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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 37 research projects under this grant, and their current status:

Project No.	PI	Project Title	Status
MITR25-1	Abou-Zeid Ben-Akiva	Capturing the Relationship between Social Interaction and Travel Behavior Using Smart Phones	active
MITR25-2	Caplice Caballero	High-Resolution Urban Freight Modeling in Cambridge, MA	active
MITR25-3	Coughlin	Assessing Navigatability and Livability of Public Transportation Systems	active
MITR25-4	Ellis Lavalliere	Transportation Workforce Health and Wellbeing	active
MITR25-5	D'Ambrosio	Understanding the Adoption of and Education about New Auto Technologies among Older Adults	active
MITR25-6	Frazzoli	Modeling the Impact of One-Way Car Sharing: An integrated data- and optimization-driven approach	active

MITR25-7	Goentzel	Fusing Structured and Unstructured Transportation Data for Decision-Making in Crisis	active
MITR25-8	Gonzalez	Coupled Mobility Networks: A Data Driven Approach	active
MITR25-9	Isaacson	Out and About in New England: Maintaining Active Life styles in Later Life	active
MITR25-10	Lee	Effectiveness of Various Information Channels on User Training and Learning in Automobiles	active
MITR25-11	Osorio	Optimal Road Traffic Operations for an Increasingly Autonomous and Connected Vehicle Fleet	active
MITR25-12	Pentland Shmueli	Incentivizing Safer Driving Using Peer-Pressure	active
MITR25-13	Reimer Dobres	Assessing the Effect of Typography on In-Vehicle Glance-Like Reading Across the Lifespan	active
MITR25-14	Salvucci Murga	MALL Transit and Wider Economic Benefit Assessment	completed
MITR25-15	Sussman	Hub Stations As Catalysts for Regional Growth: The Case of New York Penn Station	active
MITR25-16	Trancik	From Trip Data to the Energy Requirements of Personal Vehicle Travel	active
MITR25-17	Zegras Pereira	Scenario Discovery for Resilient Urban Systems (or, The Future is "Big Data")	completed
MITR25-18	Zhao	Humanizing Travel: How E-hail Apps Transform Stakeholder Relationships in Taxi Services	active
HVDR25-19	Glaeser	Transportation Stimulus Spending and Long Term Unemployment	active

HVDR25-20	Gomez-Ibanez Fagan	The Experience with Managed Toll Lanes	active
HVDR25-21	Howitt	Recreating Livable Communities after Catastrophe: Managing the Recovery from Japan's Earthquake, Tsunami, and Nuclear Disaster of 2011	active
HVDR25-22	Mayne	The Politics of Transport Policy in the Greater Copenhagen Region, Part 2	active
HVDR25-23	Shoag	The Local Effects of the American Recovery and Reinvestment Act on Economic Activity and Traffic Safety	active
UMAR25-24	Christofa Knodler	Operational and Emission Analyses of Roundabouts under Varied Vehicle and Pedestrian Demands	active
UMAR25-25	Fisher Knodler Zafian	Evaluating the Effect of Google Glass on Driver Distraction	active
UMAR25-26	Gao	Routing Policy Choice Models in Stochastic Time-Dependent Networks: The Stockholm Case Study	active
UMAR25-27	Gonzales	Route Choice in Congested Grid Networks	active
UMAR25-28	Knodler Fisher	A Driving Simulator Evaluation of Driver Distraction and Traffic Control Device Comprehension for At-Grade Railroad Crossings	active
UMAR25-29	Krishnamurty	An Innovative Design to Retrofit Seatbelts in Motorcoaches	active
UMAR25-30	Ni Wang	Supplementary Vehicle Positioning to Connected Vehicles	active
UCNR25-31	Atkinson-Palombo Garrick	A Multi-Scalar Model to Identify the Causes of Decreased Vehicle Miles Traveled (VMT) in the United States	active
UCNR25-32	Garrick Atkinson-Palombo	Factors Contributing to the Decrease in Traffic Fatality Rates for Young People in America	active

UCNR25-33	Ivan Ravishanker Townsend	Social Network Effects on Attitudes about Pedestrian Street Crossing Behavior	active
UCNR25-34	Konduri Dalal	Exploration of Human Psychological Factors Underlying Mobile Phone Usage Behaviors while Driving	active
UCNR25-35	Lownes	Clustering Algorithms for Transit Network Design	active
UMER25-36	Garder	Deficient Bridges and Safety Information	active
UMER25-37	Rubin Garder	Automated Vehicles: Economic Incentives for Environmental Benefits and Safety	active

Accomplishments under the New England UTC's research goal

Dr. Bryan Reimer Speaks at Lifesavers National Conference
April 6, 2016
New England UTC Associate Director Bryan Reimer spoke at the 2016 Lifesavers National Conference, the largest gathering of highway safety professionals in the U.S. Held in Long Beach, California in early April 2016, Reimer served on the Distracted Driving in 2016 Q&A Session with other leading distracted driving researchers including Michael L. Brown, Office of Impaired Driving & Occupant Protection National Highway Traffic Safety Administration (moderator); David Strayer, University of Utah; Robert Scopatz, VBH, Inc.; and David Kidd, Insurance Institute for Highway Safety.

New England UTC Participates in DOT Unveiling of New Self-Driving Car Policies
September 20, 2016
Today, the Department of Transportation held a press event announcing new policy statements regarding highly automated vehicles and their presence on US roads. The New England UTC was one of six academic affiliated entities invited to bring a research vehicle to this important press event and was the only organization to bring a vehicle with advanced automation features that are currently publicly available in the US, rather than a prototype of a highly automated vehicle. This selection highlights the significance of the NE UTC's approach to studying currently deployed automated vehicle technologies. By focusing on vehicles currently available to consumers, UTC researchers are deeply exploring the transition that is occurring on our nation's roads. The NE UTC believes advanced vehicle systems to be "dynamic emerging technologies," and is committed to focusing on the potential safety and mobility benefits of highly automated vehicles.

Project MITR25-1
Scenario Discovery for Resilient Urban Systems (or, The Future is "Big Data")
This research project culminated with the final demonstration of the model system uncertainty by showing how a land use-transport (LUT) model can be used to forecast the short and longer term impacts of potential 4-foot sea level rise in Greater Boston by 2030. The short-term scenario represents the immediate transport system response to inundation, which provides a measure of resiliency in the case of an extreme event, such as a storm surge. In the short run, the results reveal that transit captive users will suffer more. Assuming no supply constraints, new residential growth centers would emerge on the peripheries of the inundated zones, primarily in the inner-core suburbs. Some regional urban centers and traditional industrial towns would boom. Firms would be hit harder, due to their heavy concentration in the inner-core; firm relocation would largely follow households. Transit usage would again be decimated, but walking trips would increase.

Project MITR25-4
Transportation Workforce Health and Wellbeing
To begin understanding and addressing the challenges associated with the aging transportation workforce, a literature review has been conducted. Data analysis is ongoing and has begun by analyzing data surrounding well-being of transportation workers compared to other industries. Our analysis has found that transportation workers report lower levels of work environment well-being than other industries; further analysis is being done to understand what contributes to these differences.

Project MITR25-16
From Trip Data to the Energy Requirements of Personal Vehicle Travel:
We have continued our research activities on identifying vehicle trip patterns on high energy days where electric vehicles cannot meet the day's energy requirement. A set of data mining algorithms has been applied to understand the inherent vehicle activity patterns and clustering effect across the U.S. The result shows what types of vehicle day trips correspond to low daily adoption potential of electric vehicles. We have also continued developing and testing our vehicle energy model, TripEnergy, to allow for future studies of the feasibility of evaluating energy consumption and emissions of different vehicle choices for a specific customer, as well as the impacts of vehicle electrification on the electric grid.

Project HVDR25-19
A Clearer Picture of How Highway Construction Supports Jobs
This project evaluates how effective Recovery Act highway infrastructure spending was at creating construction jobs and boosting overall employment growth in the wake of the 2008 recession. Our clearest finding is that road construction projects have little to no impact on employment by employers in the locale of the project, whether defined as the county or broader commuting zone of the project. We also cannot conclude any sizable employment effect in the locale of the contracting firms' offices. We have submitted a manuscript to an academic journal for peer review and publication. The Taubman Center at the Harvard Kennedy School has posted the manuscript as a working paper for public comment on its website. Once we receive feedback from academic colleagues, we intend to summarize our findings in a white paper report for policy officials. The paper can be accessed at
https://www.hks.harvard.edu/centers/taubman/publications/working-papers

Project UCNR25-31
A Multi-Scalar Model to Identify the Causes of Decreased Vehicle Miles Traveled (VMT) in the United States
The work conducted has been impactful in identifying that the downward trend in VMT in the US is not a recent phenomenon. In fact, when VMT data are analyzed at the state level, it is evident that VMT decreases date back as far as twenty years, beginning with the state of Washington. This is very important because policy-makers have been interpreting this phenomenon as something that happened recently, and adopting a "wait-and-see" approach. VMT is an important determinant of many policy-oriented issues, most importantly funding. Presentations at the Transportation Research Board in January and the news article written by the Washington Post about the research garnered a great deal of attention. The data associated with the project have been made publicly available via the Washington Post website to extend discussion and analysis of this phenomenon.

Project UCNR25-33
Social Network Effects on Attitudes about Pedestrian Street Crossing Behavior
We have implemented an online cascading survey—Cascading Survey of Stated Pedestrian Behavior Implemented Online—of individual attitudes and behavior regarding crossing urban streets as a pedestrian at signalized intersections. The survey consists of questions about demographics, pedestrian crossing behavior and attitudes about traffic, as well as videos simulating different pedestrian street crossing environments. The online version of the survey was implemented and hosted by Intellitics, Inc. Members of the research team invited members of their social networks to participate in the survey, with each group identified as a unique "tribe" in order to permit learning about how membership in each group is associated with individual responses. Each tribe was permitted to cascade over several weeks, with respondents inviting other individuals they know to join the tribe and participate. The team has written SAS code to download the survey data and texts from discussions (collected by Intelletics and made available as google docs) into csv files ready for analysis. This was done for the two large and two small "tribes" for whom the online survey was administered.

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

UTC New England Associate Director Interviewed on NPR
April 29, 2016
New England UTC Associate Director Bryan Reimer offers possible autonomous vehicle solutions to Boston's traffic congestion in this roundtable interview for NPR. Dr. Reimer says, "Our work is really at the infancy of trying to understand how people relinquish control and take control back from highly autonomous vehicle situations. … I think it is an open question as we look to the future whether urban congestion will grow or decrease."

New England UTC Study on Autonomous Vehicles Goes Viral
June 8, 2016
New England UTC Associate Director Bryan Reimer along with his team have published the results of a timely consumer survey asking about autonomous technology, how satisfied they were with the technology already in their cars, and how interested they were in transportation alternatives. This recent New England UTC research study, Autonomous Vehicles, Trust, and Driving Alternatives: A survey of consumer preferences has gone viral.

Project MITR25-1
Scenario Discovery for Resilient Urban Systems (or, The Future is "Big Data")
The research was presented, by invitation, at MOBILIZE, the International Sustainable Transport Summit held in Yichang, China September 21-23, 2016 (http://staward.org/mobilize-yichang/mobilize-yichang-agenda/). The final paper resulting from the project has been invited for podium presentation (and TRR publication) at a special session on climate change adaptation and mitigation at the 2017 Annual Meeting of the Transportation Research Board. The models and results have also been shared with the Metropolitan Area Planning Council (MAPC) staff in numerous research workshops. MAPC is developing similar integrated land use-transport modeling systems so the exchanges have been on data, methods, and findings. The findings were also shared with the Chief Resilience Officer of the Boston Mayor's Office of Resilience and Racial Equity.

Project MITR25-15
Hub Stations As Catalysts for Regional Growth: The Case of New York Penn Station
Rebecca Heywood, a dual Master of Science in Transportation/ Master of City Planning student submitted her thesis in June 2016 for both degrees marking a major milestone in our research on this project. Working with her and under the supervision of Professor Sussman is Daniel Mascoop, who received his Bachelor degrees in both Civil and Environmental Engineering and Urban Studies and Planning Transport in June 2016 as well. Mascoop continues to advance this research into the immediate future.

Project MITR25-16
From Trip Data to the Energy Requirements of Personal Vehicle Travel:
We have continued our research activities on identifying vehicle trip patterns on high energy days where electric vehicles cannot meet the day's energy requirement. A set of data mining algorithms has been applied to understand the inherent vehicle activity patterns and clustering effect across the U.S. The result shows what types of vehicle day trips correspond to low daily adoption potential of electric vehicles. We have also continued developing and testing our vehicle energy model, TripEnergy, to allow for future studies of the feasibility of evaluating energy consumption and emissions of different vehicle choices for a specific customer, as well as the impacts of vehicle electrification on the electric grid.

Project UMAR25-24
Operational and Emission Analyses of Roundabouts under Varied Vehicle and Pedestrian Demands
Publication in the Advances in Transportation Studies, an International Journal, 2016 Special Issue, Vol.2: Roach, D., Christofa, E., and Knodler Jr., M.A. 2016. Safety Assessment before and after Implementation of Roundabouts through Microsimulation. Advances in Transportation Studies, an International Journal, 2016 Special Issue, Vol.2. This paper was also presented at the 2015 Road Safety & Simulation International Conference, 6-8 October, 2015, and included the safety assessment of two roundabouts that we have studied so far: University of Massachusetts Amherst campus, at N. Pleasant and Governors Dr. and the double roundabout located at Route 116 and Bay Road in Amherst, MA. This research utilized the before- and-after microsimulation models and field data that have been developed (in VISSIM) collected as part of this project and presented a safety analysis of the before-and-after conditions using field data and data obtained through the Surrogate Safety Assessment Model (SSAM).

Project UMAR25-25
Evaluating the Effect of Google Glass on Driver Distraction
A driving simulator study was conducted: Does the Presentation of Traffic Sign Information on Head-Mounted Displays Improve Latent Hazard Anticipation? The experiment determined whether warnings of an impending latent hazard, delivered on Google Glass, can improve both young and middle-aged drivers' latent hazard anticipation ability. The ability to identify latent hazards is associated with decreases in crash risk. The results showed that the latent hazard anticipation performance of young drivers was significantly affected by Google Glass, with drivers in the Glass condition anticipating nearly two times the proportion of hazards detected by those in the control condition. For middle aged drivers, their performance was not significantly affected by the warnings from Google Glass. It is concluded that head mounted displays like Google Glass offer a promising platform for the delivery of traffic warnings to help young driver better detect hazards on the road.

Project UMAR25-28
A Driving Simulator Evaluation of Driver Distraction and Traffic Control Device Comprehension for At-Grade Railroad Crossings
A first-of-its-kind rail simulation model has been fully constructed in a virtual driving environment. The precisely constructed scenarios carefully sequence the movement and placement of virtual objects in the presence of railroad crossings to test driver attention, visual detection and the effect of distraction. Fifty-three participants have been recruited for this simulator experiment. Participants were randomly assigned to one of two groups: control, or experimental. Participants assigned to the experimental group were asked to undertake a secondary task during the drive, in the form of a mock cellphone conversation or an in-vehicle task where the participant was asked to change the radio station. Eye tracker data as well as vehicle measures have been collected for each participant and the preliminary analysis is currently underway.

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 transporttation workforce to support their capacity to build, operate and manage a safe and efficient transportation system.

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

Project No.	PI	Project Title	Status
HVDE25-38	Howitt	Teaching Case Study on Korea Ferry Disaster of April 2014	active
HVDE25-39	Davis Altshuler	Transforming Urban Transport: a Set of Case Studies	active

Accomplishments under the New England UTC's education goal

New England UTC hosts "Careers in Transportation Day"
May 26, 2016
The New England UTC hosted "Careers in Transportation Day" for 15 high school sophomores on May 26. The students came from the Boston Collegiate Charter School, whose mission it is to prepare each student for college. The purpose of the day was to give students a sense of the range of different kinds of careers and disciplines that touch transportation. Dr. Lisa D'Ambrosio, UTC Associate Director of Partnerships, organized the workshop. The students heard a series of brief presentations illustrating different kinds of work and research around transportation. The talks demonstrated how STEM training was important in solving challenging real world problems. The students learned how their future interests could intersect with careers in or research about transportation.

Newton South High Student Lauren Miller Receives OMEGA scholarship
July 26, 2016
On July 26th the New England UTC, in partnership with the AARP, presented the inaugural OMEGA scholarship to Lauren Miller, a rising senior at Newton South High School. The OMEGA scholarship recognizes young people who work to foster intergenerational connections within their communities. The OMEGA scholarship will provide $1000 toward

Lauren's college tuition, and an additional $1000 to Newton South High to continue Lauren's intergenerational efforts. Lauren cofounded a student group called Crossing Generations, which organizes events to connect high schoolers with local senior citizens. OMEGA (Opportunities for Multigenerational Engagement, Growth, and Action) supports the development and growth of student programs and clubs that connect high school students with older adults. The AARP and the New England UTC are pleased to continue offering the OMEGA scholarship for the coming academic year.

Parker Sorenson named 2016 Outstanding Student of the Year
November 4, 2016
Parker Sorenson, a graduate student pursuing his master's degree in Transportation and Urban Engineering at the University of Connecticut, has been awarded the 2016 UTC Outstanding Student of the Year Award by the New England University Transportation Center at MIT. He will receive $1,000 plus the cost of attendance to the 2017 96th Annual TRB Meeting taking place in Washington, DC January 8-12, 2017. All of the national UTC award winners will be honored at the 26th Annual Outstanding Student of the Year Awards ceremony, which is scheduled to take place as part of the CUTC annual banquet on January 7, 2017.

Project MITR25-15
Hub Stations As Catalysts for Regional Growth: The Case of New York Penn Station
Daniel Mascoop was awarded the "Leo (Class of 1924) and Mary Grossman Award" in honor of Mr. Grossman who had a professional career in highway design and planning on May 13, 2016. The Grossman Award is given to an undergraduate student with a strong interest in transportation and a strong academic record. Daniel is very active in research in the transportation fields, working on an internship with Professor Ben-Akiva in Singapore and with Professor Sussman and the R/HSR Group on his senior capstone project entitled "Evaluating the Process of Developing Infrastructure Systems Through Investigation of an Important Rail Hub". Daniel was also one of the leaders in the fossil fuel divestment movement at MIT over the past year and played a positive role in its reaching an eventual agreement.

Project HVDR25-21
Recreating Livable Communities after Catastrophe: Managing the Recovery from Japan's Earthquake, Tsunami, and Nuclear Disaster of 2011
Professor Howitt has disseminated research results for this reporting period by incorporating lessons learned from Japan's recovery into the curricula for two graduate-level management courses he teaches at the Harvard Extension School and into a suite of Harvard Kennedy School Executive Education programs for senior practitioners from a range of disciplines, but primarily representing public safety, emergency management, and homeland security.

Project HVDE25-38
Teaching Case Study on Korea Ferry Disaster of April 2014
A full draft of the case study has been prepared. During this reporting period it was sent to subject matter experts for fact checking and review in preparation for publication. It was also used as curriculum for a fall semester graduate-level course offered by the project P.I. at the Harvard Extension School, to stimulate class discussion on issues of regulatory failure, the implications of shortcomings in emergency preparedness, and the potential political and commercial consequences of crisis and inadequate response. The course is MGMT 5090: Crisis Management and Emergency Preparedness, exposing graduate students to (1) the

adequacy and incentives of safety regulatory regimes in the transportation sector (2) safety procedures and emergency preparedness associated with ferry transportation, and (3) the effectiveness of rescue methods.

Project HVDE25-39
Transforming Urban Transport: a Set of Case Studies (TUT-POL)
Throughout the past 6 months TUT-POL has disseminated case study findings through a teaching course, which was developed and implemented by case study writer David Luberoff this summer in a Transportation Policy Course at Northeastern University. The course looked specifically at the New York City, Los Angeles and San Francisco cases and were used to discuss notable transportation policies while exploring the politics of getting them adopted, and generated discussion on the interplays between funding structures, politics, and planning decisions as well as how policymakers can prepare for/respond to disruptive change. Our Project Director, Diane Davis, and Senior Researcher, Lily Song, created various in-depth case analysis and analytical writing so as to offer a more systematic comparative lens for producing robust findings about how, when, and why political leadership advances positive transportation outcomes. This included various blog articles that have been written and distributed with outlets such as ITDP, Medium (available on our website). We have also created 2-page case study briefs for each of the 8 case studies summarizing each transport initiative and political story, as well as political strategies and tactics that were used to make the transportation initiatives possible. These handouts have become extremely useful for dissemination at events as well as in conceptualizing our findings.

Project UCNR25-35
Clustering Algorithms for Transit Network Design
The research team was represented in the UConn 2016 National Summer Transportation Institute held on the University of Connecticut campus in June 2016, funded by the Federal Highway Administration. Eighteen high-school students from across Connecticut participated in a week-long residential program in Storrs, CT learning about transportation careers and seeing results from several ongoing research efforts, including this research project.

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	Status
MITT25-43	Coughlin	MIT Centralized Technology Transfer Initiatives	active
UMAT25-44	Collura	UMass Centralized Technology Transfer Initiatives	active

Accomplishments under the New England UTC's technology transfer goal

Bryan Reimer Speaks at Lifesavers National Conference
April 6, 2016
New England UTC Associate Director Bryan Reimer spoke at the 2016 Lifesavers National Conference, the largest gathering of highway safety professionals in the U.S. Held in Long Beach, California in early April 2016, Reimer served on the Distracted Driving in 2016 Q&A Session with other leading distracted driving researchers including Michael L. Brown, Office of Impaired Driving & Occupant Protection National Highway Traffic Safety Administration (moderator); David Strayer, University of Utah; Robert Scopatz, VBH, Inc.; and David Kidd, Insurance Institute for Highway Safety.

New England UTC featured in Massachusetts Auto Dealer Article About AVT
June 1, 2016
The rise of autonomous vehicles is getting the attention of industry professionals of all kinds, from big company CEOs to folks who are simply trying to move cars off their lots. In an interview for the article, researcher Hillary Abraham talked about the recent NE UTC study that examined the attitudes of older drivers toward new vehicle technologies. *The*

Massachusetts Auto Dealer is a local industry trade journal. The article appears in the June 2016 issue. A PDF of the article can be accessed <u>here.</u>

Research Study on Driverless Cars Featured in the New York Time
June 16, 2016
New England UTC Director Joe Coughlin and The Hartford's Jodi Olshevski discuss findings from their study showing age may matter less than we think in driverless car technology adoption. According to surveys, no matter the age, American drivers see potential benefits in autonomous vehicles, but they want to be sure the technology works. This research study on driverless cars, performed in collaboration between the New England University Transportation Center and The Hartford, is cited in the <u>June 16th, 2016 edition of the New York Times.</u>

Project UMAT25-44
UMass Centralized Technology Transfer Initiatives
The focus of this initiative is on workforce development. A major activity included the preparation of a Research Needs Statement (RNS) in coordination with the TRB Education and Training Committee's Subcommittee on Research. The significance of this RNS is that it is intended to identify workforce development strategies. The RNS has been reviewed by the TRB Education and Training Committee and forwarded on for further review by TRB staff. Another major activity includes working with the UMass Transportation Training Institute to conduct a workshop on fundamental concepts associated with unmanned aircraft systems. Some 40 individuals participated in the workshop which included a hands-on session demonstrating the operation of several drones. A third activity includes the development of engineering design and construction documents for the Aviation Center at the Westover Air Reserve Base in Chicopee, MA. The design and construction documents have been completed and are under review by the engineering staff at Westover. The significance with this activity is that the Center will provide training to former military air traffic controllers who are on a career pathway to become gainfully employed as civilian air traffic controllers. During this period, a $500,000 grant was provided by the Emil Buehler Perpetual Trust to defray the initial costs to procure a 360-degree air traffic control simulator which will be used for training purposes.

2. Products

Journal publications

Ahangari, H., Atkinson-Palombo, C., Garrick, N.W., "Progress Towards Zero, An International Comparison: Improvements in Traffic Fatality from 1990 to 2010 for Different Age Groups in the USA and 15 of its Peers", Journal of Safety Research, April 2016.

Beckers, N., Schreiner, S., Bertrand, P., Mehler, B. & Reimer, B. (2017). Comparing the Demands of Destination Entry using Google Glass and the Samsung Galaxy S4 during Simulated Driving. *Applied Ergonomics,* 58, pp. 25-34. DOI: 10.1016/j.apergo.2016.05.005.

Bertolaccini, K. and N. Lownes (accepted) Developing and Solving an Equitable Transit Network Design Model (EqTNDP) with a Genetic Algorithm Solution Approach, *Proceedings of the 96th Annual Meeting of the Transportation Research Board*.

Buehler, Ralph, John Pucher, and Alan Altshuler. (submitted August 2016). "The Politics of Sustainable Transport in Vienna." International Journal of Sustainable Transportation.

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

Dobres, J., Chahine, N., Reimer, B., Gould, D., Mehler, B. & Coughlin, J.F. (in press). Utilising psychophysical techniques to investigate the effects of age, typeface design, size and display polarity on glance legibility. *Ergonomics*. DOI: 10.1080/00140139.2015.1137637.

Garceau, T., Atkinson-Palombo, C., and Garrick, N., Peak Car Travel in the United States: A Two-Decade Long Phenomenon at the State Level Transportation Research Record, (Accepted 03/15).

Han, Y., C. Zegras, V. Rocco, M. Dowd, M. Murga. When the Tides Come, Where Will We Go? Modeling the Impacts of Sea-level Rise on Greater Boston's Transport and Land Use System. Accepted for publication in the *Transportation Research Record* (2017)

Miotti, M., Supran, G. J., Kim, E. J., & Trancik, J. E. (2016). Personal vehicles evaluated against climate change mitigation targets. *Environmental Science & Technology, 50* (20), 10795-10804.

Needell, Z. A., McNerney, J., Chang, M. T., & Trancik, J. E. (2016). Potential for widespread electrification of personal vehicle travel in the United States. *Nature Energy, 1*, 16112.

Reimer, B., Mehler, B., Reagan, I., Kidd, D. & Dobres, J. (in press). Multi-Modal Demands of a Smartphone Used to Place Calls and Enter Addresses during Highway Driving Relative to Two Embedded Systems. *Ergonomics*. DOI: 10.1080/00140139.2016.1154189.

Roach, D., Christofa, E., and Knodler Jr., M.A. 2016. Safety Assessment before and after Implementation of Roundabouts through Microsimulation. Advances in Transportation Studies, an International Journal, 2016 Special Issue, Vol.2.

Books, dissertations, or one-time publication

Caraballo, Franklin, "Identifying Association Between Pedestrian Safety Interventions and Street Crossing Behavior Considering Demographics and Traffic Context", M.S. Thesis, University of Connecticut, May 2016.

Garceau, T. PhD Dissertation on "Vehicle Miles Travelled: An Analysis of Trends and Implications", August 2015.

Hamed Ahangari. PhD Dissertation on "A Comprehensive Comparative Assessment of Road Safety in Developed Countries", August 2015. PhD Conferred. PhD Student, Hamed Ahangari accepted a position as Post-Doctoral Fellow at UConn starting 11/16.

Other publications, conference papers and presentations

Abdić, I., Fridman, L., McDuff, D., Marchi, E., Reimer, B. & Schuller, B. (2016). Driver Frustration Detection From Audio and Video in the Wild. In *the Proceedings 25ᵗʰ International Joint Conference on Artificial Intelligence (IJCAI 2016).* New York, NY. Also appears as an extended abstract in the *Proceedings 39ᵗʰ German Conference on Artificial Intelligence, KI 2016 / ÖGAI Tagung 2016,* Klagenfurt, Austria.

Amirgholy, M., Gonzales, E.J. (2017). Efficient frontier of the trip schedules in the morning commute problem: User equilibrium, system optimum, and dynamic pricing. Paper Number 17-05891. Transportation Research Board 96th Annual Meeting, 8 – 12 January, Washington, D.C.

Diane Davis. (October 10, 2016). "Transforming Urban Transportation—The Role of Political Leadership." *Big City Planners Conference*, Cambridge, MA: Lincoln Institute of Land Policy.

Dobres, J., Reimer, B., Mehler, B., Foley, J., Ebe, K., Seppelt B. & Angell, L. (2016). The Influence of Driver's Age on Glance Allocations during Single-Task Driving and Voice vs. Visual-Manual Radio Tuning. SAE Technical Paper 2016-01-1445. DOI: 10.4271/2016-01-1445.

Fridman, L., Lee, J., Reimer, B. & Mehler, B. (2016). A Framework for Robust Driver Gaze Classification. SAE Technical Paper 2016-01-0177. DOI: 10.4271/2016-01-1426.

Han, Y. and C. Zegras. Modeling BRT Under Sea Level Rise Uncertainty. Presented at MOBILIZE, the International Sustainable Transport Summit held in Yichang, China September 21-23, 2016

Khalighi, F., Hajiseyedjavadi, F., Christofa, E., and Knodler, M. 2016. Emission Impact of Pedestrians at Roundabouts. 5th International Conference on Roundabouts, 5-7 May, Green Bay, WI. [accepted]

Keene State College, Sustainability Planning Course 2/24/15; Guest lecture / delivered a variation of the TRB talk

Lavallière, M. (2014). Survey on the Multigenerational Workforce. Paper presented at the Energy Technology Workshop Ensuring Energy Delivery, Cambridge (MA).

McWilliams, T., Brown, D.E., Reimer, B., Mehler, B. & Dobres, J. (2016). Observed Differences in Lane Departure Warning Responses during Single Task and Dual Task Driving: A Secondary Analysis of Field Driving Data. SAE Technical Paper 2016-01-1425. DOI: 10.4271/2016-01-1425.

Mehler, B., Reimer, B., Dobres, B., Foley, J. & Ebe, K. (2016). Additional Findings on the Multi-Modal Demands of "Voice-Command" Interfaces. SAE Technical Paper 2016-01-1428. DOI: 10.4271/2016-01-1428.

Rubin, Jonathan and Paul Leiby, "Economic Incentives for Vehicle Automation & Implications for its Likely Features," Second International Conference of the Sustainable Consumption Research and Action Initiative (SCORIA), Transitions Beyond a Consumer Society, University of Maine, Orono, ME, USA , June 15–17, 2016

Zhang, T., Samuel, S., Zafian, T., Nicholas, C.A., Zhang, J., Knodler, M., Jr., and Fisher, D.L. (May 2016). Can Secondary Traffic Alerts Improve the Latent Hazard Anticipation Ability of Novice and Experienced Drivers? Proceedings of the 7th International Conference on Applied Human Factors and Ergonomics (AHFE) 2016, Orlando, FL, July 2016.

Websites or other Internet sites

http://scorai.org/scorai-2016/
https://nextcity.org/daily/entry/smart-cities-local-government-big-data-private-sector-collaboration
https://www.itdp.org/interview-with-diane-davis-part-1/; https://www.itdp.org/interview-with-diane-davis-part-2/
https://www.hks.harvard.edu/news-events/publications/hks-magazine/archives/summer-2016/reinventing-the-wheel
https://medium.com/@lisa_one/how-lyft-taught-uber-to-break-the-rules-dfcccd044384#.f738xqub7 http://www.planetizen.com/node/88830/jan-gehl-politics-transforming-cities
https://happymobility.org

Media

Dashboard Type. Design Observer, April 27, 2016
The Washington Post: The American Decline in Driving Actually Began Way Earlier Than You Think. http://www.washingtonpost.com/blogs/wonkblog/wp/2015/01/16/the-american-decline-in-driving-actually-began-way-earlier-than-you-think/

Trouble Reading Your Gauges? An MIT Study Suggests Your Eyes Might Be Older Than You Think. Best Ride, March 14, 2016

Technologies or techniques

Project MITR25-1
Capturing the Relationship between Social Interaction and Travel Behavior Using Smart Phones
We have developed a conceptual approach to the collection of social interaction information within the framework of a travel survey platform that we call the Future Mobility Sensing (FMS). FMS is a smartphone-based system that tracks users' trips and activities and detects certain trip attributes such as the mode. Users can visualize their travel and activities as an activity diary on a website where they also have the option to validate their trips and answer further questions (prompted recall survey). 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. In addition, we have developed an interface to collect social media information from users. A Facebook app has been developed such that when an FMS user gives his authorization, we will be able to collect information such as number of friends, public pages that the user has liked as well as characteristics of the pages. This information helps us better understand the impact of social media on people's activity and travel decisions.

Project UCNR25-35
Clustering Algorithms for Transit Network Design
This project uses a novel form of Genetic Algorithm (GA) to solve instances of the transit network design problem. The GA uses new initial solution generation, crossover and mutation functions to address complexities introduced by the use of equity as an objective as opposed to cost minimization.

Inventions, patent applications, and licenses

Nothing to report.

Other products

Nothing to report.

3. Participants & Other Collaborating Organizations

Organizations that have been involved as partners

Charles and Anne Schewe, Sara's Wish Foundation (SWF), Amherst, MA

Environmental Science Division, Group Leader: Energy Analysis, Oak Ridge National Laboratory (in-kind support)

Healthways (provided access to the Gallup Healthways Well-Being Index data and financial support).

Metropolitan Area Planning Council (MAPC), 60 Temple Pl #6, Boston, MA 02111.

South Windsor Senior Center, South Windsor, CT—facilities, recruitment of participants for in-person survey.

Tel-Aviv University, Israel – Collaborative Research

University of Queensland, Brisbane, Australia (Collaborative research)

Volvo Research and Educational Foundations (VREF). Göteborg, Sweden

Other collaborators or contacts that have been involved

East Japan Railway Company, Tokyo, Japan
Empire State Development Corporation
London School of Economics
Masdar Institute of Science and Technology, Abu Dhabi, UAE
Metropoline (bus company), Israel –
Municipal Arts Society
NURail UTC, housed at UIUC
Rutgers University

4. Impact

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

Project MITR25-1
Capturing the Relationship between Social Interaction and Travel Behavior Using Smart Phones
The FMS technology has been recognized as state-of-the-art for smartphone based travel surveys, and is being applied and/or extended for data collection in several transportation related research projects. These include context-specific stated preferences survey for new transport modes or services (in collaboration with Ford and University College of London), happy traveler survey, truck drivers' survey, and event-driven on-phone transit satisfaction survey (with Singapore Land Transport Authority and Massachusetts Bay Transportations Authority).

Project MITR25-16
From Trip Data to the Energy Requirements of Personal Vehicle Travel
The project addresses a still open question in transportation and climate policy about the suitability of different vehicle powertrain technologies for widespread adoption and emissions reduction, especially given that the success of these various technologies depends on both their abilities to successfully meet divers travel needs of households across the U.S. and their performance under that use. It also addresses important methodological questions concerning the prediction of vehicle energy requirements under significant uncertainty and information limitations, a contribution that will be useful to many modeling and simulation efforts that produce energy estimates.

HVDE25-39 TUT – Transforming Urban Transport and the Role of Political Leadership.
Most research in urban transportation seeks to develop or evaluate proposals for improvement but pays little or no attention to the processes by which change occurs. The eight TUT-POL case studies fill this gap by exploring the role of proactive action in sparking significant and innovative change in the field of urban transportation, and in overcoming the barriers to the adoption and implementation of transformative transport policies. Taken as a whole, this project has begun to produce new knowledge that is not only valuable and useful to practitioners but also can be used by scholars. We have begun to produce a range of dissemination products, including a book-length manuscript that combines our overview analyses and each case study, peer reviewed scientific journal articles, and conference presentations—in addition to 2-page case briefs, a 20-page summary report of research findings, blog articles, media pieces, and summit/workshop presentations, which are geared towards practitioner audiences.

Project UCNR25-35
Clustering Algorithms for Transit Network Design
The research team has made advances in transit network design modeling and solution methods, most significantly with respect to the inclusion of equity as a priority in reconfiguring transit networks. This work has enhanced the ability of public transportation systems researchers to consider aspects such as equity in service provision as well as allowed them to leverage the increasing amount of data and test beds openly available to researchers.

Project UMAR25-25
Evaluating the Effect of Google Glass on Driver Distraction
The results demonstrate that head-mounted displays can actually increase the likelihood of driver behaviors that are known to reduce crashes. The reports in the literature to-date of head-mounted displays have focused, for the most part, on their distracting potential. We have shown that they can also have a safety benefit, especially for younger drivers. This will lead researchers in surface transportation human factors to explore broader, beneficial uses to drivers of head-mounted displays to promote traffic safety such as we are proposing in the second experiment with older drivers.

The impact on the development of transportation workforce development

Project UCNR25-35
Clustering Algorithms for Transit Network Design
The research team has made advances in transit network design modeling and solution methods, most significantly with respect to the inclusion of equity as a priority in reconfiguring transit networks. This work has enhanced the ability of public transportation systems researchers to consider aspects such as equity in service provision as well as allowed them to leverage the increasing amount of data and test beds openly available to researchers.

Project UMAR25-29
An Innovative Design to Retrofit Seatbelts in Motorcoaches
One of the co-inventors, who recently completed a Bachelor's degree in Mechanical Engineering, has advanced to work at an internship in Germany at BMW. The experience gained by that student while working on this project helped with the development of that person's career in transportation. This person also completed an extensive report of their work for this project on which other students built. Plus, the added business of retrofitting is expected to create more jobs in the industry in proportion to the number of installations ordered.

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

Project UMAR25-25
Evaluating the Effect of Google Glass on Driver Distraction
We have a major upgrade scheduled for the driving simulator. The research we undertook helps provide the evidence that we need in order to continue to pursue improvements to the UMass infrastructure. These improvements include adding two screens, increasing the field of view from 150 degrees horizontally to greater than 220 degrees horizontally. This increase will greatly improve our ability to study intersection behaviors. We have added SimDrive to the suite of software available to researchers. SimDrive makes it possible to provide the driver with the various levels of automation that vehicles of the future will include and study how drivers behave with the different levels of automation, especially when the automated driving suite requests or requires a transfer of control.

The impact on technology transfer

Project MITR25-16
From Trip Data to the Energy Requirements of Personal Vehicle Travel
A successful application to ARPA-E built off of the results of this project, with our TripEnergy tool providing crucial functionality, is leading towards a metropolitan area-wide transportation simulation and optimization framework that is intended to become a working commercial product. This project will optimally allocate monetary rewards to travelers in the Boston metro area to reduce system-wide energy consumption and improve transportation network performance. This project is currently in the early testing phase, including the simulation of the impacts of different reward-allocation strategies on network energy consumption and the deployment of a user-facing smartphone app to provide users information on the energy impacts of their various travel alternatives.

Project UMAR25-29
An Innovative Design to Retrofit Seatbelts in Motorcoaches
Efforts are now underway to transfer the technology to the bus industry. Motor Coach Industry (MCI) is the potential early adopter, domestically. Discussions have also begun regarding the potential to serve a much larger market potential in India where an SAE International (SAE) conference paper will be presented at a symposium in January in Pune, India. The updated design progress was presented at DATTCO in September and by conference call to American Seating in Michigan in July. A trip will be made to American Seating to present the latest work in the near future.

The impact on society beyond science and technology

Project MITR25-1
Capturing the Relationship between Social Interaction and Travel Behavior Using Smart Phones
Although the social interaction questions are not fully integrated into FMS yet, the base FMS technology has led to the initiation of a start-up company, Mobile Market Monitor, that customizes and licenses the software for smartphone based travel surveys.

Project UMAR25-29
An Innovative Design to Retrofit Seatbelts in Motorcoaches
We could have some impact on influencing public policy regarding transportation safety. Awareness and engagement throughout the motor coach industry should lead to other innovations to further improve public safety. Recently, for example, the National Highway Traffic Safety Administration (NHTSA) changed their position regarding seatbelts on school buses by an announcement that they now recommend 3-point seatbelts on all school buses. The bus industry now knows that a solution exists to retrofit seatbelts onto motorcoaches. Discussions and presentations have been done with numerous key players and stakeholders at this stage. A marketing presentation was delivered to the Ad Council to address the issue of low passenger use of seatbelts on buses. An increase in passenger demand should increase the potential market for the bus industry and accelerate the availability of seatbelts. Awareness of a solution by NHTSA and the National Safety Council are expected to support

that momentum. This is especially apt to the driver of parent's demand for safety and protection of their children. To address that compelling need, our team submitted a National Science Foundation (NSF) Grand Challenges proposal with Center for Child Injury Prevention Studies (CChIPS) to potentially extend this solution and approach to the need for seatbelts on school buses.

5. CHANGES/PROBLEMS

No change.

Additional information regarding Products and Impacts

Project UCNR25-31
A Multi-Scalar Model to Identify the Causes of Decreased Vehicle Miles Traveled (VMT) in the United States
Interactive graphs included in the Washington Post (referred to above under Accomplishments under the New England UTC's research goal) have made the data associated with project UCNR25-31, A Multi-Scalar Model to Identify the Causes of Decreased Vehicle Miles Traveled (VMT) in the United States, publicly available.

Project UMAR25-25
Evaluating the Effect of Google Glass on Driver Distraction
The Human Performance Laboratory and the University of Massachusetts Transportation Center continue to grow in numbers and visibility. The Human Performance Laboratory now has four different driving simulator setups, including a full-sized car with a Realtime Technology Inc. simulator, and often runs more than 1,000 participant sessions per year. We publish the results of our simulator and field research regularly. Research funded through these entities is now used to support two postdoctoral research associates and one research assistant professor. The postdoctoral researchers are among the very best in the world in surface transportation human factors, having received advanced degrees at the top tier national (e.g. Florida State) and international (Tsinghua University) universities

Outputs

Nothing to report

Outcomes

Nothing to report

Impacts

Nothing to report