

**Progress Performance Report  
for the  
New England University Transportation Center  
Massachusetts Institute of Technology**

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## REPORTING CATEGORIES

### 1. Accomplishments

#### 1A. Research Projects

##### Major goals as stated in New England UTC Prospectus

##### Research Goal

- To conduct research in technology applications and systems integration with related work in policy, planning and human factors that improve transportation safety as well as further our understanding and realization of livable communities to support mobility across the lifespan.
- To support peer-reviewed investigations that address safety and livability by exploring and furthering research, policy, and practice in the application of ubiquitous intelligence, use of big data, and improved human performance

Following is the list of the 45 research projects under this grant, and their current status:

Project No.	PI	Project Title	Status
MITR24-1	Ben-Akiva Abou-Zeid Zegras	Capturing the Relationship between Motility, Mobility and Well-Being Using Smart Phones	active
MITR24-2	Coughlin	Transportation Wellbeing, Age and Safety	active
MITR24-3	D'Ambrosio	Assessing Alternative Transportation Options for Older Users	active
MITR24-4	Glass Mehler	Spoken Dialog Planning to Reduce User Distraction in Mobile Environments	completed
MITR24-5	Gonzalez	Transportation Model in the Boston Metropolitan Area from Origin Destination Matrices Generated with Big Data	active
MITR24-6	Murga Salvucci	Kendall Square: Lessons Drawn from Its Past Development to Guide Its Future	completed
MITR24-7	Osorio	Simulation-Based Energy-Efficient Transit Signal Priority Strategies	completed
MITR24-8	Reimer	Technology Adoption and Use Across the Lifespan	completed

MITR24-9	Salvucci Murga	Development of a "Universal" Residential Public Transportation Pass, as Part of a Comprehensive Multi-Modal Approach to Urban Parking	active
MITR24-10	Sheffi Goentzel	Big Data During Crisis: Lessons from Hurricane Irene	completed
MITR24-11	Sussman	Determining Performance Measures to Evaluate the Effect of High Speed Rail on Communities' Livability	active
MITR24-11A	Trancik	Time Dependent Environmental Impact of Transportation	active
HVDR24-12	Howitt Giles	Disaster Recovery for Transportation: China's Wenchuan Earthquake of 2008 and Japan's Tohoku Earthquake and Tsunami of 2011	active
HVDR24-13A	Mayne	The Politics of Transport Policy in the Greater Copenhagen Region	active
HVDR24-14	Shoag	Cell Phones and Vehicle Safety	active
HVDR24-14A	Shoag	Land-Use Regulation and Commuting Patterns	active
UMAR24-14B	Christofa	Signal Timing Optimization for Improved Person Mobility and Air	active
UMAR24-15	Christofa Collura	A Person-based Comparison of Transit Preferential Treatments on Signalized Arterial Corridors	active
UMAR24-16	Collura Burleson Gao	A Decision Support System to Assess Disruptive Impacts of Alternative Transportation Financing Approaches	completed
UMAR24-16A	Fisher	ADHD Teen Driver Evaluation and Training Tool Development	active
UMAR24-17	Fisher Romoser	Moving Map Displays: Using CTIL and Eye Tracking Technologies to Measure Distraction in Locomotive Cabs	active
UMAR24-18	Ganz Collura	Hybrid NFC and Vision Based Navigation System in Subways for the Blind and Visually Impaired	active
UMAR24-19	Gao	A Spatial Learning Model for the Micro-Simulation of Travel Dynamics	completed
UMAR24-19A	Gao	An Optimal Adaptive Routing Algorithm for Large-Scale Stochastic Time-Dependent Networks	active
UMAR24-20	Gao	Cognitive Maps for Route Choice Modeling	completed

UMAR24-21	Gartner Jones Statmatiadis	Robust Performance of Transportation Networks Using Quantile Metrics	completed
UMAR24-21A	Gonzalez	Data-based Model for Regional Freight Demand	active
UMAR24-21B	Knodler	An Observational Evaluation of Safety and Operations Resulting from Driver Distraction	active
UMAR24-22	Knodler Romoser Fisher	Evaluating the Effects of Integrated Training on Minimizing Driver Distraction	active
UMAR24-22A	Ni	Efficient Methodology for Traffic Flow Model Calibration	active
UMAR24-23	Ni Gao	Making More Value out of Transportation Data	active
UMAR24-24	Ni	Modeling Drivers' Lateral Motion Control	active
UMAR24-25	Romoser Knodler Fisher	Reducing Older Driver Crashes: Technology, Training and Livable Communities	active
UMAR24-26	Stamatiadis Gartner Xie	ITS Equipment Placement for Safety and Mobility	completed
UMAR24-27	Zarillo Collura Burlison	Security & Privacy Breaches in ETPS: Problem Survey & Case Study of I-90	completed
UCNR24-28	Garrick Atkinson-Palombo	The Impact of Parking Policies on the Long-term Vitality of American Cities	completed
UCNR24-28A	Garrick Atkinson-Palombo	Assessing the Full Cost of Parking Provision from the Perspective of the Municipality	completed
UCNR24-29	Gokhale Lownes	Automated Congestion Prediction with Smart Phones	completed
UCNR24-30	Ivan Ravishanker	Investigation of Road and Roadside Design Elements Associated with Elderly Pedestrian Safety	active
UCNR24-30A	Ivan Ravishanker	Effectiveness of Interventions at Midblock Crossings for Improving Senior and Other Pedestrian Safety	completed

UCNR24-31	Konduri Lownes	Transportation System Modeling in the Information Era	active
UCNR24-31A	Konduri Lownes	Crowdsourcing Real-Time Traveler Information Services: Issues, Challenges and Recommendations	active
UCNR24-32	Lownes	t-HUB: Connecticut Public Transport Data Hub	active
UCNR24-32A	Lownes	Spring 2014 Pilot Project Competition	completed
UMER24-33	Garder	Elderly Pedestrian Safety and Driver Distractions	active
UMER24-34	Rubin	Regional Credit Trading: Economic and GHG Impacts of a National Low Carbon Fuel Standard	completed

### **Accomplishments under the New England UTC's research goal**

#### **US Secretary of Transportation visits New England Center, addresses UTC themes January 6, 2015**

The United States Secretary of Transportation, Anthony Foxx, visited the New England Center to learn about UTC research concerning the instrumented vehicles from Center director Joe Coughlin and associate director Bryan Reimer. Foxx also spoke as part of the MIT Center for Transportation and Logistic's Global Leadership Speaker Series. Governor Deval Patrick was in attendance as were representatives from the US Department of Transportation Headquarters and The Volpe Center. Foxx spoke to UTC themes, including high-speed rail development, questions surrounding the future of autonomous vehicles, and increasing access to transit throughout the US.

#### **Prof. Garrick's work on peak car travel by state reported in The Washington Post blog January 20, 2015**

New England Center researcher Norman Garrick, of the University of Connecticut, and his colleagues presented research at the 94<sup>th</sup> annual Transportation Research Board meeting held January 11-15, 2015 in Washington, DC. Prof. Garrick's research looked at "peak car travel" years by state and the findings were discussed in a recent [Washington Post](#) blog piece.

#### **Transportation Survey distributed March 16, 2015**

Residents of the Boston metropolitan area were asked to participate in a new survey on transportation during the historic winter storms that New England experienced last winter. This survey was entitled: Resilience in extreme weather situations: Transportation and day-to-day life in the Boston Metropolitan Area, winter 2015. The goal was to measure the impact that the weather has had on mobility, transportation and well-being. The New England University Transportation Center was interested in the feelings and behavior of respondents during this weather period, as well as their transportation habits, health, and demographic background. The survey is at [this link](#).

#### **UTC vehicle typeface study goes viral April 13, 2015**

New England UTC associate director Bryan Reimer authored a study published in full in the journal of Ergonomics titled, "Assessing the impact of typeface design in a text-rich automotive user interface". Now the research has been used as the basis for a popular article in Gizmodo that discusses the

impact of text-font comprehension and response time when drivers glance at vehicle interfaces. Read the Gizmodo article [HERE](#) or access the full research paper [HERE](#).

### **Project MITR24-1**

#### **Capturing the Relationship between Motility, Mobility and Well-Being Using Smart Phones**

A pilot survey has been conducted to measure happiness, both on real-time and retrospectively. The respondents came from nine countries, and included both workers and students. The results of the pilot survey helped in improving the methodology for collecting well-being information using a smart-phone app. An exploratory model has been developed to model both real-time and retrospective happiness as a function of activity attributes and socio-economic variables. In subsequent research, the happiness data will also be linked to travel behavior.

### **Project UMAR24-16A**

#### **ADHD Teen Driver Evaluation and Training Tool Development**

Major accomplishments during this reporting period are: 1. The experimental design and randomization has been completed. The design includes 8 drives with 16 scenarios to be used for Phase I – Evaluation of drivers with and without ADHD. 2. Development of the simulator drives has been underway. Of the 8 drives, most have been completed and are currently being tested. 3. The research protocol for Phase I has been submitted to the UMass IRB and, IRB feedback has been received, and the revised protocol is being submitted.

### **Project UMAR24-22A**

#### **Efficient Methodology for Traffic Flow Model Calibration**

The research team has developed an efficient methodology for traffic flow model calibration. Considering that conventional approach is time-consuming by searching for optimal model parameters from empirical data, we converted the optimization problem into a root-finding problem. As such, model calibration can be achieved by setting up a proper function and seeking its root by applying a bisection method. The team has conducted this research through international collaboration and actively engaged graduate students in this research.

### **Project UMER24-33**

#### **Elderly Pedestrian Safety and Driver Distractions:**

Prof. Garder is conducting a survey of what elderly people perceive to be the major safety problems to them in traffic, as pedestrians. To that end, he is having contact with researchers in Spain, Greece, Finland and Sweden to see if pedestrians perceive the problems to be different there as well as looking at field observations made by students. A paper will be prepared on this forthwith.

## **How the New England UTC's research results have been disseminated**

### **Coughlin Keynotes Annual TRB Human Factors Meeting January 27, 2015**

New England Center director Joe Coughlin keynoted the Annual Transportation Research Board meeting's Human Factors Plenary Session held in Washington DC, January 11, 2015. Speaking before the gathering of industry leaders, government regulators, system operators and university researchers, his talk, "Automation and the Changing Context of the Transportation Operator;" cited four contextual factors that should receive significant attention in future research and development of automated systems both in transportation and countless other applications such as smart home environments, etc.

### **Dr. Reimer authors Huffington Post blog piece on digital displays in the car March 17, 2015**

New England UTC associate director Bryan Reimer authored a blog piece for the Huffington Post entitled, "Chasing Glances". The piece discusses how a driver's attention is increasingly diverted to in-car displays and mobile devices. Reimer explored the challenge of maximizing information acquisition by the driver while maintaining attention to the road. He suggested typeface as a key factor in how long a glance to a display can last. Read the blog [here](#).

**Project HVDR24-12**

**Disaster Recovery for Transportation: China's Wenchuan Earthquake of 2008 and Japan's Tohoku Earthquake and Tsunami of 2011**

Dr. Howitt and Mr. Giles focused on preparing for a summer 2015 research trip to Japan to conduct interviews with government officials involved in disaster recovery following the 2011 earthquake and tsunami (the trip to take place immediately following this reporting period).

**Plans during the next reporting period to accomplish the New England UTC's research goal**

No change on our major goals contained within our approved Application.

## **1B. Education Projects**

### **Education & Workforce Goal**

- To introduce transportation to all levels of education: K-12, undergraduate, graduate and continuing education.
- To place graduates into transportation fields.
- To provide current and developing methods, tools and insights to today's transportation workforce to support their capacity to build, operate and manage a safe and efficient transportation system.

Following is the list of the 6 education projects under this grant, and their current status:

<b>Project No.</b>	<b>PI</b>	<b>Project Title</b>	<b>Current Status</b>
MITE24-35	Coughlin	Massachusetts Avenue Area Living Laboratory (MALL)	active
MITE24-36	Jarzombek Hendricks	Engaging emerging minority youth in real-time, community-based transportation research and modeling	completed
HVDE24-36A	Gomez-Ibanez	Transportation Cases throughout the Curriculum	active
UMAE24-37	Knodler	Creating an Education ASSET	active
UCNE24-38	Lownes	Senior Design	completed
UCNE24-39	Lownes	Graduate Course	active

### **Accomplishments under the New England UTC's education goal**

#### **Students impress at NEC-HFES 2015; win Volpe Award for best transportation presentation May 1, 2015**

Researchers at MIT's NE Center continue to make headway into the expanding field of driving behavior research with three presentations at the New England Chapter of the Human Factors and Ergonomics Society's Annual Student Conference held earlier this month. Most notably, visiting student Mauricio Muñoz won the Volpe Award for Best Transportation Presentation for his project "Using Hidden Markov Models for Classification of Driver Visual Behavior".



**STEM initiative: New England UTC hosts Career Day  
June 2, 2015**

On May 27, 2015, the New England University Transportation Center and the MIT Center for Transportation and Logistics hosted a career day for students from the Boston Collegiate Charter School in Dorchester, MA. Attendees were 15 high school sophomores, their math teacher, Ms. Daniella Suarez, and Ms. Bethany Guen, Director of Development and Communications. The school's mission is to prepare each student for college, and among students there has been a growing interest in science; as a result, the teachers have been trying to increase STEM-related opportunities for the students. This workshop exposed students to think about how different disciplines—from various branches of science and engineering to the social sciences—come together to address complex questions about transportation that don't fit neatly into simple categories.

**Project HVDR24-12**

**Disaster Recovery for Transportation: China's Wenchuan Earthquake of 2008 and Japan's Tohoku Earthquake and Tsunami of 2011**

Dr. Howitt taught several class sessions, based in part on research conducted under this grant, on Japan's recovery from the earthquake and tsunami in two Harvard Kennedy School Executive Education programs (General and Flag Officer Homeland Security Executive Seminar and Leadership in Crises) and one class at the Harvard Extension School (Disaster Relief and Recovery) on recovery from both the Japan disaster and China's Wenchuan Earthquake.

**Project UCNR24-29**

**Automated Congestion Prediction with Smart Phones**

The former postdoctoral fellow supported by this research project is now an assistant professor in the Electrical and Computer Engineering Department at the University of Massachusetts, Dartmouth. He is the author of a conference paper—which was accepted and presented—with the PI and co-PI, reporting the results of the research.

**Project HVDE24-36A**

**Transportation Cases throughout the Curriculum**

Four of the five transportation cases were test taught at Harvard University's Kennedy School of Government during the reporting period, and were revised on the basis of that experience.

**Project UCNE24-38**

**Senior Design**

This education project has successfully resulted in new senior design partnerships with the Connecticut Department of Transportation (CTDOT). CTDOT personnel were actively involved in mentoring senior Civil Engineering students associated with two design projects. Students and CTDOT engineers both report that the experience was very positive.

**Project UCNE24-39**

**"Urban Transportation Planning" online graduate course to premier in fall**

The objective of the course is to learn the theory and principles behind urban transportation planning as practiced in the US. In particular, the course will focus on the role of transport modeling in supporting transportation planning. The distance learning will adopt an asynchronous format to provide students flexibility and convenience in both time and space while ensuring the highest level of quality of instruction is maintained. The course will also utilize online collaboration tools to facilitate the collaboration/coordination entailed in completing the course. All information related to the course (including the virtual city, the simulated datasets, and additional learning resources) will be hosted on a dedicated web portal (e.g. [planthisvirtualcity.org](http://planthisvirtualcity.org)).

## 1C. Technology Transfer Projects

### Technology Transfer Goal

- To increase the awareness and level of information concerning transportation issues facing New England.
- To further our well-established technology transfer and outreach activities.
- To engage the public and private transportation sectors throughout the New England Region and the nation.

Following is the list of the 2 technology transfer projects under this grant, and their current status:

Project No.	PI	Project Title	Current Status
MITT24-45	Coughlin	MIT Technology Transfer Initiative	active
UCNT24-46	Shea	LTAP/TTAP Core Competency Development and Pilot	completed

### Accomplishments under the New England UTC's technology transfer goal

#### **Project HVDR24-14**

##### **Cell Phones and Vehicle Safety**

We have published a peer-reviewed paper based on this research (Daniel Shoag and Erich Muehlegger "Cell Phones and Motor Vehicle Fatalities" *Procedia Engineering* 78, p. 173-177, September 2014). The paper is available on ScienceDirect. We have also presented our findings at HumTech 2014 and HumTech 2015 to hundreds of researchers in the field. We have also incorporated our findings into our teaching.

#### **Project HVDR24-14A**

##### **Land-Use Regulation and Commuting Patterns**

We have published a peer-reviewed paper based on this research (Daniel Shoag and Erich Muehlegger "Commuting Times and Land Use Regulations", *Procedia Engineering* (2015) .488-493). The paper is available at ScienceDirect. We have also presented our findings at HumTech 2014 and HumTech 2015 to hundreds of researchers in the field. We have also incorporated our findings into our teaching.

#### **Project UCNR24-29**

##### **Automated Congestion Prediction with Smart Phones**

Results were prepared for submission to the International Conference on Software Engineering and Knowledge Engineering. This paper provides details of the experience gained implementing the mobile application and database server. It also reports steps that were taken to integrate these two so that location data could be transmitted from the app to the server through the internet for processing and storage. This experience report will benefit computing professionals and software engineers, increasing interest in transportation research and careers.

#### **Project UCNR24-30**

##### **Investigation of Road and Roadside Design Elements Associated with Elderly Pedestrian Safety**

The research findings have been documented in a paper submitted to and accepted for publication in

*Accident Analysis and Prevention*. The article is in press and will be published sometime in the coming months.

### **Project UCNR24-31**

#### **Transportation System Modeling in the Information Era Findings Presented at Two Conferences**

Findings from the application of earlier versions of the integrated model prototype were presented at two conferences: the Conference on Agent-Based Modeling in Transportation Planning and Operations in Blacksburg, Virginia held from September 30 – October 2, 2013; and the Innovations in Travel Demand Forecasting conference that was held in Baltimore, Maryland from April 27-30, 2014. The study team is also preparing to present latest results at the upcoming 14<sup>th</sup> International Conference on Travel Behavior Research to be held in Windsor, UK from July 19 – July 23, 2015.

### **Project UCNR24-32**

#### **Web Interface Scheduled for Late Summer Production**

The project team had made major strides during the last reporting period. A full-day t-HUB workshop (the third in the t-HUB series in the past 3 years) was held in Hartford on September 24, 2014. Details and photos from the event can be found at the project website <http://thub.uconn.edu>. The project team demonstrated an alpha version of the t-HUB web application, receiving a great deal of feedback that will be incorporated into the final version due to be launched summer of 2015. Also, development of the t-HUB web interface has progressed rapidly with the scheduled launch of the production grade application on schedule for August/September 2015.

In addition to the t-HUB workshop, the project PI was invited to speak at the Region 2 UTC's Transportation Technology Symposium on November 19, 2014 in New York, NY. The project PI had several other speaking engagements in spring 2015 that disseminated results from this project, including the CT ITE/APA Annual Meeting and an Invited Lecture at the University of Nebraska-Lincoln.

### **Project UCNE24-39**

#### **“Urban Transportation Planning” online graduate course to premier in fall**

This course will help develop instructional resources, data, and software related to transportation modeling that will benefit the transportation community at large. The proposed web portal will borrow/build on philosophies and practices from successful web education initiatives (e.g. code.org in the computer science arena) to build a publicly accessible transportation planning educational resource. All of the software will be distributed under open-source licensing agreements.

## **2. Products**

### **Journal publications**

Bertolaccini, K.; Lownes, N.E. and S.T. Waller (in review) Equitable routing of public transportation services, *Public Transport*.

Blanc, B.P., Gangi, M., Atkinson-Palombo, C., McCahill, C., Garrick, N. The Effects of Urban Fabric Changes on Real Estate Property Tax Revenue: Evidence from Six American Cities. *Transportation Research Record: Journal of the Transportation Research Board*, 2014.

Daniel Shoag and Erich Muehlegger, “Cell Phones and Motor Vehicle Fatalities” *Procedia Engineering* 78, p. 173-177, September 2014.

Daniel Shoag and Erich Muehlegger, “Commuting Times and Land Use Regulations”, *Procedia Engineering* (2015) .488-493.

Dobres, J., **Reimer, B.**, Parikhal, L., Wean, E. & Chahine, N. (2015). The Incredible Shrinking Letter: How Font Size Affects The Legibility of Text Viewed in Brief Glances. *Proceedings of the 8<sup>th</sup>*

[International Driving Symposium on Human Factors in Driver Assessment, Training, and Vehicle Design](#). Snowbird, UT. pp. 435-441. ([pdf](#))

Klemun, M. M. and Trancik, J. E., 'Hidden effects of carbon-focused energy policies call for accelerated methane mitigation', in review.

Lee, J., **Reimer, B.**, Mehler, B., Angell, L., Seppelt B. & Coughlin, J.F. (2015). Analysis of Glance Patterns of Older and Younger Drivers during a Visual-Manual HMI Interaction. Proceedings of [The Transportation Research Board 94<sup>th</sup> Annual Meeting](#), Washington, DC.

McCahill, C., Haerter, J., Garrick, N. W., Atkinson-Palombo, C. Parking in Urban Centers: Policies, Supplies, and Implications in Six Cities. *Transportation Research Record*, Volume 2469, pp. 49-56, 2014.

McCahill, C., Haerter-Ratchford, J., Garrick, N., Atkinson-Palombo, C. Parking in Urban Centers: Policies, Supplies and Implications in Six Cities. *Transportation Research Record: Journal of the Transportation Research Board*, 2014.

McCahill, C., Garrick, N. Automobile use and land consumption: Empirical evidence from 12 cities. *Urban Design International* 17 (3), 221-227, 2012.

McCahill, C., Haerter, J., Garrick, N. W., Atkinson-Palombo, C. Parking in Urban Centers: Policies, Supplies, and Implications in Six Cities. *Transportation Research Record*, Volume 2469, pp. 49-56, 2014.

McCahill, C., Haerter-Ratchford, J., Garrick, N., Atkinson-Palombo, C. Parking in Urban Centers: Policies, Supplies and Implications in Six Cities. *Transportation Research Record: Journal of the Transportation Research Board*, 2014.

McCahill, C., Garrick, N. Automobile use and land consumption: Empirical evidence from 12 cities. *Urban Design International* 17 (3), 221-227, 2012.

McWilliams, T., **Reimer, B.**, Mehler, B., Dobres, J. & McAnulty H. (2015). A Secondary Assessment of the Impact of Voice Interface Turn Delays on Driver Attention and Arousal in Field Conditions: A Consideration of 4 Vehicle Systems and a Smartphone. Proceedings of [the 8<sup>th</sup> International Driving Symposium on Human Factors in Driver Assessment, Training, and Vehicle Design](#). Snowbird, UT. pp. 414-420. ([pdf](#))

Mehler, B., Kidd, D., **Reimer, B.**, Reagan, I., Dobres, J. & McCartt, A. (2015). Multi-modal assessment of on-road demand of voice and manual phone calling and voice navigation entry across two embedded vehicle systems. Insurance Institute for Highway Safety, Arlington, VA. ([pdf](#))

Muñoz, M., Lee, J., **Reimer, B.**, Mehler, B. & Victor, T. (2015). Analysis of Drivers' Head and Eye Movement Correspondence: Predicting Drivers' Glance Location Using Head Rotation Data. Proceedings of [the 8<sup>th</sup> International Driving Symposium on Human Factors in Driver Assessment, Training, and Vehicle Design](#). Snowbird, UT. pp. 203-209. [Honda Outstanding Student Paper Award 1<sup>st</sup> Place]. ([pdf](#))

Reimer, B., Mehler, B., Reagan, I., Kidd, D. & Dobres, J. (2015). Multi-modal demands of a smartphone used to place calls and enter addresses during highway driving relative to two embedded systems. Insurance Institute for Highway Safety, Arlington, VA. ([pdf](#))

Roy, M., Edwards, M. R. and Trancik, J. E., 'Methane mitigation timelines to inform energy technology evaluation' in review (arXiv:1501.03041v1).

Sinelnikova, A., Lee, J., Reimer, B., Mehler, B. & Coughlin, J.F. (2015). Predicting Secondary Task Involvement and Differences in Task Modality Using Field Highway Driving Data. Proceedings of [the 8<sup>th</sup>](#)

[International Driving Symposium on Human Factors in Driver Assessment, Training, and Vehicle Design](#). Snowbird, UT. pp. 393-399. [Honda Outstanding Student Paper Award 2<sup>nd</sup> Place]. ([pdf](#))

Y. Zhang, S. Mamum, J. Ivan, N. Ravishanker, K. Haque, "Safety Effects of Exclusive and Concurrent Signal Phasing for Pedestrian Crossing", *Accident Analysis & Prevention*, in press.

### **Books, dissertations, or one-time publications**

K. Haque, "Safety Effects of Exclusive and Concurrent Signal Phasing for Pedestrian Crossing", M.S. Thesis, University of Connecticut, Civil Engineering, 2015.

McCahill, C., Garrick, N. Parking Supply and Urban Impacts. Parking Issues and Policies (Transport and Sustainability, Volume 5) Emerald, 2014.

McCahill, C., Garrick, N.W. (2015). The Impact of Parking Growth on the Fiscal and Social Well-Being of Cities. In Parking and the City.

McCahill, C., Garrick, N.W. (2014). Parking Supply and Urban Impacts. In Ison, S. and Mulley, C. (Ed), *Parking: Issues and Policies*, Emerald Literati Network (London).

### **Other publications, conference papers and presentations**

Bertolaccini, K.; Lownes, N.E. and S.T. Waller (2015) Equity Modeling for Public Transportation Networks, *Proc. 94<sup>th</sup> Annual Meeting of the Transportation Research Board*, Paper #15-1173.

Blanc, Bryan, Gangi, Michael, Atkinson-Palombo, Carol, Garrick, Norman W, McCahill, Chris, "The Effects of Urban Fabric Changes on Real Estate Property Tax Revenue: Evidence from Six American Cities", 93rd Annual Meeting of the Transportation Research Board.

Edwards, M. R., Roy, M., Klemun, M. M. and Trancik, J. E., 'Evaluating the time-dependent climate impacts of natural gas deployment', poster presentation, MIT Energy Initiative (MITEI) Seed Fund poster session, Cambridge, USA, February 25, 2015.

Fiondella, L., Gokhale, S.S., and Lownes, N., Automated Congestion Prediction with Smart Phones: Architectural Design and Integration Lessons Learned, *International Conference on Software Engineering and Knowledge Engineering*, Pittsburgh, PA, July 6-8, 2015.

Garrick, Norman W, "Parking Reform", National Endowment for the Arts - Mayor's Institute on City Design, NEA - MICD.

Garrick, Norman W, "What Gets Measured Gets Counted", Mobility Public Policy Summit.

Garrick, Norman W, "Historic Perspective on Parking", 93rd Annual Meeting of the Transportation Research Board

Garrick, Norman W, "What Gets Measured Gets Counted", Mobility Public Policy Summit.

Garrick, Norman W, "Historic Perspective on Parking", 93rd Annual Meeting of the Transportation Research Board.

Konduri, K.C., Ning, Y., Angueira, J., and Pendyala, R.M. Transportation System Modeling in the Information Era: An Application of a Continuous-Time Integrated Transport Modeling Framework for Capturing Activity-Travel Behaviors in Response to Real-Time Traveler Information. Presented at the Conference on Agent-Based Modeling in Transportation Planning and Operations, Blacksburg,

Virginia, September 30 – October 2, 2013.

Konduri, K.C., Ning, Y., Pendyala, R.M., and Zhou, X. Modeling Behavioral Response to Real Time Traveler Information: An Application of a Continuous-Time Integrated Modeling Framework. Presented at the 2014 Conference on Innovations in Travel Demand Forecasting, Baltimore, MD, April 27-30, 2014.

Konduri, K.C., Ning, Y., Pendyala, R.M., Zhou, X., You, D., and Garikapati, V. Modeling Behavioral Response to Real Time Traveler Information: An Application of a Continuous-Time Integrated Modeling Framework. Presented at the 14<sup>th</sup> International Conference on Travel Behavior Research, Windsor, UK, July 19-23, 2015.

Konduri, K.C., Rehan, A., and Lownes, N. Crowdsourcing Real-Time Traveler Information Services: An Exploratory Analysis of Data Quality. Submitted for Presentation to the 2014 Conference on Innovations in Travel Demand Forecasting, Baltimore, MD, April 27-30, 2014.

McCahill, Chris, Garrick, Norman W, Atkinson-Palombo, Carol, "Visualizing Urban Parking Supply Ratios", Congress for New Urbanism (CNU) 22: The Resilient Community, Buffalo, New York.

McCahill, Chris, Haerter, Jessica, Garrick, Norman W, Atkinson-Palombo, Carol, "Parking in Urban Centers: Policies, Supplies, and Implications in Six Cities", 93rd Annual Meeting of the Transportation Research Board.

Raveau, S., Ghorpade, A., Nawarathne, K., Zhenquang, Q., Ko, W., Zhao, F., Abou-Zeid M., Zegras, C. and Ben-Akiva, M. (2015) Smartphone Based Travel Survey to Study the Relationship Between Happiness and Behavior. 5th Future Urban Mobility Symposium, July 6-7, Singapore.

Trancik, J. E., Edwards, M. R., Klemun, M. M., Roy, M., 'Emissions metrics and evaluating methane-emitting natural gas as a bridge fuel', Poster presentation, Our Common Future Under Climate Change (CFUC), Paris, July 7-10, 2015.

### **Websites or other Internet sites**

[www.happymobility.org](http://www.happymobility.org)

### **Media**

"3 Enormous Benefits to Charging the Right Price for Parking". The Atlantic Cities. April 2, 2014.

"3 Enormous Benefits to Charging the Right Price for Parking". The Atlantic Cities. April 2, 2014.

"American Cities Are Haunted by Too Many Parking Spaces". BloombergBusinessweek. April 1, 2014.

"American Cities Are Haunted by Too Many Parking Spaces". BloombergBusinessweek. April 1, 2014.

"Hartford overinvested in parking". Hartford Business. April 14, 2014.

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## Technologies or techniques

### **Project UCNR24-29**

#### **Automated Congestion Prediction with Smart Phones**

A software system to collect transportation data was developed under this research project. A user installs an app on their smartphone and, as they travel, a sequence of coordinates is transmitted to a server. Trip sequences are anonymous to protect user identity and location. The mobile app developer shares the app by downloading it to the user's smartphone.

## Inventions, patent applications, and licenses

Nothing to report

## Other products

### **Project UMAR24-14B**

#### **Signal Timing Optimization for Improved Person Mobility and Air**

Farnoush Khalighi was awarded the 2nd position for best poster at the 16th University of Massachusetts Annual Technical Day and Student Research Symposium, March 26, Amherst, MA

### **Project MITR24-1**

#### **Capturing the Relationship between Motility, Mobility and Well-Being Using Smart Phones**

We have developed a conceptual approach to the implementation of happiness evaluations within the Future Mobility Sensing (FMS) survey platform. FMS is a smartphone-based system that tracks users' activities and trips, which can detect certain trip attributes such as the mode. Users can visualize their activities and trips as an activity diary on the FMS app (or alternatively on the FMS website) where they also have the option to verify their activity diary and provide further information. The FMS has initially been developed as part of the Future Urban Mobility project of the MIT-Singapore Alliance for Research and Technology (SMART) and is under continuous development as part of other projects as well including this UTC project.

### **Project UCNR24-29**

#### **Automated Congestion Prediction with Smart Phones**

Other significant products developed under this research study include a MySQL database of vehicle location sequences. Over 40,000 data points were collected. These sequences can be extracted for visualization. The raw data can also be used to develop transportation models for congestion prediction.

### **3. Participants & Other Collaborating Organizations**

#### **Organizations that have been involved as partners**

Charlotta Johansson and Lars Leden, Luleå University of Technology, Sweden. Luleå University of Technology, Sweden

Hector Monterde-i-Bort, Psychonomy Research Unit - Unitat de Reserca en Psiconomia, Dpt. Methodology of Behavioral Sciences. University of Valencia, Spain

Socrates Basbas, Dept. of Transportation & Hydraulic Engineering Faculty of Rural and Surveying Engineering, School of Technology Aristotle University of Thessaloniki, 541 24 Thessaloniki, Greece

The Department of Electrical and Computer Engineering (ECE), UMass Amherst, Dr. Lixin Gao and her student Tian Zhou.

The Hartford Center for Mature Market Excellence (formerly The Advance50 Team at The Hartford), 200 Hopmeadow, Simsbury, CT; financial support contributed to the project.

Volpe National Transportation Systems Center, the Massachusetts Institute of Technology, and the Federal Railway Administration.

#### **Other collaborators or contacts that have been involved**

Central Connecticut RPA - workshop participant

CCNY – workshop participant – workshop participant

Greater Bridgeport Transit – workshop participant

Greater Hartford Transit District – workshop participant

Greater New Haven Transit District – workshop participant

Lower CT River Valley COG – workshop participant

Northeastern Connecticut Transit District – workshop participant

South Western Regional Planning Agency – workshop participant

Southeast Area Transit District – workshop participant

Sukran Ilgin Guler, Assistant Professor, Civil and Environmental Engineering, Penn State University, [iguler@engr.psu.edu](mailto:iguler@engr.psu.edu)

Windham Regional COG – workshop participant

Windham Regional Transit District – workshop participant



## **4. Impact**

### **Project HVDR24-12**

#### **Disaster Recovery for Transportation: China's Wenchuan Earthquake of 2008 and Japan's Tohoku Earthquake and Tsunami of 2011**

Research conducted under this grant has informed lectures that Professor Howitt has given in classes at Harvard Kennedy School and the Harvard Extension School regarding recovery from large-scale disasters. Students of public management have thus gained a greater understanding of the policy and implementation challenges of organizing recovery, including in the transportation sector, in the face of complex, disruptive natural disasters.

### **Project UCNR24-29**

#### **Automated Congestion Prediction with Smart Phones**

The data collected will enable the development of dynamic profiles of the volume of traffic using roads. This will enable the creation of new transportation models to more accurately characterize the impact of congestion on the efficiency of travel within the transportation network. These models could be used to mitigate the trend toward increasingly severe congestion in cities throughout the world.

### **Project UCNR24-31**

#### **Transportation System Modeling in the Information Era**

The project team has finished the development of an integrated model prototype that combines OpenAMOS (- an open-source activity-based travel demand model implementation) and DTALite (- an open-source dynamic traffic assignment model implementation) for modeling the impacts of different types of real-time traveler information solutions. The team is currently working with authors of the DTALite software to incorporate additional software capabilities and, after completion, the study team will embark on final sets of scenario runs for the study area (i.e. Hartford metropolitan area).

### **Project UCNR24-32**

#### **t-HUB: Connecticut Public Transport Data Hub**

This research has had significant impacts on the management of transit data and the usage of data in public transit planning and operations. In particular, the t-HUB database and webtool will create a centralized repository of the network, demographic and socio-economic data necessary to perform equity and environmental justice analysis by transit planners and operators. Furthermore, the repository will create a valuable resource for students and researchers looking for living laboratory opportunities; that is, opportunities to test their methods, techniques and technologies on real data from real transit systems.

### **Project UMER24-33**

#### **Elderly Pedestrian Safety and Driver Distractions**

Prof. Garder used knowledge learned in this project when participating in a Pedestrian Safety Audit in Falmouth, Maine, and while participating in the Public Advisory Council (as a member) for reconstruction of Broadway in Bangor, Maine.

### **The impact on the development of the principal disciplines of the program**

### **Project UMAR24-19A**

#### **An Optimal Adaptive Routing Algorithm for Large-Scale Stochastic Time-Dependent Networks**

The research provides a unified framework for studying adaptive routing in stochastic time-dependent networks, where both the network stochasticity and the real-time traveler information access play a role in defining the routing problem. The developed model and algorithm is applicable to large-scale real life networks and, thus, readily available for practitioners to adopt in application projects.

### **The impact on other disciplines**

### **Project HVDR24-12**

#### **Disaster Recovery for Transportation: China's Wenchuan Earthquake of 2008 and Japan's**

### **Tohoku Earthquake and Tsunami of 2011**

Research conducted under this grant has informed lectures that Professor Howitt has given in public policy and management classes at Harvard Kennedy School and the Harvard Extension School regarding recovery from large-scale disasters. Students of public management have thus gained a greater understanding of the policy and implementation challenges of organizing recovery, including in the transportation sector, in the face of complex, disruptive natural disasters.

### **Project UMAR24-14B**

#### **Signal Timing Optimization for Improved Person Mobility and Air, UMAR24-14B**

Environmental engineers and scientists will be interested in using the developed models and mathematical program to better understand how traffic signal control and traffic levels affects the levels of emission in busy urban centers.

### **Project UMAR24-23**

#### **Making More Value out of Transportation Data**

Though this research used transportation to provide domain knowledge, the proposed methodology (such as big data processing technology and hierarchical Bayesian network) is domain-independent and lends a useful perspective to address problems in other disciplines, such as Internet traffic management and manufacturing systems.

### **Project UMAR24-25**

#### **Reducing Older Driver Crashes: Technology, Training and Livable Communities**

The training developed for this program has implications for driver training in other at-risk groups including teenage drivers and drivers recovering from brain injury as well as driving for professional services such as police, fire fighters, EMTs and commercial drivers.

### **The impact on the development of transportation workforce development**

### **Project UMAR24-14B**

#### **Signal Timing Optimization for Improved Person Mobility and Air**

The graduate student working on this project is female: Ms. Farnoush Khalighi. This assists in the effort of increasing the diversity of the transportation workforce. In addition, this research was disseminated to transportation practitioners, faculty, young people, and the public through the conferences the team participated and presented at, and through the journal publications

### **Project UMAR24-21A**

#### **Data-based Model for Regional Freight Demand**

This project funds Ms. Mahour Rahimi, who is a female Ph.D. student in transportation engineering. She is actively engaged in the student community and will be joining the transportation workforce upon graduation. Her involvement broadens the diversity of the students and researchers working on transportation engineering problems. This project also funds Mr. Aaron Keegan, who is a M.S. student in transportation engineering. He comes to this project from experience working on demand modeling for a consulting firm, and he is planning to return to practice in industry following this degree.

### **The impact on physical, institutional, and information resources at your university or other partner institutions**

### **Project MITR24-11A**

#### **Time Dependent Environmental Impact of Transportation**

This research incorporates a professional education summer course: MIT Short Program on 'Understanding and Predicting Technological Innovation: New Data and Theory', to be offered by Prof. Trancik, July 13-17, 2015.

### **Project UMAR24-15**

#### **A Person-based Comparison of Transit Preferential Treatments on Signalized Arterial Corridors**

A C++ code has been created through Aimsun's Advanced Programming Interface that can be used to provide green extension at signalized arterials when a transit vehicle is detected. This code can be utilized with minor modifications to any simulated network and can become available to other researchers within the New England UTC.

### **The impact on technology transfer**

#### **Project UCNR24-29**

##### **Automated Congestion Prediction with Smart Phones**

The research will result in new mathematical models to characterize congestion more accurately. These models may incorporate advanced statistical computing techniques such as machine learning. These methods could also be used to identify where improvements to public transportation would be most beneficial. The methods will be useful to transportation engineers and planners who can use them to mitigate the negative impact of network inefficiencies, especially within cities.

#### **Project UCNR24-32**

##### **t-HUB: Connecticut Public Transport Data Hub**

The t-HUB application will make transit system and demographic data much easier to access for transit planners. The simple, yet robust system will also serve as a straightforward means of transferring technology to users immediately. An early example will be the inclusion of the Transit Opportunity Index (TOI), which will be integrated into the initial toolset. The TOI was developed through a related prior research grant through CTDOT.

### **The impact on society beyond science and technology**

#### **Project UMAR24-25**

##### **Reducing Older Driver Crashes: Technology, Training and Livable Communities**

Driving instructors and occupational therapists who work directly with older drivers are the primary target audience for such training. Therapists can prescribe training programs for those drivers they believe would benefit from additional remediation of driving skills.

#### **Project UCNR24-29**

##### **Automated Congestion Prediction with Smart Phones**

The impact on society beyond science and technology includes improving social, economic, and environmental conditions. The app can be enhanced to conduct demographic surveys inexpensively. Studies on this data could pinpoint economic bias present in public transportation to specific underserved locations that disproportionately rely on such services. Reducing congestion through transportation models will improve the quality of life in large cities that suffer from severe congestion by reducing travel times and pollution.

## **5. CHANGES/PROBLEMS**

No change.

## **Additional information regarding Products and Impacts**

### **Project UCNR24-31A**

#### **Crowdsourcing Real-Time Traveler Information Services: Issues, Challenges and Recommendations**

The smartphone application and associated web infrastructure will be released under open-source licensing agreements. Interested users can then borrow codebase to implement a crowdsourcing-based traveler information system for transit services in a different study area. Additionally, the software can be extended to provide traveler information for other modes of transportation. Also, research conducted in the study will provide interesting insights into the feasibility and applicability of crowdsourcing as a paradigm for providing traveler information.

#### **Outputs**

Nothing to report

#### **Outcomes**

Nothing to report

#### **Impacts**

Nothing to report