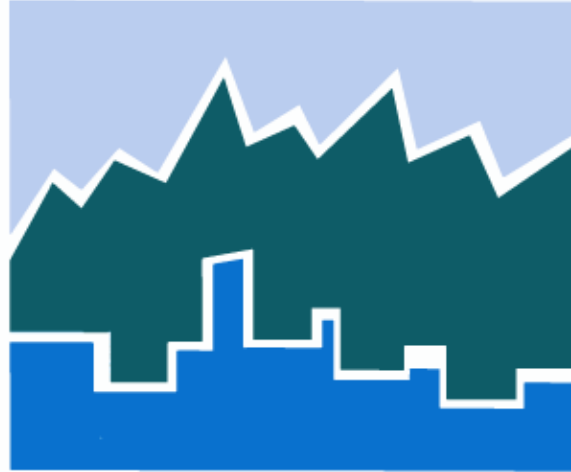

NHTS



National Household Travel Survey

Compendium of Uses

January 2017 - June 2017

Introduction

This compendium contains various uses and applications of the National Household Travel Survey (NHTS) data used in transportation planning and research from January 2017 to June 2017. 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. Energy Consumption
3. Environment
4. Health
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 short 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 96th Annual Meeting and can be found in the 2017 TRB Annual Meeting Compendium of Papers. Please note that this 2017 compendium consists of approximately 198 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.

Search and documentation support was provided by Aparna Banerjee (MacroSys), who also categorized and formatted the paper abstracts.

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1. Bicycle and Pedestrian Studies

1.1. Title: Estimating Pedestrian Exposure for Small Urban and Rural Areas

Authors: Jamali, A. and Wang, Y.

Abstract: Pedestrian exposure refers to a pedestrian's contact with vehicular traffic that can create opportunities for collisions. A myriad of metrics exist to estimate pedestrian exposure, but no consensus has been reached on what metrics should be adopted. Hence, this study attempted to synthesize previous studies and offer best practices for estimating pedestrian exposure (with a focus for rural and small urban areas). Four general types of exposure metrics emerged from area-based measures (e.g., zonal walk miles traveled), through more granular metrics at the point or segment level, to advanced metrics that utilize the behavioral attributes of walk trips (e.g., space-time prism and discrete choice). In addition, the study utilized home-based walk-only trips from nine states in the National Household Travel Survey (NHTS) (2009) data to estimate a household-level pedestrian exposure measure for rural and small urban settings. The model accounted for household characteristics (e.g., income and vehicle ownership), regional factor, and block-group-level attributes (e.g., population density and school density), with an overall goodness-of-fit of 0.41. The results can be used to infer number of walk trips at as small as the block group level or be inserted into four-step travel demand model to create point or segment-based measures where pedestrian network is defined.

Subject Areas: Pedestrian safety; Pedestrians and Bicyclists; Rural areas; Small cities; Operations and Traffic Management; Planning and Forecasting

Availability: Jamali, A. and Wang, Y., 2017. *Estimating Pedestrian Exposure for Small Urban and Rural Areas*. Transportation Research Board 96th Annual Meeting (No. 17-06576).

<https://trid.trb.org/view.aspx?id=1439632>

1.2. Title: The Reach of Bicycling in Rural, Small, and Low-Density Places

Authors: McAndrews, C., Okuyama, K. and Litt, J.S.

Abstract: Lessons derived from the urban experience of bicycling may not be broadly supportive of bicycling in what is called rural, small, and low-density (RSLD) places because of differences in built environment, social, and political contexts. In this study the authors investigated the hypothesis that bicycling is primarily an urban activity. The authors used binary logistic regression to compare the frequency of bicycling and the population characteristics of bicyclists across urban and RSLD places. The authors used multiple operational definitions of urban-rural continua to examine whether the results are sensitive to how RSLD places are defined. The data for bicycling are from the 2009 National Household Travel Survey (NHTS), which was designed to represent the population of the U.S. The authors found that bicycling is primarily-but not exclusively-an urban activity. Moreover, women and youth were more likely to bicycle in RSLD places compared to urban places. These findings suggest that an urban perspective on bicycling could limit the success of initiatives aiming to increase the diversity of populations that bicycle. Developing a base of empirical knowledge of bicycling in RSLD places is a necessary step toward developing more inclusive and effective multimodal transportation strategies.

Subject Areas: Pedestrians and Bicyclists; Planning and Forecasting; Bicycling; Built environment; Logistic regression analysis

Availability: McAndrews, C., Okuyama, K. and Litt, J.S., 2017. *The Reach of Bicycling in Rural, Small, and Low-Density Places*. Transportation Research Board 96th Annual Meeting (No. 17-00697).

http://careymcandrews.org/pdf/McAndrews_et_al_2017_TRR.pdf

1.3. Title: Using Machine Learning Techniques to Estimate Non-motorized Trips for Rural Roadways

Authors: Das, S., Dixon, K., Avelar, R.E. and Fitzpatrick, K.

Abstract: Non-motorized travel modes such as bicycling and walking are considered the green modes of traveling because of their environmental, ecological, and sustainability advantages. In recent years, the transportation profession has given increasing attention to the suitability of the roadway infrastructure for these non-motorized users. For rural roadways, the question of how many people actually use or will use non-motorized trips is a key concern. Developing a corridor for rural roadways that specifically addresses bicycle and pedestrian needs can be beneficial to both planners and users by optimizing available resources. To prioritize the selection of potential shoulder widening locations for safer non-motorized trip, there is a need to determine the number of predicted non-motorized trips per week. This study used National Household Travel Survey (NHTS) data to estimate non-motorized trips on rural roadways (two-lane and multi-lane) by applying a machine-learning tool support vector regression (SVR). Findings of this study will help the authority to logically rank the locations with more of these trips higher than locations without the prospect of any bicycle or pedestrian activity.

Subject Areas: Data and Information Technology; Highways; Pedestrians and Bicyclists; Planning and Forecasting

Availability: Das, S., Dixon, K., Avelar, R.E. and Fitzpatrick, K., 2017. *Using Machine Learning Techniques to Estimate Non-motorized Trips for Rural Roadways*. Transportation Research Board 96th Annual Meeting (No. 17-03870).

<https://trid.trb.org/view.aspx?id=1438537>

1.4. Title: Trends in Walking and Cycling Safety: Recent Evidence From High-Income Countries, with a Focus on the United States and Germany

Authors: Buehler, R. and Pucher, J.

Abstract:

Objectives: To examine changes in pedestrian and cyclist fatalities per capita (1990-2014) and per kilometer (2000-2010) in selected high-income countries, and in fatalities and serious injuries per kilometer by age in the United States and Germany (2001-2009).

Methods: We used Organisation for Economic Cooperation and Development data to estimate 5-year annual averages of per-capita fatalities relative to the 1990-1994 average. To control for exposure, we divided fatalities and serious injuries by kilometers of walking or cycling per year for countries with comparable data from national household travel surveys.

Results: Most countries have reduced pedestrian and cyclist fatality rates per capita and per kilometer. The serious injuries data show smaller declines or even increases in rates per kilometer. There are large differences by age group in fatality and serious injury rates per kilometer, with seniors having the highest rates. The United States has much higher fatality and serious injury rates per kilometer than the other countries examined, and has made the least progress in reducing per-capita fatality rates.

Conclusions: The United States must greatly improve walking and cycling conditions. All countries should focus safety programs on seniors and children.

Subject Areas: Fatalities; Pedestrians and Bicyclists; Planning and Forecasting

Availability: Buehler, R. and Pucher, J., 2017. *Trends in Walking and Cycling Safety: Recent Evidence From High-Income Countries, with a Focus on the United States and Germany*. American Journal of Public Health, (0), pp.e1-e7.

<http://ajph.aphapublications.org/doi/full/10.2105/AJPH.2016.303546>

1.5. Title: Perceived Barriers to Bicycling in an Urban U.S. Environment

Authors: Fowler, S.L., Berrigan, D. and Pollack, K.M.

Abstract: Prior research has identified several barriers influencing decisions to bicycle, including infrastructure, safety, and environmental factors. There is scant research exploring how sex and ridership status correlate with perceived barriers, which is a known barrier to being physically active. A total of 1334 Baltimore City residents aged 18 to 75 participated in an online survey (February-March 2014) assessing the major barriers to bicycling in the city. Differences by sex and ridership status were examined independently and interactively. Most respondents were women (60%) and not regular riders (66%). Safety due to traffic was the biggest barrier for non-riding women (77%) and non-riding men (54%). Weather was the biggest barrier for riding women (55%) and riding men (51%), followed by safety due to drivers (45% and 33%, respectively). Sex and ridership differences were also found for barriers regarding preference and logistics of transport. For example, riders had lower odds than non-riders of rating biking as less comfortable than driving as a major barrier, OR=0.39, $p<0.01$. Furthermore, women had greater odds than men of rating it is difficult to carry things on a bike as a major barrier, OR=1.65, $p<0.01$. Interactions between sex and ridership status revealed that riding women had lower odds than riding men of rating a) needing others to travel, OR=0.32 and b) hygiene, OR=0.41, as major barriers, p 's <0.05 . We discuss these findings in the broader context of the literature, and offer strategies for addressing specific barriers to bicycling.

Subject Areas: Physical activity; Active transportation; Built environment; Ridership; Sex differences

Availability: Fowler, S.L., Berrigan, D. and Pollack, K.M., 2017. *Perceived Barriers to Bicycling in an Urban U.S. Environment*. Journal of Transport & Health.

<http://www.sciencedirect.com/science/article/pii/S2214140517301263>

1.6. Title: Impact of Built Environment and Temporal Factors on Public Bike-Sharing

Authors: Sun, F. and Chen, P.

Abstract: As bicycling regaining popularity in U.S. cities, Seattle has implemented its own public bike-share system, Pronto, in October 13rd, 2014. After one-year operation, while the system is popularly used, it faces the challenge of bike unavailability and dock shortage at various stations. To deal with the problem, this paper seeks to understand the generation of public bike usage. Through compiling various sources of spatial and temporal data sets and linking them to the recent published Pronto bike trip data, this paper comprehensively investigates the effects of land use, transport infrastructure, demographics, weather, and events on hourly public bicycle pickups and returns at each docking station. To address temporal autocorrelation in the data, the paper implements a generalized linear mixed model by considering the joint effects of time metric and time-varying variables. Besides, the model also includes a spatial weight matrix and a location dummy variable to account for different levels of spatial autocorrelations. The paper estimates models on both the total counts and counts by gender groups. Results both confirm findings in previous studies and provide new insights. In particular, transport infrastructure, office land use, and employment density are found to have positive correlations with bicycle counts. Transit station density is found to have a substitutional effect with public bike system. Weather and time events are also correlated with bicycle counts. Moreover, the spatial and temporal effects vary between male and female customers. In conclusion, the paper also discusses the limitation of the modeling approach and future research directions.

Subject Areas: Bi-cycle; Bike-share System; Temporal autocorrelation

Availability: Sun, F. and Chen, P., 2017. *Impact of Built Environment and Temporal Factors on Public Bike-Sharing*. Transportation Research Board 96th Annual Meeting (No.17-05281).

<http://docs.trb.org/prp/17-05281.pdf>

1.7. Title: Leading Pedestrian Interval Implementation as a Marginal Costs and Benefits Problem

Authors: Sharma, A., Smaglik, E., Kothuri, S., Smith, O., Koonce, P. and Huang, T.

Abstract: To improve the safety of people walking at particular signalized intersections, traffic signal engineers may implement leading pedestrian intervals (LPI) to provide pedestrians with a walk signal for a few seconds prior to the parallel vehicular green indication. Previous research using before-after studies and simple economic analyses shows that LPIs are low cost tools that can reduce vehicle-pedestrian conflicts and crashes at some signalized intersections. Despite this evidence, there is little guidance for municipalities on when to implement LPIs. This paper develops a marginal costs and benefits framework using quantitative metrics, extending the concept of traffic conflicts and marginal safety-delay tradeoffs to analyze the appropriateness of implementing an LPI at specific signalized intersections. The guidance provided by this method helps quantify the probability of a conflict happening, and provides direction on whether or not to implement an LPI at a given location based upon macroscopic level inputs, including turning movement counts, crash data, and geometry. A case study with sample data indicates that an LPI is cost effective for the scenario presented.

Subject Areas: Pedestrian; Safety; Leading Pedestrian Interval (LPI)

Availability: Sharma, A., Smaglik, E., Kothuri, S., Smith, O., Koonce, P. and Huang, T., 2017. *Leading Pedestrian Interval Implementation as a Marginal Costs and Benefits Problem*. Transportation Research Board 96th Annual Meeting (No.17-05116).
<http://docs.trb.org/prp/17-05116.pdf>

1.8. Title: Hail a Cab or Ride a Bike? A Travel Time Comparison of Taxi and Bicycle-sharing systems in New York City

Authors: Faghih-Imani, A., Anowar, S., Miller, E.J. and Eluru, N.

Abstract: In this paper, we examine the hypothesis that bicycles can compete with cars in terms of travel time in dense urban areas. We conduct a detailed investigation of the differences in observed travel times by taxi and a bicycle-sharing system (BSS) in New York City in 2014. The taxi trips with origins and destinations in proximity to BSS stations are identified and compared to BSS trips from the same origin and destinations. The travel time comparison is conducted along following dimensions: (a) all trips, (b) temporal dimension including different time periods of the day, weekday versus weekend, and seasonal variation, and (c) distance categories. It is found that during weekdays' AM, Midday and PM time periods for more than half of OD pairs with distance less than 3 km, BSS is either faster or competitive with taxi mode. To further shed light on the travel time comparison, we develop a multivariate analysis using a random utility framework in the form of a panel mixed multinomial logit model. Identifying and understanding the factors that influence the travel time differences can help planners to enhance the BSS service offerings. The provision of information to bicycling-inclined individuals on the “faster” alternative could be used as a marketing tool to attract higher usage for BSS within dense urban cores. The comparison of BSS and taxi can also shed light on the competition between bicycle and car modes in general in dense urban areas.

Subject Areas: Bicycle sharing systems; CitiBike New York; Taxi; Travel time; Panel mixed multinomial logit model

Availability: Faghih-Imani, A., Anowar, S., Miller, E.J. and Eluru, N., 2017. *Hail a Cab or Ride a Bike? A Travel Time Comparison of Taxi and Bicycle-sharing systems in New York City*. *Transportation Research Part A: Policy and Practice*, 101, pp.11-21.

<http://www.sciencedirect.com/science/article/pii/S0965856416306978>

1.9. Title: Making Every Mode Count in Washington State

Author: Nordback, K.

Abstract: A NITC report by Krista Nordback of Portland State University offers a step toward establishing a performance metric by which statewide progress with respect to bicycling and walking can be evaluated. The Washington State Pedestrian and Bicycle Miles Traveled Project discusses the relative merits of three different methods which can be used to compute bicycle miles traveled (BMT) and pedestrian miles traveled (PMT).

Subject Areas: Commuting; Cycling; Pedestrians; Automatic data collection systems; Transportation

Availability: Nordback, K., 2017. *Making Every Mode Count in Washington State*. NITC Project Brief. Project Number 2015-708. Portland, OR: Transportation Research and Education Center (TREC)

http://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1040&context=trec_briefs

1.10. Title: Exploring the Impact of Walk-bike Infrastructure, Safety Perception, and Built-Environment on Active Transportation Mode Choice: A Random Parameter Model using New York City Commuter Data

Authors: Aziz, H.A., Nagle, N.N., Morton, A.M., Hilliard, M.R., White, D.A. and Stewart, R.N.

Abstract: This study estimates a random parameter (mixed) logit model for active transportation (walk and bicycle) choices for work trips in the New York City (using 2010-2011 Regional Household Travel Survey Data). We explored the effects of traffic safety, walk-bike network facilities, and land use attributes on walk and bicycle mode choice decision in the New York City for home-to-work commute. Applying the flexible econometric structure of random parameter models, we capture the heterogeneity in the decision making process and simulate scenarios considering improvement in walk-bike infrastructure such as sidewalk width and length of bike lane. Our results indicate that increasing sidewalk width, total length of bike lane, and proportion of protected bike lane will increase the likelihood of more people taking active transportation mode. This suggests that the local authorities and planning agencies to invest more on building and maintaining the infrastructure for pedestrians. Further, improvement in traffic safety by reducing traffic crashes involving pedestrians and bicyclists, will increase the likelihood of taking active transportation modes. Our results also show positive correlation between number of non-motorized trips by the other family members and the likelihood to choose active transportation mode. The model would be an essential tool to estimate the impact of improving traffic safety and walk-bike infrastructure which will assist in investment decision making.

Subject Areas: Active transportation; Travel behavior; Random parameter model; Walking; Bicycling

Availability: Aziz, H.A., Nagle, N.N., Morton, A.M., Hilliard, M.R., White, D.A. and Stewart, R.N., 2017. *Exploring the Impact of Walk-bike Infrastructure, Safety Perception, and Built-Environment on Active Transportation Mode Choice: A Random Parameter Model using New York City Commuter Data*. Transportation, pp.1-23.

<https://link.springer.com/article/10.1007/s11116-017-9760-8>

1.11. Title: How Bicycling Sharing System usage is affected by Land Use and Urban Form: Analysis from System and User Perspectives

Authors: Faghih-Imani, A., Eluru, N. and Paleti, R.

Abstract: There is a rapid growth of bicycle-sharing systems (BSS) around the world. Cities are supporting these systems as a more sustainable transport mode for short trips. Given the relatively recent adoption of BSS, there is substantial interest in understanding how these systems impact urban transportation. In this paper, we examine the functioning of the hugely successful New York City CitiBike system. We focus on the interaction of BSS with land-use and built environment attributes and the influence of weather condition and temporal characteristics on BSS usage. Towards this end, CitiBike system is analyzed along two dimensions: (1) at the system level, we examine the hourly station level arrival and departure rates using a linear mixed model and (2) at the trip level, we investigate users' destination station choice preferences after they pick up a bicycle from a station employing a random utility maximization approach. The results highlight clear spatial and temporal differences in the usage of CitiBike by users with annual membership and users with temporary passes. Overall, our analysis provides a framework and useful insights for cities that are planning to install a new bicycle sharing system or to expand an existing system.

Subject Areas: Bicycle-sharing; CitiBike; Destination Choice; Built environment

Availability: Faghih-Imani, A., Eluru, N. and Paleti, R., 2017. *How Bicycling Sharing System usage is affected by Land Use and Urban Form: Analysis from System and User Perspectives*. EJTIR, 17(3), pp.425-441.

http://www.tbm.tudelft.nl/fileadmin/Faculteit/TBM/Onderzoek/EJTIR/Back_issues/17.3/2017_03_07.pdf

1.12. Title: Estimating Walking and Bicycling at the State Level

Authors: Nordback, K., Sellinger, M. and Phillips, T.

Abstract: Estimates of vehicle miles traveled (VMT) drive policy and planning decisions for surface transportation. No similar metric is computed for cycling and walking. What approaches could be used to compute such a metric on the state level? This report discusses three such approaches, identifies the advantages and disadvantages of each, and applies them to Washington State. The first approach employs travel survey data. The second approach is sample-based using pedestrian and bicycle count data. The third approach is an aggregate demand model approach using demographic data combined with count data. Due to data limitations, none of these methods could be properly implemented on the statewide level. Despite the data limits, the methods were implemented for one county (King County) in order to compare findings. The travel survey method estimated the lowest bicycle and pedestrian miles traveled (BMT and PMT), and the sample-based method estimated the highest. The travel survey method is useful for a statewide measure, but it does not provide the detail needed for facility-level estimates. For bicyclists, the sample-based method is appropriate if volumes are desired at the facility level. For pedestrians, the aggregate model might be more appropriate, because of the more dispersed nature of pedestrian travel. Each method has strengths and weaknesses, and each helps us understand bicycle and pedestrian travel in different ways.

For this reason, the project team recommends improving both statewide travel survey data and pedestrian and cyclist traffic count data which feed these methods. Travel survey data should be collected statewide with oversampling for non-motorized travelers. Pedestrian and cyclist traffic counts should be expanded to include a continuous counting program in addition to the short-duration count program. After the continuous count program is in place, short-duration counts should be chosen using a stratified random sampling approach. For example, the sampling frame could consist of all road and path segments in the state divided by region (Coast Range, Puget Lowland, Cascades, Eastern Washington), by urbanity (rural, urban), by facility type (highways/arterials, local/collector roads, paths), and by whether the location is on a bridge or not. To increase sites sampled, the short-duration count program could also be rotated, with each location being counted every three years instead of every year. Better data will allow the state to quantify bicycling and walking at both the state level and facility level to inform decision-making, facility design and planning, and safety analysis.

Subject Areas: Commuting; Pedestrians; Cycling; Automatic data collection systems; Oregon; Transportation Planning

Availability: Nordback, K., Sellinger, M. and Phillips, T., 2017. *Estimating Walking and Bicycling at the State Level*. NITC-RR-708. Portland, OR: Transportation Research and Education Center (TREC).

<http://dx.doi.org/10.15760/trec.163>

1.13. Title: No Need for Training Wheels: Ideas for Including Balance Bikes in Elementary Physical Education

Authors: Becker, A. and Jenny, S.E.

Abstract: Although it was invented nearly two centuries ago in Germany, the balance bike is only now beginning to make its presence known in the United States. A balance bike is a bicycle with no pedals - propelled by running or walking - and is designed to teach young children how to ride a bike in less time by allowing them to practice balance and steering with minimal risk of falling. The use of balance bikes is gaining traction as the “new” way to transition children to riding a bicycle without the need to use training wheels. However, the implementation of a balance bike unit is surprisingly lacking in the vast majority of elementary physical education programs. The purpose of this article is to provide an introduction to the balance bike, highlight the benefits of implementing it in the elementary physical education curriculum, and offer a four-lesson, ready-to-use balance-bike unit plan.

Subject Areas: Balance-bikes; Training wheels; Children

Availability: Becker, A. and Jenny, S.E., 2017. *No Need for Training Wheels: Ideas for Including Balance Bikes in Elementary Physical Education*. *Journal of Physical Education, Recreation & Dance*, 88(4), pp.14-21.

<http://www.tandfonline.com/doi/abs/10.1080/07303084.2016.1270789>

1.14. Title: Improving Walkability Through Control Strategies at Signalized Intersections

Authors: Kothuri, S.M., Kading, A., Smaglik, E.J. and Sobie, C.

Abstract: As cities and communities nationwide seek to develop Complete Streets that foster livability and accommodate all modes, signal timing control strategies that include pedestrians in the operational decision process are gaining importance. This research tested several efficiency-focused pedestrian treatments - coordination, actuated-coordination, free operation, short cycle lengths - and safety-focused treatment including leading pedestrian intervals and Barnes Dance. Using a software-in-the-loop simulation, the operational impacts of these treatments on all users (vehicles, heavy vehicles, bicyclists and pedestrians) at an intersection were evaluated. Results showed that among the efficiency-based treatments, free operation was most beneficial for reducing minor-street pedestrian delays. Both safety treatments increased major-street vehicle delays. A new pedestrian priority algorithm is proposed and developed, which is designed to prioritize pedestrian service under certain traffic conditions. The algorithm is designed to analyze field data and change the user-defined operational strategy to match the conditions in the field. The developed algorithm was deployed at three separate locations, two of which used a Raspberry Pi device and one used the onboard logic processor of the ASC/3 controller. Before-and-after data analysis showed that the algorithm was successful in reducing pedestrian delay. While this research provides field-implementable solutions for reducing pedestrian delays, there is no one “right solution”. Ultimately, choice of a control strategy may rest on operational objectives and geometric characteristics of an intersection. The findings from this research may benefit cities that are looking to create safe, sustainable streets capable of accommodating multiple modes.

Subject Areas: Traffic signs and signals; Pedestrians; Safety measures

Availability: Kothuri, S.M., Kading, A., Smaglik, E.J. and Sobie, C., 2017. *Improving Walkability Through Control Strategies at Signalized Intersections*. NITC-RR-782. Portland, OR: Transportation Research and Education Center (TREC).

<http://www.tandfonline.com/doi/abs/10.1080/07303084.2016.1270789>

1.15. Title: Cycling in Toronto: Route Choice Behavior and Implications to Infrastructure Planning

Author: Li, S.

Abstract: This research investigates the route choice behavior of cyclists in the City of Toronto using data collected from a smartphone application deployed to a large number of cyclists in the City. A total 4,556 cyclists registered for this study and logged over 30,000 commuting trips and 9,600 recreational trips over a study period of 9 months. The routes of individual cycling trips were estimated by a map-matching algorithm using second-by-second GPS readings of each trip and Toronto's cycling road network. Personal information such as age, gender and residence, work or school place was collected from the participants on a voluntary basis. The collected cycling trip data were used to estimate path-size logit route choice models - variant of multinomial logit model for both commuting and recreational trips with various modeling options and combinations of candidate factors. The estimations of the models were evaluated using various performance measures and statistical tests, resulting in findings and conclusions on the optimal modeling structure, the factors that had statistical significant effects on cyclists' routing decisions and the magnitude of these effects.

The modeling results revealed the critical importance of cycling facilities such as bicycle lanes, multiuse pathways and trails on cyclists' route choice decisions. It was shown that directness as measured by travel distance is the most important factor considered by commuting cyclists in making their route choices. It was also found that cyclists prefer cycling along major streets than local streets and do not mind traveling along transit routes. Furthermore, they tend to choose routes with more bicycle facilities especially dedicated off-street facilities. Comparing to recreational trips, the routes chosen for commuting were in general closer to the routes of minimum distance and energy consumption. In contrast, for recreational trips, cyclists were less concerned about the directness or the degree of challenges of the routes. For these trips, cyclists appeared to place safety at a higher priority instead of time as they showed a higher preference to dedicated bike facilities such as bike lanes and off-street bike paths than on-street mixed facility. Weather and personal attributes were not found to be statistical significant in affecting cyclists' route choices. These along with other findings from this thesis research have provided valuable information for Toronto's ongoing effort on bicycle network planning. The results could also be used to enhance route-finding tools available to cyclists for improved cycling experience.

Subject Areas: Cycling; Routechoice decisions; Bicycle facilities

Availability: Li, S., 2017. *Cycling in Toronto: Route Choice Behavior and Implications to Infrastructure Planning*. M.S. Thesis, University of Waterloo

https://uwspace.uwaterloo.ca/bitstream/handle/10012/11250/Li_Siyuan.pdf?sequence=1

1.16. Title: Spring Weather Brings Bicyclists out for the Season

Author: Lavender, D.

Abstract: Blog

Subject Areas: Bicycle; Pedestrian; Commuting Modes

Availability: Lavender, D., 2017. *Spring Weather Brings Bicyclists out for the Season*. The Herald-Dispatch.

http://www.herald-dispatch.com/features_entertainment/spring-weather-brings-bicyclists-out-for-the-season/article_7ab1ab53-c841-5a0b-b8e9-273b6d7764f0.html

1.17. Title: Savannah celebrates National Bike to Work Day

Author: Ray, B.

Abstract: Newspaper Article

Subject Areas: Bike-friendly; National Bike to Work Day

Availability: Ray, B., 2017. *Savannah celebrates National Bike to Work Day*. SavannahNow, Savannah Morning News.

<http://savannahnow.com/news/2017-05-18/savannah-celebrates-national-bike-work-day>

1.18. Title: Examining the Impact of Sample Size in the Analysis of Bicycle-Sharing Systems

Authors: Faghieh-Imani, A. and Eluru, N.

Abstract: Research efforts examining bicycle-sharing systems (BSS) employed a wide range of sample size depending on the temporal or spatial aggregation. This paper proposes a systematic evaluation of the impact of sample size on model estimates, inference measures and predictive performance using data from New York City's CitiBike. We evaluate two major dimensions of BSS data: (1) system usage - impact of contributing factors on hourly arrival and departure rates at station level, (2) user destination choice - impact of factors on users' preference of destination station choice. The model estimation exercises for system demand and destination choice are conducted on several samples of data. The performance of these sample models in terms of parameters, inference statistics and predictions relative to a base sample data is observed. The results would help the analysts to make decisions on sample size for accurately examining BSS usage.

Subject Areas: Sample size; Bicycle-sharing systems; CitiBike New York; Linear mixed model; Multinomial logit model; Arrival and departure rates; Destination choice; Bicycle infrastructure; Land use and built environment

Availability: Faghieh-Imani, A. and Eluru, N., 2017. *Examining the Impact of Sample Size in the Analysis of Bicycle-Sharing Systems*. *Transportmetrica A: transport science*, 13(2), pp.139-161. <http://www.tandfonline.com/doi/abs/10.1080/23249935.2016.1223205>

1.19. Title: Evaluation of an Electric Bike Pilot Project at Three Employment Campuses in Portland, Oregon

Authors: MacArthur, J., Kobel, N., Dill, J. and Mumuni, Z.

Abstract: Oregon, and Portland in particular, is internationally known for its love for bikes. Not only does the region have some of the highest bike ridership but the Oregon bike manufacturing industry is quickly growing. Oregon's electric bike (e-bike) market is also growing but little data are available on the potential market and e-bike user behavior and interest. Only a limited amount of research has explored the potential new market segments for e-bikes and the economic, operational, safety, and transportation issues surrounding e-bikes in the United States. This report examines the results of an electric bike (e-bike) pilot project, which took place April 2014-September 2015 in the Portland region. Participants from three Kaiser Permanente Northwest campuses (1 urban and 2 suburban) were issued an e-bike for 10 weeks to use for various trip purposes, focusing on first/last-mile commuting. Participants were asked to complete three surveys - before, during and after using the e-bike - to evaluate how their perceptions and levels of cycling may have changed. Responses were analyzed using statistical software and a GIS. Results show that participants biked more often and to a wider variety of places than before the study; they become more confident cyclists after the study; and they cited fewer barriers to cycling when given the opportunity to use an e-bike, particularly for overcoming hills and reducing sweat. This study's findings support the general hypothesis that e-bikes enable users to bike to more distant locations, bike more frequently and allow a broader participation in cycling for certain segments of the population by reducing barriers to cycling. Further research is needed to understand how e-bikes might replace other modes of transportation, including standard bicycles, vehicles and public transit.

Subject Areas: Electric bicycles; Cyclists; Electric bicycles; Effect on reducing barriers to cycling

Availability: MacArthur, J., Kobel, N., Dill, J. and Mumuni, Z., 2017. *Evaluation of an Electric Bike Pilot Project at Three Employment Campuses in Portland, Oregon*. NITC-RR-564B. Portland, OR: Transportation Research and Education Center (TREC).
http://pdxscholar.library.pdx.edu/trec_reports/125/

1.20. Title: The Built Environment and Walking

Authors: Riggs, W. and Steiner, R.L.

Abstract: This chapter introduces how the built environment and walking are connected. It looks at the interrelationships within the built environment, and how those are changing given planning and policy efforts to facilitate increased walking for both leisure activity and commuting. Using a broad review and case-based approach, the chapter examines this epistemological development of walking and the built environment over time, reviews the connections, policies and design strategies and emerging issues. The chapter shows many cases of cities which are creating a more walkable environment. It also reveals that emerging issues related to technology and autonomous vehicles, vision zero and car-free cities, and increased regional policy may play a continued role in shaping the built environment for walking. This dialogue provides both a core underpinning and a future vision for how the built environment can continue to influence and respond to pedestrians in shaping a more walkable world.

Subject Areas: Pedestrians; Built Environment; Walkability; Public Health; Street Design; Complete Streets

Availability: Riggs, W. and Steiner, R.L., 2017. *The Built Environment and Walking*. Connecting Sustainable Transport with Health (pp. 139-165). Emerald Publishing Limited.
<http://www.emeraldinsight.com/doi/abs/10.1108/S2044-994120170000009010>

1.21. Title: Utah cyclists share why they ride in 200th Anniversary Year of the Bicycle's Invention

Author: Adams, K.S..

Abstract: Newspaper Article

Subject Areas: Cycling; Public Transportation; Biking trails

Availability: Adams, K.S., 2017. *Utah cyclists share why they ride in 200th Anniversary Year of the Bicycle's Invention*. Desert News Entertainment.

<http://www.deseretnews.com/article/865684237/Utah-cyclists-share-why-they-ride-in-200th-anniversary-year-of-the-bicycles-invention.html>

2. Energy

2.1. Title: Quantifying the Impacts of Electric Vehicle Travel Patterns on Battery Life Span

Authors: Agrawal, S., Liu, X., Jin, X., Vora, A., Shaver, G., Peeta, S., Dietz, J. and Pekny, J.

Abstract: Electric vehicles (EVs) are a promising alternative to conventional vehicles. Several commercial EVs have already been in the market for a few years. However, greater adoption of EVs still faces several challenges. The concern about lifespan of EV batteries due to degradation is one of them. Lifespan information of populations of EV batteries is still scarce. Understanding the lifespan characteristics of EV batteries is significant for EV adoption, vehicle and/or battery resale market, and battery warranty strategy design. This study quantifies the impacts of EV travel patterns on the battery lifespan. Real-world household vehicle travel information extracted from the National Household Travel Survey (NHTS) of 2009 data. A microscopic traffic simulation model is built for the Indianapolis road network to generate speed profiles. Then, household vehicle travel patterns are obtained by matching the NHTS travel information (such as departure time, distance, travel time, purpose, etc.) with the simulated speed profiles. A semi-empirical battery degradation model is used to predict battery lifespan for a simulated population of vehicle travel patterns based upon the NHTS data. The results indicate that vehicle travel patterns, driving behavior (that is, average speed, speed deviation, etc.), and temperature have significant impacts on EV battery lifespan. The impact of vehicle travel patterns and driving behavior increases with decrease in temperature. For Indianapolis, 10% of batteries have lifespan less than 5.15 years, 50% have less than 7.57 years, and 90% have less than 9.65 years.

Subject Areas: Energy; Highways; Vehicles and Equipment

Availability Agrawal, S., Liu, X., Jin, X., Vora, A., Shaver, G., Peeta, S., Dietz, J. and Pekny, J., 2017. *Quantifying the Impacts of Electric Vehicle Travel Patterns on Battery Life Span*. Transportation Research Board 96th Annual Meeting (No.17-00601).
<https://trid.trb.org/view.aspx?id=1437290>

2.2. Title: Regional Charging Infrastructure for Plug-In Electric Vehicles: A Case Study of Massachusetts

Authors: Wood, E., Raghavan, S., Rames, C., Eichman, J. and Melaina, M.

Abstract: This analysis of regional plug-in electric vehicle (PEV) infrastructure was conducted to provide guidance on charging infrastructure for PEVs to regional stakeholders through the U.S. Department of Energy's (DOE's) Vehicle Technologies Office. Given the complex issues associated with PEV charging and options in deploying charging infrastructure, there is interest in exploring scenarios of future charging infrastructure deployment to provide insight and guidance to national and regional stakeholders. The complexity and cost of PEV charging infrastructure pose challenges to decision makers, including individuals, communities, and companies considering infrastructure installations. The value of PEVs to consumers and fleet operators can be increased with well-planned and cost effective deployment of charging infrastructure. This will increase the number of miles driven electrically and accelerate PEV market penetration, increasing the shared value of charging networks to an expanding consumer base. Given these complexities and challenges, the objective of the present study is to provide additional insight into the role of charging infrastructure in accelerating PEV market growth. To that end, existing studies on PEV infrastructure are summarized in a literature review. Next an analysis of current markets is conducted with a focus on correlations between PEV adoption and public charging availability. A forward looking case study is then conducted focused on supporting 300,000 PEVs by 2025 in Massachusetts. The report concludes with a discussion of potential methodology for estimating economic impacts of PEV infrastructure growth.

Subject Areas: Energy; Plug-in electric vehicle (PEV); Infrastructure growth

Availability: Wood, E., Raghavan, S., Rames, C., Eichman, J. and Melaina, M., 2017. *Regional Charging Infrastructure for Plug-In Electric Vehicles: A Case Study of Massachusetts*. (No. NREL/TP-5400-67436). National Renewable Energy Lab.(NREL), Golden, CO (United States). <http://www.nrel.gov/docs/fy17osti/67436.pdf>

2.3. Title: Estimating Household Travel Energy Consumption in Conjunction with a Travel Demand Forecasting Model

Authors: Garikapati, V.M., You, D., Zhang, W., Pendyala, R.M., Guhathakurta, S., Brown, M.A. and Dilkina, B.

Abstract: This paper presents a methodology for the calculation of household travel energy consumption at the level of the traffic analysis zone (TAZ) in conjunction with information that is readily available from a standard four-step travel demand model system. The methodology presented in this paper embeds two algorithms. The first algorithm provides a means of allocating non-home-based trips to residential zones that are the source of such trips, while the second algorithm provides a mechanism for incorporating the effects of household vehicle fleet composition on fuel consumption. The methodology is applied to the Greater Atlanta metropolitan region in the United States. The methodology is found to offer a robust mechanism for calculating household travel energy footprint at the level of the individual TAZ, which makes it possible to study variations in energy footprint across space. It is found that the travel energy footprint is strongly correlated to density of the built environment, although it is likely that socio-economic differences across TAZs also contribute to differences in travel energy footprints. The TAZ-level household travel energy footprint calculator can be used to analyze alternative futures and relate differences in the energy footprint to differences in a number of contributing factors, thus enabling the design of urban form, formulation of policy interventions, and implementation of awareness campaigns that may bring about more sustainable energy consumption patterns.

Subject Areas: Integrated Modeling of Travel Demand and Travel Energy Consumption; Travel Energy Consumption Estimation; Household Travel Energy Demand; Built Environment and Transport Energy Demand

Availability: Garikapati, V.M., You, D., Zhang, W., Pendyala, R.M., Guhathakurta, S., Brown, M.A. and Dilkina, B., 2017. *Estimating Household Travel Energy Consumption in Conjunction with a Travel Demand Forecasting Model*. Transportation Research Board 96th Annual Meeting (No.17-04855).

<http://www.prism.gatech.edu/wzhang300/wenwen/papers/17-TRB-TRAVEL-ENERGY.pdf>

2.4. Title: Modelling Electric Vehicles Use: A Survey on the Methods

Authors: Daina, N., Sivakumar, A. and Polak, J.W.

Abstract: In the literature electric vehicle use is modelled using of a variety of approaches in power systems, energy and environmental analyses as well as in travel demand analysis. This paper provides a systematic review of these diverse approaches using a two-fold classification of electric vehicle use representation, based on the time scale and on substantive differences in the modelling techniques. For time of day analysis of demand we identify activity-based modelling (ABM) as the most attractive because it provides a framework amenable for integrated cross-sector analyses, required for the emerging integration of the transport and electricity network. However, we find that the current examples of implementation of AMB simulation tools for EV-grid interaction analyses have substantial limitations. Amongst the most critical there is the lack of realism how charging behaviour is represented.

Subject Areas: Electric vehicles use; Activity based models; Charging behavior

Availability: Daina, N., Sivakumar, A. and Polak, J.W., 2017. *Modelling Electric Vehicles Use: A Survey on the Methods*. *Renewable and Sustainable Energy Reviews*, 68, pp.447-460.

: <http://www.sciencedirect.com/science/article/pii/S1364032116306566>

2.5. Title: On the Impact of Single-Phase Plug-in Electric Vehicles Charging and Rooftop Solar Photovoltaic on Distribution Transformer Aging

Authors: Gray, M.K. and Morsi, W.G.

Abstract: This study investigates the impact of single-phase plug-in electric vehicles charging on increasing the rate at which center-tapped distribution transformers experience aging. Distribution transformer aging is investigated considering varying rooftop solar photovoltaic generation penetration rates. Monte Carlo methods are used to probabilistically estimate the transformer's loss of life considering the effect of time-of-use (TOU) pricing. The results of applying the proposed method have revealed that plug-in battery electric vehicle charging impact on both transformer aging and neutral current is largest in the case that vehicles charge based on time-of-use pricing methods. Further application has shown that while rooftop solar photovoltaic generation reduces transformer aging, no significant reduction in neutral current is observed.

Subject Areas: Monte Carlo methods; Plug-in electric vehicles; Power quality; Rooftop solar photovoltaics; Transformer aging

Availability: Gray, M.K. and Morsi, W.G., 2017. *On the Impact of Single-Phase Plug-in Electric Vehicles Charging and Rooftop Solar Photovoltaic on Distribution Transformer Aging*. Electric Power Systems Research, 148, pp.202-209.

<http://www.sciencedirect.com/science/article/pii/S0378779617301220>

2.6. Title: Socially Optimal Replacement of Conventional with Electric Vehicles for the U.S. Household Fleet

Authors: Kontou, E., Yin, Y., Lin, Z. and He, F.

Abstract: In this study a framework is proposed for minimizing the societal cost of replacing gas-powered household passenger cars with battery electric ones (BEVs). The societal cost consists of operational costs of heterogeneous driving patterns' cars, the government investments for charging deployment, and monetized environmental externalities. The optimization framework determines the timeframe needed for conventional vehicles to be replaced with BEVs. It also determines the BEVs driving range during the planning timeframe, as well as the density of public chargers deployed on a linear transportation network over time. We leverage datasets that represent U.S. household driving patterns, as well as the automobile and the energy markets, to apply the model. Results indicate that it takes 8 years for 80% of our conventional vehicle sample to be replaced with electric vehicles, under the base case scenario. The socially optimal all-electric driving range is 204 miles, with chargers placed every 172 miles on a linear corridor. All of the public chargers should be deployed at the beginning of the planning horizon to achieve greater savings over the years. Sensitivity analysis reveals that the timeframe for the socially optimal conversion of 80% of the sample varies from 6 to 12 years. The optimal decision variables are sensitive to battery pack and vehicle body cost, gasoline cost, the discount rate, and conventional vehicles' fuel economy. Faster conventional vehicle replacement is achieved when the gasoline cost increases, electricity cost decreases, and battery packs become cheaper over the years.

Subject Areas: Vehicle Replacement; Battery Electric Vehicles (Bevs); Internal Combustion Engine Vehicles (Icevs); Charging Density; All-Electric Driving Range

Availability: Kontou, E., Yin, Y., Lin, Z. and He, F., 2017. *Socially Optimal Replacement of Conventional with Electric Vehicles for the U.S. Household Fleet*. International Journal of Sustainable Transportation, (just-accepted).

<http://www.tandfonline.com/doi/abs/10.1080/15568318.2017.1313341>

2.7. Title: Are Consumers Poorly-Informed about Fuel Economy? Evidence from Two Experiments

Authors: Allcott, H. and Knittel, C.

Abstract: It has long been argued that people are poorly-informed about and inattentive to fuel economy when buying cars, and that this causes us to buy low-fuel economy vehicles despite our own best interest. We test this assertion by running two experiments providing fuel economy information to people shopping for new vehicles. We find zero statistical or economic effect of information on average fuel economy of vehicles purchased. In the context of a simple optimal policy model, the estimates suggest that imperfect information and inattention are not valid as significant justifications for fuel economy standards at current or planned levels.

Subject Areas: Fuel Economy; New Vehicles.

Availability: Allcott, H. and Knittel, C., 2017. *Are Consumers Poorly-Informed about Fuel Economy? Evidence from Two Experiments*. National Bureau of Economic Research,(No. w23076). <http://www.nber.org/papers/w23076>

2.8. Title: Reliability Assessment of Power Grid Supporting Sustainable Transportation

Authors: Wang, X. and Karki, R.

Abstract: This chapter titled “Reliability Assessment of Power Grid Supporting Sustainable Transportation” presents analytical models to evaluate the reliability of a power system with PHEV penetration considering the important PHEV characteristics and charging scenarios. The parameters of the PHEV-30 and the transportation data from NHTS 2009 were used to create the relevant models to obtain the load model of a PHEV. A MCS method was applied to combine individual PHEV models and build the overall model of PHEV fleet. The impact of PHEV penetration in a power system was assessed using the IEEE-RTS as a test system. Different PHEV penetrations and charging scenarios were examined to analyze the results. The results show that the system reliability degrades with the increase in PHEV penetration, and the negative impact is increased with fast charging which requires a higher power demand for a shorter duration. The negative reliability impacts can however be mitigated by shifting and controlling the charging time, which is area of ongoing research.

Subject Areas: Power System; Transportation; PHEV

Availability: Wang, X. and Karki, R., 2017. *Reliability Assessment of Power Grid Supporting Sustainable Transportation*. In *Sustainable Power Systems* (pp. 1-21). Springer Singapore.
https://link.springer.com/chapter/10.1007/978-981-10-2230-2_1

2.9. Title: On the Effects of a Routing and Reservation System on the Electric Vehicle Public Charging Network

Author: Conway, T.

Abstract: One solution to the limited range of battery electric vehicles is the provision of a public charging infrastructure to enable longer journeys. This paper describes a simulation model of a routing and charge point reservation system based on the charging infrastructure deployed in Ireland during early 2016. Extensive Monte Carlo simulations are run using the Irish population density and an estimated trip length distribution. The results show quantitatively the advantages of a routing and charge point reservation systems on a country wide scale in terms of the number of electric vehicles that can be supported. The effect of charge point fault rates is also quantitatively assessed and shown to be a critical factor in public charging infrastructure deployment.

Subject Areas: Routing; Electric vehicles; Resource management

Availability: Conway, T., 2017. *On the Effects of a Routing and Reservation System on the Electric Vehicle Public Charging Network*. IEEE Transactions on Intelligent Transportation Systems, Volume: PP, Issue: 99.

<http://ieeexplore.ieee.org/abstract/document/7811294/?reload=true>

2.10. Title: Intelligent Charge Rate Optimization of PHEVs Incorporating Driver Satisfaction and Grid Constraints

Authors: Darabi, Z., Fajri, P. and Ferdowsi, M.

Abstract: In this paper, an optimization model is developed to find a plug-in hybrid electric vehicle (PHEV) optimum charging rate profile that dynamically varies throughout the day. From the grid point of view, the model takes into account the constraints of maximum demand and charging facilities, while from the driver's point of view, waiting and charging time restrictions are considered. The novelty of this paper lies in maximizing the energy delivered to PHEVs in a region equipped with smart grid technology by intelligently alternating charging rates during the day while incorporating both driver satisfaction constraints as well as grid limitations. Using the proposed optimization model, two cases with optimized charging rates are studied and compared with constant charging levels. Furthermore, quantitative results from the perspective of both power grid contribution and driver satisfaction are presented and discussed in detail for each case.

Subject Areas: Optimization; Smart grids; Batteries; Plug-in hybrid electric vehicles; Customer satisfaction

Availability: : Darabi, Z., Fajri, P. and Ferdowsi, M., 2017. *Intelligent Charge Rate Optimization of PHEVs Incorporating Driver Satisfaction and Grid Constraints*. IEEE Transactions on Intelligent Transportation Systems, 18(5), pp.1325-1332.
<http://ieeexplore.ieee.org/abstract/document/7744591/>

2.11. Title: Energy Demand Model for Residential Sector: A First Principles Approach

Authors: Subbiah, R., Pal, A., Nordberg, E.K., Marathe, A. and Marathe, M.V.

Abstract: According to the U.S. Energy Information Administration (EIA), the residential sector accounts for one-third of the country's energy consumption. This number is steadily increasing, posing a challenge to energy regulators as well as suppliers. To manage the growing demand for energy, there is a need for energy system optimization, especially on the demand side. This paper uses a first principles approach to build a high-resolution energy demand model, which can be used as a test bed by academicians as well as policy makers for performing such optimizations. This framework generates activity-based, building-level, time-dependent demand profiles. The model associates appliance usage with each household activity and calculates energy consumption based on the appliance energy rating, the duration of the energy consuming activity, and the type of activity performed by each household member. It also accounts for shared activities among household members to avoid double counting. Additionally, passive energy consumptions such as space heating/cooling, lighting, etc. are measured. Finally, validation of the results obtained by this model against real-world data for Virginia is carried out. The results indicate that the modeling framework is robust and can be extended to other parts of the U.S. and beyond.

Subject Areas: Activity-based, Appliance Usage; Energy demand; Residential

Availability: Subbiah, R., Pal, A., Nordberg, E.K., Marathe, A. and Marathe, M.V., 2017. *Energy Demand Model for Residential Sector: A First Principles Approach*. IEEE Transactions on Sustainable Energy, PP (99).

<http://ieeexplore.ieee.org/abstract/document/7744591/>

2.12. Title: The Impact of Increased Fuel Economy for Light-Duty Vehicles on the Distribution of Income in the U.S.: A Retrospective and Prospective Analysis

Authors: Greene, D.L. and Welch, J.G.

Abstract: Lower income households tend to spend more on motor fuel than on vehicles while households in the highest income quintile tend to spend more on vehicles (NRC, 2015; CFA, 2012). This observation suggests that the regulatory standards that require increased fuel economy but at the cost of higher vehicle prices might affect the distribution of disposable income in the United States. This study analyzes the effects of historical increases in fuel economy on households' expenditures on fuel and vehicles over the past four decades and quantifies the impacts by income quintile. Distributional impacts are also estimated for future fuel economy improvements which are expected to increase through 2025 given fuel economy standards currently in place. We do not estimate the effects of fuel economy improvements on producer and consumer surplus. Rather we estimate the impacts of fuel economy improvements on disposable income: the difference between decreased expenditures on fuel and increased expenditures on motor vehicles.

Subject Areas: Fuel Economy; Expenditure per Vehicle

Availability: Greene, D.L. and Welch, J.G., 2017. *The Impact of Increased Fuel Economy for Light-Duty Vehicles on the Distribution of Income in the U.S.: A Retrospective and Prospective Analysis*. The Howard H. Baker Jr. Center for Public Policy.

<http://bakercenter.utk.edu/wp-content/uploads/2017/03/WhitePaper2-2017.pdf>

2.13. Title: Experiences and Applications of Electric and Plug-in Hybrid Vehicles in Power System Networks

Authors: Ozansoy, C., Ustun, T.S. and Zayegh, A.

Abstract: Transportation electrification is inevitable driven by rising energy costs, climate and emission control requirements, and availability of petroleum supplies. Even a realistic 10% electrification of transportation is expected to impact the electricity generation, transmission, and distribution capacities, and hence the world economy. In this chapter, the authors seek to enlighten the reader on electric vehicle usage around the world by discussing their applications, electric vehicle trials, and key learnings from these trials across three continents: America, Europe, and Australia. Special emphasis has been given to discussing the commuting trends across the three continents and how that effects the transition into the electrification of transportation. The chapter continues with an impact analysis of electric vehicles on car users, the power quality of grids, and finally carbon emissions. Finally, examples of charging infrastructure and worldwide vehicle-to-grid applications are reviewed. The chapter concludes with a discussion on the need for interoperable communication standards, as an enabling technology for the management of the transactions between the grid and electric vehicles.

Subject Areas: Electric vehicles; Grids; Impacts; Trials; Usage

Availability: Ozansoy, C., Ustun, T.S. and Zayegh, A., 2017. *Experiences and Applications of Electric and Plug-in Hybrid Vehicles in Power System Networks*. Technologies and Applications for Smart Charging of Electric and Plug-in Hybrid Vehicles (pp. 243-280). Springer International Publishing.

https://link.springer.com/chapter/10.1007/978-3-319-43651-7_7

2.14. Title: A Review of Literature on Espousal of Electric and Hybrid Vehicle

Authors: Sharma, N.K. and Sinha, D.B.

Abstract: According to National Electric Mobility Mission Plan (NEMMP) 2020 launched on 9th Jan 2013, under National Electric Vehicle Policy, the principal end objectives of the National Mission for Electric Mobility (NMEM) are national energy security, mitigation of the adverse impact of vehicles on the environment and growth of domestic manufacturing capabilities. NMEM that was approved by the National Council for Electric Mobility (NCEM), as per the projections, 6-7 million units of new vehicle sales of the full range of electric vehicles, along with resultant liquid fuel savings of 2.2-2.5 million tones can be achieved in 2020. This will also result in substantial lowering of vehicular emissions and decrease in carbon di-oxide emissions by 1.3% to 1.5% in 2020 as compared to a status quo scenario. An extensive review of published evidence for the last 20 years across the world carried out in order to capture current knowledge in the area of adoption and absorption of electric and hybrid vehicles (EHVs).

Subject Areas: Electric and Hybrid Vehicles; Attitude; Behavior

Availability: Sharma, N.K. and Sinha, D.B., 2017. *A Review of Literature on Espousal of Electric and Hybrid Vehicle*. International Journal of Business Management and Scientific Research, (27). <http://eminencejournal.com/images/pdf/MC6.pdf>

2.15. Title: San Francisco's 2030 District: Performance and Implications for Urban Energy Efficiency

Authors: Johnstone, E.

Abstract: Buildings are responsible for 40% of the United States' total energy consumption and a proportionate amount of greenhouse gas emissions. Transportation activities are responsible for another 30%, of which a significant amount is linked to workers' daily commutes by car. Individual investments in home energy retrofits are helpful in the fight against climate change, but the greatest opportunities in the built environment lie with commercial properties in urban cores. As one of 15 cities subscribed to the 2030 Challenge, San Francisco has organized 40+ downtown properties to reduce their aggregate energy consumption and commuter-based emissions by 50-100% by 2030. This master's project analyzes energy consumption by District properties against a city-established baseline and reduction target. It also calculates a commuter emissions baseline for the San Francisco 2030 District (SF2030D), and compares it to the District's current performance as measured by a custom survey. The results show that SF2030D has outperformed its peers and reached its 2030 energy target within its first reportable year (2016). These findings have significant implications for the 2030 Challenge's design, and may position SF2030D as a leader in the pursuit of energy efficiency innovations at the district scale. (EHVs).

Subject Areas: Energy consumption; Greenhouse gas emission; Transportation activities

Availability: Johnstone, E., 2017. *San Francisco's 2030 District: Performance and Implications for Urban Energy Efficiency*. M.S. Thesis, Nicholas School of the Environment of Duke University.

https://dukespace.lib.duke.edu/dspace/bitstream/handle/10161/14122/Johnstone_E_MP_2017.pdf?sequence=1

2.16. Title: A Dynamic Stochastic Optimization for Recharging Plug-in Electric Vehicles

Author: Liu, S. and Etemadi, A.H.

Abstract: Abstract: This paper presents a recharging scheme for plugin (hybrid) electric vehicles. Despite their many advantages such as reducing carbon footprint, lower fuel costs, and high performance, uncoordinated recharging of electric vehicles in a high-penetration system can increase system peak load and create new peaks in the demand profile, hence reducing system reliability and operational integrity. To optimize electric vehicle recharging costs and prevent such reliability problems, a dynamic stochastic optimization method is proposed that formulates a stochastic linear programming approach taking into account load, electricity pricing, and renewable energy generation uncertainties, and solves the day-ahead problem in an offline fashion. A second online stage is also proposed that uses offline solutions, collects real-time system data, and adjusts recharging schedules to obtain a better recharging scheme once system uncertainties are revealed. The proposed method is robust to variations in different stochastic parameters, has a low communication requirement, and benefits both users and the power utility. Recharging system structure, data models, and mathematical formulation of the proposed method are presented. Results demonstrate that unlike other recharging schemes, the proposed method does not increase system peak, does not create new peaks, and fills the valleys of demand profile to optimize power system operations.

Subject Areas: Stochastic linear programming; Electric vehicle, Recharging Schemes

Availability: Liu, S. and Etemadi, A.H., 2017. *A Dynamic Stochastic Optimization for Recharging Plug-in Electric Vehicles*. IEEE Transactions on Smart Grid, PP(99).

<http://ieeexplore.ieee.org/abstract/document/7815433/>

2.17. Title: A Data-Driven Optimization-Based Approach for Siting and Sizing of Electric Taxi Charging Stations

Author: Yang, J., Dong, J. and Hu, L.

Abstract: This paper presents a data-driven optimization-based approach to allocate chargers for battery electric vehicle (BEV) taxis throughout a city with the objective of minimizing the infrastructure investment. To account for charging congestion, an M/M/x/s queueing model is adopted to estimate the probability of BEV taxis being charged at their dwell places. By means of regression and logarithmic transformation, the charger allocation problem is formulated as an integer linear program (ILP), which can be solved efficiently using Gurobi solver. The proposed method is applied using large-scale GPS trajectory data collected from the taxi fleet of Changsha, China. The key findings from the results include the following: (1) the dwell pattern of the taxi fleet determines the siting of charging stations; (2) by providing waiting spots, in addition to charging spots, the utilization of chargers increases and the number of required chargers at each site decreases; and (3) the tradeoff between installing more chargers versus providing more waiting spaces can be quantified by the cost ratio of chargers and parking spots.

Subject Areas: Electric taxis; Charging infrastructure planning; GPS trajectory data; Integer programming; Queueing model

Availability: Yang, J., Dong, J. and Hu, L., 2017. *A Data-Driven Optimization-Based Approach for Siting and Sizing of Electric Taxi Charging Stations*. *Transportation Research Part C: Emerging Technologies*, 77, pp.462-477.

<http://www.sciencedirect.com/science/article/pii/S0968090X17300542>

2.18. Title: Model-Based Analysis of V2G Impact on Battery Degradation

Authors: Wang, L. and Chen, B.

Abstract: Vehicle-to-Grid (V2G) service has a potential to improve the reliability and stability of the electrical grid due to the ability of providing bi-directional power flow from/to the grid. However, frequent charging/discharging may impact the battery lifetime. This paper presents the analysis of battery degradation in three scenarios. In the first scenario, different battery capacities are considered. In the second scenario, the battery degradation with various depth of discharge (DOD) are studied. In the third scenario, the capacity loss due to different charging regime are compared. The charging/discharging of plug-in electric vehicles (PEVs) are simulated in a single-phase microgrid system integrated with a photovoltaics (PV) farm, an energy storage system (ESS), and ten electric vehicle service equipment (EVSE). The battery degradation model is an energy throughput model, which is developed based on the Arrhenius equation and a power law relationship between time and capacity fading. The simulation results show that V2G service potentially increases the PEV battery degradation. With the same DOD, higher battery capacity can increase the degradation degree. For a specific PEV battery, the higher DOD, higher temperature, and more frequent discharging accelerate the battery degradation to some extent.

Subject Areas: Electric vehicles; Batteries; Energy storage systems; Vehicle to grid (V2G)

Availability: Wang, L. and Chen, B., 2017. *Model-Based Analysis of V2G Impact on Battery Degradation*. . SAE Technical Paper, (2017-01-1699).
<http://papers.sae.org/2017-01-1699/>

2.19. Title: Environmentally-friendly Demand Response for Residential Plug-in Electric Vehicles

Authors: Rassaei, F., Soh, W.S., Chua, K.C. and Modarresi, M.S.

Abstract: In December 2015, the world has reached an agreement in Paris by which many countries commit to bolster their efforts about reducing adverse climate changes. Hence, we can expect that decarbonization will even attract more attention in different energy sectors in near future. In particular, both generation side and consumption side are required to be run more congruently and environmentally friendly. Thus, employing the renewables at the generation side along with our proposed decarbonized demand response (DDR) at the consumption side could significantly reduce deleterious impacts on the climate. In this paper, we present such matching demand response (DR) algorithm for residential users owning vehicle-to-grid (V2G) enabled plug-in electric vehicles (PEVs) who obtain electricity from a common retailer. The retailer itself is connected to the wholesale electricity market to purchase and sell electricity. Our simulation results illustrate that substantial cost savings can be achieved along with pollution reduction by our proposed technique.

Subject Areas: Vehicle to grid (V2G); Climate change; Plug-in electric vehicles (PEVs); Power demand elasticity; Residential load, Smart grids

Availability: Rassaei, F., Soh, W.S., Chua, K.C. and Modarresi, M.S., 2017. *Environmentally-friendly Demand Response for Residential Plug-in Electric Vehicles*. In Power and Energy Conference (TPEC), IEEE Texas (pp. 1-6). IEEE.

<http://ieeexplore.ieee.org/abstract/document/7868269/>

2.20. Title: Distribution System Planning to Accommodate Distributed Energy Resources and PEVs

Authors: Humayd, A.S.B. and Bhattacharya, K.

Abstract: With deregulation of the power industry, environmental policy changes, advancements in technology, and the transformation to smart grid, the distribution planning paradigm has gone through significant changes in recent years. Concurrently, with increase in gas prices, driven by a foreseeable fossil fuel depletion in the future, developments in the automotive sector, and environmental concerns, penetration of plug-in electric vehicles (PEVs) has been increasing. These changes will continue to drive the distribution planning problem to evolve in the coming years. This paper presents a comprehensive long-term distribution planning framework from the perspective of local distribution companies (LDCs) considering distributed generation (DG), substations, capacitors, and feeders. Apart from considering the usual demand profile, the proposed framework considers uncontrolled and controlled (smart) PEV charging demand, as well as demand response (DR) options. Based on a back-propagation algorithm combined with cost-benefit analysis, a novel approach is proposed to determine the optimal upgrade plan, allocation, and sizing of the selected components in distribution systems, to minimize the total capital and operating cost. A new iterative method is proposed which involves post-processing the plan decisions to guarantee acceptable adequacy levels for each year of the planning horizon. The performance of the proposed framework is examined considering several case studies on the 33-bus and 69-bus test systems. It is noted from the studies that the presence of uncontrolled PEV charging loads results in much higher plan costs as compared to the case without PEVs, impacts the distribution plan significantly, and hence these loads indeed need be considered in the planning process. On the other hand, smart charging of PEVs have a much reduced impact on the plan cost, and helps alleviate some investments which were needed with uncontrolled charging PEVs. Therefore, the LDCs and policy makers need to encourage customers to adapt these options in the long-run.

Subject Areas: Distributed generation; Distribution planning; Local distribution company; Plug-in electric vehicles; Demand response

Availability: Humayd, A.S.B. and Bhattacharya, K., 2017. *Distribution System Planning to Accommodate Distributed Energy Resources and PEVs*. Electric Power Systems Research, 145, pp.1-11.

<http://www.sciencedirect.com/science/article/pii/S0378779616305296>

2.21. Title: Optimal Design of Electric Vehicle Charging Stations Considering Various Energy Resources

Authors: Hafez, O. and Bhattacharya, K.

Abstract: In this paper the optimal design of an Electric Vehicle Charging Station (EVCS) with the goal of minimizing the lifecycle cost, while taking into account environmental emissions, is presented. Different energy sources such as renewable energy technology based and diesel generation are considered, with realistic inputs on their physical, operating and economic characteristics. In order to address the "range anxiety", concern of EV owners regarding the distance the vehicle can travel, the design of an EVCS along highways, as an isolated microgrid, is studied. In another study, the EVCS is assumed to be connected to the grid as a smart energy hub. The charging demand of the EVCS is estimated considering real drive data. Analysis is also carried out to compare the economics of a grid-connected EVCS with an isolated EVCS and the optimal break-even distance for the grid connected EVCS to be a viable option, is determined.

Subject Areas: Electric vehicle charging station; Renewable energy; Plug-in electric vehicle; Microgrid; Environmental emissions

Availability: Hafez, O. and Bhattacharya, K., 2017. *Optimal Design of Electric Vehicle Charging Stations Considering Various Energy Resources*. Renewable Energy, 107, pp.576-589.

https://www.researchgate.net/publication/313685398_Optimal_design_of_electric_vehicle_charging_stations_considering_various_energy_resources

2.22. Title: Reliability Studies of Modern Distribution Systems Integrated with Renewable Generation and Parking Lots

Authors: Farzin, H., Fotuhi-Firuzabad, M. and Moeini-Aghaie, M.

Abstract: This paper investigates the role of parking lots in improving the reliability of renewable-based distribution systems, through provision of vehicle-to-grid (V2G) programs during outage events. In this regard, municipal parking decks are viewed as distributed energy storage systems and the amount of available energy from these units in random contingency events is probabilistically modeled for reliability studies. Appropriate stochastic models are also introduced to capture the volatility and intermittency of renewable sources. Moreover, it is discussed that how the adopted outage management scheme (OMS) in contingency events can affect the reliability level of customers. In response, several OMSs on the basis of bankruptcy problem are proposed to fairly distribute the available resources among different microgrids/sections, once a failure occurs in the system. Subsequently, a general framework based on the non-sequential Monte Carlo simulation method is developed to evaluate different customers and system reliability indices in presence of emergency V2G programs. The effectiveness of the proposed framework is validated through implementation on a test system and several case studies are presented. The results suggest that realization of V2G programs offered by EV parking lots, accompanied by an appropriate OMS, can significantly enhance the reliability of supply in modern distribution networks.

Subject Areas: Reliability; Renewable energy sources (RESs); Parking deck; Batteries

Availability: Farzin, H., Fotuhi-Firuzabad, M. and Moeini-Aghaie, M., 2017. *Reliability Studies of Modern Distribution Systems Integrated with Renewable Generation and Parking Lots*. IEEE Transactions on Sustainable Energy, 8(1), pp.431-440.

<http://www.mdpi.com/2071-1050/9/2/323/htm>

2.23. Title: A MPC-Based PEV Charging Scheduling

Authors: Tang, W. and Zhang, Y.J.A.

Abstract: Recall that in Chap. 2, the controller of PEV charging station relies on no assumptions nor predictions of the future information. Whereas in this chapter, we study another practical scenario, where the non-causal information about future PEV arrivals is not known in advance, but its statistical information can be estimated. In fact, the statistical information of the future charging demands can often be acquired through historic data, which benefits the control of the PEV charging scheduling in practical scenarios.

Subject Areas: Plug-in Electric Vehicle (PEV); Energy

Availability: Tang, W. and Zhang, Y.J.A., 2017. *A MPC-Based PEV Charging Scheduling*. In *Optimal Charging Control of Electric Vehicles in Smart Grids* (pp. 47-76). Springer International Publishing.

https://link.springer.com/chapter/10.1007/978-3-319-45862-5_3

2.24. Title: Decentralized Electric Vehicle Charging Strategies for Reduced Load Variation and Guaranteed Charge Completion in Regional Distribution Grids

Authors: Zhang, W., Zhang, D., Mu, B., Wang, L.Y., Bao, Y., Jiang, J. and Morais, H.

Abstract: A novel, fully decentralized strategy to coordinate charge operation of electric vehicles is proposed in this paper. Based on stochastic switching control of on-board chargers, this strategy ensures high-efficiency charging, reduces load variations to the grid during charging periods, achieves charge completion with high probability, and accomplishes approximate “valley-filling”. Further improvements on the core strategy, including individualized power management, adaptive strategies, and battery support systems, are introduced to further reduce power fluctuation variances and to guarantee charge completion. Stochastic analysis is performed to establish the main properties of the strategies and to quantitatively show the performance improvements. Compared with the existing decentralized charging strategies, the strategies proposed in this paper can be implemented without any information exchange between grid operators and electric vehicles (EVs), resulting in a communications cost reduction. Additionally, it is shown that by using stochastic charging rules, a grid-supporting battery system with a very small energy capacity can achieve substantial reduction of EV load fluctuations with high confidence. An extensive set of simulations and case studies with real-world data are used to demonstrate the benefits of the proposed strategies.

Subject Areas: Battery storage system; decentralized charging strategy; Distribution grid; Electric vehicle; Load variation

Availability: Zhang, W., Zhang, D., Mu, B., Wang, L.Y., Bao, Y., Jiang, J. and Morais, H., 2017. *Decentralized Electric Vehicle Charging Strategies for Reduced Load Variation and Guaranteed Charge Completion in Regional Distribution Grids*. *Energies*, 10(2), p.147.

<http://www.mdpi.com/1996-1073/10/2/147/htm>

2.25. Title: Development of a Control System for a Series-Parallel Plug-In Hybrid Electric Vehicle

Author: Lebel, A.

Abstract: This thesis outlines the development of a control system for a series-parallel plugin hybrid electric vehicle. The vehicle, developed at McMaster University for the EcoCAR 3 Advanced Vehicle Technology Competition, was produced in an effort to provide a Chevrolet Camaro with a high-performance, fuel efficient, hybrid powertrain.

A rational design methodology was adopted and guided the development of the control system and the implementation of its respective algorithms. A simulation tool was created using MATLAB and Simulink which, in turn, allowed for the effectiveness of the supervisory control logic to be evaluated by approximating the vehicle's energy consumption, fuel consumption, and emissions. The impact of hybridizing the vehicle's powertrain was similarly assessed by comparing it against its un-electrified counterpart, the 2016 Chevrolet Camaro LT. A solution to the vehicle's energy management problem was proposed in the form of an Adaptive Equivalent Consumption Minimization Strategy (A-ECMS) which was then evaluated against more common heuristic approaches as well as non-adaptive instantaneous minimization methods. An artificial neural network was selected as the strategy's adaptation mechanism and it was used to identify specific vehicular driving patterns in real-time. The neural network addresses many issues that arise due to the sensitivity of algorithms that attempt to solve the energy management problem without prior knowledge of the driving cycle.

The methods used during the process of the control system's verification and calibration are also discussed in this thesis and, in addition, encompass the use of software representations of the vehicle's Electronic Control Units (ECUs), the development of test cases, and the supervisory control software's evaluation in the Model-in-the-Loop (MIL), Software-in-the-Loop (SIL), and Hardware-in-the-Loop (HIL) environments.

Subject Areas: Plugin hybrid electric vehicle; Energy consumption

Availability: Lebel, A., 2017. *Development of a Control System for a Series-Parallel Plug-In Hybrid Electric Vehicle*. M.S. Thesis, McMaster University.

file:///Users/Apara/Downloads/Lebel_Alexander_M_March2017_MASc.pdf

2.26. Title: Opportunistic Energy Sharing Between Power Grid and Electric Vehicles: A Game Theory-Based

Authors: Sarker, A., Li, Z., Kolodzey, W. and Shen, H.

Abstract: Electric vehicles (EVs) have great potential to reduce dependency on fossil fuels. The recent surge in the development of online EV (OLEV) will help to address the drawbacks associated with current generation EVs, such as the heavy and expensive batteries. OLEVs are integrated with the smart grid of power infrastructure through a wireless power transfer system (WPT) to increase the driving range of the OLEV. However, the integration of OLEVs with the grid creates a tremendous load for the smart grid. The demand of a power grid changes over time and the price of power is not fixed throughout the day. There should be some congestion avoidance and load balancing policy implications to ensure quality of services for OLEVs. In this paper, first, we conduct an analysis to show the existence of unpredictable power load and congestion because of OLEVs. We use the Simulation for Urban Mobility tool and hourly traffic counts of a road section of the New York City to analyze the amount of energy OLEVs can receive at different times of the day. Then, we present a game theory based on a distributed power schedule framework to find the optimal schedule between OLEVs and smart grid. In the proposed framework, OLEVs receive the amount of power charging from the smart grid based on a power payment function which is updated using best response strategy. We prove that the updated power requests converge to the optimal power schedule. In this way, the smart grid maximizes the social welfare of OLEVs, which is defined as mixed consideration of total satisfaction and its power charging cost. Finally, we verify the performance of our proposed pricing policy under different scenarios in a simulation study.

Subject Areas: Electric vehicles; Online electric vehicles; Wirelesspower transfer; Smart grid

Availability: Sarker, A., Li, Z., Kolodzey, W. and Shen, H., 2017. *Opportunistic Energy Sharing Between Power Grid and Electric Vehicles: A Game Theory-Based*. University of Virginia <http://www.cs.virginia.edu/z15uq/paper/conference/Opportunistic-ICDCS2017.pdf>

2.27. Title: Energy Efficiency Mandates Are Worse for Poor Americans Than Energy Taxes

Author: Bailey, R.

Abstract: Blog

Subject Areas: Energy efficiency standard; Energy taxes

Availability: Bailey, R., 2017. *Energy Efficiency Mandates Are Worse for Poor Americans Than Energy Taxes*. Reason.com Blog.

<http://reason.com/archives/2017/01/27/energy-efficiency-standards-are-worse-fo>

2.28. Title: Smart Operation of Four-Quadrant Electric Vehicle Chargers in Distribution Grids

Author: Restrepo Restrepo, M.

Abstract: Many policies and programs adopted in the context of climate change mitigation and substitution of fossil fuels are contributing to the continuous development and growth of Electric Vehicles (EVs) in urban mobility systems, reaching 1.26 million units on the roads through the end of 2015. Even though the increasing number of EVs will create problems in distribution systems, which can be mitigated using smart charging strategies, there will also be economic opportunities for EV owners to provide services to the grid while their vehicle are parked and plugged in, a concept known as Vehicle-to-Grid (V2G). Most of the studies on V2G have concentrated on the provision of services such as frequency regulation or spinning reserves, which may reduce the battery life because of the required extra charging/discharging cycles, and little attention has been paid to the possibility of providing reactive power control services to the grid by using the ac/dc converter and the dc link capacitor available in most advanced chargers, a practice that does not compromise the vehicle battery life. These kinds of chargers, which are known as four-quadrant EV chargers due to the capability of being operated in all quadrants of the P-Q plane, can be used in distribution networks to improve the power factor and help regulate voltage, thus facilitating larger EV penetrations, as discussed in this thesis.

In the first part of this thesis, a new average model of a single-phase, four-quadrant EV charger is developed. The steady-state and step responses of the proposed model for different P-Q requests, corresponding to the operation in the four quadrants of the P-Q plane, are used to validate its performance against a four-quadrant EV charger prototype. The model is shown to be useful for efficient time-domain simulations and studies that include a number of EV chargers, such as EV integration studies in Low-Voltage (LV) distribution networks. A practical case study is presented to demonstrate and test the performances of the four-quadrant charger and its model, investigating the voltage interactions of several chargers in an LV residential network during the provision of three vehicle-to-grid (V2G) strategies for active and reactive power.

In the second part, a novel three-stage algorithm to coordinate the operation of four-quadrant EV chargers with other volt/var control devices in Medium-Voltage (MV) and LV distribution feeders is proposed. The first stage of the algorithm is operated on a day-ahead basis and defines the Load Tap Changer (LTC) and capacitor schedules while minimizing the peak load associated with EVs in the distribution system. The second and third stages update their operation every five minutes, to fairly allocate the aggregated and individual EV loads in the MV and LV feeders, respectively, while minimizing active power losses and voltage deviations. The proposed technique is applied to CIGRE's North-American MV and LV benchmark systems to demonstrate its ability to properly allocate EV loads, and improve distribution system performance in terms of losses and voltage profiles.

Subject Areas: Electric Vehicle; Vehicle-to-Grid (V2G)

Availability: Restrepo Restrepo, M., 2017. *Smart Operation of Four-Quadrant Electric Vehicle Chargers in Distribution Grids* Doctoral Thesis, University of Waterloo, Ontario, Canada.

https://uwspace.uwaterloo.ca/bitstream/handle/10012/11870/RestrepoRestrepo_Mauricio.pdf?sequence=3&isAllowed=y

2.29. Title: A Second Order Cone Programming Model for Planning PEV Fast-Charging Stations

Author: Zhang, H., Moura, S., Hu, Z., Qi, W. and Song, Y.

Abstract: This paper studies siting and sizing of plug-in electric vehicle (PEV) fast-charging stations on coupled transportation and power networks. We develop a closed-form service rate model of PEV fast-charging stations' service abilities, which considers heterogeneous PEV driving ranges and charging demands. We utilize a modified capacitated flow refueling location model based on sub-paths (CFRLM SP) to explicitly capture time varying PEV charging demands on the transportation network under driving range constraints. We explore extra constraints of the CFRLM SP to enhance model accuracy and computational efficiency. We then propose a stochastic mixed-integer second order cone programming (SOCP) model for PEV fast-charging station planning. The model considers the transportation network constraints of CFRLM SP and the power network constraints with AC power flow. Numerical experiments are conducted to illustrate the effectiveness of the proposed method.

Subject Areas: Plug-in electric vehicle; Charging station; Heterogeneous driving ranges; Transportation; Power system; Second order cone programming.

Availability: Zhang, H., Moura, S., Hu, Z., Qi, W. and Song, Y., 2017. *A Second Order Cone Programming Model for Planning PEV Fast-Charging Stations*. IEEE, arXiv preprint.

<https://arxiv.org/pdf/1702.01897.pdf>

2.30. Title: Robust Frequency Regulation Capacity Scheduling Algorithm for Electric Vehicles

Author: Yao, E., Wong, V.W. and Schober, R.

Abstract: Electric vehicles (EVs) have the potential to provide frequency regulation service to an independent system operator (ISO) by changing their real-time charging or discharging power according to an automatic generation control (AGC) signal. Recently, the Federal Energy Regulatory Commission has issued Order 755 to ISOs to introduce a performance-based compensation scheme in the frequency regulation market. The goal is to provide economic incentives for fast ramping resources such as EVs to participate in the market. In this paper, we model the EV frequency regulation service under the performance-based compensation scheme. Thereby, a robust optimization framework is adopted for the formulation of a frequency regulation capacity scheduling problem. Our problem formulation takes into account the performance-based compensation scheme, the random AGC signal, and the dynamic arrival and departure times of the EVs. We propose an efficient algorithm to solve the formulated problem. Simulation results show that the proposed algorithm improves the revenue under the performance-based compensation scheme compared with a benchmark algorithm.

Subject Areas: Electric vehicles; Frequency regulation; Robust optimization; Scheduling algorithm

Availability: Yao, E., Wong, V.W. and Schober, R., 2017. *Robust Frequency Regulation Capacity Scheduling Algorithm for Electric Vehicles*. IEEE Transactions on Smart Grid, 8(2), pp.984-997. https://scholar.google.com/scholar?start=220&q=NHTS+%22National+Household+Travel+Survey%22&hl=en&as_sdt=0,21&as_ylo=2017&as_yhi=2017

2.31. Title: Mitigation of the Impact of High Plug-in Electric Vehicle Penetration on Residential Distribution Grid Using Smart Charging Strategies

Authors: Cao, C., Wang, L. and Chen, B.

Abstract: Vehicle electrification presents a great opportunity to reduce transportation greenhouse gas emissions. The greater use of plug-in electric vehicles (PEVs), however, puts stress on local distribution networks. This paper presents an optimal PEV charging control method integrated with utility demand response (DR) signals to mitigate the impact of PEV charging to several aspects of a grid, including load surge, distribution accumulative voltage deviation, and transformer aging. To build a realistic PEV charging load model, the results of National Household Travel Survey (NHTS) have been analyzed and a stochastic PEV charging model has been defined based on survey results. The residential distribution grid contains 120 houses and is modeled in GridLAB-D. Co-simulation is performed using Matlab and GridLAB-D to enable the optimal control algorithm in Matlab to control PEV charging loads in the residential grid modeled in GridLAB-D. Simulation results demonstrate the effectiveness of the proposed optimal charging control method in mitigating the negative impacts of PEV charging on the residential grid.

Subject Areas: Demand Response (DR); Gridlab-D; Plug-in Electric Vehicle (PEV) Charging; Power Distribution System

Availability: Cao, C., Wang, L. and Chen, B., 2016. *Mitigation of the Impact of High Plug-in Electric Vehicle Penetration on Residential Distribution Grid Using Smart Charging Strategies*. *Energies*, 9(12), p.1024.

<http://www.mdpi.com/1996-1073/9/12/1024/html>

2.32. Title: Modeling of Plug-in Electric Vehicle Travel Patterns and Charging Load Based on Trip Chain Generation

Authors: Wang, D., Gao, J., Li, P., Wang, B., Zhang, C. and Saxena, S.

Abstract: Modeling PEV travel and charging behavior is the key to estimate the charging demand and further explore the potential of providing grid services. This paper presents a stochastic simulation methodology to generate itineraries and charging load profiles for a population of PEVs based on real-world vehicle driving data. In order to describe the sequence of daily travel activities, we use the trip chain model which contains the detailed information of each trip, namely start time, end time, trip distance, start location and end location. A trip chain generation method is developed based on the Naive Bayes model to generate a large number of trips which are temporally and spatially coupled. We apply the proposed methodology to investigate the multi-location charging loads in three different scenarios. Simulation results show that home charging can meet the energy demand of the majority of PEVs in an average condition. In addition, we calculate the lower bound of charging load peak on the premise of lowest charging cost. The results are instructive for the design and construction of charging facilities to avoid excessive infrastructure.

Subject Areas: Multi-location charging; Electric power systems; Plug-in electric vehicle; Trip chain; Naive Bayes model

Availability: Wang, D., Gao, J., Li, P., Wang, B., Zhang, C. and Saxena, S., 2017. *Modeling of Plug-in Electric Vehicle Travel Patterns and Charging Load Based on Trip Chain Generation*. Journal of Power Sources, 359, pp.468-479.

<http://www.sciencedirect.com/science/article/pii/S0378775317306687>

2.33. Title: Optimal allocation for electric vehicle charging stations using Trip Success Ratio

Authors: Alhazmi, Y.A., Mostafa, H.A. and Salama, M.M.

Abstract: This paper proposes a new model for optimally allocating Plug-in Electric Vehicle (PEV) Charging Stations (CSs) in the network. The model considers Trip Success Ratio (TSR) in order to enhance CS accessibility for PEV drivers. Diversity of usage and different driving habits are considered in the presented model, as well as different trip types (In-city, Highway). The allocation model has two stages: modeling TSR to estimate Charging Station Service Range (CSSR), and the CS allocation stage. In the first stage, the service range of charging stations has been estimated using TSR with consideration of the uncertainty of trip distances (In-city, Highway) and the uncertainty in the Remaining Electric Range (RER) of PEVs. The estimated CSSR is utilized in the CS allocation stage in order to optimize the CS location set that covers the network with a certain guaranteed TSR level. The allocation problem has been formulated as the Maximum Covering Location Problem (MCLP) in order to make the optimal decision for allocating CSs in the network.

Subject Areas: Plug-in electric vehicles; Service range; Siting charging stations; Trip Success Ratio

Availability: Alhazmi, Y.A., Mostafa, H.A. and Salama, M.M., 2017. *Optimal allocation for electric vehicle charging stations using Trip Success Ratio*. . International Journal of Electrical Power & Energy Systems, 91, pp.101-116.

<http://www.sciencedirect.com/science/article/pii/S0142061516314260>

2.34. Title: Estimating the Benefits of Fuel Economy Information: An Analysis, Update and Recommendations for Enhancing ORNL's Methodology

Authors: Greene, D.L. and Welch, J.G.

Abstract: Since the mid-1970s, the federal government has produced and published information on the fuel economy of new passenger cars and light trucks as required by statute (EPA, 2017a). Beginning in 1999, the Department of Energy (DOE) and Oak Ridge National Laboratory (ORNL) established a website to more efficiently provide fuel economy information to the public. This report reviews the methods and data used by DOE/ORNL to estimate the dollar and petroleum savings due to their fuel economy information efforts. We find that the methods used to estimate savings are reasonable and appropriately transparent, given the existing state of knowledge and available data. Where possible, we updated time-sensitive data. However, empirical data are lacking for many of the key steps in the estimation process which forced DOE/ ORNL to make plausible assumptions about important parameters. In general, conservative assumptions have been used, reflecting a preference for under-estimating the program's benefits. In a few cases we recommend even more conservative estimates. We carried out an analysis of the sensitivity of estimated benefits to uncertain parameters. Parameters were grouped into three classes and assigned approximate uncertainty ranges: 1) well supported by empirical data (+/- 10%), 2) supported by incomplete or indirect empirical evidence (+/-20%) or 3) plausible conjectures (+/-50%). Ten thousand Monte Carlo simulations each were run using first uniform and then triangular probability distributions. Estimated dollar savings in 2016 due to the program's activities in that year alone ranged from a minimum of \$40 million to a maximum of \$220 million. Estimated savings in all future years due to the program's 2016 activities ranged from \$230 million to \$1.7 billion. Petroleum savings and estimated greenhouse gas (GHG) reductions were of similar magnitude. We consider the finding that the impacts of the program are orders of magnitude larger than the program's cost to be reasonably robust. Sensitivity analysis indicated that assumptions about the fraction of new car buyers visiting the website (www.fueleconomy.gov) who changed their new car choices as a result of their visit had the greatest impact on estimated benefits. Next in importance was the increase in fuel economy resulting from information obtained from the website. We make specific recommendations concerning periodic updating of data and the use of online surveys of website customers to develop empirical support of key parameters.

Subject Areas: Fuel economy; New car choices; Monte Carlo simulations; Sensitivity analysis

Availability: Greene, D.L. and Welch, J.G., 2017. *Estimating the Benefits of Fuel Economy Information: An Analysis, Update and Recommendations for Enhancing ORNL's Methodology*. Oak Ridge National Laboratory and Howard H. Baker Jr. Center for Public Policy.
<http://bakercenter.utk.edu/wp-content/uploads/2017/03/WhitePaper1-2017.pdf>

2.35. Title: A Cost Efficiency Analysis for Private Vehicles: Determinants for Households' Choices of Vehicles Using a Household-Level Commute Data Approach

Author: Vu, T.

Abstract: In attempts to evaluate the different levels of fuel efficiencies across different types of vehicles, this paper uses a household-level commute dataset to look at the different determinants for a household owning an efficient vehicle. Employing both an OLS and a Probit model, the empirical results illustrate that the current number of vehicles and the vehicle's purchasing price are the attributes that most significantly affect the household's probability to own an efficient vehicle. A similar analysis is adopted for the case of electric vehicles as well. A further analysis includes calculations for different total costs of owning vehicles with different fuel economies. The results of these calculations suggest that while the more efficient vehicle is more expensive to own at first, its benefits will outweigh its costs as the vehicle is utilized more.

Subject Areas: fuel efficiency; Household vehicle choice; OLS; Probit model

Availability: Vu, T., 2017. *A Cost Efficiency Analysis for Private Vehicles: Determinants for Households' Choices of Vehicles Using a Household-Level Commute Data Approach*. Economics Student Theses and Capstone Projects. 37, Skidmore College.

http://creativematter.skidmore.edu/econ_studt_schol/37/?utm_source=creativematter.skidmore.edu%2Fecon_studt_schol%2F37&utm_medium=PDF&utm_campaign=PDFCoverPages

2.36. Title: A New Model of Charging Demand Related to Plug-in Hybrid Electric Vehicles Aggregation

Authors: Pouladi, J., Bannae Sharifian, M.B. and Soleymani, S.

Abstract: This paper offers a comprehensive and exact model for Plug-in Hybrid Electric Vehicle (PHEV) aggregation based on the real statistics. For this purpose, available transportation and technical reports are analyzed to extract Cumulative Distribution Functions and accurate modeling of PHEVs charging load profile. We can study PHEVs effects on the distribution system by analyzing available registered data; however, the main problem is that such data, due to the low penetration of PHEVs, are not accessible, and expensive monitoring equipment such as Global Positioning Systems are needed to collect such data. Therefore, due to the lack of access to such data, researchers have offered different estimations for the charging load profile of PHEVs using statistical methods. In this study, a new model for the initial state of charge (SOC) is introduced that it is a function of fuel consumption of the vehicles. The driving behaviors such as speed and road slope have been considered in the proposed model. Simulation results show the impressiveness effectiveness and accuracy of the proposed methodology.

Subject Areas: Plug-In Hybrid Electric Vehicles (PHEVs); Load Profile, Aggregated Model; Charging Curve; Distribution System; Monte Carlo Simulation; State of Charge (SOC); All Electric Range (AER); Charge Level; Power Unbalance

Availability: Pouladi, J., Bannae Sharifian, M.B. and Soleymani, S., 2017. *A New Model of Charging Demand Related to Plug-in Hybrid Electric Vehicles Aggregation*. Electric Power Components and Systems, pp.1-16.

<http://www.tandfonline.com/doi/full/10.1080/15325008.2017.1312719?scroll=top&needAccess=true>

2.37. Title: Optimal Scheduling of the Plug-in Electric Vehicles Aggregator Energy and Regulation Services Based on Grid to Vehicle

Authors: Hou, M., Zhao, Y. and Ge, X.

Abstract: The advantage of grid-to-vehicle power over vehicle to grid is that the existing power grid infrastructure and technology are able to support its operation. In this paper, a regulation operation framework for grid-to-vehicle-based plug-in electric vehicle (PEV) aggregator is proposed. Based on that, PEVs can provide regulation services during charging. The objective function consider the influence of regulation services on the energy of battery charging for PEVs and the constraint of systems for battery charging power of PEVs, achieving the maximum aggregator earnings. A regulation algorithm is proposed for the aggregator to schedule PEVs. The algorithm considers the constraint of PEVs battery capacity and reduces the communication traffic between the aggregator and the PEVs. Simulation results indicate that the optimal scheduling can not only increase the earnings of the aggregator but also reduce the charging cost of PEV owners on the basis of meeting the charging requirements of PEVs.

Subject Areas: Plug-in electric vehicle (PEV); Grid to Vehicle

Availability: Hou, M., Zhao, Y. and Ge, X., 2017. *Optimal Scheduling of the Plug-in Electric Vehicles Aggregator Energy and Regulation Services Based on Grid to Vehicle*. International Transactions on Electrical Energy Systems, 27(6).

<http://onlinelibrary.wiley.com/doi/10.1002/etep.2364/full>

2.38. Title: Performance Evaluation of Distribution Network in Presence of Plug-in Electric Vehicles through a New Index

Authors: Pouladi, J. and Abedinzadeh, T.

Abstract: In recent decades, the presence of Plug-in Electric Vehicles (PEVs) has increased in the distribution networks. PEVs are probabilistic loads that can have negative effects on the performance of the distribution networks. These effects include overloads, losses, voltage drops, and unbalances that may take place in the distribution networks by PEV charging. Hence, the use of important and practical indices to assess a distribution network can be useful. It should be noted that it is very difficult to compare between the effects of different indices for the penetration level of the specified PEVs using the available indices. In order to compare the effects of different indices, the available ones are modified and then a new index is proposed based on the modified indices. The IEEE-37 node test feeder is used to assess the performance of the modified and proposed indices. Simulation results show the flexibility and precision of the proposed approach.

Subject Areas: Plug-in Electric Vehicles (PEVs); Demand Curve; Performance Index; Distribution Network

Availability: Pouladi, J. and Abedinzadeh, T., 2017. *Performance Evaluation of Distribution Network in Presence of Plug-in Electric Vehicles through a New Index*. In Smart Grid and Cities Congress and Fair (ICSG), 2017 5th International Istanbul (pp. 157-160). IEEE.

<http://ieeexplore.ieee.org/abstract/document/7947624/>

2.39. Title: Modelling Probabilistic Transmission Expansion Planning in the Presence of Plug-in Electric Vehicles Uncertainty by Multi-State Markov Model

Authors: Jahromi, S.N., Askarzadeh, A. and Abdollahi, A.

Abstract: Increasing penetration of plug-in electric vehicles (PEVs) in the power system makes a need to consider the impact of PEVs on the transmission expansion planning (TEP) studies especially for large-scale PEV parking lots. Modelling of PEVs (as vehicle to grid (V2G)) is highly dependent on the owner's behaviour. In this study, a systematic method based on multi-state Markov model is utilised to represent the uncertainty of V2G's presence. To investigate the impact of PEVs, a probabilistic TEP in the presence of V2Gs (P_TEP^{V2G}) is proposed. In the proposed TEP model, the objective function consists of the total line and risk costs (RCs). Moreover, the optimal place and capacity of PEV parking lots are considered as the decision variables. It is assumed that there is an electric vehicle fleet operator for the management of electric vehicles. Because P_TEP^{V2G} is a complex and non-linear optimisation problem, an improved cuckoo search algorithm (ICS) is utilised to effectively solve the problem. On the IEEE 24-bus system, simulation results show that the availability of the PEVs at the proper bus leads to decreasing RC and deferring construction of new transmission lines.

Subject Areas: Plug-in Electric Vehicles (PEVs); Markov processes; Transportation; Distributed power generation

Availability: Jahromi, S.N., Askarzadeh, A. and Abdollahi, A., 2017. *Modelling Probabilistic Transmission Expansion Planning in the Presence of Plug-in Electric Vehicles Uncertainty by Multi-State Markov Model*. IET Generation, Transmission & Distribution, 11(7), pp. 1716-1725. <http://digital-library.theiet.org/content/journals/10.1049/iet-gtd.2016.1330>

2.40. Title: How Much Do Consumers Value Fuel Economy and Performance?

Authors: Leard, B., Linn, J. and Zhou, Y.C.

Abstract: During historical periods in which US fuel economy standards were unchanging, automakers increased performance but not fuel economy, contrasting with recent periods of tightening standards and rising fuel economy. This paper evaluates the welfare consequences of automakers forgoing performance increases to raise fuel economy as standards have tightened since 2012. Using a unique data set and a novel approach to account for fuel economy and performance endogeneity, we find undervaluation of fuel cost savings and high valuation of performance. Welfare costs of forgone performance approximately equal expected fuel savings benefits, suggesting approximately zero net private consumer benefit from tightened standards.

Subject Areas: Passenger vehicles; Fuel economy standards; Technology adoption; Consumer welfare

Availability: Leard, B., Linn, J. and Zhou, Y.C., 2017. *How Much Do Consumers Value Fuel Economy and Performance?* Resources For The Future Report (RFF) Report.
http://www.rff.org/files/document/file/RFF-Rpt-WTP_FuelEconomy%26Performance.pdf

2.41. Title: Battery Aging Studies Based on Real-World Driving

Author: Liu, Z.

Abstract: While being a competitive candidate for energy storage systems in automotive applications, lithium-ion battery still needs to overcome fundamental compromises regarding energy density, power density, lifetime, costs and safety concerns. A significant breakthrough can be expected by understanding the real-world customer usage patterns and leveraging this knowledge to develop an optimized battery design and control. However, the challenges of filtering through massive real-world driving data and identifying the features relevant to the real-world battery operations still remain. This dissertation aims to bridge this gap by linking vehicle drive cycles to battery cell duty cycles, which enables quantifying the impacts of real-world variability on battery performance. In addition to performance and efficiency considerations, the methodology enables battery aging analysis in the context of optimal design and control of hybrid electric vehicles. This will facilitate design decisions that ensure adequate performance over the life span of the vehicle with considerations of the battery health objective. The novelty of this work lies in a more accurate method of synthesizing representative real-world drive cycles with a new algorithm to classify road and an innovative quantitative metric of driver style. A modified 48V mild hybrid vehicle model was built to relate the real-world drive cycles all the way to the battery cell duty cycles and to validate the impacts from driver aggressiveness on both the fuel efficiency and the battery loads. The cell duty cycles were further analyzed in frequency domain to synthesize characteristic cell test profiles representative of driver styles and road conditions. A battery cell cycle aging experiment was carried out using the synthesized test profiles. Results validate the positive correlation between driver aggressiveness and cell degradation, and further allow parameter identification of cell electro-chemical model. Modeling effort was extended to generate insights regarding the aging mechanisms, and calibrate a semi-empirical aging model. These tools will enable the inclusion of road conditions and driver styles into the development of battery pack design and propulsion system control hence improving the design assumption fidelity and real-world representativeness of the modeling approach.

Subject Areas: Vehicle drive cycles; Battery cell duty cycles; Hybrid vehicle model

Availability: Liu, Z., 2017. *Battery Aging Studies Based on Real-World Driving*. All Dissertations. 1921.

http://tigerprints.clemson.edu/all_dissertations/1921/?utm_source=tigerprints.clemson.edu%2Fall_dissertations%2F1921&utm_medium=PDF&utm_campaign=PDFCoverPages

2.42. Title: Distributed Control of PEV Charging Based on Energy Demand Forecast

Authors: Kisacikoglu, M., Erden, F. and Erdogan, N.

Abstract: This paper presents a new distributed smart charging strategy for grid integration of plug-in electric vehicles (PEVs). The main goal is to smooth the daily grid load profile while ensuring that each PEV has a desired state of charge (SOC) level at the time of departure. Communication and computational overhead, and PEV user privacy are also considered during the development of the proposed strategy. It consists of two stages: (i) an offline process to estimate a reference operating power level based on the forecasted mobility energy demand and base loading profile, and (ii) a real-time process to determine the charging power for each PEV so that the aggregated load tracks the reference loading level. Tests are carried out both on primary and secondary distribution networks for different heuristic charging scenarios and PEV penetration levels. Results are compared to that of the optimal solution and other state-of-the-art techniques in terms of variance and peak values, and shown to be competitive. Finally, a real vehicle test implementation is done using a commercial-of-the-shelf charging station and an electric vehicle.

Subject Areas: Distributed Control; Grid Integratio; Peak Shaving; Plug-In Electric Vehicle; Smart Charging

Availability: Kisacikoglu, M., Erden, F. and Erdogan, N., 2017. *Distributed Control of PEV Charging Based on Energy Demand Forecast*. IEEE Transactions on Industrial Informatics, PP(99).

<http://ieeexplore.ieee.org/abstract/document/7930409/>

2.43. Title: Balanced Charging Strategies for Electric Vehicles on Power Systems

Authors: Moon, S.K. and Kim, J.O.

Abstract: This paper presents an electric vehicle charging demand management method by modeling the demand dispatch calculation. Despite the demand shift owing to the price signal, the signal is occasionally inaccurate because of the load variability. The electricity rate has features that can shift the electric vehicle charging priorities; the application of the load fluctuation criterion is sufficient for the management plan. We expect that there is a point, wherein, both the electric vehicle users (saving costs) and the system operators (relieving loads) are satisfied with the mutually beneficial arrangements. Our method determines the balanced state in which the loads and costs are considered simultaneously with the proposing criteria. The method allows the discordance between the electrical prices and the system load fluctuations to be managed, while the time-of-use pricing and load deviation indices are accounted for. We focus on the gap corresponding to the load variation and the charging price in a daily scheme. In contrast to the typical valley filling strategies, the aim of this study is to determine and solve the mismatches in the different goals of the costs and loads, if the state is not mutually beneficial. Therefore, to ensure a system operator perspective selectively, we introduce the load weight and ranking method concepts for dispersing the charging loads, lowering the system marginal prices, and investment avoidance because electricity rates cannot describe the load curves accurately. The charging demand calculation is investigated based on the determination of the charging patterns and daily demands using the priority comparison method. The balancing strategy first fills the mutual benefit points with respect to the changing priorities and then, competes to find the balanced points. The significance of the method is that it is based on the unique relationship between two comprehensive competitive strategies. Thus, we determine that valley filling, flat load management, and regulated deviation are insufficient to describe the user and operator behaviors simultaneously.

Subject Areas: Electric vehicles; Load management; Load leveling; Time-of-use pricing; Demand scheduling

Availability: Moon, S.K. and Kim, J.O., 2017. *Balanced Charging Strategies for Electric Vehicles on Power Systems*. Applied Energy, 189, pp.44-54.

<http://www.sciencedirect.com/science/article/pii/S0306261916317895>

2.44. Title: Robust Online Algorithms for Peak-Minimizing EV Charging under Multi-Stage Uncertainty

Authors: Zhao, S., Lin, X. and Chen, M.

Abstract: This paper presents an electric vehicle charging demand management method by modeling the demand dispatch calculation. Despite the demand shift owing to the price signal, the signal is occasionally inaccurate because of the load variability. The electricity rate has features that can shift the electric vehicle charging priorities; the application of the load fluctuation criterion is sufficient for the management plan. We expect that there is a point, wherein, both the electric vehicle users (saving costs) and the system operators (relieving loads) are satisfied with the mutually beneficial arrangements. Our method determines the balanced state in which the loads and costs are considered simultaneously with the proposing criteria. The method allows the discordance between the electrical prices and the system load fluctuations to be managed, while the time-of-use pricing and load deviation indices are accounted for. We focus on the gap corresponding to the load variation and the charging price in a daily scheme. In contrast to the typical valley filling strategies, the aim of this study is to determine and solve the mismatches in the different goals of the costs and loads, if the state is not mutually beneficial. Therefore, to ensure a system operator perspective selectively, we introduce the load weight and ranking method concepts for dispersing the charging loads, lowering the system marginal prices, and investment avoidance because electricity rates cannot describe the load curves accurately. The charging demand calculation is investigated based on the determination of the charging patterns and daily demands using the priority comparison method. The balancing strategy first fills the mutual benefit points with respect to the changing priorities and then, competes to find the balanced points. The significance of the method is that it is based on the unique relationship between two comprehensive competitive strategies. Thus, we determine that valley filling, flat load management, and regulated deviation are insufficient to describe the user and operator behaviors simultaneously.

Subject Areas: Prediction algorithms; Algorithm design and analysis; Robustness; Renewable energy sources; Predictive models; Computational modeling

Availability: Zhao, S., Lin, X. and Chen, M., 2017. *Robust Online Algorithms for Peak-Minimizing EV Charging under Multi-Stage Uncertainty*. IEEE Transactions on Automatic Control.
<http://ieeexplore.ieee.org/abstract/document/7914741/>

3. Environment

3.1. Title: Greenhouse Gas and Air Quality Effects of Auto First-last Mile use with Transit

Authors: Hoehne, C.G. and Chester, M.V.

Abstract: With potential for automobiles to cause increased greenhouse gas emissions and air pollution relative to other modes, there is concern that using automobiles to access or egress public transportation may significantly increase the environmental impacts from door-to-door transit trips. Yet little rigorous work has been developed that quantitatively assesses the effects of transit access or egress by automobiles. This research evaluates the life-cycle impacts of first-and-last mile trips on multimodal transit. An environmental life-cycle assessment of transit and automobile travel in the greater Los Angeles region is developed to evaluate the impacts of multimodal transit trips by utilizing existing transportation life-cycle assessment methods. First-last mile automobile trips with transit may increase multimodal trip emissions significantly, mitigating potential impact reductions from transit usage. In some cases, multimodal transit trips with first-last mile automobile use may have higher emissions than competing automobile trips. In the near-term, first-last mile automobile trips in some Los Angeles transit services may account for up to 66% of multimodal greenhouse gas emissions, and as much as 75% of multimodal air quality impacts. Fossil fuel energy generation and combustion, low vehicle occupancies, and longer trip distances contribute most to increased multimodal impacts. Supply chain analysis indicates that life-cycle air quality impacts may occur largely locally (in Los Angeles) or largely remotely depending on the propulsion method and location of upstream life-cycle processes. Reducing 10% of transit system greenhouse emissions requires a shift of 23-50% of automobile first-last mile trips to a neutral emissions mode.

Subject Areas: First-last mile; Transit; Multimodal; Life-cycle assessment; Greenhouse gas; Air quality

Availability: Hoehne, C.G. and Chester, M.V., 2017. *Greenhouse Gas and Air Quality Effects of Auto First-last Mile use with Transit*. Transportation Research Part D: Transport and Environment, 53, pp.306-320.

<http://www.sciencedirect.com/science/article/pii/S1361920916306320>

3.2. Title: Regional Sky Transit III: The Primacy of Noise

Author: Seeley, B.A.

Abstract: The trend toward rapid urbanization into megacities and the enormous costs for transportation infrastructure that this entails are expected to continue for decades. The strong and consistent preference of individuals for distributed travel in private vehicles rather than for route-limited travel in crowded public transit also has shown no signs of diminishing. These trends have a significant adverse effect on climate change. Regional Sky Transit^{1,2} (RST) has been proposed as a system that can drastically reduce infrastructure cost and CO₂ emissions while preserving people's preference for travel in personal vehicles by providing affordable, accessible, fast, and safe flights distributed across urban regions. RST could thus provide a substantial, new, efficient, value-added supply chain. As such, RST could become aviation's largest market in terms of number of flights, significantly contributing to the growth of connectivity and productivity across population centers. The RST mass market could serve travelers on relatively short trip lengths of less than 160 kilometers. This civil mass market derives from the concept of high proximity aviation - extending air travel operations to numerous very small airparks that are close to where people live and work, so as to reduce ground travel time and thereby save time. This can only be achieved if the aircraft used in RST fulfill stringent limitations on allowable noise emissions that will be essential to high proximity aviation. Examination of the extensive prior research on allowable noise emissions shows that noise issues will dictate both the size of airparks and the concept of operations for RST. This paper reveals why this primacy of noise must be respected, and presents detailed examples of the profound constraints it imposes upon V/ESTOL aircraft designs intended to serve the RST mass market. The barriers to developing the ultra-quiet aircraft necessary to RST along with the most promising strategies for efficiently overcoming those barriers are presented. These strategies include models for how electric propulsion and its energy requirements can best be integrated into Sky Taxis that are suitable for the mission requirements of RST. Those integrations will examine the core science and technologies that affect propulsive noise emission and reveal opportunities for further competitive research. The value and benefits of RST will be compared with the costs of bringing about the necessary noise reduction breakthroughs.

Subject Areas: Sky Transit; Reduction of CO₂ emissions; Transport Infrastructure

Availability: Seeley, B.A., 2017. *Regional Sky Transit III: The Primacy of Noise*. In 55th AIAA Aerospace Sciences Meeting (p. 0208).

<http://sustainableaviation.org/RST/papers/Regional.Sky.Transit.III.Seeley.SCITECH2017NOISE.pdf>

3.3. Title: Comparison of Gasoline Direct-Injection (GDI) and Port Fuel Injection (PFI) Vehicle Emissions: Emission Certification Standards, Cold-Start, Secondary Organic Aerosol Formation Potential, and Potential Climate Impacts

Authors: Saliba, G., Saleh, R., Zhao, Y., Presto, A.A., Lambe, A.T., Frodin, B., Sardar, S., Maldonado, H., Maddox, C., May, A.A. and Drozd, G.T.

Abstract: Recent increases in the Corporate Average Fuel Economy standards have led to widespread adoption of vehicles equipped with gasoline direct-injection (GDI) engines. Changes in engine technologies can alter emissions. To quantify these effects, we measured gas- and particle-phase emissions from 82 light-duty gasoline vehicles recruited from the California in-use fleet tested on a chassis dynamometer using the cold-start unified cycle. The fleet included 15 GDI vehicles, including 8 GDIs certified to the most-stringent emissions standard, superultra-low-emission vehicles (SULEV). We quantified the effects of engine technology, emission certification standards, and cold-start on emissions. For vehicles certified to the same emissions standard, there is no statistical difference of regulated gas-phase pollutant emissions between PFIs and GDIs. However, GDIs had, on average, a factor of 2 higher particulate matter (PM) mass emissions than PFIs due to higher elemental carbon (EC) emissions. SULEV certified GDIs have a factor of 2 lower PM mass emissions than GDIs certified as ultralow-emission vehicles (3.0 ± 1.1 versus 6.3 ± 1.1 mg/mi), suggesting improvements in engine design and calibration. Comprehensive organic speciation revealed no statistically significant differences in the composition of the volatile organic compounds emissions between PFI and GDIs, including benzene, toluene, ethylbenzene, and xylenes (BTEX). Therefore, the secondary organic aerosol and ozone formation potential of the exhaust does not depend on engine technology. Cold-start contributes a larger fraction of the total unified cycle emissions for vehicles meeting more-stringent emission standards. Organic gas emissions were the most sensitive to cold-start compared to the other pollutants tested here. There were no statistically significant differences in the effects of cold-start on GDIs and PFIs. For our test fleet, the measured 14.5% decrease in CO₂ emissions from GDIs was much greater than the potential climate forcing associated with higher black carbon emissions. Thus, switching from PFI to GDI vehicles will likely lead to a reduction in net global warming.

Subject Areas: Fuel Economy; Emission standards; Superultra-low-emission vehicles (SULEV)

Availability: Saliba, G., Saleh, R., Zhao, Y., Presto, A.A., Lambe, A.T., Frodin, B., Sardar, S., Maldonado, H., Maddox, C., May, A.A. and Drozd, G.T., 2017. *Comparison of Gasoline Direct-Injection (GDI) and Port Fuel Injection (PFI) Vehicle Emissions: Emission Certification Standards, Cold-Start, Secondary Organic Aerosol Formation Potential, and Potential Climate Impacts*. Environmental Science & Technology.

<http://pubs.acs.org/doi/ipdf/10.1021/acs.est.6b06509>

3.4. Title: Hitting the Sweet Spot: Variability in Commute Lengths And Vehicle Emissions across a Diverse State

Authors: Mondschein, A. and Parkany, E.

Abstract: In this paper we consider travel across Virginia and identify sustainability “sweet spots” where commute lengths and vehicle emissions per mile combine to maximize green travel in terms of total CO₂ emissions associated with commuting. The analysis is conducted across local voter precincts (N = 2373 in the state) because they are a useful proxy for neighborhoods and well-sized for implementing policy designed to encourage sustainable travel behavior. Virginia is especially appropriate for an examination of variability in sustainable travel behavior and technologies because the state’s transportation, demographic, and political patterns are particularly diverse and have been changing rapidly. We identify four Virginia precinct-based sustainability clusters: Sweet Spots, Emerging Sweet Spots, Neutral and Non-sustaining. A model of demographic differences among the clusters shows that sustainability outcomes, understood in terms of both local commute behavior and vehicle emissions, are significantly associated with the diverse demography and politics of the state. We also look at changes in transportation sustainability and socio-demographic trends within the clusters over the past half-decade, showing that differences in sustainability and demographic metrics are actually accelerating within the state over time. We conclude with a discussion of the implications of the differences among the clusters for developing and implementing effective transportation sustainability policies across the state.

Subject Areas: Travel choices; Travel behavior; Sustainability; Emissions; Voting precincts; Demographics

Availability: Mondschein, A. and Parkany, E., 2017. *Hitting the Sweet Spot: Variability in Commute Lengths And Vehicle Emissions across a Diverse State*. Transportation Research Part D: Transport and Environment, 54, pp.348-359.

<http://pubs.acs.org/doi/ipdf/10.1021/acs.est.6b06509>

3.5. Title: More connected Urban Roads reduce US GHG Emissions

Authors: Barrington-Leigh, C. and Millard-Ball, A.

Abstract: We quantify the importance of early action to tackle urban sprawl. We focus on the long-term nature of infrastructure decisions, specifically local roadways, which can lock in greenhouse gas emissions for decades to come. The location and interconnectedness of local roadways form a near-permanent backbone for the future layout of land parcels, buildings, and transportation options.

We provide new estimates of the environmental impact of low-connectivity roads, characterized by cul-de-sacs and T-intersections, which we dub street-network sprawl. We find an elasticity of vehicle ownership with respect to street connectivity of -0.15 - larger than suggested by previous research. We then apply this estimate to quantify the long-term emissions implications of alternative scenarios for street-network sprawl. On current trends alone, we project vehicle travel and emissions to fall by 3.2% over the 2015-2050 period, compared to a scenario where sprawl plateaus at its 1994 peak. Concerted policy efforts to increase street connectivity could more than triple these reductions to 8.8% by 2050. Longer-term reductions over the 2050-2100 period are more speculative, but could be more than 50% greater than those achieved by 2050. The longer the timescale over which mitigation efforts are considered, the more important it becomes to address the physical form of the built environment.

Subject Areas: GreenHouse Gas Emissions; Environment; Vehicle Ownership; Street connectivity

Availability: Barrington-Leigh, C. and Millard-Ball, A., 2017. *More connected Urban Roads reduce US GHG Emissions*. Environmental Research Letters, 12(4), p.044008.
<http://iopscience.iop.org/article/10.1088/1748-9326/aa59ba/meta>

3.6. Title: The Unsustainability of Exurban Development in London and New York: Calculating Transport CO₂ Emissions

Author: Focas, C.

Abstract: London and New York have often been hailed for their sustainable planning practices. However, when one focuses on the entire city region, there is ever-increasing car-dependent development. This paper focuses on the exurban region of the two cities investigating transport-created CO₂ emissions. The research is based on the analysis of data of the National Travel Surveys of Great Britain and the USA through a quantification of personal travel and a top-down estimation of CO₂ emissions. It is the exurban region that accounts for the vast majority of CO₂ emissions: 77% for London and 87% for New York. In the wider region for both cities there is a policy vacuum and dearth of regional planning mechanisms to deliver policies to reduce CO₂ emissions. The paper argues that transport needs to be planned at the city-regional scale.

Subject Areas: Exurbia, London, New York, Transport Emissions

Availability: Focas, C., 2017. *The Unsustainability of Exurban Development in London and New York: Calculating Transport CO₂ Emissions*. *Journal of Environmental Planning and Management*, 60(5), pp.901-919.

<http://www.tandfonline.com/doi/abs/10.1080/09640568.2016.1187588>

4. Health

4.1. Title: Estimating the Effect of Mobility and Food Choice on Obesity in a Rural, Northern Environment

Authors: Kolodinsky, J.M., Battista, G., Roche, E., Lee, B.H. and Johnson, R.K.

Abstract: The literature suggests that energy balance is shaped by where food is accessed, mobility behaviors, beliefs, preferences, socioeconomic characteristics, and attributes of the built environment. However, the relationship of these factors with energy balance has not been simultaneously considered on a regional scale. Utilizing a social-ecological framework, this study incorporated individual level and geospatial data to estimate a structural equation model (SEM) to examine the complex association of these variables with being overweight or obese. Results indicate that food choice, mobility, demographic characteristics, and normative beliefs are related to energy imbalance. Further, accounting for the endogeneity of food access and mobility changes both the significance and magnitude of factors associated with obesity as compared to treating them as exogenous.

Subject Areas: Rural; Mobility; Obesity; Transportation; Public health

Availability: Kolodinsky, J.M., Battista, G., Roche, E., Lee, B.H. and Johnson, R.K., 2017. *Estimating the Effect of Mobility and Food Choice on Obesity in a Rural, Northern Environment*. *Journal of Transport Geography*, 61, pp.30-39.

<http://www.sciencedirect.com/science/article/pii/S0966692317302466>

4.2. Title: Exploring Parental Perceptions of a Walking-School-bus Initiative in Northern Ontario

Author: Atrooshi, D.

Abstract:

Introduction: Active transportation to school (ATS) may be a way to increase children's physical activity (PA) levels and achieve health related benefits, however only 24% of Canadian children use active transportation as a mode to travel to and from school (Gray et al., 2014). A walking-school bus (WSB) is a proposed strategy that can afford students a safe, active method of travel to school (Kearns, Collins, & Neuwelt, 2003). Few studies have examined parental perceptions of a WSB. Given that parents are typically the decision makers in regards to methods of school travel, understanding parent perceived barriers and facilitators to using a WSB is warranted.

Purpose: The primary purpose of this thesis study was to explore parental perceptions of a WSB in order to inform an effective messaging and promotional strategy. The secondary purpose was to explore barriers and facilitators related to a WSB/ATS and to explore parent ideas about ways for their children to incorporate active travel into their daily routine.

Methods: Parents of students (N=16), from three elementary schools located in Northern Ontario were recruited. Semi-structured interviews were conducted, guided by a social marketing approach (Lee & Kotler, 2011). Inductive and deductive analyses were used to identify emerging themes and to explore product, price, promotion and place barriers and/or facilitators related to a WSB. Alternative ATS strategies were compiled.

Results: Parents identified the potential for increased levels of PA and positive social interactions as key facilitators of participating in a WSB. Other key facilitators included the opportunity to be supervised while participating in ATS, and promotion of the WSB through electronic platforms such as social media. However, parents expressed concerns regarding the safety of their children and the reliability of adult supervision of the WSB. Concerns related to extreme weather conditions were also present.

Discussion: Findings from this study will be used by the North Bay Parry Sound District Health Unit to guide WSB interventions and to develop a messaging strategy to promote WSB uptake at the participating schools as a way to enhance ATS among students.

Subject Areas: Physical activity; Walking

Availability: Atrooshi, D., 2017. *Exploring Parental Perceptions of a Walking-School-bus Initiative in Northern Ontario*. M.S. Thesis, Queen's University, Ontario, Canada.

https://qspace.library.queensu.ca/bitstream/handle/1974/15391/Atrooshi_Darran_J_201702_MSc.pdf?sequence=7&isAllowed=y

4.3. Title: Using Public Transportation Reduces Obesity and Makes People Healthier

Author: Andrei, M.

Abstract: Blog

Subject Areas: Public Transit; Obesity

Availability: Andrei, M., 2017. *Using Public Transportation Reduces Obesity and Makes People Healthier*. ZMEScience.

<http://www.zmescience.com/medicine/public-transportation-vs-obesity/>

4.4. Title: Are Buffers around Home representative of Physical Activity Spaces among Adults?

Authors: K.M., Howard, A.G., Emch, M., Rodriguez, D.A. and Evenson, K.R.

Abstract: Residential buffers are frequently used to assess built environment characteristics relevant to physical activity (PA), yet little is known about how well they represent the spatial areas in which individuals undertake PA. We used System for Observing Play and Recreation in Communities data for 217 adults from five US states who wore an accelerometer and a GPS for three weeks to create newly defined PA-specific activity spaces. These PA spaces were based on PA occurring in bouts of ≥ 10 min and were defined as 1) the single minimum convex polygon (MCP) containing all of a participant's PA bout minutes and 2) the combination of many MCPs constructed using each PA bout independently. Participants spent a large proportion of their PA bout time outside of 0.5, 1, and 5 mile residential buffers, and these residential buffers were a poor approximation of the spatial areas in which PA bouts occurred. The newly proposed GPS-based PA spaces can be used in future studies in place of the more general concept of activity space to better approximate built environments experienced during PA.

Subject Areas: Physical activity; Accelerometry; Activity space; Global positioning systems; Residential buffers

Availability: K.M., Howard, A.G., Emch, M., Rodriguez, D.A. and Evenson, K.R., 2017. *Are Buffers Around Home Representative of Physical Activity Spaces among Adults?* Health & Place, 45, pp.181-188.

<http://www.sciencedirect.com/science/article/pii/S1353829216302106>

4.5. Title: Analyzing the Impact of Public Transit Usage on Obesity

Authors: She, Z., King, D.M. and Jacobson, S.H.

Abstract: The objective of this paper is to estimate the impact of county-level public transit usage on obesity prevalence in the United States and assess the potential for public transit usage as an intervention for obesity. This study adopts an instrumental regression approach to implicitly control for potential selection bias due to possible differences in commuting preferences among obese and non-obese populations. United States health data from the 2009 Behavioral Risk Factor Surveillance System and transportation data from the 2009 National Household Travel Survey are aggregated and matched at the county level. County-level public transit accessibility and vehicle ownership rates are chosen as instrumental variables to implicitly control for unobservable commuting preferences. The results of this instrumental regression analysis suggest that a one percent increase in county population usage of public transit is associated with a 0.221 percent decrease in county population obesity prevalence at the $\alpha = 0.01$ statistical significance level, when commuting preferences, amount of non-travel physical activity, education level, health resource, and distribution of income are fixed. Hence, this study provides empirical support for the effectiveness of encouraging public transit usage as an intervention strategy for obesity.

Subject Areas: Obesity; Transportation; Public Transit; Environment design

Availability: She, Z., King, D.M. and Jacobson, S.H., 2017. *Analyzing the Impact of Public Transit Usage on Obesity*. Preventive Medicine, 99, pp.264-268.
<http://www.sciencedirect.com/science/article/pii/S0091743517301093>

4.6. Title: Interrelationships of physical activity in different domains: Evidence from the Geographic Research on Wellbeing (GROW) study

Authors: Lee, R.E., Lorenzo, E., Heck, K., Kohl, H.W. and Cubbin, C.

Abstract: Research has rarely distinguished between non-work (NW) and work (W) active transport (AT) or investigated relationships to other domains of physical activity ([PA], like leisure time [LTPA] or work [WPA]). We investigated correlates of AT by employment status, accounting for LTPA and WPA, in a population-based sample of California mothers (N=2906) in the Geographic Research on Wellbeing (GROW) study (2012-2013). AT was measured by the National Household Travel Survey. LTPA was measured using the Stanford Leisure-Time Activity Categorical Item. WPA was measured with the Stanford Brief Activity Survey. Most employed mothers (53%) worked in sedentary jobs, and few (<10%) used NWAT or WAT. Over 20% of unemployed mothers used NWAT, although LTPA levels were similar to employed mothers. Multiple regression models found employed and unemployed with low education and income, and unemployed African American or Latina immigrant mothers had higher odds of using NWAT. Younger employed and unemployed mothers, and unemployed who had ≥ 4 children or had light LTPA had lower odds of using NWAT. Multiple regression models demonstrated that low education or income employed mothers, African American mothers, those who worked part time, and those with relatively low LTPA had higher odds of using WAT, while younger women had lower odds of using WAT, compared with reference groups ($p < 0.05$). WPA was associated with WAT in unadjusted models, but not in adjusted models. Different AT patterns were seen for employed vs unemployed women, but women who used AT did so for most trips. LTPA was associated with NWAT among unemployed mothers and with WAT among employed mothers. Most women were underactive across all domains, suggesting no compensatory effect of PA done in one domain reducing PA done in another domain, with few meeting minimal guidelines. Policy and practice strategies should support infrastructure to encourage a variety of domains of PA.

Subject Areas: Locomotion; Motor activity; Walking; Bicycling; Mothers; Active commuting

Availability: Lee, R.E., Lorenzo, E., Heck, K., Kohl, H.W. and Cubbin, C., 2017. *Interrelationships of physical activity in different domains: Evidence from the Geographic Research on Wellbeing (GROW) study*. Journal of Transport & Health.

<http://www.sciencedirect.com/science/article/pii/S2214140516303292>

4.7. Title: Automobile Dependence and Physical Inactivity: Insights from the California Household Travel Survey

Authors: Chakrabarti, S. and Shin, E.J.

Abstract:

Background: Auto-dependence has been linked to the physical inactivity epidemic across U.S. cities, resulting in unprecedented increases in incidences of obesity, cardiovascular diseases, depression, etc. The search for strategies to pull an overwhelming majority of auto-dependents out of their sedentary lifestyles by encouraging them to use transit, walk and bike continues to challenge planners and policy-makers.

Methods: We use the 2012-13 California Household Travel Survey data for analyzing the auto-dependence and physical inactivity connection. We select a sample of employed individuals with access to car in urban California, and classify them as discretionary transit riders (N=390), active auto-dependents (N=1287), or sedentary auto-dependents (N=8754) based on their self-reported travel mode use and time spent in physical activity over a 24-h period. We investigate factors that are associated with significantly high physical activity among some auto-dependents relative to the sedentary majority. We also revisit the transit-physical activity connection, and explore conditions that make transit use unfeasible for some active auto-dependents.

Results: Discretionary transit use is associated with higher physical activity. However, there is large variation in physical activity within auto-dependents; significantly higher physical activity is associated with factors such as higher income, flexible work schedule, shorter work hours, and mixed land use. Kids, inflexibility of work schedule, low residential density, lack of pedestrian and bicycling friendly street design, and long distance to transit stops prohibit otherwise active auto-dependents from choosing transit. Employment sector influences both physical activity and choice of transit.

Conclusion: To get sedentary auto-dependents out of endemic physical inactivity, our research indicates the need for targeting lower-incomes, incentivizing employers to provide flexible work hours, and to continue dense, mixed-use developments that make active travel feasible. In addition, to get active auto-dependents to use transit, transit managers must focus on retaining immigrant riders and non-Hispanic Asians, and attracting people with children.

Subject Areas: Physical activity; Public health; Automobile dependence; Public transit policy; Walking; Bicycling

Availability: Chakrabarti, S. and Shin, E.J., 2017. *Automobile Dependence and Physical Inactivity: Insights from the California Household Travel Survey*. Journal of Transport & Health. <http://www.sciencedirect.com/science/article/pii/S2214140516303085>

4.8. Title: Mass Transit Linked to Lower Obesity Rates in Study

Author: Caffrey, M.

Abstract: Blog

Subject Areas: Public Transit; Obesity

Availability: Caffrey, M., 2017. *Mass Transit Linked to Lower Obesity Rates in Study*. AJMC.com
<http://www.ajmc.com/newsroom/mass-transit-linked-to-lower-obesity-rates-in-study>

4.9. Title: “Transit makes you short”: On Health Impact Assessment of Transportation and the Built Environment

Authors: Ermagun, A. and Levinson, D.

Abstract: This study conducts an in-depth analysis to alert policymakers and practitioners to erroneous results in the positive impacts of transit use on health measures. We explore the correlation of transit use and accessibility by transit and walking with self-reported general health, Body Mass Index (BMI), and height. We develop a series of linear regression and binary logit models. We also depict the coefficient-p-value-sample-size chart, and conduct the effect size analysis to scrutinize the practically significant impacts of transit use and accessibility on health measures. The results indicate transit use and accessibility by transit and walking are significantly associated with general health and BMI. However, they are practically insignificant, and the power of the large sample in our particular case causes the statistically insignificant variable to become significant. At a deeper level, a 1% increase in transit use at the county level diminishes the BMI by only 0.0037% on average. The elasticity of transit use also demonstrates that every 1% increase in transit use would escalate the chance of having excellent or very good general health by 0.0003%. We show there is a thin line between false positive and true negative results. We alert both researchers and practitioners to the dangerous pitfalls deriving from the power of large samples and the weakness of p-values. Building the results on just statistical significance and sign of the parameter of interest is worthless, unless the magnitude of effect size is carefully quantified post analysis.

Subject Areas: Public transit; BRFSS data; ACS data; General health; p-hacking

Availability: Ermagun, A. and Levinson, D., 2017. “*Transit makes you short*”: *On Health Impact Assessment of Transportation and the Built Environment*. *Journal of Transport & Health*, 4, pp.373-387.

<http://www.sciencedirect.com/science/article/pii/S2214140516302390>

5. Policy and Mobility

5.1. Title: U.S. Transportation and Health Tool: Data for Action

Authors: Boehmer, T.K., Wendel, A.M., Bowers, F., Robb, K., Christopher, E., Broehm, J.E., Rose, K. and Ralph, J.

Abstract: Transportation investments have the potential to improve health, but readily available data to guide transportation decisions that could promote health are limited. In October 2015, the U.S. Department of Transportation (USDOT) and the Centers for Disease Control and Prevention (CDC) released the Transportation and Health Tool (THT). The tool is a resource to help transportation professionals in states and metropolitan areas access data about transportation and health in their jurisdictions and stimulate discussions on how to improve public health through transportation planning and policy. To develop the tool, a multidisciplinary team identified 190 possible data indicators. Using input from expert panel workshops and criteria that addressed data availability, geographic scale, timeliness, feasibility, validity, and topic area, the team selected 14 transportation and health indicators that covered the four priority topic areas of safety, active transportation, air quality, and connectivity. The THT contains the raw values for each indicator and a standardized score to enable comparisons. Additionally, the THT contains 25 evidence-based strategies that can help practitioners in states and metropolitan areas take action to improve health outcomes.

Subject Areas: Data; Policy; Indicators; Evidence-based interventions; Public health; Transportation systems

Availability: Boehmer, T.K., Wendel, A.M., Bowers, F., Robb, K., Christopher, E., Broehm, J.E., Rose, K. and Ralph, J., 2017. *U.S. Transportation and Health Tool: Data for Action*. Journal of Transport & Health.

<http://www.sciencedirect.com/science/article/pii/S2214140516304510>

**5.2. Title: Exploring the Relationship between Vehicle Type Choice and Distance Traveled:
A latent segmentation approach**

Authors: Angueira, J., Konduri, K.C., Chakour, V. and Eluru, N.

Abstract: In the context of vehicle usage decisions, there are two important choice dimensions namely, the choice of vehicle from household fleet that will be utilized for trips and second, the distance traveled to pursue the planned activities. There are interrelationships between these two choice dimensions with one dimension potentially influencing the other. The direction of the interrelationship has important implications for transportation planning and policy analyses. In an effort to explore the interrelationships, a latent segmentation-based modeling approach is proposed in this paper. The approach allows for exploring alternative interrelationship structures between choice dimensions in the same modeling framework. The methodology is demonstrated using data from the latest wave of the National Household Travel Survey (NHTS) in the United States. The results show the need for accommodating alternative structures between choice dimensions to accurately describe the vehicle usage decision processes exhibited by individuals.

Subject Areas: Policy; Latent segmentation models, Short-term vehicle usage decisions, Vehicle type choice, Distance traveled

Availability: Angueira, J., Konduri, K.C., Chakour, V. and Eluru, N., 2017. *Exploring the Relationship between Vehicle Type Choice and Distance Traveled: A latent segmentation approach*. Transportation Letters, pp.1-12.

http://www.people.cecs.ucf.edu/neluru/Papers/VT_Distance_Paper.pdf

5.3. Title: The Driving Downturn: A Preliminary Assessment

Authors: Manville, M., King, D.A. and Smart, M.J.

Abstract:

Problem, research strategy, and findings: We examine why American driving fell between 2004 and 2013, weighing two explanations: that Americans voluntarily moved away from driving (“peak car”), and that economic hardship reduced driving. We analyze aggregate data on travel, incomes, debt, public opinion, and Internet access. These data lack the precision of microdata, but unlike microdata are available annually for years before, during, and after driving’s decline. We find substantial evidence for the economic explanation. During the downturn the cost of driving rose while median incomes fell. The economy grew overall, but did so unequally. Mass driving requires a mass middle class, but economic gains accrued largely to the most affluent. We find less evidence for “peak car”. If Americans voluntarily drove less, they would likely use other modes more. However, despite heavy investment in bicycle infrastructure and public transportation in the 2000s, demand for these modes remained flat while driving fell.

Takeaway for practice: If Americans were voluntarily abandoning automobiles for other modes, planners could reduce investments in automobile infrastructure and increase investments in alternative mobility. Driving’s decline, however, was not accompanied by a transit surge or substantial shift to other modes. The lesson of the driving downturn is that people drive less when driving’s price rises. Planners obviously do not want incomes to fall, but they should consider policies that increase driving’s price. Planners might also rethink the current direction of U.S. transit policy; transit use did not rise even when driving fell at an unprecedented pace.

Subject Areas: Public Transit; Driving; Alternative Mobility; Policy

Availability: Manville, M., King, D.A. and Smart, M.J., 2017. *The Driving Downturn: A Preliminary Assessment*. Journal of the American Planning Association, 83(1), pp.42-55.

<http://www.tandfonline.com/doi/full/10.1080/01944363.2016.1247653>

5.4. Title: Integration of the National Long Distance Passenger Travel Demand Model with the Tennessee Statewide Model and Calibration to Big Data

Authors: Bernardin Jr, V.L., Ferdous, N., Sadrsadat, H., Trevino, S. and Chen, C.C.

Abstract: The Tennessee Department of Transportation chose to replace their quick-response-based long distance component in their statewide model by integrating FHWA's new national long distance passenger travel demand model into their new statewide model and calibrating it to long distance trips observed in cell-phone based origin-destination data from AirSage. The new national long distance model is a national scale, tour-based simulation model developed from FHWA research on long distance travel behavior and patterns. The tool allows the evaluation of many different policy scenarios including fare or service changes for various modes including commercial air travel, intercity bus, and Amtrak as well as highway travel. The availability of this new tool represents a new opportunity for state DOTs developing statewide models. Commercial cell-phone based big data on long distance trips also represents a new opportunity and a new data source on long distance travel patterns which have previously been the subject of very limited data collection in the form of surveys. This project is the first to seize on both of these new opportunities by integrating the new national long distance model with the new Tennessee statewide model and by processing big data for use as a calibration target for long distance travel in a statewide model. The paper demonstrates the feasibility of integrating the new national model with statewide models, the ability of the national model to be calibrated to new data sources, the ability to combine multiple big data sources, the value of big data on long distance travel as well as important lessons on its expansion.

Subject Areas: Long Distance Travel; Statewide Model; Travel Demand Forecasting

Availability: Bernardin Jr, V.L., Ferdous, N., Sadrsadat, H., Trevino, S. and Chen, C.C., 2017. *Integration of the National Long Distance Passenger Travel Demand Model with the Tennessee Statewide Model and Calibration to Big Data*. Transportation Research Board 96th Annual Meeting (No. 17-00513).

<http://docs.trb.org/prp/17-00513.pdf>

5.5. Title: Beyond Traffic: Trends and Choices 2045 - A National Dialogue About Future Transportation Opportunities and Challenges

Authors: Mendez, V.M., Monje Jr, C.A. and White.

Abstract: This paper summarizes the findings of the U.S. DOT's comprehensive report on the current and future conditions of America's transportation system, *Beyond Traffic: Trends and Choices 2045*. The full report, and in turn this paper, discusses long-term and emerging trends in passenger and freight travel and the potential impacts of technological advances, climate change, and evolving governance institutions and funding sources. This analysis provides a framework for a fact-based discussion about the critical transportation policy choices we are faced with to address these long-term challenges. *Beyond Traffic* is intended to stimulate a national dialogue about the nation's future transportation opportunities and challenges.

Subject Areas: Passenger and Freight Travel; Transportation Policy; Funding

Availability: Mendez, V.M., Monje Jr, C.A. and White, V., 2017. *Beyond Traffic: Trends and Choices 2045 - A National Dialogue About Future Transportation Opportunities and Challenges*. In *Disrupting Mobility* (pp. 3-20), Springer International Publishing.
https://link.springer.com/chapter/10.1007/978-3-319-51602-8_1

5.6. Title: Parking for Residential Delivery in New York City: Regulations and Behavior

Authors: Chen, Q., Conway, A. and Cheng, J.

Abstract: Increasing demand for direct-to-home deliveries requires frequent delivery of small volumes; these deliveries generate growth in commercial vehicle curb side parking activities in dense urban areas. In New York City, which has extremely densely developed, mixed land uses, this new demand is only exacerbating already challenging conditions for urban delivery. This study utilizes a number of existing “open” datasets from New York City to compare commercial vehicle parking regulations and violations in commercial, mixed-use, and residential land use areas in New York City. Results suggest that parking availability and resulting violation rates vary considerably by area and roadway type, and that current curb parking regulations are not adequate to accommodate growing residential demand.

Subject Areas: Urban freight; Residential delivery; Parking; Regulations

Availability: Chen, Q., Conway, A. and Cheng, J., 2017. *Parking for Residential Delivery in New York City: Regulations and Behavior*. *Transport Policy*, 54, pp.53-60.
<http://www.sciencedirect.com/science/article/pii/S0967070X16302414>

5.7. Title: Integrating Health and Transportation in Nashville, Tennessee, USA: From Policy to Projects

Authors: Meehan, L.A. and Whitfield, G.P.

Abstract: The Nashville Area Metropolitan Planning Organization (MPO) is among the first MPOs in the United States to recognize the interplay of transportation and public health, particularly regarding physical activity, air pollution, and traffic crashes. The Nashville MPO has taken a multifaceted approach to simultaneously improve the transportation system, quality of life, and health status of the region's population. The purpose of this paper is to describe the multiple programs and projects that the MPO has undertaken to this end, so that other cities might learn from Nashville's example.

The MPO's strategy comprised six processes. First, the MPO conducted the Regional Bicycle and Pedestrian Study in 2009 and 2014 that established priority issues to be addressed by bicycle and pedestrian projects in Regional Transportation Plans. Second, the MPO responded to public opinion by adopting new transportation policies in the 2035 and 2040 Regional Transportation Plans, including increasing bicycle and pedestrian options and expanding public transit. Third, the MPO created scoring criteria for proposed roadway projects that prioritized health impacts. Fourth, the MPO reserved funding for projects selected under the new criteria and established a new funding program, the Active Transportation Program. Fifth, the MPO conducted the Middle Tennessee Transportation and Health Study, one of the first regional studies in the nation linking transportation and health. Finally, the MPO implemented the Integrated Transport and Health Impact Model which predicts and monetizes population-level health impacts of shifting the population towards active transportation modes.

Recent inventories of bicycle and pedestrian infrastructure suggest these interrelated processes are increasing opportunities for walking, bicycling, and public transit use in the region. Further, each of these projects has contributed to a growing appreciation in the region of the links between transportation and health, and continued evaluation efforts can determine if transportation behaviors and health outcomes are changing.

Subject Areas: Transport projects; Health; Policies

Availability: Meehan, L.A. and Whitfield, G.P., 2017. *Integrating Health and Transportation in Nashville, Tennessee, USA: From Policy to Projects*. Journal of Transport & Health.

<http://www.sciencedirect.com/science/article/pii/S2214140516301712>

5.8. Title: A New Route to Increasing Economic Growth: Reducing Highway Congestion with Autonomous Vehicles

Authors: Winston, C. and Karpilow, Q.

Abstract: This paper argues that California's self-help county tax legislation, which funds additional highway spending, amounts to a natural experiment that can be used to construct a valid instrument to determine highway congestion's causal effect on the growth rates of GDP, employment, wages, and commodity freight flows for California counties. Our estimation results indicate that highway congestion has significantly reduced the growth rates of those performance measures. Extrapolating the results to the nation suggests that sizable reductions in highway congestion, which could be achieved with widespread adoption of autonomous (driverless) vehicles, would have large macroeconomic stimulative effects.

Subject Areas: Congestion delays; Autonomous Vehicles; Self-help County Taxes

Availability: Winston, C. and Karpilow, Q., 2017. *A New Route to Increasing Economic Growth: Reducing Highway Congestion with Autonomous Vehicles*. Mercatus Working Paper, Mercatus Center at George Mason University.

<https://www.mercatus.org/system/files/mercatus-winston-karpilow-autonomous-vehicles-v1.pdf>

5.9. Title: Going Nowhere Fast: Urban Mobility and Employment Outcomes

Author: Tyndall, J.

Abstract: The spatial isolation of workers from firms is frequently considered as a cause of localized unemployment. Increasing the capacity and efficiency of urban transportation systems is a habitually considered solution to worker isolation. This paper will quantify metropolitan level mobility with respect to home-work commuting. Commuter mobility in the US is found to vary substantially across metros in both levels and trends during the 2005-2014 study period. The impact of mobility on locational access is shown to be theoretically ambiguous due to a dispersion effect. Increased commuter mobility has proceeded contemporaneously with increased metropolitan employment dispersion. An instrumental variable method will exploit random variation in the political process governing transportation infrastructure funding. Results provide causal evidence that increased commuter mobility degrades employment outcomes, particularly for black residents and youth. Findings are consistent with increased commuter mobility exacerbating spatial mismatch through employment sprawl.

Subject Areas: Access; Mobility; Transportation; Spatial Mismatch

Availability: Tyndall, J., 2017. *Going Nowhere Fast: Urban Mobility and Employment Outcomes*. University of British Columbia.

http://www.justintyndall.com/uploads/2/8/5/5/28559839/tyndall_gnf.pdf

5.10. Title: Linking the 2016 NHTS to Emerging Applications, Uses and Policy Making

Author: Polzin, Steven E.

Abstract: Presentation

Subject Areas: Travel Behavior; Policy; Governance

Availability: Polzin, Steven E., 2017. *Linking the 2016 NHTS to Emerging Applications, Uses and Policy Making*. Center for Urban Transportation Research, TRB Session 864.

<http://www.trb.org/AnnualMeeting/Blurbs/175528.aspx>

5.11. Title: Change And Innovation in the NHTS: How it all adds up - The MPO Perspective

Author: Mullenix, Dylan.

Abstract: Presentation

Subject Areas: Policy making; Travel data; Expanding Bike Network

Availability: Mullenix, Dylan., 2017. *Change And Innovation in the NHTS: How it all adds up - The MPO Perspective*. Des Moines Area MPO. TRB Session 882.

<http://www.trb.org/AnnualMeeting/Blurbs/175528.aspx>

5.12. Title: From Gallons to Miles: A Disaggregate Analysis of Automobile Travel and Externality Taxes

Authors: Langer, A., Maheshri, V. and Winston, C.

Abstract: Policymakers have prioritized increasing highway revenues as rising fuel economy and a fixed federal gasoline tax have led to highway funding deficits. We use a novel disaggregate sample of motorists to estimate the effect of the price of a vehicle mile traveled on VMT, and we provide the first national assessment of VMT and gasoline taxes that are designed to raise a given amount of revenue. We find that a VMT tax dominates a gasoline tax on efficiency, distributional, and political grounds when policymakers enact independent fuel economy policies and when the VMT tax is differentiated with externalities imposed per mile.

Subject Areas: Gasoline tax; VMT tax; Driver heterogeneity

Availability: Langer, A., Maheshri, V. and Winston, C., 2017. *From Gallons to Miles: A Disaggregate Analysis of Automobile Travel and Externality Taxes*. *Journal of Public Economics*, 152, pp. 34-46.

<http://www.sciencedirect.com/science/article/pii/S0047272717300798>

5.13. Title: Intermodal Mobility

Authors: Willing, C., Brandt, T. and Neumann, D.

Abstract: Not Available

Subject Areas: Intermodal mobility; Multimodal mobility; Mobility markets; Spatial analytics; Location-based services; Sustainable mobility

Availability: Willing, C., Brandt, T. and Neumann, D., 2017. *Intermodal Mobility*. Business & Information Systems Engineering, 59(3), pp.173-179.

<http://aisel.aisnet.org/cgi/viewcontent.cgi?article=1419&context=bise>

5.14. Title: Understanding Changes in Youth Mobility

Authors: Coogan, M., Nygaard, N. and Weinberger, R.

Abstract: Not Available

Subject Areas: Intermodal mobility; Multimodal mobility; Mobility markets; Spatial analytics; Location-based services; Sustainable mobility

Availability: Coogan, M., Nygaard, N. and Weinberger, R., 2017. *Understanding Changes in Youth Mobility*. NCHRP 08-36, Task 132, Prepared for AASHTO Standing Committee on Planning.

[http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP08-36\(132\)_FR.pdf](http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP08-36(132)_FR.pdf)

6. Special Population Group

6.1. Title: An Analysis of the Time-of-Day Choices of the Elderly for Non Work Travel

Authors: Fariborzi, K. and Srinivasan, S.

Abstract: Pedestrian exposure refers to a pedestrian's contact with vehicular traffic that can create opportunities for collisions. A myriad of metrics exist to estimate pedestrian exposure, but no consensus has been reached on what metrics should be adopted. Hence, this study attempted to synthesize previous studies and offer best practices for estimating pedestrian exposure (with a focus for rural and small urban areas). Four general types of exposure metrics emerged from area-based measures (e.g., zonal walk miles traveled), through more granular metrics at the point or segment level, to advanced metrics that utilize the behavioral attributes of walk trips (e.g., space-time prism and discrete choice). In addition, the study utilized home-based walk-only trips from nine states in the National Household Travel Survey (NHTS) (2009) data to estimate a household-level pedestrian exposure measure for rural and small urban settings. The model accounted for household characteristics (e.g., income and vehicle ownership), regional factor, and block-group-level attributes (e.g., population density and school density), with an overall goodness-of-fit of 0.41. The results can be used to infer number of walk trips at as small as the block group level or be inserted into four-step travel demand model to create point or segment-based measures where pedestrian network is defined.

Subject Areas: Age groups; Choice models; Travel behavior; Travel demand; Trip purpose; Planning and Forecasting; Transportation (General)

Availability: Fariborzi, K. and Srinivasan, S., 2017. *An Analysis of the Time-of-Day Choices of the Elderly for Non Work Travel*. Transportation Research Board 96th Annual Meeting (No. 17-05725).

<https://trid.trb.org/view.aspx?id=1439275>

6.2. Title: The Multimodal Behavior of Millennials: Differences in Travel Choices between Young Adults and Gen Xers in California

Authors: Circella, G., Alemi, F., Berliner, R., Tiedeman, K., Lee, Y., Fulton, L., Handy, S.L. and Mokhtarian, P.L.

Abstract: Millennials are increasingly reported to behave, and travel, differently from previous generations at the same stage in life. Among the observed changes, they postpone the time they obtain a driver's license, often live in urban locations and do not own a car, drive less if they own one, and use alternative travel modes more often. However, the reasons behind these trends, and their long-term impacts on travel demand and the future growth of cities, are still largely unclear. This study investigates millennials' mobility through the analysis of a comprehensive dataset collected among 2,155 young adults and members of the preceding Generation X who live in California, as part of a panel study of millennials' residential choices, lifestyles, travel behavior and adoption of new technologies. This paper presents an overview of the research, and discusses preliminary results from the analysis of the California Millennials Dataset. We focus on the adoption of multimodality among the members of the two generations, and compare it to measures of accessibility by various travel modes of the respondents' residential location. The study highlights differences in travel behavior between those that travel by car by necessity (e.g. because they live in locations where few travel options are available) and those that do so by choice (e.g. despite the availability of other modes). The study provides useful insights for planners and policy-makers, through improving the understanding of millennials' choices and the impact of lifecycle, period and generational effects on future travel.

Subject Areas: Millennials, Travel Behavior, Lifestyles, Multimodality, Accessibility

Availability: Circella, G., Alemi, F., Berliner, R., Tiedeman, K., Lee, Y., Fulton, L., Handy, S.L. and Mokhtarian, P.L., 2017. *The Multimodal Behavior of Millennials: Exploring Differences in Travel Choices between Young Adults and Gen Xers in California*. Transportation Research Board 96th Annual Meeting (No. 17-06827).
<http://docs.trb.org/prp/17-06827.pdf>

6.3. Title: Driving Self-Regulation and Ride Service Utilization in a Multicommunity, Multistate Sample of U.S. Older Adults

Authors: Bird, D.C., Freund, K., Fortinsky, R.H., Staplin, L., West, B.A., Bergen, G. and Downs, J.

Abstract:

Objectives: This study examined a multicommunity alternative transportation program available 24 hours a day, 7 days a week, for any purpose, offering door-through-door service in private automobiles to members who either do not drive or are transitioning away from driving. Specific aims were to describe the characteristics of members by driving status and ride service usage of these members.

Methods: Data came from administrative records maintained by a nonprofit ride service program and include 2,661 individuals aged 65+ residing in 14 states who joined the program between April 1, 2010, and November 8, 2013. Latent class analysis was used to group current drivers into 3 classes of driving status of low, medium, and high self-regulation, based on their self-reported avoidance of certain driving situations and weekly driving frequency. Demographics and ride service use rate for rides taken through March 31, 2014, by type of ride (e.g., medical, social, etc.) were calculated for nondrivers and drivers in each driving status class.

Results: The majority of ride service users were female (77%) and aged 65-74 years (82%). The primary method of getting around when enrolling for the transportation service was by riding with a friend or family member (60%). Among the 67,883 rides given, nondrivers took the majority (69%) of rides. Medical rides were the most common, accounting for 40% of all rides.

Conclusions: Reported ride usage suggests that older adults are willing to use such ride services for a variety of trips when these services are not limited to specific types (e.g., medical). Further research can help tailor strategies to encourage both nondrivers and drivers to make better use of alternative transportation that meets the special needs of older people.

Subject Areas: Driving; Older Adult; Motor Vehicle; Mobility; Self-Regulation; Senior Transportation

Availability: Bird, D.C., Freund, K., Fortinsky, R.H., Staplin, L., West, B.A., Bergen, G. and Downs, J., 2017. *Driving Self-Regulation and Ride Service Utilization in a Multicommunity, Multistate Sample of U.S. Older Adults*. *Traffic Injury Prevention*, 18(3), pp.267-272.

<http://www.tandfonline.com/doi/abs/10.1080/15389588.2016.1198008>

6.4. Title: Ethnic Neighborhoods, Social Networks, and Inter-Household Carpooling: A Comparison Across Ethnic Minority Groups

Author: Shin, E.J.

Abstract: The implications of racial residential segregation on travel behavior have remained understudied, despite the persistent existence of segregation. Using the 2009 National Household Travel Survey, I investigate whether residence in a co-ethnic neighborhood affects the likelihood that ethnic minorities will form inter-household carpools, and if so, how such effects differ across race or ethnic groups. Inter-household carpooling requires arrangements and interactions between people living in geographical proximity, so it will likely reflect the social networks of a neighborhood. The results show that Hispanics and Asians who reside in their co-ethnic neighborhoods, regardless of immigrant status, are more likely to use inter-household carpools for non-work purposes than their counterparts living outside co-ethnic neighborhoods. In contrast, black neighborhood residency is not associated with the likelihood that African Americans will do inter-household carpooling, regardless of trip purpose. These differences across racial/ethnic groups suggest that the role of neighborhoods in promoting social ties as reflected by activities such as external carpooling is complex. Residence in a black neighborhood may be less of a choice than residence in a Hispanic or Asian neighborhood due to the long history of black segregation in the US. With less residential choice, the propensity to develop local social ties may be weaker.

Subject Areas: Racial Segregation; Travel Behavior; Carpooling; Ethnic Groups

Availability: Shin, E.J., 2017. *Ethnic Neighborhoods, Social Networks, and Inter-Household Carpooling: A Comparison Across Ethnic Minority Groups*. *Journal of Transport Geography*, 59, pp.14-26.

<http://www.sciencedirect.com/science/article/pii/S0966692316300497>

6.5. Title: Hidden Costs of Carpooling in Family Life: Travel Behavior of Hispanic Families with Children in the USA

Author: Matsuo, M.

Abstract: In the U.S., Hispanic immigrant households who have low access to private vehicles typically depend on carpooling rather than taking transit, the tendency that is not observed for immigrants of other race/ethnicity groups. Moreover, my previous paper reveals that females of Hispanic immigrants are heavily dependent on others' mobility and delay becoming drivers, even though they seem to choose auto-dependent lifestyle at household level. These findings leave a question how much time is wasted by dependence on carpooling when many household members are transportation disadvantaged, such as children under driving age. This paper explores travel characteristics of Hispanic immigrant households with children in the following points; (1) whether they are lower mobility at household level, (2) whether adult members' time is wasted for transporting children, and (3) whether children's total travel time and active non-commuting trip frequency are different by the number of drivers and/or vehicles in the household, using the National Household Travel Survey data of 2009.

Subject Areas: Mobility; Immigrants; Hispanics; Children

Availability: Matsuo, M., 2017. *Hidden Costs of Carpooling in Family Life: Travel Behavior of Hispanic Families with Children in the USA*. Discussion Paper Series, Research Institute for Economics and Business Administration, Kobe University. (No. DP2017-13).
<http://www.rieb.kobe-u.ac.jp/academic/ra/dp/English/DP2017-13.pdf>

6.6. Title: Achieving Mobility Access for Older Adults Through Group Travel Instruction

Authors: Lubin, A., Alexander, K. and Harvey, E.

Abstract: It is anticipated that the number of older adults in the United States will reach 70 million before midcentury. Although the majority currently meet their transport needs by driving, one in five older adults does not drive. That statistic is expected to rise as senior drivers experience disability, health-related issues, or both, that negatively affect their driving ability. For many older adults accessible public transportation can be a viable transport option provided they are aware of and familiar with available transit services, trip planning, and how to safely and independently utilize transit systems. Findings are presented from a group travel instruction program piloted with older adults in New Jersey that encompassed classroom training and a field trip. A robust survey evaluation protocol was implemented that yielded findings that included the important role of transportation to older adult quality of life; high participant program satisfaction; evidence of participant knowledge and skills gained after program completion; and participant interest, willingness, and actual usage of public transit after the program. Survey respondents also confirmed several quality-of-life indicators experienced from program participation. In total, these findings offer evidence of the benefits of group travel instruction for older adults with and without a disability as they seek to meet some or all of their travel needs via accessible public transportation. The findings also support the value of offering both classroom and field trip components in older adult travel instruction programs.

Subject Areas: Older adults; Driving; Travel Instruction

Availability: Lubin, A., Alexander, K. and Harvey, E., 2017. *Achieving Mobility Access for Older Adults Through Group Travel Instruction*. Transportation Research Record: Journal of the Transportation Research Board, (2650), pp.18-24.

<http://trjournalonline.trb.org/doi/abs/10.3141/2650-03>

6.7. Title: Driving the Poor into Debt? Automobile Loans, Transport Disadvantage, and Automobile Dependence

Author: Walks, A.

Abstract: The disadvantages relating to the financialization of household transport and transport-related debt have yet to receive sufficient attention, partly due to a general lack of data on household-level transport-related liabilities, particularly at small scales of analysis. This issue has risen in importance with increases in households debt levels and changes in the ways automobile purchases are financed. This paper examines the level of automobile-related debt among lower-income households, and the effects of living in automobile-dependent neighbourhoods, using seven of the largest Canadian metropolitan areas as case studies. Detailed household survey data pertaining to both automobile loans and other forms of debt in 2012 are analyzed and compared with census data related to automobile dependence at the neighbourhood (census tract) level. Descriptive and inferential analyses are presented, demonstrating relationships between levels of automobile dependence and higher relative burdens of household indebtedness, particularly for automobile loans, although the relationships are dependent on, and mediated by, local context. The implications for transport policy are discussed.

Subject Areas: Automobile dependence; Financial vulnerability; Debt; Transport disadvantage; Transport exclusion; Suburbanization

Availability: Walks, A., 2017. *Driving the Poor into Debt? Automobile Loans, Transport Disadvantage, and Automobile Dependence*. Transport Policy.

<http://www.sciencedirect.com/science/article/pii/S0967070X17300112>

6.8. Title: The Impact of Employment Status on the Travel Behaviour of Millennials: Assessing the Potential for Promoting Sustainable Transportation in the Greater Toronto and Hamilton Area

Author: Giallonardo Michael.

Abstract: Millennials are known to drive automobiles less than their preceding generations; this behaviour has been attributed the Great Recession and the disproportionate effect it has had on them. The validity of this theory in the Greater Toronto and Hamilton Area is assessed in this report through an exploration of the association between employment status and three indicators of travel behaviour: mode share, daily auto trips, and daily vehicle kilometres travelled. Data used in this report are from 2001, 2006, and 2011 Transportation Tomorrow Surveys and results were geographically split to assess differences between the City of Toronto and its suburbs. The data confirm an association between employment status and travel behaviour in the GTHA although individuals with full-time employment did not maintain stable automobility patterns during the study period suggesting that unique Millennial travel behaviour cannot be wholly attributed to the negative economic conditions brought on by the Great Recession. Nevertheless, Millennial travel behaviour patterns were determined to have been affected by this event in a manner that was not observed among Generation Xers. Thus, the data suggest that Millennials can be expected to drive more as they age, especially with improved employment fortunes, although perhaps not as much as their elders did at similar lifecycle stages. Planners and policymakers can interpret these results as an opportunity and challenge. While it is unlikely for automobile demand to be eliminated, the usage of this travel mode can be reduced by further promoting ridesharing, ride-hailing, and carsharing as substitutes to car ownership. Employer-based transportation demand management programs should be embraced. Compact and mixed use developments are necessary but should be combined with efforts to reduce the convenience of automobile usage to facilitate reductions in automobile demand. Finally, policymakers should capitalize on increased transit usage among Millennials by improving marketing and education about this alternative travel option.

Subject Areas: Millennials; Travel Behaviour; Automobility patterns

Availability: Giallonardo Michael, 2017. *The Impact of Employment Status on the Travel Behaviour of Millennials: Assessing the Potential for Promoting Sustainable Transportation in the Greater Toronto and Hamilton Area.* (Master's Thesis) Queens University.

https://qspace.library.queensu.ca/bitstream/handle/1974/15651/Giallonardo_Michael_C_201704_MPL.pdf.pdf?sequence=1

6.9. Title: Commuting Patterns of Immigrant workers in Indian Eateries: Focusing on Latino and Indian Immigrants

Author: Doravari, A.

Abstract: This inductive research study aimed to understand commuting patterns of low-income immigrant workers in 3 cities located in Los Angeles County and San Bernardino County. The study identified 35 potential participants from the Indian Restaurant Industry and conducted a research study at three mid-sized cities namely Pomona, Diamond Bar and Upland. The study employed mixed methods for ethnographic research using Delphi and Grounded Theory for data collection and analysis. The study enquired about three main topics: Travel Experiences in the region (2) Housing location and rationale (3) Worker dynamics and interpersonal relationships at the work place. The data was collected in the form of Travel Surveys and in-depth structured interviews. The raw data was analyzed and several inferences based on demographic and social factors became evident. There seemed to be a large number of Indian people in this sample when compared to Mexicans or Central Americans. There were also emerged a reasonable number of unauthorized immigrant workers in the sample. The part-time working community comprised majority of the unauthorized workers since these workers were full-time International students at local universities. The commute mode for this sample is drastically different from that of Native born groups. This difference is mostly due to the lack of single occupancy vehicles in this sample. More specifically, Mexicans follow some resemblance to white commute patterns, whereas the Indian community displays a multimodal commute mode patterns. The second major commute mode for this sample was car-pooling, a category that became dominant in both part-time and full-time groups. Social networks also played an important role in enhancing transportation or mobility in this sample, since strong personal relationships and mutual dependence were observed.

Subject Areas: Commuting patterns; Low-income Immigrants

Availability: Doravari, A., 2017. *Commuting Patterns of Immigrant workers in Indian Eateries: Focusing on Latino and Indian Immigrants*. MS dissertation, California State Polytechnic University, Pomona.

https://broncoscholar.library.cpp.edu/bitstream/handle/10211.3/189853/DoravariAnupama_Thesis2017.pdf?sequence=4

6.10. Title: What Explains the Decline in Driving Among Young People?

Author: Schmitt, A.

Abstract: Blog

Subject Areas: Travel behavior; Young generation

Availability: Schmitt, A., 2017. *What Explains the Decline in Driving Among Young People?* StreetsBlog USA.

<http://usa.streetsblog.org/2017/03/29/what-explains-the-decline-in-driving-among-young-people/>

6.11. Title: Multimodal Millennials? The Four Traveler Types of Young People in the United States in 2009

Author: Ralph, K.M.

Abstract: Are young Americans embracing a mix of travel modes? This article identifies four types of travelers to answer that question. Drivers travel almost exclusively by automobile; Long-distance Trekkers drive great distances; Multimodals use a mix of modes; and the Car-less rely on nonautomobile modes and make very few trips. Multimodals were exceedingly rare and eight in ten Millennials used an automobile for nearly every trip as a Driver or Long-distance Trekker. By incorporating multiple facets of travel into a single variable, this research provides valuable information for addressing twenty-first-century policy challenges such as encouraging multimodality and alleviating transportation disadvantage.

Subject Areas: Travel modes; Drivers; Millennials

Availability: Ralph, K.M., 2017. *Multimodal Millennials? The Four Traveler Types of Young People in the United States in 2009*. *Journal of Planning Education and Research*, 37(2), pp.150-163.

<http://journals.sagepub.com/doi/abs/10.1177/0739456X16651930>

6.12. Title: Humboldt Bay Trail Could Use Your Support

Author: Hughes, R.

Abstract: Blog

Subject Areas: Adult-bikers; Baby boomers; Funding

Availability: Hughes, R., 2017. *Humboldt Bay Trail Could Use Your Support*. Times Standard Columns.

<http://www.times-standard.com/opinion/20170622/humboldt-bay-trail-could-use-your-support>

6.13. Title: Gender Differences in the Commute to School and Work through Time and Space in the Greater Toronto and Hamilton Area, Canada

Author: Colley, M.E.

Abstract: Previous research on gender and mobility has pointed to differences between male and female travel patterns, but little attention has been paid in transportation planning practice to gender differences in travel demand. This thesis explores gender differences in the school and work commute through the life cycle and over time and space in effort to inform policies that begin to address the needs of a diverse population. The results suggest that school-aged males use active modes more than females, but females use active modes more than males during the years of labour force participation. Adult men continue to use the automobile to travel to work, while females make up a greater proportion of transit riders than males. Mode share differences increase with age, but have decreased since the 1980s. The relationship between male and female travel mode also differs depending on many factors including distance, time, and place.

Subject Areas: Gender differences; Commute

Availability Colley, M.E., 2017. *Gender Differences in the Commute to School and Work through Time and Space in the Greater Toronto and Hamilton Area, Canada*. M.S. Thesis, University of Toronto (Canada).

https://tspace.library.utoronto.ca/bitstream/1807/76664/1/Colley_Michele_E_201703_MA_thesis.pdf

6.14. Title: Declining Function in Older Adults: Influencing not only Community Mobility Options but also Wellbeing

Authors: Silverstein, N.M., Macàrio, R. and Sugiyama, T.

Abstract: People experience decline in physical and cognitive functioning as they age. The functional decline has a major implication on the way they move within a local environment. This issue of *Journal of Transport and Health* contains three articles on how functional capacity influences older adults' mobility choice and experience, and how the subsequent limited mobility options can affect their wellbeing. With reduced capacity to walk (primary mobility), older adults need to rely on motorized mobility options such as cars and public transport (secondary mobility). The limited availability and access to motorized transport can cause a constricted "life space", which is known to be associated with adverse health outcomes (Polku et al., 2015). However, two articles in this issue illustrate that such motorized mobility options also pose a challenge for older adults with impaired physical and cognitive function. Age changes the cognitive reaction to stimulus and phasing out of professional active life changes also quality criteria assessing services.

Schubert et al. (2017) examined the physical demand involved when riding a bus. As fatalities due to crash involvement are typically measured as death within 30 days (USDOT, 2016), the gerontological story is likely far more complex. That is, serious long term injury sustained from crash involvement may result in death later than 30 days; or lead to longer term rehabilitation or institutionalization. Schubert et al. add another dimension to this story, that is, the non-collision accidents related to use of buses: specifically, injuries due to boarding and exiting, and standing or moving during acceleration or deceleration. Their study focused on the high level of biomechanical demands that passengers who are standing must sustain and concluded that the thresholds to maintain postural control are often exceeded during acceleration and deceleration leading to a fall or degradation of the bus travel experience. This can be a major deterrence for older adults with limited physical function (e.g., balance, grip, leg muscle) in using buses for travel. Frequent and reliable bus services are often considered a key factor to promote bus ridership (Redman et al., 2013). However, for older adults, the physical demand in dealing with acceleration and deceleration is another factor that can influence the choice of this travel mode. Research investigating more innovative solutions to mitigate the biomechanical demand may help encourage older adults' bus use. While Schubert et al. focus on the physical demands, an implication of their study is the need for further research on impairments related to cognitive demands and the use of transportation options where travel-related incidents may emerge that are even more difficult to measure, such as wandering and getting lost when traveling unescorted. More research is encouraged to better understand the broader range of non-collision accidents in older adults that are associated with transportation.

Pavlou et al. (2017) examined how the self-regulation patterns of drivers with brain pathologies (Alzheimer's disease, Parkinson's disease, and mild cognitive impairment) are different from those of healthy drivers. In a matched control study, they found that the healthy controls reported a greater number of motor vehicle accidents, "near" accidents, and violations in the past two years than did persons with brain pathologies; although the healthy controls were more likely to report greater seatbelt usage. The study suggests that older drivers with cognitive problems are able to drive a car safely, but they are concerned with their deterioration in driving performance and this perception leads them to conservative driving or driving avoidance, a theme echoed by the third article authored by Deka (2017) who observed that the loss of mobility by car use negatively

influences wellbeing in older adults. Collateral data from family members and stage of disease process would have been helpful for the authors to report and also to include in future studies as these findings seem to contradict others that suggest that the lack of insight in persons with dementia may impact driving performance (Eby et al., 2012).

The third article, by Deka, examined the effect of mobility loss and car ownership on older adults' wellbeing (depression, happiness, and loneliness). This study found that developing walking difficulty had an adverse impact on depression and happiness, while not having a car was associated with depression. Interestingly, he concluded that cross-sectional models show more conclusive effects of mobility impairment than cohort models with climbing stairs and walking more significantly associated with depression; walking ability associated with happiness; and climbing stairs significantly related to loneliness. His results further revealed that the effect of automobile ownership was significant in the analytic model for depression but not for happiness or loneliness. He suggests, and we agree, that additional questions on subjective well-being, utilization of mobility options, and more health variables need to be included on national datasets such as the National Household Travel Survey (NHTS). We note that the National Health and Aging Trends Study (NHATS) is already beginning to include such modules.

In summary, the three articles suggest that older adults with impaired physical and cognitive functioning are at risk of losing both non-motorized and motorized modes of mobility, which has a detrimental impact on their mental wellbeing. Reduced physical function is clearly related to walking difficulty and may discourage bus use due to the strength needed to withstand sudden movement. Older adults with cognitive decline often relinquish driving once they are concerned with their driving performance. The loss of primary and secondary mobility means a dramatic reduction of life space leading to adverse health outcomes and social isolation. On-demand transport may be an alternative travel mode for those who are losing functional abilities. However, the availability, accessibility, and affordability of such services may be limited. An underlying issue that should be addressed is how to delay or slow the decline of functional capacities among older adults so that they can remain active and keep using a range of transport options. Promoting age-friendly communities, where older adults maintain healthy and active lifestyles in a supportive built environment, may be an effective strategy to prevent functional decline.

Subject Areas: Functional decline and mobility; Older adults; Wellbeing

Availability Silverstein, N.M., Macàrio, R. and Sugiyama, T., 2017. *Declining Function in Older Adults: Influencing not only Community Mobility Options but also Wellbeing*. Journal of Transport & Health, 4, pp.4- 5.

<http://www.sciencedirect.com/science/article/pii/S2214140517300701>

6.15. Title: Does Economic Vulnerability Moderate the Association between Transportation Mode and Social Activity Restrictions in Later Life?

Authors: Lehning, A., Kim, K., Smith, R. and Choi, M.

Abstract: Transportation is critical to older adults' ability to participate in social activities in their community. We examined the association between modes of transportation and restrictions in social activity (i.e. visiting with others, religious attendance, clubs and organized activities, and going out for enjoyment), with particular attention to the moderating effects of economic vulnerability. We used logistic regression to analyze data from 7,197 community-dwelling older adults from the 2011 wave of the National Health and Aging Trends Study, a representative sample of adults aged 65 and over in the United States of America. Economic vulnerability moderated the association between transportation mode and social activity restrictions. Findings suggest that even when economically vulnerable older adults have access to driving, walking or public transit, they may be at a higher risk for social exclusion than their counterparts with more financial resources.

Subject Areas: Older adults; Economic vulnerability

Availability: Lehning, A., Kim, K., Smith, R. and Choi, M., 2017. *Does Economic Vulnerability Moderate the Association between Transportation Mode and Social Activity Restrictions in Later Life?* *Ageing & Society*, pp.1-20.

<https://www.cambridge.org/core/journals/ageing-and-society/article/does-economic-vulnerability-moderate-the-association-between-transportation-mode-and-social-activity-restrictions-in-later-life/62E4FF5F183C513A8B69B2B85183A934>

6.16. Title: Elderly's Travel Patterns and Trends: The Empirical Analysis of Beijing

Authors: Liu, W., Lu, H., Sun, Z. and Liu, J.

Abstract: Travel by the elderly is generally characterized by relatively short distances and low frequencies. However, with social development, the travel patterns of the elderly are lacking in sustainability. In some European countries, the elderly are increasingly dependent on cars while traveling. In addition, the influencing factors of the elderly's travel behavior are also changing. At present, most foreign and domestic studies focus on the impact of individual and household socioeconomic attributes, travel attributes, and policy factors on the travel frequency, travel mode choice, and travel demand of the elderly, but they lack an analysis of the regional differences of the elderly's travel behavior characteristics and related countermeasures. The studies excessively focus on the influencing factors but overlook the difference between the elderly's travel characteristics and young people's travel characteristics, as well as the interactions at the household level. Based on data from the Fifth Travel Survey of Residents in Beijing 2014, this paper uses variance analysis, Spearman's correlation analysis, and descriptive and comparative analysis to study the difference in travel frequency over 24 hours between the elderly and middle-aged/young people in Beijing, the impact of household, individual, and travel attributes on the travel frequency difference, and the regional difference in the elderly's travel behavior characteristics. The results show that there is a significant difference in travel frequency between the elderly group and the middle-aged/young group in Beijing; the main reason is the individual difference between travelers. Travelers' attributes all exert an influence on the travel frequency of both groups, but the degree and direction of the influence are different. At the household level, middle-aged/young people with a higher household income travel less frequently, whereas the case is completely the opposite for the elderly. In terms of personal attributes, gender has a significant negative effect on the elderly's travel frequency; that is, women travel less than men, whereas there is no difference between men and women in middle-aged/young people. Regarding travel attributes, travel distance and travel duration have a significant negative effect on the two groups' travel frequencies. The elderly in some European countries are more dependent on cars, whereas a large proportion of elderly people in Beijing walk on foot, but the degree of dependence on cars of the "new generation" of the elderly in Beijing will increase rapidly, which will bring the lack of sustainability of travel patterns, further bringing new challenges to policymakers and transport planning departments.

Subject Areas: Elderly; Mobility; Sustainability; Frequency; Beijing

Availability: Liu, W., Lu, H., Sun, Z. and Liu, J., 2017. *Elderly's Travel Patterns and Trends: The Empirical Analysis of Beijing*. Sustainability, 9(6), p.981.

<http://www.mdpi.com/2071-1050/9/6/981/htm>

6.17. Title: Transportation Barriers and Use of Dental Services among Medicaid-Insured Adults

Authors: McKernan, S.C., Reynolds, J.C., Ingleshwar, A., Pooley, M., Kuthy, R.A. and Damiano, P.C.

Abstract: This study explores how travel distance and other transportation barriers are associated with dental utilization in a Medicaid expansion population. We analyzed data from the Iowa Dental Wellness Plan (DWP), which provides comprehensive dental benefits for low-income adults aged 19 to 64 y as part of Iowa's Medicaid expansion. Transportation and geographical characteristics were evaluated as enabling factors within the framework of Andersen's behavioral model of health services use. In March 2015, a random sample of DWP members (n = 4,800) was surveyed; adjusted survey response rate was 30% (n = 1,258). The questionnaire was based on the Consumer Assessment of Healthcare Providers and Systems (CAHPS) Dental Plan Survey and assessed need for dental care, use of dental services and transportation to visits, and self-perceived oral health status. Respondent and dentist addresses were geocoded and used to calculate distance to the nearest DWP general dentist. A logistic regression model predicting utilization of dental care was developed using variables representing each domain of the behavioral model. Most respondents (57%) reported a dental visit since enrolling. Overall, 11% of respondents reported unmet dental need due to transportation problems. Median distance to the nearest general dentist was 1.5 miles. In the adjusted model, travel distance was not significantly associated with the likelihood of dental utilization. However, other transportation-related issues were significantly associated with utilization, including concern about cost of transportation and driver/passenger status. As concern about transportation cost increased, likelihood of having a dental visit decreased. Targeted approaches to assisting low-income populations with transportation barriers should be considered in designing policies and interventions to improve access to dental care.

Subject Areas: Transportation Barriers; Travel distance; Dental health; Low-income adults

Availability: McKernan, S.C., Reynolds, J.C., Ingleshwar, A., Pooley, M., Kuthy, R.A. and Damiano, P.C., 2017. *Transportation Barriers and Use of Dental Services among Medicaid-Insured Adults*. JDR Clinical & Translational Research, p.2380084417714795.
<http://journals.sagepub.com/doi/abs/10.1177/2380084417714795>

6.18. Title: Understanding Immigrants' Mode Choice Behavior in Florida: Analysis of Neighborhood Effects and Cultural Assimilation

Authors: Asgari, H., Zaman, N. and Jin, X.

Abstract: The goal of this study is to develop Multinomial Logit models for mode choice behaviour of immigrants, with key focuses on neighbourhood effects and behavioural assimilation. The first aspect assumes a linkage between social network ties and immigrants' chosen mode of transportation, while the second dimension explores the gradual propensity towards alternative mode usage with regard to immigrants' settlement period in the United States. Factor analysis was carried out to establish neighbourhood typologies based on income, family structure, and education. Mode choice models were then developed for work, shopping, social and recreational, and other trip purposes to evaluate the impacts of various land use patterns, neighbourhood typology, and socioeconomic and demographic attributes on immigrants' travel behaviour. Estimated coefficients for each alternative mode (i.e., high-occupancy vehicle, public transit, and non-motorized transport) were compared to single-occupancy vehicles (SOV). The model results revealed significant influences of neighbourhood and land use variables on the usage of alternative modes among immigrants. Incorporating these indicators into the demand forecasting process is expected to provide a better understanding of diverse travel patterns for the unique composition of population groups in Florida.

Subject Areas: Immigrants'; Travel Behavior; Mode Choice Modeling; Neighborhood Effects; Principal Component Analysis

Availability: Asgari, H., Zaman, N. and Jin, X., 2017. *Understanding Immigrants' Mode Choice Behavior in Florida: Analysis of Neighborhood Effects and Cultural Assimilation*. Transportation Research Procedia, 25, pp.3083-3099.

<http://www.sciencedirect.com/science/article/pii/S2352146517306269>

6.19. Title: Measuring and Improving Seniors' Access to Medical Facilities

Authors: Zygo, A.

Abstract: The travel behaviors of older adults often shift as they retire, begin second careers and make residence location choices geared towards aging in place. Those who rely on transit as their primary mode of transportation can face many accessibility and connectivity challenges when traveling to basic amenities due to their unique travel behaviors and declining mobility with advanced age. First chapter of this thesis focuses on a subset of these travel behaviors through a literature review then evaluates the ability of public transportation to meet the specific mobility needs of older adults (defined in three ways: as those adults >65 years of age, >75 and >85). The ability of transit to provide older adults with access to medical facilities is measured using a pair-wise Transit Opportunity Index (TOI), a comprehensive measure of transit accessibility between origin-destination pairs. In particular, this study focuses on assessing whether seniors in various age groups have better or worse access to medical facilities than the general population. This analysis focuses on CT Transit New Haven, a fixed-route bus system operating in New Haven, Connecticut. Although might be varying based on time of day, the results suggest that seniors within the transit service area have better access to medical facilities than the general population in the same area.

Second chapter focuses on access improvement. Equitable access became a concern with passing of non-discrimination requirements specified in Title IV of Civil Rights Act of 1964 and Executive Order 12898 on environmental justice. Increasing need for new methodologies to incorporate equity into network design quickly gained interest of transportation researchers. Although very few methodologies have been developed on the subject, the second chapter builds on available tools on transit network optimization. It develops a frequency setting model for equitable access to medical facilities with respect to elderly population. This research is motivated by findings related to travel characteristics of this particular group, mainly, the time of day of travel and trip purpose. Seniors tend to travel during off peak hours at a rate higher than the rest of the population. Seniors also tend to have a different travel purpose than the rest of the population. Research shows that they make frequent medical trips, along with shopping and running errands all done during off peak hours. Based on the recognition of the need for more frequent service during off peak hours to accommodate the needs of increasing population of seniors' worldwide, a frequency setting model is applied to the transit network for the City of New Haven, Connecticut. The model is tested on two demand scenarios: a base case in which all demand is treated equally, and a scenario in which a population weight factor is included in the objective function to prioritize the demand of protected populations. Results show improved access by shifting bus frequency to routes serving areas with higher population of seniors.

Subject Areas: Travel Behavior; Older adults; Transit Opportunity Index (TOI)

Availability: Zygo, A., 2017. *Measuring and Improving Seniors' Access to Medical Facilities*. Master's Theses. 1042.

http://digitalcommons.uconn.edu/gs_theses/1042/

7. Survey, Data Synthesis, and Other Applications

7.1. Title: Applying Geographic-Based Demographic Targeting in Household Travel Survey Sampling Plans: Case Study from the Phoenix, Arizona Region

Authors: Selby, B., Komanduri, A., Brown, E. and Livshits, V.

Abstract: Response rates in household travel surveys are declining nationwide, yet data requirements to support model estimation continue to become more complex - especially in areas that are migrating to activity-based models (ABM). Segments with complex travel behaviors, such as transit users, large households, auto-deficient households, increasingly need to be oversampled to support ABM frameworks. In response, a slew of operational improvements have been considered, including higher incentives, use of new technology, relational databases that minimize respondent burden, and design of questionnaires that only focus on the most needed information. However, there has been limited focus to-date in the US on the development of more fine-grained sampling plans, and on the ways to refine sample purchase that could help stratify the geographic area and identify the concentration of key markets of interest. The authors showcase a sampling plan that builds on the best practices of geography-based sampling and introduces two new concepts: the use of demographics/groups of interest and the use of non-contiguous boundaries to help enhance survey efforts. This method employs oversampling and block-group based monitoring integrated into the survey plan. The objective is efficiency in getting sufficient representation of hard-to-reach or low responding populations as well as supplying models with enough information on the choices of those with more complex behavioral patterns or choices.

Subject Areas: Household travel survey; Sampling plan; Household demographics; hard-to-reach populations; Address-based Sampling

Availability: Selby, B., Komanduri, A., Brown, E. and Livshits, V., 2017. *Applying Geographic-Based Demographic Targeting in Household Travel Survey Sampling Plans: Case Study from the Phoenix, Arizona Region*. Transportation Research Board 96th Annual Meeting (No. 17-04635). <http://docs.trb.org/prp/17-04635.pdf>

7.2. Title: Measuring the Spatial Dimension of Automobile Ownership and Its Associations with Household Characteristics and Land Use Patterns: A Case Study in Three Counties, South Florida (USA)

Authors: Song, J. and Wang, R.

Abstract: Motorization and increased levels of car ownership have partly contributed to traffic congestion and air pollution, which is a prime concern in the era of climate change. Therefore, vehicle ownership-related topics have been extensively explored by transportation scholars, economists, and planning researchers. However, relatively fewer scientists have investigated the spatial patterns and socioeconomic factors of car ownership simultaneously within a large geographic scale. Thus, the goal of this article is to illuminate how high levels of auto ownership may cluster spatially and what factors relate to such phenomena by developing an integrative framework and applying it in three counties in South Florida (US). Specifically, this study first evaluated whether vehicle ownership is spatially autocorrelated using Global and Local Moran's I statistics. It then justified significant factors associated with car ownership by employing Poisson and Corrected Poisson regression models. The findings, using raw data, show that there exist locally spatial clusters of the households with high levels of automobile ownership, while globally the patterns of auto ownership are statistically random. Furthermore, the results suggest that the number of drivers, the number of workers, household income level, housing tenure, the proximity to schools, and net house density significantly influence car ownership levels. The results can assist urban planners and local governments in developing planning schemes that aim at transit, cycling, walking, and other non-motorized travel modes, thereby furthering environmentally friendly communities.

Subject Areas: Number of Cars; Autocorrelation; Spatial Distribution; Regression; Automobile; Metropolitan Region

Availability: Song, J. and Wang, R., 2017. *Measuring the Spatial Dimension of Automobile Ownership and Its Associations with Household Characteristics and Land Use Patterns: A Case Study in Three Counties, South Florida (USA)*. Sustainability, 9(4), p.558.
<http://www.mdpi.com/2071-1050/9/4/558/htm>

7.3. Title: Testing Spatial Transferability of Activity-Based Travel Forecasting Models

Authors: Bowman, J.L. and Bradley, M.

Abstract: This paper reports results from the second phase of a two-phase FHWA-sponsored project to empirically test and demonstrate the transferability of activity-based (AB) model systems between regions. Using data obtained through the 2008-2009 National Household Travel Survey “add-on” program, the principal investigators estimated activity-based models simultaneously for thirteen metropolitan regions in seven U.S. states. Statistical tests were used to test transferability, including tests of regional differences in the model coefficients, likelihood ratio tests of model equivalence, and Transferability Indexes that measure the degree of model differences. In addition, differences in prediction sensitivity between locally estimated and transferred models was tested. The project overall found evidence in favor of transferability, and that parameters associated with land use, log sum accessibilities and travel time and cost cause the biggest problems with transferability. Finally, and the primary focus of this paper, it found that transferring within a state or between regions with similar urban density improves transferability. This paper presents the data, models and testing methods used in the project, followed by details of all tests and results related to the improved transferability associated with model transfers from regions within the same state or with similar urban density. The conclusion is that agencies considering transfer of an AB model from another region would do well to find one within the same state or with similar urban density that has a model well-supported by a large household travel survey data set.

Subject Areas: Travel Demand Models; Transferability; Travel Time; Cost; Region

Availability: Bowman, J.L. and Bradley, M., 2017. *Testing Spatial Transferability of Activity-Based Travel Forecasting Models*. Transportation Research Board 96th Annual Meeting (No.17-02964).

<http://docs.trb.org/prp/17-02964.pdf>

7.4. Title: Regional Differences in the Determinants of Oregon VMT

Authors: Ke, Y. and McMullen, B.S.

Abstract: Road user charges (RUCs) in the form of per mile charges have been suggested as an alternative to fuel taxes to help keep up with the costs of maintaining and expanding public road systems. The success of a RUC in providing for the long term stability of highway finance depends partly on how drivers respond to changes in the tax structure and also other determinants of driving behavior. Region specific characteristics, such as public transit accessibility and biking infrastructure, may also affect vehicle miles traveled (VMT) demand. This paper uses econometric techniques to examine the determinants of VMT using data from the Oregon Household Activities Survey (OHAS). We use standard OLS regression to examine the impact of urban density, household income, fuel cost, transit mileage, household location, and additional household characteristics on VMT. Preliminary results show that statewide Oregon demand for VMT is positively and significantly impacted by household income. Statewide, fuel price, transit use and population density are all found to be statistically significant and negatively related to household VMT. However, at the regional level some of these variables lose significance. Holding all factors constant, household VMT is found to differ by region as well as by population density.

Subject Areas: VMT Determinants; Road Use Charge; Location Type

Availability: Ke, Y. and McMullen, B.S., 2017. *Regional Differences in the Determinants of Oregon VMT*. Research in Transportation Economics.
<http://www.sciencedirect.com/science/article/pii/S0739885917300422>

7.5. Title: A Practical Method to Test the Validity of the Standard Gumbel Distribution in Logit-Based Multinomial Choice Models of Human Travel Behavior

Authors: Ye, X., Garikapati, V.M., You, D. and Pendyala, R.M.

Abstract: Most multinomial choice models, particularly in practice (e.g., multinomial logit model), assume an extreme-value Gumbel distribution for the random components of utility functions. The use of this distribution offers a closed-form likelihood expression when the utility maximization principle is applied to model choice behaviors. The maximum likelihood estimation method can be easily applied to estimate model coefficients. However, maximum likelihood estimators are consistent and efficient only if distributional assumptions on the random error terms are valid. It is therefore important to test the validity of underlying distributional assumptions that form the basis of parameter estimation and policy evaluation. In this paper, a practical but strict method is proposed to test the distributional assumption of the random component of utility functions in both the multinomial logit (MNL) model and multiple discrete-continuous extreme value (MDCEV) model. Based on a semi-nonparametric approach, a closed-form likelihood function that nests the MNL or MDCEV model being tested is derived. Then, the traditional likelihood ratio test can be applied to test violations of the standard Gumbel distribution assumption. Simulation experiments are conducted to show that the test yields acceptable Type-I and Type-II error probabilities at commonly available sample sizes. The test is then applied to three real-world discrete and discrete-continuous choice models. For all three models, the proposed test rejects the validity of the standard Gumbel distribution in most utility functions, calling for the development of approaches that overcome adverse effects of violations of distributional assumptions.

Subject Areas: Travel Behavior Models; Discrete Choice Models; Test of Validity of Distributional Assumption; Multinomial Logit Model; Multiple Discrete-Continuous Extreme Value Model

Availability: Ye, X., Garikapati, V.M., You, D. and Pendyala, R.M., 2017. *A Practical Method to Test the Validity of the Standard Gumbel Distribution in Logit-Based Multinomial Choice Models of Human Travel Behavior*. Transportation Research Board 96th Annual Meeting (No.17-05407). <http://docs.trb.org/prp/17-05407.pdf>

7.6. Title: Long-Term Impacts of the Universal Helmet Law Changes on Motorcyclist Fatal Crashes: Comparison Group and Empirical Bayes Approaches

Authors: Lee, J., Abdel-Aty, M., Wang, J.H. and Lee, C.

Abstract: A motorcyclist helmet is considered a very important safety equipment as it prevents or minimizes head and brain injuries which are often fatal. Hence, most of the states in the United States have enacted a law requiring all motorcyclists to wear helmets in the 1960s and 1970s, which is also known as the universal helmet law. Many researchers have examined the impact of the helmet law changes by far using before-and-after study, and found that repealing the law has a negative effect on motorcyclists. In this study, the authors have attempted to explore the long-term impacts of repeal and reinstatement of the universal helmet law using 13 to 16 years-data. A before-and-after study with comparison group and Empirical Bayes (EB) methods were adopted to account for the passage of time and its effect on other factors such as exposure, maturation, trend, and regression- to-the-mean bias. A range of safety performance functions were developed based on counties and calculated the expected motorcycle fatal crashes. The results showed that the universal helmet law repeal still has significant effects on motorcycle fatal crash counts even 7-12 years after the universal helmet law repeal. The crash modification factors showed that the UHL repeal has increased the number of motorcycle fatal crashes by 15% to 41% whereas the UHL reinstatement has decreased it by 21% to 27%. It is expected that the results from this study could be helpful for states' policy makers to clearly understand the effects of the UHL on reducing motorcycle fatal crashes.

Subject Areas: Motorcycle Safety; Motorcycle Helmet-Use; Before- And-After Study With Empirical Bayes Method; Transportation Policy

Availability: Lee, J., Abdel-Aty, M., Wang, J.H. and Lee, C., 2017. *Long-Term Impacts of the Universal Helmet Law Changes on Motorcyclist Fatal Crashes: Comparison Group and Empirical Bayes Approaches*. Transportation Research Board 96th Annual Meeting (No.17-00917). <http://docs.trb.org/prp/17-00917.pdf>

7.7. Title: Incorporating Activity Space and Trip Chaining onto Facility Siting for Accessibility Maximization

Authors: Li, R. and Tong, D.

Abstract: Location models have been widely used to support locational decisions for various service provision. One common objective of location models has been to ensure maximal accessibility of sited facilities to demand populations. Accessibility evaluation in location models often assumes that trips originate from fixed locations (usually home) and are single purpose. These assumptions contradict the empirical evidence that suggests trips also commonly originate from non-home locations and may involve multiple stops. In this study, a new multi-objective location model is developed that extends the classic p-median problem (PMP) to account for a more realistic assessment of accessibility. Based on the individual accessibility assessment, notions of trip chaining and activity space are incorporated into the model development. In addition to fixed home locations, stops along chained trips are allowed for potential service site visits, and activity space is introduced as an additional dimension to evaluate accessibility of alternative opportunities. The effectiveness of the new model is demonstrated using an application in Tucson, AZ.

Subject Areas: Location modeling; Accessibility; Activity space; GIS

Availability: Li, R. and Tong, D., 2017. *Incorporating Activity Space and Trip Chaining onto Facility Siting for Accessibility Maximization*. Socio-Economic Planning Sciences.
<http://www.sciencedirect.com/science/article/pii/S0038012116301215>

7.8. Title: A Walk Trip Generation Model for Portland, OR

Authors: Tian, G. and Ewing, R.

Abstract: This study proposes a home-based walk trip generation model, based on the built environment around households, controlling for sociodemographic influences. Two-stage hurdle models are estimated based on a household travel survey in Portland, Oregon. The first stage predicts the probability of households making any home-based walk trips. The second stage predicts the number of home-based walk trips for the subset of households that make such trips. The study also tests built environment variables for three different buffer widths around household locations to see which scale best explains walking behavior. The results show that sociodemographic characteristics are strong predictors of walk trip generation. Specifically, household size, income, and number of workers in the household influence the probability of a household having any walk trips, while household size and number of children in the household affect the number of walk trips made by the subset of households making walk trips. Characteristics of the built environment are also significant. Activity density, transit stop density, employment accessibility, intersection density, and most interestingly, sidewalk quality are associated with the decision to walk as a mode of travel, while land-use entropy, transit stop density, employment accessibility, sidewalk quality, and traffic calming and signal are predictors of the number of walk trips made by households making walk trips. Sidewalk quality is represented by a single principal component that neatly captures the common variance in an array of sidewalk variables. To our knowledge, this is the first walk trip generation model to include a measure of sidewalk quality.

Subject Areas: Walk; Trip generation; D variables; Street quality; Hurdle model

Availability: Tian, G. and Ewing, R., 2017. *A Walk Trip Generation Model for Portland, OR*. *Transportation Research Part D: Transport and Environment*, 52, pp.340-353.
<http://www.sciencedirect.com/science/article/pii/S1361920917302328>

7.9. Title: Commute Mode Diversity and Public Health: A Multivariate Analysis of 148 U.S. Cities

Authors: Frederick, C., Riggs, W. and Gilderbloom, J.H.

Abstract: Urban sprawl has a negative relationship with regional health outcomes, such as high obesity and chronic diseases related to physical inactivity. At the same time, literature has shown that walkable built environments are connected to lower obesity rates and decreased physical activity. Less understood is the association of modal diversity with those health outcomes. This research studies a range of public health outcomes to determine their associations with commute mode diversity. Researchers adapted the methodology of urban sociologists Harvey Molotch and Richard Appelbaum to explore twelve different health measures in 148 U.S. counties and their metropolitan statistical areas. The test measure is the percentage of commuters who use some means other than a single-occupant vehicle. The percentage of such commuters ranges from a low of 11% in Houston County, Alabama to a high of 36% in Honolulu County, Hawaii. Using bivariate and multivariate analysis, we find better health outcomes in counties and metropolitan areas that have fewer workers commuting by single-occupant vehicle. These findings underscore the positive impact of sustainable transportation policies on community health and open up a new direction for public health research and the built environment.

Subject Areas: Modal Diversity; Sustainable Urban Development; Public Health; Automobile Dependency

Availability: Frederick, C., Riggs, W. and Gilderbloom, J.H., 2017. *Commute Mode Diversity and Public Health: A Multivariate Analysis of 148 U.S. Cities*. International Journal of Sustainable Transportation.

<http://www.tandfonline.com/doi/ref/10.1080/15568318.2017.1321705?scroll=top>

7.10. Title: A Microsimulation Model of Population Heat Exposure

Authors: Swarup, S., Gohlke, J.M. and Bohland, J.R

Abstract: Exposure to extreme heat is an important cause of morbidity and mortality throughout the world. The elevation of temperatures and increases in extended periods of high temperatures due to climate change means that heat exposure as a health concern will increase. Thus, methodologies that researchers and practitioners can use to assess heat exposure among various population groups will become increasingly important. Human exposure to heat can be measured by wearable sensors and the maintenance of activity logs of a sample of individuals over the course of their daily activities. We introduce an alternative methodology that we believe offers great promise for evaluating heat exposure of the entire population of a city, region or state. Microsimulation modeling of the daily activity patterns of a synthetic population for the state of Alabama demonstrates the efficacy of this approach in measuring “potential” heat exposure, and in evaluating the significance of demographic attributes, in this case household income, that correlate with different exposure levels.

Subject Areas: Synthetic population; Heat Exposure

Availability: Swarup, S., Gohlke, J.M. and Bohland, J.R., 2017. *A Microsimulation Model of Population Heat Exposure*.

<http://staff.vbi.vt.edu/swarup/papers/abmus2017-heat-exposure-final.pdf>

7.11. Title: Surveillance Systems to Track and Evaluate Obesity Prevention Efforts

Authors: Hoelscher, D.M., Ranjit, N. and Pèrez, A.

Abstract: To address the obesity epidemic, the public health community must develop surveillance systems that capture data at levels through which obesity prevention efforts are conducted. Current systems assess body mass index (BMI), diet, and physical activity behaviors at the individual level, but environmental and policy-related data are often lacking. The goal of this review is to describe US surveillance systems that evaluate obesity prevention efforts within the context of international trends in obesity monitoring, to identify potential data gaps, and to present recommendations to improve the evaluation of population-level initiatives. Our recommendations include adding environmental and policy measures to surveillance efforts with a focus on addressing underserved populations, harmonizing existing surveillance systems, including more sensitive measures of obesity outcomes, and developing a knowledgeable workforce. In addition, the widespread use of electronic health records and new technologies that allow self-quantification of behaviors offers opportunities for innovative surveillance methods.

Subject Areas: Population health; Obesity Policy; Surveillance; Evaluating Progress of Obesity Prevention Efforts

Availability: Hoelscher, D.M., Ranjit, N. and Pèrez, A., 2017. *Surveillance Systems to Track and Evaluate Obesity Prevention Efforts*. Annual Review of Public Health, (0).

<http://www.annualreviews.org/doi/pdf/10.1146/annurev-publhealth-031816-044537>

7.12. Title: A Generative Model of Urban Activities from Cellular Data

Authors: Yin, M., Sheehan, M., Feygin, S., Paiement, J.F. and Pozdnoukhov, A.

Abstract: Activity based travel demand models are becoming essential tools used in transportation planning and regional development scenario evaluation. They describe travel itineraries of individual travelers, namely what activities they are participating in, when they perform these activities, and how they choose to travel to the activity locales. However, data collection for activity based models is performed through travel surveys that are infrequent, expensive, and reflect the changes in transportation with significant delays. Thanks to the ubiquitous cell phone data, we see an opportunity to substantially complement these surveys with data extracted from network carrier mobile phone usage logs, such as call detail records (CDRs). In this paper, we develop Input-Output Hidden Markov Models (IO-HMMs) to infer travelers' activity patterns from CDRs. We apply the model to the data collected by a major network carrier serving millions of users in the San Francisco Bay Area. Our approach delivers an end-to-end actionable solution to the practitioners in the form of a modular and interpretable activity-based travel demand model. It is experimentally validated with three independent data sources: aggregated statistics from travel surveys, a set of collected ground truth activities, and the results of a traffic micro-simulation informed with the travel plans synthesized from the developed generative model.

Subject Areas: Cellular data; Generative models; Activity recognition; Demand forecasting; Activity-based models

Availability: Yin, M., Sheehan, M., Feygin, S., Paiement, J.F. and Pozdnoukhov, A., 2017. *A Generative Model of Urban Activities from Cellular Data*. IEEE Transactions in ITS.
http://faculty.ce.berkeley.edu/pozdnoukhov/papers/IEEE_ITS_cellular_abm.pdf

7.13. Title: National Data Sets: How to Choose Them, How to Use Them

Author: Weinberger, P.Z.

Abstract: The US population is around the 323 million mark today (and grows by 4 a minute). Transportation planners who serve this enormous population are dependent on only two national surveys for the bulk of travel data that informs infrastructure, planning and decision making: 1) The US Census Bureau's ongoing American Community Survey (ACS), from which the Census Transportation Planning Products (CTPP) data is derived, and 2) The USDOT's National Household Travel Survey (NHTS). The ACS asks a series of commute based questions that give a robust picture of the trip to work for the nation. The ACS is based on a sample of about 8 percent of households over five years. The CTPP commissions a customized tabulation of ACS data tailored for transportation planning applications. This data set is used for travel model validation and calibration; an input to the long range plans required of the 408 metropolitan areas and 50 states as a condition of Federal aid. Other uses of the CTPP range from generating demographic profiles to corridor planning to Environmental Justice analysis to trend analysis, including national commute trends detailed in *Commuting in America*. The smaller and more infrequent but more in depth NHTS is a diary based survey that has been collected seven times between 1969 and 2009 with an eighth iteration scheduled for 2016. In 2001, the NHTS collected all household travel from a national core of 26,000 households, with regional add-ons adding 43,000 more households constituting about 0.06% of total US households. In 2009, the core sample remained the same, but the national add-ons totaled nearly 125,000 households, bring the sample to about 0.13% of the total. The CTPP is better suited to assess phenomena in small geographies, while the NHTS captures all trips, not just commute trips. Both data sets are used to inform transportation policy and assess how previous transportation investments have performed. This paper is a comparative analysis of the two data sets; it discusses their methodology and statistical nuances, subjects covered, weaknesses, strengths, and uses. This work is aimed to inform practitioners dealing with large and varied data sets and give some insight into how to evaluate, how to assess, and what types of analyses are appropriate for given data.

Subject Areas: Data and Information Technology; Highways; Pedestrians and Bicyclists; Planning and Forecasting; Public Transportation

Availability: Weinberger, P.Z., 2016. *National Data Sets: How to Choose Them, How to Use Them*. European Transport Conference 2016, Association for European Transport (AET).
<https://trid.trb.org/view.aspx?id=1455180>

7.14. Title: Demographic Factors, Workplace Factors and Active Transportation Use in the USA: A Secondary Analysis of 2009 NHTS Data

Authors: Quinn, T.D., Jakicic, J.M., Fertman, C.I. and Gibbs, B.B.

Abstract:

Background While active transportation has health, economic and environmental benefits, participation within the USA is low. The purpose of this study is to examine relationships of demographic and workplace factors with health-enhancing active transportation and commuting.

Methods: Participants in the 2009 National Household Travel Survey reported demographics, workplace factors (time/distance to work, flextime availability, option to work from home and work start time) and active transportation (for any purpose) or commuting (to and from work, workers only) as walking or biking (≥ 10 min bouts only). Multiple logistic regression examined cross-sectional relationships between demographics and workplace factors with active transportation and commuting.

Results: Among 152,573 participants, active transportation was reported by 1.11% by biking and 11.74% by walking. Among 111,808 working participants, active commuting was reported by 0.80% by biking and 2.76% by walking. Increased odds ($p < 0.05$) of active commuting and transportation were associated with younger age, lower income, urban dwelling, and the highest and lowest education categories. Males had greater odds of commuting and transporting by bike but decreased odds of walk transporting. Inconsistent patterns were observed by race, but whites had greater odds of any biking ($p < 0.05$). Odds of active commuting were higher with a flexible schedule ($p < 0.001$), the option to work from home ($p < 0.05$), shorter time and distance to work (both $p < 0.001$), and work arrival time between 11:00 and 15:59 (walking only, $p = 0.001$).

Conclusions: Active transportation differed across demographic and workplace factors. These relationships could inform infrastructure policy decisions and workplace wellness programming targeting increased active transportation.

Subject Areas: Demographic factors; Workplace factors; Secondary analysis; Commuting; Transportation

Availability: Quinn, T.D., Jakicic, J.M., Fertman, C.I. and Gibbs, B.B., 2016. *Demographic Factors, Workplace Factors and Active Transportation Use in the USA: A Secondary Analysis of 2009 NHTS Data*. J Epidemiol Community Health, pp.jech-2016.

<http://jech.bmj.com/content/early/2016/12/16/jech-2016-207820.short>

7.15. Title: Examining Multimodal Transportation in the El Paso, Texas, Region: Regional Transportation Survey Results

Authors: Sener, I.N., Lee, R.J., Simek, C., Sánchez, A. and Aldrete, R.M.

Abstract: This paper summarizes a component of a multimodal transportation study conducted for the El Paso Metropolitan Planning Organization of Texas, which included a regional population survey. The El Paso Regional Multimodal Transportation Survey was implemented between September and October 2015, and the study area included all of El Paso County, Texas, and parts of Doña Ana and Otero Counties, New Mexico. The survey specifically examined the behaviors or motivations to use or not to use various modes of transportation, with a particular focus on alternative modes (i.e., walking, bicycling, and using public transportation). As one of the first known regional transportation surveys in the United States, this survey contributed to the emerging area of health and transportation through the integration of several elements of health and well-being. The results indicate that an understanding of regional and population characteristics, as well as behavioral barriers and motivators, is an important first step in the design of effective alternative travel programs and interventions. Several factors, including neighborhood environment variables, personal and social characteristics, and attitudes and habits toward health and transportation, worked together to influence residents' participation in alternative transportation. Although the personal automobile is the dominant travel mode in El Paso, residents saw great value in the extension of public transportation infrastructure in the future. Improvements of connectivity, safety, and the neighborhood environment were found to be particularly essential to encourage walking and bicycling in the region.

Subject Areas: Survey results; Alternative modes

Availability: Sener, I.N., Lee, R.J., Simek, C., Sánchez, A. and Aldrete, R.M., 2017. *Examining Multimodal Transportation in the El Paso, Texas, Region: Regional Transportation Survey Results*. Transportation Research Record: Journal of the Transportation Research Board, (2654), pp.55-64.

<http://trrjournalonline.trb.org/doi/abs/10.3141/2654-07>

7.16. Title: The Drive to Work : The Relationship between Transportation Access, Housing Assistance, and Employment among Participants in the Welfare to Work Voucher Program

Authors: Blumenberg, E. and Pierce, G.

Abstract: Transportation enables low-income individuals to find and travel to employment. This article analyzes the relationship between access to automobiles and public transit and employment outcomes of low-income households. We use longitudinal survey data from participants in the Welfare to Work Voucher Program, which was conducted in five US metropolitan areas between 1999 and 2005. Multinomial logistic regression shows that baseline access to automobiles has a strong positive relationship to follow-up employment but public transit access and receipt of housing assistance do not. Our findings suggest that enhancing car access will notably improve employment outcomes among very-low-income adults, but other assistance will have, at best, marginal effects.

Subject Areas: Multinomial logistic regression; Low-income households; Public-transit access; Employment

Availability: Blumenberg, E. and Pierce, G., 2017. *The Drive to Work : The Relationship between Transportation Access, Housing Assistance, and Employment among Participants in the Welfare to Work Voucher Program*. Journal of Planning Education and Research, 37(1), pp.66-82.

<http://journals.sagepub.com/doi/abs/10.1177/0739456X16633501>

7.17. Title: Two Perspectives on Commuting: A Comparison of Home to Work Flows Across Job-Linked Survey and Administrative Files

Authors: Green, A.S., Kutzbach, M.J. and Vilhuber, L.

Abstract: Commuting flows and workplace employment data have a wide constituency of users including urban and regional planners, social science and transportation researchers, and businesses. The U.S. Census Bureau releases two, national data products that give the magnitude and characteristics of home to work flows. The American Community Survey (ACS) tabulates households' responses on employment, workplace, and commuting behavior. The Longitudinal Employer-Household Dynamics (LEHD) program tabulates administrative records on jobs in the LEHD Origin-Destination Employment Statistics (LODES). Design differences across the datasets lead to divergence in a comparable statistic: county-to-county aggregate commute flows. To understand differences in the public use data, this study compares ACS and LEHD source files, using identifying information and probabilistic matching to join person and job records. In our assessment, we compare commuting statistics for job frames linked on person, employment status, employer, and workplace and we identify person and job characteristics as well as design features of the data frames that explain aggregate differences. We find a lower rate of within-county commuting and farther commutes in LODES. We attribute these greater distances to differences in workplace reporting and to uncertainty of establishment assignments in LEHD for workers at multi-unit employers. Minor contributing factors include differences in residence location and ACS workplace edits. The results of this analysis and the data infrastructure developed will support further work to understand and enhance commuting statistics in both datasets.

Subject Areas: Work flows; ACS; LEHD

Availability: Green, A.S., Kutzbach, M.J. and Vilhuber, L., 2017. *Two Perspectives on Commuting: A Comparison of Home to Work Flows Across Job-Linked Survey and Administrative Files*. Working Paper 17-34, Center for Economic Studies, U.S. Census Bureau.
<https://ecommons.cornell.edu/handle/1813/50976>

8. Traffic Safety

8.1. Title: Linking Transportation and Population Health to Reduce Racial and Ethnic Disparities in Transportation Injury: Implications for Practice and Policy

Authors: McAndrews, C., Beyer, K., Guse, C. and Layde, P.

Abstract: In both developing and advanced economies, it is commonly believed that lower income and minority populations are disproportionately at risk of being injured or killed in a motor vehicle crash, especially as pedestrians. However, this risk is rarely quantified with information about exposure. We argue that a combined transportation-population health framework is one way to quantify, and therefore prioritize, equity considerations in transportation safety decision-making. We illustrate this approach with an analysis that compares age-adjusted fatal and nonfatal injury rates per 100 million person-trips by race/ethnicity and sex for motor vehicle occupants, bicyclists, and pedestrians. We found that, per trip, whites are equally safe as pedestrians and motor vehicle occupants, whereas other racial and ethnic groups for whom we have data are less safe when they walk. In addition, black/African-American female motor vehicle occupants and pedestrians have higher inpatient injury risk than female travelers of other races and ethnicities (for whom we had sufficient data). Such differences in transportation injury risk by race and ethnicity warrant deeper analysis to understand the underlying reasons, such as whether certain groups of travelers are exposed to qualitatively different hazards when they travel. We discuss frameworks for including information about injury disparities in decision-making.

Subject Areas: Population Health, Race and Ethnicity, Road Safety, Transportation Equity, Walking

Availability: McAndrews, C., Beyer, K., Guse, C. and Layde, P., 2017. *Linking Transportation and Population Health to Reduce Racial and Ethnic Disparities in Transportation Injury: Implications for Practice and Policy*. International Journal of Sustainable Transportation, 11(3), pp.197-205.

<http://www.tandfonline.com/doi/abs/10.1080/15568318.2016.1231354>

8.2. Title: Review of Regulatory Emphasis on Transportation Safety in the United States, 2002-2009: Public versus Private Modes

Authors: Waycaster, G.C., Matsumura, T., Bilotkach, V., Haftka, R.T. and Kim, N.H.

Abstract: The U.S. Department of Transportation is responsible for implementing new safety improvements and regulations with the goal of ensuring limited funds are distributed to where they can have the greatest impact on safety. In this work, we conduct a study of new regulations and other reactions (such as recalls) to fatal accidents in several different modes of transportation implemented from 2002 to 2009. We find that in the safest modes of commercial aviation and bus transport, the amount of spending on new regulations is high in relation to the number of fatalities compared to the regulatory attention received by less safe modes of general aviation and private automobiles. Additionally, we study two major fatal accident investigations from commercial aviation and two major automotive recalls associated with fatal accidents. We find differences in the cost per expected fatality prevented for these reactions, with the airline accident investigations being more cost effective. Overall, we observe trends in both the automotive and aviation sectors that suggest that public transportation receives more regulatory attention than private transport. We also observe that the types of safety remedies utilized, regulation versus investigation, have varying levels of effectiveness in different transport modes. We suggest that these differences are indicative of increased public demand for safety in modes where a third party may be held responsible, even for those not participating in the transportation. These findings have important implications for the transportation industry, policymakers, and for estimating the public demand for safety in new transport modes.

Subject Areas: Automobile; Transport Industry; Safety Improvements; Funding

Availability: Waycaster, G.C., Matsumura, T., Bilotkach, V., Haftka, R.T. and Kim, N.H., 2017. *Review of Regulatory Emphasis on Transportation Safety in the United States, 2002-2009: Public versus Private Modes*. Risk Analysis. <http://onlinelibrary.wiley.com/doi/10.1111/risa.12693/full>

8.3. Title: Safer or Cheaper? Traffic Safety, Vehicle Choices and the Effect of New Corporate Average Fuel Economy Standards

Author: Liu, Y.

Abstract: The new Corporate Average Fuel Economy (CAFE) Standards increase fuel economy to 54.5 MPG by model year 2025 and determine fuel economy targets based on vehicle sizes. This paper examines the effect of the new CAFE standards on consumer choices and composition of vehicle sales, accounting for the impact of traffic safety. We first formulate and estimate a mixed logit model of consumer demand using micro-level data. Two measures of traffic safety, consumers' safety concerns and traffic fatalities, are included and interacted with two vehicle characteristics that matter most for traffic safety: weight and size. Further, we conduct simulations of three extreme firm responses to assess the potential impact of the new CAFE standards: light weighting, paying CAFE fines, and size increase. Simulation results suggest that the sales impact will fall almost entirely on the SUV and light truck segments and on US automakers that use light weighting. Moreover, consumers in states with more traffic fatalities are the most responsive, shifting away from passenger cars. In addition, the new CAFE standards could result in an increase of 8.1 percent in the share of SUV and light trucks, which will cause as many as 347 more equivalent fatalities on roads each year.

Subject Areas: Economy Standards; MPG Targets; Light Weighting; Traffic Safety; Automobile Demand

Availability: Liu, Y., 2017. *Safer or Cheaper? Traffic Safety, Vehicle Choices and the Effect of New Corporate Average Fuel Economy Standards*. Resource and Energy Economics. https://cb363a75-a-62cb3a1a-s-sites.googlegroups.com/site/yizaoliu/paper_safety_cafe_2015_11_13_s.pdf?

8.4. Title: Advertising Spending and Media Bias: Evidence from News Coverage of Car Safety Recalls

Author: Beattie, G., Durante, R., Knight, B. and Sen, A.

Abstract: Do media outlets bias news content in favor of advertisers? We study this question by examining the relationship between advertising spending by car manufacturers in U.S. newspapers and news coverage of major safety recalls issued between 2000 and 2014. Examining car safety recalls allows us to separate the effect of advertisers' influence from that of readers' tastes which, in this case, should lead to more coverage as owners of recalled vehicles demand more information about the safety risks associated with the recall. Consistent with the predictions of our theoretical model, we find that recalls involving a given manufacturer receive significantly less coverage on newspapers in which that manufacturer advertised more over the previous two years. We find that pro-advertiser bias is more pronounced in markets with a single newspaper, which indicates that competition - and the related reputational concerns - mitigates capture by advertisers. Finally, increased competition for advertising revenues from online platforms makes newspapers more vulnerable to the pressure of advertisers.

Subject Areas: Media Bias; Car Manufacturers; Safety Recalls

Availability: Beattie, G., Durante, R., Knight, B. and Sen, A., 2017. *Advertising Spending and Media Bias: Evidence from News Coverage of Car Safety Recalls*. National Bureau of Economic Research.

https://www.cemfi.es/ftp/pdf/papers/pew/ads_recalls_draft_NBER.pdf

8.5. Title: Life-threatening Motor Vehicle Crashes in Bright Sunlight

Author: Redelmeier, D.A. and Raza, S.

Abstract: Bright sunlight may create visual illusions that lead to driver error, including fallible distance judgment from aerial perspective. We tested whether the risk of a life-threatening motor vehicle crash was increased when driving in bright sunlight.

This longitudinal, case-only, paired-comparison analysis evaluated patients hospitalized because of a motor vehicle crash between January 1, 1995 and December 31, 2014. The relative risk of a crash associated with bright sunlight was estimated by evaluating the prevailing weather at the time and place of the crash compared with the weather at the same hour and location on control days a week earlier and a week later.

The majority of patients (n=6962) were injured during daylight hours and bright sunlight was the most common weather condition at the time and place of the crash. The risk of a life-threatening crash was 16% higher during bright sunlight than normal weather (95% confidence interval: 9-24, P<0.001). The increased risk was accentuated in the early afternoon, disappeared at night, extended to patients with different characteristics, involved crashes with diverse features, not apparent with cloudy weather, and contributed to about 5000 additional patient-days in hospital. The increased risk extended to patients with high crash severity as indicated by ambulance involvement, surgical procedures, length of hospital stay, intensive care unit admission, and patient mortality. The increased risk was not easily attributed to differences in alcohol consumption, driving distances, or anomalies of adverse weather.

Bright sunlight is associated with an increased risk of a life-threatening motor vehicle crash. An awareness of this risk might inform driver education, trauma staffing, and safety warnings to prevent a life-threatening motor vehicle crash.

Subject Areas: Crash; Motor Vehicle; Patients

Availability: Redelmeier, D.A. and Raza, S., 2017. *Life-threatening Motor Vehicle Crashes in Bright Sunlight*. *Medicine*, 96(1), p.e5710.

http://journals.lww.com/md-journal/Fulltext/2017/01060/Life_threatening_motor_vehicle_crashes_in_bright.28.aspx

8.6. Title: Spatial Investigation of Aging-involved Crashes: A GIS-based Case Study in Northwest Florida

Author: Ulak, M.B., Ozguven, E.E., Spainhour, L. and Vanli, O.A.

Abstract: This study attempts to understand the unique nature of crashes involving aging drivers, unlike many previous crash-focused traffic safety studies mostly focusing on the general population. The utmost importance is given to answering the following question: How do the crashes involving aging drivers vary compared to crashes involving other age groups? To achieve this objective, a three-step spatial analysis was conducted using geographic information systems (GIS) with a case study application on three urban counties in the Northwest Florida region, based on crash data obtained from the Florida Department of Transportation (FDOT). First, crash clusters were investigated using a kernel density estimation (KDE) approach. Second, a crash density ratio difference (DRD) measure was proposed for comparing maxima-normalized crash densities for two different age groups. Third, a population factor (PF) was developed in order to investigate effect of spatial dependency by incorporating the effect of both number and percent of 65+ populations in a region. This spatial analysis was followed by a logistic regression-based approach in order to identify the statistically significant factors that can help investigate the distinct patterns of crashes involving aging drivers. Results of this study indicate that crashes involving aging drivers differ from other age group crashes both spatially and temporally. Further, the DRD and PF factors are useful metrics to identify and investigate important regions of study. The GIS-based knowledge gained from this research can contribute to the development of more reliable aging-focused safety plans and models.

Subject Areas: Crash; GIS; Aging driver

Availability: Ulak, M.B., Ozguven, E.E., Spainhour, L. and Vanli, O.A., 2017. *Spatial Investigation of Aging-involved Crashes: A GIS-based Case Study in Northwest Florida*. Journal of Transport Geography, 58, pp.71-91.
https://www.researchgate.net/profile/Mehmet_Ulak/publication/311449226_Spatial_investigation_of_aging-involved_crashes_A_GIS-based_case_study_in_Northwest_Florida/links/58488be508ae95e1d1665e04.pdf

8.7. Title: A New Spatial and Flexible Multivariate Random-Coefficients Model for the Analysis of Pedestrian Injury Counts by Severity Level

Author: Bhat, C.R., Astroza, S. and Lavieri, P.S.

Abstract: We propose in this paper a spatial random coefficients flexible multivariate count model to examine, at the spatial level of a census tract, the number of pedestrian injuries by injury severity level. Our model, unlike many other macro-level pedestrian injury studies in the literature, explicitly acknowledges that risk factors for different types of pedestrian injuries can be very different, as well as accounts for unobserved heterogeneity in the risk factor effects. We also recognize the multivariate nature of the injury counts by injury severity level within each census tract (as opposed to independently modeling the count of pedestrian injuries by severity level). In concrete methodological terms, our model: (a) allows a full covariance matrix for the random coefficients (constant heterogeneity, or CH, and slope heterogeneity, or SH, effects) characterizing spatial heterogeneity for each count category, (b) addresses excess zeros (or any other excess count value for that matter) within a multivariate count setting in a simple and elegant fashion, while recognizing multivariateness engendered through covariances in both the CH and SH effects, (c) accommodates spatial dependency through a spatial autoregressive lag structure, allowing for varying spatial autoregressive parameters across count categories, and (d) captures spatial drift effects through the spatial structure on the constants and the slope heterogeneity effects. To our knowledge, this is the first time that such a general spatial multivariate model has been formulated. For estimation, we use a composite marginal likelihood (CML) inference approach that is simple to implement and is based on evaluating lower-dimensional marginal probability expressions.

The data for our analysis is drawn from a 2009 pedestrian crash database from the Manhattan region of New York City. Several groups of census tract-based risk factors are considered in the empirical analysis based on earlier research, including (1) socio-demographic characteristics, (2) land-use and road network characteristics, (3) activity intensity characteristics, and (4) commute mode shares and transit supply characteristics. The empirical analysis sheds light on both engineering as well as behavioral countermeasures to reduce the number of pedestrian vehicle crashes by severity of these crashes.

Subject Areas: Multivariate count model; Spatial dependence; Pedestrian injuries in traffic crashes

Availability: Bhat, C.R., Astroza, S. and Lavieri, P.S., 2017. *A New Spatial and Flexible Multivariate Random-Coefficients Model for the Analysis of Pedestrian Injury Counts by Severity Level*. University of Texas.

http://www.caee.utexas.edu/prof/bhat/ABSTRACTS/Spatial_Count.pdf

8.8. Title: Texting and Driving: A Look at Self-Control, Social Learning Theory, Knowledge, and Adherence to the Law among Young Drivers

Author: Green, F.L.

Abstract: Despite all the safety features the motor vehicle industry has designed over the years, many car accidents still occur here in the United States. In 2014, the National Highway Traffic Safety Association announced approximately 10% of the total 32,675 people who died on United States highways was due to distracted driving, while over 400,000 were injured in a distracted driving incident. One reason for distracted driving is the use of one's cellphone during driving. Over the past thirty years the phone industry has made many advances and introduced new ways to communicate with one another. One prominent form of communication, especially with the younger generations is text messaging. This study looks to explain texting while driving behavior through two theoretical frameworks, The General Theory of Crime and Social Learning Theory. In addition, this study explores whether knowledge of the law means adherence to the law. Four hypotheses were created including parental and peer influence derived from Social Learning Theory, self-control derived from the General Theory of Crime, and knowledge of the law to explore if these were significant predictors in texting while driving behavior. All four analyses failed to reach significance. Explanations for these findings and future research are discussed within.

Subject Areas: Traffic Safety; Cellphones and texting; Distracted driving

Availability: Green, F.L., 2017. *Texting and Driving: A Look at Self-Control, Social Learning Theory, Knowledge, and Adherence to the Law among Young Drivers*. M.S. Thesis, University of Central Missouri.

http://centralspace.ucmo.edu/bitstream/handle/123456789/493/Green_Thesis.pdf?sequence=1&isAllowed=y

8.9. Title: Crash Analysis and Road User Survey to Identify Issues and Countermeasures for Older Drivers in Kansas

Authors: Chathuranga, S. and Kankanamge, K.

Abstract: The percentage of the U.S. population aged 65 years or older is increasing rapidly. Statistics also show this age group was 14.9 percent of the population in 2015 and is expected to be 20.7 to 21.4 percent for the years 2030-2050. Kansas has similar statewide trends with its aging population. Therefore, identifying issues, concerns, and factors associated with severity of older-driver crashes in Kansas is necessary. The Kansas Crash Analysis and Reporting System (KCARS) database maintained by Kansas Department of Transportation was used in this study to identify older-driver crash characteristics, compare older drivers with all drivers, and develop crash severity models. According to KCARS data, older drivers were involved in more than one in five fatal injuries out of all drivers in Kansas from 2010 to 2014. When compared with all drivers, older drivers were overly represented in fatal and incapacitating injuries. The percentage of older-driver fatal injuries was more than the twice that of all drivers. When compared with all drivers, older drivers were involved more often in crashes at four-way intersections, on straight and level roads, in daylight hours, and at a stop or yield signs.

An in-depth crash severity analysis was carried out for the older drivers involved in crashes. Three separate binary logistic regression models were developed for single-vehicle crashes where only the older driver was present (Model A), single-vehicle crashes involving an older driver with at least one passenger (Model B), and multi-vehicle crashes involving at least one older driver (Model C). From the crash severity analysis, it was found that left turns were significant in changing the crash severity for Model A, but it was not significant in model B, meaning that older drivers may be safer with passengers. For Model B, none of the passenger attributes were significant, though it was originally developed to identify passenger attributes. Gender of the older driver was not significant in any model. For all models, variables such as safety equipment use, crash location, weather conditions, driver ejected or trapped, and light conditions distinguished crash severity. Number of vehicles, speed, collision type, maneuver, and two-lane roads were significant in Model C.

A road-user survey was also conducted to identify habits, needs, and concerns of Kansas' aging road users since it was not advisable to conclude safety factors solely on crash data. Then a contingency table analysis was carried out to identify relationships among variables. Findings of this research gave an understanding of older-driver crashes and associated factors. Since more than 85 percent of crash contributory causes were related to drivers, driver awareness programs, driver licensing restrictions, providing public transportation, and law enforcement can be used as countermeasures. Accordingly, results of this study can be used to enhance older-driver safety and awareness programs.

Subject Areas: Older driver safety; Crash severity modeling

Availability: Chathuranga, S. and Kankanamge, K., 2017. *Crash Analysis and Road User Survey to Identify Issues and Countermeasures for Older Drivers in Kansas*. M.S. Thesis, Kansas State University.

<http://krex.k-state.edu/dspace/bitstream/handle/2097/35452/SameeraChathurangaKoththigodaKankanamge2017.pdf?sequence=3>

8.10. Title: The Effect of Passengers on Driver-Injury Severities in Single-Vehicle Crashes: A Random Parameters Heterogeneity-in-means Approach

Authors: Behnood, A. and Mannering, F.

Abstract: This paper seeks to investigate the effects of passengers on driver-injury severities. Using single-vehicle crashes, a random parameters logit model with heterogeneity in parameter means is estimated to explore the differences in driver-injury severities in three distinct subgroups; vehicles with one occupant (driver-only), vehicles with two occupants (driver and a passenger), and vehicles with three occupants (driver and two passengers). In addition to considering age, gender and the presence of the passenger(s), a wide range of variables that potentially affect driver-injury severity were considered, including weather conditions, roadway characteristics, vehicle characteristics and driver attributes. Estimation results show that both the age and the gender of the passenger(s) significantly affected driver-injury severities. The findings of this research point toward the need to further study the potentially complex interactions between drivers and passengers.

Subject Areas: Random parameters logit model; Heterogeneity in means; Driver-injury severity; Single-vehicle crashes; Vehicle passenger; Age; Gender

Availability: Behnood, A. and Mannering, F., 2017. *The Effect of Passengers on Driver-Injury Severities in Single-Vehicle Crashes: A Random Parameters Heterogeneity-in-means Approach*. *Analytic Methods in Accident Research*, 14, pp.41-53.
<http://www.sciencedirect.com/science/article/pii/S2213665717300040>

8.11. Title: Assessing Route Choice to Mitigate Older Driver Risk

Authors: Payyanadan, R.P., Sanchez, F.A. and Lee, J.D.

Abstract: Older drivers face decline in perceptual, cognitive, and motor abilities, and yet, increased fragility largely explains their increased risk of fatal crashes. Adaptation and self-regulation explain why older drivers can be safe drivers in the face of declining ability. Left turns and U-turns are particularly challenging, accounting for 10% of crashes for drivers aged 60-69 and increasing to 32% for those over 80. To mitigate these driving challenges through more effective adaptation, a route risk measure was developed. The route risk measure quantifies the risk of driving challenges such as left turns, U-turns, and trip length using older driver crash statistics from the General Estimates System. We applied the risk measure to 1253 trips taken by 39 urban and rural older drivers residing in Wisconsin. A search for a low-risk alternative route was conducted by applying the measure to corresponding routes suggested by Google Maps. Results showed that the low-risk alternative reduced risk for 77.7% of the older drivers' trips, on average, by 61.4%. The low-risk alternative had 1.50 fewer left turns and 0.23 fewer U-turns and were 0.44 mi shorter. Thus, selecting low-risk alternatives from the routes suggested by Google could help drivers avoid challenging maneuvers, potentially reducing their crash risk by promoting more effective adaptation to their declining abilities.

Subject Areas: Route risk; Risk measure; Older drivers; Crash risk

Availability: Payyanadan, R.P., Sanchez, F.A. and Lee, J.D., 2017. *Assessing Route Choice to Mitigate Older Driver Risk*. IEEE Transactions on Intelligent Transportation Systems, 18(3), pp.527-536.

<http://ieeexplore.ieee.org/abstract/document/7534844/>

8.12. Title: Epidemiology of Injuries Sustained by Rear-Seat Passengers in Frontal Motor Vehicle Crashes

Authors: Bose, D., Crandall, J., Forman, J., Longhitano, D. and Arregui-Dalmases, C.

Abstract:

Objective: Advanced occupant protection systems in motor-vehicles (e.g., seat belts and airbags), while widely adopted for front-seat passengers, are either absent or offer disproportionately lower safety to rear-seat passengers in similar crashes. Optimization of advanced restraint systems for the rear-seat environment will require a detailed understanding of epidemiology and associated risk factors for injuries sustained by rear-seat passengers. Thus, the objective of the study is to use national level motor-vehicle travel and crash data to quantify rear-seat travel exposure, and determine the descriptive characteristics and the injury outcomes for rear-seat passengers involved in frontal collisions.

Methods: While U.S. travel data from the 2009 National Household Travel Survey was used to determine rear-seat travel estimates, crash data from 2001 to 2010 National Automotive Sampling System Crash Worthiness Data System was used to enroll rear-seat passengers injured in a frontal crash. The descriptive epidemiology of rear-seat crash victims was separately done for the three age-groups: children (8-15 years old), adults (16-59 years old), and senior adults (60+).

Results: The study indicated that senior adults in rear-seats were associated with a significantly higher rate of sustaining fatal (6%) and severe injuries (16% for MAIS 3+ injuries) in comparison to the younger cohorts. The distribution of severe injuries further indicated that the thorax was the most frequently injured region across all age groups irrespective of the belt-use status.

Conclusions: Findings of the study conclude that while rear-seat travel in the U.S. is still very low and improving belt usage is a primary concern among rear-seat passengers; however, the epidemiology supports the need for adapting rear-seat restraint performance for effective protection for all groups of rear-seat passengers.

Subject Areas: Rear seat passenger; Seat belt; Motor vehicle crash; Airbag; Frontal crash; Optimized restrain systems

Availability: Bose, D., Crandall, J., Forman, J., Longhitano, D. and Arregui-Dalmases, C., 2017. *Epidemiology of Injuries Sustained by Rear-Seat Passengers in Frontal Motor Vehicle Crashes*. Journal of Transport & Health, 4, pp.132-139.

<http://www.sciencedirect.com/science/article/pii/S221414051630175X>

8.13. Title: Comparison of US Metropolitan Region Pedestrian and Bicyclist Fatality Rates

Authors: Schneider, J., Vargo, J. and Sanatizadeh, A.

Abstract: Annual US pedestrian and bicyclist fatalities involving motor vehicles have each increased by 30% in just six years, reaching their highest levels in two decades. To provide information to reverse this trend, we quantified pedestrian and bicyclist fatality rates in 46 of the largest US metropolitan statistical areas (MSAs) during two five-year time periods: 1999-2003 and 2007-2011. We divided the annual average number of pedestrian and bicyclist fatalities during 1999-2003 from the Fatality Analysis Reporting System by the annual estimates of pedestrian and bicycle trips, kilometers traveled, and minutes traveled from the 2001 National Household Travel Survey (NHTS) and the annual average number of fatalities from 2007 to 2011 by similar estimates from the 2009 NHTS. The five most dangerous regions for walking during 2007-2011 averaged 262 pedestrian fatalities per billion trips while the five safest averaged 49 pedestrian fatalities per billion trips. The five most dangerous regions for bicycling averaged 458 bicyclist fatalities per billion trips while the five safest averaged 75 bicyclist fatalities per billion trips. Random-effects meta-analysis identified eight metropolitan regions as outliers with low pedestrian fatality rates, six with high pedestrian fatality rates, one with a low bicyclist fatality rate, and five with high bicyclist fatality rates. MSAs with low pedestrian and bicycle fatality rates tended to have central cities recognized as Walk Friendly Communities and Bicycle Friendly Communities for investing in pedestrian and bicycle projects and programs. Random-effects meta-regression showed that certain socioeconomic characteristics and high pedestrian and bicyclist mode shares were associated with lower MSA fatality rates. Results suggest that pedestrian and bicycle infrastructure and safety programs should be complemented with strategies to increase walking and bicycling. In particular, safety initiatives should be honed to reduce pedestrian and bicyclist fatality risk in immigrant communities and to make pedestrian travel safer for the growing senior-age population.

Subject Areas: Pedestrian; Bicycle; Metropolitan region; Fatality rates; Road safety; Active transportation

Availability: Schneider, J., Vargo, J. and Sanatizadeh, A., 2017. *Comparison of US Metropolitan Region Pedestrian and Bicyclist Fatality Rates*. *Accident Analysis & Prevention*, 106, pp.82-98. <http://www.sciencedirect.com/science/article/pii/S0001457517301550>

8.14. Title: Understanding the Role of Driver, Vehicle, Environment, and Policy Factors in Crash Injury Severity among Older Adults in the United States

Author: Lee, C.M.

Abstract: Driving is related to quality of life and health outcomes. Older drivers involved in car crashes have a higher risk of experiencing a severe injury or fatality. Understanding factors related to injury severity may identify points of intervention to promote road safety. The purpose of this study is to investigate how individual characteristics, vehicle elements, environmental elements, and driving licensing policy are associated with level of injury severity from no injury to fatal injury resulting from car crashes. Furthermore, this dissertation research utilizes the Geographic Information System (GIS) process to visualize the location of crashes and to identify the hot spots of crashes in state of Massachusetts.

This dissertation utilized motor vehicle crash data of 2010 to 2012 from General Estimate System (GES) and Fatality Analysis Reporting System (FARS) administrated by National Highway Traffic Safety Administration (NHTSA). Using the GES crash data, multinomial logistic regression analysis was performed. Results indicated that older drivers (age 65 and older) were more likely to have fatality and severe injury in a crash compared to younger drivers (age 35 to 59). Impaired drivers had a much greater likelihood of fatal and severe injuries compared to drivers with normal conditions. Drivers with sedans compared to pick-up trucks were more likely to have severe injuries. In terms of policy factors, drivers involved in a crash in states with mandatory medical reporting for at a risk driver had decreased risk of fatal and severe injuries. Also, drivers in states requiring the vision test at license renewal had reduced risk of fatal and minor injuries. Using the FARS crash data, results provided an explanation of both the identification and the visual representation of the hot spots of crash locations in MA observed by performing spatial analysis of the GIS application.

In conclusion, among adult drivers involved in crashes, those who are older or impaired (physical or mental) have a significantly greater risk of fatality or serious injury. The results suggest that license renewal policies that limit driving of those risky drivers may be an effective early intervention to enhance safety on the roads.

Subject Areas: Crashes; GIS; Older Adults

Availability: Lee, C.M., 2017. *Understanding the Role of Driver, Vehicle, Environment, and Policy Factors in Crash Injury Severity among Older Adults in the United States*. Doctoral Thesis, University of Massachusetts Boston.

http://scholarworks.umb.edu/cgi/viewcontent.cgi?article=1331&context=doctoral_dissertations

8.15. Title: Guidance to Support Vulnerable Road Users in the State of Alabama

Author: Gajkowski, T.

Abstract: Over the past decade, communities across Alabama and the United States experienced significant increases in multi-modal traffic. While this growth has been shown to promote sustainable and livable communities, reduce traffic congestion, foster healthy environments, and boost local economies, there are still meaningful concerns about maintaining roadway safety for all users. Of particular interest are vulnerable road users (VRUs), defined by FHWA as “road users who are most at risk for serious injury or death when they are involved in a motor-vehicle related collision”. This thesis provides guidance for improving Alabama state highways to support the safe travel of vulnerable road users. While the guidance presented herein is focused on Alabama and its specific needs, the recommendations were derived based on a synthesis of all the existing federal, state, and major city VRU documentation. This thesis provides information on: (a) Understanding VRU Considerations, (b) Trends in Alabama VRU Safety, (c) Models of Alabama Highway Factors Influencing VRU Safety, (d) Guidance on Selecting VRU Countermeasures, and (e) VRU Countermeasure Characteristics. This thesis provides guidance on pedestrians, bicyclists, motorcyclists and scooter users, younger drivers, older drivers, farm equipment, golf carts, and transport-service animals. Additionally, this thesis recognizes that guidance should vary based on the highway environment, so countermeasure suggestions are tailored based on urban/suburban/rural communities, roadway type, posted speeds, traffic volumes, and VRU volumes.

Subject Areas: Roadway safety; FHWA; Injury

Availability: Gajkowski, T., 2017. *Guidance to Support Vulnerable Road Users in the State of Alabama*. M.S. Thesis, University of Auburn.

<https://etd.auburn.edu/handle/10415/5687>

8.16. Title: An On-Road Evaluation of the Impact of Explicit and Implicit Cognitive Training Protocols on Safety-Related Senior Driver Behaviors

Author: Antin, J., Owens, J. and Wotring, B.

Abstract: This study presents a long-term examination of the effects of two types of perceptual-cognitive brain training programs on senior driver behavior and on-road driving performance. Seniors over the age of 69 engaged in either a Toyota-designed in-vehicle training program based on implicit learning principles or a commercially available computer-based training program developed by Posit Science. Another group served as a control group and received no training; total enrollment was 55 participants. Participants completed a series of four experimental sessions: (1) baseline pre-training, (2) immediate post-training, (3) 6-9 months post-training, and (4) 12-16 months post-training. Experimental metrics taken at each session included a laboratory metrics portion, a target-detection performance on a closed-road course, and a public-road portion examining vehicle control and glance behavior. These sessions were designed to examine not only whether training provided immediate benefit to senior drivers, but also whether any improvements persisted after training or precluded decrements in performance found in untrained individuals. The results found few statistically significant improvements in performance with either type of training. However, there were non-significant trends toward improved glance behavior at risky intersections for participants in the Car Training group, suggesting that this might be a valuable target of future research using experimental designs with increased statistical power. In addition, several tests of training improvements examined by individual differences suggested that drivers with particular deficits on physical and cognitive metrics could benefit differentially from this type of training, leading to future research questions on appropriate targeting and the potential benefits of refresher training.

Subject Areas: Road safety; FHWA; Injury

Availability: Antin, J., Owens, J. and Wotring, B., 2017. *An On-Road Evaluation of the Impact of Explicit and Implicit Cognitive Training Protocols on Safety-Related Senior Driver Behaviors*. National Surface Transportation Safety Center for Excellence Reports, Virginia Tech Transportation Institute.

<https://vtechworks.lib.vt.edu/handle/10919/77431>

8.17. Title: Modeling Bicycle-Vehicle Crash Frequency on Urban Roads

Author: Mukoko, K.K.

Abstract: Bicyclists and motorists make mistakes that contribute to traffic crashes involving bicyclists on urban roads. The likelihood of a bicyclist being severely injured or killed daily in traffic crashes is creating fear, anxiety, and becoming a potential danger to the increasing number of Americans using bicycle as a mode of transportation. It is also making bicycling to work or for other purposes less lucrative. Building bicycling friendly and safe environment is, therefore, vital to encourage and have more people use bicycle as a mode of transportation. Therefore, the main goal of this research is to improve safety of bicyclists on urban roads. The main objectives are to understand the role of explanatory variables on risk to bicyclists on urban roads and to develop macroscopic bicycle-vehicle crash frequency models (safety performance functions) for urban roads.

Subject Areas: Bicycle; Traffic crashes; GIS

Availability: Mukoko, K.K., 2017. *Modeling Bicycle-Vehicle Crash Frequency on Urban Roads*. Doctoral dissertation, The University of North Carolina at Charlotte.

<http://search.proquest.com/openview/fdc10ab9ef18432a9872f455c8c21803/1?pq-origsite=gscholar&cbl=18750&diss=y>

9. Transit Planning

9.1. Title: Transit Corridor Livability: Realizing the Potential of Transportation and Land Use Integration

Authors: Appleyard, B., Ferrell, C.E. and Taecker, M.

Abstract: In recent years, strategies to promote transportation and land use integration have gained prominence in planning-related, believed to yield many potential benefits toward travel, health, welfare and sustainability goals. And while livability has been identified as an important outcome of this approach as well, little guidance exists on what livability actually is, how to measure it, or how transportation and land use integration strategies can promote it. This paper reports on the findings of a multi-year study of the livability literature, theory, and practice, followed by an extensive quantitative and qualitative study of over 350 transit corridors including thousands of stations throughout the US. While often dismissed as subjective, this research shows that livability can be understood in well-defined and measurable ways, which are validated through an innovative GIS approach using detailed national travel survey other data. The findings in this paper show how more integrated and livable transit corridors can yield multiple benefits toward regarding our travel, health, welfare and sustainability. The findings herein show how livability goals and their measures can inform planning decisions to promote equitable access to opportunities locally and regionally yielding multiple benefits. Therefore, livability can be seen as an organizing principle for determining when and how to deploy integrated transportation and land use planning strategies. This paper also introduces a practical Handbook and Calculator for Building Livable Transit Corridors, both designed to empower practitioners and members of the public to equitably achieve higher levels of livability at both the local and regional scales.

Subject Areas: Transit Corridors; Transport; Landuse,; Livability

Availability: Appleyard, B., Ferrell, C.E. and Taecker, M., 2017. *Transit Corridor Livability: Realizing the Potential of Transportation and Land Use Integration*. Transportation Research Board 96th Annual Meeting (No. 17-03490).

<http://www.sciencedirect.com/science/article/pii/S0091743517301093>

9.2. Title: Would Congestion Pricing Harm the Poor? Do Free Roads Help the Poor?

Authors: Manville, M. and Goldman, E.

Abstract: Congestion pricing could reduce urban congestion, but might disproportionately benefit the affluent and burden the poor. We show that this common concern also applies to free roads. Free urban highways primarily subsidize richer people, and the resulting congestion creates pollution that disproportionately burdens poorer people. Furthermore, the poor drivers burdened by peak-hour road pricing would be a small minority of total peak-hour drivers and a minority of the poor. These facts suggest that the revenue generated by pricing could compensate any poor drivers harmed. Free roads, in contrast, generate no revenue to compensate the people they harm.

Subject Areas: Congestion; Poor; Mobility

Availability: Manville, M. and Goldman, E., 2017. *Would Congestion Pricing Harm the Poor? Do Free Roads Help the Poor?* Journal of Planning Education and Research, p.0739456X17696944. <http://journals.sagepub.com/doi/abs/10.1177/0739456X17696944>

9.3. Title: Risk and Resilience Analysis for Highway Assets

Authors: Herrera, E.K., Flannery, A. and Krimmer, M.

Abstract: Transportation agencies own tens of thousands of assets, providing essential mobility and economic services to the communities they serve. Moving Ahead for Progress in the 21st Century and subsequent legislation require asset managers to implement risk-based asset management. A discussion is presented on the application of one quantitatively based framework - the American Society of Mechanical Engineers Innovative Technology Institute's Risk and Resilience Analysis and Management for Critical Asset Protection - for analyzing risks posed by physical threats to highway transportation systems and assets. The application of this particular risk analysis framework by the Colorado Department of Transportation following the 2013 floods is recounted; the analysis was used to support requests for federal emergency response funding. Finally, the potential benefits of such analysis for highway transportation project planning and strategic planning are also examined.

Subject Areas: Highway; Transportation Agencies; Risk Analysis

Availability: Herrera, E.K., Flannery, A. and Krimmer, M., 2017. *Risk and Resilience Analysis for Highway Assets*. Transportation Research Record: Journal of the Transportation Research Board, (2604), pp.1-8.

<http://trrjournalonline.trb.org/doi/abs/10.3141/2604-01>

9.4. Title: Modeling Vehicle Miles Traveled on Local Roads Using Classification Roadway Spatial Structure

Authors: Wang, X.B., Cao, X., Yin, K. and Adams, T.M.

Abstract: This paper models the relationship between vehicle miles traveled (VMT) on local and collector roads with an objective to predict local road VMT by using collector road VMT. Through a continuous approximation method typically used for vehicle routing, it first analytically reveals this relationship mainly as a function of roadway density ratios between multiple roadway classifications. This structural relationship suggests regression equations using density ratios or logarithmic values of them as the explanatory variables. The use of regression equations enables to account for varying spatial distributions of roadways and demand through parameter calibration. The proposed regression equations are proved good fits through computer simulation using distinct community road network topologies. In addition, practical data from Hennepin County of Minnesota, U.S.A. that encompasses Minneapolis indicates that our developed regression equations can work well.

Subject Areas: Vehicle miles traveled; Roadway classification

Availability: Wang, X.B., Cao, X., Yin, K. and Adams, T.M., 2017. *Modeling Vehicle Miles Traveled on Local Roads Using Classification Roadway Spatial Structure*. Networks and Spatial Economics, pp.1-23.

<https://link.springer.com/article/10.1007/s11067-017-9341-6>

9.5. Title: Development of an Accessibility Formulation to Measure Customers' Evaluations of Demand-Responsive Transit (DRT) Systems: Final Report

Authors: Astroza, S., Hoklas, M., Wang, T., Loftus-Otway, L., Bhat, C.R., Castro, M. and Born, K.

Abstract: This report discusses the application of the paratransit microsimulation patron accessibility analysis tool developed by the University of Texas researchers. The research team worked on updating the DRT Accessibility Tool developed by the Texas Department of Transportation's Public Transportation Division in Project 5-5178. The primary objectives of this research are (1) classifying the rural transit districts into five distinct categories, (2) updating the DRT Accessibility Tool to make it customizable for each of the five categories, and (3) developing "what if" scenarios for the tool to test. The customization of the tool will make it functional for applications in all the rural transit districts in Texas.

Subject Areas: Rural transit; Demand responsive transit; Accessibility

Availability: Astroza, S., Hoklas, M., Wang, T., Loftus-Otway, L., Bhat, C.R., Castro, M. and Born, K., 2017. *Development of an Accessibility Formulation to Measure Customers' Evaluations of Demand-Responsive Transit (DRT) Systems: Final Report*. CTR Technical Report, The University of Texas at Austin, (No. FHWA/TX-17/0-6768-1).

<http://docs.trb.org/prp/17-00318.pdf>

9.6. Title: Doors Opening: An Analysis of Equity and Accessibility on Public Transportation Services in The United States

Authors: Williams, E.

Abstract: Despite the essential role transportation plays in most people's daily lives, the ways in which our interactions and experiences with transportation systems affect our well-being is often overlooked. Transportation is an issue more significant than the political battles over infrastructure and urban planning generally acknowledge. Existing research has shown that people's access to reliable, high-quality transportation options as well as the degree to which these options provide timely and convenient access to destinations of civic, social, educational, and recreational opportunity varies across race and income lines. As made clear through social science frameworks like social exclusion theory, these variations in accessibility can have significant consequences not only on individuals, but on entire communities. Despite the strong body of research that finds evidence of inequities in the degree to which people can use public transit services to access certain destinations, several questions have gone unanswered. Only a handful of analyses have sought to establish macro-level trends that tell us about overall social patterns regarding variations on the quality and utility of public transit service. Further, much of this work has failed to probe the sources of these variations or looked into the institutional drivers that might explain why some people have different experiences riding transit than others.

This dissertation project is comprised of three empirical research articles that respond to these oversights by introducing a sociological lens to the study of public transportation services broadly, and destination accessibility research specifically. In the first paper, I generate and describe patterns of transit-based access to destinations of opportunity across twelve cities nationwide. In the second paper, I investigate the organizational elements native to transit agencies that have been shown to impact the effectiveness of public services and the degree to which users can reap their benefits. Finally, in the third paper I evaluate the use and utility of traditional and alternative transportation planning paradigms for engendering robust accessibility outcomes. While the three analyses engage three unique research questions with their own theoretical foundation, hypotheses, and methodological technique, there is an overarching question that guides my analysis: how useful is public transportation service when it comes to actually meeting people's accessibility needs, and in what ways do public transit agencies themselves affect these accessibility outcomes?

Results of this analysis demonstrates there are macro-level, observable differences in people's ability to use public transportation to access the places they need or want to go, and that particular elements of an agency's organizational structure do in fact impact the utility of transit to various destinations in ways that are both straightforward and complex across cities and between social groups. This work also demonstrates that although transportation-based planning initiatives are currently incorporated in transit agency planning standards and guidelines, the impact of this approach is limited. Collectively, results across the three studies provide solid evidence that the physical outcomes of transit systems are reflections of institutional conditions in transit agencies. In reinforcing the role and impact of public institutions for shaping social service delivery outcomes, this research is an important contribution to both urban sociology and urban transportation planning literatures.

Subject Areas: Public transport; Transit agencies; Transportation planning

Availability: Williams, E., 2017. *Doors Opening: An Analysis of Equity and Accessibility on Public Transportation Services in The United States*. M.S. Thesis, Northeastern University.
[http://search.proquest.com/openview/2d8aca488fd7ccb656201a62d585abe5/1?
pq-origsite=gscholar&cbl=18750&diss=y](http://search.proquest.com/openview/2d8aca488fd7ccb656201a62d585abe5/1?pq-origsite=gscholar&cbl=18750&diss=y)

9.7. Title: Transportation Inclusion and Community Wellbeing: Exploring Public Transit Accessibility of Winnipeg's North End Neighbourhoods

Author: Chandran, D.

Abstract: Analyzing public transit accessibility to marginalized communities is critical to exploring the link between transportation inclusion and wellbeing in automobile-centered cultures. This study is an attempt to examine public transit accessibility to Indigenous residents in Winnipeg's North End. Apart from analyzing the current level of transit accessibility, the study explores barriers that hinder the use of public transit in the North End and examines strategies to improving transit accessibility to its residents.

This study adopts a holistic approach to understanding 'accessibility' and recognizes the importance of socio-economic, perceptual, and demographic factors in shaping the demand for transit facilities in an area. Findings of the study illustrate the need to include transportation inclusion as an essential component of the urban Indigenous welfare policies in the country. The lessons learned will also provide an initial framework to understand the link between community wellbeing and transportation inclusion of other socio-economically vulnerable communities.

Subject Areas: Indigenous communities; Transit accessibility; Transportation equity

Availability: Chandran, D., 2017. *Transportation Inclusion and Community Wellbeing: Exploring Public Transit Accessibility of Winnipeg's North End Neighbourhoods*. M.S. Thesis, University of Manitoba, Winnipeg.

https://mspace.lib.umanitoba.ca/bitstream/handle/1993/31978/CHANDRAN_DEEPA.pdf?sequence=1

9.8. Title: Why Tiny Electric Planes and \$25 Tickets could be the Future of Regional Air Travel

Author: Wang A.B.

Abstract: Blog

Subject Areas: Transit Planning; High-speed regional transit; Short-haul air system

Availability: Wang A.B., 2017. *Why Tiny Electric Planes and \$25 Tickets could be the Future of Regional Air Travel*. Washington Post.

https://www.washingtonpost.com/news/innovations/wp/2017/04/08/why-tiny-electric-planes-and-25-tickets-could-be-the-future-of-air-travel/?utm_term=.c4dd0b54ece7

9.9. Title: Riding Transit Takes Almost Twice as Long as Driving

Author: Maciag, M.

Abstract: Blog

Subject Areas: Public Transportation; Commuting times; Ridership; Operating speed

Availability: Maciag, M., 2017. *Riding Transit Takes Almost Twice as Long as Driving*. Infrastructure & Environment, Governing the States and Localities Blog.

<http://www.governing.com/topics/transportation-infrastructure/gov-transit-driving-times.html>

9.10. Title: Uber's Mildly Helpful Data Tool Could Help Cities Fix Streets

Author: Davies, A.

Abstract: Blog

Subject Areas: Public Transportation; Commuting patterns; Traffic planning

Availability: Davies, A., 2017. *Uber's Mildly Helpful Data Tool Could Help Cities Fix Streets*. Transportation, Wired.com.

<https://www.wired.com/2017/01/uber-movement-traffic-data-tool/>

9.11. Title: CatCharger: Deploying Wireless Charging Lanes in a Metropolitan Road Network through Categorization and Clustering of Vehicle Traffic

Authors: Yan, L., Shen, H., Zhao, J., Xu, C., Luo, F. and Qiu, C.

Abstract: The future generation of transportation system will be featured by electrified public transportation. To fulfill metropolitan transit demands, electric vehicles (EVs) must be continuously operable without recharging downtime. Wireless Power Transfer (WPT) techniques for in-motion EV charging is a solution. It however brings up a challenge: how to deploy charging lanes in a metropolitan road network to minimize the deployment cost while enabling EVs' continuous operability.

In this paper, we propose CatCharger, which is the first work that handles this challenge. From a metropolitan-scale dataset collected from multiple sources of vehicles, we observe the diversity of vehicle passing speed and daily visit frequency (called traffic attributes) at intersections (i.e., landmarks), which are important factors for charging lane deployment. To select landmarks for deployment, we first group landmarks with similar traffic attribute values using the entropy minimization clustering method, and choose better candidate landmarks from each group suitable for deployment. To determine the deployment locations from the candidate landmarks, we infer the expected vehicle residual energy at each landmark using a Kernel Density Estimator fed by the vehicles' mobility, and formulate and solve an optimization problem to minimize the total deployment cost while ensuring a certain level of expected residual energy of EVs at each landmark. Our trace-driven experiments demonstrate the superior performance of CatCharger over other methods.

Subject Areas: Public Transportation; Transit demands, Electric vehicles

Availability: Yan, L., Shen, H., Zhao, J., Xu, C., Luo, F. and Qiu, C., 2017. *CatCharger: Deploying Wireless Charging Lanes in a Metropolitan Road Network through Categorization and Clustering of Vehicle Traffic*. In Proc. of INFOCOM.

http://www.people.virginia.edu/~ly4ss/papers/conference/CatCharge_poster.pdf

https://www.researchgate.net/publication/310829188_CatCharger_Deploying_Wireless_Charging_Lanes_in_a_Metropolitan_Road_Network_through_Categorization_and_Clustering_of_Vehicle_Traffic

9.12. Title: 18 Equity Analysis of California High-Speed Rail

Author: Nuworsoo, C.

Abstract: The California high-speed rail (HSR) project, which began construction in 2014, plans to link the state's four largest metropolitan areas (Sacramento and San Francisco to the north; Los Angeles and San Diego to the south) with the first true high-speed train system in United States. According to studies by the California High Speed Rail Authority (CHSRA), the high-speed rail network is projected to carry between 22.6 and 32.6 million passengers per year by 2030. Who will be the main beneficiaries of this new transport system? Are there particular groups that will benefit little? This chapter presents an overview of the debates about equity that have surrounded the project and an analysis of the relative social equity of California's high-speed rail system for different segments of the population. Equity is defined here as 'fairness in the distribution of goods and services among the people in an economy'.

Subject Areas: Public Transportation; High-speed Rail, Long-distance travelers; Travel patterns

Availability: Nuworsoo, C., 2017. *18 Equity Analysis of California High-Speed Rail*. High-Speed Rail and Sustainability: Decision-Making and the Political Economy of Investment, p.299. <https://books.google.com/books?hl=en&lr=&id=2i4lDwAAQBAJ&oi=fnd&pg=PA299&dq=#v=onepage&q&f=false>

9.13. Title: Transit System Design and Vulnerability of Riders to Heat

Authors: Fraser, A.M. and Chester, M.V.

Abstract: In the United States public transit utilization has increased significantly in the last decade and is considered a critical component in reducing energy use and greenhouse gas emissions in urban areas. Despite public transit's climate change mitigation potential, the use of transit necessitates environmental exposure which may be a health hazard during periods of extreme heat. Transit system design, which includes stop location and schedules, is shown to contribute to environmental exposure resulting from access and waiting. Using Los Angeles Metro (Los Angeles County, CA) and Valley Metro (Maricopa County, AZ) as case studies of systems operating in extreme heat conditions, the research demonstrates how system design contributes to heat exposure times that vary significantly between neighborhoods. Household level access (walking) time estimates are developed using a shortest path algorithm to nearby transit stops. Waiting time estimates for individual transit stops are derived from published transit schedules and on-board survey responses. The results show that transit users from areas with low residential density, limited high capacity roadways and irregular street networks, and not located along direct paths between major activity centers are likely to experience prolonged access and/or waiting times. Public transit may help mitigate climate change impacts but transit proponents, agencies and planners should be cognizant of the impact an uncertain climate future may have on a growing base of transit riders. These insights can allow us to proactively govern and adapt transit systems to protect people from a growing health concern.

Subject Areas: Transit; Heat; Urban; Health; Climate

Availability: Fraser, A.M. and Chester, M.V., 2017. *Transit System Design and Vulnerability of Riders to Heat*. Journal of Transport & Health, 4, pp.216-225.

<http://www.sciencedirect.com/science/article/pii/S2214140516302122>

9.14. Title: Benchmarking a Transit System on Time-Constrained Trip Chain Access: A Comparative GIS Analysis of Two University Towns

Author: Lachman, M.A.

Abstract: Strong network planning is a prerequisite for mode shift to transit. One way that planners compare design alternatives is to apply accessibility metrics to them. However, many metrics currently in use do not account for human tendencies to plan travel as a whole-day unit, nor do they adequately account for constraints on time spent traveling.

In this research, a metric is developed that involves choosing a typical daily chain of trips that are tested at specific time intervals for the entire area population. The trip chain is run for transit systems in two similar university towns using GIS network analysis, and benchmarking from the literature on average daily travel time budgets is applied. Results show substantial time accessibility differences that are positively associated with relative ridership levels and explained by the frequency, schedule span, and spatial configuration of the transit network.

Subject Areas: Transit; Trip Chain; Accessibility metrics

Availability: Lachman, M.A., 2017. *Benchmarking a Transit System on Time-Constrained Trip Chain Access: A Comparative GIS Analysis of Two University Towns*. Doctoral dissertation, Ohio University.

https://etd.ohiolink.edu/pg_10?0::NO:10:P10_ACCESSION_NUM:ohiou1483613270824226

10. Travel Behavior

10.1. Title: Travel and the Built Environment: Insights Using Activity Densities, the Sprawl Index, and Neighborhood Type

Authors: Ralph, K., Voulgaris, C.T. and Brown, A

Abstract: There are many ways to evaluate the built environment, including measures of observable individual characteristics (such as activity density), continuous composite measures (such as the sprawl index), and categorically measured variables (such as neighborhood types). However, a systematic comparison of how well each of these three measurement types captures the influence of the built environment on travel behavior has not yet been undertaken. This lack presents a quandary for both researchers and practitioners who seek to quantify and describe the effects of the built environment on travel behavior. This paper assesses whether continuous, composite, or categorical measures provide more information and better-fitting models compared with measures of observable individual characteristics across four travel behaviors: vehicle miles traveled, walk trips, transit trips, and trip length. For each travel variable, four multivariate regression models were estimated with various measures of the built environment: activity density, sprawl index, neighborhood type, and combined sprawl index and neighborhood type. Both the sprawl index and the neighborhood-type models outperformed the activity density model. Moreover, a combined model with both the sprawl index and neighborhood types provided the best fit for all four travel behavior variables. These results suggest that both continuous and categorical composite variables provide unique and complementary information about how the built environment influences travel behavior. These findings underscore the importance of researchers' decisions on how to represent the built environment quantitatively in models, because measurement decisions influence the understanding of how the built environment affects travel behavior.

Subject Areas: Travel Behavior; Built environment; Sprawl Index; Density

Availability: Ralph, K., Voulgaris, C.T. and Brown, A., 2017. *Travel and the Built Environment: Insights Using Activity Densities, the Sprawl Index, and Neighborhood Types*. Transportation Research Record: Journal of the Transportation Research Board, (2653), pp.1-9.

<http://trjournalonline.trb.org/doi/pdf/10.3141/2653-01>

10.2. Title: Influence of Personal Concerns About Travel on Travel Behavior

Authors: Jeong, K., Hyun, K.K. and Ritchie, S.G

Abstract: This study estimated unobservable personal travel concerns using a structural equation modeling (SEM) approach and investigated recursive and complex relationships among travel concerns, travel behavior and individual socioeconomic status. The model was developed using 54,552 individual survey responses obtained from the 2009 US National Household Travel Survey (NHTS). The unobservable concerns about travel were categorized into cost-concerns and safety-concerns and estimated by using measurable indicators that specify the most important transportation issue to the survey respondents. Travel behavior for auto and public transit trips were represented by daily vehicle miles traveled (VMT) and public transit usage, respectively. Results showed that people who have higher safety concerns more likely reduced their daily VMT while those who have higher cost concerns tended to use more public transit. State level models with the four most populated states in the U.S., “California, Texas, Florida and New York” were further compared to consider geographical impacts on travel concerns and travel behavior. The most influential concerns and their impact on travel behavior varied amongst the states, implying that the transportation environment in different geographic regions influences psychological characteristics on travel behavior.

Subject Areas: Highways; Planning and Forecasting; Policy; Public Transportation

Availability: Jeong, K., Hyun, K.K. and Ritchie, S.G., 2017. *Influence of Personal Concerns About Travel on Travel Behavior*. Transportation Research Board 96th Annual Meeting (No. 17-06826).

<https://trid.trb.org/view.aspx?id=1439738>

10.3. Title: Impacts of standardizing school start time on children and household workers - An examination with NHTS data

Authors: Jeong, K., Hyun, K.K. and Ritchie, S.G

Abstract: Due to demonstrated health, safety, and performance benefits to children from delayed school start time, academics and government agencies in the United States are increasingly insisting on starting schools at or after 8:30 AM - the time recommended by the American Academy of Pediatrics. Despite this urging, schools across the country continue to start well before that time. A common argument against the change is potential negative impacts on working household members. Using data from the 2009 National Household Travel Survey (NHTS), this paper therefore examines the potential impacts of nationally standardizing school start time at 8:30 AM with a focus on household members who give children rides to/from school and their travel patterns before and after escorting children. In addition to estimating the number of household members and workers that may be directly affected by delayed school start time, the paper examines through multinomial logit and probit models the individual and household characteristics of children who take rides from household members and the workers who may be adversely affected by delayed school start time of household children. Analysis showed that around 4% of the country's population may have to adjust their trips before and after escorting children to/from school. Around 65% of them are workers. A comparison of adversely affected workers with other workers revealed that the delay of school start time is not likely to have disparate impacts on disadvantaged populations, but the impacts may be more significant in some regions of the country than others.

Subject Areas: Travel patterns; household workers; multinomial logit models; School children

Availability: Deka, D., 2017. *Impacts of standardizing school start time on children and household workers - An examination with NHTS data*. Journal of Transport Geography, 59, pp.40-48. <http://www.sciencedirect.com/science/article/pii/S0966692317300352>

10.4. Title: Neighborhood density and travel mode: new survey findings for high densities

Author: Lewis, S., 2017.

Abstract: At high densities, land uses get close enough to each other to support walk, bike, and transit modes above 60% of total trips. The San Francisco Bay Area census was used to define five density levels: rural, exurban, suburban, central city, and urban core. The urban core definition, over 50 persons per neighborhood acre, is much denser than in other research. The California Household Transportation Survey supplied new data on block group area, population, trip stages, trip distances, trip time, and travel mode by density. The National Household Transportation Survey supplied block group population, density, travel mode, and income data. Both sources show a strong nonlinear relationship going from rural to urban core: auto miles and trips decrease as walk and transit miles and trips increase. With density, people travel fewer miles and spend less time traveling. High-income households in dense areas travel far fewer miles than those living at higher densities. With sufficient density, complementary features play a role in furthering mode shift. For planning purposes, the need for parking greatly declines. The findings are a basis for similar research elsewhere on high densities and complementary features.

Subject Areas: Neighborhood density; Travel mode; Household travel surveys; Walkable neighborhood systems; Sustainability

Availability: Lewis, S., 2017. *Neighborhood density and travel mode: New survey findings for high densities*. International Journal of Sustainable Development & World Ecology, pp.1-14.
<http://www.tandfonline.com/doi/ref/10.1080/13504509.2017.1321052?scroll=top>

10.5. Title: School Transportation Mode, by Distance between Home and School, United States, Consumer Styles 2012

Authors: Beck, L.F. and Nguyen, D.D.

Abstract:

Background: Motor-vehicle crashes are a leading cause of death among children in the United States, and almost one-fourth of all trips by school-aged children are trips to and from school. This study sought to determine how children (5-18 years) travel to and from school and, among those living ≤ 1 mile of school, to explore the role of school bus service eligibility on school travel mode.

Methods: We used national 2012 survey data to determine prevalence of usual school travel mode, stratified by distance from school. For those living ≤ 1 mile of school, multivariable regression was conducted to assess the association between bus service eligibility and walking or bicycling.

Results: Almost half (46.6%) of all children rode in passenger vehicles (PV) to school and 41.8% did so for the trip home. Results were similar among those living ≤ 1 mile (48.1%, PV to school; 41.3%, PV to home). Among those living ≤ 1 mile, 21.9% and 28.4% of children walked or bicycled to and from school, respectively. Ineligibility for school bus service was strongly associated with walking or bicycling to school [adjusted prevalence ratio (aPR): 5.36; $p < 0.001$] and from school (aPR: 5.36; $p < 0.001$).

Conclusions: Regardless of distance from school, passenger vehicles were a common mode of travel. For children who live close to school, the role that school bus service eligibility plays in walking or bicycling deserves further consideration.

Subject Areas: Motor vehicle; Travel Pattern; Child passenger safety; Children; Pedestrians; Bicyclists

Availability: Beck, L.F. and Nguyen, D.D., 2017. *School Transportation Mode, by Distance between Home and School, United States, Consumer Styles 2012*. Journal of Safety Research. <http://www.tandfonline.com/doi/ref/10.1080/13504509.2017.1321052?scroll=top>

10.6. Title: Exploring the Influence of Built Environment on Travel Mode Choice Considering the Mediating Effects of Car Ownership and Travel Distance

Authors: Ding, C., Wang, D., Liu, C., Zhang, Y. and Yang, J.

Abstract: Though there is a growing literature on the connection between the built environment and travel behavior, limited efforts have been made to consider the intermediary nature of car ownership and travel distance simultaneously while modeling the relationship between the built environment and travel mode choice behavior. The mediating effects from car ownership and travel distance, as an important piece, are not sufficiently investigated. To fill this gap, in this study the relationships among travel mode choice, car ownership and travel distance were described using a framework of integrated structural equation model (SEM) and discrete choice model (DCM). Drawing on a rich dataset of National Household Travel Survey (NHTS) and numerous built environment measurements in Baltimore metropolitan area, this research applied the integrated SEM and DCM approach to investigate how the built environment affects travel mode choice through influencing car ownership and travel distance. Therefore, the direct and indirect effects of built environment on travel mode choice were revealed. This study hopes to give transportation planners a better understanding on how the built environment influences travel mode choice, and consequently develop effective and targeted countermeasures to reduce car use.

Subject Areas: Built environment; Travel behavior; Car ownership; Mediating effect

Availability: Ding, C., Wang, D., Liu, C., Zhang, Y. and Yang, J., 2017. *Exploring the Influence of Built Environment on Travel Mode Choice Considering the Mediating Effects of Car Ownership and Travel Distance*. . Transportation Research Part A: Policy and Practice, 100, pp.65-80.

<http://www.sciencedirect.com/science/article/pii/S0965856416303391>

10.7. Title: Active Travel Behavior in a Border Region of Texas and New Mexico: Motivators, Deterrents and Characteristics

Authors: Sener, I.N. and Lee, R.J.

Abstract:

Background: Active travel has been linked with improved transportation and health outcomes, such as reduced traffic congestion and air pollution, improved mobility, accessibility and equity, and increased physical and mental health. The purpose of this study was to better understand active travel characteristics, motivators, and deterrents in the El Paso, Texas region.

Methods: A multimodal transportation survey brought together elements of transportation and health, with a focus on attitudinal characteristics. The analysis consisted of an initial descriptive analysis, spatial analysis, and multivariate binary and ordered-response models of walking and bicycling behavior.

Results: The motivators and deterrents of active travel differed for walkers, bicyclists, and non-cyclists interested in bicycling. The link between active travel and life satisfaction was moderated by age, with a negative association for older travelers. This effect was stronger for bicycling than it was for walking.

Conclusions: Based on the findings, several interventions to encourage walking and bicycling were suggested. These included infrastructure and built environment enhancements, workplace programs, and interventions targeting specific sub-populations.

Subject Areas: Travel behavior; Walking; Bicycling; Health

Availability: Sener, I.N. and Lee, R.J., 2017. *Active Travel Behavior in a Border Region of Texas and New Mexico: Motivators, Deterrents and Characteristics*. Journal of Physical Activity and Health, pp.1-30.

<http://journals.humankinetics.com/doi/abs/10.1123/jpah.2016-0503>

10.8. Title: Synergistic Neighborhood Relationships with Travel Behavior: An Analysis of Travel in 30,000 US Neighborhoods

Authors: Voulgaris, Carole Turley, Brian D. Taylor, Evelyn Blumenberg, Anne Brown, and Kelcie Ralph.

Abstract: A now substantial body of literature finds that land use and urban form have a statistically significant, albeit relatively modest, effect on travel behavior. Some scholars have suggested that various built-environment characteristics influence travel more in concert than when considered in isolation. Yet few previous studies have combined built-environment measures to create holistic descriptions of the overall character of neighborhoods, and fewer still have related these neighborhoods to residents' travel decisions. To address this gap in the literature, we develop a typology of seven distinct neighborhood types by applying factor analysis and then cluster analysis to a set of 20 variables describing built-environment characteristics for most census tracts in the United States. We then include these neighborhood types in a set of multivariate regression models to estimate the effect of neighborhood type on the travel behavior of neighborhood residents, controlling for an array of personal and household characteristics. We find relatively little variation in the number of daily trips among neighborhood types, but there is substantial neighborhood variation in both person miles of travel and mode choice. Travel by residents of one particular neighborhood type is notably distinguished from all others by a very low number of miles traveled, little solo driving, and high transit use. However, this neighborhood type is found almost exclusively in just a few very large metropolitan areas, and its replicability is uncertain.

Subject Areas: Neighborhood classification; Travel Behavior

Availability: Voulgaris, Carole Turley, Brian D. Taylor, Evelyn Blumenberg, Anne Brown, and Kelcie Ralph, 2017. *Synergistic Neighborhood Relationships with Travel Behavior: An Analysis of Travel in 30,000 US Neighborhoods*. Journal of Transport and Land Use, 10(1): 437-461.

<https://www.jtlu.org/index.php/jtlu/article/view/840/856>

10.9. Title: The Role of Destination's Built Environment on Nonmotorized Travel Behavior: A Case of Long Beach, California

Authors: Kim, D., Park, J. and Hong, A.

Abstract: This study examines how built environment factors at trip destinations influence non-motorized travel behavior in the City of Long Beach, California. Using 2008-2009 National Household Travel Survey with California Add-Ons, we found that nonmotorized users tend to choose more clustered destinations than motorized users, and that density, diversity, and design at destinations significantly affect mode choice decisions. Transportation networks and nonmotorized facilities at trip destinations are especially important factors for nonmotorized mode choice. Future policy and research need to consider built environment factors at trip destinations to effectively accommodate nonmotorized travel within a city.

Subject Areas: Built-in Environment; Nonmotorized Travel; Transport Network; Trip Destinations

Availability: Kim, D., Park, J. and Hong, A., 2017. *The Role of Destination's Built Environment on Nonmotorized Travel Behavior: A Case of Long Beach, California*. Journal of Planning Education and Research, p.0739456X16688765.

<http://journals.sagepub.com/doi/abs/10.1177/0739456X16688765>

10.10. Title: Determinants of Route Choice Behavior: A Comparison of Shop versus Work Trips using the Potential Path Area - Gateway (PPAG) algorithm and Path-Size Logit

Authors: Dalumpines, R. and Scott, D.M.

Abstract: This paper presents an in-depth comparison of route choice models for work and shop vehicle trips - with emphasis on the interactions between route attributes and individual characteristics to better understand the route choice determinants that are assumed to vary by trip purpose. Insights into the route choice behavior involving two dominant vehicle trip purposes - work and shop trips - will help in the design of traffic facilities and implementation of measures to influence route choice in the desired direction.

In this study, we show that the utility and scale parameters for separate models of work and shop trips differ by direct comparison using a sequential scaling estimation method and likelihood ratio tests, and highlight the differences in route choice behavior by considering the interaction of route attributes and individual characteristics using Path-Size Logit modeling. In the process, we used Potential Path Area - Gateway (PPAG) algorithm - that generates feasible route choice sets for route choice modeling from GPS trajectories of observed routes.

The results show that, indeed, route choice behavior varies by trip, which suggests that drivers attach value to route choice determinants relative to trip purpose. The inclusion of interaction terms in model specifications further indicates that work route choice behavior tends to be restrictive compared to the nonrestrictive route choice for shop trips - a generalization consistent with the mandatory and discretionary nature of work and shop trips, respectively. Specifically, individual characteristics such as personal income, age, gender, tenure, household size, and access to public transit affect route choice behavior.

Subject Areas: Route choice; Path size logit; GPS; Travel behavior

Availability: Dalumpines, R. and Scott, D.M., 2017. *Determinants of Route Choice Behavior: A Comparison of Shop versus Work Trips using the Potential Path Area - Gateway (PPAG) algorithm and Path-Size Logit*. Journal of Transport Geography, , 59, pp.59-68.

<http://www.sciencedirect.com/science/article/pii/S096669231630357X>

10.11. Title: Modeling the Choice of Time-of-day for Joint Social-Recreational Activities

Authors: Lim, K.K. and Srinivasan, S.

Abstract: In modeling time of day choice, constructing choice alternatives in the case of joint tours requires the temporal synchronization of travel of all members of the travel party. This study describes how the time constraints of multiple persons can be effectively accommodated into determining the choice set and, subsequently, the choice of timing for joint social/recreational tours. Many previous studies on time-of-day choice modeling have been dominated by dividing the continuous time variable into discrete time intervals. Although the continuous representation of time in the method was proposed, their relative complexity in the estimation over the discrete choice methods is a drawback from practical perspectives. In this study, an alternate two-step approach is proposed. The first model predicts the time-window chosen for pursuing the joint discretionary tour, and the second model locates the tour within the chosen time window by determining the start- and end-hours of the tour simultaneously on a continuous scale. A MNL model within the discrete contexture is also estimated as for the predictive assessment comparison. A wide set of explanatory variables were included in the model estimations. The models developed are used to assess predictive abilities using validation samples. Overall, the fractional-split model is shown to be effective from the standpoint of predictive accuracy over the reference model based on the discrete time representations.

Subject Areas: Time-of-day Choice; Social-Recreational Activity; Fractional-Split Model

Availability: Lim, K.K. and Srinivasan, S., 2017. *Modeling the Choice of Time-of-day for Joint Social-Recreational Activities*. KSCE Journal of Civil Engineering, pp.1-9.

<https://link.springer.com/article/10.1007/s12205-017-0807-3>

10.12. Title: A Largely Unnoticed Impact on Real Estate - Self-Driven Vehicles

Authors:Levine, M.L., Segev, L.L. and Thode, S.F.

Abstract: Motor vehicles are very important in the United States and throughout the world. Certainly, motor vehicles for personal and business use are a major piece of the transportation system. Such activity impacts the use of real estate, be that for commercial buildings in the form of offices, retail, residential complexes, recreation activities, warehouses, or otherwise. Autos and buses are also important parts of residential living and the personal lives of most residents in the United States. Included with in these uses is the implied position of a driver for such vehicle. But, if a driver was no longer necessary for the use of an auto, a bus, or a truck how could this impact the use of real estate for personal and commercial uses? How could such change influence the choice of a residence, job, parking, zoning, and types of services currently employed to support the use of the vehicles? These issues are examined in this Note with a focused examination of the impact of driverless vehicles as they relate to real estate uses and activity.

Subject Areas: Driver-less Vehicle; Real estate

Availability: Levine, M.L., Segev, L.L. and Thode, S.F., 2017. *A Largely Unnoticed Impact on Real Estate - Self-Driven Vehicles*. Appraisal Journal, 85(1).

<http://web.a.ebscohost.com.proxygw.wrlc.org/ehost/pdfviewer/pdfviewer?sid=39ad3511-fc6c-4eb9-8501-7daeba2819f5%40sessionmgr4010&vid=1&hid=4107>

10.13. Title: Mobility in History through the Lens of Transport

Author: Pooley, C.G.

Abstract: All mobility requires some form of transport, whether that be human powered (walking, cycling), animal powered, or driven by steam, oil or electricity. All forms of transportation also make demands upon the environment through which they pass: competing for road space, requiring management and in the case of most non-human powered transport polluting the environment. There is much research on transport history but for the most part it remains separate from studies of migration and mobility. This chapter explores the benefits of greater interaction between these fields of enquiry, examines some of the ways in which planners and policy makers have sought to manage transport and travel over time, and considers the implications that this has both for the environment and for social equity.

Subject Areas: Transport infrastructure; Transport technologies; Traveling to school; Traveling to work; Traveling for leisure; Transport planning

Availability: Pooley, C.G., 2017. *Mobility in History through the Lens of Transport*. Migration and Transport (pp. 79-102). Springer International Publishing.
https://link.springer.com/chapter/10.1007/978-3-319-51883-1_4

10.14. Title: Improving Trip Generation Methods for Livable Communities

Authors: Clifton, K., Larco, N., Currans, K.M. and Wettach-Glosser, J.

Abstract: Recent efforts to improve trip generation data available for transportation impact analysis of new development include the collection of multimodal trip generation data, development of models that account for the built environment, and new recommendations for practice. Building on a long line of research on transportation and built environment, many studies have identified important features of the surrounding built environment that most impact trip rates and mode shares, building on a long line of research on transportation and the built environment. Despite these improvements in data and methods, less attention is placed on identifying the conditions of the site itself and the immediate surrounding environment that influence trip generation and mode choice. To fill this gap, this study builds upon previous work (Contextual Influences on Trip Generation (Project Number: OTREC 2011-407), 2012), re-examines the information collected in that study, and includes new site-level observations. The objective of this study is to examine establishment multimodal trip generation more closely from a finer-grained scale and identify site-level attributes of the built environment that help explain multimodal trip generation. From this, we have the additional objective of developing a framework for trip generation analysis that takes findings from this study into consideration. We placed emphasis on those sites in our previous study with a discord between the expected travel patterns, based upon the larger urban context and built environment of the site, and the observed. The research approach will make use of mixed methods. In addition to using archived data from the previous study, site visits provided direct observation of the overall performance of the site, including travel patterns on and around the site as well as specific site configuration, urban design details and traffic operations. The analysis of this combination of data provided a more complete picture of site-level trip generation and our findings highlight the influence of: people living nearby and using the site; the nature of the land use on the site; the development along arterial roadways; site permeability and access; and the local culture around walking and cycling. Finally, this report ends by reflecting on the numerous concerns identified from practice, the research findings from various recent studies, and the need for a sustainable process for evaluating the transportation impacts of new land development. We present a potential framework to advance the methods for how site plans fit into neighborhood and regional planning, using locally defined standards and goals. Here, we de-emphasize the site and its immediate environs as the primary (and only) scale of analysis and lessen the reliance on the problematic methodologies for estimating site-level travel demand. Rather, we argue that transportation impact analysis would benefit by first taking a district, neighborhood or area-wide approach with attention to the urban context - the built and social environment - where a site is located.

Subject Areas: Traffic surveys; Trip generation; Transportation Planning; Statistical methods; Urban transportation

Availability: Clifton, K., Larco, N., Currans, K.M. and Wettach-Glosser, J., 2017. *Improving Trip Generation Methods for Livable Communities*. NITC-RR-757. Portland, OR: Transportation Research and Education Center (TREC).

http://pdxscholar.library.pdx.edu/trec_reports/124/

10.15. Title: Tour Complexity, Variability and Pattern using Longitudinal GPS Data

Author: Shi, X.

Abstract: Trip chaining is a common phenomenon generally known as linking multiple activities and trips in one travel process. A good understanding about trip chaining complexity is important for travel demand model development and for transportation policy design. However, most of the existing studies on trip chaining limit the complexity classification scheme on number of trips chained and neglect other dimensions that also elevate the degree of complexity. The purpose of this study is to develop a new approach, Tour Complexity Index (TCI), that integrates the multi-dimensional nature of trip chaining into the complexity assessment. The study contains three analysis components. The first component introduces the TCI approach as a trip chaining complexity measure that not only considers number of trips chained but also includes the spatial relationship across destinations, the route arrangement, and the urban environment of the destinations. By comparing descriptive statistics and generalized linear model results from TCI approach with those from traditional approach, we find that the TCI approach offers more information regarding trip chaining and mode choice. The application of TCI is further demonstrated in the following components. The second component investigates the intra-personal daily and weekly travel variability with travel characterized by TCI and mode choice. The result reinforces an argument in current literature that the common single-day travel survey may produce biased estimation due to the day-to-day variance in travel behavior. Result also finds that proximity to a new transit service from place of residence is connected with a decline in variability. The third component explores a framework for travel pattern recognition where pattern is characterized by TCI as well. The discrepancy analysis which is a generalized analysis of variance (ANOVA) method is applied to associate individual characteristics with travel pattern. In addition, both components use Sequential Alignment Method (SAM) for travel pattern representation. The TCI approach and proposed analysis frameworks are validated using the longitudinal GPS trajectory data collected between 2011 and 2013 at west Los Angeles area for Expo Study.

Subject Areas: Trip chaining; Travel behavior; Travel demand model; Tour Complexity Index

Availability: Shi, X., 2017. *Tour Complexity, Variability and Pattern using Longitudinal GPS Data*. Doctoral dissertation, University of California, Irvine.

<http://search.proquest.com/openview/6d87457fa19f8503313615644e00dc80/1?pq-origsite=gscholar&cbl=18750&diss=y>

10.16. Title: Zipf's Power Law in Activity Schedules and the Effect of Aggregation

Authors: Ectors, W., Kochan, B., Janssens, D., Bellemans, T. and Wets, G.

Abstract: Modeling people's behavior in e.g. travel demand models is an extremely complex, multidimensional process. However, the frequency of occurrence of day-long activity schedules obeys a ubiquitous power law distribution, commonly referred to as Zipf's law. This paper discusses the role of aggregation within the phenomenon of Zipf's law in activity schedules. Aggregation is analyzed in two dimensions: activity type encoding and the aggregation of individual data in the dataset. This research employs four datasets: the household travel survey (HTS) NHTS 2009, two six-week travel surveys (MobiDrive 1999 and Thurgau 2003) and a 24-week set of trip data which was donated by one individual. Maximum-likelihood estimation (MLE) and the Kolmogorov- Smirnov (KS) goodness-of-fit (GOF) statistic are used in the "PowerLaw" R package to reliably fit a power law. To analyze the effect of aggregation in the first dimension, the activity type encoding, five different activity encoding aggregation levels were created in the NHTS 2009 dataset, each aggregating the activity types somewhat differently. To analyze aggregation in the second dimension, the analysis moves from study area-wide aggregated data to subsets of the data, and finally to individual (longitudinal) data.

Subject Areas: Travel Behavior; Zipf; Power law; Activity schedules; Data aggregation; Activity type classes

Availability: Ectors, W., Kochan, B., Janssens, D., Bellemans, T. and Wets, G., 2017. *Zipf's Power Law in Activity Schedules and the Effect of Aggregation*. *Procedia Computer Science*, 109, pp.225-232.

<http://www.sciencedirect.com/science/article/pii/S1877050917310049>

10.17. Title: ODM Commuter Aircraft Demand Estimation

Authors: Syed, N., Rye, M., Ade, M., Trani, A., Hinze, N., Swingle, H., Smith, J., Marien, T. and Dollyhigh, S.

Abstract: The study investigates the potential market for an On-Demand Mobility (ODM) air transportation concept. The ODM vehicle is an advanced aircraft equipped with automation, electric propulsion technology and limited Vertical Takeoff and Landing (VTOL) capabilities. The analysis presented includes an integrated approach to estimated ODM commuter demand. The approach includes: a) landing site requirements analysis, b) a calibrated Conditional Logit Model to predict commuter mode choice, c) a life cycle cost analysis, and d) detailed analysis of potential routes. The demand for ODM Commuter Aircraft - as a mode of transportation for daily commuting - was modeled considering automobile and public transit as competing modes of transportation. The study presented in this paper applies the ODM commuter vehicle demand methodology of two metropolitan areas: a) North California and b) Washington-Baltimore areas.

Subject Areas: Travel Behavior; Zipf; Power law; Activity schedules; Data aggregation; Activity type classes

Availability: Syed, N., Rye, M., Ade, M., Trani, A., Hinze, N., Swingle, H., Smith, J., Marien, T. and Dollyhigh, S., 2017. *ODM Commuter Aircraft Demand Estimation..* 17th AIAA Aviation Technology, Integration, and Operations Conference.

<https://arc.aiaa.org/doi/abs/10.2514/6.2017-3082>

10.18. Title: SmartTrips Ithaca: Encouraging Sustainable Transportation Options Through a Personalized Educational Campaign

Authors: Dotson J., Gutierrez N., Chang H., and Bosco S.

Abstract: SmartTrips Ithaca is a neighborhood-based personalized educational campaign that encouraged residents of downtown Ithaca to try out sustainable modes of transportation such as walking, biking, transit, and carsharing through incentives and communication customized to each program participant as a stepping stone towards living a car-free or car-lite lifestyle. The report offers a case study in how the SmartTrips model was adjusted to the unique context of a small college town, and summarizes the positive results in trip reduction and mode shift that occurred in a before-and-after survey of program participants. Information contained in this document, such as web page addresses, are current at the time of publication.

Subject Areas: Community-Based Social Marketing; Transportation Demand Management; Smart-Trips; Individualized Marketing.

Availability: Dotson J., Gutierrez N., Chang H., and Bosco S., 2017. *SmartTrips Ithaca: Encouraging Sustainable Transportation Options Through a Personalized Educational Campaign*. NYSERDA Report 16-34, Ithaca Carshare, Inc.

<http://search.proquest.com/openview/fdc10ab9ef18432a9872f455c8c21803/1?pq-origsite=gscholar&cbl=18750&diss=y>

10.19. Title: Investigating the impacts of Built Environment on Vehicle Miles Traveled and Energy Consumption: Differences between Commuting and Non-Commuting Trips

Authors: Ding, C., Liu, C., Zhang, Y., Yang, J. and Wang, Y.

Abstract: This research contributes to the understanding of the impacts of the built environment on vehicle miles traveled (VMT) and energy consumption by considering the mediating effects from vehicle type and travel speed. Meanwhile, whether the relationships among the built environment, VMT and energy consumption vary between commuting and non-commuting trip was examined by applying the multiple-group structural equation model (SEM). The primary travel data used in the research is drawn from the National Household Travel Survey (NHTS) Baltimore Add-on data. In this study, the built environment was measured for each residential location based on various external sources. By controlling for the socio-demographic factors, the model results show that the effects of the built environment on travel speed, VMT and vehicle energy consumption significantly vary between commuting and non-commuting trips. For the two different travel types, the direct, indirect, and total effects of the built environment measurements on VMT and vehicle energy consumption were discussed. The model results confirmed the important roles played by the built environment in influencing VMT and vehicle energy consumption. The results are expected to give urban planners and policy makers a better understanding on how the built environment factors can impact the VMT and energy consumption, and consequently develop more effective and targeted countermeasures.

Subject Areas: Built environment; VMT; Energy consumption; Multiple-group SEM; Commuting trip

Availability: Ding, C., Liu, C., Zhang, Y., Yang, J. and Wang, Y., 2017. *Investigating the impacts of Built Environment on Vehicle Miles Traveled and Energy Consumption: Differences between Commuting and Non-Commuting Trips*. *Cities*, 68, pp.25-36.

<http://www.sciencedirect.com/science/article/pii/S0264275116304887>

10.20. Title: Commuting in America; Developing a National Report from National Survey Sources

Author: Weinberger, P.Z.

Abstract: The Commuting in America (CIA) series of reports describing travelers and their commutes to work began in April 1984, using US census data to describe the emerging patterns of commuting. The original intent of CIA was to serve as a common resource of factual information upon which policymakers could draw in shaping transportation development actions and policies. The fourth iteration of CIA, CIA 2013, consists of 16 briefs in topical areas of commuting, including The Role of Commuting in Overall Travel, Population and Worker Trends, Population and Worker Dynamic, The Nature and Pattern of Jobs, Job Dynamics, Vehicle and Transit Availability, Consumer Spending on Transportation, How Commuting Influences Travel, Commuting Mode Choice, Commuting Departure Time and Trip Time, Auto Commuting, Transit Commuting, Bicycling and Walking Commuting and Commuting Flow Patterns. The project was completed in January 2014. Understanding commuting is a critical component of understanding total travel. Commuting travel patterns often define a large share of a household's total trip-making as measured in share of trips. As work trips are slightly longer than trips for other purposes, work-trip commuting comprises a slightly larger share of total person travel miles. Work trips most often occur during congested time periods and are the largest contributor to travel time delay. Work trips are sensitive to and suffer the consequences of travel delay and large variations in travel time reliability. CIA once relied on the US Census Bureau's decennial long form data to develop reports on national commuting patterns and trends. With the advent of the American Community Survey (ACS) and subsequent discontinuation of the Decennial Long Form, the methodology for discerning national commuting trends has had to change. The two chief sources for data for CIA 2013 were the ACS and the USDOT's National Household Travel Survey (NHTS). Additional national survey sources include the American Housing Survey of the Department of Housing and Urban Development, the Consumer Expenditure Survey of the Bureau of Labor Statistics, the administrative records-based Longitudinal Employment Household Dynamics (LEHD), the Transportation Energy Data Book, and FTA's National Transit Database (NTD). The US Census collects the largest, most comprehensive national data set on commuting with the "Journey to Work" questions now in the ACS. While the ACS is not a travel survey in the traditional sense, it is the source of data most used by transportation planners and modelers for demographic and commute travel behavior. This paper follows the history of Commuting in America with an emphasis on which data were used, and how. The paper discusses the introduction and history of the journey to work question, changes from the long form to the ACS, the inclusion of other US Census and non-census data sets to discern travel trends, and ways the ACS data were used to generate information on the topics. While the paper is not a traditional research paper, it provides an historic scan and concepts for how these types of data sets can be employed to generate important, topical, accessible information for consumption by decision makers and the public. This work is of use to data providers who wish to make their data more useful and to practitioners faced with large data sets needing ideas to help turn them into information.

Subject Areas: Commuting; Data analysis; Data collection; Travel behavior; Travel patterns; Travel surveys; Travel time; Work trips

Availability: Weinberger, P.Z., 2016. *Commuting in America; Developing a National Report*

from National Survey Sources. In European Transport Conference 2016, Association for European Transport (AET).

<http://abstracts.aetransport.org/paper/index/id/5078/confid/21>

10.21. Title: Investigating the Influence of Trip Distance on Travel Behaviour of Non-Motorized Transport (NMT) Users

Authors: Mondal, S., Mitra, S. and Majumdar, B.B.

Abstract: Non-Motorized Transport (NMT) modes can only be used for trips of relatively short lengths; hence it is essential to know the spatial extent of the trips taken by such modes and their variation in various land-use and geographic setup. For this exercise, good quality comprehensive data consisting of regions is a must; hence the choice of National Household Travel Survey (NHTS) data from United States. This data consists of household travel survey records from multiple urban and rural areas of all states of the United States for the year 2009 and has been used in this research. Using the mentioned dataset, this study seeks to answer the following research questions of interest: (1) How far users walk or use bicycle typically? (2) How the trip lengths varied across various populations sub-groups? and (3) How the trip lengths varied with variation of size of city, land-use and geography?

With these questions in mind, this paper analyses the nature of trips made by NMT modes and investigates the influence of trip length on travel behavior of NMT users' across various population subgroups. To start with, the average trip lengths made by walk and bicycles across various geographic locations are estimated. Additionally, estimates of drop in trip patronage with increased trip lengths are obtained using the concept of distance-decay. These distance-decay functions are also estimated for different geographic locations with varying population and land uses, using which it is possible to obtain travel impedance or deterrence of walking and bicycling with increases trip lengths.

As expected the overall results reveal that with an increase in trip length, users are less willing to walk than bicycle with as estimated impedance or level of deterrence of 0.259 for bicycle and 0.687 for walk in urban area. Similarly, the impedance values of 0.254 and 0.679 are estimated for bicycle and walk respectively for rural area. The impedance caused by trip length is observed to vary significantly among different user groups for both pedestrians and bicycle users. For example, in urban area "Shopping" trips made by bicycle users are found to have the maximum impedance of 0.371 and bicycle trips made by users with "Professional, managerial, or technical" occupation are found to be least influenced by trip length with the lowest impedance of 0.136.

Subject Areas: Non-Motorized Transport (NMT), Distance-Decay, Impedance, Trip Length Frequency Distribution, Commuting; Data analysis; Data collection; Travel behavior; Travel patterns; Travel surveys; Travel time; Work trips

Availability: Mondal, S., Mitra, S. and Majumdar, B.B. *Investigating the Influence of Trip Distance on Travel Behaviour of Non-Motorized Transport (NMT) Users*. 3rd Conference of Transportation Research Group of India (3rd CTRG).

https://www.researchgate.net/profile/Bandhan_Majumdar/publication/288786922_Investigating_the_influence_of_Trip_Distance_on_Travel_Behaviour_of_Non-Motorized_Transport_NMT_users/links/57b2e8e808aeb2cf17c73b7f.pdf

10.22. Title: Estimating Motorized Travel Mode Choice using Classifiers: An Application for High-Dimensional Multicollinear Data

Authors: Lindner, A., Pitombo, C.S. and Cunha, A.L.

Abstract: Studies in the field of discrete choice analysis are crucial for transportation planning. Generally, travel demand models are based on the maximization of the random utility and straightforward mathematical functions, such as logit models. These assumptions lead to a continuous model that presents constraints concerning fitting the data. Artificial Neural Networks (ANN) and Classification Trees (CT) are classification techniques that can be applied to discrete choice models. These techniques can overcome some disadvantages of traditional modeling, especially the drawback of not being able to model high-dimensional multicollinear data. This research paper compares the performance of estimating motorized travel mode choice through ANN and CT with a binary logit in a multicollinear study case (aggregated and disaggregated covariates). The dataset refers to an Origin-Destination Survey carried out in São Paulo Metropolitan Area, Brazil in 2007. Classification techniques have shown a good ability to forecast (approximately 80% match rate), as well as to recognize travel behavior patterns. Furthermore, by using the classifier application, the most important covariates within all the datasets can be selected. These covariates can be related to households, as well as to Traffic Analysis Zones.

Subject Areas: Artificial Neural Networks; Decision tree algorithms; Travel mode choice; Multicollinear data

Availability: Lindner, A., Pitombo, C.S. and Cunha, A.L., 2017. *Estimating Motorized Travel Mode Choice using Classifiers: An Application for High-Dimensional Multicollinear Data*. *Travel Behaviour and Society*, 6, pp.100-109.

<http://www.sciencedirect.com/science/article/pii/S2214367X16300291>

10.23. Title: Tracking a System of Shared Autonomous Vehicles across the Austin, Texas Network using Agent-Based Simulation 2

Authors: Liu, J., Kockelman, K.M., Boesch, P.M. and Ciari, F.

Abstract: This study provides a large-scale micro-simulation of transportation patterns in a metropolitan area when relying on a system of shared autonomous vehicles (SAVs). The six-county region of Austin, Texas is used for its land development patterns, demographics, networks, and trip tables. The agent-based MATSim toolkit allows modelers to track individual travelers and individual vehicles, with great temporal and spatial detail. MATSim's algorithms help improve individual travel plans (by changing tour and trip start times, destinations, modes, and routes). Here, the SAV mode requests were simulated through a stochastic process for four possible fare levels: \$0.50, \$0.75, \$1, and \$1.25 per trip-mile. These fares resulted in mode splits of 50.9%, 12.9%, 10.5%, and 9.2% of the region's person-trips, respectively. Mode choice results show longer-distance travelers preferring SAVs to private, human-driven vehicles (HVs) - thanks to the reduced burden of SAV travel (since one does not have to drive the vehicle). For travelers whose households do not own an HV, SAVs (rather than transit, walking and biking) appear preferable for trips under 10 miles, which is the majority of those travelers' trip-making. It may be difficult for traditional transit services and operators to survive once SAVs become available in regions like Austin, where dedicated rail lines and bus lanes are few. Simulation of SAV fleet operations suggest that higher fare rates allow for greater vehicle replacement (ranging from 5.6 to 7.7 HVs per SAV, assuming that the average SAV serves 17 to 20 person-trips per day); this is due to travel demands shifting away from longer trip distances, when fares rise. Empty vehicle miles traveled by the fleet of SAVs ranged from 7.8 percent to 14.2 percent, across the scenarios in this study. Implications of mobility and sustainability benefits of SAVs are also discussed in the paper.

Subject Areas: Shared Autonomous Vehicles; Car-sharing; Agent-Based Simulation; Mode Choice; Travel Demand Modeling

Availability: Liu, J., Kockelman, K.M., Boesch, P.M. and Ciari, F., 2017. *Tracking a System of Shared Autonomous Vehicles across the Austin, Texas Network using Agent-Based Simulation 2*. Transportation Research Part C: Emerging Technologies.

http://www.cae.utexas.edu/prof/kockelman/public_html/TRB17SAVs_acrossAustin.pdf

10.24. Title: A Decomposition Algorithm to Solve the Multi-hop Peer-to-Peer Ride-Matching Problem

Authors: Masoud, N. and Jayakrishnan, R.

Abstract: In this paper, we mathematically model the multi-hop Peer-to-Peer (P2P) ride-matching problem as a binary program. We formulate this problem as a many-to-many problem in which a rider can travel by transferring between multiple drivers, and a driver can carry multiple riders. We propose a pre-processing procedure to reduce the size of the problem, and devise a decomposition algorithm to solve the original ride-matching problem to optimality by means of solving multiple smaller problems. We conduct extensive numerical experiments to demonstrate the computational efficiency of the proposed algorithm and show its practical applicability to reasonably-sized dynamic ride-matching contexts. Finally, in the interest of even lower solution times, we propose heuristic solution methods, and investigate the trade-offs between solution time and accuracy.

Subject Areas: Ride sharing; Ride matching algorithm; Dynamic ride sharing; On-demand transportation; Passenger transportation; Sharing economy; Multi-modal transportation

Availability: Masoud, N. and Jayakrishnan, R., 2017. *A Decomposition Algorithm to Solve the Multi-hop Peer-to-Peer Ride-Matching Problem*. Transportation Research Part B: Methodological, 99, pp.1-29.

<http://www.sciencedirect.com/science/article/pii/S019126151730019X>

11. Trend Analysis and Market Segmentation

11.1. Title: SmartTrips Ithaca: Encouraging Sustainable Transportation Options Through a Personalized Educational Campaign

Author: Dotson J., Gutierrez N., Chang H., and Bosco S.

Abstract: SmartTrips Ithaca is a neighborhood-based personalized educational campaign that encouraged residents of downtown Ithaca to try out sustainable modes of transportation such as walking, biking, transit, and carsharing through incentives and communication customized to each program participant as a stepping stone towards living a car-free or car-lite lifestyle. The report offers a case study in how the SmartTrips model was adjusted to the unique context of a small college town, and summarizes the positive results in trip reduction and mode shift that occurred in a before-and-after survey of program participants. Information contained in this document, such as web page addresses, are current at the time of publication.

Subject Areas: Community-Based Social Marketing; Transportation Demand Management; Smart-Trips; Individualized Marketing.

Availability: Dotson J., Gutierrez N., Chang H., and Bosco S., 2017. *SmartTrips Ithaca: Encouraging Sustainable Transportation Options Through a Personalized Educational Campaign*. NYSERDA Report 16-34, Ithaca Carshare, Inc.

<http://search.proquest.com/openview/fdc10ab9ef18432a9872f455c8c21803/1?pq-origsite=gscholar&cbl=18750&diss=y>

11.2. Title: A Time-Dependent Stated Preference Approach to Measuring Vehicle Type Preferences and Market Elasticity of Conventional and Green Vehicles

Authors: Cirillo, C., Liu, Y. and Maness, M.

Abstract: The diversity of new vehicle technology and fuel markets, the governments' sustainable call to reduce energy consumption and air pollution lead to a change in the personal vehicle market. Considering the impact of these factors, a stated preference survey approach is adopted to analyze household future preferences for gasoline, hybrid electric, and battery electric vehicles in a dynamic marketplace. The stated choice experiment places respondents in a nine-year hypothetical time window with dynamically changing attributes including vehicle purchasing price, fuel economy, recharging range, and fuel price. A web-based survey was performed during 2014 in the state of Maryland. The collected data include household social-demographics, primary vehicle characteristics, and vehicle purchasing preferences of 456 respondents during the year of 2014-2022. Mixed Multinomial logit (MMNL) models are employed to predict vehicle preferences based on households' socio-demographics and vehicle characteristics. The estimation results show that young people are more likely to buy vehicles with new technology, especially battery electric vehicles (BEV). Women with a high education level (bachelor degree or higher) prefer to choose hybrid electric vehicle (HEV) while men with a high education level are more likely to buy BEV. The estimated vehicle market elasticities with respect to vehicle price are from -1.1 to -1.8 for HEV and BEV, higher than those for gasoline vehicles from -0.6 to -1.0. The vehicle market cross-elasticities estimated by MMNL models range from 0.2 to 0.6. In addition, willingness to pay (WTP) of vehicle characteristics estimated by MMNL models provide a good understanding of household future vehicle preferences.

Subject Areas: Green Vehicle; Sustainable Transport; Mixed Multinomial logit

Availability: Cirillo, C., Liu, Y. and Maness, M., 2017. *A Time-Dependent Stated Preference Approach to Measuring Vehicle Type Preferences and Market Elasticity of Conventional and Green Vehicles*. *Transportation Research Part A: Policy and Practice*, 100, pp.294-310.
<http://www.sciencedirect.com/science/article/pii/S0965856416301483>

11.3. Title: Stochastic Programming Approach for Electric Vehicle Charging Network Design

Authors: Faridimehr, S., Venkatachalam, S. and Chinnam, R.B.

Abstract: Advantages of electric vehicles (EV) include reduction of greenhouse gas and other emissions, energy security, and fuel economy. The societal benefits of large-scale adoption of EVs cannot be realized without adequate deployment of publicly accessible charging stations. We propose a two-stage stochastic programming model to determine the optimal network of charging stations for a community considering uncertainties in arrival and dwell time of vehicles, battery state of charge of arriving vehicles, walkable range and charging preferences of drivers, demand during weekdays and weekends, and rate of adoption of EVs within a community. We conducted studies using sample average approximation (SAA) method which asymptotically converges to an optimal solution for a two-stage stochastic problem, however it is computationally expensive for large-scale instances. Therefore, we developed a heuristic to produce near to optimal solutions quickly for our data instances. We conducted computational experiments using various publicly available data sources, and benefits of the solutions are evaluated both quantitatively and qualitatively for a given community.

Subject Areas: Electric Vehicles; Fuel Economy; Sustainable Transport

Availability: Faridimehr, S., Venkatachalam, S. and Chinnam, R.B., 2017. *Stochastic Programming Approach for Electric Vehicle Charging Network Design*. IarXiv preprint arXiv:1701.06723. <https://arxiv.org/abs/1701.06723>

11.4. Title: Electricity Costs for a Level 3 Electric Vehicle Fueling Station Integrated with a Building

Authors: Flores, R.J., Shaffer, B.P. and Brouwer, J.

Abstract: Despite the potential environmental benefits, plugin electric vehicles (PEVs) face challenges associated with driving range and long refueling times. Level 3 electric vehicle service equipment (EVSE) is capable of refueling PEVs quickly, but may face economic challenges, such as high utility demand charges. The current study extends prior work to determine if lower utility costs can be achieved by integrating Level 3 EVSE with a commercial or industrial building. Models are developed to simulate travel patterns using real travel data, building demand based upon real building data, and subsequent refueling of Level 3 compatible PEVs to evaluate cost implications of integrating public fast charging into real buildings operating under current electric utility rate structures. Two types of Level 3 refueling station operations are considered (conventional and valet parking). By integrating EVSE with a building, savings can be produced if lower cost energy is accessed, and by the sharing of demand charges between the PEV drivers and the building. These savings were determined to be much more significant to the refueled PEVs than any examined building. The dynamics of building electricity consumption have a large effect on overall demand charge cost reductions, with high load factor buildings providing the smallest savings. Lower load factor buildings may experience a larger benefit, but only if the maximum building demand does not coincide with the refueling of PEVs. In general, savings tend to disappear or turn into losses when valet parking is active and PEV traffic is moderate to high. Increasing building size reduces the risk of peak building and PEV refueling demand coinciding, maintaining savings for PEVs. However, the relative value of the savings due to integration disappears for larger buildings. Installing multiple EVSE can provide a cost benefit under conventional parking, but nearly always increases costs under valet parking. Increasing EVSE power always reduces savings, or increases losses. Finally, if multiple utility rates exist, EVSE integration can result in a rate switch for small buildings, significantly increasing utility costs for the building. (EHVs).

Subject Areas: Plug-in electric vehicles; Fast charging; Demand charges; Utility costs

Availability: Flores, R.J., Shaffer, B.P. and Brouwer, J., 2017. *Electricity Costs for a Level 3 Electric Vehicle Fueling Station Integrated with a Building*. *Applied Energy*, 191, pp.367-384. <http://www.sciencedirect.com/science/article/pii/S030626191730017X>

11.5. Title: Essays on Regulation and its Impact on Industry and Taxation: Studies on Cafe Standards

Author: Wang, Y., 2017.

Abstract: Adopted in 1975, Corporate Average Fuel Economy (CAFE) standards had profound influences on the automobile industry as well as fleet fuel economy in the United States. In my dissertation, I first looked into the historical impacts of CAFE standards in the automobile industry using vehicle attribute data. I found evidence that the increase in the stringency of CAFE standards can induce the innovation of fuel economy related technologies in the automobile industry. I further estimated the response rate of the induced innovation with respect to stringency increases in CAFE standards. Using these estimates, I predicted that automobile companies would be able to meet the high 2025 fuel economy target by making medium downsizing in cars and minor downsizing in light duty trucks. Such methods can also be applied in other industries that have performance based regulations. CAFE standards increased fleet fuel economy in the United States as it was designed to. However, a more fuel efficient fleet resulted in less gasoline tax revenue, which is the major source of road maintenance. This trend affected governments at both federal and state levels. With more stringent CAFE standards enforced by the Obama Administration, which seek to almost double vehicle fuel economy by 2025, the gasoline tax revenue would be further eroded. As major increases in the gasoline tax rate are not politically feasible in the United States, policy makers seek other methods, such as a vehicle mile traveled (VMT) tax, to maintain a more stable revenue flow. I estimated households' driving demand in response to driving cost changes using household survey data and estimated tax revenue under different tax scenarios. I showed that although a VMT tax can be more regressive than a gasoline tax, it provides more stable tax revenue without having to make major adjustments in tax rates when fleet fuel economy keeps increasing.

Subject Areas: Fuel economy; VMT

Availability: Wang, Y., 2017. *Essays on Regulation and its Impact on Industry and Taxation: Studies on Cafe Standards*. (Doctoral dissertation, Cornell University).

<http://search.proquest.com/openview/27540781abcb80b48c47d585573ba53b/1?pq-origsite=gscholar&cbl=18750&diss=y>

11.6. Title: CVaR-Constrained Optimal Bidding of Electric Vehicle Aggregators in Day-ahead and Real-time Markets

Authors: Yang, H., Zhang, S., Qiu, J., Qiu, D., Lai, M. and Dong, Z.

Abstract: An electric vehicle aggregator (EVA) that manages geographically dispersed electric vehicles offers an opportunity for the demand side to participate in electricity markets. This paper proposes an optimization model to determine the day-ahead inflexible bidding and real-time flexible bidding under market uncertainties. Based on the relationship between market price and bid price, the proposed optimal bidding model of EVA aims to minimize the conditional expectation of electricity purchase cost in two markets considering price volatility. Moreover, the penalty cost of the deviation between the bidding quantities is included to avoid large power variation and arbitrage. The conditional expectation optimization model is formulated as an expectation minimization problem with the conditional value-at-risk (CVaR) constraints. Based on the price data in the PJM market, simulation results verify that our model is a decision-making tool in electricity markets, which can help market players comprehend the variants of bid price, expected cost and probability of successful bidding.

Subject Areas: Electric vehicles Aggregators; Bidding Strategy; Conditional value at risk; Day-ahead and Real-time markets

Availability: Yang, H., Zhang, S., Qiu, J., Qiu, D., Lai, M. and Dong, Z., 2017. *CVaR-Constrained Optimal Bidding of Electric Vehicle Aggregators in Day-ahead and Real-time Markets*. IEEE Transactions on Industrial Informatics, PP(99).

<http://ieeexplore.ieee.org/abstract/document/7839209/>

11.7. Title: An Optimal Integrated Planning Method for Supporting Growing Penetration of Electric Vehicles in Distribution Systems

Authors: Zeng, B., Feng, J., Zhang, J. and Liu, Z.

Abstract: This paper proposes a multi-year expansion planning method for enabling distribution systems to support growing penetrations of plug-in electric vehicles. As distinct from the existing studies, the temporal characteristics of charging loads and their reliability impacts are especially focused in our work. To achieve this, a novel dual-stage optimization framework is developed. The proposed method considers the capacity reinforcement of distribution systems in conjunction with their operation decisions and coordinates them under the same frame so as to minimize the total system costs for accommodating electric vehicles. The uncertainties associated with renewable energy generation, charging behaviors, and conventional load demand are represented by multiple probabilistic scenarios. To fully reveal the impacts of electric vehicle integration, both uncontrolled and coordinated charging schemes are considered in our analysis. Furthermore, as charging loads bring about extra demand to the grid, the reliability criteria is also taken into account in the proposed model. Using a heuristic algorithm combined with reliability analysis, the optimal solution for the concerned problem can be determined, which involves the best timing, locations, and capacities for installation of distributed generation units and network components. The effectiveness of the proposed framework is examined based on a 38-bus test system and the obtained results verify the performance of the approach.

Subject Areas: Distribution network; Plug-in electric vehicle; Dual-stage optimization; Supply adequacy; Uncertainty; Chronological information

Availability: Zeng, B., Feng, J., Zhang, J. and Liu, Z., 2017. *An Optimal Integrated Planning Method for Supporting Growing Penetration of Electric Vehicles in Distribution Systems*. Energy, 126, pp.273-284.

<http://www.sciencedirect.com/science/article/pii/S0360544217303729>

11.8. Title: Effectiveness Evaluation for a Commercialized PV-Assisted Charging Station

Authors: Liu, N. and Cheng, M.

Abstract: The Photovoltaic-assisted Charging Station (PVCS) is regarded as one of the most promising charging facilities for future electric vehicle (EV) energy supplementation. In this paper, the operation mode and profitability of a commercialized PVCS are analyzed under the energy policy of China. In order to evaluate the long-term effectiveness of using the PVCS to provide guidance for the investors of the stations, a set of evaluation indexes is introduced, including the quality of service, the environmental and economic benefits, and the impacts on the grid. Furthermore, an easily-achieved charging strategy which considers the quality of service and the self-consumption of PV energy is proposed. Finally, an effectiveness evaluation for different operational scenarios of the PVCS is completed, based on the actual statistical data. The simulation and evaluation results indicate that the PVCS has the potential to produce satisfactory environmental/economic benefits and to reduce the impacts and dependence of an EV's charging load on the grid.

Subject Areas: Electric Vehicle; PV System; Effectiveness evaluation; Operation mode; Charging strategy

Availability: Liu, N. and Cheng, M., 2017. *Effectiveness Evaluation for a Commercialized PV-Assisted Charging Station*. Sustainability, 9(2), p.323.

<http://www.mdpi.com/2071-1050/9/2/323/htm>

11.9. Title: Deployment and Utilization of Plug-in Electric Vehicles in Round-trip Carsharing Systems

Authors: Jacquillat, A. and Zoepf, S.

Abstract: Electric Vehicles (EVs) and Plug-in Hybrid Electric Vehicles (PHEVs) can reduce gasoline consumption, but increase vehicle acquisition costs and introduce operational constraints. We develop a comprehensive approach to EV/PHEV deployment and utilization in round-trip carsharing systems. First, we formulate and solve the tactical problem of utilizing a mix of gasoline vehicles and EVs/PHEVs to serve trip demand, using Mixed Integer Programming optimization to estimate the minimal gasoline consumption in a computationally efficient manner, and simulation to assess the effect of reservation order on realized gasoline consumption. Second, we use these results to inform the strategic deployment of EVs/PHEVs in the carsharing fleet, using meta-optimization. We implement our approach using data from a large carsharing provider. From the perspective of a carsharing operator, our results suggest that replacing some portion of existing gasoline fleets by EVs/PHEVs would result in gasoline savings likely to outweigh upfront investments and the constraints on vehicle utilization that it creates. Moreover, we find that easily implementable heuristics can capture some of these benefits, and that the integration of vehicle utilization patterns into the design of EV/PHEV deployment strategies can result in added benefits.

Subject Areas: Reliability; Carsharing; Electric Vehicles; Mixed Integer Programming; Simulation

Availability: Jacquillat, A. and Zoepf, S., 2017. *Deployment and Utilization of Plug-in Electric Vehicles in Round-trip Carsharing Systems*. International Journal of Sustainable Transportation, (just-accepted).

<http://www.tandfonline.com/doi/abs/10.1080/15568318.2017.1328624>

11.10. Title: Adequacy Assessment of Power Distribution Network with Large Fleets of PHEVs considering Condition-Dependent Transformer Faults

Authors: Tan, J. and Wang, L.

Abstract: As a new form of distributed energy resources, massive plug-in hybrid electric vehicles (PHEVs) could affect the power distribution system adequacy considering their intermittent charging loads and the load recovery ability during system outages. This paper proposes a comprehensive framework for adequacy evaluation of power distribution networks with PHEVs penetration. A condition-dependent outage model is used in this paper to obtain the time sequential failure rate of the transformer. Also, a business model for the PHEVs is developed to encourage the PHEV owners to charge their vehicles in such a way that the distribution system adequacy is enhanced. Based on this model, a smart charging algorithm is proposed for the PHEVs to minimize their charging cost and enhance the adequacy of the distribution network at the same time. Various simulation studies are carried out to verify the effectiveness of the proposed smart charging approach. The simulation results show that the proposed approach is effective in enhancing both the adequacy of the distribution network and economic profits of PHEVs.

Subject Areas: Plug-in hybrid electric vehicle; Power system adequacy assessment; Hybrid transformer failure model; Monte Carlo simulation

Availability: Tan, J. and Wang, L., 2017. *Adequacy Assessment of Power Distribution Network with Large Fleets of PHEVs considering Condition-Dependent Transformer Faults*. IEEE Transactions on Smart Grid, 8(2), pp.598-608.

<http://ieeexplore.ieee.org/abstract/document/7491332/>

11.11. Title: Economic Analysis of Different Electric Vehicle Charging Scenarios

Authors: Ying, L., Haiming, Z., Xiufan, M. and Hao, W.

Abstract: Influence of electric vehicles (EV) to grid cannot be ignored. Research on the economy analysis of different charging scenarios is helpful to guide the user to charge or discharge orderly. EV charging models are built such as disordered charging, valley charging, intelligent charging, and V2G (Vehicle to Grid), by which changes of charging load in different scenarios can be seen to analyze the influence to initial load curve, and comparison can be done about user's average cost. Monte Carlo method is used to simulate the electric vehicle charging behavior, cost in different charging scenarios are compared, social cost is introduced in V2G scene, and the relationship between user's average cost and social cost is analyzed. By test, it is proved that user's cost is the lowest in V2G scenario, and the larger the scale of vehicles is, the more the social cost can save.

Subject Areas: Electric vehicles; Vehicle to Grid; Monte Carlo method

Availability: Ying, L., Haiming, Z., Xiufan, M. and Hao, W., 2017. *Economic Analysis of Different Electric Vehicle Charging Scenarios*. In IOP Conference Series: Materials Science and Engineering, 199(1), p. 012041, IOP Publishing.

<http://iopscience.iop.org/article/10.1088/1757-899X/199/1/012041/meta>

11.12. Title: Innovative Transit Financing: Is the New Markets Tax Credit a Viable Financing Mechanism for Transit Projects?

Author: Vachris, M.S.

Abstract: Financing transit projects is expensive and as the federal government and local municipalities balance multiple spending priorities, the pool of funds for transit could be reduced. Transit agencies and supporters should continue looking for innovative ways to source funds for projects. The New Markets Tax Credit is an established program that encourages private sector investment in qualified projects, such as transit. A comparison of New Markets Tax Credit program criteria and available public transit data proves that there is enough crossover to leverage the New Markets Tax Credit as an innovative financing option for transit projects, particularly Demand Response systems.

Subject Areas: Tax credit; Demand response; Accessibility; Financing; Public Transportation; Policy; Society

Availability: Vachris, M.S., 2017. *Innovative Transit Financing: Is the New Markets Tax Credit a Viable Financing Mechanism for Transit Projects?* Transportation Research Board, (No. 17-03490).

<http://docs.trb.org/prp/17-00318.pdf>

11.13. Title: Relationships between the Online and In-store Shopping Frequency of Davis, California Residents

Authors: Lee, R.J., Sener, I.N., Mokhtarian, P.L. and Handy, S.L.

Abstract: The growth of online shopping will likely impact rates of in-store shopping, signaling potentially significant ramifications for shopping-related vehicle travel. To better understand this relationship, we studied shoppers in Davis, California using a comprehensive survey dataset to explore the effect of personal characteristics, attitudes, perceptions, and the built environment on the frequencies of shopping online and within three distinct shopping settings. Overall, results showed that attitudes and perceptions played an important role in the shopping decision. The ordered response models of shopping frequency also revealed that the shopping motivations for each setting differed. Most notably, many of the factors influencing the frequency of shopping outside Davis had the opposite effect on shopping within Davis. Joint copula models subsequently suggested that online shopping had a complementary relationship with in-store shopping frequency, even after controlling for demographic variables and attitudes. Rather than reducing shopping travel, it appears that online shopping is associated with higher in-store shopping rates.

Subject Areas: Online shopping; Shopping trips; Shopping setting; Complementarity; Ordered response; Copula models

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