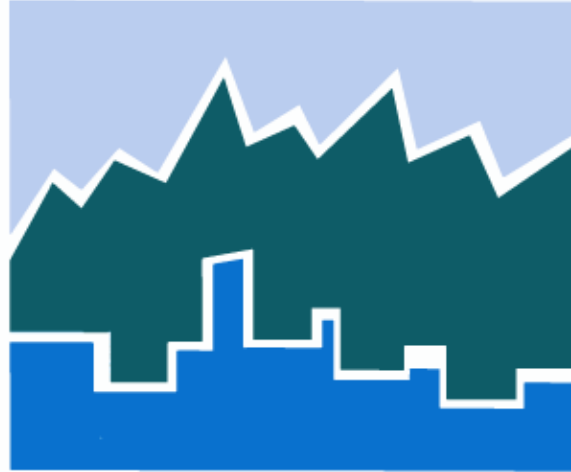# National Household Travel Survey

Compendium of Uses

January 2018 - June 2018

Introduction

This compendium contains various uses and applications of the National Household Travel Survey (NHTS) data used in transportation planning and research from January 2018 to June 2018. 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/, Google Scholar https://scholar.google.com/, 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 97th Annual Meeting and can be found in the 2018 TRB Annual Meeting Compendium of Papers. Please note that this 2018 compendium consists of approximately 172 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 Daniel Jenkins at Daniel.Jenkins@dot.gov.

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

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1. Bicycle and Pedestrian Studies

1.1. Title: Middle Modalism: The Proliferation of E-Bikes and Implications for Planning and Urban Design

Authors: Healy, J. and Chisholm, D.

Abstract: Motorized bicycles are different from non-motorized bicycles. They have greater range, cost, and weight as well as higher average and top speeds. For this reason, powered bikes, a type of Light Electric Vehicle (LEV), require consideration by urban planners and designers. Key differences for urban planners include presumed larger bike-sheds - the potential capture area for trips around any given destination - and higher speeds, which will affect the design of shared "bike" facilities. As of yet, the planning community has not developed specialized treatments and approaches for LEVs.

Subject Areas: E-Bikes; Non-motorized bicycles; Planning

Availability: Healy, J. and Chisholm, D., 2018. *Middle Modalism: The Proliferation of E-Bikes and Implications for Planning and Urban Design.* In Bicycle Urbanism (pp. 96-114). Routledge. https://www.taylorfrancis.com/books/e/9781317174349/chapters/10.4324%2F9781315569338-7

1.2. Title: Can the Built Environment Explain Gender Gap in Cycling? An Exploration of University Students? Travel Behavior in Toronto, Canada

Authors: Mitra, R. and Nash, S.

Abstract: The benefits of cycling as a healthier and more sustainable transportation alternative to private automobile is emphasized in both literature and policy. One key policy challenge in improving cycling rates is the significant gender gap in cycling that exists across urban regions in North America. In this study, travel behavior of >10,000 students attending four universities in Toronto, Canada, was analyzed to explore gender-based differences in cycling uptake. The mode share for cycling was higher for non-commute trips (9%) when compared to commuting trips to universities (7.6%). In addition, men had higher cycling rates than women, for both commute and non-commute trips. Results from binomial logistic regression models indicate that the built environment-related correlates were different between male and female students, and between commute and non-commute trips. Access to bicycle lanes or cycle tracks was found to increase the odds of female commuter cycling. This effect, however, was moderate in the neighborhoods with higher land use mix. Further, high-speed traffic was a significant barrier to cycling among female commuters. Noticeably, our analysis did not find major gender-based differences in the coefficients relating to travel attitudes and preferences. The findings provide a Canadian comparison to the limited international research on this topic, as well as offer new insights particularly relating to cycling for non-commute trips. The results identify potential avenues for policy intervention regarding the promotion of healthy and sustainable travel behavior among post-secondary students, and more broadly, the millennial generation.

Subject Areas: Commute; Cycling Facilities; Millenials; Non-Commute; Post-Secondary Students; Travel Attitudes

1.3. Title: Impact of County-Level Built Environment and Regional Accessibility on Walking: A Washington, DC-Baltimore Case Study

Authors: Mahmoudi, J. and Zhang, L.

Abstract: Existing research on built environment's impact on nonmotorized travel behavior has focused on neighborhood-level factors. However, because people live and work at a regional scale – using transit and cars to access jobs and other destinations – it can be hypothesized that a region's built environment can also be influential in nonmotorized travel behavior. This study examines the role of county-level built environment and regional accessibility in walking by developing mixed-effects models applied to household data from the Washington, DC and Baltimore metropolitan areas. The results indicate that in addition to neighborhood-level built environment, county-level built environment and regional accessibility can affect walking travel behavior by residents. The findings suggest that land-use policies to promote walking will not be fully effective if only considered at the neighborhood level. More effective land-use policies are those that consider the overall physical form of urban areas, including the composition of population and employment, the extent of street network connectivity, and regional accessibility across an entire metropolitan area.

Subject Areas: Built environment; Walking; Landuse; Nonmotorized travel behavior

1.4. Title: Why do People like Bicycling? Modeling affect toward Bicycling

Authors: Xing, Y., Volker, J. and Handy, S.

Abstract: Studies show that the way an individual feels about bicycling – the degree to which they like bicycling – is an important predictor of whether or not they bicycle. But why do some people like bicycling and others don't? This study explores factors that may influence an individual's liking of bicycling, or more formally, their bicycling affect. We analyze a rich dataset from a cross-sectional survey of residents of six small U.S. cities using an ordered logit model. Results show that bicycling behavior has the strongest association with liking bicycling, with bicycling constraints following as the second most important factor. Individual cognitions, including perceptions and normative beliefs, also play important roles in predicting bicycling affect. Individual measures of the physical environment do not correlate with liking of bicycling, but the perception that biking to various destinations is safe does. Social environment factors influence liking of bicycling as well. Longitudinal research is needed to better understand the reciprocal relationship between bicycling affect and bicycling behavior as well as the effect over time of factors such as the physical environment. Nevertheless, this study offers an initial understanding of the potential determinants of bicycling affect that provides a starting point for further research as well as direction for the development of policies for getting more people on bicycles.

Subject Areas: Bicycling; Cycling; Attitude formation; Affect; Liking; Behavior

1.5. Title: High Impact Prioritization of Bikeshare Program Investment to Improve Underserved Communities' Access to Jobs and Essential Services

Authors: Niemeier, D. and Qian, X.

Abstract: Bikeshare programs are increasingly popular in the United States, and they are an important part of sustainable transportation systems. They offer an important alternative mode choice for many types of last mile trips. Most of the current research on bikeshare focuses on bikeshare benefits (e.g., how to replace auto trips with bike trips and reduce greenhouse-gas emissions) and bikeshare system management (e.g., bike repositioning between stations). Far less attention has been paid to the programmatic potential for providing greater access to jobs and essential services for underserved communities. To date, there is virtually no quantitative research aimed at designing bikeshare systems for underserved communities. We develop a new spatial index that identifies bikeshare station locations exhibiting a high potential for providing service for underserved communities. The index can: 1) facilitate the identification of priority areas for bikeshare investment based on current infrastructure and the potential for increased job or essential service access; 2) inform the siting of bikeshare stations and investment in bike infrastructure to better assist underserved populations, and finally 3) provide an estimate of the potential for improved job and social services access via bike?to?transit.

Subject Areas: Bikeshare programs; Sustainable transportation systems; Spatial index

Availability: Niemeier, D. and Qian, X., 2018. *High Impact Prioritization of Bikeshare Program Investment to Improve Underserved Communities' Access to Jobs and Essential Services.* A Research Report from the National Center for Sustainable Transportation.
https://ncst.ucdavis.edu/wp-content/uploads/2015/10/NCST_Niemeier_Bike-Share-Underserved-Communities_Final-Report_MAR-2018.pdf

1.6. Title: Cycling in Small Suburban Communities: A Case Study of Georgetown, TX

Author: Li, Q.

Abstract: Small communities have natural advantages in promoting cycling: Smaller geographic scale, major destinations within biking distances, and relatively low volumes of vehicle traffic. Davis, CA and Boulder, CO are known exemplary cycling-friendly communities in the United States. In Texas, however, cycling in small communities remains rare as a transportation means. This study aimed at understanding the driving factors for cycling in Texas suburban communities. The report presents a case study of Georgetown, a suburban city in the Austin Metropolitan Area in Texas. Georgetown is contemplating a Bike Master Plan to address the growing interest in and concerns over cycling in the community. A survey on cycling in Georgetown was conducted in fall 2016, for which this author was a member of the survey team. The survey included two parts, an online version of questionnaire and an onsite version for environmental audits, covering the following main topics: public opinions on cycling, cycling behavioral characteristics, environmental/infrastructure conditions for cycling. The report analyzes survey results and discusses opportunities and challenges facing Georgetown to cycling. The study findings help inform the Bike Master Plan effort by Georgetown, TX planners. Lessons learned from the Georgetown study are also valuable to the state-wide endeavor to promote cycling, particularly in small communities in Texas.

Subject Areas: Small suburban cities; Cycling; Texas; Senior people cycling; Characteristics

Availability: Li, Q., 2018. *Cycling in Small Suburban Communities: A Case Study of Georgetown, TX.* Doctoral dissertation, University of Texas.
https://repositories.lib.utexas.edu/handle/2152/63779

1.7. Title: Pedestrians' Receptivity Toward Fully Automated Vehicles: Research Review and Roadmap for Future Research

Authors: Deb, S., Rahman, M.M., Strawderman, L.J. and Garrison, T.M.,

Abstract: This paper summarizes and synthesizes the existing literature relevant to pedestrian receptivity toward Fully Automated Vehicles (FAVs). Objectives of this review are to identify research gaps that need to be filled and to propose a roadmap for future research. Since FAVs are operated by software and hardware, with no human driver required, interactions between other road users and FAVs must be understood, and potential risks must be addressed. This is especially true for pedestrians, who often exhibit unpredictable behavior and are one of the most vulnerable road-user groups. A comprehensive review was conducted of 1) different aspects of pedestrian interaction with forthcoming fully automated vehicles, and 2) the existing research approaches (surveys and simulator studies) for investigating risky pedestrian behavior as well as public acceptance of fully automated vehicles. The review identified three major gaps in pedestrian research: 1) lack of a pedestrian behavior questionnaire for FAV research, 2) lack of a validated pedestrian simulator for FAV research, and 3) lack of research investigating pedestrian design suggestions for FAVs. A future research roadmap to facilitate investigating pedestrian receptivity toward FAVs was designed. Achieving pedestrian acceptance of FAVs will require investigation of pedestrian risks and needs by transportation researchers and communication of the results to vehicle manufacturers and regulatory agencies. This review will be useful to transportation researchers and automated vehicle manufacturers to help guide planning for future design and production of FAVs in order to ensure their successful implementation.

Subject Areas: Pedestrian behavior questionnaire; Autonomous vehicles; Human-automation interaction; Simulation; Virtual reality (VR)

1.8. Title: Bicyclist's Perceived Level of Comfort in Dense Urban Environments: How do Ambient Traffic, Engineering Treatments, and Bicyclist Characteristics Relate?

Authors: Abadi, M.G. and Hurwitz, D.S.

Abstract: In dense urban environments, truck loading zones introduce multimodal conflicts that could decrease the bicyclist's perceived level of comfort (PLOC), potentially reducing bicycle mode share. This study investigated the PLOC of bicyclists near urban loading zones, according to different levels of ambient traffic (low traffic volume, high traffic volume, and truck traffic), bicycle lane pavement markings (white lane markings, solid green, and dashed green), and traffic signs (no sign or warning sign). An online survey was designed and randomly distributed to 10,000 potential participants. A total of 342 participants successfully completed the survey. Repeated-measures ANOVA results indicated that when bicycling on a conventionally striped bike lane, truck traffic had the most significant effect on bicyclist PLOC, decreasing it by more than 42%. Pavement markings were more effective than traffic signs at improving bicyclist PLOC, but no difference was observed between solid and dashed green lane markings. Finally, the results of cluster analysis indicated that the effect of gender and experience on bicyclist PLOC varied with different levels of traffic and engineering treatments. Women were more affected than men by the presence of a truck in the adjacent lane but they were also more prone to a considerable increase in PLOC values due to the implementation of engineering treatments. Findings of this study could inform future policies regarding transportation infrastructure design to support safer and more comfortable bicycling in dense urban environments.

Subject Areas: Truck loading zones; Bicyclist safety; Bicyclist perceived level of comfort; Dense urban environments

1.9. Title: Do Satisfying Walking and Cycling Trips Result in More Future Trips with Active Travel Modes? An Exploratory Study

Authors: De Vos, J., Schwanen, T., Van Acker, V. and Witlox, F.

Abstract: Previous studies have indicated that travel satisfaction – the experienced emotions during, and cognitive evaluation of, a trip – can be affected by travel mode choice and other trip characteristics. However, as satisfactory trips might improve a person's attitude towards the used mode, persons may be more likely to use that same mode for future trips of the same kind. Hence, a cyclical process between travel mode choice and travel satisfaction might occur. In this paper we begin to analyse this process – using a structural equation modelling approach on cross-sectional data – for people who engage in walking and cycling for leisure trips in the Belgian city of Ghent. The focus on walking and cycling reflects recent studies indicating that active travel is often associated with the highest levels of travel satisfaction. Results of this exploratory analysis offer tentative support for the idea of a cyclical process: the evaluation of walking and cycling trips positively affects the respondents' attitude towards the respective mode, which in turn has a positive effect on choosing that mode.

Subject Areas: Active travel; Residential location; Structural equation modelling; Travel mode choice; Travel satisfaction; Travel-related attitudes

1.10. Title: Uber's Plan to Rent Electric Bikes Is Good for Uber, Traffic, and You

Author: Grabar. H.

Abstract: Blog

Subject Areas: Electric Bike; Uber; Bikeshare

Availability: Grabar. H., 2018. *Uber's Plan to Rent Electric Bikes Is Good for Uber, Traffic, and You.* SlatePlus.
https://slate.com/business/2018/02/ubers-plan-to-rent-electric-bikes-is-good-for-uber-traffic-and-you.html

1.11. Title: Walking, Biking Trail is Important Part of Infrastructure

Author: Colby, A.

Abstract: Blog

Subject Areas: Walk; Bike; Trail; Transport infrastructure

Availability: Colby, A., 2018. *Walking, Biking Trail is Important Part of Infrastructure.* Finger Lakes Times, Waterloo.
http://www.fltimes.com/opinion/letters_to_editor/letter-walking-biking-trails-important-part-of-infrastructure/article_49b5ce0b-8882-5f63-a7a0-5d55cd130ec3.html

1.12. Title: Infrastructure Bill should include Walking and Biking Trails

Author: Schwier, L.

Abstract: Blog

Subject Areas: Walk; Bike; Trail; Transport infrastructure

Availability: Schwier, L., 2018. *Infrastructure Bill should include Walking and Biking Trails.* The Brunswick Beacon. https://www.brunswickbeacon.com/content/infrastructure-bill-should-include-walking-and-biking-trails

1.13. Title: Pittsburgh Bike Share Program Expanding with New Stations

Author: Elliott, S.

Abstract: Blog

Subject Areas: Bike share program; Healthy Ride

Availability: Elliott, S., 2018. *Pittsburgh Bike Share Program Expanding with New Stations.* TribLive.
http://triblive.com/news/healthnow/13516815-74/pittsburgh-bike-share-program-expanding-with-new-stations

1.14. Title: Biking to work this spring? It just got more expensive under the new tax law

Author: Malito, A.

Abstract: Blog

Subject Areas: Biking; Tax law; Workers; Lower-income

Availability: Malito, A., 2018. *Biking to work this spring? It just got more expensive under the new tax law.* MarketWatch.
https://www.marketwatch.com/story/biking-to-work-this-spring-it-just-got-more-expensive-under-the-new-tax-law-2018-05-02

1.15. Title: Let's get Connected

Author: Schwier, L.

Abstract: Blog

Subject Areas: Biking; Walking; Infrastructure Bill

Availability: Schwier, L., 2018. *Let's get Connected.* StarnewsOnline.
http://www.starnewsonline.com/opinion/20180508/letters-may-8-renowned-expert-on-shorelines-weighs-in-on-beach-cliffs

1.16. Title: OKC celebrates 13th annual Bike to Work Day on May 18.

Author: Sheldon, D.

Abstract: Blog

Subject Areas: Bike to work day; National Bike Month

Availability: Sheldon, D., 2018. *OKC celebrates 13th annual Bike to Work Day on May 18.* The City Sentinel.
http://city-sentinel.com/2018/05/okc-celebrates-13th-annual-bike-to-work-day-on-may-18/

1.17. Title: It's National Bike Month. Let's Ride Bikes!

Author: Horn, A.

Abstract: Blog

Subject Areas: National Bike Month; Bike trips

Availability: Horn, A., 2018. *It's National Bike Month. Let's Ride Bikes!* Care2. https://www.care2.com/greenliving/its-national-bike-month-lets-ride-bikes.html

1.18. Title: Why Little Vehicles Will Conquer the City

Author: Schneider, B.

Abstract: Blog

Subject Areas: Dockless bikes; Electric Scooter

Availability: Schneider, B., 2018. *Why Little Vehicles Will Conquer the City.* Citylab.
https://www.citylab.com/transportation/2018/06/welcome-to-the-tiny-vehicle-age/563342/

2. Energy Consumption

2.1. Title: Modeling and Forecasting Household Energy Consumption and Related CO_2 Emissions Integrating UrbanSim And Transportation Models: An Atlanta Beltline Case Study

Authors: Wang, D. and Yuan, C.

Abstract: Reducing energy consumption and controlling greenhouse gas emissions are key challenges for urban residents. Because urban areas are complex and dynamic, affected by many driving factors in terms of growth, development, and demographics, urban planners and policy makers need a sophisticated understanding of how residential lifestyle, transportation behavior, land-use changes, and land-use policies affect residential energy consumption and associated CO_2 emissions. This study presents an approach to modeling and simulating future household energy consumption and CO_2 emissions over a 30-year planning period, using an energy-consumption regression approach based on the UrbanSim model. Outputs from UrbanSim for a baseline scenario are compared with those from a no-transportation-demand model and an Atlanta BeltLine scenario. The results indicate that incorporation of a travel demand model can make the simulation more reasonable and that the BeltLine project holds potential for curbing energy consumption and CO_2 emissions.

Subject Areas: Energy Consumption; Emissions; Land Use; Travel Demand; Urbansim; Forecasts; Atlanta Beltline

2.2. Title: System and Method for Estimating and Predicting Vehicle Trip Energy Consumption

Authors: Trancik, J.E., Needell, Z.A. and McNerney, J.

Abstract: A system for estimating or predicting energy consumption for a trip of a personal includes a user facing portion and a back-end portion. The user facing portion includes a display and a user interface hosting a real-time application configured to receive travel information and present a received energy distribution via the display. The back-end portion includes a back-end database and an energy processor configured to access the back-end database. The energy processor includes a demand model module configured to produce a set of possible velocity histories and a set of possible ambient temperatures. A vehicle model module is configured to receive the velocity histories and ambient temperatures to provide the energy distribution or a probabilistic prediction of future energy consumption to the user facing portion.

Subject Areas: Energy consumption; Vehicle model module

2.3. Title: Relative Economic Competitiveness of Light-Duty Battery Electric and Fuel Cell Electric Vehicles.

Authors: Morrison, G., Stevens, J. and Joseck, F.

Abstract: This paper estimates battery electric (BEV) and hydrogen fuel cell electric vehicle (FCEV) costs from today through 2040 to explore the potential market size of each vehicle type. Two main tasks are performed. First, the total cost of ownership (TCO) – including vehicle purchase, fuel, maintenance, resale, and refueling inconvenience – is estimated for 77 light-duty vehicle (LDV) segments, defined by driving range and size class. Second, data on individual travel behavior is used to estimate the fraction of vehicle owners within each of the 77 segments. In 2020, BEVs are estimated to be the cheaper vehicle option in 79-97 percent of the LDV fleet and have a weighted average cost advantage of $0.41 per mile below FCEVs across all vehicle segments and drivers. However, costs of the two powertrains quickly converge between 2025 and 2030. By 2040, FCEVs are estimated to be less expensive than BEVs per mile in approximately 71-88 percent of the LDV fleet and have notable cost advantages within larger vehicle size classes and for drivers with longer daily driving ranges. This analysis demonstrates a competitive market space for both FCEVs and BEVs to meet the different needs of LDV consumers.

Subject Areas: Electric vehicles; Market segmentation; Fuel cell vehicles; Total cost of owner-ship; Hydrogen; Greenhouse gas abatement

2.4. Title: GIS-based Probabilistic Modeling of BEV Charging Load for Australia

Authors: Li, M., Lenzen, M., Keck, F., McBain, B., Rey-Lescure, O., Li, B. and Jiang, C.

Abstract: Due to the unknown spatio-temporal distribution of Battery Electric Vehicles (BEVs) charging load, introducing large quantities of BEVs in the transportation sector has drawn growing concerns about its negative impacts on the power grid system. Based on real-world vehicle driving survey data, this paper presents a deterministic and a probabilistic model to quantitatively investigate the spatio-temporal distribution of BEV charging load for Australia. Whilst the trip-chain-related travel parameters for the deterministic model are directly taken from travel survey data, those for the probabilistic model are generated by the k-Nearest-Neighbour (kNN) algorithm. The probabilistic model is validated and applied to simulate the spatio-temporal distribution of BEV load based on GISgridded data for Australia. We are able to distinguish different temporal BEV charging load distributions for weekdays and weekends, and a heavy spatial concentration in capital cities.

Subject Areas: Electric vehicle; GIS; Charging load; kNN model

2.5. Title: Planning for Electric Vehicle Needs by Coupling Charging Profiles with Urban Mobility

Authors: Xu, Y., Çolak, S., Kara, E.C., Moura, S.J. and Gonzàlez, M.C.

Abstract: The rising adoption of plug-in electric vehicles (PEVs) leads to the temporal alignment of their electricity and mobility demands. However, mobility demand has not yet been considered in electricity planning and management. Here, we present a method to estimate individual mobility of PEV drivers at fine temporal and spatial resolution, by integrating three unique datasets of mobile phone activity of 1.39 million Bay Area residents, census data and the PEV drivers survey data. Through coupling the uncovered patterns of PEV mobility with the charging activity of PEVs in 580,000 session profiles obtained in the same region, we recommend changes in PEV charging times of commuters at their work stations and shave the pronounced peak in power demand. Informed by the tariff of electricity, we calculate the monetary gains to incentivize the adoption of the recommendations. These results open avenues for planning for the future of coupled transportation and electricity needs using personalized data.

Subject Areas: Electric vehicle; Transportation; Mobility demands

Availability: Xu, Y., Çolak, S., Kara, E.C., Moura, S.J. and Gonzàlez, M.C., 2018. *Planning for Electric Vehicle Needs by Coupling Charging Profiles with Urban Mobility.* Nature Energy. https://ecal.berkeley.edu/pubs/NE-UrbanMobility-EV.pdf

2.6. Title: The Feasibility of Using V2G to Face the Peak Demand in Warm Countries

Authors: Almansour, I., Gerding, E. and Wills, G.

Abstract: As a result of the very difficult weather in Saudi Arabia during the summer, there is too high power peak demand in the grid and this is expected to increase in the next decade. To fix this problem, power consumers should participate in the power production. Vehicle-to-grid (V2G), one of the efficient sustainable technologies, can offer this opportunity. It is defined as a concept where electric vehicle (EV) provides electric to the grid when parked. This investigation looks at the feasibility of using V2G to mitigate the problem of highest electricity peak demand in the summer period in one of the warmest countries of the world (Saudi Arabia). We conduct a survey in order to serve this issue and we use information from Saudi Arabia electricity authority. We found that, V2G is a promising solution to the peak demand challenge in the summer in Saudi Arabia since there is about 80% of the sample interested in using V2G technology. Moreover, 90% of the participants used their vehicles less than 4 hours daily. Furthermore, in the summer period, most of the participants park their vehicles for the longest time between 13:00 to 18:00, which is the peak demand period.

Subject Areas: V2G; Peak demand

Availability: Almansour, I., Gerding, E. and Wills, G., 2018. *The Feasibility of Using V2G to Face the Peak Demand in Warm Countries.* University of Southampton. International Conference on Vehicle Technology and Intelligent Transport Systems, funchal madeira, Portugal.
https://eprints.soton.ac.uk/417667/1/VEHITS_2018_9_CR.pdf

2.7. Title: Multi-agent Modeling and Analysis of EV Users' Travel Willingness based on an integrated Causal/Statistical/Behavioral Model.

Authors: Juai, W.U., Yusheng, X.U.E., Dongliang, X.I.E., Kang, L.I., Fushuan, W.E.N., Junhua, Z.H.A.O., Guangya, Y.A.N.G. and Qiuwei, W.U.

Abstract: An electric vehicle (EV) centred ecosystem has not yet been formed, the existing limited statistic data are far from enough for the analysis of EV users' travel and charge behaviors, which however tends to be affected by many certain and uncertain factors. An experimental economics (EE) based simulation method can be used to analyze the behaviors of key participants in a system. However, it is restricted by the system size, experimental site and the number of qualified human participants. Therefore, this method is hard to be adopted for the behavioral analysis of a large number of human participants. In this paper, a new method combining a questionnaire statistics and the EE-based simulation is proposed. The causal relationship is considered in the design of the questionnaires and data extraction, then a multi-agent modeling integration method is introduced in the EE-based simulation, which enables the integration of causal/statistical/behavioral models into the multi-agent framework to reflect the EV users' travel willingness statistically. The generated multi-agents are used to replace human participants in the EE-based simulation in order to evaluate EV users' travel demands in different scenarios, and compare the differences of simulated or measured travel behaviors between potential EV users and internal combustion engine (ICE) vehicle users.

Subject Areas: Travel willingness; Questionnaire design; Multi-agent; Experimental economics; Causal analysis

Availability: Juai, W.U., Yusheng, X.U.E., Dongliang, X.I.E., Kang, L.I., Fushuan, W.E.N., Junhua, Z.H.A.O., Guangya, Y.A.N.G. and Qiuwei, W.U., 2018. *Multi-agent Modeling and Analysis of EV Users' Travel Willingness based on an integrated Causal/Statistical/Behavioral Model.* Journal of Modern Power Systems and Clean Energy, pp.1-9.
https://link.springer.com/article/10.1007/s40565-018-0408-2

2.8. Title: Improving Voltage Profile and Optimal Scheduling of Vehicle to Grid Energy based on a New Method

Authors: Nazarloo, A., Feyzi, M.R., Sabahi, M. and Bannae Sharifian, M.B.

Abstract: The electric vehicles (EVs), depending on the charging or discharging modes, can act as flexible loads or as flexible energy sources. Therefore, this paper proposes a method for achieving the following objectives: improvement the voltage profile of the point of common coupling (PCC), control the charging and discharging of EVs in an appropriate scheduling so that at the end of the charging and discharging process all EVs are fully charged, improvement the profiles of active and reactive loads based on the peak shaving and the valley filling, charging rate control and energy management for the economic justification of vehicle to grid (V2G) technology based on the proposed method. Considering that the penetration of EVs and state of charge (SOC) of battery at any time is random, this paper extracts and analyzes the data that is available through national household travel surveys (NHTS). In order to determine the desired parameters, two stochastic algorithms are integrated with Monte Carlo simulations. To prove the performance superiority of the proposed method over conventional methods under high EVs-penetration, an IEEE 14-bus system is used for real-time simulation.

Subject Areas: Electric Vehicles; Vehicle to Grid Energy

2.9. Title: Battery Technologies for Mass Deployment of Electric Vehicles

Authors: Brooker, P., Qin, N., Dubarry, M. and Center, F.S.E.

Abstract: Electric vehicle (EV) batteries have significantly improved since their inception. However, lifetime of these batteries is still strongly dependent on the usage profiles. This report describes aspects of EV battery utilization, and their impact on battery lifetime. Additionally, this report will describe potential future uses of EV batteries, particularly in vehicle-to-grid applications.

Subject Areas: Electric Vehicles; Vehicle to Grid

Availability: Brooker, P., Qin, N., Dubarry, M. and Center, F.S.E., 2018. *Battery Technologies for Mass Deployment of Electric Vehicles.* (No. FSEC-CR-2079-18). University of Central Florida. Electric Vehicle Transportation Center (EVTC).
file:///Users/Apara/Downloads/dot_35686_DS1.pdf

2.10. Title: Voltage-dependent Modelling of Fast Charging Electric Vehicle Load Considering Battery Characteristics

Authors: Shukla, A., Verma, K. and Kumar, R.

Abstract: Electric vehicle (EV) integration into the power grids is increasing rapidly. To analyse the effect of charging of EVs on the distribution system, most of the literature considered EV load as constant power load (CPL) which do not represent the exact behaviour of these uncertain loads. An accurate EV load modelling is developed by determining the relationship between power consumption by EV, grid voltage and state of charges of fast charging EV load. The derived relationship is validated by simulating a realistic fast charging system to obtain a battery charging behaviour characteristics and is curve fitted on standard exponential load model. Further the impact of stochastic 24-h load profile of fast charging EVs considering the exponential load model is investigated on IEEE 123 bus distribution system and is compared with the constant impedance-constant current-constant power (ZIP) load model and CPL model. The stochastic 24-h load is developed using queuing analysis-based method. The results show that the exponential load model is the better representation of fast charging EV load and 10.19% of the reduction in annual energy demand and 11.19% of the reduction in annual energy loss is observed for exponential load model compared to the existing CPL model.

Subject Areas: Electric Vehicle charging; Battery; Power grids; Distribution networks

2.11. Title: A Charging Pricing Strategy of Electric Vehicle Fast Charging Stations for the Voltage Control of Electricity Distribution Networks

Authors: Dong, X., Mu, Y., Xu, X., Jia, H., Wu, J., Yu, X. and Qi, Y.

Abstract: With the increasing number of electric vehicles (EVs), the EV fast charging load will significantly affect the voltage quality of electricity distribution networks. On the other hand, EVs have potentials to change the choices of charging locations due to the incentives from the variations of charging prices, which can be considered as a flexible response resource for electricity distribution networks. In this paper, a charging pricing strategy of EV fast charging stations (FCSs) was developed to determine the pricing scheme for the voltage control of electricity distribution networks, which consisted of a simulation model of EV mobility and a double-layer optimization model. Considering the travel characteristics of users, the simulation model of EV mobility was developed to accurately determine the fast charging demand. Taking the total income of FCSs and the users' response to the pricing scheme into account, the double-layer optimization model was developed to optimize the charging pricing scheme and minimize the total voltage magnitude deviation of distribution networks. A test case was used to verify the proposed strategy. The results show that the spatial distribution of EV fast charging loads was reallocated by the proposed charging pricing scheme. It can also be seen that the proposed strategy can make full use of the response capacity from EVs to improve the voltage profiles without decreasing the income of the FCSs.

Subject Areas: Electric vehicle (EV); Electric vehicle mobility; Charging pricing strategy; Voltage control of electricity distribution networks

2.12. Title: Implication of Replacing the Federal and State Fuel Taxes with a National Vehicle Mile Traveled Tax

Authors: Wang, Y. and Miao, Q.

Abstract: A Vehicle Miles Traveled (VMT) tax is often proposed to replace fuel taxes for financing the nation's highway and road network. In this paper, we investigate households' driving response to driving cost changes depending on their vehicle choices. Using the empirical estimates, we simulate the vehicle usage, tax burdens, and total tax revenues generated under a possible nationwide revenue-neutral flat VMT tax. Our results confirm that, compared to the current gasoline tax, a revenue-neutral flat VMT tax can be a more stable tax revenue source. We estimate that a 50 percent increase in average miles per gallon (MPG) would lead to a 28 percent decrease in the total revenues raised by the current gasoline tax, while the same amount of increase in fuel economy would increase the VMT tax revenues by 4.4 percent (all relative to the 2009 baseline). In the meantime, we find no significant difference between the two types of tax in their total revenues, when the pre-tax gasoline prices fluctuate by different magnitudes. A VMT tax would be slightly more regressive than the gasoline tax, but the difference is negligible. Overall, our simulation shows that VMT tax could serve as a viable alternative to gasoline taxes.

Subject Areas: : Vehicle miles traveled (VMT); VMT tax; Gasoline tax; Tax equity

2.13. Title: Spatial and Temporal Optimization Strategy for Plug-In Electric Vehicle Charging to Mitigate Impacts on Distribution Network

Authors: Gong, L., Cao, W., Liu, K., Zhao, J. and Li, X.

Abstract: The large deployment of plug-in electric vehicles (PEVs) challenges the operation of the distribution network. Uncoordinated charging of PEVs will cause a heavy load burden at rush hour and lead to increased power loss and voltage fluctuation. To overcome these problems, a novel coordinated charging strategy which considers the moving characteristics of PEVs is proposed in this paper. Firstly, the concept of trip chain is introduced to analyze the spatial and temporal distribution of PEVs. Then, a stochastic optimization model for PEV charging is established to minimize the distribution network power loss (DNPL) and maximal voltage deviation (MVD). After that, the particle swarm optimization (PSO) algorithm with an embedded power flow program is adopted to solve the model, due to its simplicity and practicality. Last, the feasibility and efficiency of the proposed strategy is tested on the IEEE 33 distribution system. Simulation results show that the proposed charging strategy not only reduces power loss and the peak valley difference, but also improves voltage profile greatly.

Subject Areas: Plug-in Electric Vehicles; Coordinated Charging; Distribution Network; Trip Chain; Particle Swarm Optimization; National Household Trip Survey Data

2.14. Title: Well-being Analysis of Distribution Network in the Presence of Electric Vehicles

Authors: Kheradmand-Khanekehdani, H. and Gitizadeh, M.

Abstract: Environmental concerns, limitations of fossil fuels and their pollution are among the most important challenges of societies today. To overcome these challenges, the penetration rate of electric vehicles and renewable energy resources has highly increased. But the use of plug-in hybrid electric vehicles with unmanaged charging exerts a negative impact on the electric grid reliability. The current study presents a comprehensive investigation of the reliability of distribution grid based on stochastic behavior of plug-in hybrid electric vehicles and renewable energy resources. Moreover, a new method is introduced for grid well-being management in the presence of plug-in hybrid electric vehicles. The proposed method includes the managed charging and vehicle to grid scenarios and is tested through improved of Roy Billinton test system bus 2. The presented method manages the plug-in hybrid electric vehicles charging and power injection to the grid using system well-being analysis. The simulation results indicate that adequacy of distribution grid is put at risk state in the presence of plug-in hybrid electric vehicles with unmanaged charging, whereas the use of the proposed method not only does not deteriorate the system reliability but also improves well-being criteria and adequacy indices.

Subject Areas: Plug-in hybrid electric vehicle; Managed charging; Vehicle-to-grid' Well-being assessment; Adequacy evaluation; Monte Carlo simulation

2.15. Title: Alternative Utility Factor Versus the SAE J2841 Standard Method for PHEV and BEV Applications

Authors: Paffumi, E., De Gennaro, M. and Martini, G.

Abstract: This article explores the potential of using real-world driving patterns to derive PHEV and BEV utility factors and evaluates how different travel and recharging behaviours affect the calculation of the standard SAE J2841 utility factor. The study relies on six datasets of driving data collected monitoring 508,607 conventional fuel vehicles in six European areas and a dataset of synthetic data from 700,000 vehicles in a seventh European area. Sources representing the actual driving behaviour of PHEV together with the WLTP European utility factor are adopted as term of comparison. The results show that different datasets of driving data can yield to different estimates of the utility factor. The SAE J2841 standard method results to be representative of a large variety of behaviours of PHEVs and BEVs' drivers, characterised by a fully-charged battery at the beginning of the trip sequence, thus being representative for fuel economy and emission estimates in the early phase deployment of EVs, charged at home and overnight. However the results show that the SAE J2841 utility factor might need to be revised to account for more complex future scenarios, such as necessity-driven recharge behaviour with less than one recharge per day or a fully deployed recharge infrastructure with more than one recharge per day.

Subject Areas: Utility factor; GPS driving patterns; Databases; Electric vehicles; Plug-in hybrid electric vehicles; SAE J2841

2.16. Title: Clean Vehicles as an enabler for a Clean Electricity Grid

Authors: Coignard, J., Saxena, S., Greenblatt, J. and Wang, D.

Abstract: California has issued ambitious targets to decarbonize transportation through the deployment of electric vehicles (EVs), and to decarbonize the electricity grid through the expansion of both renewable generation and energy storage. These parallel efforts can provide an untapped synergistic opportunity for clean transportation to be an enabler for a clean electricity grid. To quantify this potential, we forecast the hourly system-wide balancing problems arising out to 2025 as more renewables are deployed and load continues to grow. We then quantify the system-wide balancing benefits from EVs modulating the charging or discharging of their batteries to mitigate renewable intermittency, without compromising the mobility needs of drivers. Our results show that with its EV deployment target and with only one-way charging control of EVs, California can achieve much of the same benefit of its Storage Mandate for mitigating renewable intermittency, but at a small fraction of the cost. Moreover, EVs provide many times these benefits if two-way charging control becomes widely available. Thus, EVs support the state's renewable integration targets while avoiding much of the tremendous capital investment of stationary storage that can instead be applied towards further deployment of clean vehicles.

Subject Areas: Electric Vehicles (EVs); Renewable generation; California

2.17. Title: Landscape Analysis: The Electric Car (Is it a Viable Alternative?)

Authors: Janzen, H., Kancherla, D.Y., Paneerselvam, S., Reddy, S.R. and Daim, T.U.

Abstract: N.A.

Subject Areas: Cleaner air; Renewable energy

Availability: Janzen, H., Kancherla, D.Y., Paneerselvam, S., Reddy, S.R. and Daim, T.U., 2018. *Landscape Analysis: The Electric Car (Is it a Viable Alternative?).* In Infrastructure and Technology Management (pp. 327-346). Springer, Cham.
https://link.springer.com/chapter/10.1007/978-3-319-68987-6_10

2.18. Title: Changes in Time Use and their Effect on Energy Consumption in the United States

Authors: Sekar, A., Williams, E. and Chen, R.

Abstract: Technological advancements and socio-economic trends are enabling rapid changes in lifestyle that influence energy use. This research tracks lifestyle changes in the United States through changes in times spent on different activities and measures the associated energy effects. We find that Americans are spending more time at home and correspondingly less time traveling and in offices and stores. We find that more time at home implies lower energy consumption due to reduced automobile travel and energy use in non-residential buildings. At the national scale, this research shows that time-based models would improve energy forecasts by capturing behavioral changes that current models fail to capture. Knowledge of such lifestyle trends can help prioritize energy efficiency policies of federal and state governments and utilities. For individuals, the research raises awareness of connections between lifestyle and energy use.

Subject Areas: Energy Consumption; Energy efficiency policies

2.19. Title: Grid Integration of Large-Scale Electric Vehicles: Enabling Support through Power Storage

Authors: Jain, P. and Jain, T.

Abstract: This chapter presents the grid assistance opportunities through charging and discharging of electric vehicles (EV) and explores the technical and operational challenges in integrating the electric vehicle storage, a movable and changeable of its kind, with the power system. The initial step discusses the development of charging load curves of EVs based on mobility attributes and charging protocols. Researchers have also proposed the vehicle-to-grid (V2G) mode of operation of EVs in which a proportion of energy stored in the battery can be injected back into the grid at the peaking periods. Based on this, the second step discusses the evolution of V2G energy profiles with various discharge power levels for a defined mobility pattern. The heterogeneity in the vehicles as well as in the mobility behavior can further be incorporated to determine the grid-to-vehicle (G2V) and V2G power capabilities of the aggregation at different moments under varying penetrations of the electric vehicles.

The coordinated grid connection of EV aggregation can also be employed to provide short-term ancillary services like regulation, thereby increasing the power system reliability and side-by-side forming a revenue stream for the grid-connected vehicles for the contracts made in the competitive services market. Through coordinated charging and discharging of EVs, the controllability of the battery storage can also be utilized to achieve the control over the peak shaving, valley filling, and load leveling functions of the system operator. Finally, this chapter discusses the possible configuration of EV and electric power utility interfacing to manage the centrally dispatched EV aggregation, comprising system operator, vehicle aggregator, power supply equipment, and vehicle owner as the key participants.

Subject Areas: Electric Vehicles (EV); Vehicle-to-grid

Availability: Jain, P. and Jain, T., 2018. *Grid Integration of Large-Scale Electric Vehicles: Enabling Support through Power Storage.* In Operation, Planning, and Analysis of Energy Storage Systems in Smart Energy Hubs (pp. 237-269). Springer, Cham.
https://link.springer.com/chapter/10.1007/978-3-319-75097-2_11

2.20. Title: Do Electric Vehicles need Subsidies? Ownership Costs for Conventional, Hybrid, and Electric Vehicles in 14 US Cities

Authors: Breetz, H.L. and Salon, D.

Abstract: Battery electric vehicles (BEVs) are an important pathway for decarbonizing transportation and reducing petroleum dependence. Although one barrier to adoption is the higher purchase price, advocates suggest that fuel and maintenance savings can make BEVs economical over time. To assess this empirically, this paper analyzes the five-year Total Cost of Ownership (TCO) for conventional, hybrid, and electric vehicles in 14 U.S. cities from 2011 to 2015. Results show spatial variation due to differences in state and local policies, fuel prices, insurance and maintenance costs, depreciation rates, and vehicle miles traveled. Yet in nearly all cities, the BEV's higher purchase price and rapid depreciation outweighed its fuel savings. Extensive sensitivity analyses highlight the impact of key parameters and show that both federal and state incentives were necessary for BEVs to be cost competitive. Future BEV cost competitiveness may improve if innovation and scaling lead to significantly reduced BEV purchase prices, but our analysis suggests that it will be challenging for BEVs to achieve unsubsidized cost competitiveness except in the most optimistic scenarios.

Subject Areas: Total cost of ownership; Battery electric vehicles; Hybrid vehicles; Resale value; Fuel economy

Availability: Breetz, H.L. and Salon, D., 2018. *Do Electric Vehicles need Subsidies? Ownership Costs for Conventional, Hybrid, and Electric Vehicles in 14 US Cities.* Energy Policy, 120, pp.238-249.
https://www.sciencedirect.com/science/article/pii/S0301421518303422

2.21. Title: Markov Chain Monte Carlo Simulation of Electric Vehicle Use for Network Integration Studies

Authors: Wang, Y. and Infield, D.

Abstract: As the penetration of electric vehicles (EVs) increases, their patterns of use need to be well understood for future system planning and operating purposes. Using high resolution data, accurate driving patterns were generated by a Markov Chain Monte Carlo (MCMC) simulation. The simulated driving patterns were then used to undertake an uncertainty analysis on the network impact due to EV charging. Case studies of workplace and domestic uncontrolled charging are investigated. A 99% confidence interval is adopted to represent the associated uncertainty on the following grid operational metrics: network voltage profile and line thermal performance. In the home charging example, the impact of EVs on the network is compared for weekday and weekend cases under different EV penetration levels.

Subject Areas: Electric vehicles; Markov Chain; Monte Carlo; Multi-place charging; Uncertainty

Availability: Wang, Y. and Infield, D., 2018. *Markov Chain Monte Carlo Simulation of Electric Vehicle Use for Network Integration Studies.* International Journal of Electrical Power & Energy Systems, 99, pp.85-94.
https://www.sciencedirect.com/science/article/pii/S0142061517307226

2.22. Title: Quantitative Calculation and Optimization of Demand for Electric Vehicle Charging Stations

Authors: Fan, R. and Zhang, W.

Abstract: The rapid development of electric vehicles (EVs) requires a reasonable plan in building charging stations. The number of charging stations should meet the charge demand of all users at least. Firstly, based on the statistics of CAAM, the bass diffusion model and the logistic regression forecast are used to obtain the EVs ownership in China in 2020. Secondly, based on the analysis of user trip data (NHTS), the expectation of the average daily mileage of electric vehicles is obtained, and is calculated as the daily average mileage with high reliability. Finally, analogous to the construction of gas stations and taking into account the user's travel habits to classify users, taking the charging stations of the State Grid and the BYD E6 model as an example, the number of charging stations that China needs to build in 2020 is calculated in detail. The calculation method is scientific and can provide a scientific theoretical basis for construction.

Subject Areas: Electric vehicles; Charging Demand; Daily mileage

2.23. Title: The Impact of High Occupancy Vehicle (HOV) Lane Access on Hybrid-electric Vehicle Adoption: Evidence from US States

Author: Chen, F.

Abstract: In 2009, nine states in the United States allowed a solo driver in a hybrid vehicle access to high occupancy vehicle (HOV) lanes without restrictions. This policy was designed to be an effective incentive to promote hybrid and electric vehicles consumption. There is little academic research specifically evaluating this policy effect and exploring the relationship between the HOV lane incentives and hybrid vehicle ownership. This paper tries to fill the gap by using the 2009 National Household Travel Survey (NHTS) data and Heckman two-step model to examine the relationship. Controlling for demographic characteristics, household composition, travel pattern, and monetary incentives, this paper finds no evidence of a meaningful relationship between the HOV lane incentive and hybrid vehicle consumption. However, there is a positive and statistically significant association between state financial incentives and hybrid vehicle adoption. Policymakers should be well advised to reexamine the hybrid vehicle purchasing incentive policy based on sound empirical evidence.

Subject Areas: High Occupancy Vehicle (HOV) Lane; Hybrid-electric Vehicle

Availability: Chen, F., 2018. *The Impact of High Occupancy Vehicle (HOV) Lane Access on Hybrid-electric Vehicle Adoption: Evidence from US States.* M.S. Thesis, Georgetown University. https://search.proquest.com/openview/b80d8763795cc8ac9b55f3c2e5fc9dfa/1?pq-origsite=gscholar&cbl=18750&diss=y

2.24. Title: Research on an Electric Vehicle Owner-Friendly Charging Strategy Using Photovoltaic Generation at Office Sites in Major Chinese Cities

Author: Su, S., Hu, Y., Yang, T., Wang, S., Liu, Z., Wei, X., Xia, M., Ota, Y. and Yamashita, K.

Abstract: Electric vehicles (EV) and photovoltaic (PV) generation are widely recognized around the world. Most EV owners in the major Chinese cities are forced to charge their EV batteries at the workplace during the daytime due to the limited space near their homes, which will increase the peak load during the daytime. On the other hand, the PV output is most likely to have a peak at around noon, which means, PVs could have a potential capability to compensate the EV charging load. An EV owner-friendly charging strategy based on PV utilization which alleviates both the EV charging constraints and the negative impact of the EV charging load on the grid is proposed. The PV utilization for compensating the unconstrained EV charging load is maximized to derive the maximum number of EVs with unconstrained charging. If the actual number of EVs exceeds the maximum number, a portion of EVs have to be charged only from the grid. Then, the line loss is introduced as the optimization objective in which the charging states are regulated. The case study shows that the proposed strategy can successfully increase the number of EVs with unconstrained charging, and reduce the peak-to-peak of the load curve.

Subject Areas: Electric vehicle; Office sites; Major Chinese cities; PV utilization; EV owner-friendly charging strategy

2.25. Title: Charging Electric Vehicles in Smart Cities: An EVI-Pro Analysis of Columbus, Ohio

Author: Wood, E., Rames, C., Muratori, M., Raghavan, S. and Young, S.

Abstract: In June 2016, the City of Columbus, Ohio, won the U.S. Department of Transportation Smart City Challenge, laying the foundation to become a model for future sustainable transportation in the United States and abroad. With the support of the U.S. Department of Energy's Vehicle Technologies Office, the National Renewable Energy Laboratory worked with the City of Columbus, The Ohio State University, Clean Fuels Ohio, the Mid-Ohio Regional Planning Commission, and American Electric Power to develop a plan for the expansion of the region's network of charging stations to support increased adoption of plug-in electric vehicles (PEVs) in the local market. Potential sites include multi-unit dwellings to support PEV ownership in urban environments, workplaces to maximize electric vehicle miles, and strategic locations along highway corridors to enable regional travel.

The National Renewable Energy Laboratory's Electric Vehicle Infrastructure Projection (EVIPro) model was used to generate scenarios of regional charging infrastructure to support consumer PEV adoption based on travel patterns provided by INRIX (a commercial mapping/traffic company) that are used to characterize regional travel in the Columbus area and anticipate future demand for PEV charging. Moreover, charging loads considering different levels of residential and public charging are reported to better inform the impact of PEV adoption on the electric load. This report provides guidance on PEV charging infrastructure to stakeholders in the Columbus area to reduce range anxiety as a barrier to PEV sales and ensure the effective use of private/public investments in PEV charging infrastructure.

Results indicate that approximately 400 Level 2 plugs at multi-unit dwellings and 350 Level 2 plugs at non-residential locations are required to support Columbus' primary PEV goal of 5,300 PEVs on the road by the end of 2019. This analysis finds that while consumer demand for fast charging is expected to remain low (due to modest anticipated adoption of short-range battery electric vehicles), a minimum level of fast charging coverage across the city is required to ease consumer range anxiety concerns by providing a safety net for unexpected charging events. Sensitivity analyses around some key assumptions have also been performed; of these, consumer preference for PHEV versus BEV and for their electric driving range, ambient conditions, and availability of residential charging at multi-unit dwellings were identified as key determinants of the non-residential PEV charging infrastructure required to support PEV adoption. The results discussed in this report can be leveraged by similar U.S. cities as part of a strategy to accelerate PEV adoption in the light-duty vehicle market.

Subject Areas: Charging stations; Plug-in electric vehicles (PEVs); Electric Vehicle Infrastructure Projection (EVIPro) model

Availability: Wood, E., Rames, C., Muratori, M., Raghavan, S. and Young, S., 2018. *Charging Electric Vehicles in Smart Cities: An EVI-Pro Analysis of Columbus, Ohio.* (No. NREL/TP-5400-70367). National Renewable Energy Lab.(NREL), Golden, CO (United States).
https://www.nrel.gov/docs/fy18osti/70367.pdf

2.26. Title: Probabilistic Multi-Objective Optimal Scheduling of Plug-in Hybrid Electric Vehicles in the Distribution System

Author: Pouladi, J. and Abedinzadeh, T.

Abstract: Unlike previous papers that hypothesize specific inputs and present fixed outputs for optimal charging of electric vehicles, this paper offers a multi-objective probabilistic charging algorithm based on the point estimate method (PEM) for aggregation of plug-in hybrid electric vehicles and investigates its impacts on the distribution system. In other words, the uncertainty related to the outputs of different charging algorithms is determined using the PEM. Moreover, from the perspective of an aggregator, simultaneous optimization of the minimum charging cost and minimum charging time is proposed to satisfy the customers. The proposed algorithm is optimized through multi-objective scheduling and applying distribution network constraints. Finally, the proposed method is applied to the IEEE-37 node test feeder, and simulation results are presented to illustrate its performance.

Subject Areas: Plug-in electric vehicles (PEVs); Optimal charging

2.27. Title: A Multi-objective Framework for Energy Resource Scheduling in Active Distribution Networks

Author: Shafiee, M., Ghazi, R. and Moeini-Aghtaie, M.

Abstract:
Purpose: The purpose of this paper is to investigate the impacts of electric vehicles' (EVs) charging/discharging decisions in energy resources scheduling problem of active distribution networks.
Design/methodology/approach: The problem under study is modelled as a two-stage optimisation problem in which the main requirements of EV owners are introduced as an objective function of the first stage. The total energy costs and the emission factor are considered as the main criteria of the second stage. The output generation schedules of distributed generation (DG) technologies together with the charging/discharging schedule of EVs are proposed as decision variables of the energy scheduling problem. Therefore, some effective methods are presented to model the uncertainties associated with these variables.
Findings: The results proved that an efficient compromise can be reached between the emission factor and the energy cost of the system. In addition, it has been emphasised on the importance of such comprehensive energy scheduling frameworks.
Originality/value: This paper contributes by: (a) providing a multi-objective framework for energy scheduling of active distribution networks, (b) extracting the mathematical model of this two-stage problem and (c) employing a linearised optimisation model to reach its global optimal solution.

Subject Areas: Charging/discharging schedule; Distributed generation (DG) technologies; Electric vehicles' (EVs); Emission

2.28. Title: An Optimal Domestic Electric Vehicle Charging Strategy for Reducing Network Transmission Loss While Taking Seasonal Factors into Consideration.

Authors: Zhao, Y., Che, Y., Wang, D., Liu, H., Shi, K. and Yu, D.

Abstract: With the rapid growth of domestic electric vehicle charging loads, the peak-valley gap and power fluctuation rate of power systems increase sharply, which can lead to the increase of network losses and energy efficiency reduction. This paper tries to regulate network loads and reduce power system transmission loss by optimizing domestic electric vehicle charging loads. In this paper, a domestic electric vehicle charging loads model is first developed by analyzing the key factors that can affect users' charging behavior. Subsequently, the Monte Carlo method is proposed to simulate the power consumption of a cluster of domestic electric vehicles. After that, an optimal electric vehicle charging strategy based on the 0-1 integer programming is presented to regulate network daily loads. Finally, by taking the IEEE33 distributed power system as an example, this paper tries to verify the efficacy of the proposed optimal charging strategy and the necessity for considering seasonal factors when scheduling electric vehicle charging loads. Simulation results show that the proposed 0-1 integer programming method does have good performance in reducing the network peak-valley gap, voltage fluctuation rate, and transmission loss. Moreover, it has some potential to further reduce power system transmission loss when seasonal factors are considered.

Subject Areas: Domestic Electric Vehicles; Charging Strategy; Network Transmission Loss; Seasonal Factor

2.29. Title: Evolving Controllers for Electric Vehicle Charging

Author: Pilát, M.

Abstract: We describe an algorithm to design controllers for the charging of electric vehicles. The controller is represented as a neural network, whose weights are set by an evolutionary algorithm in order to minimize the changes in the overall electrical consumption. The presented algorithm provides de-centralized controllers that also respect the privacy of the owner of electric vehicles, i.e. the controller does not share the information about charging with any third party. The presented controllers also require only a very small amount of memory and computational resources and are thus suitable for implementation in embedded systems.

Subject Areas: Electric vehicle charging; Evolutionary algorithm; Neural network

Availability: Pilát, M., 2018. *Evolving Controllers for Electric Vehicle Charging.* In International Conference on the Applications of Evolutionary Computation (pp. 247-255). Springer, Cham. https://link.springer.com/chapter/10.1007/978-3-319-77538-8_18

2.30. Title: Elasticity of Vehicle Miles of Travel to Changes in the Price of Gasoline and the Cost of Driving in Texas.

Authors: Wenzel, T.P. and Fujita, K.S.

Abstract: This report examines the sensitivity of annual vehicle miles of travel (VMT) of light-duty vehicles to the price of gasoline, commonly referred to as the elasticity of demand for VMT to the price of gasoline; the fuel-economy-related rebound effect is generally assumed to be of the same magnitude as the VMT elasticity of gas price or driving cost. We use detailed odometer readings from over 30 million vehicles in four urban areas of Texas, over a six-year period. We account for economic conditions over this period, as well as vehicle age. Following the literature we include fixed effects by vehicle make and individual vehicle, as well as the effect of adding an instrument to predict monthly gasoline price independent of any influences of demand for gasoline on its price.

Subject Areas: Vehicle Miles of Travel (VMT); Gasoline price

Availability: Wenzel, T.P. and Fujita, K.S., 2018. *Elasticity of Vehicle Miles of Travel to Changes in the Price of Gasoline and the Cost of Driving in Texas.* Lawrence Berkeley National Laboratory, University of California.
https://cloudfront.escholarship.org/dist/prd/content/qt3pr533kp/qt3pr533kp.pdf

2.31. Title: Assessment and Enhancement Frameworks for System Reliability Performance Using Different PEV Charging Models.

Authors: Almutairi, A. and Salama, M.

Abstract: This paper presents a comprehensive reliability framework for incorporating different PEV charging load models into the evaluation of generation adequacy. The proposed framework comprises special treatment and innovative models to achieve an accurate determination of the impact of PEV load models on reliability. First, a goodness-of-fit statistical model determines the probability distribution functions (PDFs) that best reflect the main characteristics of driver behavior. Second, robust and detailed stochastic methods are developed for modeling different charging scenarios (uncontrolled charging and charging based on TOU pricing). These models are based on the use of a Monte Carlo simulation in conjunction with the fitted PDFs to generate and assess a large number of possible scenarios while handling the uncertainties associated with driver behavior, penetration levels, charging levels, battery capacities, and customer response to TOU pricing. Also proposed is a novel reliability-based framework for the application of dynamic response to critical events programs for use with PEV charging loads. The effectiveness of the proposed framework with respect to improving system reliability is demonstrated using several case studies applied on the IEEE Reliability Test System (RTS).

Subject Areas: Reliability; Power system reliability; Load modeling; Biological system modeling; Batteries; Uncertainty; Pricing

2.32. Title: A Method for Determining The Optimal Delivered Hydrogen Pressure for Fuel Cell Electric Vehicles

Authors: Lin, Z., Ou, S., Elgowainy, A., Reddi, K., Veenstra, M. and Verduzco, L.

Abstract: Fuel cell electric vehicles (FCEVs) are considered an important part of a portfolio of options to address challenges in the transportation sector, including energy security and pollution reduction. The market success of FCEVs depends on standardization of key vehicle and infrastructure parameters, including the delivered hydrogen pressure (DHP). This study developed and utilized the Hydrogen Optimal Pressure (HOP) model to systematically identify the optimal DHP among 350, 500, and 700?bar toward the lowest total consumer cost and analyze how the optimal DHP may be affected by attributes of drivers, vehicles, and hydrogen refueling stations. The DHP of 700?bar a robustly better choice than 350?bar or 500?bar for Region Strategy, regardless of fuel availability, FCEV adoption, driver types, time values, and fuel economies. A DHP of 300 or 500?bar can the winner in Cluster Strategy if combined with certain assumptions of driving patterns and time value. the optimal pressure is found to be very sensitive to fuel availability, fuel economy, driving pattern and time value. The appeal of a higher DHP such as 700?bar (or even higher) is more obvious during the early market stages, when the number of hydrogen stations is limited and early FCEV consumers likely have higher time value, and thus may be willing to pay more for the increased range with higher DHP. Future research on mixed DHPs within a station and across stations is suggested.

Subject Areas: Fuel cell electric vehicle; Hydrogen refueling station; On-board storage; Optimization; Driving range; Hydrogen fueling pressure

2.33. Title: Range-extending Zinc-air Battery for Electric Vehicle

Authors: Sherman, S.B., Cano, Z.P., Fowler, M. and Chen, Z.

Abstract: A vehicle model is used to evaluate a novel powertrain that is comprised of a dual energy storage system (Dual ESS). The system includes two battery packs with different chemistries and the necessary electronic controls to facilitate their coordination and optimization. Here, a lithium-ion battery pack is used as the primary pack and a Zinc-air battery as the secondary or range-extending pack. Zinc-air batteries are usually considered unsuitable for use in vehicles due to their poor cycle life, but the model demonstrates the feasibility of this technology with an appropriate control strategy, with limited cycling of the range extender pack. The battery pack sizes and the battery control strategy are configured to optimize range, cost and longevity. In simulation the vehicle performance compares favourably to a similar vehicle with a single energy storage system (Single ESS) powertrain, travelling up to 75 km further under test conditions. The simulation demonstrates that the Zinc-air battery pack need only cycle 100 times to enjoy a ten-year lifespan. The Zinc-air battery model is based on leading Zinc-air battery research from literature, with some assumptions regarding achievable improvements. Having such a model clarifies the performance requirements of Zinc-air cells and improves the research community's ability to set performance targets for Zinc-air cells.

Subject Areas: Range Extender; Zinc-Air Battery; Dual Energy Storage System; Vehicle Model; Metal-Air Battery; Single Energy Storage System; Driving Profile; Vehicle Use Pattern

2.34. Title: Multicriterion Optimal Electric Drive Vehicle Selection based on Lifecycle Emission and Lifecycle Cost

Authors: Ahmadi, P., Cai, X.M. and Khanna, M.

Abstract: This research paper examines the optimal choice among conventional gasoline vehicles, hybrid electric vehicles (HEVs), plug-in HEVs (PHEV), and full-battery EVs taking into account the different characteristics of these vehicles, such as cost, emissions per mile, and vehicle miles to be traveled between refueling and acceleration time. The existing challenges for widespread deployment of EVs are availability of charging infrastructure, higher cost, long time for charging, and lower travel millage compared with conventional vehicles. Statistical data are considered for determining the spatially varying average daily vehicle miles traveled (VMT) across the United States, which, together with charging behavior, can influence the optimal choice among EV with different travel ranges. Two alternative cases for charging are examined: (1) home-only charging and (2) home plus work charging. The motivation of this work is to select the optimal EV among their types when lifecycle cost and lifecycle emission are considered. The optimization model seeks to minimize total lifecycle cost and emissions for each level of VMT per day. It is found that when lifecycle cost is the sole objective, HEV is usually the best choice, especially for higher VMT levels. When lifecycle greenhouse gas emission is the sole objective, PHEV1 (PHEV with 1 charging station) is the optimal solution over a wide range of VMTs. The outcome of this provides a roadmap for the selection of EVs based on their annual VMT to reduce both lifecycle emission and lifecycle cost.

Subject Areas: Electric Vehicles; Charging; Lifecycle emission

2.35. Title: Probabilistic-possibilistic Model for a Parking Lot in the Smart Distribution Network Expansion Planning

Authors: Nasri, A., Abdollahi, A., Rashidinejad, M. and Amini, M.H.

Abstract: Conventional distribution network departs to the smart grid. The parking lot will have an important role in the smart grid as a distributed generation. Due to the output power of parking lots is uncertain, More accurate modeling of parking lot output power is necessary for the future of distribution network studies such as Distribution Network Expansion Planning (DNEP). In this paper, a systematic method based on the Z-number concept is utilized to represent the uncertainty of Vehicle to Grid's (V2G's) presence. In order to investigate the impact of V2Gs uncertainty on the DNEP, we proposed a Probabilistic-Possibilistic DNEP in the presence of V2Gs referred to as P-PDNEPV2G. If the V2Gs historical data is incomplete, the proposed structure can significantly consider the effects of V2G on the DNEP. In P-PDNEPV2G, parking lots output power is described as a probabilistic-possibilistic variable by Z-number method. The optimization of P-PDNEPV2G is executed by the Non-Dominated Sorting Genetic Algorithm (NSGA-II). A 24-bus test system and the real 20?kV distribution network of Ghale-Ganj city of Kerman province in Iran are used to demonstrate the effectiveness of the proposed methodology. Eventually, several analyses are conducted to investigate the impact of probabilistic-possibilistic V2G model on the DNEP problem.

Subject Areas: Power distribution planning; Probability; Distributed power generation; possibility theory; Smart power grids

2.36. Title: Ancillary Services Participation for Electric Vehicle Fleets

Author: Shin, S.

Abstract: Amid growing concerns of global climate disruption, a diverse set of stakeholders are advocating for deep decarbonization efforts in sectors such as electrical power generation and transportation. This Master's Project (MP) will explore the potential scenarios when these two sectors begin to merge. As the electrification of vehicles becomes commonplace, benefits and limitations will become evident across the U.S. electric grid. The impact of fleet-scale adoption of electric vehicles (EVs) and vehicle-to-grid (V2G) implementation will be discussed. An EV fleet managed by a central entity has the possibility of aggregating their stored power for a grid service through a specialized charger that allows for bi-directional electric flow. The communication software and ability to transfer power from grid to vehicle is called vehicle-to-grid implementation, or V2G. V2G is a broad term with multiple applications. The focus of this MP will be on EV fleets' ability to provide ancillary services. The ancillary services market represents an array of services that provide general grid support, rather than outright electrical power capacity. Ancillary services include services such as frequency regulation and voltage control.

Subject Areas: V2G; EV Fleet(s); Ancillary Services; Frequency Regulation

Availability: Shin, S., 2018. *Ancillary Services Participation for Electric Vehicle Fleets.* M.S. Thesis, Duke University.
https://dukespace.lib.duke.edu/dspace/handle/10161/16526

2.37. Title: A Pattern Analysis of Daily Electric Vehicle Charging Profiles: Operational Efficiency and Environmental Impacts

Author: Desai, R.R., Chen, R.B. and Armington, W.

Abstract: Plug-in Electric Vehicles (PEVs) are considered one solution to reducing GHG emissions from private transport. Additionally, PEV adopters often have free access to public charging facilities. Through a pattern analysis, this study identifies five distinct clusters of daily PEV charging profiles observed at the public charging stations. Empirically observed patterns indicate a significant amount of operational inefficiency, where 54% of the total parking duration PEVs do not consume electricity, preventing other users from charging. This study identifies the opportunity cost in terms of GHG emissions savings if gasoline vehicles are replaced with potential PEV adopters. The time spent in parking without charging by current PEV users can be used by these potential PEV users to charge their PEVs and replace the use of gasoline. The results suggest that reducing inefficient station use leads to significant reductions in emissions. Overall, there is significant variability in outcomes depending on the specific cluster membership.

Subject Areas: Plug-in Electric Vehicles (PEVs); GHG emissions; Charging; Parking

2.38. Title: Multiobjective Scheduling of Microgrids to Harvest Higher Photovoltaic Energy

Author: Hamidi, A., Nazarpour, D. and Golshannavaz, S.

Abstract: Photovoltaics (PVs) and plug-in electric vehicles (PEVs) could instigate voltage violation issues, if not controlled properly. Besides, these components highly contribute to economic efficiency of microgrids (MGs). Being motivated to enhance technical and economic issues, this study develops an energy management system that is able to coordinate voltage control devices, say under-load tap changers (ULTC), PVs, PEV aggregators, and dispatchable distributed generations (DDGs). Active and reactive power provisions of PEVs and DDGs along with voltage control of ULTC lessen the plausible violations. So, higher renewable energy is contributed by PVs and extra monetary saving is reflected. In this manner, augmented Epsilon-constraint method followed with fuzzy decision making is applied to operation cost and voltage deviation minimizations. The proposed approach is formulated as a mixed-integer nonlinear multiobjective problem and tested on a modified IEEE 33-bus medium-voltage MG. Results are discussed in depth.

Subject Areas: Energy management system (EMS); Microgrid (MG); Multiobjective approach; Photovoltaics (PVs); Plug-in electric vehicles (PEVs)

2.39. Title: Enhancing Electric Vehicle Sustainability through Battery Life Optimal Charging

Authors: Schoch, J., Gaerttner, J., Schuller, A. and Setzer, T.

Abstract: In this article, we investigate the potential for battery life prolongation through optimized charging under consideration of individual mobility requirements. Based on a comprehensive battery aging model we introduce a continuous quadratic programming model to derive battery life optimal charging (OPT). The strategy indicates when and how much to charge to maximize the potential range throughout the battery life. We find that OPT has the potential to more than double the expected battery life compared to simple and often abundant recharging activities as observable today. The degree of battery life prolongation strongly depends on the operating temperature. Since optimal charging would require deterministic knowledge of future trips and corresponding charging levels we investigate a more convenient charging heuristic derived from "As-Late-As-Possible" (ALAP) charging. ALAP charging considers range buffers between 5% and 60% over the range required until the next re-charging opportunity. We analyze the trade-off between (long-term) battery life and (short-term) range flexibility. We find that for decreasing temperatures the trade-off between battery life and flexibility is solved with increasing range buffers. From our results battery degradation aware charging heuristics can be easily derived and applied in real-world settings.

Subject Areas: Battery aging; Optimal charging behavior; Range anxiety; Battery electric vehicle

2.40. Title: Electrified Vehicles Continue to see Slow Growth and Less Use than Conventional Vehicles

Author: Stone, D.

Abstract: Blog

Subject Areas: Diesel; Electricity; Gasoline; Liquid Fuels; Transportation; Vehicles

Availability: Stone, D., 2018. *Electrified Vehicles Continue to see Slow Growth and Less Use than Conventional Vehicles.* U.S. Energy Information Administration. https://www.eia.gov/todayinenergy/detail.php?id=36312

3. Environment

3.1. Title: Mapping The Influence of Food Waste in Food Packaging Environmental Performance Assessments.

Authors: Heller, M.C., Selke, S.E. and Keoleian, G.A.

Abstract: Scrutiny of food packaging environmental impacts has led to a variety of sustainability directives, but has largely focused on the direct impacts of materials. A growing awareness of the impacts of food waste warrants a recalibration of packaging environmental assessment to include the indirect effects due to influences on food waste. In this study, we model 13 food products and their typical packaging formats through a consistent life cycle assessment framework in order to demonstrate the effect of food waste on overall system greenhouse gas (GHG) emissions and cumulative energy demand (CED). Starting with food waste rate estimates from the U.S. Department of Agriculture, we calculate the effect on GHG emissions and CED of a hypothetical 10% decrease in food waste rate. This defines a limit for increases in packaging impacts from innovative packaging solutions that will still lead to net system environmental benefits. The ratio of food production to packaging production environmental impact provides a guide to predicting food waste effects on system performance. Based on a survey of the food LCA literature, this ratio for GHG emissions ranges from 0.06 (wine example) to 780 (beef example). High ratios with foods such as cereals, dairy, seafood, and meats suggest greater opportunity for net impact reductions through packaging?based food waste reduction innovations. While this study is not intended to provide definitive LCAs for the product/package systems modeled, it does illustrate both the importance of considering food waste when comparing packaging alternatives, and the potential for using packaging to reduce overall system impacts by reducing food waste.

Subject Areas: Food Packaging; Food waste; GHG emissions; Industrial ecology; Life Cycle Assessment (LCA)

3.2. Title: Carbon Footprint Planning: Quantifying Local and State Mitigation Opportunities for 700 California Cities

Authors: Jones, C.M., Wheeler, S.M. and Kammen, D.M.

Abstract: Consumption-based greenhouse gas (GHG) emissions inventories have emerged to describe full life cycle contributions of households to climate change at country, state and increasingly city scales. Using this approach, how much carbon footprint abatement potential is within the control of local governments, and which policies hold the most potential to reduce emissions? This study quantifies the potential of local policies and programs to meet aggressive GHG reduction targets using a consumption-based, high geospatial resolution planning model for the state of California. We find that roughly 35% of all carbon footprint abatement potential statewide is from activities at least partially within the control of local governments. The study shows large variation in the size and composition of carbon footprints and abatement opportunities by ~23,000 Census block groups (i.e., neighborhood-scale within cities), 717 cities and 58 counties across the state. These data and companion online tools can help cities better understand priorities to reduce GHGs from a comprehensive, consumption-based perspective, with potential application to the full United States and internationally.

3.3. Title: Estimating Individualized Exposure Impacts from Ambient Ozone Levels: A Synthetic Information Approach

Authors: Pires, B., Korkmaz, G., Ensor, K., Higdon, D., Keller, S., Lewis, B. and Schroeder, A.

Abstract: There is ample evidence that short-term ozone exposure is associated with increased respiratory symptoms. Many studies, however, aggregate the population, activities, or concentration levels of the pollutant across space and/or time, failing to capture critical variations in the exposure levels. We couple spatiotemporal air quality estimates of ozone with a synthetic information model of the Houston Metropolitan Area, allowing us to attach exposure levels to individuals based on exact times, geo-locations, and microenvironments of activities. Several scenarios of the model are run at different levels of resolution. When we maintain the spatiotemporal resolution of the data, the proportion of the population that experiences sharp increases in short-term exposure increases substantially. This can be particularly important if experienced by sensitive populations given the increased risk for adverse health effects. We find that individuals in the same zip code, neighborhood, and even household have varying levels of exposure.

Subject Areas: Synthetic populations; Air quality; Ozone; Microenvironment; Personal exposure

3.4. Title: The Influence of the Built Environment of Neighborhoods on Residents' Low-Carbon Travel Mode

Authors: Qian, C., Zhou, Y., Ji, Z. and Feng, Q.

Abstract: Motor vehicle travel is one of the causes of aggravation of CO_2 emission, environmental issues and urban problems. The advocation of low-carbon travel is necessary for the achievement of low-carbon city construction and sustainable development in the future. Many studies have shown that built environment tends to influence residents' travel behavior, and most studies are demonstrated from the macro level of metropolis. However, from the perspective of neighborhoods, much less attention has been paid, especially in developing countries including China. This study chooses 15 neighborhoods in the main districts of Nanjing in China, taking the location of neighborhoods and residents' socio-economic attributes into consideration, to examine the effects of residential built environment on residents' mode choice of different travel types, and to propose the recommended values for the most significant variables. The residential built environment attributes are from three dimensions of land use, road network system and transit facilities. The method of this study is three-step and successive. Primarily, a correlation analysis model is applied to initially examine the role that residents' socio-economic attributes and residential built environment attributes play on residents' low-carbon travel of three different travel types respectively. Primary significant attributes from these two aspects are preliminarily screened out for the re-screening in the next step. In addition, the study uses multivariate logit regression modeling approach, with significant socio-economic attributes as concomitant variables, to further re-screen out the key variables of built environment. Furthermore, a unary linear regression model is applied to propose the recommended values for the key built environment variables.

3.5. Title: A Life Cycle Assessment of the Environmental Impacts of A Beef System in the USA

Authors: Asem-Hiablie, S., Battagliese, T., Stackhouse-Lawson, K.R. and Rotz, C.A.

Abstract: The need to assess the sustainability attributes of the United States beef industry is underscored by its importance to food security locally and globally. A life cycle assessment (LCA) of the US beef value chain was conducted to develop baseline information on the environmental impacts of the industry including metrics of the cradle-to-farm gate (feed production, cow-calf, and feedlot operations) and post-farm gate (packing, case-ready, retail, restaurant, and consumer) segments.

Subject Areas: Beef footprints; Beef production emissions; Beef sustainability; Beef value chain

3.6. Title: Future of Mobility White Paper

Authors: Shaheen, S., Totte, H., and Stocker, A.

Abstract: Transportation is arguably experiencing its most transformative revolution since the introduction of the automobile. Concerns over climate change and equity are converging with dramatic technological advances. Although these changes – including shared mobility and automation – are rapidly altering the mobility landscape, predictions about the future of transportation are complex, nuanced, and widely debated. California is required by law to renew the California Transportation Plan (CTP), updating its models and policy considerations to reflect industry changes every five years. This document is envisioned as a reference for modelers and decision makers. We aggregate current information and research on the state of key trends and emerging technologies/services, documented impacts on California's transportation ecosystem, and future growth projections (as appropriate). During 2017, we reviewed an expanded list of 20 topics by referencing state agency publications, peer-reviewed journal articles, and forecast reports from consulting firms and think tanks. We followed transportation newsletters and media sources to track industry developments, and interviewed six experts to explore their opinions on the future of transportation. We consulted an advisory committee of over 50 representatives from local and state transportation agencies, who provided input throughout the project's evolution. We also obtained feedback on our draft report from a panel of U.S. experts.

Subject Areas: Transportation; Climate Change; Technological advances

Availability: Shaheen, S., Totte, H., and Stocker, A., 2018. *Future of Mobility White Paper.* UC Berkeley: Institute of Transportation Studies (UCB).
https://escholarship.org/uc/item/68g2h1qv#main

3.7. Title: Optimizing One-day Driving Restriction using Mathematical Programming

Authors: Silva, C.G. and Kim, M.K.

Abstract: A one-day driving restriction prohibits drivers from operating their vehicles on a given weekday in an attempt to reduce traffic congestion and air pollution. A restricted weekday is assigned based on vehicles' license number, which is somewhat random. The one-day driving restriction has been popular in developing countries due to the low cost of implementation. However, it has not been effective in reducing air pollution in the long run. Many studies have pointed out that there is an incentive for the household to purchase an old used vehicle, which might have high emission potential, to circumvent the restriction. In addition, as shown in this paper, households drive more on non-restricted weekdays to compensate for lost driving time, creating a substitution effect which may lead to increased emissions. We propose a one-day driving restriction based on mathematically assigned household vehicle registrations rather than a randomly assigned license plate number. This is valuable in overcoming flaws of the current one-day driving restriction to increase opportunity cost of cheating as such, the new one-day driving restriction will increase the cost of buying the second vehicle. Furthermore, the mathematical programming model is utilized to assign the restricted weekday to each household, while also optimizing the distribution of high and low emission vehicles on the road to reduce air pollution effectively. The numerical simulation illustrates that the goal of driving restriction is achieved.

Subject Areas: Traffic congestion; Air pollution

3.8. Title: Optimal Energy Taxation in Cities

Authors: Borck, R. and Brueckner, J.K.

Abstract: This paper presents the first investigation of the effects of optimal energy taxation in an urban spatial setting, where emissions are produced both by residences and commuting. When levying an optimal direct tax on energy or carbon use is not feasible, the analysis shows that exactly the same adjustments in resource allocation can be generated by the combination of a land tax, a housing tax, and a commuting tax. We then analyze the effects of these taxes on urban spatial structure, showing that they reduce the extent of commuting and the level of housing consumption while increasing building heights, generating a more-compact city with a lower level of emissions per capita.

Subject Areas: Environmental taxes; Greenhouse gases; Monocentric city

3.9. Title: Energy Use and Life Cycle Greenhouse Gas Emissions of Drones for Commercial Package Delivery

Authors: Stolaroff, J.K., Samaras, C., O'Neill, E.R., Lubers, A., Mitchell, A.S. and Ceperley, D.

Abstract: The use of automated, unmanned aerial vehicles (drones) to deliver commercial packages is poised to become a new industry, significantly shifting energy use in the freight sector. Here we find the current practical range of multi-copters to be about 4km with current battery technology, requiring a new network of urban warehouses or waystations as support. We show that, although drones consume less energy per package-km than delivery trucks, the additional warehouse energy required and the longer distances traveled by drones per package greatly increase the life-cycle impacts. Still, in most cases examined, the impacts of package delivery by small drone are lower than ground-based delivery. Results suggest that, if carefully deployed, drone-based delivery could reduce greenhouse gas emissions and energy use in the freight sector. To realize the environmental benefits of drone delivery, regulators and firms should focus on minimizing extra warehousing and limiting the size of drones.

Subject Areas: Greenhouse gas emissions; Environmental; Freight; Drones

4. Health

4.1. Title: Understanding Temporal Change of Spatial Accessibility To Healthcare: An Analytic Framework For Local Factor Impacts.

Authors: Yang, J. and Mao, L.

Abstract: Population demand, health service supply, and the linkages between them (e.g., transport infrastructure) are important factors that determine spatial accessibility to healthcare at a place. These three factors vary differently over time and location, leading to temporal changes and spatial disparities in access to healthcare. Few analytic methods have been developed to measure local impacts of these factors on healthcare accessibility over time, which are essential to alleviating health disparities and evaluating intervention programs. We propose a spatially explicit analytic framework to measure local factor impacts over time by adopting a chain substitution method from economics. The analysis is illustrated by a case study of spatial accessibility to physicians in Florida, USA, from 1990 to 2010. For each census block group, the results show the impact of local population change, physician relocation, and road-network expansion on the loss and gain of healthcare accessibility over time. The leading impact factor are identified for each census block group through comparison, and spatial clusters of factor impacts are discovered. To the literature of healthcare accessibility, this article presents a promising start of factor impact analysis and offers new perspectives in exploring spatial processes underlying people's access to healthcare.

Subject Areas: Access to healthcare; Spatial disparities; Temporal changes; Factor impact analysis; GIS

4.2. Title: Dietary and Physical Activity Interventions for Colorectal Cancer Survivors: A Randomized Controlled Trial

Authors: Lee, C.F., Ho, J.W., Fong, D.Y., Macfarlane, D.J., Cerin, E., Lee, A.M., Leung, S., Chan, W.Y., Leung, I.P., Lam, S.H. and Chu, N.

Abstract: There has been evidence on the protective effects of diets high in fiber and low in red and processed meat (RPM), and physical activity (PA) against colorectal cancer (CRC) development, but that against CRC recurrence has been limited. This study evaluated the efficacy of a behavioral program comprising dietary and PA interventions in improving Chinese CRC survivors' lifestyle. A 2x2 factorial randomized controlled trial of 223 CRC patients (82 females, mean age 65), randomly assigned to receive dietary, PA or both interventions, or usual care for 12 months, and assessed every 6 months for 24 months. Primary outcomes included two dietary and two PA targets. Secondary outcomes included changes in dietary consumptions and PA levels. Dietary interventions significantly increased the odds of achieving the targets of consuming less RPM at all time-points (OR 3.22–4.57, all $p<0.01$) and refined grain (RG) at months 6 (OR 3.13, $p=0.002$) and 24 (OR 2.19, $p=0.039$), and reduced RPM (2.49–3.48 servings/week, all $p<0.01$) and RG (0.31–0.5 servings/day, all $p<0.01$) consumptions. Patients receiving PA interventions potentially spent more time on moderate-to-vigorous PA. This study demonstrated the efficacy of a behavioral program in improving dietary habits of Chinese CRC survivors.

Subject Areas: Physical Activity Interventions; High fiber diet; Colorectal Cancer

4.3. Title: CTASS: An Intelligent Framework for Personalized Travel Behaviour Advice to Cardiac Patients

Authors: Batool, T., Vanrompay, Y., Neven, A., Janssens, D. and Wets, G.

Abstract: Current cardiac rehabilitation programs intending to increase physical activity of patients suffer from a lack of knowledge about effective patient's activity profiles and their associated behavior. This leads to the fact that therapies are not completely tailored to the patient, causing non-adherence to the proposed treatment schedule. An important potential for increasing the physical activity level of patients is available in their daily travel behaviour that can be made more active. To validate this potential, we propose a Cardiac Travel Advice Support System (CTASS) digital framework for personalized travel behaviour advice to cardiac patients. The travel behaviour of the group of patients whose actual physical activity level is expected to be too low is monitored by a smartphone application that objectifies their daily activity schedules. The data from the schedules is analysed semi-automatically by the CTASS. Based on this analysis, the doctor can provide a treatment that is personalized to the specific contexts of the patient. In this way, we try to optimize their travel-related physical activity. Moreover, we predict the risk of non-adherence to the therapy taking into account the derived characteristics of the patient.

Subject Areas: Active travel behaviour; Smart cardiovascular rehabilitation; Physical activity level; Behaviour prediction

4.4. Title: VA Using Telemedicine to Provide Therapy to Rural Veterans With PTSD

Author: Rubin, R.

Abstract: The Department of Veterans Affairs (VA) recently launched a pilot telehealth program to provide psychotherapy and related services by telephone and interactive video for rural veterans with posttraumatic stress disorder (PTSD). As of mid-March, more than 500 rural veterans had enrolled in the telehealth study. Participants may choose between the 2 main types of trauma-focused psychotherapy used in the VA: cognitive processing therapy and prolonged exposure therapy. Study participants receive psychotherapy via interactive video at any of 12 of the VA's community-based outpatient clinics across the country or in their home.

Subject Areas: Veterans; Health; Drivers

Availability: Rubin, R., 2018. *VA Using Telemedicine to Provide Therapy to Rural Veterans With PTSD.* Jama, 319(16), pp.1648-1648.
https://jamanetwork.com/journals/jama/article-abstract/2679260

5. Policy and Mobility

5.1. Title: Development of a Multi-modal Travel Demand Module for the Regional Strategic Planning Model

Author: Yang, H.

Abstract: Presentation

Subject Areas: Multi-modal Travel; Travel Demand Model; Regional Planning

Availability: Yang, H., 2018. *Development of a Multi-modal Travel Demand Module for the Regional Strategic Planning Model.* Transportation Research and Education Centre (TREC) Friday Seminar Series. 138, Portland State University.
https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1135&context=trec_seminar

5.2. Title: An Overview of Transportation Data

Author: Texas, A & M University

Abstract: Transportation data is the foundation for informed policy decision making. Transportation data is collected and managed as an asset. These data provide insight into many different aspects of the transportation system, including: 1. Transportation system assets and their physical condition. 2. Safety, system operation, and performance. 3. Travel behavior, demography, and modal data. 4. Transportation economics, finance, and programming. 5. Freight movement, volumes, and modes. 6. Project planning and development. 7. Public opinion data (to reflect attitudes and awareness).

Subject Areas: Automatic Data Collection Systems; Data Collection; Data Processing; Geographic Information Systems; Information Systems; Management Information Systems; Transportation; Transportation Data; Transportation Operations

Availability: Texas, A & M University, 2018. *An Overview of Transportation Data.* Technical Report, Texas A & M University and Transportation Policy Research Center.
https://rosap.ntl.bts.gov/view/dot/34908

5.3. Title: Evolution of Transportation Policy and Economics

Author: McMullen, B.S.

Abstract: This chapter discusses the shift in the focus of transportation policy from questions regarding transportation industries or carriers needed to conduct policy in a regulated environment, to issues regarding the finance and pricing of the transportation system and investment decisions on infrastructure. Policymakers are faced with the classic economic problem of allocating scarce resources in a manner that will maximize social welfare and to do so requires the expertise and advice of economists. A vehicle miles travelled (VMT) tax has been proposed as a first step in providing sustainable highway finance and correcting distortions caused by historic underpricing of roads in the United States. Several empirical studies examining the distributional Impact of a VMT tax are reviewed here as policymakers grapple with practical solutions to the finance problem. Issues regarding transit investment and subsidies as well as economic factors to consider when making multimodal investment decisions for freight are discussed. The role of transportation economists in these policy decisions is particularly critical if policies are to achieve desired objectives.

Subject Areas: Deregulation; Highway Trust Fund (HTF); Multimodal investment; Optimal road pricing; Transit; Transportation infrastructure; Regulation; Vehicle miles traveled (VMT)

Availability: McMullen, B.S., 2018. *Evolution of Transportation Policy and Economics.* In Transportation Policy and Economic Regulation (pp. 169-184).
https://www.sciencedirect.com/science/article/pii/B9780128126202000080

5.4. Title: Devolution of Transportation: Reducing Big-Government Involvement in Transportation Decision Making

Author: Pozdena, R., B.S.

Abstract: This chapter examines the role that federal, state, and local governments play in the funding and provision of transportation infrastructure and services. We build the case for dramatic devolution of authority that is presently asserted by the federal government to states, localities, or the private sector. Although the issues vary somewhat by the specific mode of transport, the general findings are the same. First, the current systems of pricing, decision making, and funding give too much authority to high levels of government. Despite the fact that the vast majority of passenger and goods movements involve short distances, high-level government decisions and funding processes dominate the transportation sector. Second, the pricing and funding mechanisms used do not create a nexus between those who need transportation services and the financing of those services. Rather, funding flows through processes that invoke pooling of revenues, subsidies, and cross-subsidies, and archaic, noneconomic allocation processes. Third, the result is that it is hard for market participants to serve the mostly localized needs of passengers and shippers. The misallocations and distortions are most marked in the case of highway-based transportation and urban transit, resulting in congested and overused highways, and transit systems that provide high-cost service with little accountability to passengers. The issues are less pressing in the case of air and water transport, but we question the need for public ownership of airports and seaports, since we find that other countries successfully privatize both ports and air traffic control systems. Finally, the chapter also concludes that pipelines, like the rail network before them, face sufficient competition to benefit from the near-complete deregulation that rail has enjoyed for over 30 years.
The chapter begins with a conceptual review of the economic bases for allocating authority and setting prices, and the determinants of the appropriate scale of government or private entities. The chapter then examines, mode by mode, the travel and shipment propensities of users of transport services. The implications of this analysis are then used to evaluate the propriety and necessity of current institutional arrangements. To provide illustrative state and local issues, the author uses observations from his home state of Oregon–a state with a unique cross-section of ocean, river, rail, pipeline, and highway facilities. Additionally, Oregon has aggressively sought to develop transit facilities. The chapter concludes that, in general, current hierarchies of authority and methods of pricing are ossified remnants of historical circumstances and technological constraints. Although we are not optimistic that major reform will come quickly, there is no longer a good case to be made for current practices, especially in the highway and transit modes. It is hoped that the technological revolution currently under way will apply sufficient pressure by users to erode out-of-date arrangements.

Subject Areas: Trip length; Transportation regulation; Role of government; Road pricing

5.5. Title: Long-Distance Overnight Values of Travel Time Across Modes and Tour Characteristics

Author: Rani, J.

Abstract: The value of travel time (VoTT) quantifies the willingness of individuals to pay money in order to save a unit of travel time. It is a critical metric for the transportation industry that underlies many policy decisions and processes, including cost-benefit analyses, project evaluations, travel demand forecasting, and economic investments. However, despite the continuous growth of long-distance intercity travel in terms of the number of miles traveled and dollars spent on local/regional economies, existing metro area-based VoTT metrics are inadequate for long-distance trips. Therefore, this study completes three objectives: 1) examine the trade-offs between travel times and costs in the mode choices in representative observed long-distance trips, 2) model mode choice to quantify the VoTT for air and personal vehicles across multiple tour types in the Alabama and Vermont regions, and 3) develop a framework for characterizing individuals' unique relationship with costs and travel times for long-distance travel. Specifically, this research combines detailed out-of-state long-distance tour records from the 2013 Longitudinal Survey of Overnight Travel (LSOT) with mode choice alternative data generated from the Bureau of Transport Statistics (BTS) and Google Maps to calculate VoTT for a variety of relevant individuals and tour factors using a multinomial logistic regression function. To represent as broad a definition as possible, long-distance trip in this study was defined as an overnight and out-of-state trip with at least 50 mi (one-way) distance between origin and destination. Trade-offs between travel cost and travel time in long-distance trips are examined to find that (1) minimizing travel costs was most important to long-distance overnight travelers, when the trip distance is less than 500 miles one-way and (2) minimizing travel time was most important to long-distance overnight travelers, when the trip distance is greater than 500 miles one-way. Values of travel time, calculated as a ratio of time and cost estimates from logistic regression, are found to have a negative sign more commonly in long-distance travel. This study identified different ways of interpreting negative VoTTs depending on the coefficients contributing to the negative sign. It further identified six different types of long-distance travel behaviors based on travelers' attitudes towards saving time and/or money while taking their tour, annual travel and annual household characteristics into consideration. The results from this study are intended to assist transportation planners and analysts in the policy-making and decision-making processes related to transportation infrastructure.

Subject Areas: Value of travel time (VoTT); Policy-making; Travel demand forecasting

5.6. Title: Not so Fast? Examining Neighborhood-Level Effects of Traffic Congestion on Job Access.

Authors: Thomas, T., Mondschein, A., Osman, T. and Taylor, B.D.

Abstract: Traffic congestion powerfully influences urban transportation policy, particularly in regional planning where transportation projects are often prioritized and funded based on expected congestion relief benefits. Congestion is universally unpopular, and it is a short, intuitive leap from frustration with traffic to the belief that congestion is a major drag on connectivity to jobs and other opportunities and, in turn, economic vitality. While much work has focused on evaluating and relieving bottlenecks and project-level traffic delays, relatively little research has quantified the precise role of congestion in limiting access to destinations more broadly, with access defined here in terms of the travel time needed to reach potential destinations. Accordingly, this study (1) captures the precise trade-offs between peak-hour travel speed and job accessibility, and (2) estimates the greatest level of accessibility benefits that congestion relief could be expected to achieve. Using two different measures of employment access for the nine-county San Francisco Bay Area, we find that travel speeds play a surprisingly small role in determining the time it takes to access job sites. One's location vis-à-vis these job sites, by contrast, plays a much larger role in determining access. In other words, the most densely developed places typically offer the highest levels of access, despite typically higher levels of congestion. We also compare these rush hour job access metrics for the Bay Area with hypothetical congestion-free peak hour conditions and find that such a dramatic transformation would result in only modest increases in employment accessibility in much of the Bay Area. Although some housing-rich, job-poor suburbs would benefit disproportionately from the complete absence of peak-hour traffic, we conclude that (1) while congestion does impede regional accessibility, it does so to a far smaller degree than is commonly thought, and (2) while dense development is associated with slower adjacent peak-hour travel speeds, capping development and limiting densities in order to maintain or increase travel speeds may have deeply counterproductive effects on overall accessibility in regions.

Subject Areas: Congestion; Job accessibility; Urban form; Travel speed; Urban transportation policy

5.7. Title: Mobility and Congestion in Urban India

Authors: Akbar, P.A., Couture, V., Duranton, G., Ghani, E. and Storeygard, A.

Abstract: Using a popular web mapping and transportation service, we generate information for more than 22 million counterfactual trip instances in 154 large Indian cities. We then use this information to estimate a several indices of mobility for these cities. We first show that our measurements are robust to a wide variety of methodological choices. Second, we decompose overall mobility into uncongested mobility and the congestion delays caused by traffic. Finally, we examine correlates of mobility, uncongested mobility, and traffic delays.

Subject Areas: Urban transportation; Roads; traffic; Determinants of travel speed; Cities

Availability: Akbar, P.A., Couture, V., Duranton, G., Ghani, E. and Storeygard, A., 2018. *Mobility and Congestion in Urban India.* Working Paper. World Bank and Zell Lurie Center for Real Estate, Wharton School.
http://www.tinbergen.nl/wp-content/uploads/2017/08/CongestionIndia11.pdf

5.8. Title: The Road to Inequality: How the Federal Highway Program Polarized America and Undermined Cities

Author: Nall, C

Abstract: NA

Subject Areas: Policy

Availability: Nall, C., 2018. *The Road to Inequality: How the Federal Highway Program Polarized America and Undermined Cities.* Cambridge University Press.
https://books.google.com/books?hl=en&lr=&id=1I5LDwAAQBAJ&oi=fnd&pg=PR8&dq=%27
NHTS%27+and+%27National+Household+Travel+Survey%27&ots=QX0fVTXSW-&sig=OZd
pMnuBPK1c-mj53wHME9pIrrA#v=onepage&q='NHTS'%20and%20'National%20Household%
20Travel%20Survey'&f=false

5.9. Title: Developing Policy for Urban Autonomous Vehicles: Impact on Congestion

Author: Metz, D.,

Abstract: An important problem for surface transport is road traffic congestion, which is ubiquitous and difficult to mitigate. Accordingly, a question for policymakers is the possible impact on congestion of autonomous vehicles. It seems likely that the main impact of vehicle automation will not be seen until driverless vehicles are sufficiently safe for use amid general traffic on urban streets. Shared use driverless vehicles could reduce the cost of taxis and a wider range of public transport vehicles could be economic. Individually owned autonomous vehicles would have the ability to travel unoccupied and may need to be regulated where this might add to congestion. It is possible that autonomous vehicles could provide mobility services at lower cost and wider scope, such that private car use in urban areas could decline and congestion reduce. City authorities should be alert to these possibilities in developing transport policy.

Subject Areas: Road traffic congestion; Autonomous vehicles; Taxis; Cities; Urban

5.10. Title: An Agent-Based Simulation Model for Shared Autonomous Taxi System

Author: Liu, Z., Miwa, T., Zeng, W. and Morikawa, T

Abstract: The shared autonomous taxis system (SATS) has been regarded as a promising traffic mode for improving travel flexibility and reducing travel costs. This study aims to examine the potential benefits of replacing all taxis with ride-sharing autonomous vehicles (AVs). Specifically, two sharing strategies are discussed: nondetour sharing, in which a subsequent customer is picked up only if no detour is required, and detour sharing, where the detour may cause a delay for the first customer. An agent-based simulation is developed to demonstrate the advantage of the SATS. Results show that the nondetour and detour sharing strategies can respectively reduce fleet size by 19% and 27%, reduce waiting time by 62% and 82%, reduce operational costs by 16% and 24%, and reduce CO2 emissions by 17% and 19% in comparison with a nonsharing strategy.

Subject Areas: Highways; Operations and Traffic Management; Planning and Forecasting; Travel costs; Mobility

Availability: Liu, Z., Miwa, T., Zeng, W. and Morikawa, T., 2018. *An Agent-Based Simulation Model for Shared Autonomous Taxi System.* Asian Transport Studies, 5(1), pp.1-13. https://www.jstage.jst.go.jp/article/eastsats/5/1/5_1/_pdf

5.11. Title: The Geography of Poverty and Nutrition: Food Deserts and Food Choices across the United States

Authors: Allcott, H., Diamond, R. and Dubé,, J.P.

Abstract: We study the causes of "nutritional inequality": why the wealthy tend to eat more healthfully than the poor in the U.S. Using event study designs exploiting supermarket entry and households' moves to healthier neighborhoods, we reject that neighborhood environments have meaningful effects on healthy eating. Using a structural demand model, we find that exposing low-income households to the same availability and prices experienced by high-income households reduces nutritional inequality by only 9%, while the remaining 91% is driven by differences in demand. These findings contrast with discussions of nutritional inequality that emphasize supply-side factors such as food deserts.

Subject Areas: Food desert; Travel to shop; Lowincome

Availability: Allcott, H., Diamond, R. and Dubé, J.P., 2018. *The Geography of Poverty and Nutrition: Food Deserts and Food Choices across the United States.* Working Paper, National Bureau of Economic Research, (No. w24094).
http://www.nber.org/papers/w24094

5.12. Title: The Housing Crisis isn't just about Affordability – It's about Economic Mobility, too

Author: Sisson, P.

Abstract: Blog

Subject Areas: Mobility; Housing Cost; Economic background

Availability: Sisson, P., 2018. *The Housing Crisis isn't just about Affordability – It's about Economic Mobility, too.* Curbed.
https://www.curbed.com/2018/4/24/17275068/jobs-mobility-high-rent-housing-costs

5.13. Title: The Future of the Micro-Mobility Industry

Author: Lambe, S.

Abstract: Blog

Subject Areas: Mobility; Bike; Walk; Transit; Trips

Availability: Lambe, S., 2018. *The Future of the Micro-Mobility Industry.* Venture Beat.
https://venturebeat.com/2018/06/09/why-micro-mobility-startups-wont-survive-as-standalone-services/

6. Special Population Groups

6.1. Title: Examining the Possible Impact of Daily Transport on Depression Among Older Adults Using an Agent-Based Model

Authors: Yang Y., Langellier B.A., Stankov I., Purtle J., Nelson K.L. and Diez Roux A.V.

Abstract:
Objectives: Daily transport may impact depression risk among older adults through several pathways including facilitating the ability to meet basic needs, enabling and promoting contact with other people and nature, and promoting physical activity (e.g. through active transportation such as walking or walking to public transit). Both daily transport and depression are influenced by the neighborhood environment. To provide insights into how transport interventions may affect depression in older adults, we developed a pilot agent-based model to explore the contribution of daily transport and neighborhood environment to older adults' depression in urban areas.
Method: The model includes about 18,500 older adults (i.e. agents) between the ages of 65 and 85 years old, living in a hypothetical city. The city has a grid space with a number of neighborhoods and locations. Key dynamic processes in the model include aging, daily transport use and feedbacks, and the development of depression. Key parameters were derived from US data sources. The model was validated using empirical studies.
Results: An intervention that combines a decrease in bus fares, shorter bus waiting times, and more bus lines and stations is most effective at reducing depression. Lower income groups are likely to be more sensitive to the public transit-oriented intervention.
Conclusion: Preliminary results suggest that promoting public transit use may be a promising strategy to increase daily transport and decrease depression. Our results may have implications for transportation policies and interventions to prevent depression in older adults.

Subject Areas: Depression; Older Adults; Agent-Based Model; Daily Transport; Aging

6.2. Title: Do Not Forget About Public Transportation: Analysis of the Association of Active Transportation to School Among Washington, DC Area Children With Parental Perceived Built Environment Measures

Authors: Roberts J.D., Rodkey L., Ray R. and Saelens B.E

Abstract: Although the active transportation (AT) indicator received an F grade on the 2016 US Report Card on Physical Activity for Children and Youth, this AT assessment excluded public transportation. An objective of the Built Environment and Active Play Study was to assess youth AT, including public transportation, among Washington, DC area children in relation to parental perceptions of neighborhood built environment (BE) variables. Methods: Questionnaires were mailed to 2000 parents of children aged 7-12 years. AT to school (ATS) was assessed with the question: "In an average school week, how many days does your child use each of the following ways to get to and from school? (a) Walk; (b) Bike; (c) Car; (d) Bus or Metro." Parental perceived BE data were obtained through questionnaire items, and logistic regression was conducted to determine if BE variables were associated with youth ATS. Results: The sample included 144 children (50% female; average age 9.7 years; 56.3% white; 23.7% African American; 10.4% Asian American). Over 30% used ATS-public transportation 5 days per week, and nearly 13% used ATS-walking daily. Parental perceived BE variables significantly predicted youth ATS-walking and ATS-public transportation. Conclusions: ATS-public transportation is common among Washington, DC area youth, and parental perceptions of BE can significantly predict ATS.

Subject Areas: BEAP Study; Cross-Sectional Study; Sociodemographics; Sample Diversity; United States

6.3. Title: Active Travel, Public Transportation Use, and Daily Transport Among Older Adults: The Association of Built Environment

Authors: Yang, Y., Xu, Y., Rodriguez, D.A., Michael, Y. and Zhang, H.

Abstract:

Objecties:To examine active travel and public transportation use among U.S. older adults and the built environment characteristics associated with them.

Methods: Total active travel, public transportation trips, travel purpose diversity, total and maximum distance traveled for older adults ($\geq$ 65 years) relative to middle age adults (45-64 years) as reported in the 2009 National Household Travel Survey (NHTS) were compared using linear regression models and logistic regression models.

Results: Overall, adults over 65 years of age had 3.3 trips and total travel distance of 20.6 miles per day. Active travel and daily transport trips declined from younger to older age groups. Among the older adults, the daily transport varied by a number of characteristics. The association of built environment on older adults' transport differed by the specific environmental characteristics and travel modes.

Discussion: Existing transportation facilities and policies need to be adjusted to meet the challenge. Our study has a potential to contribute to the design of effective interventions that enhance health and quality of life for the burgeoning aging population in the U.S.

Subject Areas: Older Adults; Active Travel; Public Transportation; Physical Activity; Built Environment

Availability: Yang, Y., Xu, Y., Rodriguez, D.A., Michael, Y. and Zhang, H., 2018. *Active Travel, Public Transportation Use, and Daily Transport Among Older Adults: The Association of Built Environment.* Journal of Transport & Health.
https://www.sciencedirect.com/science/article/pii/S2214140517301123

6.4. Title: Residence in Unsafe Neighborhoods is associated with Active Transportation among Poor Women: Geographic Research on Wellbeing (GROW) Study

Authors: Lee, R.E., Kim, Y. and Cubbin, C.

Abstract: This study investigated associations of neighborhood context with active transportation among women with children after controlling for sociodemographic variables. We used data from the Geographic Research on Wellbeing study (GROW). In 2012 - 2013, GROW surveyed mothers who participated in California's Maternal and Infant Health Assessment. The dependent variable was active vs. inactive transportation. Mothers were coded as doing active transportation if they responded that they "walked," "walked and took public transportation," or "rode a bike," to most places they went in the previous 7 days, and were coded as doing inactive transportation if they responded that they "drove" any kind of vehicle or "got rides from someone else." The independent variables were neighborhood-level (census tract) poverty, income inequality, and perceived neighborhood safety. Using a stratified sample of poor or near-poor ($\leq$200% of the federal poverty level, N = 1231) and non-poor mothers (201+% of the federal poverty level, N = 1465), weighted logistic regression was conducted to estimate associations between neighborhood-level factors with active transportation after controlling for age, race/ethnicity, marital status, number of children, car ownership, education, family income, and population density. One in seven mothers reported active transportation with mothers in poor/near-poor families having a higher proportion of active transportation than mothers in higher income families (24% vs. 3%). In adjusted models, poor/near-poor mothers had twice the odds of using active transportation in very or somewhat unsafe neighborhoods compared with those in very safe neighborhoods. Neighborhood-level poverty and income inequality were not statistically significant. Results suggest that individual poverty is a primary driver of active transportation among mothers. Poor and near-poor mothers who perceived their neighborhoods as unsafe had higher odds of using active transportation. Policy and community resources should be allocated to provide safe routes in very unsafe areas where poor women live and where active transport is most likely to occur.

Subject Areas: Active transportation; ExerciseMothers; Poverty' Safety' Minority health

6.5. Title: How Do Stressed Workers Make Travel Mode Choices That Are Good For Their Health, Safety, and Productivity?

Authors: Yang, L.Q., Wipfli, B., Cyr, L., Currans, K.M. and Wang, L.

Abstract: It is well recognized in transportation and psychology research that commuting stress has consequences for commuters' travel safety, home environment, and work performance. Little research has addressed questions involving the possible interdependence between work stress, family stress, and commuting stress: Do workers having many demands from work and family life get more stressed out from a stressful commute? Or do stressed workers try to cope with work and non-work stress by choosing more relaxing travel modes?

This proposal integrates the perspectives from transportation, psychology, and health science by focusing on the relations between commuting stress, commuting mode choice, and consequences of such choice for commuters' health. To fill the gaps in the transportation and psychology literature, our proposal addresses two key research questions:1) Under what life and work circumstances are commuting workers more likely to commute via car vs. public transit vs. bicycle vs. on foot? 2) What are the different implications of choosing different commuting modes for commuters' mental and physical health and work outcomes? In Study 1, we used nationally representative census data and we devised a series of multinomial, logistic regression models to predict the probability of choosing each commute mode to address research question 1. In Study 2, we used cortisol and survey data collected daily over a workweek to address research question 2.

Findings from this research shed light on possible intervention opportunities that help commuting workers cope with various sources of life stress while making more informed decisions on travel mode choice. We contend that commuting workers, their employers, and transportation agencies and planners can all take part in these interventions that can benefit commuting workers' productivity and well-being, organizational bottom line as well as performance and safety of the transportation system.

Subject Areas: Commute stress; Commute mode choice; Active commute; Stress; Health

6.6. Title: Understanding and Modeling the Activity-Travel Behavior of University Commuters at a Large Canadian University

Authors: Daisy, N.S., Hafezi, M.H., Liu, L. and Millward, H.

Abstract: This paper examines the daily activity-travel behavior of undergraduate students, graduate students, faculty, and staff at a large university to better understand their activity travel demands for automobile, active transportation (AT), and transit trips. The data were derived from the first university-based activity travel diary survey [Environmentally Aware Travel Diary Survey (EnACT)] conducted in spring 2016 at Dalhousie University, Canada. Results show that students reside nearer to the campus than faculty and staff, and their trip length from home to school is significantly shorter. Zero-inflated negative binomial (ZINB) models show that if housing tenure is less than 1 year, it is more likely that the traveler will make more AT trips but fewer automobile trips. It indicates that individuals living far from the campus will produce fewer transit trips than those who live nearer. Interestingly, the mean number of AT trips per day for the overall sample is more than one trip, whereas for automobile trips and transit trips it is less than one. The behavioral analysis and empirical models provide useful insights that can be utilized to represent university populations in regional travel demand models, as well as to develop campus-based travel demand management (TDM) strategies.

Subject Areas: Activity-travel behavior; University Students; Active Transportation; Trip length; Zero-inflated negative binomial (ZINB) models

6.7. Title: E-hail (Rideshare) Knowledge, Use, Reliance, And Future Expectations Among Older Adults

Authors: Vivoda, J.M., Harmon, A.C., Babulal, G.M. and Zikmund-Fisher, B.J.

Abstract: The goals of this study were to explore e-hail (e.g., Uber/Lyft) knowledge, use, reliance, and future expectations among older adults. Specifically, we aimed to identify factors that were related to e-hail, and how older adults view this mode as a potential future transportation option. Data were collected from a sample of older adults using a pencil-and-paper mailed survey. Univariate, bivariate, and regression techniques were used to assess the relationships among e-hail and several demographic and other factors. Almost three quarters of the sample (74%) reported no e-hail knowledge. Only 1.7% had used e-hail to arrange a ride, and only 3.3% reported that they relied on e-hail for any of their transportation needs. Younger age, male gender, more education, higher transportation satisfaction, and discussing transportation options with others were all independently associated with greater e-hail knowledge. Male gender also predicted e-hail use. E-hail was the mode least relied upon by older adults. Current e-hail knowledge was the biggest predictor of anticipated future use. E-hail may be a viable future option for older adults who have limited or stopped driving. More exposure to e-hail and continued evolution of these services is required to overcome older adults' lower internet/smartphone use. Policies could be implemented at departments of motor vehicles to pair information or training on transportation alternatives (like e-hail) with elimination of driving privileges, or at doctors' offices, senior centers, or hospitals. Potential underlying reasons for the findings are also discussed.

Subject Areas: Aging; Driving; Technology; Uber/Lyft

Availability: Vivoda, J.M., Harmon, A.C., Babulal, G.M. and Zikmund-Fisher, B.J., 2018. *E-hail (Rideshare) Knowledge, Use, Reliance, And Future Expectations Among Older Adults.* Transportation Research Part F, pp.426-434.
https://www.researchgate.net/profile/Ganesh_Babulal/publication/324451095_E-hail_Rideshare_Knowledge_Use_Reliance_and_Future_Expectations_among_Older_Adults/links/5ace10f0aca27 23a33419b79/E-hail-Rideshare-Knowledge-Use-Reliance-and-Future-Expectations-among-Older-Adults.pdf

6.8. Title: Turn taking Behavior in Dual Earner Households with Children: A Focus on Escorting Routines

Authors: Han, B., Kim, J. and Timmermans, H.

Abstract: This article discusses results of a study on turn taking behavior in escorting children in dual-earner households. Using a multinomial logit model, the probability of different turn taking routines in escorting children is analyzed as a function of age and gender of the children, personal and household characteristics of the parents, properties of the job, and day of the week. Two types of turn taking behavior are examined. The first concerns routines in which during a single day one of the parents drops off the child and the other parent picks up the children again after completing the concerned activity (school, day care, outdoor activity). The second concerns routines in which one of the parents takes full responsibility and commits to all escorting duties on a particular day and the other parent does the same on another day of the week. Results, based on a sample of dual-earner households, indicate that turn taking represents a substantial, yet smaller share of escorting activities. The propensity of turn taking behavior is higher for highly educated, high-income dual-earner households. Fathers show the tendency of dropping off the children in the morning. Mothers tend to take responsibility for more flexible escorting needs.

Subject Areas: Task allocation; Turn taking behavior; Escorting; Dual-earner households; Gender role

6.9. Title: Young People's Travel – What's Changed and Why?

Authors: Chatterjee, K., Goodwin, P., Schwanen, T., Clark, B., Jain, J., Melia, S., Middleton, J., Plyushteva, A., Ricci, M., Santos, G. and Stokes, G.

Abstract: Young adults in Great Britain and other countries are driving less now than young adults did in the early 1990s. The Department for Transport (DfT) commissioned the Centre for Transport and Society (UWE, Bristol) and the Transport Studies Unit (University of Oxford) to carry out a systematic assessment of available evidence on the subject, both by review of UK and overseas published literature, and by new secondary analysis of existing UK data sets. The study sought to address the questions: In what ways have changes in young people's social and economic conditions, and lifestyles and attitudes impacted on their travel behaviour? How might those drivers, or other anticipated changes, be expected to impact their future travel demand?
The evidence has been evaluated on the basis of an extensive review of both transport-specific and wider social science literature in the UK (and other countries where, despite national differences, the trends show many similar patterns), and new analysis of data from the National Travel Survey (NTS) (1995-2014), the Census (2001 and 2011) and Understanding Society (five waves from 2009/10 to 2013/14).

Subject Areas: Young adults; Travel behaviour

Availability: Chatterjee, K., Goodwin, P., Schwanen, T., Clark, B., Jain, J., Melia, S., Middleton, J., Plyushteva, A., Ricci, M., Santos, G. and Stokes, G., 2018. *Young People's Travel – What's Changed and Why?* Review and Analysis. Project Report. Department for Transport, Bristol.
http://eprints.uwe.ac.uk/34640/

6.10. Title: A Survey of Restraint Methods for the Safe Transport of Children in Ground Ambulances

Authors: Woods, R.H., Shah, M., Doughty, C. and Gilchrest, A.

Abstract:

Objectives: The National Highway Traffic Safety Administration (NHTSA) released draft recommendations in 2010 on the safe transport of children in ground ambulances. The purpose of this study was to assess awareness of these guidelines among emergency medical service (EMS) agencies and to identify implementation barriers.

Methods: We conducted a cross-sectional, anonymous online survey of 911-responding, ground transport EMS agencies in Texas. Demographics, modes of transport based on case scenarios, and barriers to implementation were assessed.

Results: Of 62 eligible EMS agencies that took the survey, 35.7% were aware of the NHTSA guidelines, 62.5% agreed they would improve safety, and 41.1% planned to implement them. Seventy-five percent of EMS agencies used the ideal or acceptable alternative to transport children requiring continuous monitoring, and 69.5% chose ideal or acceptable alternatives for children requiring spinal immobilization. The ideal or acceptable alternative was not chosen for children who were not injured or ill (93.2%), ill or injured but not requiring continuous monitoring (53.3%), and situations when multiple patients required transport (57.6%). The main requirements for implementation were provider education, ambulance interior modifications, new guidelines in the EMS agency, and purchase of new equipment.

Conclusions: Few EMS agencies are aware of the NHTSA guidelines on safe transport of children in ground ambulances. Although most agencies appropriately transport children who require monitoring, interventions, or spinal immobilization, they use inappropriate means to transport children in situations with multiple patients, lack of injury or illness, or lack of need for monitoring.

Subject Areas: Safe Transport; Children

6.11. Title: Sharing is Caring: The Potential of the Sharing Economy to Support Aging in Place

Authors: Miller, J., Ward, C., Lee, C., D'Ambrosio, L. and Coughlin, J.

Abstract: This article explores innovative applications of sharing economy services that have the potential to support a population aging in place, especially the "oldest old," aged 85 and older, and their caregivers. A mixed-methods study conducted by the MIT AgeLab examined perceptions of and experiences with sharing economy services, ultimately finding opportunities and barriers to use. Thus, although sharing economy services have potential to support aging in place, to do so successfully will require reconstructing how older adults, family caregivers, aging service professionals, gerontology educators, and gerontology students conceptualize and deliver care to an aging population. We suggest examples for gerontology educators to integrate into their classrooms to further cultivate an appreciation among students of multiple approaches to intervention, including those that leverage sharing economy and technology-enabled platforms to support older adults and their caregivers.

Subject Areas: Aging in place; Caregivers; Technology; Sharing economy; Business; Gerontology and geriatrics curricula

6.12. Title: The Gender Earnings Gap in the Gig Economy: Evidence from over a Million Rideshare Drivers

Authors: Cook, C., Diamond, R., Hall, J., List, J.A. and Oyer, P.

Abstract: The growth of the "gig" economy generates worker flexibility that, some have speculated, will favor women. We explore this by examining labor supply choices and earnings among more than a million rideshare drivers on Uber in the U.S. We document a roughly 7% gender earnings gap amongst drivers. We completely explain this gap and show that it can be entirely attributed to three factors: experience on the platform (learning-by-doing), preferences over where to work (driven largely by where drivers live and, to a lesser extent, safety), and preferences for driving speed. We do not find that men and women are differentially affected by a taste for specific hours, a return to within-week work intensity, or customer discrimination. Our results suggest that there is no reason to expect the "gig" economy to close gender differences. Even in the absence of discrimination and in flexible labor markets, women's relatively high opportunity cost of non-paid-work time and gender-based differences in preferences and constraints can sustain a gender pay gap.

Subject Areas: Uber; Gig Economy; Gender pay gap

6.13. Title: An Investigation into the Role of Information and Communication Technologies on Travel Behaviour of Working Adults and Youth

Author: Wu, G.

Abstract: This thesis aims to investigate the diverse roles information and communications technologies (ICT) play in shaping individuals' mobility behaviour. In doing so, three strands of interrelated research questions are empirically analysed to better understand the use of ICT and its implications for travel among both working adults and millennials. A cross-sectional analysis is firstly performed to examine the variations in the relationships between Internet use and non-mandatory travel patterns according to household working status. By employing data from the 2005/06 Scottish Household Survey (SHS) and the two-part model, the ICT-travel relationships are found to be characterised by individual employment status and intra-household interactions, which impose different constraints on individuals' non-mandatory mobility patterns. A repeated cross-sectional analysis using the difference-in-differences (DD) estimation and the pooling of cross sections from the 2005/06 SHS data and the 2015 Integrated Multimedia City Data (iMCD) subsequently examines the evolutions in the ICT-travel relationships over time, and how temporal changes differ between the general adult population and the millennial generation. Findings suggest that the changes over time are generally characterised by diminishing complementarity and increasing substitution. Moreover, while the temporal changes for the general population are mostly found among the medium-to-heavy Internet users, for millennials, it is the light or medium-to-light users who see significant temporal changes. Finally, using the longitudinal datasets from the British Household Panel Survey (BHPS) and the Understanding Society Survey, an exploration is undertaken of the direct and indirect effects of prior experience with using ICT (as children) on millennials' current travel behaviour. The structural equation model is applied to examine the relationships between ICT use, travel choices, and environmental attitude. The longitudinal analysis finds that millennials' long-term exposure to ICT (since adolescence) may shape their current travel patterns by influencing their environmental attitudes. The findings from these analyses highlight the importance of considering the effects of personal, household, and social characteristics on the ICT-travel interactions. In addition, the research focuses on dynamic interactions and on the indirect or higher order roles of ICT in affecting travel behaviour as well as on the implications for transport planning practices and policy making.

Subject Areas: Information and Communications technologies (ICT); Mobility behaviour; Working adults and millennials

Availability: Wu, G., 2018. *An Investigation into the Role of Information and Communication Technologies on Travel Behaviour of Working Adults and Youth.* Doctoral dissertation, University of Glasgow.
http://theses.gla.ac.uk/8749/1/2018%20Wu%20PhD.pdf

6.14. Title: The Alabama VIP Older Driver Study Rationale and Design: Examining The Relationship Between Vision Impairment and Driving Using Naturalistic Driving Techniques

Authors: Owsley, C., McGwin, G., Antin, J.F., Wood, J.M. and Elgin, J.

Abstract: Older drivers aged ≥70 years old have among the highest rates of motor vehicle collisions (MVC) compared to other age groups. Driving is a highly visual task, and older adults have a high prevalence of vision impairment compared to other ages. Most studies addressing visual risk factors for MVCs by older drivers utilize vehicle accident reports as the primary outcome, an approach with several methodological limitations. Naturalistic driving research methods overcome these challenges and involve installing a high-tech, unobtrusive data acquisition system (DAS) in an older driver's own vehicle. The DAS continuously records multi-channel video of driver and roadway, sensor-based kinematics, GPS location, and presence of nearby objects in front of the vehicle, providing an objective measure of driving exposure. In this naturalistic driving study, the purpose is to examine the relationship between vision and crashes and near-crashes, lane-keeping, turning at intersections, driving performance during secondary tasks demands, and the role of front-seat passengers. An additional aim is to compare results of the on-road driving evaluation by a certified driving rehabilitation specialist to objective indicators of driving performance derived from the naturalistic data.

Subject Areas: Vision; Vision impairment; Driving; Aging; Motor vehicle collision; Naturalistic driving

Availability: Owsley, C., McGwin, G., Antin, J.F., Wood, J.M. and Elgin, J., 2018. *The Alabama VIP Older Driver Study Rationale and Design: Examining The Relationship Between Vision Impairment and Driving Using Naturalistic Driving Techniques.* BMC ophthalmology, 18(1), p.32. https://bmcophthalmol.biomedcentral.com/articles/10.1186/s12886-018-0686-5#Abs1

6.15. Title: When rideshare companies strand seniors the Jewish community does the driving

Author: Kronenfeld, J.

Abstract: Blog

Subject Areas: Seniors; Driving; Rideshare; Jewish Community; Transportation

Availability: Kronenfeld, J., 2018. . *When rideshare companies strand seniors the Jewish community does the driving.* Jewish News.
http://www.jewishaz.com/community/when-rideshare-companies-strand-seniors-the-jewish-community-does-the/article_ef02c290-74ac-11e8-a2e4-f348a04adda2.html

6.16. Title: Millennials Are Driving Again (but Not the Rich Ones)

Author: Grabar. H.

Abstract: Blog

Subject Areas: Millennials; Vehicle Miles Travelled

Availability: Grabar. H., 2018. *Millennials Are Driving Again (but Not the Rich Ones).* SlatePlus. https://slate.com/business/2018/05/rich-young-americans-drive-less-than-their-low-income-peers.html

6.17. Title: Uber gender pay gap 'explained' - Men drive faster than Women

Author: Bodkin. H.

Abstract: Blog

Subject Areas: Uber; Gender gap;

Availability: Bodkin. H., 2018. *Uber gender pay gap 'explained' - Men drive faster than Women.*
The Telegraph.
https://www.telegraph.co.uk/news/2018/02/07/uber-gender-pay-gap-explained-men-drive-faster-women/

7. Survey, Data Synthesis, and Other Applications

7.1. Title: Optimizing Copious Activity Type Classes Based on Classification Accuracy and Entropy Retention

Authors: Ectors, W., Reumers, S., Lee, W.D., Kochan, B., Janssens, D., Bellemans, T. and Wets, G.

Abstract: Despite the advantages, big transport data are characterized by a considerable disadvantage as well. Personal and activity-travel information are often lacking, making it necessary to deduce this information with data mining techniques. However, some studies predict many unique activity type classes (ATCs), while others merge multiple activity types into larger ATCs. This action enhances the activity inference estimation, but destroys important activity information. Previous studies do not provide a strong justification for this practice. An objectively optimized set of ATCs, balancing model prediction accuracy and preserving activity information from the original data, becomes essential. Previous research developed a classification methodology in which the optimal set of ATCs was identified by analyzing all possible ATC combinations. However, for the US National Household Travel Survey (NHTS) 2009 data set which comprises 36 ATCs (home activity excluded), this approach is practically impossible in a finite amount of time since there would be 3.82x10wedge30 unique combinations. The aim of this paper is to optimize which original ATCs should be grouped into a new class, and this for data sets for which it is impossible or impractical to simply calculate all ATC combinations. The proposed method defines an optimization parameter U (based on classification accuracy and information retention) which is maximized in an iterative search algorithm. The optimal set of ATCs for the NHTS 2009 data set was determined. A comparison finds that this optimum is considerably better than many expert opinion activity type classification systems. Convergence was confirmed and performance gains were benchmarked.

Subject Areas: Accuracy; Activity choices; Algorithms; Classification; Data analysis; Data fusion; Entropy (Communications); Machine learning; Optimization; Sensitivity analysis; Trip purpose

7.2. Title: Tool for Querying the National Household Travel Survey Data

Author: Rathore, A.

Abstract: The goal of the project is to create a database for storing the National Household Travel Survey (NHTS) data, and a user interface to query the database. Currently, the survey data is stored in excel files in the CSV format, which makes it hard to perform complex analyses over the data. Analyses of interest to transportation community include comparisons of the trips made by urban household to those made by rural household, finding the average trip time spent based on ethnicity, the total travel time of a particular household, the preferred vehicle by a specific household, average time spent per shopping trip, etc. The tool designed for the purpose of querying the NHTS database is a Python-based Web application. Django is used as the Web framework for this project and PostgreSQL is used for the back-end purpose. The user interface consists of various drop-down lists, text-boxes, buttons and other user interface components that facilitate querying the database and presenting the results in formats that allow easy interpretation. FusionCharts Django-Wrapper and FusionCharts Jquery-Plugin are used to visualize the data in the chart form. A Codebook of the NHTS dataset is also linked for the reference purpose at any point for the user. The tool built in the project allows the user to get a deeper understanding of the data, not only by plotting the data in the form of line charts, bar charts, two column graph, but also by providing the results of the queries in the CSV format for further analysis.

Subject Areas: NHTS; National Household Travel Survey; Database; Python; FusionCharts

Availability: Rathore, A., 2018. *Tool for Querying the National Household Travel Survey Data.*Kansas State University, MS Thesis.
http://krex.k-state.edu/dspace/handle/2097/38795

7.3. Title: Assessing the Effects of A Mixed-Mode Design in a Longitudinal Household Travel Survey

Authors: Eisenmann, C., Chlond, B., Minster, C., Jödden, C. and Vortisch, P.

Abstract: The German Mobility Panel (MOP) is a national household travel survey, which has been collecting data on travel behavior in Germany since 1994. One of the MOP's central assets is its ability to provide time-series data on travel behavior. Thus, the comparability of survey results from different years is a major objective of the survey method used. Declining survey participation rates in the last decade in various socio-demographic groups resulted in the implementation of a mixed-mode design for the MOP in 2013, both for the sampling stage (landline and mobile phone recruitment) and the data collection stage (paper and web). In this study, we analyze whether the adaptations in the survey mode do indeed improve the results and, if so, why and to what degree. Ideally, the survey mode adaptions have increased the representativeness of the MOP. However, measurement biases due to the mixed-mode design are also conceivable. To decompose survey mode effects, we applied the propensity score weighting method. This method imputes the hypothetical responses participants would have given in different survey modes; disparities between actual responses and hypothetical responses under another mode are then traced back to the mixed-mode design. Our analysis indicates that trip-rate biases on shopping, leisure, and short trips are partly caused by the mixed-mode design; in contrast, quantities of time spent in the transportation system, trips made by car and public transportation, and commuting trips are hardly biased.

Subject Areas: Germany Mobility Panel; Mixed-Mode Survey; National Household Travel Survey; Propensity Score Weighting

7.4. Title: Are Cars Used Differently in Germany than in California? Findings from Annual Car-Use Profiles

Authors: Eisenmann, C. and Buehler, R.

Abstract: The personal car is the most important mode of transport in most countries. Many policies are in place in different countries and regions to tackle unsustainable trends associated with car travel. A reason for the varying success of the same measure from one country to another might be different car-usage patterns. Using Germany and California as case studies to investigate differences and similarities in car use, we adapted the CUMILE model both for Germany and California in order to generate detailed profiles of car use over one year. Hierarchical cluster analysis subdivided the sample into clusters with similar car-usage characteristics. Then, we compared clusters of cars with similar usage between Germany and California in terms of cluster size, car properties and sociodemographic characteristics of their owners. The same eight car-usage clusters emerged in both study areas - with varying cluster sizes. We descriptively labeled the clusters: standing cars, moderate-range cars, day-to-day cars, workday cars, weekend cruisers, long-distance cars, short-haul cars and all-rounders. A better understanding of car-use patterns throughout a year and the size and characteristics of car-use clusters is beneficial for the identification of policies to make transport systems more sustainable.

Subject Areas: Car-use; Cluster analysis; German mobility panel; California Household Travel Survey

7.5. Title: Aggregation Biases in Discrete Choice Models

Authors: Wong, T., Brownstone, D. and Bunch, D.S.

Abstract: This paper examines the common practice of aggregating choice alternatives within discrete choice models. We carry out a Monte Carlo study based on realistic vehicle choice data for sample sizes ranging from 500 – 10,000 individuals. We consider methods for aggregation proposed by McFadden (1978) and Brownstone and Li (2017) as well as the more commonly used methods of choosing a representative disaggregate alternative or averaging the attributes across disaggregate alternatives. The results show that only the "broad choice" aggregation method proposed by Brownstone and Li provides unbiased parameter estimates and confidence bands. Finally, we apply these aggregation methods to study households' choices of new 2008 model vehicles from the National Household Travel Survey (NHTS) where 1120 unique vehicles are aggregated into 235 make/model classes. Consistent with our Monte Carlo results we find large differences between the resulting estimates across different aggregation methods.

Subject Areas: Discrete choice; Aggregation; Household vehicle demand

7.6. Title: An Investigation of Tour Generation Models Combining Two Waves of Household Travel Surveys through Pooled Models

Authors: Shams, K., Asgari, H., Hossan, M.S. and Jin, X.

Abstract: This paper presents a study that examines two waves of travel survey data through a pooled model structure. The pooled model structure provides a means to take advantage of multiple data sources which will lead to a better estimate and understanding of travel behavior. In particular, it accounts for the difference in data variance and therefore allows for the comparison of the true impacts of the model parameters on travelers' tour-making behavior. Larger variance is found in the 1998 data than in the 2010 data. Comparison between model parameters reveals significant behavioral changes among several socio-economic and demographic groups. In terms of common variables, the magnitude of the coefficient values has generally decreased, which conforms to the overall decreasing trend in traveling. Overall, the model equality tests indicate that the models developed based on the two data sources do not have equal taste parameters, thus the transferability hypothesis is rejected. The results of this study are expected to have implications for the application of models based on cross-sectional data, especially over long time periods.

Subject Areas: Pooled Model; Temporal Transferability; Tour Generation Models; Regional Household Travel Survey; Model Equality Test Statistics

7.7. Title: Human-Machine Interaction for Vehicles: Review and Outlook

Author: Kun, A.L.

Abstract: Today's vehicles have myriad user interfaces, from those related to the moment-to-moment control of the vehicle, to those that allow the consumption of information and entertainment. The bulk of the research in this domain is related to manual driving. With recent advances in automated vehicles, there is an increased attention to user interactions as they relate to automated vehicles. In exploring human machine interaction for both manual and automated driving, a key issue has been how to create safe in-vehicle interactions that assist the driver in completing the driving task, as well as to allow drivers to accomplish various non-driving tasks. In automated vehicles, human-machine interactions will increasingly allow users to reclaim their time, so that they can spend time on non-driving tasks. Given that it is unlikely that most vehicles will be fully automated in the near future, there are also significant efforts to understand how to help the driver switch between different modes of automation. This paper provides a review of these areas of research, as well as recommendations for future work.

Subject Areas: Research; Future recommendations; Autonomous Vehicle; Safe in-vehicle interactions

7.8. Title: How Commuters' Motivations to drive relate to Propensity to Carpool: Evidence from the United Kingdom and the United States

Authors: Neoh, J.G., Chipulu, M., Marshall, A. and Tewkesbury, A.

Abstract: This paper examines how commuter motivations to drive relate to propensities to carpool, using two sequential studies: Study 1 determines the key dimensions of commuters' motivations for driving using secondary data (N=432) from staff and postgraduate student commuters at a United Kingdom university. We code the contents of the respondents? self-reported reasons for driving (i.e. the instrumental rationalities attributed to driving with respect to varying purposes) to identify keywords representing motivation to drive; we then analyse the keyword data using multidimensional scaling (MDS). Study 2 examines how the dimensions discovered through study 1 relate to propensity to carpool, using structural equation modelling (SEM). Data for Study 2 are the survey responses of commuters (N=1028) based in the United States. The MDS reveals four key dimensions of motivation to drive. These capture instrumental rationalities for driving within four situational domains which we term: (1) Family; (2) Public transport impractical changes; (3) Rigid schedule; and (4) Non-urban areas. The SEM results show that the regression coefficients on propensity to carpool of Public transport impractical changes and Rigid schedule are significant and negative; the Family domain has a positive but non-significant regression coefficient. Regarding demographics, men's mean values on all four domain variables are significantly higher than those for women, except for the Family domain where the mean value for women is higher; meanwhile, age predicts decreasing propensity to carpool. Additionally, the situational domains of Public transport impractical changes, Rigid schedule and Non-urban areas significantly positively correlate. Consequently, overall, the results imply that addressing commuters' instrumental rationalities for driving, namely increasing schedule flexibility and providing more direct or quicker public transport, could indirectly encourage commuters to carpool. The study makes an original contribution by estimating the causal relationship between commuters' motivation to drive and propensity to carpool.

7.9. Title: Construction of Register-based Commuting Measures

Authors: Blind, I., Dahlberg, M., Engström, G. and Östh, J.

Abstract: Early empirical studies in labour and urban economics addressing the role of commuting (on, e.g., wages and locational choice) have typically been confined to the use of survey data. Researchers are, however, increasingly getting access to large register databases with detailed information on where individuals live and work. A variety of methods have thus emerged to exploit the geocoded characteristic of the data to calculate commuting measures that go beyond simple Euclidean metrics. These methods involve new techniques that make use of geographic information system (GIS) routing software or application programming interfaces provided by third-party developers. This article provides (i) a brief survey of the small but emerging literature that uses geocoded register data to calculate different commuting measures, (ii) an example on how register-based commuting measures can be constructed along with descriptive evidence on how different commuting measures compare for different socio-economic groups using rich Swedish register data, (iii) a discussion of the pros and cons of different methods and measures, and (iv) a discussion of the potential of using mobile phone data to further improve register-based commuting measures.

Subject Areas: Commuting; Geographic Information System (GIS); Research; Databases; Euclidean metrics

7.10. Title: Are We Ready to Embrace Connected and Self-Driving Vehicles? A Case Study of Texans

Authors: Akbar, Bansal, P. and Kockelman, K.M.

Abstract: While connected, highly automated, and autonomous vehicles (CAVs) will eventually hit the roads, their success and market penetration rates depend largely on public opinions regarding benefits, concerns, and adoption of these technologies. Additionally, the introduction of these technologies is accompanied by uncertainties in their effects on the carsharing market and land use patterns, and raises the need for tolling policies to appease the travel demand induced due to the increased convenience. To these ends, this study surveyed 1088 respondents across Texas to understand their opinions about smart vehicle technologies and related decisions. The key summary statistics indicate that Texans are willing to pay (WTP) $2910, $4607, $7589, and $127 for Level 2, Level 3, and Level 4 automation and connectivity, respectively, on average. Moreover, affordability and equipment failure are Texans? top two concerns regarding AVs. This study also estimates interval regression and ordered probit models to understand the multivariate correlation between explanatory variables, such as demographics, built-environment attributes, travel patterns, and crash histories, and response variables, including willingness to pay for CAV technologies, adoption rates of shared AVs at different pricing points, home location shift decisions, adoption timing of automation technologies, and opinions about various tolling policies. The practically significant relationships indicate that more experienced licensed drivers and older people associate lower WTP values with all new vehicle technologies. Such parameter estimates help not only in forecasting long-term adoption of CAV technologies, but also help transportation planners in understanding the characteristics of regions with high or low future-year CAV adoption levels, and subsequently, develop smart strategies in respective regions.

Subject Areas: Connected and autonomous vehicles; Ordered probit; Interval regression; Public opinion survey; Willingness to pay

7.11. Title: Detecting Popular Temporal Modes in Population-scale Unlabelled Trajectory Data

Authors: Xu, F., Xia, T., Cao, H., Li, Y., Sun, F. and Meng, F.

Abstract: With the rapid process of urbanization, revealing the underlying mechanisms behind urban mobility has become a crucial research problem. The movements of urban dwellers are often constituted by their daily routines, and exhibit distinct and contextual temporal modes, i.e., the patterns of individuals allocating their time across different locations. In this paper, we investigate a novel problem of detecting popular temporal modes in population-scale unlabelled trajectory data. Our key finding is that the detected temporal modes capture the semantic feature of human's living style, and is able to unravel meaningful correlations between urban mobility and human behavior. Specifically, we represent the temporal mode of a trajectory as a partition of the time duration, where the time slices associated with same locations are partitioned into same subsets. Such abstraction decouples the temporal modes from actual physical locations, and allows individuals with similar temporal modes yet completely different physical locations to have similar representations. Based on this insight, we propose a pipeline system composed of three components: 1) noise handler that eliminates the noises in the raw mobility records, 2) representation extractor for temporal modes, and 3) popular temporal modes detector. By applying our system on three real-world mobility datasets, we demonstrate that our system effectively detects the popular temporal modes embedded in population-scale mobility datasets, which is easy to be interpreted and can be justified through the associated PoIs and mobile applications usage. More importantly, our further experiments reveal insightful correlations between the popular temporal modes and individuals' social economic status, i.e. occupation information, which sheds light on the mechanisms behind urban mobility.

Subject Areas: Urban mobility; Temporal modes; Trajectory data; Mobility datasets

7.12. Title: Residential Location Choice in the Era of Shared Autonomous Vehicles

Authors: Zhang, W. and Guhathakurta, S.

Abstract: This study examines the potential changes in residential location choice in a scenario where shared autonomous vehicles (SAVs) are a popular mode of travel in the Atlanta metropolitan area. This hypothetical study is based on an agent-based simulation approach, which integrates residential location choice models with a SAV simulation model. The coupled model simulates future home location choices given current home location preferences and real estate development patterns. The results indicate that commuters may relocate to neighborhoods with better public schools and more amenities due to reductions in commute costs.

Subject Areas: Shared autonomous vehicles; Residential location choice; Urban form; Sprawl

7.13. Title: Tool for Querying the National Household Travel Survey Data

Author: Rathore, A.

Abstract: The goal of the project is to create a database for storing the National Household Travel Survey (NHTS) data, and a user interface to query the database. Currently, the survey data is stored in excel files in the CSV format, which makes it hard to perform complex analyses over the data. Analyses of interest to transportation community include comparisons of the trips made by urban household to those made by rural household, finding the average trip time spent based on ethnicity, the total travel time of a particular household, the preferred vehicle by a specific household, average time spent per shopping trip, etc. The tool designed for the purpose of querying the NHTS database is a Python-based Web application. Django is used as the Web framework for this project and PostgreSQL is used for the back-end purpose. The user interface consists of various drop-down lists, text-boxes, buttons and other user interface components that facilitate querying the database and presenting the results in formats that allow easy interpretation. FusionCharts Django-Wrapper and FusionCharts Jquery-Plugin are used to visualize the data in the chart form. A Codebook of the NHTS dataset is also linked for the reference purpose at any point for the user. The tool built in the project allows the user to get a deeper understanding of the data, not only by plotting the data in the form of line charts, bar charts, two column graph, but also by providing the results of the queries in the CSV format for further analysis.

Subject Areas: NHTS; National Household Travel Survey; Database; Django; Python; Fusion-Charts

8. Traffic Safety

8.1. Title: A High-Injury Network for Atlanta: How are Severe and Fatal-Injury Crashes Concentrated on Atlanta's Streets?

Author: Saxton, J.

Abstract: Following the lead of Sweden in 1997, 32 US cities have adopted Vision Zero policies that aim to eliminate all traffic deaths on their streets (Vision Zero Network 2017). After New York City in 2012, numerous cities in the northeast and on the west coast have adopted such policies as a first step toward eliminating the tens of thousands of preventable deaths that occur in the US every year. Adding urgency to their cause is the fact that in the United States, the annual number of traffic fatalities has increased since 2011, after decreasing steadily for decades. Cities can target future investments by creating a High-Injury Network which identifies the city streets where the majority of severe injuries and fatalities occur. This paper examines the precedent of Vision Zero policies and High-Injury Networks established in US cities and around the world. It looks at varying approaches to analyzing and representing severe injury and fatality data while considering a number of challenges posed in implementing a High-Injury Network. It aims to address the following question: How does street design in Atlanta impact the incidence of severe injury and fatality in traffic collisions?

Subject Areas: Vision Zero policies; Traffic deaths; High-Injury Networks

Availability: Saxton, J., 2018. *A High-Injury Network for Atlanta: How are Severe and Fatal-Injury Crashes Concentrated on Atlanta's Streets?*. M.S. Thesis, School of City and Regional Planning, Georgia Institute of Technology.
https://smartech.gatech.edu/handle/1853/59993?show=full

8.2. Title: The Exploration of Factors That Affect Travel Safety of Child Passengers

Author: Liu, K.

Abstract: There are few studies on the travel safety of child passenger in China. The study aims to describe the seating position and restraint practice of child passenger in China's first-tier cities. The travel information on the children enrolled in 10 early education institutions, 15 kindergartens and 10 primary schools was randomly selected in Beijing, Shanghai, Guangzhou, Chongqing and Jinan in recent years. A total of 4900 parents were surveyed to collect children's travel information and 3556 valid questionnaires were taken back. The adjusted rate ratios for optimal seating position (rear-seated alone) versus suboptimal seating position and restraint use versus non-use of restraints among child passengers were analyzed and evaluated using multivariate binomial regression. Through the survey, it is found that the suboptimal seating position (31.2%) and non-use of restraints (45.4%) were common among child passengers. Younger age ($\leq$8 years old) is an unfavorable factor resulting in seating in rear seats by child passengers; and the higher the driver?s degree of education, the higher the family income and the more understanding about car seat is, the bigger likelihood of being rear-seated alone by child passengers is. Younger age ($\leq$8 years old) is also an unfavorable factor resulting in restraint use by child passengers; and the more understanding about car seat, the more concern on the relevant legislative information and the more knowledge about defective car seat recall have by parents, the bigger likelihood of using restraints for their children during travel. This study suggests that restraint non-use and suboptimal seating position are still common among child passengers in China's first-tier cities and also identifies the factors influencing restraint use and seating position choice for child passengers. There is an urgent need to improve child passenger safety in China. At the same time, it is also necessary to strengthen the publicity about child passenger's safety before the relevant laws and regulations are promulgated.

Subject Areas: Child Passengers; Restraints; Seating Position; Questionnaire Survey; Travel Safety

8.3. Title: Sturdy Inference and the Amelioration Potential For Driverless Cars: The Reduction of Motor Vehicle Fatalities due to Technology

Author: Fowles, R. and Loeb, P.D.

Abstract: Motor vehicle crashes continue to result in a large number of fatalities each year and represent the leading cause of death for young persons. This study is the first to examine specifically the effects of a set of focus variables thought to be major contributors to motor vehicle fatalities including distractions caused by, for example, cell phones, suicidal propensities among others using a newly developed Bayesian technique designed to measure the sturdiness of the results. The analysis is conducted using a rich panel data set for the period 1980-2010 by the State and the District of Columbia which includes motor vehicle, economic, and driver-related variables. As mentioned, the analysis makes use of a new Bayesian statistic developed by Leamer, that is, S-values. This statistic summarizes both estimation uncertainty and model ambiguity by considering millions of potential models of motor vehicle fatalities. Once the major factors of motor vehicle fatalities are unambiguously determined and their influences measured, the study considers the ameliorating potential of driverless cars on such fatalities as well as their costs to society. In particular, the ability of driverless cars with, for example, their self-braking capacity, to reduce the number of crashes, and their associated fatalities and injuries in a significant manner is examined. In addition, they may offer individuals the ability to use cell phones for calls and texting while not enhancing risks to vehicle occupants and pedestrians. Obviously, they may also serve in place of a designated driver should alcohol use be an issue. However, the ability of driverless vehicles to provide safe transportation is not without costs. These include developing and maintaining reliable computer systems and sensors along with back-up systems while addressing legal and possible environmental issues. We conclude that driverless cars offer the potential to ameliorate motor vehicle fatalities due to distractions, such as with the use of cell phones, alcohol use, and suicidal propensities. In addition, modernization of the vehicle fleet is expected to reduce motor vehicle fatalities since newer vehicles are expected to incorporate technologies which may be life saving.

Subject Areas: Alcohol; Bayesian econometrics; Driverless vehicles; Motor vehicle crashes; Motor vehicle fatalities; Vehicle safety

Availability: Fowles, R. and Loeb, P.D., 2018. *Sturdy Inference and the Amelioration Potential For Driverless Cars: The Reduction of Motor Vehicle Fatalities due to Technology*. In Transportation Policy and Economic Regulation (pp. 331-361).
https://www.sciencedirect.com/science/article/pii/B9780128126202000134

8.4. Title: Work Zone Intrusion Report Interface Design

Authors: Craig, C.M., Morris, N.L., Libby, D. and Davis, B.

Abstract: While necessary for roadways, work zones present a safety risk to crew. Half of road workers deaths between 2005 and 2010 were due to collisions with motorists intruding on the work zone. Therefore, addressing intrusions is an important step for ensuring a safe work environment for crew members. However, a recent research synthesis at the Minnesota Department of Transportation found that few states had an explicit method for systematically collecting work zone intrusion data. The purpose of this work zone intrusion interface design project was to design an efficient, comprehensive, and user-friendly reporting system for intrusions in work zones. A user-centric, iterative design process was employed to design an adaptable web-based and paper report to account for simple documentation of intrusions not deemed a threat to worker safety and a detailed report for more thorough documentation of serious intrusion events. Final recommendations include organizational changes and support to encourage workers to complete the form and provide valuable data to the state.

Subject Areas: Human factors in crashes; Transportation safety; Work zones; Data collection; Feasibility analysis

Availability: Craig, C.M., Morris, N.L., Libby, D. and Davis, B., 2018. *Work Zone Intrusion Report Interface Design.* Minnesota Department of Transportation, Retrieved from the University of Minnesota Digital Conservancy.
https://conservancy.umn.edu/handle/11299/197459

8.5. Title: "Complete Streets" Policies and Eliminating Pedestrian Fatalities

Author: Schneider, R.J.

Abstract: NA

Subject Areas: Public health; "Complete Street" Policy; Traffic injuries

Availability: Schneider, R.J., 2018. *"Complete Streets" Policies and Eliminating Pedestrian Fatalities.* American Journal of Public Health (AJPH), Vol 108(4), pp:431. https://ajph.aphapublications.org/doi/abs/10.2105/AJPH.2018.304317?journalCode=ajph

8.6. Title: The Post-Discharge Car Seat Challenge: An Investigation of Utilization and Feasibility

Author: Haupt-Harrington, R.L.

Abstract: Assuring the safe transportation of infants is a well-known requirement at the time of hospital discharge, and consequently, medically fragile and/or premature infants generally undergo a car seat challenge to ensure they are physiologically ready to travel in a rear-facing car seat. Most tested (or challenged) infants will travel home from the hospital in a properly fitted car seat; however, because some infants are unable to maintain a patent airway in the semi-reclined position of a car seat, they must instead travel home in a recumbent car bed. Infants that initially fail the car seat challenge should undergo an additional car seat challenge prior to transitioning to a traditional, semi-reclined car seat. Although predischarge challenges are performed at the author?s local hospital on an as-needed basis, there was no locally accessible option for car seat challenges to occur after hospital discharge. To address this service gap, the author explored the feasibility, utilization, and potential implementation of a program to provide post-discharge car seat challenges using Kotter's Change Management Model as a guide for program development. Informed by the evidence and study findings, the local clinic subsequently adopted a post-discharge car seat challenge program into current practice.

Subject Areas: Car seat; Car seat challenge; Airway; Safe infant transportation

Availability: Haupt-Harrington, R.L., 2018. *The Post-Discharge Car Seat Challenge: An Investigation of Utilization and Feasibility.* Pediatric Nursing, 44(2), pp.61-80.
https://search.proquest.com/openview/e1490ce637d311a61c34dae44a8810dd/1?pq-origsite=gscholar&cbl=47659

8.7. Title: Awareness of Vision Zero among United States' Road Safety Professionals

Author: Evenson, K.R., LaJeunesse, S. and Heiny, S.

Abstract: <u>Background:</u> Vision Zero is a strategy to eliminate all fatalities and serious injuries from road traffic crashes, while increasing safe and equitable mobility for all. In 2015, the United States' Department of Transportation announced the official target of the federal government transportation safety policy was zero deaths. In 2017, we assessed the dissemination of Vision Zero in the United States.

<u>Methods:</u> We conducted a web-based survey in 2017 among road safety professionals. Email invitations were sent using relevant membership directories and conference lists.

<u>Results:</u> We surveyed 192 road safety professionals, including planning/engineering (57.8%), public health (16.7%), and law enforcement/emergency medical services (EMS) (8.9%). Awareness of Vision Zero was higher among planning/engineering fields (97.3%) compared to law enforcement/EMS (76.5%) and public health (75.0%). Awareness was similar by number of years working in the field. Awareness was higher in the South (95.9%) and Northeast (95.0%) regions, followed by the West (90.8%) and Midwest (85.2%) Census regions. Among those that heard of Vision Zero (n=174), 41.8% worked at a municipality with a Vision Zero campaign, while 41.2% did not. Among those working at a municipality with a Vision Zero campaign (n=71), about half participated in the campaign (54.9%) while the other half did not (45.1%).

<u>Conclusions:</u> With widespread dissemination of the Vision Zero strategy to road safety professionals, next steps include evaluating how Vision Zero is being adopted, implemented, and maintained in communities, as well as the awareness and acceptability by community members, and to identify the most promising policies and practices.

Subject Areas: Awareness; Bicycling; Diffusion of innovations; Motor vehicle crashes; Road safety; Pedestrians Walking

8.8. Title: Evaluation of Surrogate Measures for Pedestrian Trips at Intersections and Crash Modeling

Authors: Lee, J., Abdel-Aty, M. and Shah, I.

Abstract: Pedestrians are considered the most vulnerable road users who are directly exposed to traffic crashes. With a view to addressing the growing concern of pedestrian safety, Federal and local governments aim at reducing pedestrian-involved crashes. Nevertheless, pedestrian volume data are rarely available even though they among the most important factors to identify pedestrian safety. Thus, this study aims at identifying surrogate measures for pedestrian exposure at intersections. A two-step process is implemented: the first step is the development of Tobit and generalized linear models for predicting pedestrian trips (i.e., exposure models). In the second step, negative binomial and zero inflated negative binomial models were developed for pedestrian crashes using the predicted pedestrian trips. The results indicate that among various exposure models the Tobit model performs the best in describing pedestrian exposure. The identified exposure-relevant factors are the presence of schools, car-ownership, pavement condition, sidewalk width, bus ridership, intersection control type and presence of sidewalk barrier. It was also found that the negative binomial model with the predicted pedestrian trips and that with the observed pedestrian trips perform equally well for estimating pedestrian crashes. Also, the difference between the observed and the predicted pedestrian trips does not appear as statistically significant, according to the results of the t-test and Wilcoxon signed-rank test. It is expected that the methodologies using predicted pedestrian trips or directly including pedestrian surrogate exposure variables can estimate safety performance functions for pedestrian crashes even though when pedestrian trip data is not available.

Subject Areas: Pedestrian exposure; Pedestrian safety; Pedestrian crash analysis; Surrogate measures; Zero inflated negative binomial model; Risk factors

8.9. Title: Integrated Modeling Approach for Non-Motorized Mode Trips and Fatal Crashes in the Framework of Transportation Safety Planning

Authors: Lee, J., Abdel-Aty, M., Cai, Q., Wang, L. and Huang, H.

Abstract: In recent decades, considerable efforts have been made to incorporate traffic safety into long-term transportation plans (LTTPs), a process which is often termed transportation safety planning (TSP). Although some researchers have attempted to integrate transportation plans and safety by adopting transportation planning data (e.g., trip generation) for estimating traffic crash frequency at the macroscopic level, no studies have attempted to develop trip and safety models in one structure simultaneously. A Bayesian integrated multivariate modeling approach is suggested for estimating trips and crashes of non-motorized modes (i.e., walking and cycling). American Housing Survey (AHS) data were collected from the U.S. Census Bureau and were used for the proposed approach. In the first part of the proposed model, the probabilities of choosing walking and cycling modes were estimated, and the estimated probabilities were converted to trips by multiplying the number of sampled households. In the second part, the estimated trips were fed into crash prediction models (or safety performance functions) as an exposure variable. The modeling result revealed many contributing factors for pedestrian/bicycle trips and crashes. Possible shared unobserved features between pedestrian and bicycle trips, and between pedestrian and bicycle crashes, were accounted for by adopting a multivariate structure. In addition, it was found that the crash models with the estimated exposures outperform those with the observed exposures. It is expected that the integrated modeling approach for trips and crashes in this study will provide great insights into the future directions of TSP.

Subject Areas: Long-term transportation plans (LTTPs); Trips; Crashes

9. Transit Planning

9.1. Title: The Impacts of Built Environment Characteristics of Rail Station Areas on Household Travel Behavior

Authors: Park, K., Ewing, R., Scheer, B.C. and Tian, G.

Abstract: Transit-oriented development (TOD) has gained popularity worldwide as a sustainable form of urbanism by concentrating developments near a transit station so as to minimize auto-dependency and maximize ridership. Existing TOD studies, however, have limits in terms of small sample size and aggregate-level analysis. This study examines various travel outcomes - VMT, auto trips, transit trips, and walk trips - in rail-based station areas in eight U.S. metropolitan areas in order to understand the role of neighborhood built environment characteristics. Two-stage hurdle models handle excess zero values in trip count variables and multi-level models deal with three-level data structure - household within station areas within regions. The final models show that automobile use is associated with land-use diversity and street network design of a station area; transit use is strongly related to transit availability and land-use diversity; and walking is related to transit availability, land-use diversity, and street network design. The weakest influence among station-area environment factors is density. In sum, a TOD, a station area having a dense, mixed-use, walkable, and transit-friendly environment, motivates residents to walk more and take transit more while driving less.

Subject Areas: Transit-oriented development; Travel outcomes; Household travel survey; Two-stage hurdle model; Multi-level model

Availability: Park, K., Ewing, R., Scheer, B.C. and Tian, G., 2018. *The Impacts of Built Environment Characteristics of Rail Station Areas on Household Travel Behavior.* Cities. http://mrc.cap.utah.edu/wp-content/uploads/sites/8/2015/12/RailStationImpacts.pdf

9.2. Title: Determining Transit Service Coverage by Non-Motorized Accessibility to Transit: Case Study of Applying GPS Data in Cincinnati Metropolitan Area

Authors: Zuo, T., Wei, H. and Rohne, A.

Abstract: To more effectively expand transit service coverage through promoting bicycling, a practical approach is presented in the paper for estimating the coverage of transit service accessible by non-motorized modes (i.e. walking and bicycling). The non-motorized accessibility to transit is determined by the connectivity and facilities of non-motorized network. Using the data from 2009 to 2010 GPS-based Household Travel Survey in the Cincinnati metropolitan area, the study examines distance thresholds of such non-motorized transit access trips and identifies the spatial boundary and geographic area of transit catchment areas in the Geographic Information System environment. Results suggest that bicycle enables people to access the transit service. The bicycle-transit catchment area is estimated as 1.7 and 2.3 times of the size of pedestrian-transit catchment area at home and activity ends respectively. As a result, more households and employment can reach the transit service via bicycling than walking (52.45% vs. 36.72% for households and 47.82%. vs. 33.07% for employment in the study area). Suburbs, where near half of population and employment situate, are comparatively underserved. Especially, only 27.14% % of the disadvantaged population in suburbs, can access transit by walking, but the percent is increased to 50.96% if using a bicycle. Besides the distance threshold, the non-motorized accessibility to transit is found to be a significant factor determining transit catchment areas. The transit service area can be expanded if a safer and more comfortable bicycling environment is available. Those findings can also be further used as references in the transit-oriented development planning.

Subject Areas: Transit service coverage; Non-motorized accessibility to transit; Transit catchment area

9.3. Title: Can Public Transportation Compete with Automated and Connected Cars?

Author: Buehler, R.

Abstract: Over the next 30 years, technological innovation will make automobile travel more convenient. Automated and connected vehicles will perform an increasing number of driving tasks without human input and will lure customers away from traditional public transportation. This paper first explores key characteristics of public transportation demand in the United States today – based on an international comparison with other Western countries. Next, the paper provides potential pathways on how public transportation agencies and local governments in the United States could respond to the emergence of automated and connected vehicles. The paper argues that space efficiency in urbanized areas and the rush hour commute will remain public transportation's key strengths. In addition, public transportation will retain its important role in providing mobility for all – in particular, for those who cannot afford costly automated and connected vehicles. To remain competitive with the car, public transportation agencies and governments have to harness emerging automated and connected technologies for public transportation, integrate public transportation with other mobility services, coordinate and integrate public transportation services regionally, and coordinate planning for public transportation and land use.

Subject Areas: Technological innovation; Automobile travel; Public transportation

9.4. Title: Multi-level Urban Form and Commuting Mode Share in Rail Station Areas across the United States; A Seemingly Unrelated Regression Approach

Authors: Nasri, A. and Zhang, L.

Abstract: Transit-friendly development has recently become a popular strategy to increase transit mode share in the United States. Many policies and programs have been proposed and implemented across the country to increase residential and job densities, walkability, and mixed-use development around major transit stations in order to encourage transit ridership. Using data from all rail transit stations across the United States, this paper presents an analysis of commute mode share for people who live within walking distance to rail transit with regard to the urban form at both neighborhood and regional levels. This study provides additional evidence to better understand how transit accessibility and urban design jointly aim to encourage transit use and reduce driving in rail stations areas across the U.S. and thus cope with ever-growing traffic congestion in urban areas. It is one of the first analyses to examine the relationships between urban form measured at both local/neighborhood and metropolitan levels and the commuting mode share across major transit station areas nationwide. It utilizes a Seemingly Unrelated Regression modeling method (SUR) - which is based on generalized least squares (GLS) - and estimates three primary modes of auto, transit, and walk/bike.
Findings suggest that urban form at both station area (local effect) and at the whole metropolitan area (regional effect) influences commuting patterns. Factors such as population and employment densities, walkability, and transit accessibility at both local and regional levels are significantly associated with commute mode share. Job accessibility via transit in the entire region (measured by the number of jobs located within 45?min from a transit stop) is another important factor encouraging transit ridership for every-day commuting trips.

Subject Areas: Built environment; Regional urban form; Transit accessibility; TOD; Commute mode choice; Seemingly unrelated regression; Travel behavior; Urban design

9.5. Title: Can Metro Transit Reduce Driving? Evidence from Xi'an, China

Authors: Huang, X., Cao, X.J., Yin, J. and Cao, X.

Abstract: Rail transit investment has increased greatly because of its potential to attract choice riders to switch from driving to transit. However, there is limited knowledge about the impacts of rail transit on driving, particularly in fast-growing developing countries. Furthermore, many studies are subject to one or more limitations from methodological and practical perspectives. Using the 2014 data from Xi'an, this paper employs both cross-sectional and quasi-longitudinal analyses to examine how metro transit influences driving. The quasi-longitudinal analysis shows that moving into metro neighborhoods is negatively associated with change in driving although the cross-sectional analysis shows no effect. Therefore, the results based on cross-sectional analysis may be misleading. Taken all together, metro transit development and the design of station-area neighborhoods have the potential to reduce driving, and mitigate its impact on environment and slow the growth of traffic congestion.

Subject Areas: Transit-oriented development; Residential self-selection; Rail transit; Longitudinal design; Sustainable travel

9.6. Title: Comparative Trip Generation Models of the US Households: With and Without Heavy Rail System

Author: Uddin, M.S.

Abstract: This study is conducted with an object to develop the general trip generation models of US households with and without the existence of heavy rail system. Four multiple linear regression models are developed in this study. First two models are developed for predicting total household daily trips. Rest two modes are developed for estimating household auto and non-auto trips. Seven socio-economic variables are incorporated in the models as predictors. Predictors are selected based on their individual power of explaining the total number of household trips per day. Besides these seven variables, two dummy variables are also included in the models. One is for the existence heavy rail system and another one is for the urban and rural area. Data of National Household Travel Survey,2017 are used in this study. Total 89,414 household's information are considered in this study. 9175 households were deleted from the primary database due to the lack of information. As training dataset 80% (71,535) households are randomly selected from the dataset. Rest 17884 households are used for the verification of the models. US households are vastly dependent on auto trips. About 82% trips of total household trips are automobile dependent. Only 18% trips of total household trips use other types of modes. In case of trip purpose, US households generate a significant percentage of Non-home base (NHB) trips which is about 31%. People also travel longer mileage (31 miles) for NHB trips. In general, from the models, it is found that household with female members generates more trips than a household with male members. Household income, number of drivers in a household influence the number of trips positively. Number of working persons in a household negatively influence the total number of trips. The impact nature of household vehicle is not statistically identified in the developed models. The existence of heavy rail system helps to reduce the overall trip numbers. Finally, it is also found that people in the urban area are producing more trips than the people of rural areas.

Subject Areas: Trip generation models; Heavy rail system; Regression models

9.7. Title: Just Around the Corner: The Future of US Public Transportation

Author: Polzin, S.E.

Abstract: N.A.

Subject Areas: Public transportation; Mobility

Availability: Polzin, S.E., 2018. *Just Around the Corner: The Future of US Public Transportation.* Journal of Public Transportation, 21(1), p.5.
http://scholarcommons.usf.edu/cgi/viewcontent.cgi?article=1739&context=jpt

9.8. Title: Associations between Public Transit Usage and Bikesharing Behaviors in The United States

Authors: Zhang, Y. and Zhang, Y.

Abstract: Public bikesharing systems have rapidly expanded across many cities in the United States (US). Previous studies in the literature found that, in general, bikesharing is associated with public transit ridership. However, the interdependencies between public transit usage and bikesharing behaviors have been mixed and have not been fully understood. Therefore, the objective of this research is to examine the associations between the frequency of public transit usage and the probability and frequency of bikesharing usage in the US using data from the 2017 National Household Travel Survey. The respondents were asked how many times they had used public transit and bikesharing in the last 30 days. Zero-inflated negative binomial regression models were conducted to assess the associations between the frequency of public transit usage and the probability and frequency of bikesharing usage. The results show that, in general, a one-unit increase in the frequency of public transit usage is significantly associated with a 4.0% increase in the probability of bikesharing usage and a 1.4% increase in the frequency of bikesharing usage. The significantly positive relationship between the frequency of public transit usage and the frequency of bikesharing usage is more pronounced among those living in areas with higher population density or with rail service. The empirical results demonstrate that public transit usage is significantly positively associated with bikesharing usage, and suggest policy implications that improving public transit usage tends to increase the usage of bikesharing. This study also provides significant empirical evidence for the formulation of interventions and policies targeting to promote integrated transportation systems that support multimodal transportation and mutually sustainable transport networks.

Subject Areas: bikesharing; Public Transit; Regression models

9.9. Title: Transit in the 2000s: Where Does It Stand and Where Is It Headed?

Authors: Manville, M., Taylor, B.D. and Blumenberg, E.

Abstract: U.S. public transit has experienced something of a renaissance in the 2000s, with per capita service levels increasing nationwide and public investment growing even faster – particularly expenditures on rail transit. Despite this expansion, overall transit patronage has been relatively flat, and has declined significantly since 2014. What is behind these trends, and what do they portend for the future of transit? In this paper we consider three challenges shaping transit today and in the years ahead: (1) the asymmetry of transit supply and use make it especially vulnerable to changes and disruptions; (2) many of the factors that determine transit ridership, such as levels of private vehicle ownership and use, are largely beyond the control of transit agencies; and (3) there remains no consensus about what purpose transit should serve – politically the industry thrives on the idea that it will reduce congestion or clean the air, while in practice it primarily moves poor people, a very different and sometimes conflicting role. How successfully transit systems manage each of these challenges will shape their future roles and significance.

Subject Areas: Transit supply; Ridership; Private vehicle ownership

9.10. Title: Transit Fare Structure and Equity: Case of MARTA, Atlanta

Authors: Rao, P.

Abstract: Public transit in the US is heavily used by captive riders who depend on transit for their mobility. Studies have shown that the poor and minority groups live in the inner-city areas, travel shorter distances to downtown jobs and thus subsidize the trips by the rich suburban dwellers. These transit dependent riders also travel during non-peak hours and thus pay more for the service. However, studies have also indicated a trend of suburbanization of poverty across the cities of the United States. This is in contradiction to the earlier studies on travel patterns of transit dependent riders. This applied research paper uses the Atlanta Regional Commission's (ARC) 2009-2010 Regional On-Board Transit Survey data to examine this discrepancy and evaluate equity impacts of alternative variable fare structures.

Subject Areas: Transit; Mobility; Riders; Fare structure

Availability: Rao, P., 2018. *Transit Fare Structure and Equity: Case of MARTA, Atlanta.* M.S. Thesis, School of City and Regional Planning, Georgia Institute of Technology. https://smartech.gatech.edu/handle/1853/59992?show=full

9.11. Title: A Transport Justice Evaluation of Employer-Based Transit Subsidies

Author: Hamre, A.K.M.

Abstract: National statistics regarding subsidized commuting suggest that employer-based transit subsidies may be inaccessible to the vast majority of the working poor. My main purpose with this study is to increase our understanding of employer-based transit subsidies from a transport justice perspective. I apply the theory of transport justice developed by Karel Martens to evaluate whether the provision of transit subsidies varies significantly by income, and whether the subsidies are significantly associated with accessibility as measured by daily trip levels. I use worker-level data from household travel surveys for 10 of the 22 largest MPOs in the U.S., organized into 7 cases: 1) Atlanta; 2) Baltimore and Washington, DC; 3) Denver; 4) Los Angeles and San Diego; 5) New York and Newark; 6) Philadelphia; and 7) San Francisco. In each of the 7 cases, the odds of being offered a transit subsidy were significantly lower for workers in the 1st income quintile compared to workers in the 4th and 5th income quintiles, even after controlling for other relevant worker and employer characteristics. I found a lack of evidence, in most cases, that transit subsidies are significantly associated with accessibility, both in terms of daily trip levels for low-income workers and daily trip differentials between income groups. Given my finding that low-income workers are the least likely to have access to employer-based transit subsidies, policymakers may consider reform alternatives, such as commuter benefit ordinances, a refundable tax credit for commuting expenses, or alternatives such as income- and location-based subsidies for transit that may support all trip purposes. I hope this study will serve as a reference for policymakers deliberating commuter benefit reforms as well as strategies to support affordable access to opportunities for the working poor.

Subject Areas: Transit subsidies; Daily trip levels; Income; MPOs

Availability: Hamre, A.K.M., 2018. *A Transport Justice Evaluation of Employer-Based Transit Subsidies.* Doctoral dissertation, Virginia Tech.
https://vtechworks.lib.vt.edu/handle/10919/81911

9.12. Title: Trade-offs between Headway, Fare, and Real-Time Bus Information under different Weather Conditions

Authors: Rahman, M.M., Kattan, L. and Wirasinghe, S.C.

Abstract: Given the increasing interest in real-time bus information, quantifying the value of such information from a user's perspective is useful for transport modelers and service planners. Although a number of studies have investigated several other aspects of real-time bus information systems, there is a lack of studies that compare the disutility associated with the bus headway of a scheduled arrival information system and that of a real-time information system from a user's perspective. In addition, no analyses in the literature examined the value of real-time information as affected by trip purpose and weather, which is important especially for the cities in which the weather remains below zero degrees during winter. The primary objectives of this research are to elucidate these issues. A stated preference survey describing the choice between scheduled and real-time information systems was conducted in Calgary, Canada. A total of 426 people participated in the survey, and each person was presented with three randomly selected choice situations. This data set was utilized to estimate the coefficients in different utility functions using a mixed logit model, which avoided several major limitations of a standard multinomial logit model. It was found that the disutility of the headway of a real-time information system was about half of the disutility of a scheduled information system. The analysis also showed that there was a nonlinear trend for the real-time information system, in which people found a higher disutility rate for a longer headway. Further, the value of real-time information availability was normally distributed in the population, with a mean of \$0.50 and a standard deviation of \$0.40. The results also revealed that the value of real-time information was significantly different when the weather was below and above $0°C$, those values were \$0.59 and \$0.41, respectively. Many of the findings obtained here are novel and have implications for both theory and practice. Particularly, they are important for transport modelers and service planners to design or adjust the headway for a desired level of service for a given (or a change in) bus arrival information type.

9.13. Title: Elevating access: Comparing Accessibility to Jobs by Public Transport for Individuals With and without a Physical Disability

Authors: Grisé, E., Boisjoly, G., Maguire, M. and El-Geneidy, A.

Abstract: Equal access to opportunities has emerged in public transport planning as a social objective that many transport agencies are trying to achieve. Yet in practice, not all public transport agencies are currently providing urban residents with comparable levels of service due to physical barriers in the public transport network that can significantly hinder the ability of individuals with physical disabilities to access opportunities. In countries without a strong federal accessibility act and/or with major financial constraints, some public transport agencies fall behind in applying universal access design principles, making it even harder for people with a physical disability to access opportunities. The objective of this study is to develop a methodology that can be used by public transport agencies or disability advocates to clearly highlight and quantify the performance of the public transport network in a region, in terms of providing transit services to people in a wheelchair and compare that to the service offered to an individual not in a wheelchair. In this study we use accessibility, the ease of reaching destinations, by public transport as the key performance measure in two major Canadian Cities (Montreal and Toronto). Furthermore, we focus on job accessibility in the most socially vulnerable census tracts in both cities, to evaluate levels of job accessibility for wheelchair users residing in socially vulnerable areas. The findings from our study show striking contrasts between the numbers of accessible jobs by public transport for wheelchair users compared to the general population. On average, wheelchair users in Toronto have access to 75% of jobs that are accessible to users that are not in a wheelchair, whilst their counterparts in Montreal have access to only 46% of the jobs accessible to other users. This research is expected to highlight for public transport engineers, planners, policy makers and advocates for those with disabilities, the importance of universal access in a region, especially along public transport networks, using a widely used land use and transport performance measure.

Subject Areas: Public transport planning; Physical disabilities; Job accessibility

Availability: Grisé, E., Boisjoly, G., Maguire, M. and El-Geneidy, A.,2018. *Elevating access: Comparing Accessibility to Jobs by Public Transport for Individuals With and without a Physical Disability*. Transportation Research Part A.
http://tram.mcgill.ca/Research/Publications/Wheelchair_Access.pdf

9.14. Title: Public Transit in America 2017

Authors: Godfrey. J., Polzin. S., Chu. X., Driscoll. R, and Lehmann. K.

Abstract: Understanding transit ridership and the characteristics of transit markets is a fundamental necessity for all individuals involved in planning, operating, marketing, and policy decision-making for public transit. The 2017 National Household Travel Survey (NHTS) data set is set to be released in early 2018. This will afford researchers the ability to assess a range of public transit markets from multiple perspectives such as socio-demographics of transit markets, transit-specific trip characteristics, modal shares, overall transit market size, attitudes on transportation issues within each transit market, etc. The Mobility Policy Research Team has a strong history of participation and extensive dissemination of NHTS data analysis with published reports dating back to the early 1990's. This research will build on the series of reports titled "Public Transit in America: Findings From the 1995 Nationwide Personal Transportation Survey," "Public Transit in America: Analysis of Access Using the 2001 National Household Travel Survey," and "An Assessment of Public Transportation Markets Using NHTS Data" which analyzed the 2009 NHTS data set. Given the history of NHTS data analysis involvement, our research team will have the ability to draw meaningful conclusions by understanding of the nuances associated with the trends. In addition to the trend analysis, the new NHTS survey will have unique data relative to the emerging transportation network company (TNC) mode of travel, allowing the exploration of meaningful modal relationships with quality data.

Subject Areas: Transit; National Household Travel Survey; Trend Analysis

Availability: Godfrey. J., Polzin. S., Chu. X., Driscoll. R, and Lehmann. K.,2018. *Public Transit in America 2017.* Project Scope. National Center for Transit Research and Center for Urban Transportation Research at the University of South Florida.
https://www.nctr.usf.edu/2018/02/public-transit-in-america-2017-scope/

10. Travel Behavior

10.1. Title: Does Context Matter? A Comparative Study Modelling Autonomous Vehicle Impact on Travel Behaviour for Germany and the USA.

Authors: Kröger, L., Kuhnimhof, T. and Trommer, S.

Abstract: This paper, for the first time, presents comparable projections of travel behaviour impacts of the introduction of autonomous vehicles (AVs) into the private car fleet for two countries, namely the USA and Germany. The focus is on fully autonomous vehicles (AVs) which allow drivers to engage in other activities enroute. Two 2035 scenarios - a trend scenario and an extreme scenario - are presented for both study countries. For these projections, we combine a vehicle technology diffusion model and an aspatial travel demand model. Factors that influence AV impact in the behavioural model are mainly new automobile user groups, e.g. travellers with mobility impairments, and altered generalized costs of travel, e.g. due to a lower value of travel time savings for car travel. The results indicate that AV penetrations rates might be higher in Germany (10% or 38% respectively) than in the USA (8% or 29% respectively) due to a higher share of luxury cars and quicker fleet turnover. On the contrary, the increase of vehicle mileage induced by AVs is not higher in Germany (+2.4% or +8.6% respectively) than in the USA (+3.4% or +8.6% respectively). This is mainly due to the lack of mode alternatives and lower fuel costs resulting in a higher share of travel times among the total generalized costs of travel in the USA. These results clearly indicate that context factors shaped by national policy will influence AV adoption and impact on travel demand changes. Based on these results the paper draws policy recommendations which will help to harness the advantages of AVs while avoiding their negative consequences.

Subject Areas: Vehicle automation; Autonomous vehicles; Diffusion rates of autonomous vehicles; Market penetration; Fleet evolution; Modelling travel demand; Impact on travel demand

10.2. Title: Metropolitan Size and the Impacts of Telecommuting on Personal Travel

Authors: Zhu, P., Wang, L., Jiang, Y. and Zhou, J.

Abstract: Telecommuting has been proposed by policy makers as a strategy to reduce travel and emissions. In studying the metropolitan size impact of telecommuting on personal travel, this paper addresses two questions: (1) whether telecommuting is consistently a substitute or complement to travel across different MSA sizes; and (2) whether the impact of telecommuting is higher in larger MSAs where telecommuting programs and policies have been more widely adopted. Data from the 2001 and 2009 National Household Travel Surveys are used. Through a series of tests that address two possible empirical biases, we find that telecommuting consistently had a complementary effect on one-way commute trips, daily total work trips and daily total non-work trips across different MSA sizes in both 2001 and 2009. The findings suggest that policies that promote telecommuting may indeed increase, rather than decrease, people's travel demand, regardless of the size of the MSA. This seems to contradict what telecommuting policies are designed for. In addition, model results show that the complementary impact of telecommuting on daily travel is lower in larger MSAs, in terms of both daily total work trips and daily total non-work trips.

Subject Areas: Telecommuting; Personal travel; Commute; Non-work trips

10.3. Title: Understanding Urban Travel Behaviour by Gender for Efficient and Equitable Transport Policies

Authors: Ng, W.S. and Acker, A.

Abstract: Gender is one of the key socio-demographic variables that can influence travel behaviour, but it is often the least understood. Understanding travel behaviour by gender will help better design transport policies that are efficient and equitable. Due to the gendered division of work in households, women often have multiple tasks and activities. As a result, women are more likely to have shorter commute distances, to chain trips, to have more non-work related trips, to travel at offpeak hours, and to choose more flexible modes. This study examines travel behaviour by gender in eight different cities, across three different continents, focusing on transport mode, trip purpose, travel distance and departure time for Auckland, Dublin, Hanoi, Helsinki, Jakarta, Kuala Lumpur, Lisbon and Manila. The most common trends found in the cities are that women tend to travel shorter distances and prefer public transport and taxi services to cars more than men.

Subject Areas: Telecommuting; Personal travel; Commute; Non-work trips

10.4. Title: Transportation Impacts of Affordable Housing: Informing Development Review With Travel Behavior Analysis

Authors: Howell, A., Currans, K., Gehrke, S., Norton, G. and Clifton, K.

Abstract: Planning for affordable housing is challenged by development policies that assess transportation impacts based on methodologies that often do not distinguish between the travel patterns of residents of market-rate housing and those living in affordable units. Given the public goals of providing affordable housing in areas with good accessibility and transportation options, there is a need to reduce unnecessary costs imposed by the potential overestimation of automobile travel and its associated impacts. Thus, the primary objective of this paper is to examine and quantify the influences of urban characteristics, residential housing type, and income on metrics commonly used to assess the transportation impacts of new development, namely total home-based trips and home-based vehicle trips. Using the 2010-2012 California Household Travel Survey, we regressed these metrics on urban place type, regionally adjusted income, and housing type, controlling for household size, weekday travel, and home location. The results indicate significant reductions in vehicle trip making with lower incomes and increasing urbanization. These findings support more differentiation of affordable and market-rate housing in the development review process and emphasize the need for development standards to be more sensitive to the characteristics of future residents and location.

Subject Areas: Affordable Housing; Transportation Impact Analysis; Vehicle Miles Traveled; Vehicle Ownership; Low-Income; Land Use

10.5. Title: Estimating Revenue Neutral Mileage-Based Fees For Urban And Rural Households In Eight Western States

Authors: Fitzroy, S.S. and Schroeckenthaler, K.

Abstract: Presentation

Subject Areas: Travel Pattern; Rural-urban; Vehicle Miles Travelled

Availability: Fitzroy, S.S. and Schroeckenthaler, K., 2018. *Estimating Revenue Neutral Mileage-Based Fees For Urban And Rural Households In Eight Western States.*Transportation Research Board 97th Annual Meeting (No.18-03534).
https://www.edrgroup.com/pdf/Urban-Rural-Presentation—TRB-Annual-Meeting—January-8-2018.pdf

10.6. Title: The Relationship Between Urban Environment and Travel Behavior

Author: Antipova, A.

Abstract: This chapter links urban landscape and residential travel behavior. Travel behavior can be measured by modal choice, car ownership rates, trip generation, commuting time and distance, and trip chaining. This chapter focuses on active travel, including walking and cycling, promoted by researchers. Alternative travel modes are compared between Germany and the United States as well as policies increasing public transport demand and improving road safety. Germany's land-use and public policies promote compact, mixed-use development, and active travel. Other countries might build upon Germany's experience. To control traffic congestion, impact travel behavior, and drive cars less, urban development strategies are pursued including transit-oriented development (TOD). Research findings on the links between neighborhood characteristics and non-motorized transport can be useful to investigate the effects of neighborhood environment on residential health.

Subject Areas: Urban landscape; Residential travel behavior; Modal Choice

10.7. Title: Does Telecommuting Promote Sustainable Travel and Physical Activity?

Author: Chakrabarti, S.

Abstract: Researchers have explored the efficacy of telecommuting as a travel demand management strategy in the U.S. Conditions under which telecommuting can reduce VMT (vehicle miles traveled) and ease peak-period traffic congestion have been extensively investigated; empirical findings are well documented in the literature. Analysis of the impact of telecommuting on non-motorized travel, public transit use, and physical activity, however, has received relatively less attention in the past.

In this paper, I use the 2009 U.S. National Household Travel Survey to explore how telecommuting is associated with usual travel behavior, i.e. walking/bicycling, transit use and driving, as well as with average time spent in daily physical activity. I also compare telecommuters' travel behavior and physical activity on a typical workday in telecommuting vs. non-telecommuting scenarios.

I find that frequent telecommuting (4+ times/month) is associated with 15% more walk trips per week, 56% higher odds of 1+ transit trip per month, 44% higher odds of 30+ minutes of physical activity per day, and 27% higher odds of driving 20,000+ miles per year compared to no-telecommuting scenario. On a typical workday, telecommuting is associated with 41% higher odds of walking/bicycling>1 mile, 71% higher odds of 30+ minutes of physical activity, 71% lower odds of riding transit, and 3.58 times greater odds of driving<10 miles. Findings suggest that telecommuting can increase non-motorized travel and physical activity in the presence of latent demand for active living. Increase in transit ridership and reduction in VMT are not automatic. Planning and policy implications are discussed.

Subject Areas: Telecommuting; Travel behavior; Non-motorized transportation; Public transit; Physical activity

10.8. Title: An Analysis of the Relationship between Land Use and Weekend Travel: Focusing on the Internal Capture of Trips

Author: Gim, T.H.T.

Abstract: Weekend travel has not been duly considered in academics and practice regarding its relationship with land use. A lack of consideration is notable in terms of how land use internalizes weekend travel. Thus, by separating the internal and external travel of the traffic analysis zone, this study analyzes the land use effect on weekend travel in comparison with that on weekday travel. Two structural equation models, each of which is specified for weekday and weekend travel, construct the same sample and their results become comparable. At the travel variable level, the models find consistent results: Stronger effects are made on internal travel than on external travel and particularly, on trip frequency than on travel time. This implies that compact land use causes a stronger addition of internal trips and a less strong reduction of external trips, that is, changes in destinations rather than in total travel time. At the factor level, unlike the weekday model in which the sociodemographic factor exerts a stronger effect, the weekend model presents that land use more strongly affects travel patterns. This magnitude difference is explained by the different flexibility of compulsory weekday travel and discretionary weekend travel in relation to the choice of trip destination and frequency.

Subject Areas: Weekend travel; Land Use; Internal Trips; Traffic Analysis Zone; Structural Equation Modeling; Seoul

10.9. Title: Ridehail Revolution: Ridehail Travel and Equity in Los Angeles

Author: Brown, A.E.

Abstract: A stark mobility divide separates American households with and without cars. While households with cars move easily across space, households without cars face limited access to opportunities. But no longer. Ridehail companies such as Uber and Lyft divorce car access from ownership, revolutionizing auto-mobility as we know it. Despite its high-tech luster, we do not yet know how ridehailing serves different neighborhoods and travelers, and who, if anyone, is left behind. The closest historical analog to new ridehail services is the taxi industry, which has a history of discrimination, particularly against black riders and neighborhoods. Ridehail services may discriminate less than taxis and extend reliable car access to neighborhoods underserved by taxis. Or they may not.

In this study, I pose and answer three questions about ridehail access and equity in Los Angeles. First, what explains the geographical distribution of ridehail trips across neighborhoods? Second, what explains ridehail use by individuals? Finally, is there evidence of racial or gender discrimination on ridehail and taxi services? To answer these questions, I relied on two novel data sets. First, I used trip-level data to evaluate ridehail travel in neighborhoods and by individuals. Second, I conducted an audit study of ridehail and taxi services to evaluate if and how wait times and ride request cancellation rates vary by rider race, ethnicity, or gender.

I find that ridehailing extends reliable car access to travelers and neighborhoods previously marginalized by the taxi industry. Ridehailing served neighborhoods home to 99.8 percent of the Los Angeles County population. Strong associations between ridehail use and neighborhood household vehicle ownership suggests that ridehailing provides auto-mobility in neighborhoods where many lack reliable access to cars. For most users, ridehailing filled an occasional rather than regular travel need, and a small share of avid users made the majority of ridehail trips. While hailing shared rides was common in low-income neighborhoods, I also find that people shared less if they lived in racial or ethnically diverse neighborhoods. Finally, audit data reveal high levels of discrimination against black riders by taxi drivers. Black riders were 73 percent more likely than white riders to have a taxi trip cancelled and waited between six and 15 minutes longer than white riders, all else equal. By contrast, ridehail services nearly eliminate the racial-ethnic differences in service quality. Policy and platform-level strategies can erase the remaining mobility gap and ensure equitable access to ridehailing and future technology-enabled mobility services.

Subject Areas: Ridehail services; Neighborhoods home; Trips

10.10. Title: Are Activity Patterns Stable or Variable? Analysis of Three-Year Panel Data

Authors: Hilgert, T., Behren, S., Eisenmann, C. and Vortisch, P.

Abstract: Routines and mandatory activities, such as work and school, shape the activity patterns of individuals and strongly influence travel demand. Knowledge about stability and variability of these routines could strengthen travel demand modelling and forecasting. A longitudinal perspective is required to investigate these aspects. In this study, the activity patterns of a sample of people is compared for one week in two successive years. It is analyzed whether the activity patterns of a given person vary from year to year, to what degree, and how this variability and stability can be measured. It is considered whether socio-demographic factors and life events determine stability in weekly activity patterns. The study is based on the representative panel survey, German Mobility Panel. The weekly activity patterns of the same respondents in different years is assessed, using two methods to measure stability and variability. The survey respondents are clustered into three groups according to the degree of variability in their activity patterns. A logistic regression model is also used to identify socio-economic and demographic covariates for similarity in weekly activity patterns. Results show that about one-third of the sample had the same or very similar weekly activity patterns in the two years examined. A person's occupation status is a good predictor for the variability of activity patterns. Moreover, persons undergoing a change in occupation status are quite likely to show a greater variability in their activity patterns.

Subject Areas: Activity Pattern; German Mobility Panel; Modelling; Forecasting

10.11. Title: Perceptions and Preferences of Autonomous and Shared Autonomous Vehicles: A Focus on Dynamic Ride-Sharing

Author: Gurumurthy, K.M.

Abstract: This thesis covers certain aspects of autonomous and shared autonomous vehicles (S/AVs), with a focus on dynamic ride-sharing (DRS). The first part investigates Americans' preferences in adopting AVs. Rapid advances in technologies have accelerated the timeline for public use of fully-automated and communications-connected vehicles. Public opinion on self-driving vehicles or AVs is evolving rapidly, and many behavioral questions have not yet been addressed. This study emphasizes AV mode choices, including Americans' willingness to pay (WTP) to ride with a stranger in a shared AV fleet vehicle on various trip types and the long-distance travel impacts of AVs. 2,588 complete responses to a stated-preference survey with 70 questions provide valuable insights on privacy concerns and crash ethics, safety and ride-sharing with strangers, long-distance travel and preferences for smarter vehicles and transport systems. While the starting sample data were relatively demographically unbiased, Texans were purposefully over-sampled, and all statistics adjusted/corrected (via sample weights) to match US demographics on gender, education, income, and age. Weighted results suggest that Americans are willing to pay, on average, $2073 to own AVs over conventional vehicles and an additional $1078 to maintain/include a manual driving option on such vehicles. Ride-sharing will be popular at 75c per mile, under most scenarios, and many Americans are willing to pay $1, on average, to anonymize their trip ends' addresses. Most are also willing to let children 16 years of age and older have unsupervised access to AVs (both privately owned and shared). Nearly 50% of long-distance travel appears captured by AVs and SAVs in the future, rather than airlines, at least for one-way trip distances up to 500 miles. Two hurdle models (which allow for a high share of zero-value responses) were estimated: one to predict WTP to share a ride and another to determine WTP to anonymize location while using AVs. The first two-part model shows how travel time delays, person and household attributes, and land use densities can significantly affect Americans' willingness to share rides. The second hurdle model suggests that traveler age, presence of children, household income, vehicle ownership and driver's license status are major predictors of one's WTP to obscure pick-up and drop-off locations. A binary logit was used to model current mode choice for long-distance (over 50 miles, one-way) travel (between one's private car and an airplane), with household income as the leading predictor. On average, older Americans and/or those with children prefer such travel by car. Finally, a multinomial logit anticipated mode shifts when AVs and SAVs become available and affordable. Everything else constant, private cars remain preferred by older people, but SAVs may be used in the future for more business travel. In the second part of this thesis, a trip-matching framework is programmed to evaluate DRS opportunities for trips across Orlando, Florida. Transportation network companies (TNCs) are regularly demonstrating the economic and operational viability of DRS to any destination within a city, thanks to real-time information from smartphones. In the foreseeable future, fleets of SAVs may largely eliminate the need for human drivers, while lowering per-mile operating costs and increasing the convenience of travel. This may dramatically reduce private vehicle ownership and deliver extensive use of SAVs. Using AirSage's cellphone-based trip tables across 1,267 zones over 30 consecutive days, this study anticipates DRS matches (by assigning independent travelers with overlapping routes in time and space to the same SAV) and simulates SAV travel across the Orlando network to determine optimal SAV fleet size. Those results suggest significant opportunities for DRS-enabled SAVs: Nearly

60% of the single-person trips can be shared with other persons traveling solo and with less than 5 minutes added travel time (to arrive at their destinations). This value climbs to 80% and 86% for 15 and 30 minutes of added wait or travel time, respectively. On the average travel day in Orlando, a fleet of just 30,000 SAVs can serve nearly 45% of those 3 million person-trips traveled solo. In other words, just 1 SAV per 100 person-trips is able to serve almost half of the region's demand, helping reduce congestion while filling up passenger vehicle seats.

Subject Areas: Autonomous vehicles; Shared; Dynamic ride-sharing; Travel behavior; Models; Willingness to pay; Mode choice

Availability: Gurumurthy, K.M., 2018. *Perceptions and Preferences of Autonomous and Shared Autonomous Vehicles: A Focus on Dynamic Ride-Sharing.* Doctoral dissertation, University of Texas.
https://repositories.lib.utexas.edu/handle/2152/63553

10.12. Title: Examining the Relationship between Different Urbanization Settings, Smartphone use to Access the Internet and Trip Frequencies

Authors: Hong, J. and Thakuriah, P.V.

Abstract: N.A.

Subject Areas: Urbanization Settings; Smartphone Use; Travel Behaviour

Availability: Hong, J. and Thakuriah, P.V., 2018. *Examining the Relationship between Different Urbanization Settings, Smartphone use to Access the Internet and Trip Frequencies.* Journal of Transport Geography, 69, pp.11-18.
https://www.sciencedirect.com/science/article/pii/S0966692317303514

10.13. Title: Analyzing Destination Choices of Tourists and Residents from Location Based Social Media Data

Author: Hasnat, M.M.

Abstract: Ubiquitous uses of social media platforms in smartphones have created an opportunity to gather digital traces of individual activities at a large scale. Traditional travel surveys fall short in collecting longitudinal travel behavior data for a large number of people in a cost effective way, especially for the transient population such as tourists. This study presents an innovating methodological framework, using machine learning and econometric approaches, to gather and analyze location-based social media (LBSM) data to understand individual destination choices. First, using Twitter's search interface, we have collected Twitter posts of nearly 156,000 users for the state of Florida. We have adopted several filtering techniques to create a reliable sample from noisy Twitter data. An ensemble classification technique is proposed to classify tourists and residents from user coordinates. The performance of the proposed classifier has been validated using manually labeled data and compared against the state-of-the-art classification methods. Second, using different clustering methods, we have analyzed the spatial distributions of destination choices of tourists and residents. The clusters from tourist destinations revealed most popular tourist spots including emerging tourist attractions in Florida. Third, to predict a tourist's next destination type, we have estimated a Conditional Random Field (CRF) model with reasonable accuracy. Fourth, to analyze resident destination choice behavior, this study proposes an extensive data merging operation among the collected Twitter data and different geographic database from state level data libraries. We have estimated a Panel Latent Segmentation Multinomial Logit (PLSMNL) model to find the characteristics affecting individual destination choices. The proposed PLSMNL model is found to better explain the effects of variables on destination choices compared to trip-specific Multinomial Logit Models. The findings of this study show the potential of LBSM data in future transportation and planning studies where collecting individual activity data is expensive.

Subject Areas: Travel Behavior; Logit Model

Availability: Hasnat, M.M., 2018. *Analyzing Destination Choices of Tourists and Residents from Location Based Social Media Data.* University of Central Florida. Electronic Theses and Dissertations. 5774.
http://stars.library.ucf.edu/etd/5774/

10.14. Title: Getting Paid to Commute: Will it Work?

Author: Ved, N.R.

Abstract: Traffic congestion is a phenomenon that occurs when transportation infrastructure begins to reach or exceed capacity in relation to the number of drivers, riders or bikers utilizing the same space at the same time. From Monday through Friday in the United States this phenomenon generally occurs twice a day: once in the morning and once in the evening as individuals travel to and from their homes and their workplaces. In the United States, the workday in each city begins and ends at roughly the same time for all individuals which means that the vast majority of commuters enter and exit the available transportation infrastructure at roughly the same time every day. Yet outside of those commuting times, the available infrastructure is usually clear and free of traffic. This report seeks to add to ongoing research of relieving congestion at peak travel times by examining the possibility of workers incorporating commutes into their workday within the Austin metropolitan area. Essentially, workers will get paid for their commutes.

Subject Areas: Travel Behavior; Commute; Pay for commute

10.15. Title: Microsimulation of Activity Participation, Tour Complexity, and Mode Choice within an Activity-Based Travel Demand Model System

Author: Daisy, N.S.

Abstract: Over the past few decades, trip-based travel demand approaches have been replaced by activity-based microsimulation travel demand techniques, which are able to capture the latent demand for activity participation, interdependency among trips, and household interactions. Activity-based models consider trips as a derived demand which arise from activity engagement behavior. This research aims to depict the daily activity-travel behavior of travelers as a result of choice decision making processes through the development of the Scheduler for Activities, Locations, and Travel (SALT) microsimulation travel demand model. The SALT model is comprised of five main components: population synthesis, time-use activity pattern recognition, tour mode choice, activity destination choice, and activity/trip scheduling. A series of advanced econometric micro-behavioral modules are developed to model behavioral mechanisms of different population groups in the region. An under-recognized issue in most of the econometric activity-based models is that they treat all out-of-home travelers, whether workers or non-workers, as undifferentiated groups, decreasing the ability to predict activity-travel decisions. To this end, an advanced disaggregated modeling framework is developed that can derive separate utility functions for both in-home and out-of-home activities for travelers with heterogeneous daily-activity patterns, along with simulation of correlation matrices. Additionally, a cluster-based technique is developed to model trip chaining, tour complexity, and tour mode choice of worker and non-worker clusters. These models capture associations between socio-demographics characteristics, trip attributes, and land use patterns in order to predict travel tour incidence and type, and mode choice. For empirical analysis of activity-travel behavior this study employs data from the large Halifax Space Time Activity Research (STAR) household time-use and travel survey, which consists of GPS-verified data for 2,778 person-days. This study also contributes by designing and conducting the first Canadian university-based travel-diary survey (EnACT), to better understand activity-travel patterns and trip making frequencies of university commuters. In addition, a synthetic pseudo-panel modeling framework is developed to explore the longitudinal activity-travel behavior of urbanities. In summary, the disaggregated modeling framework presented in this study is useful for deeper understanding of individuals' activity-travel decisions, and may be operationalized to examine sensitive policy issues such as transportation control measures and congestion-pricing.

Subject Areas: Travel Behavior; Activity Participation; Tour Complexity; Mode Choice; Activity-based Travel Demand Model

10.16. Title: Modality, Activity Participation and Well-being: Evidence from Commuters in Beijing

Author: Mao, Z.

Abstract: In the recent decades, daily mobility and mode choice in Chinese cities have developed in the presence of fundamental transformations in the built environment and soaring car ownership. Encouraging sustainable travel become a goal for planners and also transport policy makers in China. In this research, empirical analyses are carried out to understand the share and determinants of individuals' modality styles in Beijing, and to explore how their modality styles affect activity participation, social interaction, travel time and well-being. Our study finds that not only the share of the modality styles but also the determinants and the interpretation of determinant values can vary across different contexts at different developing stages. Car ownership does not necessarily lead to car dependency but rather provides an extra choice and increases multimodality at the current stage. The interpretation of this result can be closely associated with both the geographical and institutional background in Beijing. As for the influence of modality styles, this research shows that to a certain extent, the functionality of car use can be substituted by the use of multiple travel modes in the research context of Chinese cities. At the weekly level, multimodal travelers benefit from more participation in non-work activities, while car users do not show much advantage. However, this influence may differ when the commuters have different activity agendas between commute and non-commute days and differ between the companionship of different social contacts. Our findings reveal that a conclusion regarding the facilitating/impeding effect of car on activity participation cannot generally be achieved without considering the context for observations, including geographic context, social-cultural settings, and also the observed time period. In addition to the participation in travel/activities, this study also investigates individuals' experience of their daily travel and activities in the context of Chinese cities. Consistent with previous studies in Western contexts, it is found that active commuters always have the highest levels of travel satisfaction, and activities at leisure/recreational facilities are generally more satisfying than other non-work activities. This research extends the current literature of trip/activity satisfaction, by including the context of travel choices as an explanatory factor. Specifically, trip satisfaction is not only affected by travel modes but also individual' experiences with other modes (due to multimodality) and their freedom in decision making (with different modal flexibility levels). For activity satisfaction, it is not only related to the objectively observed activity attributes but also the factors related to the freedom in choosing the timing and location for these activities (temporal and spatial flexibility). The research also delivers some implications for transport policies.

Subject Areas: Modality; Activity participation; Well-being; Commuter; Beijing

10.17. Title: Virtual Immersive Reality for Stated Preference Travel Behavior Experiments: A Case Study of Autonomous Vehicles on Urban Roads

Authors: Farooq, B., Cherchi, E. and Sobhani, A.

Abstract: Stated preference experiments have been criticized for lack of realism. This issue is particularly visible when the scenario does not have a well understood prior reference, as in the case of research into demand for autonomous vehicles. The paper presents Virtual Immersive Reality Environment (VIRE), which is capable of developing highly realistic, immersive, and interactive choice scenarios. We demonstrate the use of VIRE in researching pedestrian preferences related to autonomous vehicles and associated infrastructure changes on urban streets in Montréal, Canada. The results are compared with predominantly used approaches: text-only and visual aid. We show that VIRE results in respondents having better understanding of the scenario and it yields more consistent results.

Subject Areas: Virtual Immersive Reality Environment (VIRE); Stated Preference experiments; Travel Behavior

10.18. Title: Toward Sustainable Travel Behavior and Activity Engagement: Connected Users, Technology Engagement and Cohort Effects

Author: Mjahed, L.B.

Abstract: The ongoing generational shift whereby millennials are overtaking baby boomers as the largest generation in the U.S. population, along with the technology-fueled evolution of transportation patterns, offer opportunities for policy makers to leverage changing behavior and build a more sustainable future. Much research has emerged seeking to understand whether the observed changes in travel behavior stemming from these trends are transient or permanent, though it has remained limited in several respects, including: (1) looking at travel as a single transaction, focusing only on interactions preceding travel (i.e. looking for information for travel) or following the decision to travel (i.e. navigation), and (2) neglecting to explicitly capture the childhood technology experience and its impact on adulthood behavior.

This dissertation tackles some of these limitation through novel approaches to: (1) characterizing the travel behavior and activity engagement of young adults and the sample population more broadly, (2) capturing the underlying attitudinal and behavioral mechanisms behind their travel decisions, and (3) assessing the long-term prospects of uncovered patterns of behavior. The originality of the approach includes disaggregating the travel process (capturing the permeation of technology therein) and retrospectively capturing the technology use during childhood as a measure of "digital nativeness" and in turn cohort effects. This approach is formalized in a full-fledged conceptual framework and tested by collecting and modeling original qualitative and quantitative data.

Subject Areas: Travel Behavior; Sustainable future; Cohort effects

Availability: Mjahed, L.B., 2018. *Toward Sustainable Travel Behavior and Activity Engagement: Connected Users, Technology Engagement and Cohort Effects.* Doctoral dissertation, Northwestern University.
https://search.proquest.com/openview/fdeb5df299bc4c9366cd0569230d69f9/1?pq-origsite=gscholar&cbl=18750&diss=y

10.19. Title: Minneapolis-Saint Paul Metro Travel Mode Shares

Author: Totten, J.

Abstract: Blog

Subject Areas: Mode share; Trips

Availability: Totten, J., 2018. *Minneapolis-Saint Paul Metro Travel Mode Shares.* Streets.MN. https://streets.mn/2018/04/19/chart-of-the-day-minneapolis-saint-paul-metro-travel-mode-shares/

10.20. Title: U.S. households with two vehicles log 21,600 miles per year

Author: Kallanish Energy

Abstract: Blog

Subject Areas: Household; Vehicle ownership; Vehicle Miles Travel

Availability: 2018. *U.S. households with two vehicles log 21,600 miles per year.* Kallanish Energy Daily News & Analysis.
https://www.kallanishenergy.com/2018/06/08/u-s-households-with-two-vehicles-log-21600-miles-per-year/

10.21. Title: FHWA survey finds multiple-vehicle homes are able to travel significantly more

Author: Galford, C.

Abstract: Blog

Subject Areas: Household; Vehicle ownership; Vehicle Miles Travel; FHWA

Availability: Galford, C., 2018. *FHWA survey finds multiple-vehicle homes are able to travel significantly more.* Transportation Today.
https://https://transportationtodaynews.com/news/9644-fhwa-survey-finds-multiple-vehicle-homes-able-travel-significantly/

11. Trend Analysis and Market Segmentation

11.1. Title: Evaluating Effects of Future Shared Mobility and Electrification Trends on Key Intermediate Indicator of Aluminum Transportation Demand: US Vehicle Fleet Size

Authors: Deshmukh, S., Bustamante, M. and Roth, R.

Abstract: The North American auto industry is in the midst of a major change with the emergence of disruptive technologies like ride-sharing and electrification of vehicles. These disruptive technologies are expected to change the vehicle stock and hence the embodied aluminum content of vehicles. These technologies are predicted to have a negative impact on the vehicle stock. The present work tries to address this gap by quantifying the impact of ride-sharing on growth of US vehicle fleet size, a key intermediate indicator of aluminum transportation demand, in the mid-term future.

Subject Areas: Light-vehicles; Ride-sharing; Electric vehicles; Vehicle fleet demand; Material demand

11.2. Title: Dynamic Ride-sharing and Fleet Sizing for a System of Shared Autonomous Vehicles in Austin, Texas

Authors: Fagnant, D.J. and Kockelman, K.M.

Abstract: Shared autonomous (fully-automated) vehicles (SAVs) represent an emerging transportation mode for driverless and on-demand transport. Early actors include Google and Europe's CityMobil2, who seek pilot deployments in low-speed settings. This work investigates SAVs' potential for U.S. urban areas via multiple applications across the Austin, Texas, network. This work describes advances to existing agent- and network-based SAV simulations by enabling dynamic ride-sharing (DRS, which pools multiple travelers with similar origins, destinations and departure times in the same vehicle), optimizing fleet sizing, and anticipating profitability for operators in settings with no speed limitations on the vehicles and at adoption levels below 10 % of all personal trip-making in the region. Results suggest that DRS reduces average service times (wait times plus in-vehicle travel times) and travel costs for SAV users, even after accounting for extra passenger pick-ups, drop-offs and non-direct routings. While the base-case scenario (serving 56,324 person-trips per day, on average) suggest that a fleet of SAVs allowing for DRS may result in vehicle-miles traveled (VMT) that exceed person-trip miles demanded (due to anticipatory relocations of empty vehicles, between trip calls), it is possible to reduce overall VMT as trip-making intensity (SAV membership) rises and/or DRS users become more flexible in their trip timing and routing. Indeed, DRS appears critical to avoiding new congestion problems, since VMT may increase by over 8% without any ride-sharing. Finally, these simulation results suggest that a private fleet operator paying $70,000 per new SAV could earn a 19% annual (long-term) return on investment while offering SAV services at $1.00 per mile for a non-shared trip (which is less than a third of Austin's average taxi cab fare).

Subject Areas: Connected and autonomous vehicles; Shared autonomous vehicles; MATSim simulation; Dynamic ride-sharing

11.3. Title: A Hazard-based Approach to Modelling the Effects of Online Shopping on Intershopping Duration

Authors: Suel, E., Daina, N. and Polak, J.W.

Abstract: Despite growing prevalence of online shopping, its impacts on mobility are poorly understood. This partially results from the lack of sufficiently detailed data. In this paper we address this gap using consumer panel data, a new dataset for this context. We analyse one year long longitudinal grocery shopping purchase data from London shoppers to investigate the effects of online shopping on overall shopping activity patterns and personal trips. We characterise the temporal structure of shopping demand by means of the duration between shopping episodes using hazard-based duration models. These models have been used to study inter-shopping spells for traditional shopping in the literature, however effects of online shopping were not considered. Here, we differentiate between shopping events and shopping trips. The former refers to all types of shopping activity including both online and in-store, while the latter is restricted to physical shopping trips. Separate models were estimated for each and results suggest potential substitution effects between online and in-store in the context of grocery shopping. We find that having shopped online since the last shopping trip significantly reduces the likelihood of a physical shopping trip. We do not observe the same effect for inter-event durations. Hence, shopping online does not have a significant effect on overall shopping activity frequency, yet affects shopping trip rates. This is a key finding and suggests potential substitution between online shopping and physical trips to the store. Additional insights on which factors, including basket size and demographics, affect inter-shopping durations are also drawn.

Subject Areas: Online shopping; Intershopping duration; Trip frequency; Hazard-based duration models; Travel demand modeling; Consumer panel data

11.4. Title: Shared Autonomous Vehicles and their Potential Impacts on Household Vehicle Ownership: An Exploratory Empirical Assessment

Authors: Menon, N., Barbour, N., Zhang, Y., Pinjari, A.R. and Mannering, F.

Abstract: Emerging transportation technologies have the potential to significantly reshape the transportation systems and household vehicle ownership. Key among these transportation technologies are the autonomous vehicles, particularly when introduced in shared vehicle fleets. In this paper, we focus on the potential impact that fleets of shared autonomous vehicles might have on household vehicle ownership. To obtain initial insights into this issue, we asked a sample of university personnel and members of the American Automobile Association as to how likely they would consider relinquishing one of their household's personal vehicles if shared autonomous vehicles were available (thus reducing their household vehicle ownership level by one). For single-vehicle households, this would be relinquishing their only vehicle, and for multivehicle households (households owning two or more vehicles) this would be relinquishing just one of their vehicles. Possible responses to the question about relinquishing a household vehicle if shared autonomous vehicles are present are: extremely unlikely, unlikely, unsure, likely, and extremely likely. To determine the factors that influence this response, random parameters ordered probit models are estimated to account for the likelihood that considerable unobserved heterogeneity is likely to be present in the data. The findings show that a wide range of socioeconomic factors affects people's likelihood of vehicle relinquishment in the presence of shared autonomous vehicles. Key among these are gender effects, generational elements, commuting patterns, and respondents' vehicle crash history and experiences. While people's opinions of shared autonomous vehicles are evolving with the continual introduction of new autonomous vehicle technologies and shifting travel behavior, the results of this study provide important initial insights into the likely effects of shared autonomous vehicles on household vehicle ownership.

Subject Areas: Automated Vehicles; Car Ownership; Econometric Modeling; Mobility On-Demand; Shared Mobility

11.5. Title: The Impact of Private Autonomous Vehicles on Vehicle Ownership and Unoccupied VMT Generation

Authors: Zhang, W., Guhathakurta, S. and Khalil, E.B.

Abstract: With 36 ventures testing autonomous vehicles (AVs) in the State of California, commercial deployment of this disruptive technology is almost around the corner (California Department of Transportation, 2016). Different business models of AVs, including Shared AVs (SAVs) and Private AVs (PAVs), will lead to significantly different changes in regional vehicle inventory and Vehicle Miles Travelled (VMT). Most prior studies have already explored the impact of SAVs on vehicle ownership and VMT generation. Limited understanding has been gained regarding vehicle ownership reduction and unoccupied VMT generation potentials in the era of PAVs. Motivated by such research gap, this study develops models to examine how much vehicle ownership reduction can be achieved once private conventional vehicles are replaced by AVs and the spatial distribution of unoccupied VMT accompanied with the vehicle reduction. The models are implemented using travel survey and synthesized trip profile from Atlanta Metropolitan Area. The results show that more than 18% of the households can reduce vehicles, while maintaining the current travel patterns. This can be translated into a 9.5% reduction in private vehicles in the study region. Meanwhile, 29.8 unoccupied VMT will be induced per day per reduced vehicles. A majority of the unoccupied VMT will be loaded on interstate highways and expressways and the largest percentage inflation in VMT will occur on minor local roads. The results can provide implications for evolving trends in household vehicles uses and the location of dedicated AV lanes in the PAV dominated future.

Subject Areas: Autonomous vehicles; Vehicle ownership; Unoccupied VMT

11.6. Title: Ridesourcing, the Sharing Economy, and the Future of Cities

Authors: Jin, S.T., Kong, H., Wu, R. and Sui, D.Z.

Abstract: As an integral part of the emerging sharing economy, ridesourcing refers to transportation services that connect community drivers with passengers via mobile devices and applications. The spectacular growth of ridesourcing has sparked a burgeoning literature discussing how it affects the future of cities. This paper presents a systematic review of the existing literature concerning the impact of ridesourcing on the efficiency, equity, and sustainability of urban development. Ridesourcing has a positive impact on economic efficiency. It both complements and competes with public transit, but its influence on traffic congestions near city centers is still unclear. Regarding urban equity, ridesourcing further amplifies the issue of the digital divide and raises concerns over the issues of discrimination and data privacy and security. It is also hotly contested whether prosumers (producers/consumers) are exploited by the sharing economy platforms, whether ridesourcing drivers are reasonably compensated, and how to better protect on-demand workers' rights. Even though ridesourcing has been promoting a green image, its true environmental impact has not been thoroughly investigated. According to the evidence reported in the literature so far, it is unlikely that ridesourcing will reduce private car ownership. Ridesourcing's impacts on energy consumption and greenhouse gas emissions are uncertain based on existing research. This paper outlines the danger of conceptual confusion and the methodological issues in the existing literature. Further research is sorely needed as the future of cities is indisputably tied to the sharing economy and its impacts on shared mobility.

Subject Areas: Ridesourcing; Shared mobility; The sharing economy; On-demand work; Future cities

11.7. Title: Trends Found by the 2017 National Household Travel Survey May Surprise You

Author: Wochit News

Abstract: Blog

Subject Areas: Driving; Lower income; Millennials; National Household Travel Survey.

Availability: Wochit News, 2018. *Trends Found by the 2017 National Household Travel Survey May Surprise You.* World, MSN News.
https://www.msn.com/en-us/news/world/trends-found-by-the-2017-national-household-travel-survey-may-surprise-you/vp-AAwLiBP

11.8. Title: Transportation Capital and Its Effects on the US Economy: A General Equilibrium Approach

Authors: Gallen, T. and Winston, C.

Abstract: We analyze the effect of the transportation system on U.S. economic activity by building a dynamic computable general equilibrium model with a publicly provided transportation capital stock, which affects firm productivity, worker and shopping commute times, and government expenditures, thereby affecting households' labor and consumption decisions. Our model highlights stark differences between the effect of infrastructure spending on GDP and welfare in the long run, and its effects when we account for the transition (time and delay) costs to build. Calibrating our model to the U.S. economy, we find that $50 billion in additional annual spending on the transportation capital stock increases annual welfare net of taxes by $29 billion in the long run, but that the addition has a much smaller, and potentially negative positive present value due to transition costs. Our paper highlights the importance of general equilibrium when considering transportation infrastructure, showing that slightly more than half of the response to GDP comes from the endogenous responses of capital and labor. Finally, an extension of our model finds possible GDP multipliers below one for high-investment countries like Japan.

Subject Areas: General Equilibrium, Transportation infrastructure, Efficiency

11.9. Title: Impacts of Transit and Walking Amenities on Robust Local Knowledge Economy

Authors: Zandiatashbar, A. and Hamidi, S.

Abstract: As of 2013, knowledge economy has held more than 10% of U.S. employment, generated nearly 20% of national GDP and expect to increase to 25% during the next 20?years. Likewise, Eurostat 2020 aims to increase investment in Knowledge Intensive Business Services (KIBS) to bypass the competitors, Japan and the U.S. As the result, investigating the determinants of robust knowledge economy is a continuing concern between city scholars, planners and leaders. To date, several locational and non-locational factors have been found to be influential. For instance, transit service, walkable street networks and dense neighborhoods that provide walkable access to urban amenities are the location preferences for the creative class. Creative class, in turn, attracts KIBS, and produces innovation which are all contributive to the knowldge-based economic vitality. While such trend is widely supported by the theoretical efforts, there is little empirical evidence on these complex multidimensional relationships and hence this study seeks to investigate both direct and indirect impacts of transit and walking amenities on the robust local knowledge economy. Using Structural Equation Modeling (SEM), we developed a comprehensive model that accounts for KIBS, creative economy and innovation productivity and investigates their locational and non-locational determinants with the particular focus on walking and transit amenities. Our results generally echo the findings of previous studies about the key role of industry clustering, place quality amenities, diversity and tolerance on the three drivers of robust local knowledge economy. We found that among all exogenous variables racial diversity and industry clustering have the most significant direct effect on innovation productivity. We also found that transit service quality and walkability contribute to a robust local knowledge economy through KIBS and creative class, but they have an adverse relationship to the innovation production of the STEM small firms. This might be due to the fact that walkability and transit access increase the property values and, therefore, make them unaffordable for small innovative firms. Our findings on the impacts of walkability and transit access on innovation productivity in vulnerable small firms call for attention to the equity aspects of innovation-supportive urban developments.

Subject Areas: Transit; Walkability; Knowledge economy; KIBS; Creative industries; Innovation

Availability: Zandiatashbar, A. and Hamidi, S., 2018. *Impacts of Transit and Walking Amenities on Robust Local Knowledge Economy.* Cities.
https://www.sciencedirect.com/science/article/pii/S0264275117310442

11.10. Title: The Great Divide: What Consumers Are Buying vs. The Investments Automakers & Suppliers Are Making in Future Technologies, Products & Business Models

Authors: Bailo, C., Dziczek, K., Smith, B., Spulber, A., Chen, Y. and Schultz, M.

Abstract: N.A.

Subject Areas: Light vehicle; Transport; Market; Consumer

Availability: Bailo, C., Dziczek, K., Smith, B., Spulber, A., Chen, Y. and Schultz, M., 2018. *The Great Divide: What Consumers Are Buying vs. The Investments Automakers & Suppliers Are Making in Future Technologies, Products & Business Models.* Technical report, Center for Automotive Research.
http://www.cargroup.org/wp-content/uploads/2018/02/The-Great-Divide-What-Consumers-Are-Buying-vs-The-Investments-Automake....pdf

11.11. Title: The Ongoing Transformation of the Global Transportation System: A US DOT Volpe Center Thought Leadership Series

Author: Merrefield, C.

Abstract: Automation, artificial intelligence, robotics, sensing technology, and computing will transform the future of travel and commerce. Technological advances continue to change the national and global transportation landscape at an unprecedented pace. As the private sector drives innovation across all modes, there is potential for dramatic impacts on the safety and efficiency of the future transportation system and the composition of the nation's transportation workforce. The U.S. DOT Volpe Center's 2017 speaker series – The Ongoing Transformation of the Global Transportation System – explored challenges and opportunities affecting the advancement of transportation systems.

Subject Areas: Future transportation system; Transformation

Availability: Merrefield, C., 2018. *The Ongoing Transformation of the Global Transportation System: A US DOT Volpe Center Thought Leadership Series.* (No. DOT-VNTSC-18-04). John A. Volpe National Transportation Systems Center (US).
https://www.volpe.dot.gov/events/transforming-transportation

11.12. Title: Defining The Sharing Economy, Part I: Excess Capacity

Author: Schwartz, H.

Abstract: Blog

Subject Areas: Economy; Rideshare; Vehicle; Trip duration

Availability: Schwartz, H., 2018. *Defining The Sharing Economy, Part I: Excess Capacity.* The Fuse.
http://energyfuse.org/defining-sharing-economy-part-excess-capacity

11.13. Title: Americans' Plans for Acquiring and Using Electric, Shared, and Self-Driving Vehicles and Costs and Benefits of Electrifying and Automating US Bus Fleets

Author: Quarles, N.T.

Abstract: This thesis is divided into three parts. The first part surveys 1,426 Americans to gauge how technology availability and costs influence public opinion, vehicle ownership decisions, travel, and location choices, and then adjusted all results for population weights, to offset any sample biases in U.S. demographics. Example results include average willing to pay (WTP) for full automation (on a newly acquired vehicle) of $3,252 with a very high standard deviation of +/- $3,861 with a human-driven-vehicle (HV) mode option and $2,783 (standard deviation=$3,722) without that option (AV driving only). These averages rise to $3685 and $3112 for AV with and without an HV option, respectively, if responses of zero WTP are removed. Americans' average WTP for use of shared autonomous vehicles (SAVs) is $0.44 per mile (standard deviation=$0.43). If given the option, Americans expect to set their vehicles in AV (self-driving) mode 36.4% of the time. Respondents believe about 20% of AV miles should be allowed to travel empty, for both privately-owned AVs and shared AV fleets, which would be quite congesting in urban regions at many times of day. Among those likely to move their home in the next few years, 15.5% indicate that availability of AVs and SAVs would shift their new home locations relatively closer to the city center, while 10% indicate further away; the other 74.5% do not expect such technologies to influence their home location choices.

Subject Areas: Willing to pay (WTP); Costs; Self-Driving Vehicles; Shared autonomous vehicles (SAVs)

Availability: Quarles, N.T., 2018. *Americans' Plans for Acquiring and Using Electric, Shared, and Self-Driving Vehicles and Costs and Benefits of Electrifying and Automating US Bus Fleets.* Doctoral dissertation, University of Texas.
https://repositories.lib.utexas.edu/bitstream/handle/2152/64110/QUARLES-THESIS-2017.pdf?sequence=1

11.14. Title: Can Tolling Help Everyone? Estimating the Aggregate and Distributional Consequences of Congestion Pricing

Author: Hall, J.D.

Abstract: Economists have long advocated road pricing as an efficiency-enhancing solution to traffic congestion, yet it has rarely been implemented because it is thought to create losers as well as winners. This paper uses survey and travel time data, combined with a structural model of traffic congestion, to estimate the joint distribution of agent preferences and evaluate the aggregate and distributional effects of road pricing. I find that adding tolls on half of the lanes of a highway yields a Pareto improvement. Further, the social welfare gains from doing so are substantial – up to $1,740 per road user per year.

Subject Areas: Road pricing; Congestion; Travel time data

Availability: Hall, J.D., 2018. *Can Tolling Help Everyone? Estimating the Aggregate and Distributional Consequences of Congestion Pricing.* University fo Torento.
http://individual.utoronto.ca/jhall/documents/Can_Tolling_Help_Everyone.pdf