miles traveled (VMT). In particular, we investigate the impact of obesity and overweight by employing both reduced form (linear panel model) and structural model (joint discrete/continuous choice model). Our empirical study suggests that the comprehensive impacts of obesity and overweight on gasoline consumption are little or ambiguous. In other words, the effect of the policy to reduce the rate of obesity and overweight are not as rosy as prior studies expect.

**Subject Area:** obesity; vehicle choice behavior;

**Availability:** Jeon, Hocheol. "Does Obesity Matter for the Environment? Evidence from Vehicle Choices and Driving." (2014).

[http://ageconsearch.umn.edu/bitstream/170550/2/2014AAEA\\_Slected\\_Paper\\_JEON.pdf](http://ageconsearch.umn.edu/bitstream/170550/2/2014AAEA_Slected_Paper_JEON.pdf)

# **Advanced and Alternative Fuel Vehicle Policies: Regulations and Incentives in the United States** *Alan Theodore Jenn*

**Abstract:** Transportation policy is playing an increasingly important role in the transition towards more fuel-efficient vehicles and alternative fuel vehicles (AFVs). Whether the policy seeks to promote adoption through mandatory requirements or through monetary incentives, or to address issues related to adoption of AFVs, it is clear that such policies can have large ranging impacts on the future of the US transportation system. The work I conduct in my dissertation seeks to understand these policies, in the past, present, and future. I evaluate the effects of the Energy Policy Act of 2005 (EPACT) on the adoption of HEVs. As part of EPACT, a tax credit incentives program was implemented for consumers purchasing HEVs. Using a unique fixed effects regression approach with lagged instrumental variables, I am able to estimate the effects of the incentives. I go on to examine the effects of the adoption of electric vehicles on funding for transportation infrastructure. A significant portion of revenue for transportation infrastructure comes from taxes on gasoline, these funds will likely be diminished to some extent as electric vehicles are adopted as they consume little to no gasoline as fuel. The total annual revenue generation at the federal level could decrease by as much as \$200 million by 2025, though this is quite a small portion of total revenues for transportation infrastructure. I demonstrate that the revenue decrease can easily be made up through small policy fee changes in either at fixed or through incremental increases in use fees, though implementation of such policies can be difficult politically. I also focus on the recent implementation of alternative fuel vehicle incentives in the v2009 update of the CAFE standards. I demonstrate that while the AFV incentives help spur the production and adoption of AFVs, there is a short-term emissions penalty due to the structure of the policy. I find that every AFV sold results in an increase in emissions rate for another vehicle of 50-400 grams of CO<sub>2</sub> per mile, comparable to adding an additional conventional vehicle onto the road. I further extends this work by investigating how other policies promoting AFV sales interact with the CAFE policy. I focus specifically on the California ZEV mandate interaction and find that there is an increase of 120 million metric tons of CO<sub>2</sub> for new cars sold between 2012 and 2025. Finally I examine the response of driving behavior response to changes in gasoline prices. Using a unique dataset obtained from Pennsylvanias Department of Transportation, we are able to observe annual driving behavior at the individual vehicle level from 2000 through 2010. We observe heterogeneity of price elasticities using two methods: separating data by quantiles over the factors of interest and by interacting the factors of interest as categorical variables with gasoline prices.

**Subject Area:** Alternative Fuels Vehicle; gasoline prices; travel behavior

**Availability:** Jenn, A. T. (2014). Advanced and Alternative Fuel Vehicle Policies: Regulations and Incentives in the United States (Doctoral dissertation, Carnegie Mellon University).

<http://www.contrib.andrew.cmu.edu/~ajenn/wordpress/wp-content/papercite-data/pdf/phdthesis-full.pdf>

## **Online Appendix For “Pareto Improvements From Lexus Lanes: The Case For Pricing A Portion Of The Lanes On Congested Highways” Jonathan D. Hall**

**Abstract:** This appendix contains a brief discussion of other barriers to congestion pricing as well as evidence that the received wisdom among academics, policy makers, and the public is that congestion pricing is a Kaldor-Hicks improvement that while efficient, hurts many road users. Other barriers to implementing congestion pricing include the belief that it is unfair to let some pay with money to get faster travel times, concern that since tolling brings in more revenue for the government it will lead to increased government spending, and worry that it will hurt downtown retail. For an example of the first belief see Malady, Matthew. 2013. “Want to Save Civilization? Get in Line,” New York Times, May 31, 2013. When drivers in Southern California were asked why they oppose congestion pricing, in the specific form of allowing solo drivers to pay to travel in carpool only lanes, 40% responded that either the government will waste the money or it will increase government bureaucracy (Fall 1999 Commuter Survey from Sullivan [1999]). For evidence on the downtown retail store’s opposition to congestion pricing see De Borger and Russo [2013] As evidence for the received wisdom being that congestion pricing is a Kaldor-Hicks improvement, consider the following examples. Starting with academics, Lindsey and Verhoef [2008] suggest that “most likely, these losses are the root of the longstanding opposition to congestion tolling in road transport,” a view echoed in Starkie [1986], Cohen [1987], Giuliano [1992], Arnott et al. [1994], Lave [1994], Small et al. [2005] and Small and Verhoef [2007]. Turning to the views of policy makers, Ison [2000, p. 276] finds that in the United Kingdom 80% of local politicians with responsibility for transportation issues, academics who studied such issues, and transport interest groups “view urban road pricing as being publicly unacceptable.” Furthermore, the public almost always oppose congestion pricing. For example, Jones [1991] reports on twelve polls in the United Kingdom and finds widespread opposition to congestion pricing; Harrington et al. [2001] cites a number of surveys in the United States finding opposition to congestion pricing as well as finding 57% of their survey respondents oppose congestion pricing; and Podgorski and Kockelman [2006] find that 70% of Texans oppose pricing existing roads. The notable counter-example is that after congestion pricing has been implemented it generally finds widespread support. For example, in Stockholm they voted to keep congestion pricing after a seven month trial [Hårsman and Quigley, 2010]. As one voter put it, “Turkeys don’t vote for Christmas—and motorists won’t vote for more taxes to drive.”<sup>1</sup>

**Subject Area:** Pricing; VMT tax; Traveler welfare; Travel time savings; Travel demand model

**Availability:** Hall, Jonathan D. "Online Appendix For “Pareto Improvements From Lexus Lanes: The Case For Pricing A Portion Of The Lanes On Congested Highways”." (2014).

[http://www.tinbergen.nl/wp-content/uploads/2014/04/PI\\_from\\_LL-Appendix1.pdf](http://www.tinbergen.nl/wp-content/uploads/2014/04/PI_from_LL-Appendix1.pdf)



## **A framework for determining road pricing revenue use and its welfare effects**

*Timothy F. Welch, & Sabyasachee Mishra*

**Abstract:** In the last five decades, much of the focus on travel cost has been on what form pricing should take, whether it should be a direct road toll, in the form a Vehicle Miles Traveled (VMT) tax, encapsulated in the gas tax, or by some other mechanism. An area that has received much less attention, but is nonetheless important when considering any pricing change, is the impact of such mechanisms on traveler welfare and travel time savings. While an increase in the cost of travel may achieve traffic flow efficiencies, it may also unduly burden low-income travelers or unjustly benefit higher-income drivers. An important aspect of the road pricing debate is not just whether pricing will produce an efficient market, but also if such pricing is implemented, how the generated revenue will be managed. We propose a model to analyze transport equity by measuring change in traveler welfare and travel time savings as a result of a mix of road pricing, revenue recycling (tax cuts) and transit subsidies. In this paper we introduce a multimodal travel demand model to incorporate road pricing mechanisms with various subsidy options. A base case and five scenarios are developed to address various hypothetical pricing scenarios. We find the structure of the road pricing mechanism on average has a small impact on annual per capita traveler welfare. Replacing the state gas tax with a VMT tax can have a positive impact on traveler welfare, particularly for lower-income groups and rural residents. A VMT tax increase would be the least detrimental to welfare, especially for low-income groups.

**Subject Area:** Pricing; VMT tax; Traveler welfare; Travel time savings; Travel demand model

**Availability:** Welch, Timothy F., and Sabyasachee Mishra. "A framework for determining road pricing revenue use and its welfare effects." *Research in Transportation Economics* (2014). <http://www.sciencedirect.com/science/article/pii/S0739885914000079>

## **Household Demand and Willingness to Pay for Hybrid Vehicles** *Yizao Liu*

**Abstract:** This paper quantitatively evaluates consumers' willingness to pay for hybrid vehicles by estimating the demand of hybrid vehicles in the U.S. market. Using micro-level data on consumer purchases of hybrid and non-hybrid vehicles from National Household Travel Survey 2009, this paper formulates a mixed logit model of consumers' vehicle choices. Parameter estimates are then used to evaluate consumers' willingness to pay for hybrids. Results suggest that households' willingness to pay for hybrids ranges from \$963 to \$1,718 for different income groups, which is significantly lower than the average price premium (over \$5,000) of hybrid vehicles, even when taking the fuel costs savings of hybrid vehicles into consideration. The differences reveal that although the market has shown increasing interest in hybrid vehicles, consumers' valuation of the hybrid feature is still not high enough to compensate for the price premium when they make new purchases. Policy simulations are conducted to examine the effects of raising federal tax incentives on the purchase of hybrid vehicles.

**Subject Area:** Willingness to Pay; Fuel Economy; Hybrid Vehicles; Tax Incentives

**Availability:** Liu, Yizao. "Household Demand and Willingness to Pay for Hybrid Vehicles." *Energy Economics* (2014). <http://www.sciencedirect.com/science/article/pii/S0140988314000747>

## **No Californian Left Behind: Clean and affordable transportation options for all through vehicle replacement** *Cole Wheeler, Jesse Morris, and Kate Gordon*

**Abstract:** In this report, we discuss the contribution made by these highly polluting vehicles to the state's air quality problems; we also discuss the serious drag that driving these vehicles can have on household budgets. After outlining these problems, we discuss the state's current policies aimed at promoting vehicle retirement and replacement and offer some recommendations for improving those programs. We have specific recommendations to maximize the impact of the current Enhanced Fleet Modernization Program (EFMP). California is already a leader in advanced and high-tech transportation and transit solutions. It is time we also became a leader in pragmatic solutions for a population that is sometimes left behind in these discussions: non-urban, low-income, car dependent households. Bringing solutions to these communities will have a huge impact on our current air quality and family budgets; it will also widen the circle of Californians who play an active part in moving this state toward a cleaner, less oil dependent future.

**Subject Area:** Fleet Modernization; CAFÉ, California; vehicle replacement

**Availability:** Wheeler, Cole, Jesse Morris, and Kate Gordon. "No Californian Left Behind." (2014). [http://thenextgeneration.org/files/No\\_Californian\\_Left\\_Behind\\_FINAL.pdf](http://thenextgeneration.org/files/No_Californian_Left_Behind_FINAL.pdf)

## **The Effect of Urban Form on Residential Relocation and Non-work Travel Patterns: A Case of Florida Households** *Concas, Sisinnio & DeSalvo, Joseph S*

**Abstract:** The authors investigate the impact of polycentric urban form and decentralized employment on residential location decisions and non-work motor vehicle travel. The authors first present empirically testable models of the interaction between urban form and motor vehicle travel demand drawn from urban economic theory. Then travel behavior responses are modeled at the household level using a dataset that combines tour-based activity-travel data with land-use measures at the United States Census block group level. The travel behavior data comes from a sample of 15,884 households from the Florida add-on version of the 2009 National Household Travel Survey (NHTS), as provided by the Florida Department of Transportation System Planning Office. Using geographic information system mapping software, the authors merge the NHTS data with parcel-level housing data to estimate accessibility measures. Preliminary findings provide evidence linking measures of polycentric urban form to changes in home-work commuter patterns and changes in non-work motor vehicle travel. The authors observe that residency status positively affects residential location choices, as indicated by selected residency tenure variables. Households residing in the State for less than two years have a 10-percent longer home-work commuting pattern. These households tend to have a more disperse activity space (a realization of the time-space prism), resulting in increased miles traveled and longer home-work distance. The combined effect of relocation patterns on the demand of travel results in an increase of about 21 percent in daily tour-level vehicle miles of travel and an increase of about 5.7 percent in the size of the activity space. These results provide evidence to support policies that would reduce the spatial allocation of activities and improve connectivity to other modes of transport at and around subcenters.

**Subject Area:** Commuting; Geographic information systems; Households; Land use; Residential location; Travel demand; Travel patterns; Vehicle miles of travel

**Availability:** Concas, Sisinnio, and Joseph S. DeSalvo. "The Effect of Urban Form on Residential Relocation and Non-work Travel Patterns: A Case of Florida Households." Transportation Research Board 93rd Annual Meeting. No. 14-3543. 2014.  
<http://trid.trb.org/view.aspx?id=1288880>

## **Network Structure and Travel** *Pavithra Kandadai Parthasarathi*

**Abstract:** Changing the design aspects of urban form is a positive approach to improving transportation. Land use and urban design strategies have been proposed to not only to bring about changes in travel behavior but as a way of providing a better quality of life to the residents. While the research on the relationship between urban form and travel behavior has been pretty extensive, there is a clear gap in the explicit consideration of the underlying transportation network, even though researchers acknowledge its importance. This dissertation aims to continue on the research interest in understanding travel behavior while explicitly accounting for the underlying transportation network structure.

Transportation networks have an underlying structure, defined by the layout, arrangement and the connectivity of the individual network elements, namely the road segments and their intersections. The differences in network structure exist among and between networks. This dissertation argues that travelers perceive and respond to these differences in underlying network structure and complexity, resulting in differences in observed travel patterns. This hypothesized relationship between network structure and travel is analyzed in this dissertation using individual and aggregate level travel and network data from metropolitan regions across the U.S. Various measures of network structure, compiled from existing sources, are used to quantify the structure of street networks. The relation between these quantitative measures and travel is then identified using econometric models.

The underlying principle of this research is that while the transportation network is not the only indicator of urban form and travel, an understanding of the transportation network structure will provide a good framework for understanding and designing cities. The importance of such an understanding is critical due to the long term and irreversible nature of transportation network decisions. The comprehensive analyses presented in this dissertation provide a clear understanding of the role of network design in influencing travel.

**Subject Area:** land use; transportation network

**Availability:** Parthasarathi, Pavithra Kandadai, and David Levinson. "A DISSERTATION SUBMITTED TO THE FACULTY OF THE GRADUATE SCHOOL OF THE UNIVERSITY OF MINNESOTA." <http://trid.trb.org/view.aspx?id=1248222>

## **The Effect of Smart Growth Policies on Travel Demand** *Cervero, Robert & Kockelman, Kara*

**Abstract:** Smart growth policies are often considered by planning agencies as a strategy to reduce congestion, emissions and other impacts on travel demand, but most of the current planning application tools are not sufficiently sensitive to the aspects of smart growth policies needed to determine travel demand. This project reviewed available research to determine the underlying relationships between households, firms and travel demand and then turned these relationships into a regional scenario planning tool that can be used to evaluate the impacts of various smart growth policies. The Smart Growth Area Planning (SmartGAP) tool synthesizes households and firms in a region and determines the travel demand characteristics of these households and firms based on the characteristics of their built environment and transportation policies affecting their travel behavior. The software has been developed with a Graphical User Interface (GUI) to allow non-technical users to be able to use the tool for planning activities more easily. Three pilot tests were completed to demonstrate the usefulness and reasonableness of SmartGAP to evaluate how smart growth policies affect travel demand, environmental, financial and economic, location and community impacts.

**Subject Area:** Graphical user interfaces; Impact studies; Regional planning; Smart growth; Software; Transportation policy; Travel behavior; Travel demand

**Availability:** Cervero, Robert, and Kara Kockelman. The Effect of Smart Growth Policies on Travel Demand. No. SHRP 2 Capacity Project C16. 2013.

<http://trid.trb.org/view.aspx?id=1248222>

**The Elder Economic Security Standard Index: A New Indicator for Evaluating Economic Security in Later Life** *Jan E. Mutchler, Yao-Chi Shih, Jiyoung Lyu, Ellen A. Bruce, & Alison Gottlieb*

**Abstract:** Efforts to evaluate the impact of programs designed to safeguard the well-being of older adults in the US are stymied by the absence of adequate tools to answer a key question: how much income is “enough” in later life? The purpose of this paper is to report on a new indicator of income adequacy designed to correct this measurement gap. The Elder Economic Security Standard Index (Elder Index) is a geographically specific measure of the cost of living independently for older adults aged 65 and over. This paper provides an overview of the development of the Elder Index, demonstrates the variability in Elder Index values both geographically and across different residential settings, and provides an illustration of how the Elder Index may be used in establishing differences in economic hardship across subgroups of older adults. The paper concludes with a discussion of the potential research and policy uses of this new measure.

**Subject Area:** elderly; income adequacy; Elder Economic Security Standard Index; Cost of Living

**Availability:** Mutchler, Jan E., et al. "The Elder Economic Security Standard Index™: A New Indicator for Evaluating Economic Security in Later Life." *Social Indicators Research*: 1-20.  
<http://link.springer.com/article/10.1007/s11205-014-0577-y>

## **Measuring community completeness: jobs–housing balance, accessibility, and convenient local access to nonwork destinations** *Louis A Merlin*

**Abstract:** Using 2007 travel-diary data from metropolitan Chicago, I investigate what aspects of urban form contribute most to community completeness, as defined by internal tour capture for nonwork tours. I examine two distinct geographic scales: census-defined ‘places’, and synthetically constructed ‘centered communities’. Centered communities are defined as nonwork travel sheds centered upon well-defined concentrations of activity. Higher accessibility share (a new urban form measure defined in the paper) and higher mixed use both significantly predict greater community completeness, as do higher levels of residential or employment density. Furthermore, I find that mixed-use measures describe something other than simple proximity to job-based attractions; these measures also address the appropriate balance of activities necessary for a complete community. To build more-complete communities, planners need to ensure that local accessibility to a variety of destinations of interest is high relative to the regional accessibility to these same types of destinations outside the community.

**Subject Area:** complete communities, jobs–housing balance, internal trip capture, mixed use, accessibility, nonwork travel

**Availability:** Merlin L A, 2014, "Measuring community completeness: jobs–housing balance, accessibility, and convenient local access to nonwork destinations" *Environment and Planning B: Planning and Design* advance online publication, doi:10.1068/b120010p  
<http://www.envplan.com/abstract.cgi?id=b120010p>



## **Time Dependent Accessibility** *Nikhil Kaza*

**Abstract:** Many place based accessibility studies ignore the time component. Relying on theoretical frameworks that treat distance between two fixed points as constant, these methods ignore the diurnal and seasonal changes in accessibility. Furthermore, network distances between two nodes are dependent on the network structure and weight distribution on the edges. These weights can change quite frequently and the network structure itself is subject to modification because of availability and unavailability of links and nodes. All these reasons, point to considering the implications of time variation in accessibility of a place. Using the case of transit, where all these feature are readily apparent simultaneously, I demonstrate the volatility in accessibility for two counties in North Carolina. Significant diurnal changes are observed in quarter of the locations and in the rest the changes are minimal mostly because of low levels of transit accessibility. I argue not for minimizing the volatility, but acknowledging its impacts on mode choices, location choices and therefore on spatial structure of cities.

**Subject Area:** diurnal and seasonal changes; accessibility

**Availability:** Kaza, Nikhil. "Time Dependent Accessibility."

[http://sia.planning.unc.edu/uploads/publications/Time\\_Dependent\\_Transit\\_Accessibility\\_v1.pdf](http://sia.planning.unc.edu/uploads/publications/Time_Dependent_Transit_Accessibility_v1.pdf)

## **User Guide of the ORNL MA3T Model (V20130729)** *Zhenhong Lin, David Greene & Jake Ward*

**Abstract:** The Market Acceptance of Advanced Automotive Technologies (MA3T) model has been developed by Oak Ridge National Laboratory (ORNL) as a tool for analyzing scenarios of demand for various automotive powertrain technologies in response to changes in technologies, infrastructure, energy prices, consumer preferences, and policies. Implemented using Microsoft® Excel for Windows, MA3T simulates market demand by representing relevant attributes of technologies and consumer behavior, such as technological learning by doing, range anxiety, access to recharging points, daily driving patterns and willingness to accept technological innovation. Much remains to be learned about how consumers will evaluate novel vehicle technologies, such as plug-in hybrid electric vehicles (PHEV), extended-range electric vehicle (EREV), battery electric vehicles (BEV) and fuel cell vehicles (FCV), as well as how these vehicles are likely to be operated. Due to data limitation, the approach taken in developing the MA3T model is to create a framework for integrating data and behavioral models at an appropriate level of detail, whether or not the data are fully available or the behaviors are fully understood at the present time. As more is learned about the advanced vehicle technologies and consumers' preferences towards them, the model will be continuously updated and improved.

This report is intended to provide general instructions regarding how to use MA3T. For a more detailed description of the methodology and applications, readers are encouraged to refer to Lin and Greene (2010, 2011). The rest of the report is organized as follows. In Section 2, the file structure of MA3T is introduced, followed by the description of the procedures to run the model in Section 3. After running the model, a result file will be generated, which is explained in Section 4. Finally, the last two sections describe how to change input assumptions and generate new scenarios.

**Subject Area:** Market Acceptance of Advanced Automotive Technologies model; MA3T; automotive powertrain technologies; PHEV; EREV; BEV; FCV;

**Availability:** Lin, Zhenhong, David Greene, and Jake Ward. "User Guide of the ORNL MA 3 T Model (V20130729)." <http://cta.ornl.gov/ma3t/MA3T%20User%20Guide%20v20130729.pdf>

## **Synthesis of a High Resolution Social Contact Network for Delhi With Application to Pandemic Planning** *Huadong Xia, Kalyani Nagaraj, Jiangzhuo Chen, & Madhav V. Marathe*

**Abstract:** We analyze targeted-layered containment (TLC) strategies to contain an influenza pandemic in Delhi, India. A key contribution of our work is a methodology for the synthesis of a realistic individual-based social contact network for Delhi using a wide variety of open source and commercial data. New techniques were developed to infer daily activities for individuals using aggregate data published in transportation science literature in combination with human development surveys and targeted local surveys. The resulting social contact network is the first such network constructed for any urban region of India. This time varying, spatially explicit network has over 13 million people and more than 200 million people-people contacts. The network has several interesting similarities and differences as compared to similar networks for US cities. As a second step, we use a high performance agent-based modeling environment to study how an influenza-like illness would spread over the Delhi network. We also analyze well understood pharmaceutical and non-pharmaceutical containment strategies to control a pandemic outbreak. The results suggest: (i) targeted layered containment strategies perform better than any of the individual interventions; (ii) the epidemic dynamics of the region are strongly influenced by the activity patterns and the demographic structure of its local residents; and (iii) a high resolution social contact network helps in analyzing effective public health policies. To the best of our knowledge, this study is the first of its kind in the Indian sub-continent.

**Subject Area:** networked-epidemiology, high performance computing, synthetic contact network, targeted-layered containment, pandemic response, sensitivity test

**Availability:** Xia, Huadong, et al. "Synthesis of a High Resolution Social Contact Network for Delhi With Application to Pandemic Planning."

[http://staff.vbi.vt.edu/chenj/nonpub/2014\\_AI\\_Delhi2\\_Submitted.20140120.pdf](http://staff.vbi.vt.edu/chenj/nonpub/2014_AI_Delhi2_Submitted.20140120.pdf)

## **Three Essays in Urban Economics** *Victor Couture*

**Abstract:** This thesis studies the benefits and costs of urban living. Chapter 1 is a theoretical and empirical analysis of the benefits of urban density for consumers, while Chapter 2 proposes a model of how cities enhance the incentives for knowledge diffusion. Chapter 3 investigates the costs of congestion and the determinants of car travel speed across us cities.

In Chapter 1, I study the consumption value of urban density by combining Google's local business data with microgeographic travel data. I show that increased density enables consumers to both realize welfare gains from variety and save time through shorter trips. I estimate the gains from density in the restaurant industry, identifying willingness to pay for access to a slightly preferred location from the extra travel costs incurred to reach it. The results reveal large but very localized gains from density. Increasing the density of destinations generates little reduction in trip times, so most of these gains from density are gains from variety, not savings on travel time.

In Chapter 2, I propose a new micro-foundation for knowledge spillovers. I model a city in which uncompensated knowledge transfers to entrepreneurs are bids by experts in auctions for jobs. The model derives from the key ways in which knowledge differs from other inputs of production, namely that knowledge must be possessed for its value to be assessed, and that knowledge is freely reproducible. Agglomeration economies result from growth in the number of meetings between experts and entrepreneurs, and from heightened competition for jobs among experts.

In Chapter 3, written jointly with Gilles Duranton and Matt Turner, we investigate the determinants of driving speed in large us cities. We first estimate city-level supply functions for travel in an econometric framework where both the supply and demand for travel are explicit. These estimations allow us to calculate a city-level index of driving speed. Our investigation of the determinants of speed provides the foundations for a welfare analysis. This analysis suggests large gains in speed if slow cities can emulate fast cities, and sizable deadweight losses from congestion.

**Subject Area:** urban living; urban density; knowledge diffusion; congestion

**Availability:** Couture, Victor. Three Essays in Urban Economics. Diss. University of Toronto, 2013.

[https://tspace.library.utoronto.ca/bitstream/1807/43494/3/Couture\\_Victor\\_201311\\_PhD\\_thesis.pdf](https://tspace.library.utoronto.ca/bitstream/1807/43494/3/Couture_Victor_201311_PhD_thesis.pdf)

## **Consumer Heterogeneity and the Energy Paradox** *Benjamin Leard*

**Abstract:** This paper presents an analysis of the energy paradox -the idea that consumers undervalue cost savings from investments in energy efficiency -with a focus on how consumers vary in their preferences for energy cost savings. By formulating a mixed logit discrete choice model of new vehicle demand that accounts for unobserved product characteristics, I estimate the distribution of household willingness-to-pay (WTP) for reducing gasoline costs by one dollar. While I find that the average household puts equal weight on vehicle price and fuel cost, I find significant heterogeneity in WTP where a non-trivial fraction of households appear to be inattentive to fuel cost differences. Encouraging these households to fully value fuel costs generates welfare gains that are on the same order of magnitude as the cost of increasing fuel economy standards. By calibrating a simple model of the new vehicle market, I find, however, that existing policies for increasing fuel economy fall short of realizing these gains because the policies influence the purchase decisions of all households, including those that fully or overvalue fuel costs. I also find tremendous variation in the ability of existing policies to preferentially encourage households that undervalue fuel costs to buy more fuel efficient vehicles, which highlights the importance of understanding and evaluating how energy efficiency programs target different consumer types.

**Subject Area:** jobs; housing; travel behavior; growth management

**Availability:** Leard, Benjamin. "Consumer Heterogeneity and the Energy Paradox."

[http://www.econ.iastate.edu/sites/default/files/benjamin\\_leard\\_jmp\\_0.pdf](http://www.econ.iastate.edu/sites/default/files/benjamin_leard_jmp_0.pdf)

## **Comprehensive Equity Analysis of Mileage Based User Fees: Taxation And Expenditures For Roadways And Transit** *Justin David Carlton*

**Abstract:** Lack of sustainable revenue generation for transportation infrastructure has created a need for alternative funding sources. The most prominent of which is the Mileage Based User Fee (MBUF), where drivers would be charged based on the number of miles they drive, thus holding them accountable for their use of the roadway. While numerous equity related issues have been addressed, the interrelation of transportation taxation and expenditures on all levels of government (State, County, and Local) is not well understood. Using National Household Travel Survey data and information collected from over one hundred agencies, roadway taxation and expenditures were assigned to individual households in the Houston core based statistical area (CBSA). Using both Gini Coefficients and Theil Indices to analyze equity relationships, the research demonstrated that implementation of a MBUF would not have a pronounced effect on the current distribution of transportation taxation and expenditures, with the number of miles traveled and the total transit ridership remaining mostly unchanged. This also means that the equity of a MBUF is mostly equivalent to the current fuel tax. The relative winners of the current system are rural and high income urban households, while the relative losers are all other urban households. Increasing the MBUF to meet the Texas 2030 Committee recommendations would decrease the average benefit to taxation ratio, causing households to receive less than they pay into the system. Additionally, it would decrease the total number of miles traveled by 22.8% and increase transit ridership by as much as 10.2%. Still, equity of this scenario changed little from the equity of the current transportation funding system. However, excluding public transit expenditures resulted in a statistically significant and undesirable change in the Gini Coefficient, indicating that public transit has a positive impact on equity when considering the transportation system as a whole. Due to relatively flat rate taxes (vehicle registration, property tax, sales tax, etc.), the higher the miles driven, the lower the effective tax is per mile. When miles traveled are decreased by 22.8%, the effective tax per mile increases, which is the reason why the average benefit to taxation ratio was reduced. If transportation related taxation were to shift towards user based methods, then the benefit to taxation ratio should tend towards a value of one, indicating that all users receive exactly the value they pay for. If revenues are increased while the methods of taxation remain the same, low income urban households will be negatively impacted to the greatest degree.

**Subject Area:** mileage based user fee;

**Availability:** CARLTON, JUSTIN DAVID. COMPREHENSIVE EQUITY ANALYSIS OF MILEAGE BASED USER FEES: TAXATION AND EXPENDITURES FOR ROADWAYS AND TRANSIT. Diss. Texas A&M University, 2014. [https://ceprofs.civil.tamu.edu/mburris/Papers/Carlton\\_Justin\\_Thesis.pdf](https://ceprofs.civil.tamu.edu/mburris/Papers/Carlton_Justin_Thesis.pdf)

**Even Smarter Growth? Land Use, Transportation and Greenhouse Gas in Maryland** *Uri Avin, Timothy F. Welch, Gerrit Knaap, Fred Ducca, Sabyasachee Mishra, Yuchen Cui and Sevgi Erdogan*

**Abstract:** Urban form studies have generally used regional density vs. sprawl land use scenarios to assess travel behavior outcomes. The more nuanced but nonetheless important allocation of jobs and housing and their relationship to each other as a factor in travel behavior has received much less attention. That relationship is explored in this state-wide urban form study for Maryland. This is a state where county land use has a long tradition of growth management, but one whose regional and statewide implications have not been evaluated. How does a continuation of the County level smart growth regime play out statewide compared to other scenarios of job and housing distribution that are driven by higher driving costs or transit oriented development goals or local zoning rather than local policy-driven projections? Answers are provided through the application of a new statewide travel demand model. The findings suggest that the debate should move beyond walkability, density and compact growth and towards a more productive dialog about how we organize whole cities and regions.

**Subject Area:** jobs; housing; travel behavior; growth management

**Availability:** Avin, Uri; Timothy F. Welch; Gerrit Knaap; Fred Ducca; Sabyasachee Mishra; Yuchen Cui and Sevgi Erdogan; “Even Smarter Growth? Land Use, Transportation and Greenhouse Gas in Maryland” TRB January 2014

<http://assets.conferencespot.org/filesserver/file/64198/filename/14-5306.pdf>

**The Effect of Gasoline Taxes and Public Transit Investments on Driving Patterns** *Elisheba Spiller, Heather Stephens, Christopher Timmins & Allison Smith*

**Abstract:** This paper analyzes how driving patterns are affected by gasoline taxes and the availability of a substitute for driving—public transportation. We develop a measure of transportation substitutability based on the difference between individuals' predicted commute times by private and public transit, conditional upon their demographic characteristics and geographic location. Improved substitutability decreases annual vehicle miles traveled (VMT) by inducing modal shifts to public transit, though gasoline taxes are found to have a much larger impact on VMT. Our results imply that a policy that raises gasoline taxes and recycles the revenues into public transit improvements can have even larger impacts on driving patterns than either policy alone.

**Subject Area:** gas tax; public transportation; commute time; VMT

**Availability:** Spiller, Elisheba, et al. "The Effect of Gasoline Taxes and Public Transit Investments on Driving Patterns." *Environmental and Resource Economics* (2012): 1-25.  
<http://link.springer.com/article/10.1007/s10640-013-9753-9>



## 6. SPECIAL POPULATION GROUPS

### **Connecting Low-Income People to Opportunity with Shared Mobility** *Michael Kodransky & Gabriel Lewenstein*

**Abstract:** In the last decade, shared mobility services have taken off across the United States as a complement to local public transit and an alternate to private car ownership.

These services, which include car-share, bike-share and ride-share, maximize the use of vehicles by sharing them among multiple users, encourage more transport options, and aim to reduce transportation costs for users. While mass rapid transit moves the most people most efficiently and is the backbone for urban development, this paper is concerned mostly with recent advances in low-volume passenger carrier models in the United States. The purpose of this report is to highlight the potential for shared mobility systems such as bike-share and car-share to benefit low-income individuals.

As these models have developed, advocates, policymakers and shared mobility operators have explored how the emerging field can more directly benefit low-income individuals, who often face longer and more costly commute times, through pilot programs, research, and other strategies. However, current usage of shared mobility systems among low-income communities remains lower than usage by the general population.

Current usage of shared mobility systems among low-income communities remains lower than usage by the general population.

This report is a survey of existing shared mobility strategies and their attempt to expand services to low-income individuals. It is our hope that the findings can inform operators, government agencies, funders, non-profit organizations and others as they try to tap into the potential of shared mobility strategies to improve the lives of low-income individuals.

**Subject Area:** public transit; sharing economy; shared mobility systems;

**Availability:** Kodransky, Michael, and Gabriel Lewenstein. "Connecting Low-Income People to Opportunity with Shared Mobility." (2014).

<https://livingcities.s3.amazonaws.com/resource/284/download.pdf>

**Video: This Minnesota man travels 6 hours to New York for work each week**  
*Adam Uren*

**Abstract:** In fall, the Minneapolis family man published a time lapse video of his six-hour journey to his job in Manhattan – yes, the one in New York – where he works at a visual effects production company.

**Subject Area:** super commuter; work commute

**Availability:** Rick Kupchella's BringMeTheNews December 17, 2014; "Video: This Minnesota man travels 6 hours to New York for work each work"

<http://bringmethenews.com/2014/12/16/video-this-minnesota-man-travels-6-hours-to-new-york-for-work-each-week/>

## **The impact of millennials' travel behavior on future personal vehicle travel**

*Steven E. Polzin, Xuehao Chu, & Jodi Godfrey*

**Abstract:** The millennial generation, born between 1980 and 2000, is exhibiting different travel behavior trends than previous generations, which are shaped by several different yet correlated characteristics such as; place of residence, race/ethnicity, labor force participation, education level, income, living arrangements, lifecycle status, licensure status, vehicle ownership/availability, values, and propensity to substitute technology for travel. Many millennials are living with their parents longer, obtaining drivers licenses at older ages, postponing marriage and procreation, and substituting travel for work and socializing with telecommuting and social media. Millennials are currently shaping the nation's changing demographics, which in turn directly affect future travel behavior trends and their consequences on energy consumption and the environment.

**Subject Area:** Millennials; Vehicle travel; Travel behavior; Travel demand

**Availability:** Polzin, Steven E., Xuehao Chu, and Jodi Godfrey. "The impact of millennials' travel behavior on future personal vehicle travel." *Energy Strategy Reviews* (2014).  
<http://www.sciencedirect.com/science/article/pii/S2211467X14000431>

## **Physical Activity in Childhood Cancer Survivors** *Megan Elizabeth Slater*

**Abstract:** Background: Childhood cancer survivors (CCS) are at high risk of developing treatment related late effects, including cardiovascular disease and diabetes, which can be exacerbated by inadequate physical activity (PA). Relationships between PA, physical fitness, and cardiometabolic risk factors in CCS have not been well described. Furthermore, active transportation, a specific domain of PA, has not been previously studied in CCS. The primary aims of this dissertation were to examine associations between PA/fitness and cardiometabolic risk factors and to identify active transportation behaviors and barriers in CCS. Methods: In Project 1, associations between PA and cardiometabolic risk factors were examined in 319 CCS and 208 sibling controls aged 9-18 years. In Project 2, associations between PA/fitness and cardiometabolic risk factors were examined in 119 adult CCS with a history of hematopoietic cell transplantation and 66 adult sibling controls. In Project 3, we recruited 158 adult CCS and 153 controls matched on age, sex, and location to complete a survey regarding active transportation behaviors and perceptions. Linear and logistic regression models accounting for correlation among siblings or matched participants were used to address research questions. Results: Higher levels of PA in CCS aged 9-18 (Project 1) and higher levels of endurance in adult CCS (Project 2) were associated with a favorable cardiometabolic profile. In Project 3, adult CCS engaged in similar levels of active transportation as controls despite perceiving greater health-related barriers. Marital/relationship status, planning/psychosocial barriers, and perceived neighborhood walkability were the strongest correlates of active transportation among CCS, while objective neighborhood walkability was the strongest correlate among controls. Conclusions: Findings suggest that efforts to increase PA and endurance in CCS may reduce the risk of future cardiovascular disease. Interventions might consider promoting active transportation as a moderate intensity PA option, since it appears to be as well accepted in CCS as in healthy adults. Such interventions will not be successful, however, without existing or improved pedestrian and bicycle infrastructure, safety, and access to local amenities. Additional research is needed to confirm results and explore the feasibility and efficacy of active transportation interventions in this population.

**Subject Area:** childhood cancer survivors; active transportation; cardiometabolic risk factors

**Availability:** Slater, Megan Elizabeth. Physical Activity in Childhood Cancer Survivors. Diss. UNIVERSITY OF MINNESOTA, 2014.

[http://conservancy.umn.edu/bitstream/handle/11299/167573/Slater\\_umn\\_0130E\\_15316.pdf?sequence=1&isAllowed=y](http://conservancy.umn.edu/bitstream/handle/11299/167573/Slater_umn_0130E_15316.pdf?sequence=1&isAllowed=y)

## **Evaluating Household Chauffeuring Burdens, Understanding Direct and Indirect Costs of Transporting Non-Drivers** *Todd Litman*

**Abstract:** Household chauffeuring refers to personal motor vehicle travel specifically made to transport independent non-drivers (people who could travel on their own if they had suitable travel options). This additional vehicle travel imposes various direct and indirect costs. This paper identifies factors that affect the amount of chauffeuring that occurs in a community. It develops a Chauffeuring Burden Index which can be used to quantify chauffeuring costs and therefore the savings and benefits of transport improvements that reduce chauffeuring burdens. This analysis indicates that in automobile dependent communities, chauffeuring costs often exceed congestion costs. Motorists often benefit from improved transport options which reduce their chauffeuring burdens, even if they do not use those options themselves.

**Subject Area:** chauffeuring, ridesharing, transit, burden

**Availability:** Litman, Todd. "Evaluating Household Chauffeuring Burdens." Victoria Transport Policy Institute (2014). <http://www.vtpi.org/chauffeuring.pdf>

## **The role of household members in transporting adults with disabilities in the United States** *Devajyoti Deka*

**Abstract:** Because of certain requirements under US federal law, many studies have been published in recent years on the role of fixed-route transit and paratransit in meeting the travel needs of persons with disabilities. Although persons with disabilities are several times more likely to take rides from household members than to take public transit, little research has been conducted to explore the circumstances under which such rides are given or taken. To address this gap in literature, this study examines the role of household members in transporting persons with disabilities in contemporary America. It explores how the circumstances for the ride takers may change in the future, identifies future challenges in providing mobility to persons with disabilities, and examines ways to meet those challenges. Using nationwide data from the 2009 National Household Travel Survey, the study compares the rides taken by persons with disabilities from household members with trips made by other travel modes, the persons who take rides with those who do not take rides, and the drivers who provide rides with those who do not provide rides. Probit models are used for the comparisons. Implications of the findings are discussed in light of potential demographic changes in the future, especially the growth of single-person households and the consequent loss of household support for transportation. Due to similarities in circumstances in other developed countries, an international context to the study is also provided.

**Subject Area:** Disability; Disabilities; Mobility; Automobile passenger; Household transportation

**Availability:** Deka, Devajyoti. "The role of household members in transporting adults with disabilities in the United States." *Transportation Research Part A: Policy and Practice* 69 (2014): 45-57. <http://www.sciencedirect.com/science/article/pii/S0965856414001906>

**Younger Teens Mode Choice for School Trips: Do Parent's Attitudes Towards Safety and Traffic Conditions along the School Route Matter?** *Mintesnot Woldeamanuel*

**Abstract:** Walking, bicycling, and all other alternative-to-driving modes of transportation used by teenagers promote physical activity, which is important for creating a healthy and sustainable community. On the other hand, most of the US's younger teens are being driven by their parents to and from school and other activities by their parents, which give them fewer opportunities for physical activities. This research investigates factors affecting the mode choice of younger teens. The focus of the study is to analyze the effect parents' views of the safety and traffic conditions along school routes have on younger teens' mode choice. The study uses the 2009 U.S. National Household Travel Survey (NHTS). Younger teens in this study are defined as the age group from 12 to 16 years old, which is a non-driving, active age group. The results of the study show that there is a strong correlation between parental attitude and younger teens' mode choice. Factors that affect parents' decisions to drive their teens to and from school include distance between home and school, traffic congestion and crime along school routes.

**Subject Area:** mode choice, NHTS 2009, parents' attitude, travel behavior, younger teens

**Availability:** Woldeamanuel, Mintesnot. "Younger Teens Mode Choice for School Trips: Do Parent's Attitudes Towards Safety and Traffic Conditions along the School Route Matter?." *International Journal of Sustainable Transportation* just-accepted (2014). <http://www.tandfonline.com/doi/abs/10.1080/15568318.2013.871664>

## **A nationwide look at the immigrant neighborhood effect on travel mode choice** *Michael J. Smart*

**Abstract:** Immigrants to the United States walk, bicycle, and use transit and carpools more than U.S.-born residents do. These differences persist over time and across income groups. The differences appear strongest when immigrants reside in immigrant neighborhoods with high concentrations of other immigrants. This analysis uses a large, geocoded national dataset to analyze these differences and finds that living in an immigrant neighborhood has a strong influence on mode choice for immigrant residents and a much weaker effect on non-immigrant residents of immigrant neighborhoods. These effects are strongest for walking and bicycling, and particularly for shopping-related travel, and they persist after controlling for a number of variables. That these effects are considerably stronger for immigrants than for their U.S.-born neighbors suggests that social factors of the neighborhoods may play a role in structuring travel decisions.

**Subject Area:** Immigration, Mode choice, Neighborhood effects, Built environment

**Availability:** Smart, Michael J. "A nationwide look at the immigrant neighborhood effect on travel mode choice." *Transportation* (2014): 1-21.

<http://link.springer.com/article/10.1007/s11116-014-9543-4>



**Non-compliance with graduated driver licensing (GDL) requirements:  
Changes in GDL-related conviction rates over time among 16–17-year-old  
California drivers** *Scott V. Masten, Eric A. Chapman, Debra B. Atkinson, & Kelly K.  
Browning*

**Abstract:** Introduction: Self-reports by novice teen drivers in California and elsewhere suggest that many violate graduated driver licensing (GDL) nighttime and passenger restrictions, and to a lesser extent, drive on learner permits without being supervised. Is this corroborated by their traffic conviction records? Method: We examined historical aggregated conviction rates for GDL-related violations before and after GDL, and Poisson regressions of conviction rates over time among 16–17-year-old California novices. Results: During the year before they received their provisional licenses, <1% of 16-year-old novices and <2% of 17-year-old novices were convicted of driving unlicensed or unsupervised on their learner permits. Statewide historical conviction rates for these offenses were not higher after GDL was implemented, despite the longer holding period. Convictions for violating GDL nighttime or passenger restrictions were highest almost immediately after provisional licensure, though only about 3% of 16-year-old novices and 2% of 17-year-old novices were ever convicted of violating either restriction. Discussion: California 16–17-year-old novice drivers were very rarely convicted of GDL-related violations. The contradictory, large differences between the current findings and self-report surveys are likely due in part to the fact that most self-reports assessed only whether teens had ever violated a GDL-related requirement, which exaggerates prevalence. Our conviction findings are more similar to estimates of non-compliance with GDL-related requirements from naturalistic driving studies that monitor actual driving behavior and take exposure into account, but are lower likely due to issues related to detection, enforcement, and adjudication of violations, as well as limitations of existing naturalistic studies

**Subject Area:** GDL restrictions; Conviction rates; Prevalence; Learner permits; Nighttime restrictions; Passenger restrictions

**Availability:** Masten, Scott V., et al. "Non-compliance with graduated driver licensing (GDL) requirements: Changes in GDL-related conviction rates over time among 16–17-year-old California drivers." *Accident Analysis & Prevention* 72 (2014): 230-243.  
<http://www.sciencedirect.com/science/article/pii/S0001457514002115>

## **Factors Which Predict the Use of Active Transportation to School Among Children in Clark County, NV** *Sheila G. J. Clark*

**Abstract:** Active transportation to school (ATS) shows promise for increasing activity levels in children, but prevalence and correlates vary widely in cities and regions with different barriers and supports for active travel. Classification of ATS users is a current issue in the field. The purpose of this study was to determine the prevalence of ATS use and develop a predictive model of ATS for the novel population of children enrolled in grades K-8 in Clark County School District, a large metropolitan school district in Southern Nevada. Methods: This study used a secondary data from the National Center for Safe Routes to School's Parent Survey collected in 17 school communities by Clark County School District in 2013 (n=2,054). Variables representing demographic characteristics, socioeconomic status, distance from school, and barriers to the use of ATS were assessed for correlations and normality Logistic Regression for survey data was used to develop predictive models for two measures of ATS. Results: The returned surveys represent a response rate of 13.5%. ATS use was categorized as some use (use of active methods of transportation for either the morning or afternoon commute or both on most days) and exclusive use (use of ATS for both trips on most days). Logistic regression revealed that some ATS use was predicted by distance from school, parental level of education, child's request to use ATS, and the number of barriers reported by the parent. Exclusive ATS use was also predicted by these characteristics, but was also predicted by the number of children in grades K-8 in the family. Both models explained about one third of the variation in ATS use in the sample. Discussion: Results suggest that ATS use among K-8 students in Clark County is predicted by distance and socioeconomic status, as with other populations. Requesting permission to use ATS and the number of K-8 students in the family also predicted the use of ATS, but the implications of these findings require further analysis.

**Subject Area:** active transportation; school;

**Availability:** Clark, Sheila GJ. "Factors Which Predict the Use of Active Transportation to School Among Children in Clark County, NV." University of Nevada Las Vegas (2014).

<http://digitalscholarship.unlv.edu/thesesdissertations/2064/>

## **Trends in older driver crash involvement rates and survivability in the United States: An update** *Jessica B. Cicchino & Anne T. McCartt*

**Abstract:** Previous research has shown that fatal crash involvement rates per licensed driver aged 70 and older declined significantly more per year in the United States than rates for middle-aged drivers aged 35–54 during 1997–2008, and per vehicle mile traveled from 1995–1996 to 2001–2002. Analyses of police-reported crash data during 1997–2005 indicated that the greater declines for older drivers were due to decreases in crash involvement and in the risk of dying in the crashes that occurred. The current study examined if trends in crash rates, crash involvements, and survivability persisted into more recent years.

Although declines in fatal crash involvement rates in recent years have not differed between older and middle-aged drivers, this did not undo earlier gains for older drivers. The recent slowing in the relative magnitude of the decline for older drivers may be related to the differential effect of the U.S. recession on fatal crash involvements of drivers in these age groups. The decreased likelihood of being involved in a crash of any severity and increased survivability when a crash occurred held when examining data through 2008, and for drivers 80 and older, significant declines in crash involvement relative to middle-aged drivers extended to non-fatal injury crashes.

**Subject Area:** Older drivers; crash trends

**Availability:** Cicchino, Jessica B., and Anne T. McCartt. "Trends in older driver crash involvement rates and survivability in the United States: an update." *Accident Analysis & Prevention* 72 (2014): 44-54. <http://www.sciencedirect.com/science/article/pii/S0001457514001845>

**Estimation of Truck Trips on Large-Scale Irrigation Project: A Combinatory Input-Output Commodity-Based Approach** *Ackchai Sirikijpanichkul, Sarintorn Winyoopadit, and Chavalek Vanichavetin*

**Abstract:** For the agricultural-based countries, the requirement on transportation infrastructure should not only be limited to accommodate general traffic but also the transportation of crop and agricultural products during the harvest seasons. Most of the past researches focus on the development of truck trip estimation techniques for urban, statewide, or nationwide freight movement but neglect the importance of rural freight movement which contributes to pavement deterioration on rural roads especially during harvest seasons. Recently, the Thai Government initiated a plan to construct a network of reservoirs within the northeastern region, aiming at improving existing irrigation system particularly in the areas where a more effective irrigation system is needed. It is expected to bring in new opportunities on expanding the cultivation areas, increasing the economy of scale and enlarging the extent market of area. As a consequence, its effects on truck trip generation needed to be investigated to assure the service quality of related transportation infrastructure. This paper proposes a combinatory input-output commodity-based approach to estimate truck trips on rural highway infrastructure network. The large-scale irrigation project for the northeastern of Thailand is demonstrated as a case study.

**Subject Area:** Input-output, commodity-based, truck trips, rural roads

**Availability:** Sirikijpanichkul, Ackchai, Sarintorn Winyoopadit, and Chavalek Vanichavetin.

"Estimation of Truck Trips on Large-Scale Irrigation Project: A Combinatory Input-Output Commodity-Based Approach."

[http://www.ppml.url.tw/EPPM\\_Journal/volumns/accepted\\_papers/ID\\_96\\_04\\_author\\_proofed.pdf](http://www.ppml.url.tw/EPPM_Journal/volumns/accepted_papers/ID_96_04_author_proofed.pdf)

**Neighbourhood parks and reduction in stress among adolescents: results from Buffalo, New York** *D. M. Feda, A. Seelbinder, S. Baek, S. Raja, L. Yin, & J. N. Roemmich*

**Abstract:** Planners and landscape architects have long recognized the critical role of green space in urban environments. This cross-sectional field study of 68 adolescents determined the association between percent neighbourhood park area and perceived stress among adolescents, while controlling for physical activity. This study is the first to examine this association using objective measures of park area and adolescents' physical activity. A multivariate regression model indicated that percentage of park area ( $\beta = -62.573$ ,  $p < 0.03$ ) predicts perceived stress among adolescents. Access to neighbourhood parks buffers adolescents against perceived stress after controlling for socio-economic status and physical activity. Policy recommendations for incorporating parks into neighbourhood design are given.

**Subject Area:** Perceived stress; adolescent; neighborhood environment; parks, physical activity

**Availability:** Feda, D. M., et al. "Neighbourhood parks and reduction in stress among adolescents: results from Buffalo, New York." *Indoor and Built Environment* (2014): 1420326X14535791.  
<http://ibe.sagepub.com/content/early/2014/05/19/1420326X14535791.abstract>

**Gaming to Sit Safe: The Restricted Body as an Integral Part of Gameplay** *Petra Sundström, Axel Baumgartner, Elke Beck, Christine Döttlinger, Martin Murer, Ivana Randelshofer, David Wilfinger, Alexander Meschtscherjakov, & Manfred Tscheligi*

**Abstract:** This paper presents a design exploration of full-body interaction games played in cars. It describes how we have designed, implemented, and evaluated the core experiences of three different games, which were all aimed at making sitting properly more fun for players/children while travelling by car. By making the restricted body an integral part of gameplay, we hope to, as a side product of gameplay, bring about the best and also most safe body posture for young players/children travelling by car, i.e., sitting reasonably upright and still in their child seat with their head leaning back on the neck rest. Another outcome of this could also be an overall safer situation in the car, in that children not sitting still in their child seats while being driven might be stressful for the driver. By presenting the details of our design efforts in this particular design context, we hope to add also to the knowledge we, in HCI, have for how to design bodily experiences with technology at large.

**Subject Area:** Restricted; Still; Calm; Bodily; Core; Experiences; Automotive; Gameplay; Explorative; Grounded; Design

**Availability:** Sundström, Petra, et al. "Gaming to Sit Safe: The Restricted Body as an Integral Part of Gameplay." (2014).

<http://www.mobilelifecentre.org/sites/default/files/Gaming%20to%20Sit%20Safe.pdf>

**How many walking and cycling trips made by elderly are beyond commonly used buffer sizes: Results from a GPS study** *R.G. Prins, F. Pierika, A. Etmanb, R.P. Sterkenburga, C.B.M. Kamphuisb, F.J. van Lenthe*

**Abstract:** In choosing appropriate buffer sizes to study environmental influences on physical activity, studies are hampered by insufficient insight into the distance elderly travel actively. This study aims at getting insight into the number of trips walked and cycled within various buffer sizes using GPS measures. Data were obtained from the Elderly And their Neighborhood study (Spijkenisse, the Netherlands (2011–2012)). Trip length and mode of transport were derived from the GPS data (N=120; total number of trips=337). Distance decay functions were fitted to estimate the percentage of trips to grocery stores within commonly used buffer sizes. Fifty percent of the trips walked had a distance of at least 729 m; for trips cycled this was 1665 m. Elderly aged under 75 years and those with functional limitations walked and cycled shorter distances than those over 75 years and those without functional limitations. Males cycled shorter distances than females. Distance decay functions may aid the selection of appropriate buffer sizes, which may be tailored to individual characteristics.

**Subject Area:** Active transport; Buffer; GIS; Distance; Demographic differences

**Availability:** Prins, R. G., et al. "How many walking and cycling trips made by elderly are beyond commonly used buffer sizes: Results from a GPS study." *Health & Place* 27 (2014): 127-133.  
<http://www.sciencedirect.com/science/article/pii/S1353829214000240>

## **Car use in the leisure lives of adolescents. Does household structure matter?**

*Kristin Ystmark Bjerkan, & Marianne Elvsaa Nordtømme*

**Abstract:** Travel is becoming an increasingly essential part of adolescents' leisure. As a large part of organized leisure activities takes place beyond the local neighborhood, access to transport becomes a prerequisite for participation. This article investigates transport mode choices in the leisure lives of Norwegian adolescents and the potential influence of household structures. The study finds that car use is less prominent in the leisure activities of adolescents from single-parent households, and that living in households with unemployed parents reduces the probability of leisure travels by car.

**Subject Area:** Adolescents; Leisure; Transport mode; Travel survey; Household structure

**Availability:** Bjerkan, Kristin Ystmark, and Marianne Elvsaa Nordtømme. "Car use in the leisure lives of adolescents. Does household structure matter?." *Transport Policy* 33 (2014): 1-7.  
<http://www.sciencedirect.com/science/article/pii/S0967070X14000341>



## **Physical Activity, Length of Residence, And Vehicle Ownership Among U.S. Immigrants: An Analysis of The 2003 New Immigrant Survey** *Dale Terasaki*

**Abstract:** BACKGROUND: As immigrants' length of residence in the U.S. increases, it is unclear how their levels of physical activity change. Vehicle ownership may play a role by discouraging active transportation.

METHODS: Using data from the 2003 New Immigrant Survey, a nationally representative questionnaire of recent, documented immigrants (n=7240), we assessed the cross-sectional relationship between length of U.S. residence and levels of light (LPA) and vigorous (VPA) physical activity with descriptive analysis and multivariate logistic regression. We also assessed the impact of vehicle ownership on this relationship.

RESULTS: Some 38.8% reported engaging in LPA five or more times per week, 31.2% reported VPA at least once per week, and 56.9% reported either LPA or VPA beyond thresholds. During the first ten years of residence, there was a small decrease in average LPA and small increase in average VPA. Most of the decline in LPA occurred within three years after arrival. In regression models adjusted for demographic and socioeconomic factors, those living in the U.S. more than one year were less likely to engage in LPA five or more times per week than the newest arrivals (e.g. 1 to <5 vs. <1y of residence, OR: 0.82 95% CI: 0.71-0.96). This relationship was not significant after controlling for vehicle ownership. In models adjusting for demographic and socioeconomic factors, those living in the U.S. five to less than ten years and fifteen or more years were more likely to engage in VPA at least once per week than those living in the U.S. less than one year. This relationship did not change when vehicle ownership was added to the model.

CONCLUSIONS: These data suggest that many immigrants participate in high levels of light physical activity upon arrival, but this percentage decreases within the first three years of residence. Curbing the decline in may require an understanding of how vehicle ownership decreases light physical activity, particularly active transportation. Levels of vigorous activity may increase slightly over time but remain relatively low regardless of length of residence.

**Subject Area:** immigrant physical activity; vehicle ownership

**Availability:** Terasaki, Dale. Physical Activity, Length Of Residence, And Vehicle Ownership Among Us Immigrants: An Analysis Of The 2003 New Immigrant Survey. Diss. University of Washington, 2013. <https://digital.lib.washington.edu/xmlui/handle/1773/25061>

## **Factors Influencing Children's Mode Of Travel: A Case Study Of Walking And Biking To School At Paradise Elementary, Paradise, California** *Paul R. Muse*

**Abstract:** The increasing rate of childhood and adolescent obesity in the United States is a big concern. From 1980 to 2008 obesity rates in children age 6 to 11 increased from 6.5% to 19.6% and in adolescents age 12 to 19 from 5% to 18%. Also of concern is the decrease in the number of children and adolescents who walk and bike (actively commute) to school. In 1969, 40.7% of children actively commuted to school and by 2001 only 12.9% actively commuted. Many researchers believe that the decrease in the number of children that actively commute to school and the increase in childhood and adolescent obesity are connected. Research shows that in general, people who are more physically active are less likely to become obese. Since actively commuting to school increases daily physical activity, children that participate in it lower their chances of becoming obese. This study focuses on an elementary school in Paradise, California. A parent survey was administered to find out what modes of transportation their children used most frequently and what factors were most influential when deciding how their children get to school. Results showed that almost all students (93.5%) never actively commuted to school. The lack of sidewalks and distance to school proved to be the two main reasons parents drove their children rather than let them actively commute. Seven streets within close proximity to the school were analyzed and given safety recommendations to help increase the number of children that actively commute to the school in the future.

**Subject Area:** student travel; obesity; active commute

**Availability:** Muse, Paul R. Factors Influencing Children's Mode Of Travel: A Case Study Of Walking And Biking To School At Paradise Elementary, Paradise, California. Diss. California State University, Chico, 2013. <http://csuchico-dspace.calstate.edu/handle/10211.3/115640>

**Does urban living influence baby boomers' travel behavior?** *Jae Seung Lee, P. Christopher Zegras, Eran Ben-Joseph, & Sungjin Park*

**Abstract:** We compare the travel behavior of urban versus suburban baby boomers in the Boston metropolitan area. Using propensity score matching to attempt to control for self-selection and data from two surveys implemented in 2008 and 2010, we find that the urban boomers tend to be less automobile-dependent than suburban baby boomers. Urban baby boomers also make more recreational non-motorized transport (NMT), social, utilitarian, and transit commute trips. Most of these differences seem to be primarily a result of the urban setting, not the particular preferences of boomers living in urban settings. We find very small self-selection effects on automobile commuting, recreational NMT, and utilitarian trips: 1–7% of observed influence. We also find some evidence that baby boomers' preference for social activities tends to be mismatched to their environments – suburban boomers want more social opportunities than their settings enable. For public transport, we find a relatively large self-selection effect, 43% of observed influence, suggesting a transit-oriented boomer market segment exists.

**Subject Area:** Baby boomers; Travel behavior; Self-selection; Propensity score matching

**Availability:** Lee, Jae Seung, et al. "Does urban living influence baby boomers' travel behavior?." *Journal of Transport Geography* 35 (2014): 21-29.  
<http://www.sciencedirect.com/science/article/pii/S0966692314000052>

## 7. SURVEY, DATA SYNTHESIS, AND OTHER APPLICATIONS

### **An Assessment of the Relationship between Self-Control and Ambient Temperature: A Reasonable Conclusion is that Both Heat and Cold Reduce Self-Control** *Matthew T. Gailliot*

**Abstract:** The current paper is a review of published literature on the relationship between ambient, environmental temperature and self-control, defined as consisting of discrete domains, namely complex cognition, attention control, aggressive and criminal restraint, passivity, physical persistence, sexual control, work regulation, alcohol and tobacco regulation, helping, and bias avoidance. The typical pattern was that both heat and cold reduced self-control. Optimal self-control was at middle temperatures. An analysis of mediators that account for the relationship indicated that changes in negative affect, arousal, and physiology (energy provision) mediated the effect of temperature on self-control. Temperature is ubiquitous. It may influence people across the world, at all times, meaningfully across important domains of thought and behavior.

**Subject Area:** Temperature, self-control, self-regulation, heat, cold

**Availability:** Gailliot, Matthew T. "An Assessment of the Relationship between Self-Control and Ambient Temperature: A Reasonable Conclusion is that Both Heat and Cold Reduce Self-Control." [http://www.irssh.com/yahoo\\_site\\_admin/assets/docs/14\\_IRSSH-971-V8N1.309145019.pdf](http://www.irssh.com/yahoo_site_admin/assets/docs/14_IRSSH-971-V8N1.309145019.pdf)

## **Varying influences of the built environment on household travel in 15 diverse regions of the United States** *Zhenwei Ding, Yusuke Omori, Ryoichi Shinkuma, & Tatsuro Takahashi*

**Abstract:** This study pools household travel and built environment data from 15 diverse US regions to produce travel models with more external validity than any to date. It uses a large number of consistently defined built environmental variables to predict five household travel outcomes – car trips, walk trips, bike trips, transit trips and vehicle miles travelled (VMT). It employs multilevel modelling to account for the dependence of households in the same region on shared regional characteristics and estimates ‘hurdle’ models to account for the excess number of zero values in the distributions of dependent variables such as household transit trips. It tests built environment variables for three different buffer widths around household locations to see which scale best explains travel behaviour. The resulting models are appropriate for post-processing outputs of conventional travel demand models, and for sketch planning applications in traffic impact analysis, climate action planning and health impact assessment.

**Subject Area:** D variables; Envision Tomorrow software; household travel; hurdle models; multilevel modelling; walk and bike trip generation

**Availability:** Ewing, Reid, et al. "Varying influences of the built environment on household travel in 15 diverse regions of the United States." *Urban Studies* (2014): 0042098014560991.  
<http://usj.sagepub.com/content/early/2014/12/05/0042098014560991.abstract>

## **Designing Mobility Models Based on Relational Graph** *Zhenwei Ding, Yusuke Omori, Ryoichi Shinkuma, & Tatsuro Takahashi*

**Abstract:** Simulating the mobility of mobile devices has always been an important issue as far as wireless networks are concerned because mobility needs to be taken into account in various situations in wireless networks. Researchers have been trying, for many years, to improve the accuracy and flexibility of mobility models. Although recent progress of designing mobility models based on social graph have enhanced the performance of mobility models and made them more convenient to use, we believe the accuracy and flexibility of mobility models could be further improved by taking a more integrated structure as the input. In this paper, we propose a new way of designing mobility models on the basis of relational graph [1] which is a graph depicting the relation among objects, e.g. relation between people and people, and also people and places. Moreover, some novel mobility features were introduced in the proposed model to provide social, spatial and temporal properties in order to produce results similar to real mobility data. It was demonstrated by simulation that these measures could generate results similar to real mobility data.

**Subject Area:** mobility model, relational graph, social graph, contact duration, inter-contact time

**Availability:** Zhenwei, D. I. N. G., et al. "Designing Mobility Models Based on Relational Graph." IEICE TRANSACTIONS on Information and Systems 97.12 (2014): 3007-3015.  
[http://search.ieice.org/bin/summary.php?id=e97-d\\_12\\_3007](http://search.ieice.org/bin/summary.php?id=e97-d_12_3007)

## **Experts' Opinions Concerning The Minimum Content Of A National Household Travel Survey** *Mario Cools, Jimmy Armoogum, and Marco Diana*

**Abstract:** Although an extensive literature is available concerning the design of travel surveys, fewer research initiatives have been carried out to determine the content of the survey itself. The objective of the present work is to identify such minimum set through a survey (MTSQ – Mini-Travel Survey Questionnaire) targeted to experts in this field. Moreover, it is investigated whether unanimity exists in the experts' opinions concerning the importance of various types of questions and whether regional and/or professional differences exist. The MTSQ survey was successfully completed by 81 respondents in October-November 2012, mainly from Europe and North America. The study identified the most important questions, which should form the core of any NHTS. This list is especially useful for countries which do not yet have implemented a NHTS, and for defining the set of questions in case a harmonized household travel survey spanning across different countries will be initialized. Secondly, the paper investigated whether unanimity exists in the experts' opinions. Our analyses clearly pinpointed different evaluations according to the experts' characteristics, thus it could be concluded that unanimity is certainly not complete. Thus, whenever developing standards for travel surveys these differences should be taken into account, according to both the prospective data users the intended data usages. Especially the differences with respect to the regional context (North-American versus European), and involvement with the NHTS should be acknowledged.

**Subject Area:** National Household Travel Surveys; contents; uses; purpose

**Availability:** Cools, Mario, Jimmy Armoogum, and Marco Diana. "Experts' opinions concerning the minimum content of a national household travel survey." 10th International Conference on Transport Survey Methods. 2014. <http://orbi.ulg.ac.be/handle/2268/174203>

# **Archiving Data from New Survey Technologies: Lessons Learned on Enabling Research with High-Precision Data While Preserving Participant Privacy** *J. Gonder, E. Burton & E. Murakami*

**Abstract:** During the past 15 years, increasing numbers of organizations and planning agencies have begun collecting high-resolution Global Positioning System (GPS) travel data. Despite the significant effort and expense to collect it, privacy concerns often lead to underutilization of the data. To address this dilemma of providing data access while preserving privacy, the National Renewable Energy Laboratory, with support from the U.S. Department of Transportation and U.S. Department of Energy, established the Transportation Secure Data Center (TSDC). Lessons drawn from best-practice examples from other data centers have helped shape the structure and operating procedures for the TSDC, which functions under the philosophy of first and foremost preserving privacy, but doing so in a way that balances security with accessibility and usability of the data for legitimate research. This paper provides details about the TSDC approach toward achieving these goals, which has included creating a secure enclave with no external access for backing up and processing raw data, a publicly accessible website for downloading cleansed data, and a secure portal environment through which approved users can work with detailed spatial data using a variety of tools and reference information. This paper also describes lessons learned from operating the TSDC with respect to improvements in GPS data handling, processing, and user support, along with plans for continual enhancements to better support the needs of both data providers and users and to thus advance the research value derived from such valuable data.

**Subject Area:** GPS travel data storage; privacy; Transportation Secure Data Center; NREL

**Availability:** Gonder, J., E. Burton, and E. Murakami. Archiving Data from New Survey Technologies: Lessons Learned on Enabling Research with High-Precision Data While Preserving Participant Privacy. No. NREL/CP-5400-62901. National Renewable Energy Laboratory (NREL), Golden, CO., 2014. <http://www.nrel.gov/docs/fy15osti/62901.pdf>



## **Developing Tolled-Route Demand Estimation Capabilities For Texas: Opportunities For Enhancement Of Existing Models**

*Kevin Hall, Kara Kockelman, Andy Mullins, T. Donna Chen, & Dan Fagnant,*

**Abstract:** The travel demand models developed and applied by the Transportation Planning and Programming Division (TPP) of the Texas Department of Transportation (TxDOT) are daily three-step models (i.e., trip generation, trip distribution, and traffic assignment sequentially invoked). Currently, TxDOT TPP does not have a procedure to account for existing or planned toll roads in the urban travel demand models. TxDOT TPP has been operating under guidance established when toll roads existed as planned facility improvements in either the interim or forecast year model applications. Although the larger urban areas in Texas have embraced tolled facilities for quite some time (i.e., Dallas-Fort Worth, Houston, and Austin), roads that charge users a fee to bypass congestion or provide alternative routes have only been implemented recently in a select few small to medium-sized urban areas still under the purview of TxDOT TPP model development. In order to calibrate base year travel models with operational toll roads or models with planned tolled facilities, TxDOT TPP needs a procedure to account for facilities that charge fees to the user. For the tolled facilities currently operational in small to medium-sized study areas, the fees are fixed and are not dynamic by time of day or congestion levels. The technical objective of this research report is to provide TxDOT TPP with a menu of potential procedures that could be selected for implementation in the current Texas Package suite of travel demand models to reasonably estimate toll road demand, primarily for the small to medium-sized urban areas. Nationally, generally two approaches are used: a path-based system and a choice-based system. Researchers reviewed both approaches as well as different supplemental techniques (i.e., time of day, market segmentation, and mode choice) implemented nationally and within the state that are complementary to any toll demand estimation techniques. Challenges and considerations for each of the approaches are reviewed and presented. The procedures and applications reviewed in this project are not intended to replace or compete with existing toll-financing-level analysis.

**Subject Area:** Travel Demand Model, Toll Demand Estimation, Generalized Cost, Value of Time, Time of Day Models, Auto Operating Costs

**Availability:** Hall, Kevin, et al. "Developing Tolerated-Route Demand Estimation Capabilities For Texas: Opportunities For Enhancement Of Existing Models."  
<http://ntl.bts.gov/lib/52000/52700/52760/0-6754-1.pdf>

## **Use of Mobile Application Development Technologies in Capstone Projects** *Shuju Wu, Xiaobing Hou & Karen Coale Tracey*

**Abstract:** This paper presents the authors' continued efforts to apply mobile application development technologies in our undergraduate and graduate capstone projects in the Department of Computer Electronics and Graphics Technology (CEGT) at Central Connecticut State University (CCSU). Specifically, the efforts are introduced in the context of three graduate and one undergraduate senior capstone project, all of which are closely related to the State of Connecticut's first bus rapid transit system, namely CTfastrak. The projects have successfully promoted student engagement in hands-on research, a high impact practice identified by the American Association of Colleges and Universities, enhanced various technological and project management knowledge in their areas of study and skills of collaboration with teammates, other teams, and local government and business. In addition to the bus tracking and trip planning system developed, the success of the projects has also provided a framework for faculty and students to develop similar projects, with components usually available on campus.

**Subject Area:** capstone, mobile application development

**Availability:** Wu, Shuju, Xiaobing Hou, and Karen Coale Tracey. "Use of Mobile Application Development Technologies in Capstone Projects."

[http://cd14.ijme.us/papers/003\\_Shuju%20Wu,%20Xiaobing%20Hou,%20en%20Coale%20Tracey.pdf](http://cd14.ijme.us/papers/003_Shuju%20Wu,%20Xiaobing%20Hou,%20en%20Coale%20Tracey.pdf)

## **Evaluating Charging Service Reliability for Plug-In EVs From the Distribution Network Aspect** *Cheng, L. Chang, Y. Wu, Q. & Lin, W*

**Abstract:** A survey of Beijing China private passenger car driving behavior was conducted based on global positioning system (GPS) data loggers. The survey focused on the distribution of daily driving distance, number of trips, and parking time. Second-by-second data on vehicle location and speed for 112 private cars were collected. The data covered 2,003 travel days, from June 2012 to March 2013, and nearly 10,000 km for a total of 4,892 trips. The trips covered six major urban and suburban areas in Beijing. The survey results showed average daily driving distances of 31.4, 39.1, and 48 km, and average single trip distances of 13.1, 15.1, and 17.2 km, respectively, on workdays, weekends, and holidays in Beijing urban areas. Average daytime parking times were 5.78, 3.39, and 3.12 h, and average numbers of daily trips were 2.3, 2.6, and 2.8; about 60 % of the vehicles parked last at home, starting from 17:30 to 22:30. These results were used to evaluate electric vehicle (EV) and plug-in hybrid electric vehicle (PHEV) deployment. A vehicle with a 60-km all-electric range (AER) could meet 70 % of daily driving demands. However, EVs with double the AER, such as the Nissan Leaf and Honda Fit, could only increase daily travel by EVs by 20 %. Based on Beijing's daily driving distance distribution, the estimated average fuel consumptions for the PHEV10 (Toyota Prius) and PHEV40 (Chevrolet Volt) are 2.92 and 1.08 L per 100 km (L/100 km), respectively. These estimates are 20 and 58 % lower, respectively, compared with fuel consumption for the same vehicles used in the USA.

**Subject Area:** Daily driving distance, Private passenger car, GPS logger, Electric vehicle, Plug-in hybrid electric vehicle, Charging strategy, All electric range, Fuel saving

**Availability:** Wang, Hewu, et al. "Beijing passenger car travel survey: implications for alternative fuel vehicle deployment." *Mitigation and Adaptation Strategies for Global Change* (2014): 1-19. <http://link.springer.com/article/10.1007/s11027-014-9609-9>

# **Comparison of Different Approaches to Estimating Budgets for Kuhn-Tucker Demand Systems: Applications for Individuals' Time-Use Analysis and Households' Vehicle Ownership and Utilization Analysis**

*Bertho Augustin*

**Abstract:** This thesis compares different approaches to estimating budgets for Kuhn-Tucker (KT) demand systems, more specifically for the multiple discrete-continuous extreme value (MDCEV) model. The approaches tested include: (1) The log-linear regression approach (2) The stochastic frontier regression approach, and (3) arbitrarily assumed budgets that are not necessarily modeled as a function of decision maker and choice-environment characteristics.

The log-linear regression approach has been used in the literature to model the observed total expenditure as way of estimating budgets for the MDCEV models. This approach allows the total expenditure to depend on the characteristics of the choice-maker and the choice environment. However, this approach does not offer an easy way to allow the total expenditure to change due to changes in choice alternative-specific attributes, but only allows a reallocation of the observed total expenditure among the different choice alternatives. To address this issue, we propose the stochastic frontier regression approach. The approach is useful when the underlying budgets driving a choice situation are unobserved, but only the expenditures on the choice alternatives of interest are observed. The approach is based on the notion that consumers operate under latent budgets that can be conceived (and modeled using stochastic frontier regression) as the maximum possible expenditure they are willing to incur.

To compare the efficacy of the above-mentioned approaches, we performed two empirical assessments: (1) The analysis of out-of-home activity participation and time-use (with a budget on the total time available for out-of-home activities) for a sample of non-working adults in Florida, and (2) The analysis of household vehicle type/vintage holdings and usage (with a budget on the total annual mileage) for a sample of households in Florida. A comparison of the MDCEV model predictions (based on budgets from the above mentioned approaches) demonstrates that the log-linear regression approach and the stochastic frontier approach performed better than arbitrarily assumed budgets approaches. While the log-linear regression approach allows the total expenditures to change as a result of changes in relevant socio-demographic and choice environment characteristics, it does not allow the total expenditures to change as a result of changes in alternative-specific attributes.

**Subject Area:** Stochastic frontier model, MDCEV model, activity participation, multinomial logit model, vehicle type/vintage

**Availability:** Augustin, Bertho. "Comparison of Different Approaches to Estimating Budgets for Kuhn-Tucker Demand Systems: Applications for Individuals' Time-Use Analysis and Households' Vehicle Ownership and Utilization Analysis." (2014). <http://scholarcommons.usf.edu/etd/5174/>

## **Seventy Minutes Plus or Minus 10 — A Review of Travel Time Budget Studies** *Asif Ahmed & Peter Stopher*

**Abstract:** This paper provides a comprehensive review of travel-time budget (TTB) studies in the literature for about the past four decades. Starting with the concept of TTBs, it discusses both the studies that support the existence of TTB and also those that deem the concept to be unfounded. Sociodemographic variables and their relation to TTB are also discussed briefly. However, as past studies use different data sources, survey techniques, and methodology for analysis, cross comparison of studies is not possible. Most importantly, the underlying cause of the regularity that is found at an aggregate level is still not known. The idea of TTB is important because, if it exists, it would mean that the total time spent on travelling per person per day will remain unchanged in spite of all improvements to transport. TTB has immense implications for transport policies and it is usually ignored. The paper also explores the available theoretical explanation of this concept, past research gaps and new analysis potentials. Recent directions in TTB studies are also discussed together with the potential use of multiday multiyear panel data in TTB research to explore the phenomenon better than before.

**Subject Area:** travel-time budgets, travel-time expenditure, human energy expenditure on travel, constant travel budget, multiday GPS travel survey data

**Availability:** Ahmed, Asif, and Peter Stopher. "Seventy Minutes Plus or Minus 10—A Review of Travel Time Budget Studies." *Transport Reviews* ahead-of-print (2014): 1-19.  
<http://www.tandfonline.com/doi/abs/10.1080/01441647.2014.946460>

## **Proposal of Route Optimization in PMIPv6 Enabled Nested Network to Support Power Critical Devices in Vehicular Network** *Barman, Subhajyoti*

**Abstract:** Vehicular network can be seen as an ad-hoc type of network, where they form temporary infrastructure for communication which can be used for efficient traffic controlling. This concept is the current topic of interest for many researchers in the networking field. If it is possible to connect vehicular network with the Internet, providing Internet access point in highways, it would be a noble concept because this integration will provide an opportunity to monitor and control those moveable network nodes from anywhere in the world. Moreover if this type of infrastructure is used to connect other communicating devices which are within a vehicle, it will make this concept more cost effective as it will abolish the need of separate network for those communicating devices. From the point of view of end-users this type of network would be very appreciable, but implementation of such network is a huge challenge from the prospective of network engineers. In this work we try to identifies those challenges and provide a solution which can make this ambitious thought a reality. This work only considers the network related issues, so we rely on the existing link layer protocols. We visualized this proposed scenario as a case of nested network mobility. We also assumed that this type of network will be used by resource critical devices, so in our solution we try to rely on an IP protocol stack which is more efficient for mobility management of resource critical device and this is the reason behind the selection of PMIPv6 for our proposed scheme. Finally a mathematical model is proposed for the sake of justification of correctness and effectiveness of our proposed proposal.

**Subject Area:** Mobile Computing & Communication

**Availability:** Barman, Subhajyoti. Proposal of Route Optimization in PMIPv6 Enabled Nested Network to Support Power Critical Devices in Vehicular Network. Diss. 2014.

<http://dspace.jdvu.ac.in/handle/123456789/29547>

## **A Latent-Segmentation Based Approach To Investigating The Spatial Transferability Of Activity-Travel Models** *Zeina Wafa; Chandra Bhat; Ram Pendyala; & Venu Garikapati*

**Abstract:** Spatial transferability of travel demand models has been an issue of considerable interest, particularly for small and medium sized planning areas that often do not have the resources and staff time to collect large scale travel survey data and estimate model components native to the region. With the advent of more sophisticated microsimulation-based activity-travel demand models, the interest in spatial transferability has surged in the recent past as smaller metropolitan planning organizations seek to take advantage of emerging modeling methods within the limited resources they can marshal. Traditional approaches to identifying geographical contexts that may borrow and transfer models between one another involve the exogenous a priori identification of a set of variables or criteria that are used to characterize the similarity between geographic regions. However, this ad hoc procedure presents considerable challenges as it is difficult to identify the most appropriate criteria a priori. To address this issue, this paper proposes a latent segmentation approach whereby the most appropriate criteria for identifying areas with similar profiles are determined endogenously within the model estimation phase. In other words, the relationships embedded in the data set help identify the optimal set of criteria that can be used to cluster regions according to their similarity with respect to activity-travel characteristics of interest. The methodology is demonstrated and its efficacy established through a case study in this paper that utilizes the National Household Travel Survey (NHTS) data set. It is found that the methodology offers a robust mechanism for identifying latent segments and establishing criteria for assessing transferability of models between areas.

**Subject Area:** spatial transferability, activity-travel model, geographic contexts, MDCEV model, latent segmentation approach, regional similarity

**Availability:** Wafa, Zeina, et al. "A LATENT-SEGMENTATION BASED APPROACH TO INVESTIGATING THE SPATIAL TRANSFERABILITY OF ACTIVITY-TRAVEL MODELS."

<http://www.cae.utexas.edu/prof/bhat/ABSTRACTS/SpatialTransferabilityLatentSeg.pdf>

## **From traces to trajectories: How well can we guess activity locations from mobile phone traces?** *Cynthia Chena, Ling Bianb, & Jingtao Ma*

**Abstract:** Passively generated mobile phone dataset is emerging as a new data source for research in human mobility patterns. Information on individuals' trajectories is not directly available from such data; they must be inferred. Many questions remain in terms how well we can capture human mobility patterns from these datasets. Only one study has compared the results from a mobile phone dataset to those from the National Household Travel Survey (NHTS), though the comparison is on two different populations and samples. This study is a very first attempt that develops a procedure to generate a simulated mobile phone dataset containing the ground truth information. This procedure can be used by other researchers and practitioners who are interested in using mobile phone data and want to formally evaluate the effectiveness of an algorithm.

To identify activity locations from mobile phone traces, we develop an ensemble of methods: a model-based clustering method to identify clusters, a logistic regression model to distinguish between activity and travel clusters, and a set of behavior-based algorithms to detect types of locations visited. We show that the distribution of the activity locations identified from the simulated mobile phone dataset resembles the ground truth better than the existing studies. For home locations, 70% and 97% of identified homes are within 100 and 1000 m from the truth, respectively. For work places, 65% and 86% of the identified work places are within 100 and 1000 m from the true ones, respectively. These results point to the possibility of using these passively generated mobile phone datasets to supplement or even replace household travel surveys in transportation planning in the future.

**Subject Area:** Household travel survey; Mobile phone datasets; Activity locations; Clustering

**Availability:** Chen, Cynthia, Ling Bian, and Jingtao Ma. "From traces to trajectories: How well can we guess activity locations from mobile phone traces?." *Transportation Research Part C: Emerging Technologies* 46 (2014): 326-337.

<http://www.sciencedirect.com/science/article/pii/S0968090X14002022>



## **A Framework for Data Quality for Synthetic Information** *Ragini Gupta*

**Abstract:** Data quality has been an area of increasing interest for researchers in recent years due to the rapid emergence of “big data” processes and applications. In this work, the data quality problem is viewed from the standpoint of synthetic information. Based on the structure and complexity of synthetic data, a need to have a data quality framework specific to it was realized. This thesis presents this framework along with implementation details and results of a large synthetic dataset to which the developed testing framework is applied. A formal conceptual framework was designed for assessing data quality of synthetic information. This framework involves developing analytical methods and software for assessing data quality for synthetic information. It includes dimensions of data quality that check the inherent properties of the data as well as evaluate it in the context of its use. The framework developed here is a software framework which is designed considering software design techniques like scalability, generality, integrability and modularity. A data abstraction layer has been introduced between the synthetic data and the tests. This abstraction layer has multiple benefits over direct access of the data by the tests. It decouples the tests from the data so that the details of storage and implementation are kept hidden from the user. We have implemented data quality measures for several quality dimensions: accuracy and precision, reliability, completeness, consistency, and validity. The particular tests and quality measures implemented span a range from low-level syntactic checks to highlevel semantic quality measures. In each case, in addition to the results of the quality measure itself, we also present results on the computational performance (scalability) of the measure.

**Subject Area:** big data; data quality framework

**Availability:** Gupta, Ragini. A Framework for Data Quality for Synthetic Information. Diss. Virginia Polytechnic Institute and State University, 2014.  
<http://vtechworks.lib.vt.edu/handle/10919/49675>

**Quantifying travel behavior for infectious disease research: a comparison of data from surveys and mobile phones** *Amy Wesolowski, Gillian Stresman, Nathan Eagle, Jennifer Stevenson, Chrispin Owaga, Elizabeth Marube, Teun Bousema, Christopher Drakeley, Jonathan Cox & Caroline O. Buckee*

**Abstract:** Human travel impacts the spread of infectious diseases across spatial and temporal scales, with broad implications for the biological and social sciences. Individual data on travel patterns have been difficult to obtain, particularly in low-income countries. Travel survey data provide detailed demographic information, but sample sizes are often small and travel histories are hard to validate. Mobile phone records can provide vast quantities of spatio-temporal travel data but vary in spatial resolution and explicitly do not include individual information in order to protect the privacy of subscribers. Here we compare and contrast both sources of data over the same time period in a rural area of Kenya. Although both data sets are able to quantify broad travel patterns and distinguish regional differences in travel, each provides different insights that can be combined to form a more detailed picture of travel in low-income settings to understand the spread of infectious diseases.

**Subject Area:** Computational science; Malaria

**Availability:** Wesolowski, Amy, et al. "Quantifying travel behavior for infectious disease research: a comparison of data from surveys and mobile phones." *Scientific reports* 4 (2014). <http://www.nature.com/srep/2014/140714/srep05678/full/srep05678.html>

# Demographic Evolution Modeling System for Activity-Based Travel Behavior Analysis and Demand Forecasting *Sanjay Paul*

**Abstract:** The activity-based approach to travel demand analysis and modeling, which has been developed over the past 30 years, has received tremendous success in transportation planning and policy analysis issues, capturing the multi-way joint relationships among socio-demographic, economic, land use characteristics, activity participation, and travel behavior. The development of synthesizing population with an array of sociodemographic and socio-economic attributes has drawn remarkable attention due to privacy and cost constraints in collecting and disclosing full scale data. Although, there has been enormous progress in producing synthetic population, there has been less progress in the development of population evolution modeling arena to forecast future year population. The objective of this dissertation is to develop a well-structured full-fledged demographic evolution modeling system, capturing migration dynamics and evolution of person level attributes, introducing the concept of new household formations and apprehending the dynamics of household level long-term choices over time. A comprehensive study has been conducted on demography, sociology, anthropology, economics and transportation engineering area to better understand the dynamics of evolutionary activities over time and their impacts in travel behavior. This dissertation describes the methodology and the conceptual framework, and the development of model components. Demographic, socio-economic, and land use data from American Community Survey, National Household Travel Survey, Census PUMS, United States Time Series Economic Dynamic data and United States Center for Disease Control and Prevention have been used in this research. The entire modeling system has been implemented and coded using programming language to develop the population evolution module named 'PopEvol' into a computer simulation environment. The module then has been demonstrated for a portion of Maricopa County area in Arizona to predict the milestone year population to check the accuracy of forecasting. The module has also been used to evolve the base year population for next 15 years and the evolutionary trend has been investigated.

**Subject Area:** population evolution model; demographic evolution model

**Availability:** Paul, Sanjay. Demographic Evolution Modeling System for Activity-Based Travel Behavior Analysis and Demand Forecasting. Diss. ARIZONA STATE UNIVERSITY, 2014.  
[http://repository.asu.edu/attachments/135142/content/Paul\\_asu\\_0010E\\_14038.pdf](http://repository.asu.edu/attachments/135142/content/Paul_asu_0010E_14038.pdf)

## **Research and Guidance for Model Transferability** *Thomas F. Rossi & Chandra R. Bhat*

**Abstract:** Typically, travel model parameters are estimated using observed local travel data, usually from surveys, which can be difficult and expensive to conduct in a manner that leads to sufficient sample sizes for model parameter estimation. This has led to the practice of model transfer in many areas. Model transfer has become commonplace in transportation planning as resources for planning continue to be constrained. This research brief presents information relevant to the transfer of model parameters and synthesizes the research on model transferability. Planners in many cases may have superior alternatives to the use of national average parameters, especially when some local data are available. The synthesis of transferability studies indicates mixed results for model transferability and suggests ways of improving transferability results, including use of small amounts of local data in an updating process when transferring models. This document seeks to present that knowledge to provide planners with practical guidance in determining the best transferability methods for their unique situations.

**Subject Area:** travel model; model transfer; transferability

**Availability:** Bhat, Chandra R., et al. "Research and Guidance for Model Transferability"  
<http://onlinepubs.trb.org/onlinepubs/conferences/2014/ITM/Resources/71.pdf>

## **Mixed Geographically Weighted Regression Models for Daily Vehicular Travel Volumes** *Roosbeh Nowrouzian, Sivaramakrishnan Srinivasan & Ruoying Xu*

**Abstract:** In the recent years, there is an increasing interest in the application of spatial models for transportation problems. One such popular model is the geographically-weighted regression (GWR) which extends the conventional regression model by allowing the parameters to vary over space. The need to use GWR models is generally motivated by the inherent spatial clustering in travel-patterns and the superiority of the GWR models over conventional regression is established using statistical measures (mostly R<sup>2</sup>). However, GWR models require the estimation of a very large number of parameters and as such are not efficient. Further, to our knowledge, practically all studies that report GWR models simply report all coefficients to be spatially-varying without examining whether the spatial-differences are indeed statistically significant. In this context, this study presents mixed-GWR models which allow for a combination of spatially-fixed and spatially-varying parameters. The methodological innovation is applied in the context of modeling vehicle-miles-traveled (VMT) and vehicle-time-traveled (VTT), two important measures of daily vehicular travel volumes. While the effects of land-use on these transportation system performance measures have been studied very extensively using global / aspatial models, empirical insights into spatial variability in the sensitivity of parameters are limited. Therefore, the application of mixed-GWR models in this context is timely and would support the evaluation of local or context-specific" strategies aimed at reducing vehicular traffic volumes, fuel consumption, and emissions.

**Subject Area:** spatial model; geographically-weighted regression (GWR)

**Availability:** Nowrouzian, Roosbeh, Sivaramakrishnan Srinivasan, and Ruoying Xu. "Paper Author (s)." <http://onlinepubs.trb.org/onlinepubs/conferences/2014/ITM/Resources/54.pdf>

## **Personalisation in multi-day GPS and accelerometer data processing** *Lara Montini, Nadine Rieser-Schüssler, & Kay W. Axhausen*

**Abstract:** In this paper, we analyse how personalisation during processing of multi-day GPS and accelerometer data can improve the quality of the produced travel diaries. The main focus is on trip purpose detection using random forests. Two main approaches are followed. First, the effect of person-based input features is shown, In particular distance to home and work improve classification result (median accuracy + 3.8 %). Second, it is analysed how usage of annotated data improves prediction. Most strategies like selecting the best classifier out of many, have no effect. But, improvements are possible if the classifier is learned including some of the participant's annotated data (median accuracy + 5.5 %).

**Subject Area:** GPS processing, trip purpose, personalisation

**Availability:** Montini, Lara, Nadine Rieser-Schüssler, and Kay W. Axhausen. "Personalisation in multi-day GPS and accelerometer data processing." (2014).

[http://www.strc.ch/conferences/2014/Montini\\_EtAl.pdf](http://www.strc.ch/conferences/2014/Montini_EtAl.pdf)

## **Trip Internalization in Multi-Use Developments** *Pinjari, Abdul and Vivek Koneru*

**Abstract:** Internal trip capture refers to how the number trips to and from a development are reduced by the proximity of complementary land uses within the development (e.g., residential to retail). Internal trips occur within the development and do not encumber the traffic flow on the public roadways connecting the development with the transportation network. Internal trip capture rates are used to estimate trip generation on mixed-use developments by adjusting the single land use estimates. These single land use estimates tend to overestimate the trip generation behavior for mixed-use developments. Accurate internal trip capture rate estimates and methodologies are necessary to improve the trip generation estimates for mixed-use developments. Nationwide, there have been efforts to enhance both the data availability and estimation methodologies to estimate internal trip capture rates. In this project, internal trip capture data from four mixed-use developments in Florida were collected and analyzed using a recently-enhanced internal trip capture methodology developed by the National Cooperative Highway Research Program (NCHRP). Results showed that the enhanced methodology produced generally more accurate estimates than those from the traditional ITE internal trip capture procedure. In the NCHRP methodology, the maximum unconstrained internal trip capture rates from land use pairs are chosen in mixed-use developments. Data collected in this project can potentially contribute with 33 percent of these unconstrained internal trip capture rates used in the enhanced methodology for internal trip capture estimation. A series of prediction tests was developed to assess the contribution of the unconstrained internal trip capture rates supplied by this study to the accuracy of the trip generation estimates. It was found that the use of the revised unconstrained internal trip capture rates based on the combined NCHRP and FDOT data improved the prediction capability in five out of eight test cases, with one test case tied. In addition to internal trip capture estimates, this project also collected transportation mode and internal trip length information. Guidance for improving the data collection process and estimation are also provided.

**Subject Area:** Trip generation, internal trip capture , planning mixed-used developments

**Availability:** Pinjari, Abdul, and Mr Vivek Koneru. "Trip Internalization in Multi-Use Developments." (2014). <http://ntl.bts.gov/lib/51000/51700/51758/FDOT-BDK84-977-10-rpt.pdf>

## **Building a validation measure for activity-based transportation models based on mobile phone data** *Feng Liu, Davy Janssens, JianXun Cui, YunPeng Wang, Geert Wets, & Mario Cools*

**Abstract:** Activity-based micro-simulation transportation models typically predict 24-h activity-travel sequences for each individual in a study area. These sequences serve as a key input for travel demand analysis and forecasting in the region. However, despite their importance, the lack of a reliable benchmark to evaluate the generated sequences has hampered further development and application of the models. With the wide deployment of mobile phone devices today, we explore the possibility of using the travel behavioral information derived from mobile phone data to build such a validation measure. Our investigation consists of three steps. First, the daily trajectory of locations, where a user performed activities, is constructed from the mobile phone records. To account for the discrepancy between the stops revealed by the call data and the real location traces that the user has made, the daily trajectories are then transformed into actual travel sequences. Finally, all the derived sequences are classified into typical activity-travel patterns which, in combination with their relative frequencies, define an activity-travel profile. The established profile characterizes the current activity-travel behavior in the study area, and can thus be used as a benchmark for the assessment of the activity-based transportation models. By comparing the activity-travel profiles derived from the call data with statistics that stem from traditional activity-travel surveys, the validation potential is demonstrated. In addition, a sensitivity analysis is carried out to assess how the results are affected by the different parameter settings defined in the profiling process.

**Subject Area:** Activity-travel sequences; Activity-based transportation models; Travel surveys; Mobile phone data

**Availability:** Liu, Feng, et al. "Building a validation measure for activity-based transportation models based on mobile phone data." *Expert Systems with Applications* (2014).  
<http://www.sciencedirect.com/science/article/pii/S0957417414002036>



## **Review of GPS Travel Survey and GPS Data-Processing Methods** *Li Shen & Peter R. Stopher*

**Abstract:** Global positioning system (GPS) devices have been utilised in travel surveys since the late 1990s. Because GPS devices are very accurate at recording time and positional characteristics of travel, they can correct the trip-misreporting issue resulting from self-reports of travel and improve the accuracy of travel data. Although the initial idea of using GPS surveys in transport data collection was just to replace paper-based travel diaries, GPS surveys currently are being applied in a number of transport fields. Several general reviews have been done about GPS surveys in the literature review sections in some papers, but a detailed systematic review from GPS data collection to the whole procedure of GPS data processing has not been undertaken. This paper comprehensively reviews the development of GPS surveys and their applications, and GPS data processing. Different from most reviews in GPS research, this paper provides a detailed and systematic comparison between different methods from trip identification to mode and purpose detection, introduces the methods that researchers and planners are currently using, and discusses the pros and cons of those methods. Based on this review, researchers can choose appropriate methods and endeavour to improve them.

**Subject Area:** GPS survey, GPS data processing, trip/segment identification, mode detection, trip purpose imputation

**Availability:** Shen, Li, and Peter R. Stopher. "Review of GPS Travel Survey and GPS Data-Processing Methods." *Transport Reviews* ahead-of-print (2014): 1-19.  
<http://www.tandfonline.com/doi/abs/10.1080/01441647.2014.903530>

## **Human mobility in opportunistic networks: Characteristics, models and prediction methods** *Poria Pirozmand, Guowei Wu, Behrouz Jedari, & Feng Xia*

**Abstract:** Opportunistic networks (OppNets) are modern types of intermittently connected networks in which mobile users communicate with each other via their short-range devices to share data among interested observers. In this setting, humans are the main carriers of mobile devices. As such, this mobility can be exploited by retrieving inherent user habits, interests, and social features for the simulation and evaluation of various scenarios. Several research challenges concerning human mobility in OppNets have been explored in the literature recently. In this paper, we present a thorough survey of human mobility issues in three main groups (1) mobility characteristics, (2) mobility models and traces, and (3) mobility prediction techniques. Firstly, spatial, temporal, and connectivity properties of human motion are explored. Secondly, real mobility traces which have been captured using Bluetooth/Wi-Fi technologies or location-based social networks are summarized. Furthermore, simulation-based mobility models are categorized and state-of-the-art articles in each category are highlighted. Thirdly, new human mobility prediction techniques which aim to forecast the three aspects of human mobility, i.e.; users' next walks, stay duration and contact opportunities are studied comparatively. To conclude, some major open issues are outlined.

**Subject Area:** Opportunistic networks; Human mobility characteristics; Real traces; Simulation-based models; Mobility prediction

**Availability:** Pirozmand, Poria, et al. "Human mobility in opportunistic networks: Characteristics, models and prediction methods." *Journal of Network and Computer Applications* (2014). <http://www.sciencedirect.com/science/article/pii/S1084804514000587>

## **Characterizing Household Vehicle Fleet Composition And Count By Type In An Integrated Modeling Framework** *Venu M. Garikapati, Raghuprasad Sidharthan, Ram M. Pendyala, & Chandra R. Bhat*

**Abstract:** There has been considerable interest, and consequent progress, in the modeling of household vehicle fleet composition and utilization in the travel behavior research domain. The Multiple Discrete Continuous Extreme Value (MDCEV) model is a modeling approach that has been applied frequently to characterize this choice behavior. One of the key drawbacks of the MDCEV modeling methodology is that it does not provide an estimate of the count of vehicles within each vehicle type alternative represented in the MDCEV model. Moreover, the classic limitations of the multinomial logit model such as violations of the IIA property in the presence of correlated alternatives and the inability to account for random taste variations apply to the MDCEV model as well. A new methodological approach, developed to overcome these limitations, is applied in this paper to model vehicle fleet composition and count within each body type. The modeling methodology involves tying together a multiple discrete-continuous probit (MDCP) model and a multivariate count model capable of estimating vehicle counts within vehicle type categories considered by the MDCP model. The joint MDCP-multivariate count model system is estimated using a Greater Phoenix, Arizona travel survey data set. The joint model system is found to offer behaviorally intuitive results and provide superior goodness of- fit in comparison to an independent model system that ignores the jointness between the MDCP component and the multivariate count component.

**Subject Area:** vehicle fleet composition modeling, multiple discrete continuous probit (MDCP) model, multivariate count model, joint model estimation, vehicle type choice, activity-travel modeling

**Availability:** Garikapati, Venu M., et al. "Characterizing Household Vehicle Fleet Composition and Count by Type in an Integrated Modeling Framework." Transportation Research Board 93rd Annual Meeting. No. 14-4711. 2014.  
[http://www.ce.utexas.edu/prof/bhat/ABSTRACTS/MDCPCount\\_VehicleFleetComposition.pdf](http://www.ce.utexas.edu/prof/bhat/ABSTRACTS/MDCPCount_VehicleFleetComposition.pdf)

## **Passenger Transportation Networks & Urbanization Level: A Comparison of Classification Schemes 2** *Pyrialakou, V. Dimitra, Inya Nlenanya, and Konstantina Gkritza*

**Abstract:** Planning and operating effective transportation networks rely heavily on the knowledge of current and future transport patterns, which in turn relies on the current and future land use and urbanization levels of an area. However, while various organizations have developed classification schemes to classify areas by urbanization levels, there has been no literature to assess the suitability of such schemes for use in transportation planning and research applications, considering also the status quo of transportation networks and transportation infrastructure systems under a comprehensive approach. The goal of this study is to compare the well-established classification schemes in the United States and evaluate their ability to capture the key elements of the two-fold relationship between transportation systems and urbanization levels. To achieve this goal, we consider the main passenger transportation networks and other transportation infrastructure systems in a case study of the Midwest region. The results of this study suggest that each scheme's classification criteria, as well as the level of aggregation considered, depend on the primary purpose each scheme has been developed to serve. Additionally, the results suggest that all schemes are inadequate for use in transportation research since they do not capture all key elements that affect transportation patterns and needs under a comprehensive framework. Finally, to address the above issues, we design and evaluate a new classification scheme that focuses on transportation-related aspects, captures key elements, and considers the heterogeneity within rural areas. The ultimate outcome will be a geographic framework suitable for transportation planning and system's evaluation.

**Subject Area:** Urbanization classification scheme; transportation networks; transport patterns

**Availability:** Pyrialakou, V. Dimitra, Inya Nlenanya, and Konstantina Gkritza. "Passenger Transportation Networks & Urbanization Level: A Comparison of Classification Schemes 2." Transportation Research Board 93rd Annual Meeting. No. 14-3528. 2014.  
<http://docs.trb.org/prp/14-3528.pdf>

**Development of a Vehicle Fleet Composition Model System for Implementation in an Activity-Based Travel Model** *Daehyun You, Venu M. Garikapati, Ram M. Pendyala, Chandra R. Bhat, Subodh Dubey, Kyunghwi Jeon, & Vladimir Livshits*

**Abstract:** This paper describes the development of a vehicle fleet composition and utilization model system that may be incorporated into a larger activity-based travel demand model. It is of interest and importance to model household vehicle fleet composition and utilization behavior as the energy and environmental impacts of personal travel are not only dependent on the number of vehicles, but also on the mix of vehicles that a household owns and the extent to which different vehicles are utilized. A vehicle composition (fleet mix) and utilization model system has been developed for integration in the activity based travel demand model that is being developed for the Greater Phoenix metropolitan area in Arizona. At the heart of the vehicle fleet mix model system is a multiple discrete continuous extreme value (MDCEV) model capable of simulating vehicle ownership and use patterns of households. Vehicle choices are defined by a combination of vehicle body type and age category and the model system is capable of predicting household vehicle composition and utilization patterns at the household level. The paper describes the model system and presents results of a validation and policy sensitivity analysis exercise demonstrating the efficacy of the model.

**Subject Area:** vehicle fleet composition, vehicle utilization, multiple discrete continuous extreme value (MDCEV) model, vehicle count modeling, travel demand forecasting

**Availability:** You, Daehyun, et al. "Development of a Vehicle Fleet Composition Model System for Implementation in an Activity-Based Travel Model." Transportation Research Board 93rd Annual Meeting. No. 14-4236. 2014.

[http://www.caee.utexas.edu/prof/bhat/ABSTRACTS/VehicleFleetCompositionModelSystem\\_Mar2014.pdf](http://www.caee.utexas.edu/prof/bhat/ABSTRACTS/VehicleFleetCompositionModelSystem_Mar2014.pdf)

**State of the Art in Risk Analysis of Workforce Criticality Influencing Disaster Preparedness for Interdependent Systems** *Joost R. Santos, Lucia Castro Herrera, Krista Danielle S. Yu, Sheree Ann T. Pagsuyoin, & Raymond R. Tan*

**Abstract:** The objective of this article is to discuss a needed paradigm shift in disaster risk analysis to emphasize the role of the workforce in managing the recovery of interdependent infrastructure and economic systems. Much of the work that has been done on disaster risk analysis has focused primarily on preparedness and recovery strategies for disrupted infrastructure systems. The reliability of systems such as transportation, electric power, and telecommunications is crucial in sustaining business processes, supply chains, and regional livelihoods, as well as ensuring the availability of vital services in the aftermath of disasters. There has been a growing momentum in recognizing workforce criticality in the aftermath of disasters; nevertheless, significant gaps still remain in modeling, assessing, and managing workforce disruptions and their associated ripple effects to other interdependent systems. The workforce plays a pivotal role in ensuring that a disrupted region continues to function and subsequently recover from the adverse effects of disasters. With this in mind, this article presents a review of recent studies that have underscored the criticality of workforce sectors in formulating synergistic preparedness and recovery policies for interdependent infrastructure and regional economic systems

**Subject Area:** Disasters; hurricanes; infrastructure systems; pandemics; workforce sectors

**Availability:** Santos, Joost R., et al. "State of the Art in Risk Analysis of Workforce Criticality Influencing Disaster Preparedness for Interdependent Systems." *Risk Analysis* (2014).  
<http://onlinelibrary.wiley.com/doi/10.1111/risa.12183/full>

## **Trip Purpose Estimation for Urban Travel in the U.S.: Model Development, NHTS Add-on Data Analysis, and Model Transferability Across Different States**

*Lu, Yijing & Zhang, Lei*

**Abstract:** It's becoming a trend that the traditional travel survey will be supplemented or replaced by advanced survey based on GPS technology. However, the pivotal key to successfully establish the dominance of the GPS-based travel survey in future is the efficient post-processing methods that can generate the essential components such as travel time, trip purpose, travel mode, and trip length as accurately as possible. This paper therefore concentrates on part of the geospatial data post-processing: trip purpose derivation. Two released 2009 NHTS add-on data sets (Georgia and Arizona) containing geospatial location data provide the possibility of imputing trip purpose, validating the trip purpose model and further evaluating the model transferability. Multiple classifiers are explored employing machine learning methods with 2009 NHTS add-on data sets and land use data at both parcel level and point level. Different validation methods including 10-fold cross validation, within-sample and cross-sample validation are used to evaluate, test and validate the developed models. Results indicate that the trip purpose models perform well for Home, Work, School/Daycare and Shopping/Errands trips with accuracy above 80%, but present unsatisfactory results for transport someone, meals, social/recreation, family personal business/obligations and other trips. In addition, aggregating discretionary trips into one trip purpose category usually improves the trip purpose imputation accuracy. Furthermore, when applying the models to a different geographic place to predict the trip purpose without any model calibration, the models present non-striking model transferability.

**Subject Area:** Data collection; Global Positioning System; Mathematical models; Mode choice; Technological innovations; Transportation modes; Travel behavior; Travel surveys; Travel time; Trip length; Trip purpose

**Availability:** Lu, Yijing, and Lei Zhang. "Trip Purpose Estimation for Urban Travel in the US: Model Development, NHTS Add-on Data Analysis, and Model Transferability Across Different States." Transportation Research Board 93rd Annual Meeting. No. 14-3412. 2014.  
<http://trid.trb.org/view.aspx?id=1288821>

## **Family and Medical Leave in 2012: Methodology Report** *ABT Associates*

**Abstract:** This report summarizes the methods used by Abt Associates in conducting the 2012 Family and Medical Leave Act (FMLA) Employee and Worksite Surveys for the Department of Labor (DOL). The 2012 Employee Survey is as an overlapping, dual frame landline and cell phone random digit dial (RDD) telephone survey. The target population is U.S. adults age 18 or older who were employed for pay in the past 12 months. The survey features both a screener and an extended interview. Adults who needed or took family/medical leave in the 18 months prior to the interview are oversampled and administered an extended interview roughly twice the length of the extended interview for respondents who did not need or take such leave. In order to identify the extended interview respondent, the screener includes a roster of all the adults in the household, including their relevant employment history and leave-taking behavior. Within-household selection is conducted for both landline and cell phone cases. The 2012 Worksite Survey is a mixed-mode telephone and internet survey of U.S. businesses. The Study was conducted to obtain estimates of the use of leave under the FMLA and examine the impact on U.S. private business establishments. The sampling frame was drawn from the Dun and Bradstreet (D&B) Market Identifiers (DMI) file. The final sample excluded self-employed without employees, government and quasi-government units (federal, state, and local governments, public educational institutions, and post offices).

**Subject Area:** survey methods; dual frame landline and cell phone RDD;

**Availability:** DOLF, TO. "mily and M 012: Meth."

<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.278.7147&rep=rep1&type=pdf>



## **Age, Autos, and the Value of a Statistical Life** *James O'Brien*

**Abstract:** The value of a statistical life (VSL) is used to assign a dollar value to the benefits of health and safety regulations. Many of those regulations disproportionately benefit older people, but most estimates of the VSL come from hedonic wage regressions with few older workers and no retirees. Although underrepresented in the labor force, seniors account for the sizeable share of annual vehicle acquisitions. Using automobile purchase decisions rather than labor market decisions, I estimate a VSL for individuals from the age of 18 up to the age of 85. Combining information on vehicle holdings and use, household attributes, used vehicle prices, crash test results, and yearly fatal accidents for each make, model, and vintage automobile, I calculate a separate willingness to pay for reduced mortality for different age groups. I find a significant inverted-U shape to the age-VSL function that ranges from \$1.5 to \$19.2 million (in 2009 dollars). This extends the range of revealed preference estimates of the age- VSL relationship and highlights the importance of considering the specific ages of affected individuals when evaluating public policy.

**Subject Area:** Value of statistical life; senior discount; vehicle choice

**Availability:** O'Brien, James. "November 5m, 2013."  
<http://economics.stanford.edu/files/O'BRIEN.pdf>

**Understanding the Impact of Face Mask Usage through Epidemic Simulation of Large Social Networks** *Susan M. Mniszewski, Sara Y. Del Valle, Reid Priedhorsky, James M. Hyman, and Kyle S. Hickman*

**Abstract:** Evidence from the 2003 SARS epidemic and 2009 H1N1 pandemic shows that face masks can be an effective non-pharmaceutical intervention in minimizing the spread of airborne viruses. Recent studies have shown that using face masks is correlated to an individual's age and gender, where females and older adults are more likely to wear a mask than males or youths. There are only a few studies quantifying the impact of using face masks to slow the spread of an epidemic at the population level, and even fewer studies that model their impact in a population where the use of face masks depends upon the age and gender of the population. We use a state-of-the-art agent-based simulation to model the use of face masks and quantify their impact on three levels of an influenza epidemic and compare different mitigation scenarios. These scenarios involve changing the demographics of mask usage, the adoption of mask usage in relation to a perceived threat level, and the combination of masks with other non-pharmaceutical interventions such as hand washing and social distancing. Our results show that face masks alone have limited impact on the spread of influenza. However, when face masks are combined with other interventions such as hand sanitizer, they can be more effective. We also observe that monitoring social internet systems can be a useful technique to measure compliance. We conclude that educating the public on the effectiveness of masks to increase compliance can reduce morbidity and mortality.

**Subject Area:** epidemic simulation, face masks, social distancing

**Availability:** Mniszewski, Susan M., et al. "Understanding the Impact of Face Mask Usage Through Epidemic Simulation of Large Social Networks." *Theories and Simulations of Complex Social Systems*. Springer Berlin Heidelberg, 2014. 97-115.

[http://link.springer.com/chapter/10.1007/978-3-642-39149-1\\_8](http://link.springer.com/chapter/10.1007/978-3-642-39149-1_8)

## **Accuracy of Geoimputation: An Approach to Capture Microenvironment** *Xin Wang, Asad Khattak, & Juyin Chen*

**Abstract:** The role of the built environment in travel behavior has seen increased interest by strategic transportation planners. To capture relationships between travel behavior and the built environment, microenvironment variables representing infrastructure and land uses surrounding trip origins and destinations are being used as explanatory variables in travel demand models. Buffers of various sizes can be created around origins or destinations to capture the microenvironments. A key requirement is knowledge of the exact coordinates (latitude and longitude) of trip locations. However, such information is commonly removed from public use data because of privacy concerns. To assess whether synthetic geoimputed residences can overcome the removal of exact location information, two data sets from activity-based travel surveys in North Carolina (Research Triangle survey, N = 4,724, and Charlotte survey, N = 3,310) were analyzed. The fundamental question was whether the geoimputed microenvironmental measurements could be used to model travel behavior sufficiently and accurately. Residences, geoimputed residences, and residences assumed to be located at centroids of census blocks (as is current practice) were compared. The data indicate that (a) the assignment of census block centroids results in statistically significant systematic errors when the accessibility measures are measured; (b) geoimputation based on the level of the traffic analysis zone can provide reasonably accurate accessibility measures in larger buffer sizes of 0.75 mi but not in smaller buffers of 0.25 mi; and (c) geoimputation based on census block level provides accessibility measures that are sufficiently accurate for specifying travel behavior models.

**Subject Area:** geoimputation; land use; travel behavior models

**Availability:** Wang, Xin, Asad J. Khattak, and Juyin Chen. "Accuracy of Geo-imputation: An Approach to Capture Micro-Environment." 92nd Annual Meeting of the Transportation Research Board, Washington, DC. 2013.

<http://trb.metapress.com/content/e2w6033g22w20361/>

**An integrated model for discrete and continuous decisions with application to vehicle ownership, type and usage choices** *Yangwen Liu, Jean-Michel Tremblay & Cinzia Cirillo*

**Abstract:** This paper proposes an integrated modeling framework for discrete and continuous choice dimensions. The model system is applied to the problem of households vehicle ownership, type and usage. A multinomial probit is used to estimate household vehicle ownership, a multinomial logit is used to estimate the vehicle type (class and vintage) choices, and a regression is used to estimate the vehicle usage decisions. Correlation between the discrete and the continuous parts is captured with a full variance-covariance matrix of the unobserved factors. The model system is estimated using Simulated Log-Likelihood methods and Monte-Carlo simulation on data extracted from the 2009 US National Household Travel Survey and a secondary dataset on vehicle characteristics. Model estimates are applied to evaluate changes in vehicle holding and miles driven, in response to the evolution of social societies, living environment and transportation policies.

**Subject Area:** Discrete-continuous model, Monte-Carlo simulation, vehicle ownership, Vehicle Miles Traveled

**Availability:** Liu, Yangwen, Jean-Michel Tremblay, and Cinzia Cirillo. "An integrated model for discrete and continuous decisions with application to vehicle ownership, type and usage choices." <http://www.tinbergen.nl/wp-content/uploads/2014/01/An-Integrated-Model-for-Discrete-and-Continuous-decisions-with-Application-to.pdf>

**Cover your Cough! Quantifying the Benefits of a Localized Healthy Behavior Intervention on Flu Epidemics in Washington DC** *Nidhi Parikh, Mina Youssef, Samarth Swarup, Stephen Eubank, and Youngyun Chungbaek*

**Abstract:** We use a synthetic population model of Washington DC, including residents and transients such as tourists and business travelers, to simulate epidemics of influenza-like illnesses. Assuming that the population is vaccinated at the compliance levels reported by the CDC, we show that additionally implementing a policy that encourages healthy behaviors (such as covering your cough and using hand sanitizers) at four major museum locations around the National Mall can lead to very significant reductions in the epidemic. These locations are chosen because there is a high level of mixing between residents and transients. We show that this localized healthy behavior intervention is approximately equivalent to a 46.14% increase in vaccination compliance levels.

**Subject Area:** disease dynamics, intervention strategies, synthetic social network, transient population

**Availability:** Parikh, Nidhi, et al. "Cover your Cough! Quantifying the Benefits of a Localized Healthy Behavior Intervention on Flu Epidemics in Washington DC."  
<http://staff.vbi.vt.edu/swarup/papers/trPop-sbp.pdf>

## **Evaluating Two Methods for Identifying Trip Purpose in GPS-based Household Travel Surveys** *Marcelo G. Simas Oliveira, Peter Vovsha, Jean Wolf and Michael Mitchell*

**Abstract:** Data needs for developing travel demand models have increased at the same time that household travel survey (HTS) participation rates have generally fallen over recent decades. Global Positioning System (GPS) assisted HTS are recognized today as the most promising direction in further enhancement of individual travel data collection. The principal advantage of the GPS-assisted survey technology is that a full stream of locations visited by the person is identified with a high level of spatial and temporal resolution. The automatic identification of trip purpose (i.e. activity associated with the trip destination location) remains an issue that is difficult to solve. This paper evaluates the performance of two methods, choice modeling and decision tree analysis, that can be used to build models capable of identifying trip purpose. The developed methods assume that basic household and person level data, typically collected in the recruitment interview stage of HTS, are available as are supporting spatial datasets such as land use and points of interest. The methods presented are then evaluated using a case study which employed data from the 2011 Atlanta Regional Commission HTS. The developed models produced encouraging results were obtained with overall accuracies above 70% across all purpose and around 90% for mandatory activities (i.e. work and school). Performance of the developed models is evaluated in terms of error rates by purpose category and the impact of ancillary spatial data. The paper concludes with a summary of findings and recommendations for practitioners.

**Subject Area:** travel demand model; GPS Household Travel Survey

**Availability:** Oliveira, Marcelo G. Simas. "Evaluating Two Methods for Identifying Trip Purpose in GPS-based Household Travel Surveys."

<http://assets.conferencespot.org/fileservers/file/66618/filename/14-3407.pdf>

## 8. TRAFFIC SAFETY

**Sensing Phone Use of Motorcycle Drivers** *Jyh-Cheng Chen, Chun-Feng Wu, Wei-Ho Chung, & Ping-Fan Ho*

**Abstract:** Due to safety reasons, using mobile phones while driving is prohibited in many countries. Research has also shown that motorcycle riders are 20 times more likely to be killed in a crash than vehicle occupants. Therefore, it is more critical to restrict the use of mobile phones of motorcycle drivers than car drivers. There are some studies that focus on how to distinguish phone use between a driver and other passengers in a car. The techniques used for cars, however, are not always applicable to motorcycles. In this paper, we propose a way to detect phone use of motorcycle drivers. By using two low-cost Bluetooth emitters, mobile phones of the driver and the passenger can measure the signal strengths and decide their locations. We have conducted extensive experiments with various smartphones. The results show that on average we can achieve 96% accuracy.

**Subject Area:** Driving safety, sensing driver phone, smartphone, motorcycle, scooter, Bluetooth, location classification

**Availability:** Chen, Jyh-Cheng, et al. "Sensing Phone Use of Motorcycle Drivers."  
<http://www.citi.sinica.edu.tw/papers/whc/4166-F.pdf>

## **Development of a Predictive Collision Risk Estimation Scheme for Mixed Traffic** *Je Hong Yoo and Reza Langari*

**Abstract:** Driven by the emergence of autonomous/semi-autonomous driving technologies, the mixed situation of autonomous vehicles and human drivers is of considerable significance. Toward this end, it is necessary to better understand human driving characteristics so as to predict the actions of the other cars. In this regard, we develop a basic framework for modeling driver behaviors in view of human prediction ability. Through the game theoretic estimation of the counterpart's behaviors and the corresponding time-evolution of unsafe collision areas, we compute an objective collision model. In turn, we design a human-like predictive perception model on collision with an adjacent vehicle based on the objective collision model and the driver's subjective level of safety assurance. Since drivers have different safety requirements, the subjective estimate on the collision was designed as a region in which has less safety than the driver's own safety requirement in the objective probabilistic collision prediction. The region that is subjectively perceived based on the driver's own safety standard is regarded as a deterministic unsafe region for the driver. That is to say, the subjective perception acts as a collision area with the collision probability of 1 so that the driver should avoid while driving. In our subsequent work, we will address the issue of controller design to avoid the subjective collision estimation.

**Subject Area:** Collisions (Physics), Risk assessment, Traffic

**Availability:** Yoo, Je Hong, and Reza Langari. "Development of a Predictive Collision Risk Estimation Scheme for Mixed Traffic." ASME 2014 Dynamic Systems and Control Conference. American Society of Mechanical Engineers, 2014.

<http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleid=2086091>



## **The relationship between gasoline price and patterns of motorcycle fatalities and injuries** *He Zhu, Fernando A Wilson, & Jim P Stimpson*

**Abstract:** Objective Economic factors such as rising gasoline prices may contribute to the crash trends by shaping individuals' choices of transportation modalities. This study examines the relationship of gasoline prices with fatal and non-fatal motorcycle injuries. Methods Data on fatal and non-fatal motorcycle injuries come from California's Statewide Integrated Traffic Records System for 2002–2011. Autoregressive integrated moving average (ARIMA) regressions were used to estimate the impact of inflation-adjusted gasoline price per gallon on trends of motorcycle injuries. Results Motorcycle fatalities and severe and minor injuries in California were highly correlated with increasing gasoline prices from 2002 to 2011 ( $r=0.76, 0.88$  and  $0.85$ , respectively). In 2008, the number of fatalities and injuries reached 13 457—a 34% increase since 2002, a time period in which inflation-adjusted gasoline prices increased about \$0.30 per gallon every year. The majority of motorcycle riders involved in crashes were male (92.5%), middle-aged (46.2%) and non-Hispanic white (67.9%). Using ARIMA modelling, we estimated that rising gasoline prices resulted in an additional 800 fatalities and 10 290 injuries from 2002 to 2011 in California. Conclusions Our findings suggest that increasing gasoline prices led to more motorcycle riders on the roads and, consequently, more injuries. Aside from mandatory helmet laws and their enforcement, other strategies may include raising risk awareness of motorcyclists and investment in public transportation as an alternative transportation modality to motorcycling. In addition, universally mandated training courses and strict licensing tests of riding skills should be emphasised to help reduce the motorcycle fatal and non-fatal injuries.

**Subject Area:** motorcycle; crash; gas prices

**Availability:** Zhu, He, Fernando A. Wilson, and Jim P. Stimpson. "The relationship between gasoline price and patterns of motorcycle fatalities and injuries." *Injury prevention* (2014): injuryprev-2014. <http://injuryprevention.bmj.com/content/early/2014/11/04/injuryprev-2014-041314.abstract>

**Female Drivers Increasingly Involved in Impaired Driving Crashes: Actions to Ameliorate the Risk** *Federico E. Vaca, Eduardo Romano and James C. Fell*

**Abstract:** Emergency physicians are confronted daily with the care of traumatically injured patients. A considerable proportion of blunt trauma cases are due to motor vehicle crashes. While men have historically been overrepresented in crash-related injuries and deaths, unfavorable trends for women in alcohol-impaired driving crashes have emerged. This extended commentary with in-depth review presents an examination of the evolving role of sex and gender in alcohol-impaired driving and its outcomes.

**Subject Area:** women; alcohol; crash; gender

**Availability:** Vaca, Federico E., Eduardo Romano, and James C. Fell. "Female Drivers Increasingly Involved in Impaired Driving Crashes: Actions to Ameliorate the Risk." *Academic Emergency Medicine* 21.12 (2014): 1485-1492.

<http://onlinelibrary.wiley.com/doi/10.1111/acem.12542/full>

**Assessing multimodal school travel safety in North Carolina** *Noreen C. McDonald, Ann B. McGrane, Eric A. Rodgman, Ruth L. Steiner, W. Mathew Palmer, & Benjamin F. Lytle*

**Abstract:** School transportation has been the subject of numerous federal and state policies since the early twentieth century—the Safe Routes to School program is the most recent example. However, few recent studies have thoroughly analyzed the risks and costs associated with different modes of transportation to school. Our descriptive study assessed the injury and fatality rates and related safety costs of different modes of school transportation using crash and exposure data from North Carolina, USA from 2005 to 2012. We found that riding with a teen driver is the most dangerous mode on a per trip basis with injury rates 20 times higher and fatality rates 90 times higher than school buses, which had the lowest injury rates. Non-motorized modes had per trip injury rates equivalent to school buses but per trip fatality rates were 15 times higher than for school buses. The economic costs of school travel-related injuries and fatalities for walking, biking, and teen drivers were substantially higher than other modes. This research has important policy implications because it quantified the risks of different school travel modes which allows policymakers to consider how safety investments can reduce risks. Decades of effort by schools, communities, and the government have made school buses a very safe mode and endeavored to reduce risks to teen drivers. This study highlighted the need for these same actors to reduce the risks of injury for walking and bicycling. As more improvements are made to infrastructure around schools, repeated studies of this type will allow practitioners to examine whether the improvements help mitigate the risks.

**Subject Area:** School bus; Pedestrian; Teen driver; School travel; Injury; Fatality; Cost

**Availability:** McDonald, Noreen C., et al. "Assessing multimodal school travel safety in North Carolina." *Accident Analysis & Prevention* 74 (2015): 126-132.

<http://www.sciencedirect.com/science/article/pii/S0001457514003030>

**Vital Signs: Health Burden and Medical Costs of Nonfatal Injuries to Motor Vehicle Occupants — United States, 2012** *Gwen Bergen, PhD, Cora Peterson, PhD, David Ederer, MPH, Curtis Florence, PhD, Tadesse Haileyesus, MS, Marcie-jo Kresnow, MS, & Likang Xu, MD*

**Abstract:** Background: Motor vehicle crashes are a leading cause of death and injury in the United States. The purpose of this study was to describe the current health burden and medical and work loss costs of nonfatal crash injuries among vehicle occupants in the United States. Methods: CDC analyzed data on emergency department (ED) visits resulting from nonfatal crash injuries among vehicle occupants in 2012 using the National Electronic Injury Surveillance System – All Injury Program (NEISS-AIP) and the Healthcare Cost and Utilization Project National Inpatient Sample (HCUP-NIS). The number and rate of all ED visits for the treatment of crash injuries that resulted in the patient being released and the number and rate of hospitalizations for the treatment of crash injuries were estimated, as were the associated number of hospital days and lifetime medical and work loss costs. Results: In 2012, an estimated 2,519,471 ED visits resulted from nonfatal crash injuries, with an estimated lifetime medical cost of \$18.4 billion (2012 U.S. dollars). Approximately 7.5% of these visits resulted in hospitalizations that required an estimated 1,057,465 hospital days in 2012. Conclusions: Nonfatal crash injuries occur frequently and result in substantial costs to individuals, employers, and society. For each motor vehicle crash death in 2012, eight persons were hospitalized, and 100 were treated and released from the ED. Implications for Public Health: Public health practices and laws, such as primary seat belt laws, child passenger restraint laws, ignition interlocks to prevent alcohol impaired driving, sobriety checkpoints, and graduated driver licensing systems have demonstrated effectiveness for reducing motor vehicle crashes and injuries. They might also substantially reduce associated ED visits, hospitalizations, and medical costs.

**Subject Area:** vehicle crashes; public health; healthcare cost

**Availability:** Bergen, Gwen, et al. "Vital Signs: Health Burden and Medical Costs of Nonfatal Injuries to Motor Vehicle Occupants—United States, 2012." *MMWR. Morbidity and mortality weekly report* 63.40 (2014): 894.

<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm63e1007a1.htm>

## **Reality of Road Safety Conditions at Critical Locations in Nablus City with a Road Map for Future Interventions** *Hozaifa Hasan Saad Khader*

**Abstract:** Nablus Governorate occupies the second level among the Palestinian governorates for the frequency of traffic crashes, while it was the first regarding the number of injuries resulting from traffic crashes during the years of this research, which are 2009, 2010 and 2011. This research aims to study the reality of traffic safety conditions at selected locations in the city of Nablus. Traffic crash data and information was collected based on crash reports from the Police Directorate in Nablus city for the study period. Data was collected at selected links and intersections in Nablus city, which are known as main an important location in terms of their traffic conditions compared to other locations in the city. Analysis was done for several patterns of traffic conditions that may have an effect on traffic safety at these sensitive locations, such as crash rate, weather, lighting, road surface, road geometry, types and causes of crashes, etc. Studying the reality of traffic safety at these locations shows that certain conditions and patterns may contribute to the level of safety. Several results emanated from this thesis. For example, the highest intersection crash rates were at Al-Ghawi Intersection followed by the Western Graveyard Intersection and Al-Salam Mosque Intersection. As for streets, the highest rates were on Sufian Street followed by Omar Ibn Al-Khattab Street and Faisal Street. Furthermore, pedestrian crashes formed approximately 20 percent of all crashes, no problem of crashes involving pedestrians on Schools Street on the contrary to Rafeedia Street, less than 3 percent of all crashes involved old drivers, half of crashes on Al-Fatimah Intersection occurred during night lighting, less than 6 percent of crashes occurred in wet and cloudy weather conditions, female drivers were involved in only 6.6 percent of all studied crashes with 23.0 percent of crashes at the intersections of Rafeedia and Tunis Streets, and the highest percentage of crash causes (approximately 25 percent) was “failure to maintain safe distance.” This research and its results outline the realities of traffic crashes in Nablus city and form the road map for follow ups, further studies, and for improving traffic safety conditions in the city.

**Subject Area:** traffic crashes;

**Availability:** Khader, Hozaifa Hasan Saad. Reality of Road Safety Conditions at Critical Locations in Nablus City with a Road Map for Future Interventions. Diss. National University, 2014.

[http://scholar.najah.edu/sites/default/files/Hozaifa%20Khader\\_0.pdf](http://scholar.najah.edu/sites/default/files/Hozaifa%20Khader_0.pdf)

## **An Intelligent Driver Behaviour System by Using Face Recognition and Alcohol Sensing** *K. Kishore Babu & T. Chandra Sekhar Rao*

**Abstract:** At the present time cars and other private vehicles are being used daily by large numbers of people. The biggest problem regarding the increased use of private transport is the rising number of fatalities that are occurring as a consequence of accidents on the roads; the associated expense and related dangers have been recognized as a serious problem that is being confronted by modern society. The existing paper focuses on developing a novel and non-intrusive driver behavior detection system using a context-aware system in VANET to detect abnormal behaviors exhibited by drivers, and to warn other vehicles on the road so as to prevent accidents from happening. A five-layer context aware architecture is proposed which is able to collect contextual information about the driving environment, perform reasoning about certain and uncertain contextual information and react upon that information. In the proposed system we are going to implement a new technique to find out driver's condition 1.driver drowsiness, 2.drunk and drive condition. Most of the accidents occur because of these two conditions only; to avoid this we are using a camera for detecting the driver drowsiness by using matlab and alcohol sensor for detecting the driver's drunken state. If any of these two conditions occurs mean the vehicle will automatically stops slowly and intimates the vehicle location to the authorized person by using GSM & GPS.

**Subject Area:** Context-aware system, VANET, dynamic Bayesian networks, driver behaviour, safety application

**Availability:** Babu, K. Kishore, and T. Chandra Sekhar Rao. "An Intelligent Driver Behaviour System by Using Face Recognition and Alcohol Sensing." [http://ijaem.org/papers/Vol.1-Issue3/9\\_CN0245.pdf](http://ijaem.org/papers/Vol.1-Issue3/9_CN0245.pdf)

**Help on the road: Effects of vehicle manual consultation in driving performance across Modalities** *Ignacio Alvarez, Hanan Alnizami, Jerone Dunbar, France Jackson, & Juan E. Gilbert*

**Abstract:** The growing advancements of in-vehicle electronics and the intrusion of consumer electronics in the vehicle cockpit have increased the complexity of in-car experiences. Therefore, vehicle manuals are needed, now more than ever, to provide information and guidance. Automakers have extended user assistance through multimedia, integrated manuals, online services and telephonic assistance. However, no driver-centric interfaces have been created to provide vehicle documentation assistance effectively. Drivers are expected to interrupt the driving experience in order to find vehicle information in a paper manual. This paper compares the effects on driving performance and cognitive load when consulting a manual in a simulated driving environment through various conditions. These conditions consist of interacting with a voice activated vehicle manual called the Voice User Help, an on-board multimedia manual, a passenger, and a call center. Results suggest that any kind of interaction to access information while driving has an impact on the driver's attention based on a decrease in driving performance and increase of cognitive load. However, amongst all modalities, voice interfaces seem to be the better option for consulting information while driving. Also, and under some circumstances, interaction with a conversational manual system appears to be safer than human-to-human communication.

**Subject Area:** Vehicle documentation; Car manual; Safety; Driver distraction; Cognitive load; Driver performance; Usability; IVIS; Voice user help; In-vehicle interaction; User-centric design spoken language systems

**Availability:** Alvarez, Ignacio, et al. "Help on the road: Effects of vehicle manual consultation in driving performance across Modalities." *International Journal of Human-Computer Studies* (2014). <http://www.sciencedirect.com/science/article/pii/S1071581914000974>

## **Distracted Driving and Seat Belt Use in New York City** *William Milczarski*

**Abstract:** The number of distractions while driving has grown rapidly in recent years due to the changing life style of Americans and advances in technology. Americans spend a great deal of time in their cars. According to the most recent (2009) National Household Travel Survey, the average amount of time per day spent in a vehicle (as a driver or passenger) was about an hour (Federal Highway Administration, 2011). As a result, the car increasingly has become a center of activities which traditionally were carried out in the confines of one's home (e.g., drinking, eating, grooming, being entertained, etc.). The car has also become the location for many new communication and entertainment devices such as DVD players, CD players, GPS navigators, and the cell phone. Not surprisingly, the growth in the number of distractions has had an adverse effect on highway safety. According to the National Highway Traffic Safety Administration (NHTSA) 3,328 people were killed on America's roadways in 2012 due to distracted driving. An additional 421,000 people were injured in motor vehicle crashes involving a distracted driver. At any given daylight moment across America, approximately 660,000 drivers are using cell phones or manipulating electronic devices while driving (National Highway Traffic Safety Administration, 2014a).

A number of national and state studies have been conducted on this topic. However, except for a prior study conducted in 2007 by Hunter College students little, if any, systematic inquiry concerning driver distractions in New York City has been undertaken (Hunter College, 2007).

The major objectives of the present study are: 1) to determine the incidence of specific types of distractions among drivers in the city; 2) to identify certain demographic characteristics of those drivers; and 3) to examine whether there are differences in the locations where distracted driving occurs.

**Subject Area:** Distracted driving; Seat belt; injury

**Availability:** Milczarski, William, and Peter Tuckel. "Distracted Driving and Seat Belt Use in New York City." (2014). <http://silo-public.hunter.cuny.edu/8dfe86373c3477df412802e84c68df8baf19ebe1/Distracted-Driving-and-Seat-Belt-Use-in-New-York-City.pdf>



## **Texting and Driving: Can it be Explained by the General Theory of Crime?**

*Phillip Neil Quisenberry*

**Abstract:** There has been quite a bit of media attention devoted recently to the topic of distracted driving generally, and texting and driving specifically. Recent studies by scholars, as well as the Department of Transportation, have continued to demonstrate the dangers of texting while driving. Previous studies have found that texting while driving reduces reaction and control times even more than drinking and driving. At least one study found that drivers who text are 23 times more likely to crash relative to non-distracted drivers. Tougher laws may be alluring as a deterrent to this behavior, but according to the data in this study, 96 % of respondents knew it was against the law but continued to text and drive anyway. This finding casts doubt on the effectiveness of any new distracted driving laws. The general theory of crime (Gottfredson & Hirschi, 1990) posits that levels of self-control are tied to deviant behaviors such as texting while driving. Other studies have also found that levels of self-control were significantly tied to other dangerous driving behaviors such as driving while drinking and driving without using a seatbelt. The findings in this study add support to the general theory of crime by demonstrating that, among college students in this sample, higher self-control significantly reduces the amount of texting while driving.

**Subject Area:** Distracted driving; Texting and driving; Deviance; Self-control; Risky driving; The general theory of crime; juvenile justice

**Availability:** Quisenberry, Phillip Neil. "Texting and Driving: Can it be Explained by the General Theory of Crime?." *American Journal of Criminal Justice* (2014): 1-14.

<http://link.springer.com/article/10.1007/s12103-014-9249-3>

## **Trustworthy communications in Vehicular Ad Hoc NETWORKS** *Serna, Jetzabel*

**Abstract:** Vehicular Ad-Hoc NETWORKS (VANETs), a pillar for the Internet of Vehicles, aim to improve road safety by preventing and reducing traffic accidents. While VANETs offer a great variety of safety and infotainment applications, there remain a number of security and privacy challenges, such as, user profiling and vehicle tracking, which, must be addressed. This paper contributes with a framework to address security and privacy issues in VANETs. The proposed framework consists of i) an inter-domain authentication system able to provide a near realtime certificate status service, ii) a mechanism to quantitatively evaluate the trust level of a CA and establish a on-the-fly interoperability relationship, and iii) a privacy enhancing model that addresses privacy in terms of linkability.

**Subject Area:** Authentication; Internet; Privacy; Protocols; Vehicles; Vehicular ad hoc networks

**Availability:** Serna, Jetzabel, et al. "Trustworthy communications in Vehicular Ad Hoc NETWORKS." Internet of Things (WF-IoT), 2014 IEEE World Forum on. IEEE, 2014.

[http://ieeexplore.ieee.org/xpls/abs\\_all.jsp?arnumber=6803167](http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6803167)

## **Analysis of residence characteristics of at-fault drivers in traffic crashes**

*Jaeyoung Lee, Mohamed Abdel-Aty, & Keechoo Choi*

**Abstract:** In recent years many studies have investigated traffic crashes with various contributing factors at the macroscopic level. Nevertheless, while previous studies have concentrated only on zones where the crash occurred, there have been few studies that focused on residence characteristics associated with the origin of the drivers causing traffic crashes, so called at-fault drivers. Intuitively, it is reasonable to assume that the number of at-fault drivers is related to socio-demographic features of the at-fault drivers' residence area. Thus, the main objective of this study is to find out the relationship between the number of at-fault drivers and zonal characteristics of the residence where at-fault drivers came from. The Bayesian Poisson-lognormal model was adopted to find out the contributing factors of the residence zones on the number of crashes based on the at-fault drivers. The findings from the study implied that the crash occurrence is not only affected by roadway/traffic factors but also by several demographic and socioeconomic characteristics of residence zones. The result from this study can be used to identify zones with a higher potential of at-fault drivers; thus we can concentrate on these zones for safety treatments, including more targeted awareness, education or stricter enforcement.

**Subject Area:** Bayesian modeling; Poisson-lognormal model; Residence analysis; ZIP code; Socioeconomic factors; Census data

**Availability:** Lee, Jaeyoung, Mohamed Abdel-Aty, and Keechoo Choi. "Analysis of residence characteristics of at-fault drivers in traffic crashes." *Safety Science* 68 (2014): 6-13.  
<http://www.sciencedirect.com/science/article/pii/S0925753514000459>

**The association of graduated driver licensing with miles driven and fatal crash rates per miles driven among adolescents** *Motao Zhu, Peter Cummings, Songzhu Zhao, Jeffrey H Coben, & Gordon S Smith*

**Abstract:** Background: Graduated driver licensing (GDL) laws are associated with reduced crash rates per person-year among adolescents. It is unknown whether adolescents crash less per miles driven or drive less under GDL policies. Methods: We used data from the US National Household Travel Survey and Fatality Analysis Reporting System for 1995–1996, 2001–2002 and 2008–2009. We compared adolescents subject to GDL laws with those not by estimating adjusted IRRs for being a driver in a crash with a death per person-year (aIRRpy) and per miles driven (aIRRm), and adjusted miles driven ratios (aMR) controlling for changes in rates over time. Results: Comparing persons subject to GDL policies with those not, 16 year olds had fewer fatal crashes per person-year (aIRRpy 0.63, 95% CI 0.47 to 0.91), drove fewer miles (aMR 0.79, 95% CI 0.63 to 0.98) and had lower crash rates per miles driven (aIRRm 0.83, 95% CI 0.65 to 1.06). For age 17, the aIRRpy was 0.83 (95% CI 0.60 to 1.17), the aMR 0.80 (95% CI 0.63 to 1.03) and the aIRRm 1.03 (95% CI 0.80 to 1.35). For age 18, the aIRRpy was 0.93 (95% CI 0.72 to 1.19), the aMR 0.92 (95% CI 0.77 to 1.09) and the aIRRm 1.01 (95% CI 0.84 to 1.23). Conclusions: If these associations are causal, GDL laws reduced crashes per person-year by about one-third among 16 year olds; half the reduction was due to fewer crashes per miles driven and half to less driving. For ages 17 and 18, there was no evidence of reduced crash rates per miles driven.

**Subject Area:** graduated driver licensing; crash rates; adolescents

**Availability:** Zhu, Motao, et al. "The association of graduated driver licensing with miles driven and fatal crash rates per miles driven among adolescents." *Injury prevention* (2014): injuryprev-2013. <http://injuryprevention.bmj.com/content/early/2014/02/13/injuryprev-2013-040999.short>

**Distracted driving: prevalence, problems, and prevention** *Tiffany L. Overton, Terry E. Rives, Carrie Hecht, Shahid Shafi & Rajesh R. Gandhi*

**Abstract:** While the number of motor vehicle crashes has declined over the years, crashes resulting from distracted driving are increasing in the United States resulting in significant morbidity and mortality. The national public seems to be aware of the dangers associated with using technology while driving, but continues to engage in this dangerous behaviour, and may be unaware of or underestimate the impact of cell phone use on their own driving performance. Problems associated with distracted driving are not limited to novice or teenage drivers; multifaceted universal prevention efforts aimed at impacting large segments of the population may have the greatest impact. Legislation limiting drivers' cell phone use has had little impact, possibly due to low regulation and enforcement. Behaviour change programmes, improved vehicle safety, and public awareness campaigns have been developed as potential preventive efforts to reduce accidents caused by distracted drivers.

**Subject Area:** distracted driving, cell phone use, injury prevention, motor vehicle collisions, trauma

**Availability:** Overton, Tiffany L., et al. "Distracted driving: Prevalence, problems, and prevention." *International journal of injury control and safety promotion* ahead-of-print (2014): 1-6. <http://www.tandfonline.com/doi/abs/10.1080/17457300.2013.879482>

## **How's My Driving: Sensing Driving Behaviours by Using Smartphones** *Lei Kang, Zihao Liu & Suman Banerjee*

**Abstract:** We present a driving rating system to evaluate driving quality by using smartphones. It uses embedded sensors in smartphones (i.e. gyroscope and accelerometer) to extract and evaluate the patterns of different driving behaviours. We recruit 15 passengers and 7 drivers and ask the passengers to rate different driving behaviours of different drivers. By comparing with passenger ratings, the effectiveness of our system can be verified. The correlations of our system ratings with passengers' ratings are higher than 0:6 in more than 85% of cases. The results are comparable to (or even higher than) the correlations between each pair of passengers. To work with arbitrary device orientations, we use a movement-aware coordinate projection method to project the coordinates of the phone to those of the vehicle. We also deploy Android devices on 8 volunteers' cars to capture their daily driving behaviours. From the 340 miles driving traces we collected, the dangerous driving behaviours are captured and scores of different drivers are compared in terms of different driving behaviours.

**Subject Area:** driving rating system; driving behavior

**Availability:** Kang, Lei, Zihao Liu, and Suman Banerjee. "How's My Driving: Sensing Driving Behaviours by Using Smartphones."

[http://pages.cs.wisc.edu/~zihao/other\\_resources/drivesense.pdf](http://pages.cs.wisc.edu/~zihao/other_resources/drivesense.pdf)

## **Circumstances of Bicyclist Injuries** *Paul Schimek*

**Abstract:** Understanding the circumstances of bicyclist injuries is an important prerequisite in developing effective interventions. This study uses U.S. national databases of emergency room visits, police reported crashes, and fatalities. Exposure is measured using the National Household Travel Survey and the National Survey of Bicyclist and Pedestrian Attitudes and Behaviors. The study finds that bicycle injury rates drop significantly with increasing bicyclist age. Adults over 35 have fewer than half the crashes per mile of college-age adults, who in turn have half the crash rate of teenagers, suggesting that as they age bicyclists learn behaviors to avoid injuries. One third of bicyclists who collided with a motor vehicle were riding in the sidewalk or crosswalk, whereas bicyclists who ride mostly on the sidewalk account for 15% of bicycle trips. The bicyclist was facing traffic in 42% of bicycle-motor vehicle collisions. Bicyclists operating in the crosswalk and bicyclists operating facing traffic were disproportionately represented among the crash types that are nominally caused by motorist failure to yield, but in these cases are likely due to the unexpected position of the bicyclist. Crashes in low-light conditions account for 20% of injuries and 47% of fatalities. Only 24% of bicyclists who ride after dark reported using taillights. Motorist overtaking crashes accounted for 8% of crashes, and are disproportionately related to low-light conditions and higher-speed roadways. Given that most car-bike collisions involve a violation of the rules of the road, changing bicyclist and motorist behavior has a great potential to reduce them.

**Subject Area:** bicycle injuries;

**Availability:** Schimek, Paul. "CIRCUMSTANCES OF BICYCLIST INJURIES."  
<http://assets.conferencespot.org/fileservers/file/65792/filename/14-4340.pdf>

## 9. TRANSIT PLANNING

**Think public transit, high speed rail in the new year** *MacGregor "Goya" Eddy*

**Abstract:** online news article

**Subject Area:** transit; multimodal public transportation; high speed rail

**Availability:** The Salinas Californian, December 28, 2014 "Think public transit, high speed rail in the new year" MacGregor "Goya" Eddy

<http://www.thecalifornian.com/story/news/local/2014/12/28/think-public-transit-high-speed-rail-new-year/20979727/>



## **A New Transit Safety Narrative** *Todd Litman*

**Abstract:** Public transportation is, overall, a relatively safe (low crash risk) and secure (low crime risk) transport mode. Transit travel has about one-tenth the traffic casualty (injury or death) rate as automobile travel, and residents of transit-oriented communities have about one fifth the per capita crash casualty rate as in automobile-oriented communities. Transit also tends to have lower overall crime rates than automobile travel, and transit improvements can help reduce overall crime risk by improving surveillance and economic opportunities for at-risk populations. Despite its relative safety and security, many people consider transit travel dangerous and are reluctant to use it or support service expansions in their communities. Various factors contribute to this excessive fear, including the nature of transit travel, heavy media coverage of transit-related crashes and crimes, and conventional traffic safety messages that emphasize danger rather than safety. Transit agencies can help create a new transit safety narrative by better communicating transit's overall safety and security impacts and providing better guidance concerning how users and communities can enhance transit safety and security.

**Subject Area:** safety; crash; crime; security; perception

**Availability:** Litman, Todd. "A New Transit Safety Narrative." Center for Urban Transportation Research 17.4 (2014): 2014114. <http://www.nctr.usf.edu/wp-content/uploads/2014/12/JPT17.4.pdf#page=118>

## **Friday Exception Scheduling in Transit Systems: An Exploratory Analysis When Data Are Limited** *Michael D. Benson, Robert B. Noland, Alan. M. Voorhees*

**Abstract:** Most transit agencies operate the same schedule Monday through Friday, except on holidays. Recent work suggests that agencies potentially could save money by operating different schedules on Friday. This research paper aims to identify factors associated with different ridership patterns on Friday, especially when limited data are available. Ridership data for seven bus routes serving Newark, New Jersey, were analyzed, along with characteristics of the routes and areas they serve. These data were limited in that they were provided as a PDF file and were for one month only. Land uses associated with commuting, specifically those with a mix of high residential density and employment density, were found to have different ridership patterns on Friday. A three-part screening process is outlined, looking at the base level of weekday ridership, service frequency, and the residential and employment land uses served. Based on this, two routes serving Newark were identified for which an alternative schedule potentially could be implemented on Friday. This screening process will be useful for transit agencies with limited data resources and that may benefit from Friday exception scheduling, when it is feasible to implement.

**Subject Area:** Friday; transit; scheduling

**Availability:** Benson, Michael D., Robert B. Noland, and Alan M. Voorhees Transportation Center. "Friday Exception Scheduling in Transit Systems: An Exploratory Analysis When Data Are Limited." Center for Urban Transportation Research 17.4 (2014): 35.  
[http://www.nctr.usf.edu/wp-content/uploads/2014/12/JPT17.4\\_Benson.pdf](http://www.nctr.usf.edu/wp-content/uploads/2014/12/JPT17.4_Benson.pdf)

## **Walk, Bicycle and Transit Trips of Transit Dependent and Choice Riders in the NHTS 2009** *Lachapelle U.*

**Abstract:** BACKGROUND: Previous research has shown that public transit use may be associated with active transportation. Access to a car may influence active transportation of transit riders. METHODS: Using the 2009 United States National Household Travel Survey (NHTS), transit users over 16 (n=25,550) were categorized according to driver status and number of cars and drivers in the household. This typology ranged from choice transit riders, "fully motorized drivers", to transit dependent "Unmotorized non-driver". Transit trips, walking and bicycling trips of transit users are estimated in negative binomial models against the car availability typology. RESULTS: 16% of participants took transit in the past month; most (85%) lived in car owning households. As income increased, car availability also increased. Groups with lower car availability were generally more likely than fully motorized drivers to take more public transit, walking and bicycle trips. Transit riders have varying levels of vehicle access; their use of combinations of alternative modes of transportation fluctuates accordingly. Transit dependent individuals without cars or sharing cars used active transportation more frequently than car owners. CONCLUSION: Policies to reduce vehicle ownership in households may enable increases in the use of alternative modes of transportation for transit users, even when cars are still owned.

**Subject Area:** active transportation; alternative modes; transit dependent

**Availability:** Lachapelle, Ugo. "Walk, Bicycle and Transit Trips of Transit Dependent and Choice Riders in the NHTS 2009." *Journal of physical activity & health* (2014).  
<http://www.ncbi.nlm.nih.gov/pubmed/25347916>

## **Transit-Induced Gentrification: Who Will Stay, and Who Will Go?** *Casey Dawkins and Rolf Moeckel*

**Abstract:** Transit-Oriented Development (TOD) has been promoted by planners and policy advocates as a solution to a variety of urban problems, including automobile traffic congestion, air pollution, and urban poverty. By mixing residential and commercial land uses at high densities near transit stations, TODs can theoretically enhance access to jobs and other urban activities for those living within walking distance of a transit stop. Since poverty-stricken families often lack access to an automobile, TOD is seen as a particularly important piece of the puzzle linking unemployed persons to job opportunities. The new Sustainable Communities Partnership between the U.S. Department of Housing and Urban Development (HUD), the U.S. Environmental Protection Agency (EPA), and the U.S. Department of Transportation (DOT) aims to capitalize on these benefits to promote more sustainable and equitable development patterns through TOD-based land use strategies.

Since the enhanced accessibility offered by transit proximity is often capitalized into land and housing prices, many express concern that new transit investments will result in the displacement of the low income populations likely to benefit most from transit access, a phenomenon which we term "transit-induced gentrification." In response to these concerns, policy advocates at the local, state and federal level have proposed a variety of policy interventions designed to ensure that affordable housing for low to moderate income households is produced and preserved in areas proximate to transit stations. For example, in Denver, Colorado, a TOD Fund was established to support the creation and preservation of over 1,000 affordable housing units through the strategic acquisition of properties in current and planned transit corridors. Another example is the Transit-Oriented Development Housing Program approved by California voters through Proposition 1C in November 2006. The TOD Housing Program provides \$2.85 billion for housing and infrastructure programs. To qualify for this funding, developments must be within one half mile of a transit station, and 15 percent of units must be affordable to low- or very-low-income households (Dawkins and Buehler 2010). California is also one of several states that award additional points to Low Income Housing Tax Credit (LIHTC) applications that propose new affordable housing near public transit stations. Local jurisdictions around the country, including several in the Washington, D.C. region, rely on inclusionary zoning strategies to award density bonuses to developers proposing affordable housing projects near transit stations.

**Subject Area:** TOD, new sustainable communities

**Availability:** Dawkins, Casey, and Rolf Moeckel. "Transit-Induced Gentrification: Who Will Stay, and Who Will Go?." Presented at the Transit, Transit Oriented Development, and Urban Form:A Bi-National Symposium Featuring Paris, France, and Washington, DC October 18, 2014. [http://smartgrowth.umd.edu/assets/tod\\_gentrification\\_v3.pdf](http://smartgrowth.umd.edu/assets/tod_gentrification_v3.pdf)

## **Public transportation objectives and rider demographics: are transit's priorities poor public policy?** *Brian D. Taylor & Eric A. Morris*

**Abstract:** Strong public and political support for mass transit in the U.S. is based on lofty goals, including congestion reduction, economic development, aesthetics, sustainability, and much more. Yet, as is the case in many areas of public policy, the pursuit of multiple and broad objectives, however worthy, can diffuse efforts and fail to achieve desired results. Moreover, these goals suggest a lack of focus on the needs of transit riders themselves, particularly the poor and transit dependent. We examine this by combining data from the National Household Travel Survey, the National Transit Database, the American Public Transportation Association, and a survey we conducted of 50 U.S. transit operators. First, we find that while rail transit riders in the aggregate are approximately as wealthy as private vehicle travelers, bus patrons have far lower incomes, and this disparity is growing over time. Second, few transit agencies publicly identify serving the poor or minorities as a goal, instead focusing on objectives that appeal to more affluent riders and voters as a whole. Finally, in recent decades transit spending priorities have been slanted away from bus service and towards commuter-oriented rail services favored by the wealthier general voting public, although most members of this group rarely if ever ride transit. We contend that efforts to secure popular support for transit subsidies stifle agencies' ability to acknowledge transit's critical social service function and serve the needs of its core demographic. While such strategies make sense politically, underserving the poor may be poor public policy.

**Subject Area:** Goal ambiguity, Transit goals, Transit subsidies, Transit patronage, Transit rider, demographics

**Availability:** Taylor, Brian D., and Eric A. Morris. "Public transportation objectives and rider demographics: are transit's priorities poor public policy?." *Transportation* (2014): 1-21. <http://link.springer.com/article/10.1007/s11116-014-9547-0>

**Analyzing the Potential for High-speed Rail as Part of the Multimodal Transportation System in the United States' Midwest Corridor** *Jeffrey C. Peters, En-Pei Han, Srinivas Peeta, Daniel DeLaurentis*

**Abstract:** With increasing demand and rising fuel costs, both travel time and cost of current intercity passenger transportation modes are becoming increasingly relevant. Around the world, high-speed rail (HSR) is seen as a way to alleviate demand on highways and at airports. Ridership is the critical element in determining the viability of a large capital, long-term transportation investment. This paper provides a systematic, consistent methodology for analyzing systemwide modal ridership with and without a proposed HSR network and analyzes the potential for high-speed rail as part of the existing multimodal transportation system in a region in terms of ridership. Considerations of capital investment (e.g., network design and HSR speed), along with exogenous demographic, technological, economic, and policy trends in the long-term, are used to project ridership over time. This study represents an important step toward a consistent, comprehensive economic analysis of HSR in the United States.

**Subject Area:** intercity passenger rail; high-speed rail

**Availability:** Peters, Jeffrey C., et al. "Analyzing the Potential for High-speed Rail as Part of the Multimodal Transportation System in the United States' Midwest Corridor." *International Journal of Transportation Science and Technology* 3.2 (2014): 129-148. <http://multi-science.metapress.com/index/LW2V26W2237HL60N.pdf>

## **Transit-Related Walking to Work in Promoting Physical Activity** *Yu CY & Lin HC*

**Abstract:** BACKGROUND: Transit-related walking to work is a potential strategy for incorporating physical activity into daily life and promoting health benefits. This study estimated the transit-related walking time for work trips on the journey to and from work and examined the predictors of transit users who walked to/from transit and the workplace, and those who walked 30 minutes or more per day. METHODS: This study used the 2009 National Household Travel Survey (NHTS) and identified 772 subjects who took transit to/from work, 355 subjects who walked to/from transit and the workplace, and 145 subjects who walked 30 minutes or more per day among the 40,659 workers. Weighted logistic regressions were used for the analysis. RESULTS: 40.9% of people who walked to/from transit and the workplace walked 30 minutes or more per day. The weighted logistic regressions revealed that low income groups and workers living in high population density areas were more likely to walk to/from transit and the workplace. Workers living in high population density areas were more likely to walk 30 minutes or more per day. CONCLUSIONS: Transit-related walking to work provides an opportunity to increase physical activity levels and to meet the physical activity recommendations.

**Subject Area:** Transit-related walking; physical activity

**Availability:** Yu, C. Y., and H. C. Lin. "Transit-Related Walking to Work in Promoting Physical Activity." *Journal of physical activity & health* (2014).  
<http://www.ncbi.nlm.nih.gov/pubmed/24905190>

## **Does service reliability influence transit patronage? Evidence from Los Angeles, and implications for transit policy** *Sandip Chakrabarti*

**Abstract:** This paper explores whether service reliability determines transit patronage. Using a unique historical archive of service supply, performance, and patronage data from the Los Angeles Metro bus and rail system, we analyze whether service reliability explains in part the variation in patronage across transit lines during weekday peak and off-peak periods. By estimating a simple single-stage model of transit line patronage, and a simultaneous equations model to address the recognized endogeneity between transit service supply and consumption, we provide conclusive evidence that service reliability is indeed a significant determinant of peak-period patronage.

This means that, all else equal, more reliable transit lines can attract more patrons across their service corridors as they are chosen over alternate lines and competing modes. Our paper presents first empirical evidence on the demand for transit service reliability. Results suggest that transit agencies can expect some system-wide patronage gains from reliability improvements. From a policy perspective, reliability investments may be cost-effective means for increasing productivity of transit lines and systems.

**Subject Area:** Public transportation; Transit service reliability; Public transit policy

**Availability:** Chakrabarti, Sandip. "Does service reliability influence transit patronage? Evidence from Los Angeles, and." *Transportation Research Part B* 40: 709-730.

[http://lusk.usc.edu/sites/default/files/working\\_papers/LUSK%20paper\\_Sandip%20Chakrabarti\\_Apr%209%202014.pdf](http://lusk.usc.edu/sites/default/files/working_papers/LUSK%20paper_Sandip%20Chakrabarti_Apr%209%202014.pdf)



## **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*

**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.

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.

**Subject Area:** transit; walkability; transportation policy; VMT

**Availability:** Boarnet, Marlon G., Doug Houston, and Steven Spears. "The Exposition Light Rail Line Study: “Before-After” Opening Travel Impacts and New Resident Sample Preliminary Analysis." (2013). <http://community-wealth.org/sites/clone.community-wealth.org/files/downloads/paper-boarnet.pdf>

# 10. TRAVEL BEHAVIOR

**Measuring transit service impacts on vehicle ownership and use** *Yangwen Liu, Cinzia Cirillo*

**Abstract:** In this paper we measure the impact of public transportation on household vehicle ownership and use. Advanced econometric models are estimated on household travel survey data and on geographic data. In particular, data from the 2009 US National Household Travel Survey is merged with geographic information obtained from the General Transit Feed Specification source. The integration of variables specific to the spatial and temporal coverage of the transit service allows the analysis of different policy scenarios. Results obtained for the Washington DC Metropolitan Area indicate that enhanced transit services reduce the number of private vehicles and vehicle miles traveled. Effects are more marked when bus services are improved and on car use. The study is important for all Metropolitan Regions that are dealing with the problem of congestion, high levels of greenhouse gas emissions and that are planning to invest in more efficient and accessible public transportation services.

**Subject Area:** Transit service index; metropolitan area; GTFS; NHTS; Vehicle ownership; Discrete–continuous model

**Availability:** Liu, Yangwen, and Cinzia Cirillo. "Measuring transit service impacts on vehicle ownership and use." *Public Transport*: 1-20. <http://link.springer.com/article/10.1007/s12469-014-0098-8>

## **Modeling intra-household interactions in the generation of social-recreational tours** *Kwang-Kyun Lim*

**Abstract:** Household members often interact with each other during their daily activity- and travel-related decision-making process. In the context of social and recreational activities, these interactions lead to decisions about pursuing such episodes either independently or jointly with others. The substantial focus of the study is on the operationalizing household interactions in various modeling mechanisms by the ways of seeking to maximize the utility of each household member in an interdependent fashion. Florida add-on samples from the 2009 National Household Travel Survey are utilized. The results indicate that household income, age of male, engagement of mandatory activities, engagement of maintenance activities, day of the week, and whether raining have strong impacts on the choice of social-recreational activity participations. Overall, no one model turned out to be a clear “winner” in terms of statistical goodness of fit and predictive abilities, rather on the behavioral insights, the multi-linear logit and parallel constrained logit models do highlight differences in the “power” across household heads, and the trivariate binary probit models capture strong correlations in the choices across the male and female and between solo and joint choices.

**Subject Area:** household interaction; social-recreational activity; joint activities; group-decision making; multi-linear logit; parallel constrained logit; trivariate binary probit

**Availability:** Lim, Kwang-Kyun. "Modeling intra-household interactions in the generation of social-recreational tours." *KSCE Journal of Civil Engineering* (2014): 1-12.  
<http://link.springer.com/article/10.1007/s12205-014-0156-4>

## **The stops made by commuters: evidence from the 2009 US National Household Travel Survey** *Rui Wang*

**Abstract:** Trip chaining, especially during peak-hour commute trips, is an important aspect of travel behavior that impacts the private and social costs and benefits of urban passenger travel. Combining large-sample data from the 2009 National Household Travel Survey (NHTS) and the 2010 US Census, this study analyzes the relationship between the complexity of commute tours and the characteristics of not just commuters and their households, but also their neighborhoods and regions. Different from most existing studies, this analysis controls more detailed individual, household, employment, and location characteristics and important interactions. In particular, by linking the restricted-use location data of households and work places from the NHTS survey to the US Census data, this study quantifies the effects of job-end population and employment densities. Results confirm the important impact of socio-demographics (gender, household responsibilities, and flexible work schedule), which underwent significant changes in the recent past, but fail to identify strong effects of socio-economic status, the regional and local built environment, or gasoline price.

**Subject Area:** Commute; Tour; Stop; Trip chaining; US

**Availability:** Wang, Rui. "The stops made by commuters: evidence from the 2009 US National Household Travel Survey." *Journal of Transport Geography* (2014).

<http://www.sciencedirect.com/science/article/pii/S0966692314002415>

## **Daily spatial mobility and transport behaviour in the Czech Republic: pilot study in the Písek and Bystrice and Pernštejnem regions** *Stanislav Kraft*

**Abstract:** This study focuses on one of the most important processes in our society: daily mobility. Its importance has grown over the last decades. From the geographical point of view, the growing level of mobility has a whole array of geographical causes and impacts. In the first phase, the study analyses the main features of daily mobility in the Czech Republic based on official statistics. In the second phase, it evaluates detailed daily mobility research in selected regions of the Czech Republic through case studies. The monitored regions were Písek and Bystrice nad Pernštejnem within their administrative regions. It brings new and original information about daily mobility, transport behaviour, modal split, average travel time, etc. and their differences evaluated by particular population groups (age, economic activity, gender, etc.) and by three main mobility measures. The study tries to fill a gap in the research of daily mobility and transport behaviour in the Czech Republic.

**Subject Area:** Spatial mobility, Daily mobility, Transport behaviour, Písek, Bystrice nad Pernštejnem, Czech Republic.

**Availability:** Kraft, Stanislav. "Daily spatial mobility and transport behaviour in the Czech Republic: pilot study in the Písek and Bystrice and Pernštejnem regions." (2014).

[http://cenars.upol.cz/wp-content/uploads/2014/12/a\\_82\\_4\\_kraft.pdf](http://cenars.upol.cz/wp-content/uploads/2014/12/a_82_4_kraft.pdf)

## **The multimodal majority? Driving, walking, cycling, and public transportation use among American adults** *Ralph Buehler, & Andrea Hamre*

**Abstract:** Multimodality, the use of more than one mode of transportation during a specified time period, is gaining recognition as an important mechanism for reducing automobile dependence by shifting trips from automobiles to walking, cycling, or public transportation. Most prior research on multimodality focuses on Western European countries. Based on the 2001 and 2009 National Household Travel Surveys, this paper analyzes trends and determinants of multimodal car use in the U.S. during a typical week by distinguishing between (1) monomodal car users who drive or ride in a car for all trips, (2) multimodal car users who drive or ride in a car and also use non-automobile modes, and (3) individuals who exclusively walk, cycle, and/or ride public transportation. We find that during a typical week a majority—almost two thirds—of Americans use a car and make at least one trip by foot, bicycle, or public transportation. One in four Americans uses a car and makes at least seven weekly trips by other modes of transportation. Results from multinomial and logistic regression analyses suggest there may be a continuum of mobility types ranging from monomodal car users to walk, bicycle, and/or public transportation only users—with multimodal car users positioned in-between the two extremes. Policy changes aimed at curtailing car use may result in movements along this spectrum with increasing multimodality for car users.

**Subject Area:** Multimodality, USA Trends 2001–2009, multimodal and monomodal car users, Walk, bicycle, and public transportation only users, Individual travel behavior

**Availability:** Buehler, Ralph, and Andrea Hamre. "The multimodal majority? Driving, walking, cycling, and public transportation use among American adults." *Transportation* (2014): 1-21. <http://link.springer.com/article/10.1007/s11116-014-9556-z>

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**Subject Area:** Multimodality, USA Trends 2001–2009, multimodal and monomodal car users, Walk, bicycle, and public transportation only users, Individual travel behavior

**Availability:** Buehler, Ralph, and Andrea Hamre. "The multimodal majority? Driving, walking, cycling, and public transportation use among American adults." *Transportation* (2014): 1-21. <http://link.springer.com/article/10.1007/s11116-014-9556-z>

**Incorporating travel behaviour and travel time into TIMES energy system models** *Hannah E. Daly, Kalai Ramea, Alessandro Chiodi, Sonia Yeh, Maurizio Gargiulo, & Brian Ó Gallachóir*

**Abstract:** Achieving ambitious climate change mitigation targets clearly requires a focus on transport that should include changes in travel behaviour in addition to increased vehicle efficiency and low-carbon fuels. Most available energy/economy/environment/engineering (E4) modelling tools focus however on technology and fuel switching and tend to poorly incorporate mitigation options from travel behaviour, and in particular, switching between modes is not an option. This paper describes a novel methodology for incorporating competition between private cars, buses and trains in a least-cost linear optimisation E4 model, called TIMES. This is achieved by imposing a constraint on overall travel time in the system, which represents the empirically observed fixed travel time budget (TTB) of individuals, and introducing a cost for infrastructural investments (travel time investment, TTI), which reduces the travel time of public transport. Two case studies from California and Ireland are developed using a simple TIMES model, and results are generated to 2030 for a reference scenario, an investments scenario and a CO<sub>2</sub> emissions reduction scenario. The results show that with no travel time constraint, the model chooses public transport exclusively. With a travel time constraint, mode choice is determined by income and investment cost assumptions, and the level of CO<sub>2</sub> constraint, with greater levels of public transport in the mitigation scenario. At low travel investment cost, new rail is introduced for short distances and increased bus capacity for longer distances. At higher investment costs rail is increasingly chosen for long distances also.

**Subject Area:** Modal choice; Travel behaviour; Energy systems modelling; Climate mitigation

**Availability:** Daly, Hannah E., et al. "Incorporating travel behaviour and travel time into TIMES energy system models." *Applied Energy* 135 (2014): 429-439.  
<http://www.sciencedirect.com/science/article/pii/S0306261914008629>



## **Can the built environment influence nonwork activity participation? An analysis with national data** *Louis A. Merlin*

**Abstract:** Most of the research on the influence of the built environment on travel has focused on reducing the impacts of travel, but one of the primary benefits of travel is the opportunity to engage in activities. This study examines a national travel data set to see if variation in the built environment can facilitate participation in out-of-the-home, nonwork activities for households. Although several studies have examined the relationship between the built environment and nonwork trip generation in the past, none have looked at such a wide range of built environments as a national data set can provide. Built environment variables are associated with higher than expected impacts on household participation in nonwork activities, increasing or decreasing activity levels in the range of 8–47 %, depending largely upon the level of household vehicle ownership. For households without vehicles, high residential and employment densities appear to support greater nonwork activity. Households with full access to vehicles appear to be supported by higher than average residential and employment densities and mid-range urban and metropolitan area sizes. Interestingly, activity participation in households with limited vehicle access is for the most part not affected by the built environment in a statistically significant way. In sum, these results suggest that the built environment may play a larger role in facilitating activity participation than previously presumed.

**Subject Area:** Activity participation; Trip generation; Built environment; Nonwork travel

**Availability:** Merlin, Louis A. "Can the built environment influence nonwork activity participation? An analysis with national data." *Transportation*: 1-19.  
<http://link.springer.com/article/10.1007/s11116-014-9554-1>

**An Alternative Approach to Network Demand Estimation: Implementation and Application in Multi-Agent Transport Simulation (MATSim)** *Enock T. Mtoi, Ren Moses, & Eren Erman Ozguven*

**Abstract:** This paper introduces a novel network demand estimation framework consistent with the input data structure requirements of Multi-Agent Transport Simulation (MATSim). The sources of data are the American Community Survey, US Census Bureau, National Household Travel Surveys, travel surveys from South East Florida Regional Planning Authority, OpenStreetMap and Florida Statewide Transportation Engineering Warehouse for Archived Regional Database. The developed framework employs mathematical and statistical methods to derive probability density functions and multinomial logit models for activity and location choices. The implementation of demand estimation process resulted into the creation of 1,200,889 agents (only those using cars). The scenario for the estimated agents was configured and simulated in MATSim. The results from the simulated scenario resulted in the expected morning, afternoon and evening traffic patterns as well as the desirable level of agreement between simulated and observed traffic volumes.

**Subject Area:** Demand estimation; Multi-agent simulation; MATSim; Smart mobility

**Availability:** Mtoi, Enock T., Ren Moses, and Eren Erman Ozguven. "An Alternative Approach to Network Demand Estimation: Implementation and Application in Multi-Agent Transport Simulation (MATSim)." *Procedia Computer Science* 37 (2014): 382-389.  
<http://www.sciencedirect.com/science/article/pii/S1877050914010229>

**Long-Distance Work and Leisure Travel Frequencies: Ordered Probit Analysis Across Non-Distance-Based Definitions** *Jeffrey J. LaMondia, Lisa Aultman-Hall & Elizabeth Greene*

**Abstract:** The objective of this research was to isolate the factors influencing non-distance-based definitions of long-distance travel to help long-distance survey makers know which demographic factors they should query about in their surveys. Instead of the use of a distance-based threshold to define long-distance travel, this study included variations in purpose (e.g., work travel or leisure or personal travel), durations (e.g., overnight trips), modes (e.g., intercity rail or bus), and destinations (e.g., international travel) to consider which demographic, employment, commute, household, and geographic factors affected the frequency of long-distance travel. The data were from self-reported retrospective surveys collected from approximately 1,200 participants. Results from ordered probit analysis revealed that education and income generally increased most types of long-distance travel, whereas having a spouse or children decreased some types of long-distance travel. In general, limited factors had the same impact on the work and non-work travel and modes used. Factors also varied by trip type. Commute and employment factors were valuable even for non-work trip frequency estimation. The findings suggest that future data collection for long-distance travel can be tailored to address the specific definition being studied.

**Subject Area:** long distance travel, surveys

**Availability:** LaMondia, Jeffrey J., Lisa Aultman-Hall, and Elizabeth Greene. "Long-Distance Work and Leisure Travel Frequencies." *Transportation Research Record: Journal of the Transportation Research Board* 2413.1 (2014): 1-12. <http://trb.metapress.com/index/RQ8Q61N8U6U43152.pdf>

## **The Built Environment and Car Use in Mexico City Is the Relationship Changing over Time?** *Erick Guerra*

**Abstract:** This article explores differences in the relationship between the built environment and households' car use in Mexico City in 1994 and 2007. After controlling for income and other household attributes, population and job density, transit and highway proximity, destination diversity, intersection density, and accessibility are statistically correlated with households' weekday car travel in Mexico City. These correlations are generally stronger than those found in studies from U.S. cities and fairly stable over time. Where correlations have changed, they have strengthened. Findings suggest that land use planning can play a modest and growing role in reducing car travel in Mexico City.

**Subject Area:** transportation; land use; vehicle kilometers traveled; Mexico City; car travel; urban form

**Availability:** Guerra, Erick. "The Built Environment and Car Use in Mexico City Is the Relationship Changing over Time?" *Journal of Planning Education and Research* (2014): 0739456X14545170.

<http://jpe.sagepub.com/content/early/2014/07/11/0739456X14545170.abstract>

## **Walking down the habitual lane: analyzing path dependence effects of mode choice for social trips** *Fariya Sharmeena, & Harry Timmermans*

**Abstract:** In the field of transportation, several studies have researched commute mode choice and its dynamics in the short and in the long term. Relatively less is known about mode choice for discretionary and more flexible activities, such as social visits. These choices are dynamic and depend on personal habits and preferences, reflected to some extent in the history of similar choices. This study adopts the theory of path dependence to take life cycle dynamics and habitual preferences into account. Using a dataset collected in the Netherlands in 2011, a multinomial logit model of mode choice was developed. Results suggest that mode choices for social activities are path dependent, yet not entirely. There is also evidence of switching towards faster and more flexible modes after a life cycle event.

**Subject Area:** Mode choice; Social travel; Long term dynamics; Path dependence; Habit and attitude; Past behavior

**Availability:** Sharmeen, Fariya, and Harry Timmermans. "Walking down the habitual lane: analyzing path dependence effects of mode choice for social trips." *Journal of Transport Geography* 39 (2014): 222-227.

<http://www.sciencedirect.com/science/article/pii/S0966692314001604>

**A Tour-Based National Model System To Forecast Long-Distance Passenger Travel In The United States** *Maren L. Outwater, Mark Bradley, Nazneen Ferdous, Chandra Bhat, Ram Pendyala, Stephane Hess, Andrew Daly & Jeff LaMondia*

**Abstract:** Relatively little attention has been paid to the relationship between commute time variances and city size. In this paper, we utilize 2009 Nationwide Highway Travel Survey data and test the relationship between area commute-time means as well as variances in metropolitan-area size. We include tests for metropolitan areas as a whole and for residents from urban, suburban, second city, and town-and-county areas. The regression analysis shows that all estimated slopes are statistically significant but not much greater than zero. Commute time means and variances are highly correlated. These relationships are also invariant with respect to the place of residence. An extensive collection of literature provides evidence for the co-location of workers and jobs hypothesis: average commute times do not rise appreciably as metropolitan population increases. We conclude that these results are additional, although indirect, evidence for the co-location hypothesis.

**Subject Area:** Long-Distance Travel, Synthetic Population, Scheduling, Time Use and Activity Participation, Joint Mode and Destination Choice, Business and Leisure Travel, Tour Frequency

**Availability:** University of Texas

[http://www.cae.utexas.edu/prof/bhat/ABSTRACTS/FHWA\\_Long\\_Distance\\_Passenger\\_Model.pdf](http://www.cae.utexas.edu/prof/bhat/ABSTRACTS/FHWA_Long_Distance_Passenger_Model.pdf)

## **A note on commuting times and city size: Testing variances as well as means**

*Qian An, Peter Gordon, James E. Moore II*

**Abstract:** Relatively little attention has been paid to the relationship between commute time variances and city size. In this paper, we utilize 2009 Nationwide Highway Travel Survey data and test the relationship between area commute-time means as well as variances in metropolitan-area size. We include tests for metropolitan areas as a whole and for residents from urban, suburban, second city, and town-and-county areas. The regression analysis shows that all estimated slopes are statistically significant but not much greater than zero. Commute time means and variances are highly correlated. These relationships are also invariant with respect to the place of residence. An extensive collection of literature provides evidence for the co-location of workers and jobs hypothesis: average commute times do not rise appreciably as metropolitan population increases. We conclude that these results are additional, although indirect, evidence for the co-location hypothesis.

**Subject Area:** commute time; city size

**Availability:** An, Qian, Peter Gordon, and James E. Moore. "A note on commuting times and city size: Testing variances as well as means." *Journal of Transport and Land Use* 7.2 (2014).

<https://research.cts.umn.edu/index.php/jtlu/article/view/427>

## **Impact of Traffic Images on Route Choice and the Value of Time Estimates in Stated Preference Surveys** *Carl E. Harline, & Mark W. Burris*

**Abstract:** A difficult aspect of the use of stated preference (SP) experiments to predict travel behavior is the proper presentation of attributes and characteristics of hypothetical trips to respondents. With an increase in the number of transportation choices, the task of concisely and accurately communicating trip attributes in the SP setting becomes increasingly more important. Recent attempts to introduce innovative strategies into the SP setting have yielded techniques to summarize trip attributes more efficiently for respondents. One technique is to use images of traffic conditions as a supplemental means to summarize average trip speed, travel time reliability, and degree of congestion. However, little research has been performed to test the effects of the use of traffic images on models of route choice built from this kind of SP data. In this research, an SP setting was developed to measure the influence of images of traffic conditions on SP responses. Pictures of traffic conditions that correlated to average trip speed were either shown to or withheld from a survey population from Austin, Texas, depending on random assignment. A panel-effects, mixed, multinomial logit model was built to estimate the respondent's route choice behavior. Overall, the model parameters discovered no evidence to support the assertion that traffic image presentation had a statistically significant effect on route choice with respect to the value of travel time savings or the value of travel time reliability.

**Subject Area:** travel survey methods; stated preference; route choice; travel time reliability

**Availability:** Harline, Carl E., and Mark W. Burris. "Impact of Traffic Images on Route Choice and the Value of Time Estimates in Stated Preference Surveys." *Transportation Research Record: Journal of the Transportation Research Board* 2405.1 (2014): 24-32.  
<http://trb.metapress.com/index/C0R538W051450754.pdf>



## **Assessing the Impact of Metropolitan-Level, County-Level, and Local-Level Built Environment on Travel Behavior: Evidence from 19 U.S. Urban Areas**

*Arefeh Nasri and Lei Zhang*

**Abstract:** Research on land use and travel behavior has been mostly focused on the effects of local land use as opposed to the overall form of metropolitan area, regional employment accessibility and growth pattern, and job-housing balance in the whole metro area. The present work attempts to shed some light on the overlooked impacts of metropolitan-level built environment on travel behavior. It presents results from structural equations modeling (SEM) analysis on the basis of data from 19 metropolitan areas across the United States to construct a systematic cause-effect relationship among macrolevel land use, regional mobility, and travel behavior. The results provide evidence on the direction and magnitude of these impacts and confirm the hypothesis that changing land use policies at the neighborhood/local level alone is not followed by a significant change in people's travel behavior towards less driving. Effective land use policies are those which consider the overall form of urban areas and the composition of jobs and services in the entire region.

**Subject Area:** Built environment, Metropolitan-level land use, Travel behavior, Vehicle miles traveled (VMT), Structural equations modeling, Causal effect, Self-selection

**Availability:** Nasri, Arefeh, and Lei Zhang. "Assessing the Impact of Metropolitan-Level, County-Level, and Local-Level Built Environment on Travel Behavior: Evidence from 19 US Urban Areas." *Journal of Urban Planning and Development* (2014).

[http://ascelibrary.org/doi/abs/10.1061/\(ASCE\)UP.1943-5444.0000226](http://ascelibrary.org/doi/abs/10.1061/(ASCE)UP.1943-5444.0000226)

## **Household/Zonal Socioeconomic Characteristics And Tour Making: Case Of Richmond/Tri-Cities Model Region In Virginia** *Xueming Chen*

**Abstract:** This paper statistically assesses the impacts of household/zonal socio economic characteristics on tour making within the Richmond/Tri-Cities Model Region, Virginia, United States, based on the dataset made available through the 2009 Virginia National Household Travel Survey (NHTS) Add-On Program. The tour analysis distinguishes nine tour types (three simple tours and six complex tours) stratified by aggregate tour purposes of work (including school and other subsistence activities), maintenance and discretionary. A series of regression model runs have yielded the following conclusions: First, at aggregate level, the number of drivers, median household income, household size, number of workers, and zonal walking modal share are statistically significant and positively impact tour frequency. Tour length and complexity are positively related to household income and number of vehicles, but negatively related to zonal walking modal share. Second, at an individual tour type level, each tour type's frequency/length/complexity is impacted by a different set of household/zonal socioeconomic characteristics. Zonal socioeconomic characteristics have little or no impacts on household tour making. It is recognized that many unknown factors may also have impacted tour activities, which require further in-depth studies in order to better explain complex tours.

**Subject Area:** tour, Richmond/Tri-Cities model region, household and zonal socio-economic characteristics, regression model

**Availability:** Xueming, C. H. E. N. "Household/Zonal Socioeconomic Characteristics And Tour Making: Case Of Richmond/Tri-Cities Model Region In Virginia." *Journal of Urban And Regional Analysis* 6.1 (2014): 53-70. [http://www.jurareview.ro/2014\\_6\\_1/p\\_53\\_70.pdf](http://www.jurareview.ro/2014_6_1/p_53_70.pdf)

## **Peak Travel in a Megacity: Exploring the Role of Infrastructure Saturation on the Suppression of Automobile Use** *Andrew Fraser*

**Abstract:** Contrary to many previous travel demand forecasts there is increasing evidence that vehicle travel in developed countries may be peaking. The underlying causes of this peaking are still under much debate and there has been a mobilization of research, largely focused at the national scale, to study the explanatory drivers but research focused at the metropolitan scale, where transportation policy and planning are frequently decided, is relatively thin. Additionally, a majority of this research has focused on changes within the activity system without considering the impact transportation infrastructure has on overall travel demand. Using Los Angeles County California, we investigate Peak Car and whether the saturation of automobile infrastructure, in addition to societal and economic factors, may be a suppressing factor. After peaking in 2002, vehicle travel in Los Angeles County in 2010 was estimated at 78 billion and was 20.3 billion shy of projections made in 2002. The extent to which infrastructure saturation may contribute to Peak Car is evaluated by analyzing social and economic factors that may have impacted personal automobile usage over the last decade. This includes changing fuel prices, fuel economy, population growth, increased utilization of alternate transportation modes, changes in driver demographics, travel time and income levels. Summation of all assessed factors reveals there is at least some portion of the 20 billion VMT that is unexplained in all but the worst case scenario. We hypothesize that the unexplained remaining VMT may be explained by infrastructure supply constraints that result in suppression of travel. This finding has impacts on how we see the role of hard infrastructure systems in urban growth and we explore these impacts in the research.

**Subject Area:** vehicle travel; Peak car;

**Availability:** Fraser, Andrew. Peak Travel in a Megacity: Exploring the Role of Infrastructure Saturation on the Suppression of Automobile Use. Diss. ARIZONA STATE UNIVERSITY, 2014. [http://www.transportationlca.org/losangelesroadways/AndrewFraser\\_ASU\\_2014\\_MastersThesis.pdf](http://www.transportationlca.org/losangelesroadways/AndrewFraser_ASU_2014_MastersThesis.pdf)

## **Out of Prague: a week-long intermodal shift from air to rail transport after Iceland's Eyjafjallajökull erupted in 2010** *Martin Kvizdaa, & Daniel Seidenglanz*

**Abstract:** In April 2010, the eruption of Eyjafjallajökull considerably disrupted air travel across Europe. The grounding of air transport forced passengers to cancel journeys or find alternative means of transport. We analyse short-term intermodal shifts as a reaction to sudden changes in air transport availability. The question addressed is whether, and in what capacity, air passengers used railways when Prague International Airport was closed. To compare the degree of intermodal shift in Prague for particular European destinations during the closure, we calculated an InterModal Shift Index. We concluded that approximately 20% of passengers travelling to neighbouring countries and 6% of passengers travelling to more distant European destinations chose rail as an alternative. Following the airport closure, travellers were willing to choose rail transport as an alternative, but this willingness varies for different countries and areas.

**Subject Area:** Intermodal shift; Air transport; Rail transport; Airspace closure; Passenger behaviour; Transport policy

**Availability:** Kvizda, Martin, and Daniel Seidenglanz. "Out of Prague: a week-long intermodal shift from air to rail transport after Iceland's Eyjafjallajökull erupted in 2010." *Journal of Transport Geography* 37 (2014): 102-111.

<http://www.sciencedirect.com/science/article/pii/S0966692314000751>

## **Meteorological variation in daily travel behaviour: evidence from revealed preference data from the Netherlands** *Lieve Creemers, Geert Wets, & Mario Cools*

**Abstract:** This study investigates the meteorological variation in revealed preference travel data. The main objective of this study is to investigate the impact of weather conditions on daily activity participation (trip motives) and daily modal choices in the Netherlands. To this end, data from the Dutch National Travel Household Survey of 2008 were matched to hourly weather data provided by the Royal Dutch Meteorological Institute and were complemented with thermal indices to indicate the level of thermal comfort and additional variables to indicate the seasonality of the weather conditions. Two multinomial logit-generalised estimation equations (MNL-GEE) models were constructed, one to assess the impact of weather conditions on trip motives and one to assess the effect of weather conditions on modal choice. The modelling results indicate that, depending on the travel attribute of concern, other factors might play a role. Nonetheless, the thermal component, as well as the aesthetical component and the physical component of weather play a significant role. Moreover, the parameter estimates indicate significant differences in the impact of weather conditions when different time scales are considered (e.g. daily versus hourly based). The fact that snow does not play any role at all was unexpected. This finding can be explained by the relatively low occurrence of this weather type in the study area. It is important to consider the effects of weather in travel demand modelling frameworks because this will help to achieve higher accuracy and more realistic traffic forecasts. These will in turn allow policy makers to make better long-term and short-term decisions to achieve various political goals, such as progress towards a sustainable transportation system. Further research in this respect should emphasise the role of weather conditions and activity-scheduling attributes.

**Subject Area:** Atmospheric Sciences; Climatology; Atmospheric Protection/Air Quality; Control/Air Pollution; Waste Water Technology / Water Pollution Control / Water Management / Aquatic Pollution

**Availability:** Creemers, Lieve, Geert Wets, and Mario Cools. "Meteorological variation in daily travel behaviour: evidence from revealed preference data from the Netherlands." *Theoretical and Applied Climatology* (2014): 1-12. <http://link.springer.com/article/10.1007/s00704-014-1169-0>

## **Human mobility in opportunistic networks: Characteristics, models and prediction methods** *Poria Pirozmand, Guowei Wu, Behrouz Jedari, & Feng Xia*

**Abstract:** Opportunistic networks (OppNets) are modern types of intermittently connected networks in which mobile users communicate with each other via their short-range devices to share data among interested observers. In this setting, humans are the main carriers of mobile devices. As such, this mobility can be exploited by retrieving inherent user habits, interests, and social features for the simulation and evaluation of various scenarios. Several research challenges concerning human mobility in OppNets have been explored in the literature recently. In this paper, we present a thorough survey of human mobility issues in three main groups (1) mobility characteristics, (2) mobility models and traces, and (3) mobility prediction techniques. Firstly, spatial, temporal, and connectivity properties of human motion are explored. Secondly, real mobility traces which have been captured using Bluetooth/Wi-Fi technologies or location-based social networks are summarized. Furthermore, simulation-based mobility models are categorized and state-of-the-art articles in each category are highlighted. Thirdly, new human mobility prediction techniques which aim to forecast the three aspects of human mobility, i.e.; users' next walks, stay duration and contact opportunities are studied comparatively. To conclude, some major open issues are outlined.

**Subject Area:** Opportunistic networks; Human mobility characteristics; Real traces; Simulation-based models; Mobility prediction

**Availability:** Pirozmand, Poria, et al. "Human Mobility in Opportunistic Networks: Characteristics, Models and Prediction Methods." *Journal of Network and Computer Applications* (2014). <http://www.sciencedirect.com/science/article/pii/S1084804514000587>

## **Modeling the Choice of Time-of-Day for Joint Social-Recreational Tours** *Lim, Kwang-Kyun, & Srinivasan, Sivaramakrishnan*

**Abstract:** Joint travel, which is often undertaken to pursue social/recreational activities, requires temporal synchronization of travel of all members of the travel party. Consequently, these trips are often scheduled within specific time windows of the day after other constrained travel (such as mandatory and maintenance related) has been scheduled for all the members in the travel party. This study presents a two-step approach to the simultaneous modeling of departure- and arrival- times for such joint tours. The first model predicts a time-window for pursuing the joint discretionary tour from among all possible windows. The second model locates the tour within this chosen time window. The data used in this analysis comprised 2,609 joint tours undertaken by couple-adult households obtained from 2009 US National Household Travel Survey (NHTS). A wide set of explanatory variables (i.e., time window attributes, socio-economic characteristics, and tour attributes) were considered. Predictive assessments indicate the ability of the model system to capture the departure and arrival times effectively. Implicitly, the total tour durations were also determined effectively. Overall, the two-step model system demonstrated in this study is a simple and parsimonious approach to predicting the time of day choices for joint tours. In particular, the use of the fractional split model for locating the tour within the chosen window allows for modeling time of day choices at the continuous scale.

**Subject Area:** Choice models; Data collection; Time windows; Travel patterns; Travel surveys; Trip chaining

**Availability:** Lim, Kwang-Kyun, and Sivaramakrishnan Srinivasan. "Modeling the Choice of Time-of-Day for Joint Social-Recreational Tours." Transportation Research Board 93rd Annual Meeting. No. 14-5372. 2014. <http://trid.trb.org/view.aspx?id=1289914>

## **A Tour-Based Analysis on the Interrelationships of Built Environment, Travel Behavior, and Car Ownership** *Ding, Chuan; Liu, Chao; Lin, Yaoyu; Ma, Ting*

**Abstract:** In recent years, there is a growing body of literature on exploring how the built environment affects travel behavior indirectly by affecting intermediating factors (such as car ownership, travel distance, and tour complexity). The aim of this paper is to provide insight into the impact of the built environment on tour-based travel behavior, considering car ownership, travel distance, and tour complexity as intermediating factors simultaneously. By using the 2009 National Household Travel Survey (NHTS) data, this paper empirically examined the effects of the built environment on tour-based personal travel behavior in the Maryland-Washington, D.C. Region area. This study also investigated whether and how the influences of the built environment on travel vary between home-based work tour and home-based non-work tour. A multiple-group structural equation model (SEM) was employed in this study and the model results confirmed that the effects of car ownership, travel distance, and tour complexity on travel behavior are statistically significant and should be considered as mediating factors when analyzing the relationship between the built environment and travel behavior. It was also found that the impacts of the built environment on tour-based travel behavior significantly differ between home-based work tour and non-work tour. These findings can help planners and policy makers develop a more thorough understanding on how the built environment influences travel behavior.

**Subject Area:** Automobile ownership; Structural equation modeling; Travel behavior; Trip length; Work trips

**Availability:** Ding, Chuan, et al. "A Tour-Based Analysis on the Interrelationships of Built Environment, Travel Behavior, and Car Ownership." Transportation Research Board 93rd Annual Meeting. No. 14-5326. 2014. <http://trid.trb.org/view.aspx?id=1289884>



## **'Exceptions' in Queuing Theory** *Harpreet Singh, & Muhammad Ghazie Ismail*

**Abstract:** The efficiency of queuing system depends upon the behavior of customer(s) and server(s). Most of time the problem in queuing system arises due to some unethical behaviors. An analysis and approximation of queuing models with specific behaviors during various situations has been covered by many researchers. However, many obscure behaviours factors and be appealing to queuing models, which are still at large to consider during the study of such system. There are occasions where ignorance due to cultural background can block the queue flow. Under those circumstances the 'exception' occurs. This paper shall introduce some of behavioural events that are not in compliance with study of queuing system rules, are termed as 'exceptions'. In order to model how the 'exception' can overcrowd and extends waiting times, the probability theory and stochastic process are a part of interesting concepts. A general purpose probability models formulated to simulates such parameters by considering certain 'exceptions', that finds out, the 'exceptions' has major effects on queuing system.

**Subject Area:** Waiting time; Overcrowding; Erlang; Exception; Non-queue; Delays in queuing system

**Availability:** Singh, Harpreet, and Muhammad Ghazie Ismail. "'Exceptions' in Queuing Theory."  
<http://ijcit.com/archives/volume3/issue1/Paper030118.pdf>

**A New Course: How Innovative University Programs are Reducing Driving on Campus and Creating New Models for Transportation** *Tom Van Heeke, Elise Sullivan & Phineas Baxandall*

**Abstract:** Over the past two decades, colleges and universities have increasingly adopted the goal of reducing driving as part of their long-term plans to develop healthy, sustainable and successful institutions. Parking consumes land and is expensive. Reducing driving helps the environment. Reducing driving helps “town-grown relations. Young people often prefer communities that are served by multiple transportation options. America’s universities and colleges are leading the way in developing strategies to reduce driving: free or discounted access to transit services, programs to promote bicycle use, building new biking and walking paths, ridesharing initiatives, carsharing programs, distance learning and online resources. The policies adopted by colleges and universities to reduce driving have impacts that can be felt beyond campus. Policymakers should learn from the success of college strategies to reduce driving, and encourage local partnerships to expand transportation options, adopt explicit strategies to support non-driving modes of transportation and adapt to the transportation needs of a new generation.

**Subject Area:** VMT; driving reduction strategies; colleges and universities

**Availability:** Baxandall, Phineas, and US PIRG Education Fund. "A NEW COURSE." (2014). [http://www.connpirgedfund.org/sites/pirg/files/reports/US\\_A\\_New\\_Course\\_scrn\\_0\\_6.pdf](http://www.connpirgedfund.org/sites/pirg/files/reports/US_A_New_Course_scrn_0_6.pdf)

# 1 1 . TREND ANALYSIS AND MARKET SEGMENTATION

## **An Examination of Recent Trends in Multimodal Travel Behavior Among American Motorists** *Ralph Buehler & Andrea Hamre*

**Abstract:** 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 paper 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. This paper identifies trends of multimodal behavior among car users in the U.S. and provides profiles of these multimodal motorists.

During a typical day about 14% of American car users make at least two trips by foot, bicycle, or public transport, while during a typical week about 25% of motorists make at least 7 trips by means of transport other than the car. Results from a bivariate analysis and logistic regressions suggest significant shifts toward more multimodal behavior among motorists between 2001 and 2009. Multimodal motorists tend to be younger, educated beyond high school, in households without cars, and live in high-density neighborhoods with access to 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.

**Subject Area:** multimodal car user, sustainable transport, travel behavior, trends 2001-2009, USA

**Availability:** Buehler, Ralph, and Andrea Hamre. "An Examination of Recent Trends in Multimodal Travel Behavior Among American Motorists." *International Journal of Sustainable Transportation* just-accepted (2014).

<http://www.tandfonline.com/doi/abs/10.1080/15568318.2014.945672#.VKq4lpMo5LM>

## **Peer-to-Peer Rental Markets in the Sharing Economy** *Samuel Fraiberger & Arun Sundararajan*

**Abstract:** We develop a new dynamic model of peer-to-peer Internet-enabled rental markets for durable goods in which consumers are heterogeneous in their price sensitivity and asset utilization rates. We analyze the welfare effects of introducing such a market when consumers may also trade the durable assets they own in (traditional) secondary markets, while transaction costs and depreciation rates vary with self-utilization and rental intensity. We characterize the stationary equilibrium of the model. We then calibrate the model by combining data about US automobile ownership and usage with 2 years of transaction-level data we have obtained from a large peer-to-peer car rental marketplace. Our calibration allows us to project the longer-run welfare and distributional effects of this kind of 'sharing economy'. Counterfactual analyses show that peer-to-peer rental markets change the allocation of goods significantly, may diminish asset trade volumes, but increase consumers' surplus. The increase in consumer surplus is about three times larger for households in the top decile of the price sensitivity distribution than for households in the bottom decile, which suggests that lower-income consumers will capture the greater fraction of eventual welfare gains from the sharing economy.

**Subject Area:** car sharing; sharing economy; car rental

**Availability:** Fraiberger, Samuel, and Arun Sundararajan. "Peer-to-Peer Rental Markets in the Sharing Economy." (2014). [http://www.samuefraiberger.com/s/Sharing\\_Economy.pdf](http://www.samuefraiberger.com/s/Sharing_Economy.pdf)

## **Weighing the Effects of Obesity on the Environment** *Hocheol Jeon & Joseph A. Herriges*

**Abstract:** Obesity has become a prominent social concern in the U.S. and throughout the world, increasing the risks of high blood pressure, coronary heart disease, and Type 2 diabetes, and linked to a number of other adverse health conditions. More recently, a number of studies have suggested that the societal impacts of obesity also extend into the environmental arena. It is argued that obesity can increase gasoline consumption, both directly through the additional fuel required as passenger weight increases and indirectly through the move towards less fuel efficient vehicles by obese and overweight individuals. A limitation of the existing research is that it relies on aggregate data, potentially masking important factors determining vehicle choice and usage. Moreover, in order to understand the interaction between obesity and gasoline consumption (and subsequent emissions), it is important to understand the linkages between obesity on the one hand and both vehicle choice and usage on the other. The goal of this paper is to address these two shortcomings of the existing literature by drawing on a unique household level panel data set provided by the Panel Study of Income Dynamics. We model both vehicle choice and usage using a reduced form linear fixed effects model and controlling for the potential endogeneity of obesity through the use of instrumental variables. We also compare these results to those obtained using a structural discrete/continuous choice model similar in spirit to Bento et al.

**Subject Area:** Obesity; vehicle choice; gasoline consumption

**Availability:** Jeon, Hocheol, and Joseph A. Herriges. "Weighing the Effects of Obesity on the Environment." (2014). [https://www.aereconference.org/sites/default/files/job-market/papers/obesity\\_11102014.pdf](https://www.aereconference.org/sites/default/files/job-market/papers/obesity_11102014.pdf)

## **Where to Fill Up Your Tank in Illinois for Low Gas Prices This Holiday Weekend** *Huffington Post*

**Abstract:** More Americans travel around the Thanksgiving holiday than during any other time of the year. According to the United States Department of Transportation, long-distance travel during the six-day Thanksgiving holiday period increases 54 percent. That's more even than the Christmas travel period, when long-distance travel increases only 23 percent.

**Subject Area:** Gas prices, Illinois

**Availability:** [http://www.huffingtonpost.com/reboot-illinois/where-to-fill-up-your-tan\\_b\\_6226742.html](http://www.huffingtonpost.com/reboot-illinois/where-to-fill-up-your-tan_b_6226742.html)

## **Emerging travel trends, high-speed rail, and the public reinvention of U.S. transportation** *Camille Kamga*

**Abstract:** By examining emerging travel trends and the resurgence of rail transport in the United States, this paper suggests that deploying high-speed rail (HSR) in the U.S. could help accelerate a transportation paradigm shift that is already underway, increase density, improve the service and sustainability of transportation, and accelerate economic activity. This shift is especially notable among young Americans who are driving less, buying fewer cars, and settling in urban areas where they can walk, bike, and use public transport. Meanwhile, baby boomers, though driving more than previous generations did at the same age, are joining this urbanizing trend and, as they grow older, seeking mobility alternatives to car dependence. Other trends, such as the transformation of society by mobile communication and digital technology, are also affecting change and forcing planners to re-think the current imbalance of the U.S. transport system. Using the success revealed by passenger rail services in the Northeast Corridor, this paper examines how high-speed rail and its station hubs could enhance urbanization and help to rebalance the three main passenger modes—road, air, and rail—so that each flourishes within its most sustainable niche. In these ways, the benefits of HSR extend beyond rail service itself to include this mode's ability to reinvent the transportation system in ways that better serve the needs of a changing society while urgently addressing livability and sustainability.

**Subject Area:** High-speed rail; Livability; Sustainability; Environment; Land use; Rail transport

**Availability:** Kamga, Camille. "Emerging travel trends, high-speed rail, and the public reinvention of US transportation." *Transport Policy* 37 (2015): 111-120.  
<http://www.sciencedirect.com/science/article/pii/S0967070X14002133>

## **Socioeconomics of Urban Travel: Evidence from the 2009 National Household Travel Survey with Implications for Sustainability** *Renne, John L & Bennett, Peter*

**Abstract:** This article summarizes patterns of mobility for urban travel across the United States based on the 2009 National Household Travel Survey (NHTS). It examines how patterns vary by socioeconomics and highlights policy implications of current mobility patterns for creating a more sustainable society. Key findings include the reaffirmation that over 80 percent of trips in America are made by automobiles. While vehicle ownership is the most significant factor in variations in mode use, income, trip purpose, regional variation, race/ethnicity, gender and age are all factors examined for variation in travel behavior. The paper concludes with recommendations for promoting a sustainable society through shifting transportation priorities.

**Subject Area:** Automobile travel; Demographics; Mobility; Modal split; Policy analysis; Socioeconomic factors; Sustainable development; Travel behavior; Urban travel

**Availability:** Renne, John L., and Peter Bennett. "Socioeconomics of Urban Travel: Evidence from the 2009 National Household Travel Survey with Implications for Sustainability." *World Transport Policy & Practice* 20.4 (2014). <http://trid.trb.org/view.aspx?id=1326943>



## **The 10 Biggest Factors Changing Millennial Driving Habits** *Eric Jaffe*

**Subject Area:** millennial driving habits

**Availability:** Jaffe, Eric; The 10 Biggest Factors Changing Millennial Driving Habits. Nov 14, 2014; From The Atlantic CITLAB; <http://www.citylab.com/commute/2014/11/the-10-biggest-factors-changing-millennial-driving-habits/382763/>

**Physical activity mediates the relationship between perceived crime safety and obesity** *Barbara B. Brown, Carol M. Werner, Ken R. Smith, Calvin P. Tribby, & Harvey J. Miller*

**Abstract:** Objective. The current cross-sectional study tests whether low perceived crime safety is associated with body mass index (BMI) and obesity risk and whether less moderate-to-vigorous physical activity (MVPA) accounts for part of this relationship. Method. Adults (n=864) from a relatively low-income and ethnically mixed neighborhood in Salt Lake City UT (2012) were assessed for perceived crime safety, objective physical activity, and BMI measures. Results. This neighborhood had lower perceived safety than for other published studies utilizing this safety measure. In a mediation test, lower perceived crime safety was significantly associated with higher BMI and greater risk of obesity, net of control variables. Residents with lower perceived safety had less MVPA. Lower MVPA partially explained the relationship between less safety and both elevated BMI and higher obesity risk, suggesting that perceiving less crime safety limits MVPA which, in turn, increases weight. Conclusion. In this neighborhood, with relatively low perceived safety from crime, residents' low perceived safety related to more obesity and higher BMI; lower MVPA among residents explained part of this relationship. If residents are to become more active in their neighborhood it may be important to address perceived crime safety as part of broader efforts to enhance active living.

**Subject Area:** crime safety; body mass index; obesity risk

**Availability:** Brown, Barbara B., et al. "Physical activity mediates the relationship between perceived crime safety and obesity." *Preventive medicine* 66 (2014): 140-144.  
<http://www.sciencedirect.com/science/article/pii/S0091743514002229>

## **Explore the relationship between online shopping and shopping trips: An analysis with the 2009 NHTS data** *Yiwei Zhou, & Xiaokun (Cara) Wang*

**Abstract:** The rapid growth of ecommerce brings great changes to the transportation system. However, most existing studies focus on the impact of ecommerce on freight system. Its impact on personal trips is relatively less studied. It is reasonable to argue that online shopping reduces the need of shopping trips by making goods accessible via door-to-door deliveries. On the other hand, online shopping may also create more shopping trips as online shoppers travel to stores to experience, compare or pick up the goods. Understanding the connections between online shopping and shopping trips is critical for transportation planners to prepare for changes that information technology will continue to bring to this nation in the future. Using the 2009 National Household Travel Survey (NHTS) data and a structural equation model (SEM), this paper disentangles the bidirectional connections between online shopping and shopping trips. Results show that online shopping encourages shopping trips while shopping trips tend to suppress the online shopping propensity. Besides, both online shopping and shopping trips are influenced by exogenous factors such as shoppers' demographic features, regional specific factors and household attributes. A closer examination at the state level further confirms model validity while disclosing spatial variation in their relationship.

**Subject Area:** Online shopping; E-commerce; Personal trips; NHTS; SEM

**Availability:** Zhou, Yiwei, and Xiaokun Cara Wang. "Explore the relationship between online shopping and shopping trips: An analysis with the 2009 NHTS data." *Transportation Research Part A: Policy and Practice* 70 (2014): 1-9.

<http://www.sciencedirect.com/science/article/pii/S096585641400233X>

**Assessing Impact of Carsharing on Household Car Ownership in Montreal, Quebec, Canada** *Mary G. Y. Klinevicius, Catherine Morency, & Martin Trépanier*

**Abstract:** Carsharing is a service in which members of an organization have access to vehicles for predetermined periods of time (usually with short duration). One of the main impacts of this service in a city is said to be the reduction of car ownership. However, most studies used surveys of carsharing members to evaluate this effect, and these surveys may contain a bias because of the members' interpretation of reality. This study proposes a first assessment of the reduction of car ownership in an area served by station-based carsharing service; the study used historical empirical data describing the population (Canadian census), typical travel behaviors, and car ownership (origin-destination surveys). Multiple regression models are used to study the relation between household and individual car ownership and exposure to carsharing, while controlling for other variables known to also influence ownership. Although more complex model formulations need to be tested to enhance the analysis, the results obtained in this analysis using linear regression models indicate that the number of shared vehicles in a 500-m radius is negatively correlated with car ownership.

**Subject Area:** carsharing; vehicle ownership; Canadian census; regression

**Availability:** Klinevicius, Mary GY, Catherine Morency, and Martin Trépanier. "Assessing Impact of Carsharing on Household Car Ownership in Montreal, Quebec, Canada." *Transportation Research Record: Journal of the Transportation Research Board* 2416.1 (2014): 48-55. <http://trb.metapress.com/index/5200820535203MH2.pdf>

**Malicious Data Detection in Vehicular Ad-hoc Networks** *Fuad A. Ghaleb, Murad A. Rassam, & Anazida Zainal*

**Abstract:** Vehicle Ad hoc Network (VANET) is an emerging and promising technology for the Intelligent Transportation System (ITS). VANET can help to increase safety and traffic efficiency in flexible and feasible way. However, disseminating incorrect information in VANET has wide range of implications effecting drivers' behaviors and causing serious, and may be catastrophic, results. Misbehaving attackers can create traffic illusion to disturb VANET operations as well as the potential deployment of safety and traffic efficiency applications. In this paper, we studied the existing approaches for detecting malicious data in VANET. In addition, the importance and the challenges faced when verifying the correctness of VANET data are discussed. Finally, the drawbacks of existing detection and verification approaches are analyzed.

**Subject Area:** ITS ; VANET; Misbehavior Detection, Malicious Data Verification

**Availability:** Ghaleb, Fuad A., Murad A. Rassam, and Anazida Zainal. "Malicious Data Detection in Vehicular Ad-hoc Networks." <http://www.ysrgst.org/irict/wp-content/uploads/2014/10/50.pdf>

**Fast charging: An in-depth look at market penetration, charging characteristics, and advanced technologies** *Rajagopalan, Satis; Maitra, Arindam; Halliwell, John; Davis, Morgan; & Duvall, Mark*

**Abstract:** Plug-in Electric Vehicles (PEVs) are now available in many North American and European markets, with more models expected to become available to consumers in the coming years. These vehicles will present utilities with opportunities as well as challenges as their numbers potentially grow to hundreds of thousands of vehicles connected to the electric grid for charging. In order to support PEV adoption in the market place, it is expected that consumers will demand faster charge rates especially for the all electric vehicles. Faster charge rates require higher power electrical charging systems and the infrastructure to support these fast charging systems. With a view to comprehensively understand the impact of DC fast charging on the customer as well as the electric utility, Electric Power Research Institute (EPRI) has been conducting detailed research into the market potential, technical capabilities, and installation costs. Demand charges and installation costs are currently the most significant barriers widespread adoption of fast charging. Creating a sustainable business case for fast charging will require economics that match utilization. This paper will discuss these findings in depth and will also provide an update on the status of DC fast charging related standards. With a view to address these shortcomings, EPRI has developed a direct medium-voltage fed all solid-state fast charging system, the Utility Direct Medium Voltage Fast Charger (UDFC). Such a system would allow the charging system to be connected directly to the medium voltage system, offer multiple ports so that total charging capacity can be intelligently shared between multiple vehicles at once, simplify installation and increase overall system efficiency. This paper will also present an overview of this concept and its benefits.

**Subject Area:** Batteries; Connectors; Electric vehicles; Europe; Protocols; Standards

**Availability:** Rajagopalan, Satish, et al. "Fast Charging: An In-Depth Look at Market Penetration, Charging Characteristics, and Advanced Technologies."

[http://ieeexplore.ieee.org/xpls/abs\\_all.jsp?arnumber=6914945](http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6914945)

**Assessing The Electric Vehicle Charging Network In Washington State** *Nick Nigro, Jason Ye, & Matt Frades*

**Abstract:** The Washington State Legislature is interested in exploring government's role in fostering new business models that will expand the private sector commercialization of electric vehicle (EV) charging services. This paper provides an assessment of the existing EV publicly available charging network in Washington. The paper begins with the challenges of ensuring adequate access to EV charging infrastructure and identifies the barriers to increasing the private sector role in expanding charging access. Next, the paper assesses the current state of publicly available charging infrastructure in the state and identifies where additional infrastructure may be needed. Finally, the paper investigates specific travel corridors where private investment could increase EV adoption.

**Subject Area:** Electric Vehicles; charging infrastructure

**Availability:** Nigro, Nick, Jason Ye, and Matt Frades. "Assessing the Electric Vehicle Charging Network in Washington State." Center for Climate and Energy Solutions (2014).

[http://www.leg.wa.gov/JTC/Documents/Studies/EV/Task1\\_Final.pdf](http://www.leg.wa.gov/JTC/Documents/Studies/EV/Task1_Final.pdf)

## **The Future Of Fully Automated Vehicles: Opportunities For Vehicle- And Ride-Sharing, With Cost And Emissions Savings** *Daniel Fagnant and Kara Kockelman*

**Abstract:** Fully automated or autonomous vehicles (AVs) hold great promise for the future of transportation. By 2020 Google, auto manufacturers and other technology providers intend to introduce self-driving cars to the public with either limited or fully autonomous capabilities. AVs may be able to save the U.S. economy up to \$37.7 billion in comprehensive costs from safety, mobility and parking improvements at the 10% market penetration, and potentially up to \$447.1 billion with 90% market penetration. Even with only 10% market share, over 1,000 lives could be saved annually. However, realizing these potential benefits while avoiding potential pitfalls requires more than just technology advancements: significant barriers to a successful rollout include AV costs, liability, security, and privacy.

Once fully self-driving vehicles can safely and legally drive unoccupied on U.S. streets, a new transportation mode for personal travel looks set to arrive. This new mode is the shared automated vehicle (SAV), combining on-demand service with self-driving capabilities. This work simulates a fleet of SAVs operating within the city of Austin, using Austin's transportation network and travel demand flows. This model incorporates dynamic ride-sharing (DRS), allowing two or more travelers with similar origins, destinations and departure times to share a ride.

Model results indicate that each SAV could replace around 10 conventionally-owned household vehicles while serving over 56,000 person-trips. SAVs' ability to relocate while unoccupied between serving one traveler and the next may cause an increase of 4-8% more travel; however, DRS can result in reduced overall VMT, given enough SAV-using travelers willing to ride-share. SAVs should produce favorable emissions outcomes, with an estimated 16% less energy use and 48% lower volatile organic compound (VOC) emissions, per person-trip formerly served by a household vehicle.

**Subject Area:** Autonomous Vehicles, Automated Vehicles, Car-Sharing, Ride-Sharing, Emissions

**Availability:** Fagnant, Daniel James. The future of fully automated vehicles: opportunities for vehicle-and ride-sharing, with cost and emissions savings. University of Texas Diss. 2014.

<http://repositories.lib.utexas.edu/handle/2152/25932>



## **An Investigation Of Market Sustainability Of Electric Vehicles** *Wenjing Shen*

**Abstract:** Passenger Vehicles are the primary commute transportation in the United States, especially in rural and small urban areas. The increasing need of conventional vehicles bring us critical problems, such as increment of gas demand, climate change and environment pollution. Although other power sources are suggested in replacing gasoline powered vehicles, for instance, natural gas and solar, people are more willing to support electric-powered vehicles for its cleanness and efficiency. This paper looks into the electric vehicle market in the United States at present, and builds two models to predict the market of electric vehicles by using historical sales data and factors that might affect the future sales. It also discusses the future of EV market from investors and consumers' perspectives

**Subject Area:** electric vehicle market; sales; investors; consumers

**Availability:** Shen, Wenjing. An Investigation of Market Sustainability of Electric Vehicles. Diss. The University of Akron, 2014.

[https://etd.ohiolink.edu/!etd.send\\_file?accession=akron1408015133&disposition=attachment](https://etd.ohiolink.edu/!etd.send_file?accession=akron1408015133&disposition=attachment)

## **Impacts of battery characteristics, driver preferences and road network features on travel costs of a plug-in hybrid electric vehicle (PHEV) for long-distance trips** *Okan Arslan , Barış Yıldız , & Oya Ekin Kardeşan*

**Abstract:** In a road network with refueling and fast charging stations, the minimum-cost driving path of a plug-in hybrid electric vehicle (PHEV) depends on factors such as location and availability of refueling/fast charging stations, capacity and cost of PHEV batteries, and driver tolerance towards extra mileage or additional stopping. In this paper, our focus is long-distance trips of PHEVs. We analyze the impacts of battery characteristics, often-overlooked driver preferences and road network features on PHEV travel costs for long-distance trips and compare the results with hybrid electric and conventional vehicles. We investigate the significance of these factors and derive critical managerial insights for shaping the future investment decisions about PHEVs and their infrastructure. In particular, our findings suggest that with a certain level of deployment of fast charging stations, well established cost and emission benefits of PHEVs for the short range trips can be extended to long distance. Drivers' stopping intolerance may hamper these benefits; however, increasing battery capacity may help overcome the adverse effects of this intolerance.

**Subject Area:** PHEV economics; Fast charging stations; Long-distance travel; Driving patterns; Charging strategies

**Availability:** Arslan, Okan, Barış Yıldız, and Oya Ekin Kardeşan. "Impacts of battery characteristics, driver preferences and road network features on travel costs of a plug-in hybrid electric vehicle (PHEV) for long-distance trips." *Energy Policy* (2014).

<http://www.sciencedirect.com/science/article/pii/S0301421514004686>

## **Why Americans are driving less?** *Teeparthi Ramya*

**Abstract:** Since 2007 car ridership in the US has been declining at a rate of over 93 million miles per year. Taking population growth (0.07 percent) into consideration, this development raises questions about the future of automobile dependence in America (Puentes, 2012). Several studies identify the influence of changing lifestyle attitudes and increased use of information technology as reasons behind this drop in per capita travel. Yet little research has focused on the possible association between age, telecommunications and annual mileage. This thesis looks at differences in driving trends between different generations and their potential implications for overall American transportation services and the US economy. In particular the paper addresses the question whether age, belonging to the millennial generation, leads to a drop in miles driven. Using National Household Travel Survey (NHTS) data from 2009, I examine the relationship between different generations and annual mileage. I hypothesize that changes in the habits of the younger population is primarily driving the drop in car ridership. I find that Internet use has no significant relationship with car ridership, there is a statistically significant negative relationship between the millennial generation and car ridership. Due to the auto dependence evident in American society, this reduction in driving for the millennial generation could not only affect road congestion, but in long term lead to paradigm shifts in overall urban and economic policy.

**Subject Area:** car ridership; millennials

**Availability:** Teeparthi, Ramya. Why Americans Are Driving Less?. Diss. Georgetown University, 2014. <http://gradworks.umi.com/15/55/1555409.html>

## **The Political Consequences of Spatial Policies: How Interstate Highways Facilitated Geographic Polarization** *Clayton Nall*

**Abstract:** In the postwar era, Republican voters have become increasingly more likely than Democratic voters to live in non-urban counties, and the two parties distributed across increasingly distinct geographic enclaves. Public policies that shape geographic space have been a major contributor to this geographic polarization. This article examines the effect of the Interstate Highway System, the largest public works project in American history, on this phenomenon. Drawing on a historical database of postwar U.S. highway construction since passage of 1956 highway legislation, it shows that suburban counties with Interstate became more Republican than they would have otherwise, primarily in the less urbanized South and where highways were built earlier. Metropolitan areas with denser Interstate networks also became more polarized. Analysis of the Youth-Parent Socialization Panel Study (1965-1997) reveals individual-level mechanisms underlying these changes: suburbs along Interstates facilitated white flight and became home to more affluent residents, reinforcing partisan geographic polarization.

**Subject Area:** spatial policy; interstate highway history

**Availability:** Nall, Clayton. "The Political Consequences of Spatial Policies: How Interstate Highways Facilitated Geographic Polarization." Stanford (2014).  
<http://web.stanford.edu/~nall/docs/nall--ident9.6.pdf>

## **Advanced Vehicle Powertrain Design Using Model-Based Design** *David Andrew Ord*

**Abstract:** The use of alternative fuels and advanced powertrain technologies has been increasing over the past few years as vehicle emissions and fuel economy have become prominent in both manufacturer needs and consumer demands. With more hybrids emerging from all automotive manufacturers, the use of computer modeling has quickly taken a lead in the testing of these innovative powertrain designs. Although on-vehicle testing remains an important part of the design process, modeling and simulation is proven to be an invaluable tool that can be applied anywhere from preliminary powertrain design to controller software validation.

**Subject Area:** model-based design, hybrid electric vehicle, plug-in, architecture selection, greenhouse gases, petroleum, fuel economy, powertrain modeling

**Availability:** Ord, David Andrew. Advanced Vehicle Powertrain Design using Model-Based Design. Diss. Virginia Polytechnic Institute and State University, 2014.  
<http://vtechworks.lib.vt.edu/handle/10919/49106>

## **Excess passenger weight impacts on US transportation systems fuel use (1970–2010)** *Michelle Tom, Paul Fischbeck, & Chris Hendrickson*

**Abstract:** Over the past 40 years, the percentage of the US population that is overweight and obese has increased significantly, with nearly 70% of American adults now overweight or obese (National Center for Health Statistics (NCHS), 2013). The excess weight that Americans are carrying is taking a toll on the social and physical infrastructure of the country, and may also be counteracting the efforts of industries and policymakers to move towards a more energy efficient and sustainable future. This article analyzes the transportation industry to determine the amount of additional fuel use, greenhouse gas emissions, and fuel costs that are attributed to excess passenger weight in light-duty vehicles, transit vehicles, and passenger aircraft in the US from 1970 to 2010. Using driving and passenger information in the US and historical anthropometric data, it is estimated that since 1970 over 205 billion additional liters of fuel were consumed to support the extra weight of the American population. This is equivalent to 1.1% of total fuel use for transportation systems in the United States. Also, excess passenger weight results in an extra 503 million metric tonnes of equivalent carbon dioxide emissions and \$103 billion of additional fuel cost over the last four decades. If overweight and obesity rates continue to increase at its current pace, cumulative excess fuel use could increase by 460 billion liters over the next 50 years, resulting in an extra 1.1 billion metric tonnes of equivalent carbon dioxide and \$200 billion of additional fuel costs by the year 2060.

**Subject Area:** Overweight; Obesity; Transportation; Fuel use; GHG emissions; Fuel cost

**Availability:** Tom, Michelle, Paul Fischbeck, and Chris Hendrickson. "Excess passenger weight impacts on US transportation systems fuel use (1970–2010)." *Journal of Transport & Health* (2014). <http://www.sciencedirect.com/science/article/pii/S221414051400036X>

## **Development and Application Of A Network-Based Shared Automated Vehicle Model In Austin, Texas** *Daniel Fagnant & Kara M. Kockelman*

**Abstract:** The emergence of self-driving vehicles holds great promise for the future of transportation. While it will still be a number of years before fully self-driving vehicles can safely and legally drive unoccupied on U.S. street, once this is possible, a new transportation mode for personal travel looks set to arrive. This new mode is the shared automated vehicle (SAV), combining features of short term rentals with the vehicles' powerful automated self-driving capabilities. This investigation examines SAVs' potential implications at a low level of market penetration (1.3% of regional trips) by simulating a fleet of SAVs serving travelers in Austin, Texas' 12-mile by 24-mile regional core. The simulation uses a synthetic population derived from the Capital Area Metropolitan Planning Organization's regional planning model trip tables to generate demand across zone origins, destinations and departure times. CAMPO's regional transportation network is also used, with link-level travel times varying by time of day in response to congestion, with average hourly travel speeds estimated using Nagel and Axhausen's (2013) MATSim agent-based dynamic traffic assignment simulation software. Results show that each SAV is able to replace around 8.5 to 10 conventional vehicles while still maintaining a reasonable level of service (as proxied by user wait times). Additionally, approximately 18.5 to 20 percent more vehicle-miles traveled (VMT) may be generated, due to SAVs journeying unoccupied to the next traveler, or relocating to a more favorable position in anticipation of next-period demand.

**Subject Area:** self-driving vehicle; shared automated vehicle

**Availability:** Fagnant, Daniel J., and Kara M. Kockelman. "The travel and environmental implications of shared autonomous vehicles, using agent-based model scenarios."

Transportation Research Part C: Emerging Technologies 40 (2014): 1-13.

<http://www.sciencedirect.com/science/article/pii/S0968090X13002581>

## **The Travel And Environmental Implications Of Shared Autonomous Vehicles, Using Agent-Based Model Scenarios** *Daniel Fagnant & Kara M. Kockelman*

**Abstract:** Carsharing programs that operate as short-term vehicle rentals (often for one-way trips before ending the rental) like Car2Go and ZipCar have quickly expanded, with the number of U.S. users doubling every one to two years over the past decade. Such programs seek to shift personal transportation choices from an owned asset to a service used on demand. The advent of autonomous or fully self-driving vehicles will address many current carsharing barriers, including users' travel to access available vehicles. This work describes the design of an agent-based model for Shared Autonomous Vehicle (SAV) operations, the results of many case-study applications using this model, and the estimated environmental benefits of such settings, versus conventional vehicle ownership and use. The model operates by generating trips throughout a grid-based urban area, with each trip assigned an origin, destination and departure time, to mimic realistic travel profiles. A preliminary model run estimates the SAV fleet size required to reasonably service all trips, also using a variety of vehicle relocation strategies that seek to minimize future traveler wait times. Next, the model is run over one-hundred days, with driverless vehicles ferrying travelers from one destination to the next. During each 5-minute interval, some unused SAVs relocate, attempting to shorten wait times for next-period travelers.

**Subject Area:** car sharing; shared autonomous vehicle

**Availability:** Fagnant, Daniel J., and Kara M. Kockelman. "The travel and environmental implications of shared autonomous vehicles, using agent-based model scenarios."

Transportation Research Part C: Emerging Technologies 40 (2014): 1-13.

<http://www.sciencedirect.com/science/article/pii/S0968090X13002581>



## **An Exploration of Short-Term Vehicle Usage Decisions** *Jaime R. Angueira*

**Abstract:** Vehicle choice decisions are important to consider because they have implications on fuel consumption and greenhouse gas emissions. Much research has been done in the past regarding the types of vehicles that people own and how much they use each vehicle on annual basis. However, these are all long-term vehicle choice decision, and very little research has been done to explore short-term decisions. Short term decisions provide information about how much vehicles in the household are being used at a day level. In addition to the capturing the role of socio-demographics and economic factors on the short term vehicle choices, the fine scale temporal analysis allows for exploring the relationship between vehicle choices and daily activity-travel engagement decisions which shape the selection and use of different vehicles in the household fleet. In the context of the short-term vehicle choices, there are two important choices to consider: the vehicle chosen from the household fleet to pursue the trip and the distance traveled. Further, there are important interrelationships between these two variables namely, vehicle choice may affect distance or distance may affect vehicle choice. Depending on the directionality of this relationship, there are different policy implications. It is important to understand these short-term decisions and their interrelationships so as to make informed decisions for creating efficient transportation systems, reducing fuel use, and decreasing greenhouse gas emissions. To explore the relationship between distance and vehicle type, data from the 2009 National Household Travel Survey (NHTS) was used. The thesis is divided into two parts. In the first part, findings from the examination of distance and vehicle type choice dimensions are presented. This section also explores the potential interrelationships between the choice dimensions. Further, the section also discusses findings from a comparative analysis of differences in vehicle choice behaviors across three metropolitan areas namely New York, Los Angeles, and Washington. The second part of the thesis explored the possibility that not one but both interdependencies could hold true but each for a different subgroup of the population to explain the short-term vehicle choice and usage behaviors. To this end, a latent segmentation approach was used to model both interdependencies and the corresponding interrelationships between vehicle type choice and distance within the same modeling framework. Both studies provide statistically significant and plausible results. Further, the results provide evidence in support of the importance of short-term vehicle choices and the importance of them in planning and policy analysis.

**Subject Area:** short term vehicle choice

**Availability:** Angueira, Jaime R. "An Exploration of Short-Term Vehicle Usage Decisions." (2014). [http://digitalcommons.uconn.edu/gs\\_theses/548/](http://digitalcommons.uconn.edu/gs_theses/548/)

**A parametric study of light-duty natural gas vehicle competitiveness in the United States through 2050** *Meghan B. Peterson, Garrett E. Barter, Todd H. West, & Dawn K. Manley*

**Abstract:** We modeled and conducted a parametric analysis of the US light-duty vehicle (LDV) stock to examine the impact of natural gas vehicles (NGVs) as they compete with electric vehicles, hybrids, and conventional powertrains. We find that low natural gas prices and sufficient public refueling infrastructure are the key drivers to NGV adoption when matched with availability of compressed natural gas powertrains from automakers. Due to the time and investment required for the build out of infrastructure and the introduction of vehicles by original equipment manufacturers, home natural gas compressor sales and bi-fuel NGVs serve as bridge technologies through 2030. By 2050, however, NGVs could comprise as much as 20% of annual vehicle sales and 10% of the LDV stock fraction. We also find that NGVs may displace electric vehicles, rather than conventional powertrains, as they both compete for consumers that drive enough miles such that fuel cost savings offset higher purchase costs. Due to this dynamic, NGVs in our LDV stock model offer little to no greenhouse gas emissions reduction as they displace lower emission powertrains. This finding is subject to the uncertainty in efficiency technology progression and the set of powertrains and fuels considered.

**Subject Area:** Natural gas vehicle; Compressed natural gas; Greenhouse gas emission

**Availability:** Peterson, Meghan B., et al. "A parametric study of light-duty natural gas vehicle competitiveness in the United States through 2050." *Applied Energy* 125 (2014): 206-217. <http://www.sciencedirect.com/science/article/pii/S030626191400302X>

**Agent-based Modeling and Simulation for the Pricing Strategy of the Electric Vehicle Battery Switching Station** *Peng Han, Jinkuan Wang, Yinghua Han and Yan Li*

**Abstract:** The pricing strategy is critical for the construction and operation of the battery switching stations as well as the service quality to the EV owners. In this paper, operation cost of the battery switching station is firstly analyzed, and then an agent-based model of the battery switching service is proposed, which enables the observation of the EV refueling request, the simulation of the battery switching station, and the assessment of different pricing strategies. Furthermore, considering the current high cost of the EV batteries and their quality decreasing due to recharging times, this paper proposed a battery condition- based pricing strategy. And developed a 3D simulation platform to verify the effectiveness of the proposed model and the performance of the pricing strategy. Simulation denotes that the model can well reveal the driving mode of the EV owners and the battery conditions, which will be of significant meanings in making decisions about the configuration of the station and the pricing strategy. And due to the fluctuation in the battery quality in the simulation, the cost of the battery is dominant in the cost of the station compared with the cost of the electricity, and the proposed pricing is a preferred way in making up the battery cost of the station while providing a fair service for the EV owners.

**Subject Area:** Electric Vehicle; Battery Switching Station; Battery Condition; Agent-based Modeling; Pricing Strategy

**Availability:** Han, Peng, et al. "Agent-based Modeling and Simulation for the Pricing Strategy of the Electric Vehicle Battery Switching Station\*." *Journal of Computational Information Systems* 10.7 (2014): 2803-2812. [http://www.jofcis.com/publishedpapers/2014\\_10\\_7\\_2803\\_2812.pdf](http://www.jofcis.com/publishedpapers/2014_10_7_2803_2812.pdf)

## **Incorporating heterogeneity to forecast the demand of new products in emerging markets: Green cars in China** *Lixian Qiana, & Didier Soopramanien*

**Abstract:** Emerging markets are becoming increasingly important for many companies and it is not surprising to see that an increasing number of new products, especially technology products, are now being launched in these markets fairly quickly after they are launched in Western markets. However, most of the research on forecasting demand for new products focuses on developed markets. Marketing managers in multinational companies may therefore be tempted to use models that have been applied in developed markets to forecast demand of new products in emerging markets. However, there is ample evidence that supports the contention that emerging markets are different to markets in developed economies. This research proposes a dynamic segmentation approach to forecast demand that explicitly incorporates heterogeneity of consumers within and across segments: a key distinguishing feature of emerging markets. The research is applied in the context of the Chinese green car market but can be replicated for other products and in similar market conditions.

**Subject Area:** New product forecasting; Emerging markets; Market segmentation; Preference heterogeneity; Market dynamics; Green cars

**Availability:** Qian, Lixian, and Didier Soopramanien. "Incorporating heterogeneity to forecast the demand of new products in emerging markets: Green cars in China." *Technological Forecasting and Social Change* (2014).

<http://www.sciencedirect.com/science/article/pii/S0040162514000390>

**An Analysis of Possible Energy Impacts of Automated Vehicles** *Austin Brown, Jeffrey Gonder, and Brittany Repac*

**Abstract:** Automated vehicles (AVs) are increasingly recognized as having the potential to decrease carbon dioxide emissions and petroleum consumption through mechanisms such as improved efficiency, better routing, and lower traffic congestion, and by enabling advanced technologies (such as greater vehicle electrification). However, some impacts of AVs have the potential to increase fuel consumption through possible effects such as longer distances traveled, increased use of transportation by underserved groups, and increased travel speeds. The net effect on greenhouse gas emissions and petroleum use is still uncertain. Here we make initial estimates of the range of energy impacts possible due to widespread adoption of AVs. To do this, we collect available estimates for the energy impacts of ten potential effects of AVs. We then use a modified Kaya Identity approach to estimate the overall range of possible effects. Depending on the specific effects that come to pass, there is a wide range of potential energy outcome scenarios. Therefore, widespread AV deployment can lead to dramatic fuel savings, but has the potential for unintended consequences.

**Subject Area:** automated vehicles; vehicle electrification; Kaya Identity approach

**Availability:** Brown, Austin, Jeffrey Gonder, and Brittany Repac. "An Analysis of Possible Energy Impacts of Automated Vehicles."

<http://assets.conferencespot.org/fileserver/file/64302/filename/14-5077.pdf>

## **Making advanced travel forecasting models affordable through model transferability** *John L. Bowman, Mark Bradley, Joe Castiglione, & Supin L. Yoder*

**Abstract:** The research objective is to empirically test the transferability of activity-based (AB) models between regions. Using 2008-2009 National Household Travel Survey data, AB models are estimated simultaneously for six regions, in California and Florida. Statistical tests are applied to identify regional differences in the models. Tests reject the hypothesis that models based on data from different regions are identical, but most individual coefficients are not significantly different from region to region. There is evidence of model similarity among regions, but small sample sizes prevent strong conclusions. Estimability improves with larger survey samples; 6,000 households provide much better information for estimating coefficients than samples of size 2,500 or less. Thus, although estimation of models using a large local sample is best, it is better to transfer models built using a large sample from a similar region than to estimate new models using a much smaller local sample. However, local survey data is needed for calibrating components of the model. Four specific transferability hypotheses are tested, with results as follows: (1) Supported: Variables that apply to population segments defined by characteristics of individuals or their situational context (segment-specific variables) are more transferable than variables that apply to all individuals. (2) Not supported: Segment-specific variables are more transferable than alternative-specific constants. (3) Strongly supported: Models that deal with activity generation and scheduling are more transferable than models that deal with mode choice and location choice. (4) Inconclusive: Models for different regions within the same state are more transferable than models from different states.

**Subject Area:** transferability; activity-based models;

**Availability:** Bowman, John L., et al. "Making advanced travel forecasting models affordable through model transferability." Final Report, Prepared for Federal Highway Administration, US Department of Transportation, Washington, DC (2013).  
<https://www.fbo.gov/spg/DOT/FHWA/OAM/DTFH61-11-C-00023/listing.html>