

Center for Teaching Old Models New Tricks (TOMNET)
A USDOT Tier 1 University Transportation Center

PROJECT PROPOSAL: 2017-2018

Title: Attitudes towards Emerging Mobility Options and Technologies – Phase 1: Survey Design

Principal Investigator: Michael Maness, Ph.D., Department of Civil and Environmental Engineering, Postdoctoral Research Scholar

1. Introduction/Problem Statement

Emerging transportation technologies including electric and autonomous vehicles and emerging mobility services such as ride-hailing and vehicle sharing are bringing about transformative changes in the transportation landscape. How will these emerging technologies and mobility services impact user's travel choices, activity-travel patterns, residential location, quality of life, land use, and the energy and environmental footprint? It is very important to understand and predict the behavioral impacts of these changes and plan future transportation systems with a view to improving mobility, accessibility, and environmental sustainability for all, regardless of location and socioeconomic status.

Autonomous vehicles (AV) (also referred to as driverless cars or self-driving cars) are capable of navigating without human input using an array of technologies such as radar, lidar, GPS, Odometry, and computer vision. Most industry experts suggest that autonomous vehicles will be on the road within a few years (1). The Secretary of Transportation in the US stated at the 2015 Frankfurt Auto show that he expects driverless cars to be in use all over the world by 2025 (2). Google plans to have its driverless cars on the market no later than 2018 (3). The Institute of Electrical and Electronics Engineers (IEEE) is predicting that up to 75% of all vehicles will be autonomous by 2040 (4). Virtual ridehailing companies such as Uber and Lyft are beginning to change the transportation landscape in significant ways as they provide door-to-door mobility-on-demand through the use of mobile apps. In general, information technology is making rideshare and transit travel options more convenient using location-aware services and real-time data analytics.

With the emergence of new transportation technologies and services, it is critical that transportation forecasting models be enhanced to account for market dynamics that will result from the increasing penetration of disruptive forces in the transportation domain. To enhance transportation forecasting models, 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 adaptation patterns. It is envisioned that such models will help decision-makers better plan transportation infrastructure systems and design marketing and policy strategies that maximize the benefits of these disruptive technologies. Attitudes and perceptions are likely to vary by socioeconomic characteristics, existing travel patterns and mobility experiences, and land use and built environment attributes.

This project will collect survey data from a sample of about 1000 residents in the Tampa Bay metro area to understand how the market may perceive, adopt, and adapt to transformative transportation technologies. In parallel projects, supported by TOMNET UTC, our collaborators at Georgia Institute of Technology and Arizona State University (TOMNET partners) will collect the same data with similar sample sizes from residents of Atlanta and Phoenix metro areas. Moreover, our close collaborators at the University of Texas Austin (supported by D-STOP UTC) will also collect similar data from the Austin

metro area. It is envisioned that the four studies yield a dataset of more than 4000 responses across four southern metro areas (Phoenix, AZ; Atlanta, GA; Austin, TX; and Tampa, FL) to understand the perceptions, attitudes and potential behavior toward new transportation transformative changes including autonomous vehicles and ridehailing services.

The entire survey effort, TOMNET Transformative Transportation Technologies Survey (T4 Survey), is planning to do the whole project in three phases of literature review and survey design, survey administration, and data analysis. The pilot phase of the survey will take place during the second phase of the project only in the Phoenix metro area. The goal of the pilot phase with a sample size around 200 is to finalize the survey instrument method and the survey questionnaire. The multi-jurisdiction nature of the survey will deliver a harmonized set of data sets from multiple locations that would afford the ability to perform comparisons and test spatial transferability of behavioral models.

During the initial one-year duration of the project, the research team will review relevant behavioral studies, design the survey instrument, and produce the required reports and documentation. Thus, the focus of this phase-I effort is to understand the contents of related previous surveys and trying to define the main research questions that this study is going to answer. Based on the defined goals and objectives, a team consisting of a dozen travel behavior scientists, across the agencies in charge of conducting the survey, will design a unique survey to collect a rich dataset of users' attributes and mobility choices, together with attitudes, perceptions and stated preferences towards new mobility options and technologies. Covering all these aspects in a professionally designed survey instrument warrant significant efforts during the first year of this project from all the team members.

2. Project Objectives

The overall goal of this project is to collect a rich set of data that includes information about people's attitudes towards and perceptions of advanced transportation technologies and mobility options with a view to inform the development of robust behavioral models of technology adoption capable of reflecting impacts of these disruptive forces on traveler behavior and values.

The objectives of this phase of the project include the development of a harmonized survey instrument, survey design and administration protocol, and sampling plan that other jurisdictions can adopt to conduct similar surveys in their areas. There is significant interest in understanding how people may adapt and respond to the introduction of transformative transportation technologies, but there is considerable uncertainty in how best to design a survey and set of questions that elicit the information needed to develop well-specified behavioral models. This project will provide a data collection protocol and methodology that can be widely adopted.

3. Proposed Methodology and Data

This project will commence with a review of previous studies on attitudes towards and behavioral impacts of autonomous transportation technologies and mobility services. A comprehensive review of previous studies will help identify data needs and behavioral dimensions of interest. The review will help identify data gaps that need to be addressed; gaps may take the form of data content and/or sample groups. The survey instrument may take the form of an online or paper-based mail-out/mail-back survey. A random address-based sample of people living in the Tampa Bay metro area will be purchased from a marketing company representing the people who the survey will be mailed or emailed to. The survey design decisions will be made as part of the project tasks.

Overview of Survey Content

1. General Information

- Socioeconomic and demographic attributes
- Usual travel patterns and vehicle ownership
- Residential preferences
- General and transportation-related attitudes

2. Attitudes towards and perceptions of transformative technologies
 - Automated vehicles
 - Ridehailing services
 - Micro-mobility Services
3. Behavioral impacts of transformative technologies on mobility patterns and choices (short- and long-run impacts)
 - Stated preference questions/scenarios
 - Likert-scale statements
 - Multiple-choice questions

The exact content and set of questions will be designed as part of the project tasks.

4. Work Plan (Project Tasks)

The following tasks will be undertaken in this project.

Task 1 - *Review of behavioral studies about the adoption of and adaptation to transformative transportation technologies:* The project will commence with a comprehensive review of the literature on studies that aimed to provide insights on the behavioral impacts of new transportation services and technologies. The design of the survey within this project will be informed by this literature review, and the project team will seek to ensure that the proposed survey addresses gaps found in the literature.

Task 2 – *Define survey research questions and objectives:* Based on the literature review, the research questions that are not covered in previous studies or need further explorations will be defined in this step which will lead to the exact list of survey goals and objectives.

Task 3 - *Design of the survey questionnaire:* In this task, the project team will first identify behavioral and attitudinal variables that are needed to address the research questions and inform behavioral model specifications. The survey instrument will be designed so that the data needs are met. Findings from the literature review will be used to help guide the survey design and sampling plan. It is envisioned that a respondent sample size of 1,000 will be targeted. The survey design and sampling plan will be harmonized across projects being undertaken in multiple jurisdictions to ensure that the data and findings can be compared across metropolitan regions. Moreover, having a team of a dozen researchers for survey design further enhance the survey questionnaire contents.

Task 4 – *Coding and pretesting the survey:* After the initial survey draft becomes ready, it will be coded in an online platform and designed on a paper questionnaire. Then the online and paper questionnaire will be distributed across colleagues and students to conduct an internal pretest and finalize the survey questionnaire in terms of content, wordings, and design.

Task 5 – *Submission of final deliverables:* The final deliverables of the project will include a comprehensive report documenting the literature review, survey design and sampling plan, and data documentation. The project will also result in the delivery of a complete survey questionnaire that can be used to study attitudes towards and behavioral impacts of autonomous vehicles and emerging mobility services.

5. Project Schedule

The project schedule is shown in figure 1.

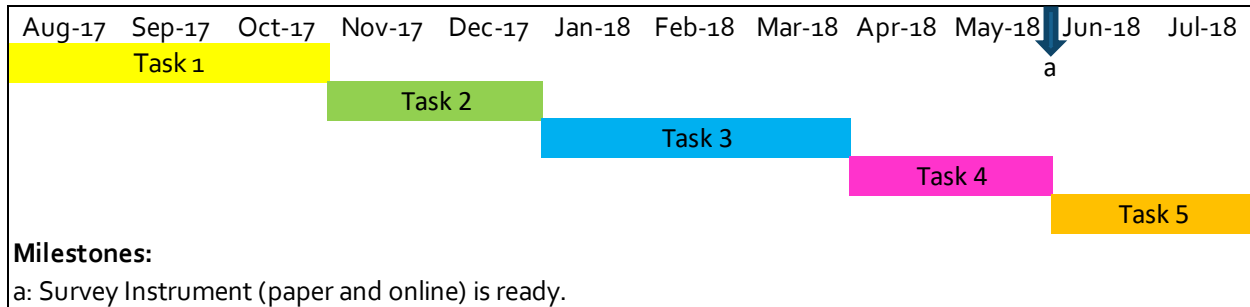


Figure 1 Project planner

As per the schedule, the literature review will be undertaken in August, September, and October of 2017, the first three months of the project. The design of the survey will commence in May 2018. It is anticipated that this task will take five months after defining the survey research questions. During the last two months, the survey questionnaire becomes finalized in the survey recruitment platforms (online and paper) and all the procedures and outputs will be documented in the project report. The next phases of the project consist of defining the sampling plan, survey administration, data collection in the pilot and full phases, followed by data analysis.

6. Relevance to the Center Theme/Mission

This research project involves the collection of attitudinal data to better understand how people perceive and value autonomous vehicles, mobility-as-a-service options, and other disruptive and transformative transportation technologies. Transportation planning agencies are increasingly seeking to forecast travel demand and mobility patterns/choices under alternative future states; however, they are limited in their ability to do so due to a severe paucity of data and behavioral insights on how individuals may adopt and adapt to various disruptive transportation services and technologies. Many studies to date have not gathered data about attitudinal variables, which are likely to play a very important role in shaping the behavioral response to alternative technologies and services. This project directly addresses the theme of the center by collecting attitudinal data together with behavioral and socio-economic information. The resulting data set can be used to develop new behavioral forecasting models that explicitly account for attitudes, perceptions, and values. Therefore, the attitudinal data collection effort contemplated in this project directly addresses the mission of TOMNET, namely, to advance data and methods to explicitly reflect the role of attitudes, perceptions, values, and preferences in activity-travel behavior and mobility choice models.

7. Anticipated Outcomes and Deliverables

The proposed project will result in the development of a rich dataset incorporating information about people's socioeconomic attributes, current travel behavior, attitudes toward and perception of new mobility choices and advanced technologies in transportation, and expected impact of advanced mobility options on traveler behavior and values. It is envisioned that parallel harmonized data collection efforts will take place in three other metropolitan areas, namely, Atlanta, Austin, and Tampa. The project will result in the delivery of harmonized data sets that can be pooled or analyzed separately in subsequent phases (years) of the overall research enterprise. The project will also result in the publication of a final report and the preparation of presentations that document the entire study including the literature review, and survey design plan. It is anticipated that the survey design developed in this research effort can be used by any jurisdiction in the country interested in collecting similar data within its metropolitan region or context.

8. Research Team and Management Plan

The research team is led by Michael Maness, who will serve as the Principal Investigator for the project at USF. Dr. Fred Mannering will provide support for the project. The project will support one Ph.D. student and half a M.S. student.

Michael Maness is a Postdoctoral Research Fellow in the Department of Civil and Environmental Engineering at the University of South Florida. His research interests are in the methodology and application of behavioral modeling in urban and regional systems. His dissertation, which was awarded the 2015 Eric Pas Dissertation Prize, involved incorporating social interactions into activity and travel behavior models. Maness is experienced in advanced choice models with applications to activity behavior, car ownership, autonomous vehicles, electric vehicles, managed lanes, cycling, and communication behavior. His professional experience includes a postdoc at Oak Ridge National Laboratory and a graduate research fellowship at Turner-Fairbank Highway Research Center. He has published articles in top transportation journals including *Transportation Research Part B*, *Transportation Research Part A*, and *Journal of Transport Geography*.

Fred Mannering is currently the Associate Dean for Research in the College of Engineering and a Professor of Civil and Environmental Engineering (with a courtesy appointment in Economics) at the University of South Florida. His research interests are in the application of econometric and statistical methods to a variety of engineering problems, highway safety, transportation economics, automobile demand, and travel behavior. He has published extensively in these fields with over 130 journal articles and has coauthored two books: *Principles of Highway Engineering and Traffic Analysis* and *Statistical and Econometric Methods for Transportation Data Analysis*. He is also Editor-in-Chief of the journal *Analytic Methods in Accident Research* and previous Editor-in-Chief (2003-2012) and current Associate Editor for *Transportation Research Part B*.

Michael Maness will be the primary point of contact for all aspects related to this research and will manage all aspects of the project. He will work closely with the graduate students to accomplish the project tasks. He will also collaborate efforts with other research groups conducting the same survey in other US metropolitan areas to ensure consistency in the survey data and products. Fred Mannering will work with the graduate students by providing technical support, guidance, and teaching coursework involving survey data analysis.

9. Technology Transfer Plan

The project team believes in executing an effective technology transfer plan by disseminating project information and results widely to the professional community. During the one-year duration of this particular project, each milestone will be disseminated using one of the TOMNET communication mechanisms (e.g., website, webinar, seminar, teleconference). Project team members will prepare articles about the survey and data set for publication in refereed journals and conference proceedings. Project team members will participate in conferences and deliver presentations about this work and the outcomes of the effort. The project will also result in the preparation of data and survey products that can be shared with the broader professional community so that other jurisdictions can mimic the study without any difficulty. The project team will conduct webinars and seminars and post all interim reports and technical memoranda online at the TOMNET website.

10. Workforce Development and Outreach Plan

The project incorporates a strong workforce development and outreach plan. The project will employ a two graduate student as graduate research assistants. The doctoral student will be involved in all aspects of the project including survey design, sampling plan, data collection, and data analysis. Findings from the project will be integrated into graduate-level courses taught at various institutions in the consortium so that the research and workforce development activities of the center are seamlessly blended together.

11. References

John D. Stoll, The Wall Street Journal (2016, May 10). Retrieved on 2017, June 6 from:

<https://www.wsj.com/articles/gm-executive-credits-silicon-valley-for-accelerating-development-of-self-driving-cars-1462910491>

Jan Hauser, Wirtschaft (2015, Oct 19). Retrieved on 2017, June 6 from:

<http://www.faz.net/aktuell/wirtschaft/unternehmen/verkehrsminister-foxx-selbstfahrende-autos-in-10-jahren-standard-13811022.html>

Driverless car market watch. Retrieved on 2017, June 6 from:

http://www.driverless-future.com/?page_id=384

IEEE 2012 news. Retrieved on 2017, June 6 from:

http://www.ieee.org/about/news/2012/5september_2_2012.html

Tam Hunt (2015, April 01). Retrieved on 2017, June 6 from:

<https://www.greentechmedia.com/articles/read/the-future-of-the-electric-car>

2016 MAG Household Travel Survey. Retrieved on 2017, June 6 from:

<http://www.azmag.gov/Projects/Project.asp?CMSID=1058&CMSID2=7215>

12. Qualifications of Investigators

MICHAEL MANESS

Postdoctoral Scholar, Department of Civil and Environmental Engineering
University of South Florida (USF), Tampa, FL 33620 Email: manessm@usf.edu

Education

Ph.D., Civil Engineering, University of Maryland, May 2015.

M.S., Civil Engineering, University of Maryland, December 2010.

B.S., Civil Engineering, University of Maryland, May 2009

B.S., Computer Science, University of Maryland, May 2009

Selected Employment and Professional Experience

Postdoctoral Scholar, Department of Civil and Environmental Engineering, USF, 2017-present.

Graduate Research Fellow, Office of Operations Research and Development, Federal Highway Administration, 2013-2014.

Fields of Interest and Expertise

(1) Advanced discrete choice modeling; (2) agent-based modeling of people and freight; (3) The role of social networks and social interactions in decision making; (4) Forecasting emerging technologies in transportation; (5) Data collection and experimentation in transportation

Recent Relevant Publications

1. M. Maness (forthcoming). Comparison of Position Generators and Name Generators as Social Capital Indicators in Predicting Activity Selection. *Transportation Research Part A: Policy and Practice*, 106, 374-395.
2. M. Maness (forthcoming). 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, 30-39.
3. C. Calastri, S. Hess, A. Daly, M. Maness, M. Kowald, and K. Axhausen (2017). Modelling Contact Mode and Frequency of Interactions with Social Network Members Using the Multiple Discrete-continuous Extreme Value Model. *Transportation Research Part C: Emerging Technologies*, 76, 16-34.
4. M. Maness and C. Cirillo (2016). An Indirect Informational Conformity Social Influence Choice Model: Formulation and Case Study. *Transportation Research Part B: Methodological*, 93, 75-101.
5. M. Maness, C. Cirillo, and E. Dugundji (2015). Generalized Behavioral Framework for Choice Models of Social Influence: Behavioral and Data Concerns in Travel Behavior. *Journal of Transport Geography*, 46, 137-150.
6. M. Maness and C. Cirillo (2012). Measuring Future Vehicle Preferences: Stated Preference Survey Approach with Dynamic Attributes and Multiyear Time Frame. *Transportation Research Record: Journal of the Transportation Research Board*, 2285, 100-109.

Recent Honors and Awards

2015 Eric Pas Dissertation Prize, International Association for Travel Behaviour Research, 2017
Outstanding Student of the Year, University Transportation Centers Program, 2015
Eisenhower Transportation Fellowship, Federal Highway Administration, 2010-2012, 2013-2014

13. Budget Including Non-Federal Matching Funds

Institution: University of South Florida

Project Title: Attitudes towards Emerging Mobility Options and Technologies – Phase 1: Data Collection

Principal Investigator: Dr. Michael Maness, Postdoctoral Research Associate

Budget Period: 8/1/2017 to 7/31/2018

CATEGORY	Budgeted Amount from Federal Share	Budgeted Amount from Matching Funds	Explanatory Notes; Identify Source of Matching Funds
Faculty Salaries			
Other Staff Salaries			
Student Salaries (includes data entry costs)			
Fringe Benefits			
Total Salaries & Benefits			
Student Tuition Remission			
Operating Services and Supplies (data storage)			
Domestic Travel			
Other Direct Costs (specify): Survey Related Costs (address database, URL, printing and mailing)			
Other Direct Costs (specify)			
Total Direct Costs			
F&A (Indirect) Costs			
TOTAL COSTS			Budget incorporated into the other FY01 USF project

Grant Deliverables and Reporting Requirements for UTC Grants (November 2016)
Exhibit F

UTC Project Information	
Project Title	Attitudes towards Emerging Mobility Options and Technologies – Phase 1: Data Collection
University	University of South Florida
Principal Investigator	Michael Maness
PI Contact Information	Address: 4202 E. Fowler Ave, ENB 118 Tampa, FL 33620 Email: manessm@usf.edu
Funding Source(s) and Amounts Provided (by each agency or organization)	US Department of Transportation (Federal UTC): \$0 University of South Florida (Cost Share): \$0
Total Project Cost	\$0 (Cost is incorporated into the project: “Investigation of the Role of Attitudinal Factors on the Adoption of Emerging Automated Vehicle and Safety Technologies”)
Agency ID or Contract Number	
Start and End Dates	8/1/2017 - 07/31/2018
Brief Description of Research Project	Emerging transportation technologies including electric and autonomous vehicles and emerging mobility services such as ride-hailing and vehicle sharing are bringing about transformative changes in the transportation landscape. With the emergence of new transportation technologies and services, it is critical that transportation forecasting models be enhanced to account for behavioral dynamics that will result from the increasing penetration of disruptive forces in the transportation marketplace. To enhance transportation forecasting models, people’s attitudes towards and perceptions of emerging 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 adaptation patterns. It is envisioned that such models will help decision-makers better plan transportation infrastructure systems and design marketing and policy strategies that maximize the benefits of these disruptive technologies. This project aims to collect survey data from a sample of 1000 residents in the Tampa Bay metro area to understand how the market perceives, adopts, and adapts to transformative transportation technologies. During the one-year duration of the project, the research team will review relevant behavioral studies, design the survey instrument and sampling plan, conduct a survey pre-test, perform full-fledged data collection through the administration of a comprehensive attitudinal and behavioral survey, compile and clean

	<p>data, and produce reports and documentation. Thus, the focus of this phase-I effort is to collect a rich dataset of users' attributes and current mobility choices, together with attitudes, perceptions and stated preferences towards new mobility options and technologies. It is envisioned that this project will result in the development of a data collection protocol and methodology that can be widely adopted in any jurisdiction interested in replicating the study. (285 words)</p>
<p>Describe Implementation of Research Outcomes (or why not implemented)</p> <p>Place Any Photos Here</p>	<p>This research at phase 1 ended up with a survey questionnaire that will be deployed in the next phases. The data that will be collected through this survey will be used in policy and decision making around new transportation technologies today and in the future.</p>
<p>Impacts/Benefits of Implementation (actual, not anticipated)</p>	<p>Producing the right policies that can promote positive aspects and limit the negative consequences of new transportation technologies is the main benefit of this survey.</p>
<p>Web Links</p> <ul style="list-style-type: none"> • Reports • Project Website 	<p>https://www.tomnet-utc.org/asu-av-survey-project.html</p>