Center for Understanding Future Travel Behavior and Demand (TBD)

Semi-Annual Progress Report for University Transportation Centers

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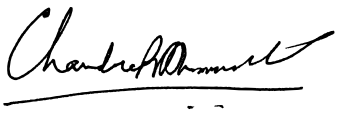
Signature:	

1. ACCOMPLISHMENTS

a. Goals

The overarching goal of the Center, hosted within UT's Center for Transportation Research (CTR), is to undertake breakthrough research that will fundamentally re-examine and transform the scientific base for measuring, monitoring, modeling, and managing traveler behaviors to foster the design, development, and operation of a people-centric, multimodal, intelligent transportation system that meets the needs of the people, institutions, and businesses for generations to come. **The TBD initiative aligns with the USDOT strategic goal of transformation, and anticipates significant contributions to equity and climate and sustainability goals**. In particular, the Center, while pursuing a multitude of different activities, will undertake **two flagship endeavors of national significance to bring about transformative impacts in planning and decision-making**. One will be a *travel behavior data hub* that the public, transportation planners, and policy-makers alike can leverage to understand the state of the transportation system, with built-in *quality of life/well-being, energy footprint, and mobility poverty calculators* to aid in planning for equity, sustainability, and community well-being. The second will be a panel-based multi-year *Transportation Heartbeat of America Travel Behavior and Demand Survey, including a survey of individuals, businesses, and employers*, to understand how **t**ravel **b**ehavior and **d**emand is evolving, which will provide critical insights on the future of transportation and the priorities of the nation.

b. Accomplished under these Goals

A list of 20 projects have been identified, received, and approved for funding as part of the first-year funding of the Center. One additional project idea/proposal from Arizona State University, and one additional project idea/proposal from the University of Michigan are still forthcoming.

Arizona State University

"Trends in Time, Travel, Transit, Telework, and Treasure (T^5)", PI: Steven E. Polzin

"An Exploration of Factors Contributing to and Inhibiting Electric Vehicle Adoption", PI: Irfan Batur

"Future Travel Foresight Catalyst: A Unique Approach to Exploring the Intersection of Transformative Technologies and Future Travel Behavior and Demand", PI: Andrew Maynard

"City-wide Strategic EV Charging Network Design: Demand-Supply Integration via Market Dynamics", PI: Xuesong (Simon) Zhou

Cal Poly Pomona

"Deep Learning with LiDAR Point Cloud Data for Automatic Roadway Health Monitoring", PI: Yongping Zhang

City College of New York

"The Effects of Changing Commutes on Home Delivery Activity", PI: Alison Conway

"Measuring the Last-Mile: A Comprehensive Evaluation of Synthesis Approaches to Address Data Gaps for Local Freight Decision-Making (Phase 1)", PI: Alison Conway

Georgia Tech

"A pilot experimental project for predicting pedestrian flows using computer vision and deep learning", PI: Subhrajit Guhathakurta

"How effective are marker variables at predicting attitudinal factor scores? An out-of-sample evaluation", PI: Patricia Mokhtarian

"Promoting Sustainable Travel within Communities through Behavioral Interventions and Emerging Mobility Solutions", PI: Srinivas Peeta

University of Texas at Austin

"Enhanced Network Models for Multimodal Resiliency", PI: Steven Boyles

"Identifying Targets for Electric Vehicle Industry Improvement", PI: Randy Machemehl

"A Dynamic Analysis of the Built Environment-Travel Behavior Relationship Using Three Activity-Travel Surveys in the Austin, Texas Region", PI: Ming Zhang

"Identifying Travel Needs, Barriers, and Solutions", PI: Alex Karner

"Telemedicine Adoption Before, During, and After COVID-19: The Role of Socioeconomic and Built Environment Variables", PI: Chandra Bhat

"Teleworking to Play or Playing to Telework? A Latent Segmentation Approach to Exploring the Relationship Between Telework and Nonwork Travel", PI: Chandra Bhat

University of Washington

"Consumer Preferences for Restaurant and Grocery Delivery Services in Seattle: Impacts on Travel Behavior", PI: Amelia Regan

"The Effect of Urban Infrastructure Change on Movement", PI: Cynthia Chen

"The Differential Accessibility Effects of Work from Home: Travel Behavior Outcomes and Transportation Equity Implications", PI: Qing Shen

"A Pilot Study to Integrate Mobility Data Collection APPs with Personalized Recommendation Systems", PI: Shuai Huang

c. Dissemination of Results

Organized a Short Course on Advanced Choice Modeling Methods at UT Austin in May 2023. This short course drew graduate students from around the country and exposed them to the latest cutting-edge choice analysis techniques. The short course included hands-on estimation experience, and included the following topics:

Day 1 Topics:
MVNCD Evaluation, Multinomial Probit (set up and estimation)
Multinomial Probit: Estimation (lab session)
Multivariate Ordinal Probit
Multivariate Ordinal Probit: Estimation (lab session)
Multiple Discrete-Continuous Extreme Value (MDCEV) Model: Preliminaries and setup

Day 2 Topics:
Traditional MDCEV: Estimation and forecasting
Traditional MDCEV: Estimation (lab session)
MDCEV Variants: Linear profile outside good, MDGEV, etc.
MDCEV Variants: Estimation (lab session)

d. Plans for Next Reporting Period

Initiated discussions with the Bureau of Transportation Statistics Director, Dr. Patricia Hu, and colleagues to discuss support and collaboration opportunities to accomplish the two flagship endeavors of national significance.

Organizing the Austin Travel Behavior and Demand Symposium that will bring about 30 international experts in the field to a "by invitation only" event to be held on the UT Austin campus between October 30-November 1, 2023. Five topic areas have been identified as follows:

1. "*Reflecting concepts of time use and monetary expenditures in modeling frameworks*"
   Resource Paper Authors: Atiyya Shaw and Maren Outwater; Moderator: Sergio Jara Diaz
2. "*Integration of emerging and future mobility services/technologies in activity-travel forecasting models*"
   Resource Paper Authors: David Ory and Giovanni Circella; Moderator: Peter Jones
3. "*The formation, evolution, and dynamics of activity-mobility-location choices and choice sets*"
   Resource Paper Authors: Soora Rasouli and Brian Lee; Moderator: Aruna Sivakumar
4. "*Leveraging the data revolution for advancing behaviorally robust activity-travel models*"
   Resource Paper Authors: John Gliebe and Alison Conway; Moderator: Michel Bierlaire
5. "*Behavioral foundations of route choice and implications for models*"
   Resource Paper Authors: Jay Jayakrishnan and Pedro Camargo; Moderator: Hani Mahmassani

Through addressing the five topics identified above (and related issues that will inevitably arise), the Austin Symposium presents a "watershed" opportunity to rethink the foundations of our travel demand models, and how those foundations may be brought together into a conceptual guidance framework -- a pathway forward -- for our demand and policy analyses of tomorrow. This is particularly timely because planning professionals, and many decision-makers, are increasingly interested in shaping, not just forecasting, demand. There also is greater uncertainty in our forecasting ability, especially because communication substitution for travel, new and rapidly evolving mobility technologies, crime, disaster risk exposure, and even political culture are becoming increasingly important considerations, along with the traditional power of accessibility, in forecasting future land use and transportation.

Symposium participants will work with the resource paper authors/moderator of each topic area to redirect each sub-theme discussion within the topic area into a chapter form for a book entitled "*Rethinking Travel Demand*" (we already have an arrangement with Edward Elgar Publishing).

2. PARTICIPANTS & COLLABORATING ORGANIZATIONS

a. Organizations Involved as Partners

Nothing to report.

b. Other Collaborators or Contacts

Had collaborative discussion within and across partner universities related to web design, center logo, and first year projects.

3. OUTPUTS

a. Publications, Conference Papers, and Presentations

Paper submitted for consideration for presentation at the 103rd Transportation Research Board (TRB) Annual Meeting, to be held in Washington DC, January 2024:

Fong, A., and A. Shaw. "Chore or Cherish? Gender Differences in Stress, Happiness, and Meaningfulness during Mobility of Care among American Adults."

Karner, A., Pereira, R.H.M., Farber, S. "New Directions for Measuring Transportation Equity."

Situ, M., Karner, A. "Choice or Constraint? A locally tailored assessment of housing and transportation costs in Central Texas."

Soria, J., S.E. Choi, X. Wang, and P.L. Mokhtarian. "What Kinds of People Expect to Travel by Car More, or Less, for Non-commute Purposes in the Post-pandemic Era? A Latent Class Approach."

Choi, S.E., X. Wang, J. Soria, and P.L. Mokhtarian "Exploring the Influences on Mid-Pandemic Non-Commute Activity Engagement."

Anderson, S.M., K.E. Asmussen, S. Saxena, I. Batur, R.M. Pendyala, and C.R. Bhat, "An Investigation of Dissonance in Telework Frequency."

Asmussen, K.E., A. Mondal, and C.R. Bhat, "The Interplay between Teleworking Choice and Commute Distance."

Asmussen, K.E., V. Verma, and C.R. Bhat, "A Guideline Framework for Using Information and Communication Technology (ICT)-Based Data in Travel Demand Modeling."

Haddad, A.J., A. Mondal, and C.R. Bhat, "Where and How Often are Consumers Eating Out? Implications for Transportation, Public Health, and Food Service Fields."

Haddad, A., A. Mondal, N. Eluru, and C.R. Bhat, "A Novel Integrated Approach to Modeling and Predicting Crash Frequency by Crash Event State."

Hwang, H., A. Haddad, I. Batur, S. Saxena, R.M. Pendyala, and C.R. Bhat, "An Analysis of Walking Frequency Before and After the Pandemic."

Kothawala, A., A. Haddad, B. Ozbilen, C.R. Bhat, G. Circella, C. Saridakis, Z. Wadud, Y. Yang, S. Grant-Muller, S. Castellanos, "Investigating Objective and Subjective Factors Influencing the Adoption, Frequency, and Characteristics of E-Scooter Trips."

Mondal, A., A.R. Pinjari, and C.R. Bhat, "A Flexible Non-Normal Random Coefficient Multinomial Probit Model: Application to Investigating Commuter's Mode Choice Behavior in a Developing Economy Context."

Robbennolt, D., A.J. Haddad, A. Mondal, and C.R. Bhat, "Housing Choice in an Evolving Remote Work Landscape."

Saxena, S., C.R. Bhat, and A.R. Pinjari, "Analysing Household Vehicle Holdings and Usage in California using a Two-Stage Budgeting-Based Multiple Discrete-Continuous Model."

Batur, I., A. Mondal, V.O. Alhassan, K.E. Asmussen, C. Bhat, and R.M. Pendyala, "The Induced Demand Implications of Alternative Adoption Modalities of Automated Vehicles."

Batur, I., V.O. Alhassan, M.V. Chester, S.E. Polzin, C. Chen, C.R. Bhat, and R.M. Pendyala, "Understanding the Impacts of Extreme Heat on Human Activity-Mobility and Time Use Patterns."

b. Journal Publications

Under Review:

Haddad, A., A. Mondal, N. Eluru, and C.R. Bhat, "A Novel Integrated Approach to Modeling and Predicting Crash Frequency by Crash Event State," under review, *Analytic Methods in Accident Research*.

Mondal, A., A.R. Pinjari, and C.R. Bhat, "A Flexible Non-Normal Random Coefficient Multinomial Probit Model: Application to Investigating Commuter's Mode Choice Behavior in a Developing Economy Context," under review, *Journal of Choice Modelling*.

Haddad, A.J., A. Mondal, and C.R. Bhat, "Where and How Often are Consumers Eating Out? Implications for Transportation, Public Health, and Food Service Fields," under review, *Transportation Research Part A*.

Robbennolt, D., A.J. Haddad, A. Mondal, and C.R. Bhat, "Housing Choice in an Evolving Remote Work Landscape," under review, *Transportation Research Part A*.

Anderson, S.M., K.E. Asmussen, S. Saxena, I. Batur, R.M. Pendyala, and C.R. Bhat, "An Investigation of Dissonance in Telework Frequency," under review, *Transportation Research Part C*.

Asmussen, K.E., A. Mondal, and C.R. Bhat, "The Interplay between Teleworking Choice and Commute Distance," under review, *Transportation Research Part C*.

Batur, I., V.O. Alhassan, M.V. Chester, S.E. Polzin, C. Chen, C.R. Bhat, and R.M. Pendyala, "Understanding the Impacts of Extreme Heat on Human Activity-Mobility and Time Use Patterns," under review, *Transportation Research Part D*.

Fong, A., and A. Shaw. "Well-Being Implications of Mobility of Care: Gender Differences among American Adults," under review, *Transportation Research Part D*.

Asmussen, K.E., V. Verma, and C.R. Bhat, "A Guideline Framework for Using Information and Communication Technology (ICT)-Based Data in Travel Demand Modeling," under review, *Transportation Research Record*.

Hwang, H., A. Haddad, I. Batur, S. Saxena, R.M. Pendyala, and C.R. Bhat, "An Analysis of Walking Frequency Before and After the Pandemic," under review, *Transportation Research Record*.

Kothawala, A., A. Haddad, B. Ozbilen, C.R. Bhat, G. Circella, C. Saridakis, Z. Wadud, Y. Yang, S. Grant-Muller, S. Castellanos, "Investigating Objective and Subjective Factors Influencing the Adoption, Frequency, and Characteristics of E-Scooter Trips," under review, *Transportation Research Record*.

Saxena, S., C.R. Bhat, and A.R. Pinjari, "Analysing Household Vehicle Holdings and Usage in California using a Two-Stage Budgeting-Based Multiple Discrete-Continuous Model," under review, *Transportation Research Record*.

c. Books or other non-periodical, one-time publications
Nothing to report.

d. Other publications, conference papers and presentations
Nothing to report.

e. Websites
Website for the Center is under preparation through the Liberal Arts Instructional Technology Services (LAITS) at UT Austin. The URL will be: tbd.ctr.utexas.edu

f. Technologies or techniques
Nothing to report.

g. Inventions, patent applications, and/or licenses
Nothing to report.

4. OUTCOMES

The projects template developed for each funded project requires a list of outcomes to be specifically identified. These are available in each project proposal.

5. IMPACTS

a. Impact on the effectiveness of the transportation system
Nothing to report.

b. Impact of technology transfer on industry and government entities, on the adoption of new practices, or on research outcomes which have led to initiating a start-up company
Nothing to report.

c. Impact on the body of scientific knowledge
Nothing to report.

d. Impact on transportation workforce development
Nothing to report.

6. CHANGES / PROBLEMS

a. Changes in approach and reasons for change
Nothing to report.

b. Actual or anticipated problems or delays and actions or plans to resolve them
Nothing to report.

c. Changes that have a significant impact on expenditures
Nothing to report.

d. Significant changes in use or care of human subjects, vertebrate animals, and/or biohazards
Nothing to report.

e. Change of primary performance site location from that originally proposed
Nothing to report.

7. SPECIAL REPORTING REQUIREMENTS

Nothing to report.