PROGRAM PROGRESS PERFORMANCE REPORT (PPPR #2)

TOMNET
Center for Teaching Old Models New Tricks

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Signature of Submitting Official:	Ram Pendyala Ram M. Pendyala, PhD, Director

INTRODUCTION

This document constitutes the Program Progress Performance Report (PPPR) for the Center for Teaching Old Models New Tricks (TOMNET), a Tier 1 University Transportation Center sponsored by the US Department of Transportation. The center commenced operation on November 30, 2016 and has been active during the period of December 1, 2016 to March 31, 2018. This PPPR covers work accomplished and performance metrics for the period of June 1, 2017 to March 31, 2018.

1. ACCOMPLISHMENTS: What was done? What was learned?
The information provided in this section allows the OST-R grants official to assess whether satisfactory progress has been made during the reporting period.

The TOMNET University Transportation Center aims to advance the state-of-the-art and state-of-the-practice in transportation demand modeling by collecting and incorporating data about human attitudes, behavioral processes, perceptions, values, and preferences in travel models. The center leverages a number of methods and tools to advance this mission, including the application of data fusion and machine learning algorithms to integrate data sets with disparate information thus facilitating the development of comprehensive models of travel demand that reflect the effects of attitudinal variables.

What are the major goals of the program?

TOMNET has a three-pronged mission, not unlike any other university transportation center (UTC). These include a *research* mission, an *education* and *workforce development* mission, and a *technology transfer* mission.

The *research* mission of TOMNET is to advance the science of activity-travel behavior modeling by developing new methods for incorporating the effects of people's attitudes, values, preferences, and perceptions in transportation demand forecasting models. The center aims to accomplish this by fusing information about attitudes, behaviors, socio-economic characteristics, built environment attributes, and transportation networks contained in different data sets using machine learning algorithms; and developing new models capable of providing deep insights into underlying relationships among the myriad variables in the fused data sets. TOMNET is undertaking a number of inter-related research projects that involve survey design and data collection, data fusion and machine learning, modeling and forecasting, and policy simulation and analysis. Through a portfolio of well-coordinated research projects, TOMNET researchers are deriving new and deep insights about traveler behavior and values under alternative futures, and developing new methods, models, tools, and algorithms for forecasting travel demand in regional planning processes.

The *education* and *workforce development* mission of TOMNET is to train a transportation planning and modeling workforce for the future that is capable of solving complex multi-disciplinary challenges confronting the profession. Solutions to transportation challenges require the ability to leverage concepts, methods, and tools in engineering, humanities, social sciences, behavioral sciences, management sciences, geographical sciences, urban and regional planning, health, economics, and psychology. Through a multi-disciplinary approach to education and training, the center aims to train a cadre of professionals who can work in industry, public agencies, academia, and non-profit organizations. These individuals will be equipped to design transportation solutions of the future while taking advantage of emerging technologies and paradigms *and* addressing the occasionally competing challenges of economic growth, quality of life, community resiliency, equity and environmental justice, affordability, health, and energy and environmental sustainability. In addition, a critical mission of TOMNET is to attract a *diverse body* of students into the transportation profession by undertaking a number of K-12 school

outreach activities, particularly in under-represented communities. Finally, TOMNET aims to empower the current transportation workforce by offering a number of workshops, continuing education (short) courses, symposia, and professional development seminars/webinars on cutting edge topics and methods that will help professionals address emerging and complex transportation issues.

The *technology transfer* mission of TOMNET is to disseminate information about research findings, methods, tools, and data to a global audience of transportation professionals, students, researchers, policy-makers, and the broader public. TOMNET recognizes that transportation plays an important part in affecting the quality of life, health, and resilience of communities; therefore, TOMNET is undertaking activities to transfer knowledge and communicate accurate information about traveler behavior and values to various stakeholders who are affected by and/or make decisions regarding the future transportation system. By developing and disseminating open source software tools and methods, new algorithms and modeling approaches, and research reports and policy briefs, TOMNET will inform decision-makers and empower communities. TOMNET will enhance the capabilities of the workforce of today and tomorrow by providing new and rich data about behaviors, choices, and attitudes; conducting hands-on training workshops and boot camps; and organizing specialized executive courses and information sessions specifically aimed at decision-makers.

What was accomplished under these goals?

Within the reporting period, TOMNET completed a rigorous review of a set of initial project proposals that would be undertaken by the core TOMNET faculty scholars. The 2017-2018 list of projects (with principal investigator) is provided in Table 1. It should be noted that TOMNET has a focused mission and hence undertakes a small number of targeted projects that directly meet the goals of the center.

Table 1. 2017-2018 TOMNET Research Projects

Project Topic/Title	Lead Institution	Institution PI
Quantifying the Relative Contribution of Various Factors to Household Vehicle Miles of Travel*	ASU	Ram Pendyala
Modeling Level of Interest in Autonomous Mobility Services and Vehicles*	ASU	Ram Pendyala
An Exploration of Feelings of Subjective Well-Being During Travel Episodes*	ASU	Ram Pendyala
Attitudes Towards Transformative Mobility Options/Technologies – A Multi-region Survey Design and Data Collection Effort	ASU	Sara Khoeini
Comprehensive Review of Attitudes-Travel Behavior Literature	ASU	Deborah Salon
Assembling Integrated Data Sets for Analyzing Connections between Travel Behavior, Attitudes, and the Built Environment	ASU	Deborah Salon
Attitudes Towards Transformative Mobility Options/Technologies – A Multi-region Survey Design and Data Collection Effort	GT	Giovanni Circella
An Investigation of the Contribution of Targeted Marketing Data to the Prediction of Attitudes	GT	Patricia Mokhtarian
Attitudes Towards Transformative Mobility Options/Technologies – A Multi-region Survey Design and Data Collection Effort	USF	Abdul Pinjari/ Michael Maness
Investigation of the Role of Attitudinal Factors on Adoption of Emerging Automated Vehicle and Vehicle Safety Technologies	USF	Fred Mannering
Role of Attitudes in Shaping Resilience Behavior - Developing a Scalable Survey Methodology	UW	Cynthia Chen

Note: ASU = Arizona State Univ; USF = Univ of South Florida; UW = Univ of Washington; GT=Georgia Tech

*These projects are joint efforts of TOMNET UTC and D-STOP UTC (led by the University of Texas at Austin).

The following is a brief description of a number of key projects. Due to page limitations, detailed descriptions of progress are not provided for *all* projects underway.

Project Title: Quantifying the Relative Contribution of Various Factors to Household Vehicle Miles of Travel
Lead Institution and Investigator: Arizona State University, Ram Pendyala
Description: This project aimed to unravel the relative contribution of various factors in explaining the variation in household vehicle miles of travel (VMT). By doing so, the project team hopes to provide information that agencies and policy makers can use to most effectively curb the growth of VMT without adversely affecting quality of life and economic progress. The project team considered socio-demographics, built environment, residential self-selection (attitudes), social/spatial dependency, and unknown effects. Among the five effects, it was found that socio-demographics accounted for explaining nearly 40 percent of the variation in household VMT, while built environment attributes explained 8.5 percent, and attitudes (residential self-selection) explained only 5.9 percent. The remaining variance is unexplained by the factors considered in the study. The study suggests that socio-economic and demographic characteristics are key to explaining household VMT change, with built environment effects and residential self-selection (lifestyle preference) effects quite modest in comparison.

Project Title: Modeling Level of Interest in Adoption of Autonomous Mobility Services and Vehicles
Lead Institution and Investigator: Arizona State University, Ram Pendyala
Description: Surveys of behavior often obtain information about people's ranking of choice alternatives, thus providing rich data about level of preferences for different mobility options. Not only is this done in some revealed preference surveys of actual behavior, but rank ordered data is often collected in stated preference surveys where respondents are asked to rank hypothetical alternatives (rather than choose a single alternative) to better understand their preferences. Despite the widespread interest in collecting data on and modeling people's preferences for alternative activity-travel choices, very little progress has been made in the ability to rigorously model such data and obtain reliable parameter estimates. This project involved the development of a rank ordered probit modeling approach to overcome methodological challenges associated with modeling rank ordered data. Given current attention being paid to analyzing preferences for and interest in potential adoption and usage of autonomous vehicles (AV), the proposed rank ordered probit model is applied in this study to understand preferences for AV using the 2015 Puget Sound Regional Travel Study survey data set. The methodology is found to offer behaviorally intuitive estimation results, thus demonstrating the efficacy of the approach. A variety of socio-economic and demographic characteristics were found to be significantly associated with level of preference for alternative configurations of AV adoption, ownership, and shared usage. The methodology developed in this project offers a pathway for better utilizing rank ordered data to understand preferences, and recognize that choices may not be absolute in many instances.

Project Title: An Exploration of Emotional Feelings of Subjective Well-Being During Travel Episodes
Lead Institution and Investigator: Arizona State University, Ram Pendyala
Description: This project is concerned with understanding the determinants of subjective well-being (SWB) in the context of travel episodes. The amount of travel that people undertake, both in terms of frequency and distance or duration, is likely influenced by the emotional feelings that are engendered by the travel experience. Not only is little known about how people feel during travel episodes, but even less is known about the determinants of those feelings. This paper offers a comprehensive analysis of the emotion associated with travel episodes using a rich data set extracted from the well-being module of the American Time Use Survey (ATUS), in which respondents rated their SWB for travel episodes on six different emotional scales. A multivariate ordered probit model system that accounts for error correlation structures (i.e., the influence of common unobserved attributes that affect multiple emotional

dimensions) is estimated and presented. Results suggest that mode, travel duration, the nature and location of the preceding and subsequent activities, and socio-economic and demographic variables are important determinants of travel episode-related SWB. Travel in public transport vehicles is viewed more negatively than that in private vehicles, even after controlling for all other variables. This suggests that shared (autonomous) mobility services of the future need to offer benefits, cost structures, and levels of service that significantly outweigh the discomfort associated with riding with strangers in shared vehicles.

Project Title: Attitudes Towards Transformative Mobility Options/Technologies – A Multi-region Surey Design and Data Collection Effort
Institution and Investigators: Arizona State University, Sara Khoeini; Georgia Tech, Giovanni Circella; University of South Florida, Michael Maness
Description: Emerging mobility options and technologies, including autonomous vehicles and mobility-on-demand services, are bringing transformative changes in the transportation landscape. To enhance transportation forecasting models in the wake of potential increasing penetration of disruptive technologies in the marketplace, people's attitudes towards and perceptions of these technologies and services need to be measured and understood. Armed with such an understanding, it will be possible to specify and develop behavioral models that account for attitudes and perceptions, adoption cycles and timelines, and behavioral adaptation patterns. This project involves the development of a comprehensive survey instrument and survey administration protocol to obtain rich and deep data about this phenomenon.

During this reporting period, the research team comprising of scholars at each of the TOMNET partner institutions (with the exception of the University of Washington) met virtually every week via teleconference and developed a comprehensive survey instrument. In addition, the team discussed logistics, instrument type, timeline for survey deployment, best survey practices, and survey administration protocols. The team has been moving through appropriate Institutional Review Board (RB) processes to obtain the necessary approvals for the survey effort. In addition to Arizona State University, Georgia Tech, and University of South Florida which are all TOMNET affiliates, the Data-Supported Transportation Operations and Planning (D-STOP) Tier 1 USDOT University Transportation Center led by Professor Chandra Bhat at the University of Texas-Austin is participating in the collaborative project. The research team is planning for a target sample size of 1000 respondents in each of four metropolitan areas (Phoenix, AZ; Atlanta, GA; Austin, TX; and, Tampa, FL) when the survey is deployed in earnest in Fall 2018.

The survey is quite comprehensive with sections dedicated to the following: 1) Individual Attitudes and Preferences; 2) Current Travel Behavior; 3) Adoption of Emerging Transportation Technologies, Mobility on Demand, and Shared Mobility Services; 4) Attitudes Towards Autonomous Vehicles; and 5) Household and Individual Socio-demographic Attributes. The survey data will provide a rich basis to understand how the market may perceive, adopt, and adapt to transformative transportation technologies including autonomous vehicles and mobility-on-demand services. It is envisioned that the data will help decision-makers better plan transportation infrastructure systems and design policy strategies and regulatory frameworks that maximize the benefits of these disruptive technologies, while minimizing any negative consequences. This project will also provide a data collection protocol and methodology that can be widely adopted in other areas.

Project Title: Assembling Integrated Data Sets for Analyzing Connections Between Travel Behavior, Attitudes, and the Built Environment
Lead Institution and Investigator: Arizona State University, Deborah Salon
Description: The goal of this project is to merge three existing survey data sets that focused on travel choices and attitudes with detailed tax assessor-based information about the neighborhoods and specific residences that survey respondents chose to live in. Where possible, the project aims to add information

on vehicles owned by each survey respondent household and how far those vehicles are driven. The survey data sets include the 2012 ASU Faculty-Staff-Students Travel Survey, the 2011 Northern California Commuter Multitasking Survey, and the 2015 California Millennials Survey.

Thus far, the 2012 ASU Travel Survey data has been successfully merged with detailed Maricopa County assessor information. Because the 2012 ASU Travel Survey included only TAZ-level geographic locations for respondents' homes, multiple average and median attributes of the homes were calculated in each TAZ, based on the assessor data. In addition, the process of merging the 2011 Northern California Commuter Multitasking Survey with California Department of Motor Vehicles/Bureau of Automotive Repair odometer reading data has begun for each surveyed household. This is a complex process, but is moving forward. Finally, the project team has been successful in gaining access to property assessor and transaction history data for the entire United States from the Zillow Corporation. This was a long negotiation, but Zillow is providing this data access free of charge, thus saving precious project resources from a potentially large data purchase.

In the next quarter, the merger of both California survey datasets with assessor-based data and Zillow data will be completed. Many of the survey respondents in the California surveys provided exact home addresses, so it will be possible to add not only average and median home attributes by neighborhood, but also specific property characteristics of homes in which survey respondents live. It is also hoped that odometer reading data may be added to both the 2011 and the 2015 California surveys.

Project Title: Investigating the Contribution of Targeted Marketing Data to the Prediction of Attitudes
Lead Institution and Investigator: Georgia Institute of Technology, Patricia Mokhtarian
Description: This project involves the "fusion" of two datasets collected in 2016-2017 in Georgia: the behaviorally-rich Georgia add-on to the National Household Travel Survey ("NHTS", N ~ 8,000), and the attitudinally-rich survey designed by the project team and funded by the Georgia Department of Transportation (the "GDOT survey" or dataset, N ~ 3,500, before cleaning). The goal of this TOMNET funded project is to use machine learning methods to develop attitude-prediction training functions on the GDOT survey (donor, or source) sample, which will then be applied to the NHTS (recipient) sample to impute (or "transfer") attitudes into the latter. The inputs to the training function must be variables that are common, or available, to both datasets. A previous study used socioeconomic/demographic (SED) and land use (LU) characteristics as the common variables (CVs); a distinctive feature of the current study is the addition of targeted marketing (TM) variables to the CV set. TM variables can be purchased economically from third-party providers (such as the consumer credit reporting agency Experian), and include a host of indicators of lifestyle and various behaviors. The premise of the current study is that these kinds of variables may be very informative about individuals' attitudes, and thus substantially improve our ability to predict attitudes. If so, this methodology will be of great value to Metropolitan Planning Organizations, because it offers an economically viable way to obtain attitudinal variables for use in regional models.

During the reporting period, two PhD students (one incoming to the program; the other new to TOMNET) were oriented to the study. They assisted with the GDOT data collection and management process, and reviewed pertinent literature on machine learning and the use of targeted marketing data. While awaiting the GDOT data, the project team has undertaken some pertinent additional analyses. Specifically, (1) we have begun a process of using machine learning methods to fuse multiple attitudinal data sets collected by the PI over the course of her 28-year faculty career. Once complete, this dataset will contain somewhere around 10,000 or more observations, which can be used for a variety of analyses. (2) We have developed a mode choice model in which the travel time *coefficient* is expressed as a function of demographic and attitudinal variables. This will enable us to analyze how the valuation of travel time is changing as a function of the ability to multitask while traveling, among other characteristics. Such models can be used to inform the judgmental manipulation of travel time coefficients in regional models

to reflect certain hypothetical future scenarios, such as one in which automated vehicles are a reality. A draft manuscript of the results has been completed and is currently undergoing refinement in preparation for submission to a journal.

Project Title: Understanding Community Behaviors and Attitudes for Resilience: Developing a Scalable Survey Methodology
Lead Institution and Investigator: University of Washington, Cynthia Chen
Description: Specific goals for the first phase of this project include the following: Understand, via a thorough literature review, the state of the field in survey methodology with a focus on intersections between transportation, resilience, and appreciative inquiry literatures; Identify and address issues relevant to creating a scalable methodology; Develop a scalable survey methodology focused on identifying and characterizing community resources as well as attitudes about those resources, including their current and future use; Potentially implement a small pilot project and collect preliminary data.

During the reporting period, the TOMNET team engaged community partners interested in building resilient communities in a collaborative research initiative. These partners have helped contribute to the framework guiding the pilot survey and will serve as the test community for the pilot survey. The team has also engaged research partners in other academic departments and local agencies, including UW Medicine Telehealth and Seattle's Office of Emergency Management. The team is currently in the process of drafting a concept paper inspired by interactions with community and agency partners that deocuments the potential role of creatively combining low and high technology transportation and communication networks for both every day and disaster-situation community benefit. The team is now in the process of creating a scalable community self-assessment survey focused on understanding community adaptive capacity as a function of social and infrastructural networks.

Project Title: Investigation of the Role of Attitudinal Factors on Adoption of Emerging Automated Vehicle and Vehicle Safety Technologies
Lead Institution and Investigator: University of South Florida, Fred Mannering and Michael Maness
Description: The project team completed a number of project objectives that involved using previously collected survey data on attitudes toward autonomous vehicles (AVs). A through descriptive analysis of the previously collected AV survey responses was performed and a standardized dataset with data dictionary was created. Also, an econometric assessment of shared autonomous vehicles and their potential impacts on household vehicle ownership was performed. To determine the factors that influence this potential response, this study used random parameters ordered probit models to assess people's opinions regarding the impacts of shared autonomous vehicles and account for the likelihood that considerable unobserved heterogeneity was present in the data. The findings show a wide range of socio-economic factors affects people's likelihood of vehicle relinquishment in the presence of shared autonomous vehicles. Key among these are gender effects, generational elements, commuting patterns, and respondents' vehicle crash history and experiences. Further analysis was conducted to study consumer shared autonomous vehicle adoption likelihoods and concerns. Two random-parameter logit models were estimated to gain insights into the likely usage/concerns. Some of the key variables playing statistically significant roles in the willingness to use shared autonomous vehicles were ethnicity, household size, daily travel times, and vehicle crash history. With regard to shared autonomous vehicle concerns, the statistical analysis identified characteristics of respondents who were more or less likely to be concerned with safety, reliability, privacy, and travel time/travel cost.

In other project tasks, the research team completed a detailed review of the literature on the temporal instability of model estimates, unobserved heterogeneity, and attitudes. This review drew from research previously conducted in fields such as psychology, neuroscience, economics, and cognitive science to build a case for why the effects of explanatory variables should not be expected to be stable

over time. The review of this literature suggests that temporal instability is likely to exist for a number of fundamental behavioral reasons, and this temporal instability is supported by the findings of several recent transportation data analyses. The review goes on to discuss the implications of this temporal instability on contemporary modeling methods (unobserved heterogeneity, data driven, and traditional, and causal inference methods) and concludes with a discussion of how temporal instability might be addressed by future TOMNET projects and how its likely presence can be used to better interpret transportation data-analysis findings.

What opportunities for training and professional development has the program provided?
In the *education* and *workforce development* domain, all of the TOMNET partners offered a number of undergraduate and graduate courses at their respective institutions during the 2017-2018 academic year (that spans the reporting period covered by this PPPR). Table 2 offers a rather detailed summary of the courses offered by faculty members closely affiliated with the TOMNET center. It should be noted that there are many additional transportation-related courses taught at each institution at both undergraduate and graduate levels; however, the scope of activities reported in this PPPR is limited to the activities of faculty members who comprise the core group of TOMNET and are deeply engaged in advancing the activities and mission of the center.

Table 2. Courses Offered by Mission-Critical Faculty Members of TOMNET

Semester	Course Level	Course Number	Course Title	No.	Instructor	Unit
Arizona State University						
Fall 17	Undergrad	CEE 372	Transportation Engineering	110	Pendyala	SSEBE
Fall 17	Undergrad/ Graduate	CEE 474/598	Transportation Systems Planning	40	Livshits (MAG)	SSEBE
Fall 17	Graduate	CEE 591	Transportation Systems Seminar	40	Lou	SSEBE
Fall 17	Graduate	CEE 598	Traffic Simulation Model Application	12	Zhou	SSEBE
Fall 17	Graduate	CEE 598	Transportation Safety	12	Kar (ADOT)	SSEBE
Fall 17	Graduate	PUP 591	Transportation Professional Seminar	10	Kelley	SGSUP
Fall 17	Graduate	PUP 642	Urban and Regional Economic Analysis	25	Salon	SGSUP
Spring 18	Undergrad	PUP 424	Planning Methods	32	Salon	SGSUP
Spring 18	Graduate	CEE 591	Transportation Systems Seminar	40	Pendyala	SSEBE
Spring 18	Graduate	CEE 598	Activity Travel Behavior Model	10	Pendyala	SSEBE
Spring 18	Graduate	CEE 506	Life Cycle Assessment of Infrastructure	15	Chester	SSEBE
Spring 18	Graduate	CEE 507	Urban Infrastructure Anatomy	16	Chester	SSEBE
Spring 18	Graduate	CEE 598	Public Transportation	14	Zhou	SSEBE
Spring 18	Graduate	CEE 598	Airport Design	35	Stempihar	SSEBE
Georgia Institute of Technology						
Sum 17	Undergrad	CEE 4803	Sustainable Transport Abroad	8	Watkins	CEE
Fall 17	Undergrad	CEE 4610	Multimodal Transportation	43	Watkins	CEE
Fall 17	Graduate	CEE 8813E	Complete Streets	12	Watkins	CEE
Fall 17	Graduate	CEE 6623	Transportation Survey Methods	25	Mokhtarian	CEE
Spring 18	Undergrad	CEE 4803	Sustainable Transport Abroad	14	Watkins	CEE
Spring 18	Graduate	CEE 8811	Practical Issues in Statistical Application	38	Mokhtarian	CEE
Spring 18	Graduate	CEE 6642	Transit Planning and Operations	40	Watkins	CEE
University of Washington						
Winter 18	Undergrad/ Graduate	URBDP 424/524	Site Planning: Issues and Techniques	19	Abramson	UrbDP

Spring 18	Undergrad/ Graduate	URBDP 423/523	Introduction to Urban Design	17	Abramson	UrbDP
Spring 18	Graduate	URBDP 507B	General Urban Planning Studio	13	Abramson	UrbDP
University of South Florida						
Fall 17	Undergrad	TTE4006	Transportation and Society	32	Flynn	CUTR
Fall 17	Graduate	TTE6507	Travel Demand Modeling	14	Maness	CEE
Fall 17	Graduate	TTE6307	Statistical and Econometric Methods I	19	Mannering	CEE
Fall 17	Graduate	TTE5501	Transportation Planning and Economics	38	Lee	CUTR
Fall 17	Graduate	TTE6930	Graduate Transportation Seminar	6	Zhang	CEE
Spring 18	Undergrad	TTE4004	Transportation Engineering I	20	Maness	CEE
Spring 18	Graduate	TTE6930	Graduate Transportation Seminar	7	Li	CEE
Spring 18	Graduate	TTE6651	Transportation and Land Use	23	Polzin	CEE
Spring 18	Graduate	TTE6315	Transportation Safety	35	Wang	CUTR
Spring 18	Graduate	TTE6501	Statistical and Econometric Methods II	12	Mannering	CEE
Spring 18	Graduate	CGN6933	Transportation Infrastructure Network Analysis	9	Li	CEE

Notes:

Arizona State University

- SSEBE = School of Sustainable Engineering and the Built Environment
- SGSUP = School of Geographical Sciences and Urban Planning
- CIDSE = School of Computing, Informatics, and Decision Systems Engineering

Georgia Institute of Technology

- CEE = School of Civil and Environmental Engineering
- ME = Mechanical Engineering
- SCaRP=School of City and Regional Planning

University of Washington

- UrbDP = Department of Urban Design and Planning

University of South Florida

- CEE = Department of Civil and Environmental Engineering
- CUTR= Center for Urban Transportation Research

Partner Agencies

- MAG = Maricopa Association of Governments
- ADOT = Arizona Department of Transportation

In addition, TOMNET faculty supervised a number of students and post-doctoral scholars, providing them guidance and mentorship necessary to pursue independent research and discovery. Students engaged in TOMNET related research and education activities are listed in Table 3. Please note that some of these students are not necessarily receiving financial support or stipends through TOMNET funding; however, they are all engaged in research and education activities on topics of direct relevance to and inspired by the themes of TOMNET, and are hence considered TOMNET scholars. Besides graduate students pursuing Masters and PhD degrees, the TOMNET consortium is involving 12 undergraduate students in various research endeavors in an effort to provide research experiences for undergraduate students and inspire them to pursue advanced studies and a career in transportation systems engineering and planning.

Table 3. Students and Post-Doctoral Scholars Engaged in TOMNET Research and Education and Activities

Name of Scholar	Level	Major/ Unit	Supervisor/ Advisor	Gender	Minority?
Arizona State University					
Calvin Thigpen	Post-doc	SGSUP	Nelson	Male	No

Denise Capasso da Silva	PhD Student	SSEBE	Pendyala	Female	No
Shivam Sharda	PhD Student	SSEBE	Pendyala	Male	No
Taehooie Kim	PhD Student	SSEBE	Pendyala	Male	No
Matthew Conway	PhD Student	SGSUP	Salon	Male	No
Monirehalsadat Mahmoudi	PhD Student	SSEBE	Zhou	Female	No
Jiangtao Liu	PhD Student	SSEBE	Zhou	Male	No
Sumit Kumar	MS Student	CIDSE	Pendyala	Male	No
Aman Srivastava	MS Student	CIDSE	Pendyala	Male	No
Allison Charles	Undergrad	SSEBE	Pendyala	Female	No
Elyse Kats	Undergrad	Sustainability	Salon	Female	No
Georgia Institute of Technology					
Giovanni Circella	Sr Research Engineer	CEE	Mokhtarian	Male	No
Yongsung Lee	PhD Student	SCaRP	Circella/Mokhtarian	Male	No
Ali Etezady	PhD Student	CEE	Circella/Mokhtarian	Male	No
Alyas Widita	PhD Student	SCaRP	Circella	Male	No
Xinyi Wang	PhD Student	CEE	Mokhtarian	Female	No
Faaiqa (Atiyya) Shaw	PhD Student	CEE	Mokhtarian	Female	No
Aliaksandr Malokin	PhD Student	CEE	Mokhtarian	Male	No
Richard Sinz	MS Student	CEE	Mokhtarian	Male	Yes (Hispanic)
Sung Hoo Kim	PhD Student	CEE	Mokhtarian	Male	No
Zahra Khan	Undergrad	CEE	Mokhtarian	Female	No
Robert Brown	Undergrad	CEE	Mokhtarian	Male	No
Cynthia Bledsoe	Undergrad	CEE	Mokhtarian	Female	No
Salsabil Ainina	Undergrad	CEE	Mokhtarian	Female	No
Jeremy Dodson	Undergrad	CEE	Mokhtarian	Male	No
Blane Solomon	Undergrad	CEE	Mokhtarian	Female	Yes (Black)
Sarah Wilson	Undergrad	CEE	Mokhtarian	Female	No
Sanghyun Park	Undergrad	ME	Mokhtarian	Male	No
Oluwasanmi Toyobo	Undergrad	CEE	Mokhtarian	Female	Yes (Black)
University of Washington					
Katie Idziorek	PhD student	UrbDP	Chen/ Abramson	Female	No
Jenny Phan	Undergrad	UrbDP	Chen/Abramson	Female	No
University of South Florida					
Dr. Michael Maness	Post-doc	CEE	Pinjari/Mannering	Male	Yes
Parvathy Vinod Sheela	Graduate	CEE	Pinjari/Mannering	Female	No
Suryaprasanna Balusu	PhD student	CEE	Pinjari/Mannering	Male	No
Divyakant Tahlyan	MS Student	CEE	Pinjari/Mannering	Male	No
Natalia Barbour	PhD student	CEE	Zhang/Mannering	Female	No
Nawaf Alnawmasi	PhD student	CEE	Fred Mannering	Male	No
Dr. Nikhil Menon	Post-doc	CEE	Robert Bertini	Male	Yes

Note: Please see footnotes of Table 2 for explanation of acronyms.

TOMNET faculty and students developed two workforce development workshops entitled *Household Travel Survey Experience* and *Future Careers in Transportation* for high-school/middle-school students. These workshops are included in the K-12 camp programs at the consortium institutions so that students participating in the camps are exposed to transportation concepts and research projects. These outreach efforts have been very successful with dozens of participating middle and high school students getting exposure to transportation career information. Sara Khoeini (TOMNET Assistant Director) and

Sumit Kumar (TOMNET Student) presented the Household Travel Survey Experience workshop to 50 high school students on July 11, 2017. The students learned about travel survey data collection and how the data is used to develop computer models and forecast future travel demand, which is critical to planning future transportation infrastructure. The workshop was received very well and the students were extremely engaged in the exercise. Materials from these workshops are currently being packaged and will be posted to the TOMNET website so that other institutions can adapt and implement these workshops in their own contexts.

In the *technology transfer* domain, TOMNET has undertaken a few key activities that have had significant outreach elements. All of the TOMNET partner institutions have transportation seminar series that are open to the public and professionals in the community. These seminars are held generally on a weekly basis at each of the institutions and include a mix of attendees comprising students, professionals, academics, scholars, and members of the public. Because each of the institutions already has a vibrant transportation seminar series in place, TOMNET institutions have not launched separate seminar series that would unnecessarily compete with and dilute the audience for existing transportation seminar series. Rather, TOMNET faculty members are participating in existing transportation seminar series at each institution, and helping to organize specific seminars that are badged as TOMNET-sponsored seminars. These seminars, delivered by renowned speakers, specifically address topic areas of relevance to TOMNET and are of broad interest to the professional and academic community.

TOMNET-sponsored seminars cover topic areas related to traveler behavior and values, relationships between attitudes and behavior, traveler choices under emerging technological and mobility service scenarios, and driver behaviors that impact safety outcomes. The center plans to conduct webinars in the next six months to further disseminate TOMNET research and facilitate technology transfer. Table 4 presents a list of TOMNET-sponsored seminars for the period covered by this PPPR. Speakers met with TOMNET faculty and students, thus enabling the development of collaborative ties.

Table 4. Key TOMNET-Sponsored Technology Transfer Events

Seminar Title	Speaker/Affiliation	Date
Arizona State University		
Linking Transportation Systems Operations and Active Demand Management	Yi-Chang Chiu, Univ of Arizona and Metropia	8/31/2017
Transportation Career Paths	Karen Aspelin, ITE International Director and CEO, MaxGreen	9/15/2017
Big-Data and Transportation Decision Making	Monique des los Rios, Maricopa Association of Governments	9/21/2017
Demand and Policy Intervention for EVs and AVs	Simon Washington, Univ of Queensland, Australia	10/5/2017
ITS Innovations and Pilot Projects at Peoria	Steve McKenzie, City of Peoria, Arizona	10/19/2017
The Five Elements of Agent-based Modeling-a Transportation Perspective	Montasir Abbas, Virginia Tech	10/26/2017
NSF Civil Infrastructure Systems (CIS) Program: Past, Present, Future	Cynthia Chen, NSF Program Director (CIS)	10/31/2017
Transportation's Transformation: The Confluence of Demographic, Economic and Technology Trends	Steven Polzin, Ph.D. Director, CUTR, Univ. of South Florida	11/2/2017
The End of Car Ownership	Peter Gigante, Head of Policy Research, Lyft	11/30/2017
Arizona's Transportation Systems: Present State and Future Challenges	Matthew Clark, Transportation Policy Advisor, Office of the Governor of Arizona	2/8/2018
Say Hello to Waymo	Timothy Papandreou, WAYMO	2/15/2018
Uber and the Future of Urban Mobility	Russell Brooks, Sr Regional Operations Manager, UBER	3/15/2018

Other Consortium Partners		
Planning for Resilience: the Role of Place-based Communities in a Time of (Dis)Connectedness	Daniel Abramson, University of Washington Urban Design and Planning	2/1/2018
Modeling and Understanding Factors Affecting the Demand for Electric Cars Fast Charging	Gil Tal, University of California, Davis	9/21/2017

It should be noted that seminars at partner institutions (University of Washington, Georgia Tech, and University of South Florida) are largely omitted from the listing in Table 4 because the seminars are listed in the PPPR documents of other University Transportation Centers (UTCs) for which these institutions serve as either a lead or a consortium partner. In an effort to avoid double-counting seminars across UTC PPPR documents, only those seminars that can be truly counted as TOMNET seminars are listed in Table 4. The Georgia Tech transportation seminars are video-recorded and available on YouTube at https://www.youtube.com/user/gatechtranspo. Recordings of ASU seminars will also be available online starting Fall 2018; funds from the TOMNET UTC are enabling the recording and archiving of seminars.

Information about the seminars is disseminated widely through large distribution channels and e-mail lists maintained by the respective institutions. At Arizona State University, for example, announcements about the seminars and other transportation-related events on campus are sent out via e-mail to a list of 100 faculty members (who, in turn, distribute the announcements to all of their students) and 135 professionals. Similar lists are maintained by partner institutions, thus enabling effective technology transfer as well as the engagement of the professional community and trans-disciplinary faculty and students in the activities of TOMNET. TOMNET is currently enhancing its technology transfer infrastructure to streamline information sharing and dissemination. The team is currently working to enhance the TOMNET website (which is a work in progress) at http://www.tomnet-utc.org, to make it a comprehensive resource for technology transfer events and activities.

TOMNET performed a soft launch of its TOMNET Scholar Program in the Fall of 2017 and Winter of 2018. Through its scholar program, TOMNET is supporting the education and research activities of a number of faculty members, graduate students, and undergraduate students. The scholar initiative enabled the involvement of 12 undergraduate students in TOMNET research activities.

What do you plan to do during the next reporting period to accomplish the goals and objectives?
TOMNET has a number of activities planned for the next reporting period to ensure rapid growth in the portfolio of accomplishments of the center. In the *research* domain, the Center is going to issue a call for research ideas in April 2018 with research ideas due in the first week of May. The research ideas will be reviewed by TOMNET leadership team at the four consortium institutions to identify those that are most promising, both in terms of impact and advancing the mission of TOMNET. Through this call for research ideas, TOMNET hopes to broaden the cadre of faculty members (from a disciplinary and demographic perspective) involved in the activities of the center. Selected faculty members who submitted promising research ideas will be invited to submit full length research proposals. These proposals will be subjected to a full-scale peer review process with external reviewers drawn from academia, government, and industry. The final set of projects to be funded for the 2018-2019 school year will be selected based on the outcome of the external peer review process. Within the research domain, the TOMNET faculty members currently working on various projects will submit Year 1 reports by August 31, 2018 and these reports will be posted to the TOMNET website by September 30, 2018. These reports will be disseminated widely through various channels.

In the *education and workforce development* domain, TOMNET faculty members will continue to teach undergraduate and graduate courses at their respective institutions while enhancing the content to reflect new discoveries and trends in the profession. In particular, TOMNET faculty members are introducing concepts related to traveler behavior and values, attitudes and perceptions, and data fusion

and machine learning technologies in their courses. TOMNET faculty members will continue to mentor students and guide them to completion of their studies and towards appropriate career pathways in transportation.

Several additional activities are being planned to further advance the educational component of the TOMNET portfolio of accomplishments. First, TOMNET will be launching the data science challenge inviting students from around the world to participate in a data challenge and student paper competition. Students will be required to submit entries that aim to enhance the profession's understanding of the relationships between traveler attitudes, behaviors, perceptions, and preferences, while clearly explaining how their submissions can be translated into real-world tools and models that can be implemented in planning agencies to advance the state-of-the-practice. This data challenge and student paper competition will be launched in Summer 2018. Second, TOMNET scholars will be engaged in considerable K-12 outreach activities. At Arizona State University, TOMNET team members will participate in summer K-12 engineering camps organized by the Ira A. Fulton Schools of Engineering. TOMNET will conduct hands-on activities with middle and high school students participating in the camps so that they gain a deeper appreciation for career opportunities and educational pathways in transportation. Similar to the activity conducted in July 2017, the TOMNET team will engage students in a household travel survey exercise and demonstrate how such data enables the development of travel forecasting models, which are in turn critical to planning transportation infrastructure investments.

At the University of Washington, the TOMNET research team will host an interactive exhibit at the annual Engineering Discovery Days event. This event brings students in grades 4-8 from the Puget Sound region to the University of Washington campus to learn about ongoing research in engineering disciplines via hands-on activities. The TOMNET team has created two activities that will engage participants in resource matching for different types of disaster scenarios. The University of South Florida TOMNET team has scheduled a K-12 Outreach Activity to occur in May 2018 at Lee Academy for Gifted Education in Tampa, FL. The TOMNET team will deliver presentations on careers in transportation and lead students through hands-on activities and interactive discussions to gain an appreciation for transportation careers.

In the *technology transfer* domain, the TOMNET team will continue to organize and conduct seminars such as those listed previously in Table 4. Through funding made possible by the UTC grant, the TOMNET team will record and archive seminar videos on the website so that the broader community can benefit from the seminar events. TOMNET will expand the portfolio of outreach activities to include a quarterly webinar series, to be delivered by TOMNET faculty members as well as specially invited guest speakers. These webinars will be recorded and archived at the TOMNET website for the benefit of those who could not attend the webinars live and in-person. The seminars and webinars will be publicized via various distribution lists and e-mail listservs (as well as the CUTC e-mail list) to ensure broad participation and awareness.

The TOMNET Center has developed the necessary infrastructure to conduct short courses, workshops, and symposia. The Center expects to conduct a 3.5 day short course on Travel Survey Methods in September 2018. This course, to be taught by TOMNET faculty and invited guest lecturers, will be aimed at professionals who are interested in learning about best practices in travel survey data collection – including the use of technology (such as smartphone apps and social media) to obtain detailed behavioral and movement data. Other workshops and short courses are being planned with an activity-based travel modeling workshop likely to take place in December 2018. These short courses or workshops will be held at ASU first, but then conducted at other partner institution locations in subsequent reporting periods to broaden the opportunities for participation across the country.

Discussions are underway to organize an annual or biannual TOMNET symposium, called the A^4 Symposium. This symposium will focus on Attitudes, Automation, Autonomy, and Access (hence, A^4) and bring together the many key themes addressed by TOMNET. The first symposium will likely be held in Fall

2018 or Spring 2019, with a view to bring together a diverse worldwide audience working in these domains and discuss methods, tools, and models that can help leverage data about attitudes and behaviors to understand how the future of transportation may evolve in an era of automation and autonomy (as well as *sharing*). TOMNET is also going to expand the reach of its newsletter and launch a blog within the next reporting period to greatly enhance the impact and reach of its technology transfer activities. The newsletter will be sent to an e-mail list of more than 1,500 professionals that the TOMNET partners have carefully assembled through their respective networks; recipients will, of course, have the ability to unsubscribe and manage their subscription to the TOMNET communications (as TOMNET will be using a professional service such as Constant Contact to handle all communications and newsletter production). Within the next reporting period, TOMNET will also develop and post its 2017 annual report (a purely online document) so that the broader community becomes aware of the products of the Center and how to best engage with the faculty and students of the Center.

Needless to say, TOMNET researchers and scholars will continue to engage in many traditional technology transfer activities that involve presenting research results at conferences and symposia around the country and world, writing papers for publication in journals and conference proceedings, preparing manuscripts for publication in edited books and volumes, and guest editing special issues of journals dedicated to topics of interest to TOMNET. All of these products will be disseminated through the TOMNET website.

2. PRODUCTS: What has the program produced?

Publications are the characteristic product of research projects funded by the UTC Program. OST-R may evaluate what the publications demonstrate about the excellence and significance of the research and the efficacy with which the results are being communicated to colleagues, potential users, and the public, not the number of publications. Many research projects (though not all) develop significant products other than publications. OST-R may assess and report both publications and other products to Congress, communities of interest, and the public.

The following is a list of **publications and conference papers** produced by TOMNET core faculty members during the reporting period covered by this PPPR. To the extent possible, papers and presentations likely to be listed in other UTC PPPR documents have been omitted to avoid double-counting products.

Arizona State University

1. Mokhtarian, P.L. and Pendyala, R.M. (2018) Travel Satisfaction and Well-Being. In L.E. Olsson, M. Friman, and D. Ettema, eds., *Quality of Life and Daily Travel*, Springer, pp. 17-39.
2. Singh, A.C., Astroza, S., Garikapati, V.M., Pendyala, R.M., Bhat, C.R. and Mokhtarian, P.L. (2018) Quantifying the Contribution of Various Factors to Household Vehicle Miles of Travel. Paper presented at the 97th Annual Meeting of the Transportation Research Board, January, Washington, D.C.
3. Dias, F.F., Astroza, S., Garikapati, V.M., Pendyala, R.M., Bhat, C.R. and Mokhtarian, P.L. (2018) A Multivariate Exploration of Emotional Feelings of Subjective Well-Being During Travel Episodes. Paper presented at the 97th Annual Meeting of the Transportation Research Board, January, Washington, D.C.
4. Vinayak, P., Dias, F.F., Astroza, S., Bhat, C.R., Pendyala, R.M. and Garikapati, V.M. (2018) Accounting For Multi-dimensional Dependencies among Decision-makers within a Generalized Model Framework: An Application to Understanding Shared Mobility Service Usage Levels. Paper presented at the 97th Annual Meeting of the Transportation Research Board, January, Washington, D.C.
5. Astroza, S., Bhat, P.C., Bhat, C.R., Pendyala, R.M., and Garikapati, V.M. (2018) Understanding Activity Engagement Across Weekdays and Weekend Days: A Multivariate Multiple Discrete-Continuous Modeling Approach. Paper presented at the 97th Annual Meeting of the Transportation Research Board, January, Washington, D.C.

6. Astroza, S., Garikapati, V.M., Pendyala, R.M., Bhat, C.R. and Mokhtarian, P.L. (2018) Representing Heterogeneity in Structural Relationships among Multiple Choice Variables Using a Latent Segmentation Approach. Paper presented at the 97th Annual Meeting of the Transportation Research Board, January, Washington, D.C.
7. Li, H., Cebe, J., Khoeini, S., Xu, Y. A., Dyess, C. and Guensler, R. (2018) A Semi-automated Method to Generate GIS-based Sidewalk Networks for Asset Management and Pedestrian Accessibility Assessment. Paper presented at the 97th Annual Meeting of the Transportation Research Board, January, Washington, D.C.
8. Seo, Kihwan, Deborah Salon, Michael Kuby, and Aaron Golub (2018) Hedonic Modeling of Commercial Property Values: Distance Decay from the Links and Nodes of Rail and Highway Infrastructure. Transportation, https://doi.org/10.1007/s11116-018-9861-z.
9. Salon, D. and McIntyre, A. (2018) Determinants of Pedestrian and Bicyclist Crash Severity by Party at Fault in San Francisco, CA. Accident Analysis and Prevention 110, pp. 149-160.
10. Thigpen, C.G. (2018) Giving Parking the Time of Day: A Case Study of a Novel Parking Occupancy Measure and an Evaluation of Infill Development and Carsharing as Solutions to Parking Oversupply. Research in Transportation Business and Management, https://doi.org/10.1016/j.rtbm.2018.03.003.
11. Thigpen, C.G. and Handy, S.L. (2018) Driver's Licensing Delay: A Retrospective Case Study of the Impact of Attitudes, Parental and Social Influences, and Intergenerational Differences. Transportation Research Part A, 111, pp. 24-40.
12. Handy, S.L. and Thigpen, C.G. (2018) Commute Quality and Its Implications for Commute Satisfaction: Exploring the Role of Mode, Location, and Other Factors. Travel Behaviour and Society, https://doi.org/10.1016/j.tbs.2018.03.001.
13. Zhang, W., Guhathakurta, S., Pendyala, R.M., Garikapati, V.M. and Ross, C. (2017) A Generalizable Method for Estimating Household Energy by Neighborhoods in US Urban Regions. Energy Procedia, 143, pp. 859-864.
14. Robinson, C., Dilkina, B., Hubbs, J., Zhang, W., Guhathakurta, S., Brown, M.A. and Pendyala, R.M. (2017). Machine Learning Approaches for Estimating Commercial Building Energy Consumption. Applied Energy 208, pp. 889-904.
15. Wang, K., Ye, X., Pendyala, R.M. and Zou, Y. (2017) On the Development of a Semi-nonparametric Generalized Multinomial Logit Model for Travel-related Choices. PLOS One 12(10), e0186689.
16. Astroza, S., Garikapati, V.M., Bhat, C.R., Pendyala, R.M., Lavieri, P.S. and Dias, F.F. (2017) Analysis of the Impact of Technology Use on Multimodality and Activity Travel Characteristics. Transportation Research Record: Journal of the Transportation Research Board 2666, pp. 19-28.
17. Dias, F.F., Lavieri, P.S., Garikapati, V.M., Astroza, S., Pendyala, R.M. and Bhat, C.R. (2017) A Behavioral Choice Model of the Use of Car-sharing and Ride-sourcing Services. Transportation 44(6), pp. 1307-1323.
18. Lavieri, P.S., Garikapati, V.M., Bhat, C.R., Pendyala, R.M., Astroza, S. and Dias, F.F. (2017) Modeling Individual Preferences for Ownership and Sharing of Autonomous Vehicle Technologies. Transportation Research Record: Journal of the Transportation Research Board 2665, pp. 1-10.
19. Lavieri, P.S., Garikapati, V.M., Bhat, C.R. and Pendyala, R.M. (2017) Investigation of Heterogeneity in Vehicle Ownership and Usage for the Millennial Generation. Transportation Research Record: Journal of the Transportation Research Board 2664, pp. 91-99.
20. Garikapati, V.M., You, D., Zhang, W., Pendyala, R.M., Guhathakurta, S., Brown, M.A. and Dilkina, B. (2017) Estimating Household Travel Energy Consumption in Conjunction with a Travel Demand Forecasting Model. Transportation Research Record: Journal of the Transportation Research Board 2668, pp. 1-10.
21. Liu, J., Kang, J.E., Zhou, X. and Pendyala, R.M. (2017) Network-Oriented Household Activity Pattern Problem for System Optimization. Transportation Research Part C, https://doi.org/10.1016/j.trc.2017.09.006.
22. Sultana, S., Salon, D. and Kuby, M. (2017) Transportation Sustainability in the Urban Context: A Comprehensive Review. Urban Geography, https://doi.org/10.1080/02723638.2017.1395635.
23. Thigpen, C.G. and Volker, J.M. (2017) Repurposing the Paving: The Case of Surplus Residential Parking in Davis, CA. Cities 70, pp. 111-121.
24. Fang, K. and Thigpen, C.G. (2017) Transportation Policy at the Ballot Box. Transportation Research Record: Journal of the Transportation Research Board 2605, pp. 92-98.

Georgia Institute of Technology

25. Ben-Elia, E., Lyons, G., and Mokhtarian, P.L. (2018) Epilogue: The New Frontiers of Behavioral Research on the Interrelationships Between ICT, Activities, Time Use and Mobility. Transportation 45, pp. 479-497.
26. Tang, J., Zhen, F., Cao, J., and Mokhtarian, P.L. (2018) How Do Passengers Use Travel Time? A Case Study of Shanghai-Nanjing High Speed Rail. Transportation 45, pp. 451-477.
27. Lyons, G., Mokhtarian, P.L., Dijst, M., and Böcker, L. (2018). The Dynamics of Urban Metabolism in the Face of Digitalization and Changing Lifestyles: Understanding and Influencing Our Cities. Resources, Conservation and Recycling 132, 2018, pp. 246-257.
28. Dijst, M., Worrell, E., Böcker, L., Brunner, P., Davoudi, S., Geertman, S., Harmsen, R., Helbich, M., Holtslag, A.A.M., Kwan, M-P., Lenz, B., Lyons, G., Mokhtarian, P.L., Newman, P., Perrels, A., Poças Ribeiro, A., Rosales Carreón, J., Thomson, G., Urge-Vorsatz, D., and Zeyringer, M. (2018) Exploring Urban Metabolism—Towards an Interdisciplinary Perspective. Resources, Conservation and Recycling 132, 190-203.
29. Zhen, F., Du, X., Cao, J., and Mokhtarian, P.L. (2018) The Association between Spatial Attributes and E-Shopping in the Shopping Process for Search Goods and Experience Goods: Evidence from Nanjing. Journal of Transport Geography 66, pp. 291-299.
30. Watkins, K. (2018) Does the Future of Mobility Depend on Public Transportation? Journal of Public Transportation 21(1), pp. 53-59.
31. Wu, H. and Watkins, K. (2018). Accessibility Disparity between Transit and Automobile: A Study of Atlanta and Seattle. Online proceedings, Transportation Research Board 2018 Annual Meeting.
32. Ederer, D., Boyd, N., and Watkins, K. (2018) Cycling for Transport or Fun? Determining Cyclist Trip Purpose on Off-street Urban Trails. Paper presented at the 97th Annual Meeting of the Transportation Research Board, January, Washington, D.C.
33. Queen, C., Ross, C., and Watkins, K. (2018) Urban Transit Mode Selection in the United States of America. Paper presented at the 97th Annual Meeting of the Transportation Research Board, January, Washington, D.C.
34. Zhai, Q., Cao, J., Mokhtarian, P.L., and Zhen, F. (2017) The Interactions between E-shopping and Store Shopping in the Shopping Process for Search Goods and Experience Goods. Transportation 44(5), 885-904.
35. Lee, R. J., Sener, I.N., Mokhtarian, P.L., and Handy, S.L. (2017) Relationships Between the Online and In-Store Shopping Frequency of Davis, California Residents. Transportation Research Part A 100, pp. 40-52.
36. Stillwater, T., Kurani, K.S., and Mokhtarian, P.L. (2017) The Combined Effects of Driver Attitudes and In-vehicle Feedback on Fuel Economy. Transportation Research Part D, 52, pp. 277-288.

University of Washington

37. Wang, F. and Chen, C. (2018) Data Processing Required to Derive Mobility Patterns From Passively Generated Mobile Phone Data. Transportation Research Part C 87, pp. 58-74.
38. Abramson, D. (2017) The Uses of Planning History in China. In Hein, C., ed., The Routledge Handbook of Planning History, Routledge, pp. 260-272.

University of South Florida

39. Mannering, F.L. (2018) Temporal Instability and the Analysis of Highway Accident Data. Analytic Methods in Accident Research 17, pp. 1-13.
40. Sarwar, M., Anastasopoulos, P., Ukkusuri, S., Murray-Tuite, P., and Mannering, F.L. (2018) A Statistical Analysis of the Dynamics of household hurricane-evacuation decisions. Transportation 45(1), pp. 51-70.
41. Fountas G., Anastasopoulos, P., and Mannering, F.L. (2018) Analysis of Vehicle Accident-injury Severities: A Comparison of Segment- versus Accident-based Latent-class Ordered Probit Models with Class-probability Functions. Analytic Methods in Accident Research 18, pp. 15-32.
42. Enam, A., Konduri, K., Pinjari, A.R., and Eluru, N. (2018) An Integrated Choice and Latent Variable Model for Multiple Discrete Continuous Choice Kernels: Application Exploring the Association Between Day Level Moods and Discretionary Activity Engagement Choices. Journal of Choice Modelling 26, pp. 80-100.
43. Aziz, H., Park, H., Morton, A., Stewart, R., Hilliard, M., and Maness, M. (2018) A High Resolution Agent-based Model to Support Walk-Bicycle Infrastructure Investment Decisions: A Case Study with New York City. Transportation Research Part C 86, pp. 280-299.

44. Maness, M. (2017) Comparison of Position Generators and Name Generators as Social Capital Indicators in Predicting Activity Selection. Transportation Research Part A 106, pp. 374-395.
45. Maness, M. (2017) A Theory of Strong Ties, Weak Ties, and Activity Behavior: Leisure Activity Variety and Frequency. Transportation Research Record: Journal of the Transportation Research Board 2665, pp. 30-39.
46. Cirillo, C., Liu, Y., and Maness, M. (2017) A Time-dependent Stated Preference Approach to Measuring Vehicle Type Preferences and Market Elasticity of Conventional and Green Vehicles. Transportation Research Part A: Policy and Practice, 100, pp. 294-310.
47. Behnood, A. and Mannering, F.L. (2017) The Effects of Drug and Alcohol Consumption on Driver-injury Severities in Single-vehicle Crashes. Traffic Injury Prevention 18(5), pp. 456-462.
48. Behnood, A. and Mannering, F.L. (2017) The Effect of Passengers on Driver-injury Severities in Single-vehicle Crashes: A Random Parameters Heterogeneity-in-Means Approach. Analytic Methods in Accident Research 14, pp. 41-53.
49. Seraneeprakarn, P., Huang, S., Shankar, V.N., Mannering, F.L., Venkataraman, N., and Milton, J. (2017) Occupant Injury Severities in Hybrid-vehicle Involved Crashes: A Random Parameters Approach with Heterogeneity in Means and Variances. Analytic Methods in Accident Research 15, pp. 41-55.
50. Behnood, A. and Mannering, F.L. (2017) Determinants of Bicyclist Injury Severities in Bicycle-vehicle Crashes: A Random Parameters Approach with Heterogeneity in Means and Variances. Analytic Methods in Accident Research 16, pp. 35-47.

In summary, TOMNET core faculty generated 50 publications in well-respected journals and conference venues within the reporting period covered by this PPPR. A number of these publications (particularly those with 2018 publication year) are directly attributable to funding provided by the TOMNET UTC. The other publications, made possible through a number of other complementary and collaborative initiatives including student theses and dissertations engendered by TOMNET, address and advance the discourse on topics and themes of considerable relevance to the core mission of TOMNET.

In addition to the many publications listed above, TOMNET researchers delivered many a presentation at conferences, symposia, seminars, and other events around the world. In the interest of brevity, the full list of presentations delivered by TOMNET researchers and students is not provided here. In summary, however, TOMNET core faculty, post-docs, and students delivered a total of 67 presentations during the reporting period covered by this PPPR. Among the 67 presentations, 20 were delivered by ASU faculty and students, 31 were delivered by Georgia Tech faculty and students, 12 were delivered by University of Washington faculty and students, and 4 were delivered by University of South Florida faculty and students. It should be noted that a few presentations are duplicated, primarily between ASU and Georgia Tech presentation lists due to the close collaborative research endeavors engendered by TOMNET. There are four presentations (similar to publications) where both ASU and Georgia Tech faculty and students appear as co-authors/co-presenters; removal of the duplicates between the ASU and Georgia Tech lists would yield a total of 63 unduplicated unique presentations. Many of the presentations are inspired by TOMNET and include a mention of the work underway at TOMNET with a view to making the broader community aware of the research and technology transfer activities of the Center. A full list of presentations is available upon request and is being submitted as a separate attachment in the interest of completeness.

Website(s) or other Internet site(s)

One major product of the center is the TOMNET website that is being continuously enhanced to support the mission of the center. The website, http://www.tomnet-utc.org, is a portal with comprehensive information about activities of the Center. Over the past several months, the website has been enhanced to include information about TOMNET students and TOMNET research projects. Research project descriptions have also been entered in the RiP (Research in Progress) database (eight projects can be seen by doing a keyword search on TOMNET). In addition, individual faculty members maintain their own

websites with information about their publications, presentations, research projects, professional activities, and courses. A few websites of interest and relevance to advancing the TOMNET mission include the following:

1) http://www.mobilityanalytics.org: This is the website of the research group of Professor Ram Pendyala, the Director of TOMNET.
2) https://sustainability.asu.edu/person/deborah-salon/: This is the website of Professor Deborah Salon, who serves as an Associate Director of TOMNET.
3) http://mokhtarian.ce.gatech.edu/: This is the website of Professor Patricia Mokhtarian, who serves as the Research Director of TOMNET.
4) http://cee.eng.usf.edu/faculty/flm/: This is the website of Professor Fred Mannering, who serves as an Associate Director of TOMNET.
5) http://abdulpinjari.weebly.com: This is the website of Professor Abdul Pinjari, who serves as an Associate Director of TOMNET, but has now transitioned to the Indian Institute of Science in Bangalore, India. This has facilitated a new international partnership with a leading institution of higher education located in a major city that is regarded as a leading technology hub in Asia.
6) http://depts.washington.edu/thinklab/: This is the website of Professor Cynthia Chen's laboratory and research group. Professor Chen is an Associate Director of TOMNET.

The TOMNET website is being enhanced further to incorporate a blog where TOMNET faculty and students can share research stories, profiles, and other news about events and seminars. The website also has a calendar that includes information about transportation related events and conferences around the world. Over time, the website will be enhanced further to serve as a major resource to the broader community of scholars and practitioners in the transportation industry.

Software Programs, Codes, and Products

During the reporting period covered by this PPPR, the TOMNET team has worked diligently towards developing a few key products that would be of value to the transportation planning and modeling community. The TOMNET team at ASU has been heavily involved in the development and application of a synthetic population generator called PopGen (please see https://www.mobilityanalytics.org/popgen.html). This synthetic population generator has been adopted by a number of agencies around the country for microsimulation modeling of activity-travel demand. This product has been further refined and enhanced over the past several months to improve the capabilities, functionality, and user-friendliness of the software. Although the software system has been implemented and adopted in a number of agency settings and consultants in the industry are regularly using the software to generate synthetic populations, the TOMNET team at ASU believes that the use and adoption of the software product can be further enhanced by moving the program into the cloud. This is the effort that the TOMNET team has pursued over the past several months. TOMNET-sponsored students derived from multiple disciplines (Civil and Environmental Engineering, Computer Science, and Software Engineering) have been working together as a team to move the entire software system into the cloud. An initial prototype has been developed and tested, and the full beta-version will be released to the user community during the next TOMNET reporting period. The cloud version of PopGen can be accessed and run by any user in the world who has an internet connection and does not require any local installation of program files or software. After the beta version has been extensively tested and used by the community, the TOMNET team will develop a basic business model that would allow the cloud version to be a self-sustaining enterprise.

Over the past few months, the TOMNET team has worked extensively on the development of comprehensive survey instruments that can be used to measure behaviors, attitudes, perceptions, and

preferences in the context of new and emerging mobility technologies and community resilience challenges. Georgia Tech, ASU, and USF are collaborating on a multi-city survey of attitudes and perceptions towards transformative transportation technologies; this survey has a number of sections including a stated preference section and separate sections dedicated to collecting data about socio-economic and demographic characteristics, current travel behavior patterns, general attitudes and preferences towards modes of transportation and lifestyles, attitudes towards and potential adoption of mobility-on-demand services, and attitudes towards and potential adoption of automated vehicle systems. The University of Washington team is working on a standardized survey that can be used to determine how communities access information and respond to disaster situations and crises. As part of this effort, the TOMNET team at the University of Washington is meeting with stakeholders, reviewing the literature in different disciplines, and compiling a comprehensive list of disaster and crises scenarios for which transportation professionals would benefit from understanding how people in different types of communities respond, obtain information, interact, use services, and adapt. This survey is a product that the TOMNET team envisions making available to any community that may wish to collect such data. Finally, the TOMNET team embarked on a comprehensive review of the literature on the role of attitudes in explaining traveler behavior and values. As part of this review, the TOMNET team noticed that there are a large number of studies dedicated to this topic, but they all use different attitudinal questions and statements to get at rather similar concepts and constructs. It would be of value to the profession to develop a more consistent, robust, and uniform set of attitudinal questions and statements that can be included in future surveys, thus enabling comparisons over time and between different studies and geographic contexts. The TOMNET team will develop a product that documents the consistent set of questions and statements that may be adopted in future studies, regardless of the geographic context.

TOMNET scholars are developing a few other products as well. The TOMNET team is developing two or three modules of hands-on activities that anybody can implement as part of a K-12 and school teacher outreach program. These materials are being packaged and will be posted on the TOMNET website within the next reporting period. The TOMNET team is pilot-testing the materials once and ensuring their efficacy prior to making them available to the wider community online. In addition, the TOMNET team continues to make progress on the development of R and Python codes for transportation model estimation and implementation. These codes are undergoing further testing and will be posted to the TOMNET website shortly. In particular, the programs will enable the estimation of advanced econometric choice models (such as integrated choice latent variable or ICLV models) that are most suited to jointly modeling attitudes and behaviors in a simultaneous equations framework. The TOMNET team has already published a few R and Python codes for model development and estimation; these codes can be found at https://www.mobilityanalytics.org/r-codes-for-travel-modeling.html.

At this time, the TOMNET team does not have any other products to report under the following categories:
Databases and data sets
Technologies or techniques
Inventions, patent applications, and/or licenses
Other products (Databases, Physical collections, Audio or video products, Software or NetWare, Models, Educational aids or curricula, Instruments or equipment, Data and Research Material, Other)

3. PARTICIPANTS and COLLABORATING ORGANIZATIONS: Who has been involved?
OST-R needs to know who has worked on the project to gauge and report performance in promoting partnerships and collaborations.

TOMNET researchers have been actively collaborating with a number of organizations and partners in

academia and industry. These partnerships have created many opportunities for the impact of TOMNET to be felt on a broad scale. In addition to establishing an External Advisory Board (EAB), whose details will be furnished on the TOMNET website shortly (once all biographical sketches and photographs are obtained), TOMNET has actively pursued partnerships and engaged with a number of other entities so that the research projects and products are of value to a broad set of stakeholders and constituents.

A major partnership that has been established is that with the Maricopa Association of Governments (MAG). MAG and ASU have signed a Memorandum of Agreement (MOA) in the last reporting period committing to a strong collaborative partnership. As part of this partnership, MAG staff will be engaged in collaborative research activities, reviewing products and deliverables, helping identify fruitful research directions, and testing the products of the TOMNET Center in a real-world planning and modeling environment. MAG is also sharing all of its planning and survey data sets to enable TOMNET researchers to develop and estimate models that are based on state-of-the-art recent survey data sets. MAG is lending critical support to the Center in the form of a $60,000 commitment (in cash resources) to support a graduate student who works at the nexus of transportation and computer/data science. The first student supported through the MAG partnership is now on-board and working on significant efforts related to enhancing MAG's activity-based travel demand model system along multiple dimensions. It is envisioned that this experience is directly contributing to workforce development as MAG has expressed a desire to hire the student (upon his graduation) full-time as a staff person if there is a mutual interest in such an employment.

What organizations have been involved as partners?

A number of other organizations are partnering with TOMNET researchers and have provided financial or in-kind support. These include:

- Georgia Department of Transportation, Atlanta, Georgia: Financial support, survey research, data sets, collaborative research
- Atlanta Regional Commission, Atlanta, Georgia: Data sets, model networks and files, survey data
- Florida Department of Transportation, Tallahassee, Florida: Financial support, survey research, data sets, collaborative research
- Puget Sound Regional Council, Seattle, Washington: Data sets, model networks and files
- AAA Traffic Safety Foundation, Washington, DC: In-kind support, collaborative survey research, data sets
- Cambridge Systematics, Inc., Cambridge, Massachusetts: Financial support, survey research, data sets, collaborative research
- Resource Systems Group, Inc., White River Junction, Vermont: Survey research, data sets, collaborative research
- D-STOP University Transportation Center, Center for Transportation Research, University of Texas at Austin, Austin, Texas: In-kind support, collaborative research, data sets
- University of California at Santa Barbara, Department of Geography, Santa Barbara, California: In-kind support, collaborative research, data sets
- University of California at Davis, Institute of Transportation Studies, Davis, California: In-kind support, collaborative research, data sets
- Arizona State University Engineering Summer Outreach Programs (https://outreach.engineering.asu.edu/summer-programs/): In-kind support and collaborative efforts for high school student outreach and workforce development
- City of Seattle Office of Emergency Management: Policy support, collaborative research
- Laurelhurst Earthquake Action Preparedness (LEAP): In-kind support, collaborative research, community outreach

- UW Medicine Telehealth: collaborative research
- UW School of Social Work, Indigenous Wellness Research Institute: collaborative research
- WA State Emergency Management Division: collaborative research
- Northwest Healthcare Response Network: collaborative research, stakeholder outreach
- King County Public Health: collaborative research
- Seattle Public Schools: collaborative research

Have other collaborators or contacts been involved?
TOMNET researchers have a very close working relationship with members of the D-STOP University Transportation Center led by the Center for Transportation Research at the University of Texas at Austin. TOMNET and D-STOP have elevated their level of cooperation in the past nine months, generating six jointly authored papers that were all accepted for presentation at the 97th Annual Meeting of the Transportation Research Board held in January 2018. The papers are currently under review for possible publication in a number of top-tier journals. All six papers received excellent reviews from the Transportation Research Board Committees that handled the review processes for the papers. A key element of the strategic partnership between the two centers is the participation of D-STOP in the multicity survey on attitudes towards and adoption of transformative transportation technologies. The University of Texas at Austin D-STOP researchers are participating in the development of the survey and will be administering the same survey in Austin, Texas, thus enabling the addition of another city to the overall project effort (thus, the survey is going to be administered in Phoenix, Tampa, Atlanta, and Austin). TOMNET team members are pursuing close working relationships with other University Transportation Centers. Currently, there is a close working relationship with the Regional UTC in the Pacific Northwest, the National UTC led by the University of California at Davis, and the Regional UTC in Region 9 led by the University of Southern California.

TOMNET team members at ASU are playing a leading role in unifying transportation research and education activities at Arizona State University through the ASU Transportation Campaign. Ram Pendyala, the TOMNET Director serves as one of the co-leads for the Transportation Campaign. TOMNET is playing a critical role in bringing faculty members working in the area of transportation in many different schools, disciplines, programs, and colleges at ASU together to build new coalitions and address the grand challenges in transportation. TOMNET has facilitated conversations between an inter-disciplinary cadre of transportation faculty members at ASU with leading industry entities such as Lyft, Intel, Uber, Waymo, Local Motors, Stantec, Office of the Governor of Arizona, and Eberle Design, Inc. Thanks to these efforts, ASU has successfully executed non-disclosure agreements (NDAs) with Waymo, Lyft, Stantec, Intel, and Eberle Design, Inc.

Global partnerships are expanding in the TOMNET sphere. For example, Prof. Patricia Mokhtarian has collaborated with Prof. Rolf Moeckel of the Technical University of Munich (TUM) and Prof. Taha Rashidi of the University of Sydney, on a proposal to the TUM Global Incentive Fund. The proposed project would explore the use of machine learning techniques to improve the calibration of integrated land use/transportation models – directly in line with TOMNET's mission. If funded, Georgia Tech would host one of two workshops for the project team, as well as assist in the execution of the project.

4. IMPACT: What is the impact of the program? How has it contributed to transportation education, research and technology transfer?

As TOMNET is still a rather young UTC, having been in existence for just a little over a year, it is still somewhat premature to fully measure and articulate the impacts of the program. Yet, even within a short period of time, the Center and its personnel have engaged in significant impactful activities and produced products that are being appreciated by many.

What is the impact on the development of the principal discipline(s) of the program?
TOMNET has had an impact on the principal discipline(s) largely through its research and education/workforce development activities. In the research domain, core TOMNET researchers have published 50 papers that cover critical aspects of traveler behavior and values, attitudes and perceptions, and preferences and willingness-to-pay. In particular, there is considerable uncertainty about how people will respond to the many disruptive forces that are redefining the transportation landscape and greatly changing the mobility options available to businesses and people alike. TOMNET researchers have engaged in a number of studies, and produced a number of papers that shed light on the implications of emerging mobility options such as shared mobility services and autonomous vehicle systems on traveler behavior and the future of travel demand. TOMNET researchers are developing robust and comprehensive survey instruments that can be deployed to obtain deep insights about the future of mobility and the resilience of communities. These surveys are being developed so that they can be deployed in any context. Tools developed by TOMNET researchers (such as PopGen) are being used by agencies, practitioners, and academics around the nation for advancing transportation modeling practice.

What is the impact on other disciplines?
The work of TOMNET is highly multi-disciplinary in nature, and therefore impacts other disciplines in important ways. Ultimately, the work of TOMNET is concerned with planning and designing the critical transportation infrastructure of the future. To do this, however, requires an accurate understanding of how travel demand and mobility needs will evolve into the future; infrastructure investments and improvements of the future will be informed by such a deep understanding of attitudes, behavior, and demand. Recognizing that sound planning processes and principles are critical to ensuring that infrastructure investments of the future are well designed and meet the needs of diverse constituents, TOMNET is enabling cross-cutting conversations and research collaborations between engineers who design the critical infrastructure on the one hand, and planners and geographers who plan urban spaces on the other. The work of TOMNET is leading to new insights on the interactions between land use and transportation, enabling more informed discussions on the role that built environment policies and transit oriented developments can play in shaping future mobility and communities. In particular, ongoing work of the Center aimed at understanding people's residential location choices and preferences, particularly in the context of the advent of transformative and disruptive transportation technologies, is helping to enhance the planning discipline by tightly integrating behavioral principles within its fold.

As mentioned in the previous PPPR, the work of TOMNET is creating many new opportunities for faculty members in a number of other disciplines to apply their methods and techniques in the transportation domain. In particular, computer scientists are working with TOMNET researchers to develop new software and tools for modeling traveler behavior in microsimulation frameworks, apply machine and deep learning algorithms to fuse and mine big data with behavioral data and derive predictive analytics, and design new algorithms for optimizing shared mobility services while considering behavioral responses to alternative service configurations and options. TOMNET researchers are working with faculty in the new ASU School for the Future of Innovation in Society to explore ways in which new transportation technologies can be deployed to enhance overall quality of life.

What is the impact on the development of transportation workforce development?
During the reporting period covered by this PPPR, TOMNET faculty members taught a number of transportation related courses at the undergraduate and graduate levels at all of the partner institutions. While teaching courses is a regular activity of the faculty members involved in TOMNET (and hence nothing new), TOMNET is beginning to significantly impact and re-shape the course content (in several courses). Courses dealing with statistical modeling of travel demand now include topics on machine learning and deep learning; courses in traffic simulation include exercises in the use of big data and the

fusion of big data with smaller behavioral data; courses in activity-travel modeling include modules specifically dedicated to covering the latest work emanating from TOMNET, most notably addressing methods for and the value of incorporating attitudes into travel demand forecasting models and planning processes. TOMNET faculty members are mentoring dozens of graduate students, including women and minorities, thus advancing a diverse workforce. TOMNET is directly supporting more than a dozen graduate students who are committed to careers in transportation and are actively engaged in a number of professional societies such as Institute of Transportation Engineers and Women's Transportation Seminar. TOMNET is promoting transportation as a career pathway by offering Research Experiences for Undergraduates (REU) opportunities to a dozen undergraduate students. These students are likely to pursue graduate studies in transportation and further their knowledge of the work of TOMNET and the application of that knowledge to improving transportation systems. TOMNET faculty members are encouraging graduate students to apply for various types of fellowship and awards; TOMNET graduate students have won prestigious NSF graduate fellowships, ITE and WTS fellowships, IRF Fellowships, and ENO Transportation Fellow recognitions.

TOMNET is greatly enhancing its K-12 outreach activities. In the last reporting period, hands-on transportation activities were conducted as part of summer camps that seek to enhance the level of interest in STEM fields among middle and high school students. These activities have had a significant impact as students (who participated in the summer activities) are pursuing high school projects in the field of transportation and writing to TOMNET faculty and graduate students seeking help and advice.

What is the impact on physical, institutional, and information resources at the university or other partners?
As mentioned in the previous PPPR, TOMNET has been provided dedicated space at the campus of Arizona State University; thus TOMNET has made it possible for transportation research and education to obtain dedicated space where students and faculty members can pursue research and engage in intellectually stimulating conversations about the next great discovery or technology that will transform transportation. Over the past several months, TOMNET has become a key leading entity in engendering cross-disciplinary dialogue in the transportation field. Working closely with the ASU administration, TOMNET played a role in establishing the ASU Transportation Campaign, a university wide initiative aimed at bringing diverse faculty together to pursue complex and challenging questions that require trans-disciplinary perspectives to build effective solutions. The campaign, assisted by TOMNET, has developed an e-mail listserv of 100 faculty members working in many different colleges, schools, programs, and disciplines across the university. TOMNET has made it possible to develop a weekly news bulletin (which will be transformed into a more sophisticated e-newsletter very shortly for external dissemination as well) that is sent out by TOMNET Director Ram Pendyala to the entire e-mail list. The weekly news bulletin includes headlines from the world of transportation, information about the transportation seminar, and information about opportunities for research grants, proposal deadlines, and awards for faculty and students alike. A calendar of events (worldwide) is also included in the communique. This news bulletin, combined with the seminar series and other special events, has helped bring together dozens of faculty members on a regular basis to discuss the future of transportation. TOMNET is also working closely with the media relations offices at the respective institutions to ensure that new discoveries and findings coming out of TOMNET research are effectively disseminated to a wider audience.

What is the impact on technology transfer?
TOMNET faculty members are engaged in a number of technology transfer activities as detailed earlier in this report. TOMNET is primarily organizing seminars and webinars to help transfer TOMNET technologies and results into the real world transportation planning context. These seminars (at all of the partner institutions) bring academics and practitioners together to learn

and discuss about a specific topic; through these activities, the Center is significantly impacting technology transfer. The Center faculty are now engaged in collaboratively developing a robust technology transfer plan that can be implemented immediately upon receiving approval. TOMNET is engaged in additional activities to enable technology transfer. In particular, TOMNET faculty members are delivering short courses and workshops to teach the latest methods and tools to practitioners. TOMNET is developing software systems and tools that are being made available to the broader community through open source software licensing arrangements.

What is the impact on society beyond science and technology?

The work of TOMNET has just begun and hence it is rather premature to attempt to articulate the impacts on society beyond science and technology. Nevertheless, it is of value to discuss the broader societal implications of the work of the Center. Over the last several months, TOMNET faculty and students have undertaken a number of studies that aim to better understand the well-being of individuals and how transportation plays an important role in shaping human well-being and quality of life. The research findings produced by TOMNET help transportation planning agencies make more informed decisions about transportation investments and policies that would enhance quality of life while mitigating any unintended consequences. Thus, the work of the Center may be viewed as directly impacting the quality of life of communities. Likewise, TOMNET faculty members are undertaking key research efforts in studying and understanding human response to disasters and the role that transportation services and systems can play in advancing community resilience. The efforts of team members at the University of Washington are particularly noteworthy in this regard. Through a series of stakeholder meetings, TOMNET members at the University of Washington are being able to devise measures and strategies that would better match resources to individuals based on their attitudes, preferences, and perceptions. Another area in which TOMNET researchers are heavily engaged is that of safety. Recently, TOMNET Director Ram Pendyala participated in a special panel in the lawn of the Arizona State Capitol to address the menace of distracted driving. Pendyala talked about the importance of understanding attitudes and perceptions towards distracted driving if policies aimed at curbing the menace are to be truly effective. Even though people know that distracted driving is dangerous, they continue to engage in such behaviors on a continuous basis. Why? The answer lies in studying and understanding human attitudes and perceptions; thus the work of TOMNET is influencing the transportation safety domain which undoubtedly has a direct impact on society. Yet another area of influence for TOMNET is that of health. TOMNET researchers are engaged in studies to better understand the attitudes and values that engender the use of active modes of transportation. Through its portfolio of activities in this space, TOMNET is helping to identify interventions and public information and awareness campaigns that could potentially promote the use of active modes of transportation, minimize exposure to harmful pollutants, and facilitate access to health care for disadvantaged segments of the population. Thus, the activities of TOMNET are significantly impacting society in the health and wellness domain.

5. CHANGES/PROBLEMS

There are no changes to or problems with the scope, mission, budget, or operations of TOMNET.