



USDOT NATIONAL CENTER FOR UNDERSTANDING FUTURE
TRAVEL BEHAVIOR AND DEMAND

Semi-Annual Progress Report for University Transportation Centers

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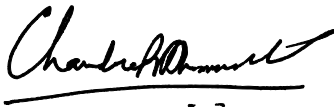
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1. ACCOMPLISHMENTS

The mission of TBD National Center is to revolutionize the understanding and management of travel behavior and demand through pioneering research and education, fostering a fair, efficient, and accessible transportation system that effectively serves and adapts to the evolving needs of the public. Led by The University of Texas at Austin and in partnership with Arizona State University, California State Polytechnic University – Pomona, Diné College, Georgia Institute of Technology, The City College of New York, University of Michigan, and University of Washington, the TBD Consortium is committed to serving all communities and the entirety of the U.S. economy through the safe, efficient, and accessible movement of people and goods.

What are the major goals of the program?

The TBD's overarching goal 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 directly supports the U.S. DOT research priority area of improving mobility of people and goods and contributes to advancing a safe, efficient, and modern transportation system. Among its multitude of activities, the Center aims to undertake two flagship endeavors of national significance to bring about transformative impacts in planning and decision-making. The first is a *Travel Behavior Data (TBD) 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, energy footprint, and mobility efficacy calculators* to aid in planning for efficiency, safety, and community wellbeing. The second is a panel-based multi-year *Transportation Heartbeat of America (THA) Travel Behavior and Demand Survey, including a survey of individuals, businesses, and employers*, to understand how travel behavior and demand are evolving, which will provide critical insights into the future of transportation and the priorities of the nation.

What was accomplished under these goals?

Center-Wide Accomplishments

The TBD Center has continued to advance its mission through impactful research, technology transfer, workforce development, and outreach activities over the past six months. It released new data products to inform research and policy analysis, including the launch of a new American Time-Use Survey (ATUS)-based dashboard and updates to existing dashboards following the release of new national datasets. The Center also published new policy briefs that provide timely insights into emerging topics such as transportation governance, climate resilience, and the evolving role of technology in mobility. TBD scholars and students shared findings at major international and national venues, including the 13th International Conference on Travel Survey Methods (ISCTSC 2025), the Modeling Mobility (MoMo) Conference, and the ASCE International Conference on Transportation & Development (ICTD). Researchers further shaped the national transportation dialogue through high-profile media engagements, invited talks, and advisory committee participation. These and other Center-wide accomplishments are summarized below:

- TBD Center launched The Mobility Dashboard ([TMD](#)), a new addition to the TBD Hub. This interactive platform visualizes travel behavior patterns from the American Time Use Survey, enabling researchers, planners, and policymakers to explore trip purposes, modes, zero-trip making, and daily travel patterns through customizable filters and analyses.
- The THA Survey wave 1 data collected last year were comprehensively analyzed to generate new insights into emerging travel behavior and demand trends in the national transportation landscape, covering topics such as transportation insecurity, congestion pricing, mileage-based user fees, household vehicle fleet evolution, and the growing prevalence of online delivery services.
- The newly released 2024 American Time Use Survey (ATUS) data was integrated into TBD dashboards – The Mobility Dashboard ([TMD](#)), the Time Use, Travel, and Telework Dashboard ([T3D](#)), and the

Wellbeing Estimator for Activities and Travel ([WBEAT](#)) Dashboard – enabling researchers, planners, and policymakers to examine up-to-date trends in time use, travel, telework, and wellbeing.

- TBD Senior Adviser Dr. Steven Polzin authored a three-part research series for the Reason Foundation, examining how travel trends influence [greenhouse gas emissions](#), [the role of public transit in achieving climate goals](#), and [strategies for developing more climate-resilient transportation systems](#). Dr. Polzin also contributed an [article](#) titled “As Travel Changes So Must Transportation Governance” to the Eno Center for Transportation’s *Reimagining Reauthorization* special edition (August 2025), calling for a comprehensive rethinking of federal transportation reauthorization to reflect evolving trends and needs.
- Dr. Chandra Bhat has authored a paper with former graduate student, Angela Haddad, and the developers of the GAUSS matrix programming language, to develop a code library for public use that can aid in estimating and predicting travel choices for transport policy development.
- The TBD Center [website](#) continued to serve as the main hub for archiving and distributing information about the Center’s activities, including research updates, workforce development initiatives, and data products. During the current reporting period, the site attracted over 3,000 visitors.

Some other overall accomplishments of the TBD Center in this reporting period are listed below:

Selected TBD Awards and Honors:

- Dr. Ram Pendyala, TBD Center Associate Director at Arizona State University, [received](#) the 2025 Frank M. Masters Transportation Engineering Award from the American Society of Civil Engineers (ASCE) in recognition of his pioneering contributions to multimodal transportation planning, travel demand forecasting, and activity-based analysis over a distinguished 30-year career.
- Dr. Cynthia Chen, TBD Center Associate Director at the University of Washington, was [elected](#) to the Washington State Academy of Sciences in recognition of her pioneering contributions to human mobility analysis, infrastructure resilience, and community-based transportation solutions.
- Dr. Chandra Bhat, TBD Center Director at the University of Texas at Austin, was [named](#) a Transportation Center Fellow by the Northwestern University Transportation Center in recognition of his impactful contributions to the transportation profession through research, policy, and education.
- Dr. Alison Conway, TBD Center Associate Director at The City College of New York, was appointed as Chair of the TRB’s Transportation and Data Analytics Section, recognizing her leadership in advancing data-driven approaches to freight and urban transportation research.
- Dr. Stephen Boyles (TBD researcher) was [named](#) to UT Austin’s Academy of Distinguished Teachers in recognition of his excellence in teaching and contributions to engineering education.



TBD leadership team and students joined Dr. Ram Pendyala at ICTD 2025 to celebrate his Frank M. Masters Award.

Selected TBD Media Interviews and Blogs:

- TBD Director Dr. Chandra Bhat was [featured](#) in *Smart Cities Dive* where he discussed key findings from the 1st wave of the THA Survey on car dependence, multimodal transportation, and other national

trends. He was also [featured](#) on the *Byte Size* podcast, where he discussed the role of human psychology in travel demand analysis and the importance of aligning transportation innovation with public interest.

- Dr. Patricia Mokhtarian, TBD Associate Director at Georgia Tech, was [featured](#) in an interview with *The Future Of Where*, where she discussed long-term trends in travel behavior, the lasting impacts of telework, and the enduring human need for face-to-face connection.
- Dr. Srinivas Peeta, TBD researcher at Georgia Tech, was featured in multiple media outlets, including the *Atlanta Journal-Constitution*, [Fox 5 News](#), and [NBC 11Alive](#), sharing expert insights on the rollout and expansion of Waymo in Atlanta and its implications for urban mobility and driver adaptation.

Workforce Development/Technology Transfer Events:

- TBD hosted two major webinars during this reporting period. The first, titled “*The Mobility Dashboard (TMD) Unleashed: Translating Travel Data into Actionable Insights*,” was presented by Dr. Irfan Batur (Arizona State University) on June 5, 2025, attracting over 190 participants across live and recorded sessions. The second, “*Leveraging New Technologies to Assess Active Travel and Complete Streets with Examples from Atlanta, GA*,” was delivered by Dr. Subhro Guhathakurta (Georgia Institute of Technology) on September 5, 2025, with more than 120 attendees. Recordings of these events have been made publicly available through the TBD YouTube [Channel](#).
- TBD sponsored a pre-conference workshop titled “*Empowering Early Academic Careers: Innovative Teaching Strategies and K–12 Outreach*” at the ASCE International Conference on Transportation & Development (ICTD 2025) in Glendale, Arizona. The session, moderated by TBD Director Dr. Chandra Bhat, was held on June 8, 2025, and drew about 40 participants.
- Dr. Cynthia Chen, TBD Associate Director at the University of Washington, delivered an invited seminar talk titled “*From Biases to Opportunities: Leveraging Location-Based-Service (LBS) Data for Transportation Planning*” at Rensselaer Polytechnic Institute on September 17, 2025.
- Dr. Irfan Batur, Assistant Director of the TBD Center, was invited to speak at the NextGen National Household Travel Survey (NHTS) Technical Advisory Committee (TAC) meeting in Detroit on September 5, 2025, where he presented key findings from wave 1 of the THA Survey and discussed strategies for enhancing micromobility data collection in national travel surveys.
- Dr. Andrew Maynard (TBD researcher at Arizona State University) continued to engage audiences through the Future of Being Human initiative, including [podcasts](#) and [online content](#) exploring the intersection of transformative technologies and future travel behavior.

Project-Specific Accomplishments

During this reporting period, TBD researchers made significant progress across various projects. A total of 16 projects initiated over the past two years were completed, while others advanced into subsequent phases. Final reports for the completed projects have either been distributed or are in the final stages of proofing for distribution in the coming months, per U.S. DOT guidelines. A comprehensive list of all 44 TBD projects, including their active periods, is presented in Table 1. To ensure accessibility and transparency, the TBD [website](#) continues to be regularly updated with information and deliverables related to all ongoing and completed research projects. Additionally, during this reporting period, the Center initiated 29 new projects, which have been submitted to the U.S. DOT for review and approval.

Table 1. TBD Research Projects (2023 to Present)

Project Topic/Title	Institution (PI)	Active Period	Status
1* Travel Behavior Data (TBD) Hub	Multi-Institution (Bhat)	2023 - Present	⚙️
2* Transportation Heartbeat of America (THA) Travel Behavior and Demand Survey	Multi-Institution (Bhat)	2023 - Present	⚙️
3 A U-Shaped Paradigm: Understanding the Impact of Telecommuting on Public Transit Ridership Before and After the Pandemic	ASU (Batur)	2023 - 2025	✓

	Project Topic/Title	Institution (PI)	Active Period	Status
4	City-Wide Strategic EV Charging Network Design: Demand-Supply Integration via Market Dynamics	ASU (Zhou)	2023 - Present	⚙️
5	Future Travel Foresight Catalyst: A Unique Approach to Exploring the Intersection of Transformative Technologies and Future Travel Behavior and Demand	ASU (Maynard)	2023 - 2025	✓
6	Exploring the Changing Dynamics of Household Vehicle Ownership and Use in the U.S.	ASU (Batur)	2023 - Present	⚙️
7*	Trends in Time, Travel, Transit, Telework, and Treasure (T5)	ASU (Polzin)	2023 - 2025	✓
8	Analysis and Implications of the Vehicle Inventory and Use Survey (VIUS)	ASU (Polzin)	2024 - 2025	✓
9	Future Travel Foresight Catalyst: Phase 2	ASU (Maynard)	2024 - 2025	✓
10	Smart Transportation Digital Infrastructure: Advancing System Efficiency, Resilience, and Safety through Multi-Source Open-Standard Data Integration	ASU (Zhou)	2024 - Present	⚙️
11	From Cross-Sectional to Longitudinal: The Impact of Sampling Strategies on Measuring Mobility Choices	ASU (Pendyala)	2024 - Present	⚙️
12	Time Use, Travel, and Telework Dashboard (T3D)	ASU (Batur)	2024 - Present	⚙️
13	Measuring the Last-Mile: A Comprehensive Evaluation of Synthesis Approaches to Address Data Gaps for Local Freight Decision-Making (Phase 1)	CCNY (Conway)	2023 - Present	⚙️
14	The Effects of Changing Commutes on Home Delivery Activity	CCNY (Conway)	2023 - 2025	✓
15*	Exploring Top-Down Visual Attention for Transportation Behavior Analysis	CCNY (Zhu)	2024 - Present	⚙️
16	Investigation of Emerging Sensing and AI/ML Technologies to Enhance the Safety of Vulnerable Roadway Users at Signalized Intersection	CCNY (Li)	2024 - Present	⚙️
17	Blockchain Application on Smart Transportation Systems	CCNY (Allahviranloo)	2024 - Present	⚙️
18	Analysis of Changes in the Activity Prisms of Individuals to Predict a Shared Life Experience Metric Over Different Regions and Population Groups	CCNY (Allahviranloo)	2024 - Present	⚙️
19	Deep Learning with LiDAR Point Cloud Data for Automatic Roadway Health Monitoring	CPP (Wang)	2023 - Present	⚙️
20*	Vehicle Edge Computing for Travel Behavior and Demand in Future Intelligent Transportation Systems (ITS)	CPP (Wang)	2024 - Present	⚙️
21	Promoting Sustainable Travel within Communities through Behavioral Interventions and Emerging Mobility Solutions	GT (Peeta)	2023 - 2024	✓
22	How Effective Are Marker Variables at Predicting Attitudinal Factor Scores? An Out-of-Sample Evaluation	GT (Mokhtarian)	2023 - 2024	✓
23	A Pilot Experimental Project for Predicting Pedestrian Flows using Computer Vision and Deep Learning	GT (Guhathakurta)	2023 - 2024	✓
24	Empirical Investigation of Post-Disaster Travel Behavior to Points of Distribution of Relief Supplies	GT (Perez-Guzman)	2024 - Present	⚙️
25*	How Much Do Attitudinal Variables Improve Travel Demand Models? Evaluation Using an Overlap Sample from an Attitude-rich Survey and the 2017 National Household Travel Survey	GT (Mokhtarian)	2024 - 2025	✓
26	Improving Mobility Options through Transit Signal Priority (TSP)	GT (Hunter)	2024 - Present	⚙️
27	How Complete are Your City's Streets? Evaluating the Completeness of Urban Streets Using Big Data and Computer Vision	GT (Guhathakurta)	2024 - Present	⚙️
28*	Investigating Travel Survey Representativeness: Who's Missing and What Can We Do?	UM (Shaw)	2024 - Present	⚙️
29	Michigan Mobility Metrics (M3): An Outcome-Focused, Multi-Year Survey Deployment and Data Collection Effort	UM (Shaw)	2024 - Present	⚙️
30	Telemedicine Adoption Before, During, and After COVID-19: The Role of Socioeconomic and Built Environment Variables	UT (Bhat)	2023 - 2024	✓
31	Teleworking to Play or Playing to Telework? A Latent Segmentation Approach to Exploring the Relationship Between Telework and Nonwork Travel	UT (Bhat)	2023 - 2024	✓
32*	Enhanced Network Models for Multimodal Resiliency	UT (Boyles)	2023 - Present	⚙️

Project Topic/Title		Institution (PI)	Active Period	Status
33	Identifying Targets for Electric Vehicle Industry Improvement	UT (Machemehl)	2023 - Present	⚙️
34	A Dynamic Analysis of the Built Environment-Travel Behavior Relationship Using Three Activity-Travel Surveys in the Austin, Texas Region	UT (Zhang)	2023 - 2025	✓
35	A Model of EV Adoption and Rank-Based Contributing Factors	UT (Bhat)	2024 - Present	⚙️
36	An Evaluation of the Long-Term Effects of the COVID-19 Pandemic on Public Transportation Use	UT (Bhat)	2024 - Present	⚙️
37	The Reverse Side of Online Shopping: Examining Sociodemographic and Built-Environment Determinants of Delivery Returns	UT (Bhat)	2024 - Present	⚙️
38	A Multidimensional Analysis for Understanding Walking Habits in Older Adults Post-Pandemic	UT (Bhat)	2024 - Present	⚙️
39	The Effects of Street Repurposing on Pedestrian, Vehicle and Visitor Patterns	UW (Chen)	2023 - 2025	✓
40	A Pilot Study to Integrate Mobility Data Collection APPs with Personalized Recommendation Systems	UW (Huang)	2023 - 2025	✓
41	The Differential Accessibility Effects of Work from Home: Travel Behavior Outcomes and Broader Transportation Implications	UW (Shen)	2024 - 2025	✓
42	Quasi-Sparsity in Transportation Origin-Destination Demand	UW (Ban)	2024 - Present	⚙️
43*	Imputing Socio-Demographics for Mobile Trajectories	UW (Chen)	2024 - Present	⚙️
44	Disabled Parking CV: Scalable Methods to Analyze Disability Parking Using Computer Vision and High-Resolution Aerial and Streetscape Images	UW (Froehlich)	2024 - Present	⚙️

ASU = Arizona State University; CCNY = The City College of New York; CPP = California State Polytechnic University – Pomona; GT = Georgia Institute of Technology; UM = University of Michigan; UT = The University of Texas at Austin; UW = University of Washington. ✓ = Completed; ⚙️ = In progress; * = Narrative provided below.

A few illustrative details about the progress made for a sample of active projects or projects completed within this reporting period are provided below.

Project #1: Travel Behavior Data (TBD) Hub

PI: Chandra Bhat (UT) **Co-PIs:** Irfan Batur (ASU) and Ram Pendyala (ASU)

Progress: This TBD flagship endeavor aims to develop a comprehensive Travel Behavior Data (TBD) Hub that brings a variety of data sets into a single unified platform, thus serving as a one-stop shop for instant data-driven insights on travel behavior and demand. The team is leveraging advanced techniques in data aggregation, fusion, imputation, weighting, prediction, and visualization to build a national hub that can be used by the public, planners, and policymakers to better understand the state of the transportation system. The Hub is being built through a multi-year, multi-university effort spanning multiple disciplines and thrust areas. In previous reporting periods, the team developed the first dashboard integrated into the Hub, the Time Use, Travel, and Telework Dashboard ([T3D](#)). During this reporting period, the team released The Mobility Dashboard ([TMD](#)), which provides a comprehensive view of travel episodes in the American Time Use Survey (ATUS). Since its launch in July, TMD has been well-received, reaching over 3,500 users. The team also began work on the Community Adaptation and Resilience to Extremes (CARE) Dashboard, which will include a survey explorer tool for a nationwide survey dedicated to understanding how people adapt to extreme events, how these events alter daily routines, and the resulting transportation needs. CARE will also feature a scenario analysis tool to assess how different user groups may be impacted under different extreme event conditions. In the next reporting period, the team will continue refining T3D and TMD based on user feedback and advance development of the CARE Dashboard's core components.

Project #2: Transportation Heartbeat of America (THA) Travel Behavior and Demand Survey

PI: Chandra Bhat (UT) **Co-PIs:** Irfan Batur (ASU), Ram Pendyala (ASU), Patricia Mokhtarian (GT), Atiyya Shaw (UM), Steve Polzin (ASU), Alison Conway (CCNY), and Cynthia Chen (UW)

Progress: TBD has begun to deploy a comprehensive longitudinal travel behavior and demand survey across the nation as the Center’s second flagship endeavor. In the previous year, the first wave of the Transportation Heartbeat of America (“THA”) survey was developed and deployed to collect a statistically representative frame of attitudes, values, choices, socio-demographics, well-being, mobility, and accessibility from more than 8,000 participants. To assess rapidly changing travel conditions and behaviors, the THA survey will continue by employing a combination of panel and cross-sectional methods to collect several additional waves of data during the fall of each subsequent year until 2027. This combination will track, for a subset of sampled individuals and households, attitudes and behaviors across multiple waves of data collection (the “panel” component), as well as incorporate fresh respondents in each subsequent wave (the “cross-sectional component”). During the current reporting period, data from the initial survey wave were analyzed, and several projects were developed to examine a wide range of existing transportation behaviors and policy preferences. Additionally, development of an updated survey instrument for the second wave was initiated, focusing on collecting a more detailed set of safety-related behaviors and work arrangement choices, as well as expanding the focus on use of delivery services and autonomous and electric vehicles. In the next reporting period, the survey instrument for the second survey wave will be completed, and the second wave will be disseminated, targeting a mix of new and returning respondents to achieve an overlapping and nationally representative sample, as described above.

Project #7: Trends in Time, Travel, Transit, Telework, and Treasure (T5)

PI: Steven Polzin (ASU) **Co-PI:** Ram Pendyala (ASU) and Irfan Batur (ASU)

Progress: The early 21st century has been a pivotal period for studying travel behavior and time use, with transformative shifts in how individuals allocate time and make travel decisions. This project examines trends in time, travel, transit, telework, and treasure (T5). Over the years, the team has analyzed publicly available datasets, with findings disseminated through two policy briefs and multiple presentations. During this reporting period, a journal article that was submitted to *Transport Policy* was successfully published. The team also presented findings at the ASCE International Conference on Transportation and Development (ICTD) and the 2025 Modeling Mobility (MoMo) Conference. In addition, the team analyzed newly released 2024 data to capture post-pandemic trends and documented the findings and policy implications in a new policy brief. As the project concludes its final funding stage, major activities have been completed. In the next reporting period, the team will release its third policy brief covering the 2024 data and finalize the project report for dissemination.

Project #15: Exploring Top-Down Visual Attention for Transportation Behavior Analysis

PI: Zhigang Zhu (CCNY) **Co-PIs:** Alison Conway (CCNY)

Progress: This project aims to create a novel top-down attention framework that leverages bio-inspired visual attention techniques to predict and react to human behaviors within the transportation context. By bridging the gap between human cognitive processes and machine perception using AI and deep learning, the project offers significant safety-related insights into the interactions between drivers, vehicles, and pedestrians. The team also plans to implement research findings into dashboards capable of providing actionable information to policymakers. During this reporting period, the team has continued the effort in developing machine learning architectures that mimic human visual attention, enabling better prediction of drivers’ and pedestrians’ attention and reaction patterns. A comprehensive survey on the topic of human action recognition using deep learning models and attention mechanisms submitted to the IEEE Transactions on Human and Machine Systems is still under review. In the next reporting period, the team will tailor the work particularly to pedestrian behavior analysis and develop machine learning models with attention mechanisms, particularly for pedestrian behavior understanding.

Project #20: Vehicle Edge Computing for Travel Behavior and Demand in Future Intelligent Transportation Systems (ITS)

PI: Yunsheng Wang (CPP) **Co-PIs:** Wen Cheng (CPP) and Yongping Zhang (CPP)

Progress: This project investigates how edge computing influences travel behavior by conducting field studies and developing simulations to measure travelers' responsiveness to real-time data and its effects on travel choices and demand patterns. During this reporting period, progress was made in developing and evaluating a vehicle edge computing framework to support real-time travel behavior analysis and demand prediction in future Intelligent Transportation Systems. For the experiments, three autopilot models were implemented: (1) a linear model employing a single neuron to output a continuous value through the Keras Dense layer with linear activation; (2) a categorical model dividing steering and throttle decisions into discrete angles and using categorical cross-entropy to train the network to activate a single neuron for each decision; (3) a recurrent neural network (RNN) model leveraging sequences of images to guide driving decisions rather than relying on a single frame. Initial findings have resulted in two papers accepted for presentation at the 2026 TRB Annual Meeting. In the next reporting period, the team will refine the three models to improve their performance and predictive capabilities and disseminate the project findings.

Project #25: How Much Do Attitudinal Variables Improve Travel Demand Models? Evaluation Using an Overlapping Sample from an Attitude-Rich Survey and the 2017 National Household Travel Survey

PI: Patricia Mokhtarian (GT)

Progress: This project investigates the practicality of including attitudes as explanatory variables in practice-oriented travel demand forecasting models. The project team exploits the rare opportunity offered by the 2017 Georgia Department of Transportation (GDOT) Emerging Technologies (ET) survey and the 2017 Georgia add-on to the National Household Travel Survey (NHTS), having 1,245 respondents in common. The non-overlap GDOT ET survey dataset (N = 2,043) is selected as the donor sample, based on which elastic net regression (ENR) models are trained for imputation of attitudinal factor scores using marker variables (MVs). The overlap NHTS dataset (N = 1,245) is treated as if it has only MVs, with attitude scores needing to be imputed using the ENR models trained on the donor sample. The ENR models display high prediction performance in both the donor and recipient datasets, while MVs present excellent performance as well. Three travel behavior variables in the recipient dataset are modeled with no attitudes, predicted attitude scores, and MVs: household vehicle count, (personal yearly) VMT, and hybrid/electric vehicle adoption. For each dependent variable, several attitudes show statistical significance, although their contributions to model fit vary. The results indicate that including attitudes leads to (a) better prediction of less-common alternatives (zero vehicles and hybrid/electric vehicle adoption), primarily by improving the prediction of the groups most likely to select such alternatives, and (b) discovery of additional non-attitude variables that would have been considered insignificant otherwise. Thus, the study helps build the case for the value of including attitudinal variables in practice-oriented models. The final report for this project was submitted during this reporting period (in April 2025), and a paper based on this report is currently undergoing revision following the first round of peer review at a major transportation journal.

Project #28: Investigating Travel Survey Representativeness: Who's Missing and What Can We Do?

PI: Atiyya Shaw (UM)

Progress: This project investigates household travel survey biases and their causes, and proposes potential solutions through: (1) a quantitative investigation of national and state transportation household survey biases across diverse metropolitan regions in the United States; (2) documentation and comparison of the sampling methods, instrument designs, and post-processing correction methods used across various survey implementations; (3) a case study for the Detroit metro area to more closely analyze and define hard-to-reach populations and geographies, providing targeted insights for sampling strategies, outreach, and instrument design; and (4) the development of a methodological guide in the form of a white paper for use by transportation organizations, agencies, and firms. During this reporting period, the project team made two presentations on this work and submitted the project's final report. In the next reporting period, the team will finalize a journal paper for publication and continue disseminating the project's findings.

Project #32: Enhanced Network Models for Multimodal Resiliency | PI: Stephen D. Boyles (UT)

Progress: This project aims to develop next-generation network resiliency models representing more than one travel mode. In particular, the project team has been focusing on integrating maritime waterway systems with landside port systems. The intent is to understand and better identify bottlenecks in these multimodal systems; in particular, the apparent bottlenecks when considering only one mode of transportation may not be the same bottlenecks in the larger, multimodal system. The team is working with publicly available data sets (such as AIS vessel tracking data) to understand capacity and resilience in these systems. During this reporting period, the team studied how fog events cause channel closures at the Port of Houston and the impacts on regional freight and industry (as no vehicles may enter the port during these conditions). The team used AIS data together with the capacity definitions they developed earlier to measure the queue growth rate, maximum recovery rate, and total recovery rate for the anchorage queue. The team also compared the impact of fog events to hurricane disruptions; the former are more common but less severe, whereas the latter are less common but much more disruptive.

Project #43: Imputing Socio-Demographics for Mobile Trajectories | PI: Cynthia Chen (UW)

Progress: This project develops methods to infer household/individual socio-demographics from mobility signals derived from passively collected GPS traces. In the first leg of this effort, the team has finalized one paper, which was accepted for TRB 2026 and submitted to Transportation Research Part C. Working with planners at the Puget Sound Regional Council (PSRC) and Professor Filipe Rodrigues from DTU, the team evaluated the effectiveness of multi-task (MT) neural networks for joint inference of age, gender, HH income, and HH size using harmonized travel behavior feature sets. Major activities included standardizing a behaviorally-grounded family of higher-order descriptors based on mobility graphs; establishing uncertainty quantification metrics to assess predictive calibration and error dispersion; and running large-scale experiments to compare MT learning against matched single-task model variants under different training data fractions. When appended to classical mobility features, the proposed higher-order feature set consistently raised the out-of-sample accuracy of demographic inference in multiple experimental setups. Furthermore, training a unified model to predict sociodemographic attributes jointly improved sample efficiency and enhanced generalization to new data compared to single-task baselines. These findings highlight the potential of *transfer learning* in urban mobility applications. In parallel, the team developed data processing pipelines for the follow-up study, which will examine the impact of scale differences between the household travel survey (HTS) and GPS data, as well as bias introduced through inferred trip attributes. In the next reporting period, the team will focus on finalizing the first paper submitted to TR Part C, while preparing and submitting a second paper based on these new analyses. Stakeholder engagement with PSRC and other planning partners will continue throughout, ensuring that emerging methods are aligned with practitioner needs and positioned for effective dissemination to the planning community.

What opportunities for training and professional development has the program provided?

The center-wide workforce development/technology transfer events are discussed earlier in this SAPR. In terms of education, the courses offered by faculty members closely affiliated with the Center are presented in Table 2. While there are many additional transportation-related courses taught at each TBD institution, the scope of activities reported in this SAPR is limited to the activities of faculty members who comprise the *core* group of the TBD, who are deeply engaged in advancing the activities and mission of the Center.

Table 2. Courses Offered by Core Faculty Members of TBD (Spring & Summer 2025)

Semester	Level	Course No	Course Title	No*	Instructor	Unit
Arizona State University						
Spring 25	Grad	CEE 578	Activity-Travel Behavior Modeling	14	Pendyala	SSEBE
Spring 25	Undergrad	CEE 372	Transportation Engineering	65	Zhou	SSEBE
Spring 25	Undergrad	FIS 394	Topic: Pizza & A Slice of Future	17	Maynard	FIS
Cal Poly Pomona						
Spring 25	Undergrad	CE 3601	Transportation Engineering	92	Zhang	CoE

Spring 25	Undergrad	EGR 4820/4830	Senior Project	21	Zhang	CoE
Spring 25	Undergrad	EGR 4820/4830	Senior Project	36	Cheng	CoE
Summer 25	Undergrad	CE 4811/L	Design of Transportation Facilities Lecture/Lab	11	Zhang	CoE
Summer 25	Undergrad	EGR 4820/4830	Senior Project	15	Cheng	CoE
Spring 25	Undergrad	CS 3010	Numerical Methods	72	Ji	CS
Spring 25	Undergrad	CS 3310	Design and Analysis of Algorithms	71	Wang	CS
Summer 25	Undergrad	CS 4210	Machine Learning and Its Applications	23	Ji	CS
City College of New York						
Spring 25	Undergrad	CE 32700	Transportation Systems Engineering	21	Li	GSOE
Spring 25	Undergrad	CSC 59867	Senior Project (Capstone)	21	Zhu	GSOE
Spring 25	Undergrad	CSC 32200	Software Engineering	70	Wei	GSOE
Spring 25	Undergrad	SOC 32100	Housing and Community Development	20	Kucheva	CPS
Spring 25	Grad	CE H0200	Transportation Economics	1	Allahviranloo	GSOE
Spring 25	Grad	CE I2600	Urban Transportation Planning	4	Kamga	GSOE
Spring 25	Grad	CE I9700	Master's Report	1	Kamga	GSOE
Spring 25	Grad	CSC I9900	Master's Thesis	1	Zhu	GSOE
Georgia Institute of Technology						
Spring 25	Grad	CEE 6601	Statistics in Transportation	9	Mokhtarian	CEE
Spring 25	Grad	CEE 8813-F	Transportation Systems Analysis	22	Peeta	CEE
Spring 25	Undergrad/ Grad	VIP 2601, 3601-2, 4601-3, 6601-3	Autonomous and Connected Transportation (ACT) Driving Simulator	65	Peeta	VIP
Spring 25	Grad	CEE 8813	Freight Transportation Modeling	8	Perez-Guzman	CEE
University of Michigan						
Spring 25	Undergrad	CEE 450	Introduction to Transportation Systems Engineering	44	Shaw	CEE
University of Texas at Austin						
Spring 25	Undergrad	CE 311S	Probability and Statistics for Civil Engineers	76	Boyles	CE
Spring 25	Undergrad	CE 321	Transportation Systems	42	Boyles	CE
Spring 25	Undergrad	CE 321	Transportation Systems	51	Machemehl	CE
Spring 25	Undergrad	CE 367T	Traffic Engineering	36	Machemehl	CE
Spring 25	Grad	CE 397	Traffic Engineering	8	Machemehl	CE
Spring 25	Grad	CRP 384	Transportation Equity Analysis	15	Karner	CRP
Summer 25	Grad	CRP 384	Megaregional Planning (First term)	8	Zhang	CRP
University of Washington						
Spring 25	Grad	CET 589	Transit Systems Planning	14	MacKenzie	CET
Spring 25	Grad	URBAN 561	Urban Economics and Public Policy	19	Shen	URB

Notes: CEE = Civil and Environmental Engineering; CET = Civil, Environmental, and Transportation Engineering; FIS = School for the Future of Innovation in Society; ISE = Industrial and Systems Engineering; SSEBE = School of Sustainable Engineering and the Built Environment; URB = Urban Planning; GSOE = Grove School of Engineering. *Enrollment number.

Many students across all levels and post-doctoral scholars at TBD institutions have participated in TBD-related activities. Table 3 provides a comprehensive listing of these individuals. During this reporting period, several students from the University of Texas at Austin achieved significant academic milestones. Anna Beliveau and Dylan Croteau graduated with bachelor's degrees, while Maitreyee P. Gorase, Debojjal Bagchi, and Ali Kothawala earned their master's degrees. Dr. Angela Haddad completed her Ph.D. in Civil Engineering in August 2025 and joined Kittelson & Associates in Orlando, Florida. In addition, Dr. Lu Xu, a TBD post-doctoral researcher supervised by Dr. Stephen Boyles, transitioned to a full-time Research Scientist position at the Center for Transportation Research in June 2025.

Table 3. Students and Research Staff Engaged in TBD-Related Research and Education Activities

Name of Scholar	Level	Major/ Unit	Supervisor/ Advisor
Arizona State University			
Eleanor Hennessy	Postdoctoral Scholar	Civil, Env., and Sust. Eng.	Ram Pendyala
Roberto Dimas Valle	PhD Student	Civil, Env., and Sust. Eng.	Ram Pendyala
Fan Yu	PhD Student	Civil, Env., and Sust. Eng.	Ram Pendyala
Victor O. Alhassan	PhD Student	Civil, Env., and Sust. Eng.	Ram Pendyala
Jinghai Huo	PhD Student	Civil, Env., and Sust. Eng.	Ram Pendyala
Miguel Rodriguez Ocana	MS Student	Civil, Env., and Sust. Eng.	Ram Pendyala

Roshan Varghese	MS Student	Computer Science	Ram Pendyala
Mohammed Zaid	MS Student	Information Technology	Ram Pendyala
Cal Poly Pomona			
Yichi Cheng	MS Student	Civil Engineering	Yongping Zhang
Ziliang Wang	MS Student	Civil Engineering	Yongping Zhang
Rafael Trinidad	MS Student	Computer Science	Yunsheng Wang
Michael Ly	Undergraduate Student	Computer Science	Yunsheng Wang
City College of New York			
Nikhita Kannam	MS Student/PhD Student	Data Sci./Civil Eng.	Mahdieh Allahviranloo
Xiaoyang Lee	PhD Student	Civil Engineering	Mahdieh Allahviranloo
Fateme Rezapour Fardin	PhD Student	Civil Engineering	Alison Conway
Shradha Godse	MS Student/PhD Student	Data Sci./Civil Eng.	Alison Conway/Michael Grossberg
Cosmo Bjorkenheim	MS Student	Urban Planning	Alison Conway/Yana Kucheva
Faed Ahmed Arnob	PhD Student	Civil Engineering	Yiqiao Li
Bo Shang	Postdoctoral Scholar	Civil Engineering	Yiqiao Li
Tak Kit Yeung	Undergraduate Student	Computer Science	Yiqiao Li
Wen Jie Long	Undergraduate Student	Computer Science	Yiqiao Li
Bilal Abdulrahman	PhD Student	Computer Science	Zhigang Zhu /Alison Conway
Gong Qi Chen	PhD Student	Computer Science	Z. Zhu /Zihao Zhang/Alison Conway
Georgia Institute of Technology			
Chaeyeon Han	PhD Student	City and Reg. Planning	Subhrajit Guhathakurta
Sujin Lee	MS Student	Urban Analytics	Subhrajit Guhathakurta
Animesh Agrawal	MS Student	Computer Science	Subhrajit Guhathakurta
Seung Jae Lieu	PhD Student	City and Reg. Planning	Subhrajit Guhathakurta
Jae Geon Lee	PhD Student	City & Reg. Plan.	Subhrajit Guhathakurta
Bryce Jones	MS Student	City and Reg. Planning	Subhrajit Guhathakurta
Sung Ho Synn	MS Student	City and Reg. Planning	Subhrajit Guhathakurta
Shreya Chivikar	MS Student	Computer Science	Subhrajit Guhathakurta
Dickness Kwesiga	Ph.D. Student	Civil and Env. Eng.	Michael Hunter
Ilsu Kim	PhD Student	Civil and Env. Eng.	Patricia Mokhtarian
Seung-eun (Katy) Choi	PhD Student	Civil and Env. Eng.	Patricia Mokhtarian
Rachael Panik	Postdoctoral Scholar	Civil and Env. Eng.	Patricia Mokhtarian
Viswa Sri Rupa Anne	PhD Student	Civil and Env. Eng.	Srinivas Peeta
Md Gulam Kibria	PhD Student	OR/ISyE	Srinivas Peeta
Yuming Chang	PhD Student	Civil and Env. Eng.	Srinivas Peeta
Valentina Castañeda-Torres	PhD Student	Civil and Env. Eng.	Sofia Perez-Guzman
Keke Li	MS Student	Industrial Engineering	Sofia Perez-Guzman
University of Michigan			
Amy Fong	PhD Student	Civil and Env. Eng.	Atiyya Shaw
Ivan Shih	PhD Student	Civil and Env. Eng.	Atiyya Shaw
Sungho Lim	PhD Student	Civil and Env. Eng.	Atiyya Shaw
Brynn Woolley	PhD Student	Civil and Env. Eng.	Atiyya Shaw
Emily Youngs	PhD Student	Civil and Env. Eng.	Atiyya Shaw
University of Texas at Austin			
Angela Haddad	PhD Student	Civil Engineering	Chandra Bhat
Hyunjun Hwang	PhD Student	Civil Engineering	Chandra Bhat
Ali Kothawala	PhD Student	Civil Engineering	Chandra Bhat
Dale Robbennolt	PhD Student	Civil Engineering	Chandra Bhat
Anna Beliveau	Undergraduate Student	Civil Engineering	Chandra Bhat
Justin Chang	Undergraduate Student	Computer Science	Chandra Bhat
Emily Ann Podnar	Undergraduate Student	Civil Engineering	Chandra Bhat
Devina Sharma	Undergraduate Student	Civil Engineering	Chandra Bhat
Kyle Bathgate	PhD Student	Civil Engineering	Stephen Boyles
Jake Robbennolt	PhD Student	Civil Engineering	Stephen Boyles
Debojjal Bagchi	MS Student	Civil Engineering	Stephen Boyles
Lu Xu	Postdoctoral Scholar	Civil Engineering	Stephen Boyles
Dylan Croteau	Undergraduate Student	Civil Engineering	Stephen Boyles
Doyun Lee	Undergraduate Student	Civil Engineering	Stephen Boyles
Md Hamidur Rahman	PhD Student	City and Reg. Planning	Alex Karner

Maitreyee P. Gorase	MS Student	Information Science	Randy Machemehl
Seunggwon Park	PhD Student	City and Reg. Planning	Ming Zhang
University of Washington			
Ekin Ugurel	PhD Student	Civil and Env. Eng.	Cynthia Chen
Grace Jia	PhD Student	Civil and Env. Eng.	Cynthia Chen
Jeremy Chan	MS Student	Civil and Env. Eng.	Cynthia Chen
Kaitlyn Ng	MS Student	Civil and Env. Eng.	Cynthia Chen
Lyra Chen	Research Scientist	Civil and Env. Eng.	Cynthia Chen
Yuteng Zhang	MS Student	Industrial and Systems Eng.	Cynthia Chen
Donghun Son	Postdoctoral Scholar	Civil and Env. Eng.	Cynthia Chen
Adam Schultz	MS Student	Civil and Env. Eng.	Cynthia Chen
Chu Li	PhD Student	Civil and Env. Eng.	Jon E. Froehlich
Jared Hwang	PhD Student	Civil and Env. Eng.	Jon E. Froehlich
Chithira Unnikrishnan	MS Student	Civil and Env. Eng.	Jeff Ban
Shakiba Naderian	PhD Student	Civil and Env. Eng.	Jeff Ban

What do you plan to do during the next reporting period to accomplish the goals?

In the next reporting period, active projects will continue to advance according to their proposed schedules, and the two flagship endeavors will proceed with major milestones. The first-wave data will continue to be extensively analyzed for the THA Survey, and a series of policy briefs summarizing key findings will be produced. In addition, the second-wave instrument will be finalized and deployed, and initial development of the business-focused survey component will begin. The TBD Hub will continue to grow with the release of additional data products (including the CARE Dashboard).

While detailed project-specific plans are provided in earlier sections for a sample of projects, several key activities are anticipated across the TBD project portfolio in the next reporting period at the University of Texas at Austin and beyond. Research teams will continue advancing methodological and applied innovations across multiple domains, including the development of advanced human action recognition models for pedestrian behavior analysis using attention-based machine learning, and ongoing work to make video data more interpretable through integration with large language models. Software codes to assist in travel prediction will be released within the GAUSS software for public policy use. At The City College of New York, researchers will also build upon the blockchain simulation framework completed in Project 17 by extending their analysis through an agent-based modeling approach to simulate cryptocurrency adoption dynamics among diverse transit users. At Georgia Tech, researchers will continue analyzing THA Survey data with a focus on motorcycle use and safety perceptions, while another project will deploy a post-disaster mobility survey in Puerto Rico and model behavioral responses related to access to relief supplies and willingness to travel.

At Arizona State University, the TBD team will deploy the National Household Vehicle Survey (NHVS), produce new policy briefs, and finalize multiple journal submissions. The team will also analyze THA Survey and NHVS data for additional behavioral insights and continue the development of the CARE Dashboard to visualize survey findings on resilience and adaptive behaviors. At the University of Washington, researchers will extend their multi-task learning framework to large-scale GPS datasets, developing uncertainty-aware models that integrate survey and GPS data to improve predictive accuracy and transferability. The team will continue engagement with planning partners, such as the Puget Sound Regional Council (PSRC), to ensure that methodological advances align with practitioner needs. Additionally, Project 44 will disseminate its findings at the ASSETS 2025 Conference in Denver and release an open-source [repository](#) to support broader research and innovation in accessibility analytics.

Across the Center, dissemination efforts will continue through publications, presentations, and outreach. TBD-supported papers accepted for presentation at the 2026 TRB Annual Meeting will highlight the Center's research accomplishments and impact. In addition, TBD researchers will participate in international, national, and regional conferences, workshops, and professional events to further disseminate findings, strengthen collaborations within the transportation community, and help advance the nation's transportation priorities. A number of seminars/webinars is also planned for the next reporting period.

2. PARTICIPANTS & COLLABORATING ORGANIZATIONS

What organizations have been involved as partners?

- Arizona Department of Transportation (ADOT), Phoenix, Arizona: Collaborative research
- Army Corps of Engineers Coastal Hydraulics Laboratory, Vicksburg, MS: Datasets, collaboration, in-kind support
- CCNY College-wide Research Vision (CRV) project: Collaborative research between CS/Civil Eng and Architecture to perform research and data analytics for urban scenes.
- City of Peachtree Corners, Georgia: Transit ridership data, AV shuttle data, community engagement
- Commute Seattle and the Seattle Department of Transportation: Collaborative research
- Foothill Transit: In-kind support, panel discussion and hands-on activities for the Summer Transportation Institute
- Institute for Social Research Survey Methodology Program, Ann Arbor, MI: Collaboration and personnel exchanges
- Institute of Urban Science/Department of Transportation Engineering, University of Seoul, South Korea: Collaborative research
- King County Metro: Collaborative research
- Maricopa Associations of Government (MAG): Collaborative research
- Metropolitan Council, regional planning agency for the Twin Cities region, Minneapolis-St.Paul: Collaborative research
- Michigan Department of Transportation, Lansing, Michigan: Collaborative research and data sharing
- National Renewable Energy Laboratory (NREL), CO: In-kind support. access to their mobile application
- New York City Department of Transportation, NY: In-kind support, datasets, participation in a workshop
- Puget Sound Regional Council (PSRC): Collaborative research
- Seattle Department of Transportation: Collaborative research
- Sky Packets, New York, NY: Sensor Installation
- Southeast Michigan Council of Governments: Collaborative research and data sharing
- Technical University of Denmark: Collaborative research
- Texas Department of Transportation (TxDOT), Austin, TX: Collaborative research
- Town of Queen Creek, AZ: Collaborative research
- Urban and Regional Planning Department at University of Michigan: Collaboration and personnel exchanges
- Women's Transportation Seminar-Los Angeles Chapter (WTS-LA): Co-hosted Girls' Empowerment Day

Have other collaborators or contacts been involved?

- Dr. Abdul R. Pinjari, Indian Institute of Science, India
- Dr. Abolfazl Mohammadian, Univ of Illinois-Chicago, IL
- Dr. Baloka Belezamo, ADOT, Phoenix, AZ
- Dr. Basar Ozbilen, U. of California, Davis
- Dr. Bert van Wee, Delft University of Technology
- Dr. Brian German, Georgia Tech, Atlanta, GA
- Dr. Brian Lee, PSRC, Seattle, WA
- Dr. Deborah Salon, ASU, Tempe, AZ
- Dr. Diana Ramirez-Rios, University of New York at Buffalo
- Dr. Filipe Rodrigues, DTU, Copenhagen, DK
- Dr. Giovanni Circella, Ghent Univ, Belgium
- Dr. Jason Soria, Cintra
- Dr. Jinhua Zhao, Massachusetts Institute of Technology
- Dr. Joe Grengs, University of Michigan, Ann Arbor, MI
- Dr. Laurie Garrow, Georgia Tech, Atlanta, GA
- Dr. Maryam Hosseimi, UC Berkeley
- Dr. Mikhail Chester, ASU, Tempe, AZ
- Dr. Peter Stopher, ASU, Tempe, AZ
- Dr. Seungnam Kim, Chung-Ang University, S. Korea
- Dr. Steve Mooney, University of Washington
- Dr. Sung Hoo Kim, Hanyang Univ, S. Korea
- Dr. Sunghee Lee, University of Michigan, Ann Arbor, MI
- Dr. Sybil Derrible Univ of Illinois-Chicago, IL
- Dr. Taehooie Kim, Maricopa, MAG, Phoenix, AZ
- Dr. Tassio Magassy, WSP USA
- Dr. Vivien Lim, National Univ of Singapore
- Dr. Xinyi Wang, MIT, Cambridge, MA
- Dr. Ying Chen, Northwestern U, Evanston, IL
- Dr. Yongsung Lee, U. of California, Davis
- Dr. Zihao Zhang, City College of New York, NY
- Brice Nichols, PSRC, WA
- Henry Quintin, Sky Packets, New York, NY
- Kerwin Trenard, MS, Haiti Community Representative
- Kurt Winner, Commute Seattle, WA
- Ms. Joanne Lin, PSRC, Seattle, WA
- Tianming Liu, U. of Michigan, Ann Arbor, MI

3. OUTPUTS

Publications, conference papers, and presentations:

Journal Publications: Papers Published Within Reporting Period

1. Bhat, C.R., A. Mondal, and A.R. Pinjari (2025). A Flexible Non-Normal Random Coefficient Multinomial Probit Model: Application to Investigating Commuter's Mode Choice Behavior in a Developing Economy Context. *Transportation Research Part B*, 195, 103186.
2. Chen, Z., Xu, Y. and Peeta, S. (2025). "Deep Learning-Based Travel Choice Prediction with Provable and Adaptable Fairness Guarantees," *Transportation Research, Part B: Methodological*, Vol. 200, ID 103318.
3. Conway, A. (2025) (Invited). Aligning Urban Transportation Policies with the Modern Movement of Consumer Goods. *Journal of Critical Infrastructure Policy*, 2. <https://doi.org/10.1002/jci3.12041>

4. Crocker, A. J., and S. D. Boyles (2025). Heuristic selection in disaster recovery sequencing. *Journal of Infrastructure Systems*, 31(3), 04025010.
5. Giubergia, D., A.J. Haddad, F. Piras, C.R. Bhat, and I. Meloni (2025). Modeling Spatial and Social Interdependency Effects on Commuting Mode Choice. *Transportation Research Part A*, 196, 104474.
6. Guan, X.; Huang, S.; and Chen, C. (2025) Using Multiple Biased Datasets to Recover Missing Trips with a Behaviorally-informed Model, *Transportation Science*, published May 16, <https://doi.org/10.1287/trsc.2024.0550>.
7. Kim, Ilsu, Yongsung Lee, Patricia L. Mokhtarian, and Giovanni Circella (2025) “How Will People Spend Travel Time in Autonomous Vehicles? A Four-Region Study Focusing on Heterogeneous Preferences”. *Transportation*.
8. Kothawala, A., A.J. Haddad, P. Loa, Y. Lee, G. Circella, and C.R. Bhat (2025). Hybrid Workers' Activity Intensity: Post-Pandemic Comparison of Telework-Only and In-Person Workdays. *Transportation Research Record: Journal of the Transportation Research Board*. <https://doi.org/10.1177/03611981251347299>
9. Liu, Y. and Peeta, S. (2025). “Human-Like Lane-Change Control Strategy for Connected and Autonomous Vehicles to Improve Interactions with Human-Driven Vehicles,” *Transportation Research, Part C: Emerging Technologies*, Vol. 177, ID 105211.
10. Ng, K.; Chen, C. and Jenelius, E. (2025) The 15-minute city around one's trajectory: Evaluating food accessibility for transit users in Stockholm, Sweden, *Journal of Transport Geography*, Volume 127, July 2025, 104283.
11. Ng, K.; Mishra, G.S.; Chen, C. (2025) Understanding access to restaurants through personas: A latent class approach integrating preferences and travel behavior, *Journal of Transport & Health*, Volume 44, 102135, ISSN 2214-1405.
12. Robbennolt, D., S. Hardman, J. Firestone, and C.R. Bhat (2025). A Model of Electric Vehicle Adoption and Motivating Reasons for Adoption. *Transportation Research Part D*, 146, 104906.
13. Robbennolt, J., D. Robbennolt, and S. D. Boyles (2025). Relaxed Singly Constrained Static Traffic Assignment Model with Elastic Demand: Application to Telework and Urban Development Scenarios in Austin, Texas. *Transportation Research Record: Journal of the Transportation Research Board*, 2679(10), 855-869.
14. Robbennolt, J., L. Xu, K. Bathgate, S. Pan, and S. D. Boyles (2025). Identifying critical locations for traffic monitoring devices during hurricane evacuations. *Journal of Infrastructure Systems*, 31(2), 04025006.
15. Robbennolt, J., M. Li, J. Mohammadi, and S. D. Boyles (2025). Balancing passenger transport and power distribution: A distributed dispatch policy for shared autonomous electric vehicles. *IEEE Transactions on Industry Applications*, 61(5).
16. Shang, B., Li, Y., Amin, A., Kamga, C., Wei, J. (2025). Sensing Perspective on Vulnerable Road User Monitoring for Traffic Safety: A Survey, *The 22nd International Conference on Mobile Systems and Pervasive Computing (MobiSPC)*.
17. Smith, B.V., D. Robbennolt, and C.R. Bhat (2025). An Evaluation of the Long-Term Effects of the COVID-19 Pandemic on Public Transit Use in the United States. *Transport Policy*, 169, 90-100.
18. Soria, Jason M., and Patricia L. Mokhtarian (2025) “Using marker statements to impute attitudes: evaluating their efficacy in vehicle ownership models”. *Transportation*. <https://doi.org/10.1007/s11116-025-10652-3>.
19. Tejada, C., & Conway, A. (2025). An empirical approach to modeling online shopping and its effects on urban freight planning: The case of New York City. *Case Studies on Transport Policy*, 101473. <https://doi.org/10.1016/j.cstp.2025.101473>
20. van Wee, Bert and Patricia Mokhtarian (2025) “A Meta-Theory for Travel-related Choices”. *Transportation Research Interdisciplinary Perspectives* 34, 101653. <https://doi.org/10.1016/j.trip.2025.101653>.
21. Zafri, N. M. and M. Zhang (2025). A novel integrated machine learning and inferential modeling approach to explore non-linear effects of built environment on travel: a three-wave repeated cross-sectional study. *Travel Behavior and Society*. Forthcoming: <https://doi.org/10.1016/j.tbs.2025.101146>
22. Zhu, T., S. D. Boyles, and A. Unnikrishnan (2025). Plug-In Hybrid Electric Vehicle Traveling-Salesman Problem with Drone. *Transportation Research Record: Journal of the Transportation Research Board*, 2679(3), 438-456.

Presentations Within Reporting Period

1. Bar-Gera, H., S. D. Boyles, and L. Ravner. Departure time choice with parametric heterogeneity: equilibrium and instability. Accepted for presentation, 29th International Conference of Hong Kong Society for Transportation Studies (HKSTS), Hong Kong, China, December 2025.
2. Batur, I. (invited talk) “Transportation Heartbeat of America (THA) Survey and Enhancing Micromobility Data in NHTS.” NextGen NHTS Technical Advisory Committee (TAC) Meeting, Detroit, Michigan. September 3–4, 2025.
3. Bhat, C.R., "Intro to Civil Engineering," My Introduction To Engineering (MITE) Summer Enrichment Camp, Equal Opportunity in Engineering Program, UT Austin, June 2024.
4. Chen, Cynthia (2025) From biases to opportunities: leveraging Location-Based-Service (LBS) data for transportation planning, Modeling Mobility Conference, 2025, Minneapolis, MN, September 2025.
5. Chen, Cynthia (2025) Troy, NY, From biases to opportunities: leveraging Location-Based-Service (LBS) data for transportation planning, Rensselaer Polytechnic Institute (RPI), Civil and Environmental Engineering, September 17.
6. Chen, Y., Agrawal, S., Benedyk, I., and Peeta, S. (2025). Cyberattack Impacts in Mixed-Flow Traffic: Driving Simulator Study. 16th International Conference on Applied Human Factors and Ergonomics, Orlando, FL, July 2025.
7. Chen, Y., Wang, C. & Peeta, S. (2025). Deep Reinforcement Learning-based Stealthy Cyberattack Modeling in Mixed-Flow Traffic. 2025 Traffic Management Symposium, Athens, Greece.
8. Conway, A. Home Delivery Behavior vs. Personal Travel Activity: Lessons from Two Recent Surveys in the USA. Chalmers University of Technology, Gothenburg, Sweden, August 21, 2025.
9. Conway, A. Freight Data for Local Decision-Making: Recent Advances and Remaining Gaps. Joint Session: Heavy Vehicle Transport Technology Symposium and Canadian Transportation Research Forum, Quebec City, Canada, May 28, 2025.

10. Fong, A. Z., and F. A. Shaw. *Evaluating Strategies for Improving Travel Survey Representativeness*. Presented at the Modeling Mobility (MoMo) Conference, Minneapolis, MN, September 14-17, 2025.
11. Fong, A. Z., I. Shih, F. A. Shaw, J. Grengs, and S. Lee. *Strategies to Improve Travel Survey Representativeness: U.S.-based Case Study on Weights and Convenience Sampling*. Presented at the 13th Conference on Travel Survey Methods, Da Nang, Vietnam, April 2025.
12. Haddad, A. and C.R. Bhat, "Improving Pedestrian Safety: A Study of Vehicle-Pedestrian Interactions using Videography and Virtual Reality," *Good Systems Symposium on Shaping the Future of Ethical AI*, UT Austin, Austin, TX, April 3, 2025.
13. Haddad, A., C.R. Bhat, L. Macias, "Improving Pedestrian Safety: A Study of Vehicle-Pedestrian Interactions using Videography and Virtual Reality," *Good Systems Symposium on Shaping the Future of Ethical AI*, UT Austin, Austin, TX, April 2, 2025.
14. Haddad, A.J. and C.R. Bhat, "Telemedicine Adoption Before, During, and After COVID-19: The Role of Socioeconomic and Built Environment Variables," *Center for Transportation Research (CTR) Annual Symposium*, Austin, TX, April 2025.
15. Kibria, G. & Peeta, S. (2025). Enhancing Transportation System Performance by Promoting Sustainable Travel through Public-Private Mobility Partnerships. 2025 IISE Annual Conference. Atlanta, Georgia, United States.
16. Mokhtarian, Patricia. "Teleworking in the US: Where have we been, and where are we going?" Critical Issues in Transportation, Northwestern University Transportation Center, May 7, 2025.
17. Mokhtarian, Patricia. Can practice-oriented travel demand forecasting models include attitudinal explanatory variables? Progress at the Frontier. "Meet the Expert" lecture, Ghent University, Belgium, May 21, 2025.
18. Mokhtarian, Patricia. Can practice-oriented travel demand forecasting models include attitudinal explanatory variables? Progress at the Frontier. Beijing Jiaotong University, Beijing, China, June 27, 2025.
19. Mokhtarian, Patricia. Can practice-oriented travel demand forecasting models include attitudinal explanatory variables? Progress at the Frontier. 3rd International Symposium on Cities and Sustainable Transportation, Chang'an University, Xi'an, China, June 30 – July 1, 2025.
20. Mokhtarian, Patricia. Can practice-oriented travel demand forecasting models include attitudinal explanatory variables? Progress at the Frontier. Seoul Institute, Chung-Ang University, Seoul, Korea, August 6, 2025.
21. Pérez-Guzmán, Sofia. Empirical Investigation of Post-Disaster Travel Behavior to Points of Distribution of Relief Supplies. HOPE Workshop. University of Notre Dame, Indiana, September 26, 2025
22. Polzin, S. E., I. Batur, and R. M. Pendyala. *Evolving Travel Behavior and Mobility Trends: Key Insights and Implications from Two Decades of National Surveys*. Presentation at the ASCE International Conference on Transportation and Development (ICTD 2025), June 8–11, 2025, Glendale, Arizona.
23. Polzin, S. E., R. M. Pendyala, and I. Batur. "Evolving Travel Behavior and Mobility Trends: Key Insights and Implications from Two Decades of National Surveys." Presentation at the 2025 Modeling Mobility Conference, September 14-17, 2025, Minneapolis, Minnesota.
24. Rezapour Fardin, F. and A. Conway. How Teleworking Affects Online Shopping and Home Delivery: A Joint Modeling Perspective from Post-pandemic NYC. International Urban Freight Conference. Los Angeles, CA, April 10, 2025.
25. Robbennolt, D., A.J. Haddad, and C.R. Bhat, "A Rank-Based Model of Residential Location Preferences Before and During the COVID-19 Pandemic," *Center for Transportation Research (CTR) Annual Symposium*, Austin, TX, April 2025.
26. Robbennolt, D., and C.R. Bhat, "A Model of Electric Vehicle Adoption and Rank-Based Contributing Factors," *Transportation Research Symposium 2025*, Rotterdam, The Netherlands, May 2025.
27. Robbennolt, D., and C.R. Bhat, "A Model of Electric Vehicle Adoption and Rank-Based Contributing Factors," *ASCE International Conference on Transportation & Development (ICTD 2025)*, Glendale, AZ, June 2025.
28. Robbennolt, J., D. Bagchi, and S. D. Boyles. Localized queue spillback with uncertain demand. 10th International Symposium on Dynamic Traffic Assignment, Salerno, Italy, September 2025.
29. Rodríguez Ocaña, M. G., F. Yu, I. Batur, and R. M. Pendyala. *Investigation of Emerging Mobility Preferences and Attitudes in a Suburban Context*. Presentation at the ASCE International Conference on Transportation and Development (ICTD 2025), June 8–11, 2025, Glendale, Arizona.
30. Rossi, T., C. Porter, K. Dannemiller, R. B. Noland, R. M. Pendyala, and I. Batur. *Developing an Induced Travel Assessment Framework*. Presentation at the 2025 Modeling Mobility Conference, September 14–17, 2025, Minneapolis, Minnesota.
31. Shang, B., Arnob, F., Li, Y.*, (2025), LiDAR for Transportation Perception, An Infrastructure Conference for High School Students. City University of New York. New York, September 26, 2025.
32. Shang, B., Li, Y., Wei, J., Kamga, C. (2025). Is More Always Better? Investigating the LiDAR Beam Count Needed for Effective Vulnerable Road User Detection, *The 22nd International Conference on Mobile Systems and Pervasive Computing*.
33. Tsiotras, H., Kajani, I., Kibria, G., Anne, V. S. R., & Peeta, S. (2024). Fostering Sustainable Travel Through Engaged Communities. PIN Summer Internship Closing Ceremony 2025. Kennesaw, Georgia, United States.
34. Zhang Y. (Invited Talk) Leveraging Edge Computing for Smarter Transportation, ITS California – Research to Reality (ITS California SoCal Luncheon), April 10, 2025.

Other Publications Within Reporting Period

1. Hwang, J., Li, C., Kang, H., Hosseini, M., Froehlich, J. E. (2025). "Where Can I Park?" Understanding Human Perspectives and Scalably Detecting Disability Parking from Aerial Imagery. Proceedings of ASSETS 2025.
2. Li, Y., Wei, J., & Kamga, C. (2025). Investigating Vision-Language Model for Point Cloud-based Vehicle Classification. The IEEE/CVF Conference on Computer Vision and Pattern Recognition DriveX Workshop. *arXiv preprint arXiv:2504.08154*.

Website(s) or other Internet site(s)

One of the center's significant products is the TBD [website](#), which serves as a central hub for all information related to the Center's objectives and activities. The website includes dedicated sections for [research projects](#), along with detailed descriptions, updates, and reports. It also houses [data products](#) and [software and tools](#) developed by TBD researchers. Additionally, the site provides a platform for sharing [policy briefs](#), as well as disseminating TBD [events](#) and [news](#) to a global audience. Similar to previous reporting periods, the TBD website has been consistently maintained to reflect developments in TBD's research, technology transfer, education, workforce development, and outreach activities. The Project #5 team also maintains an affiliated [web page](#) through the ASU Future of Being Human initiative to document and promote project outputs, including articles, podcasts, and media engagements.

Technologies or Techniques (software codes and products)

As noted in prior progress reports, the TBD team at ASU has been heavily involved in the development and application of open-source tools that reflect model outputs of the TBD projects. In this reporting period, the ASU team has released **The Mobility Dashboard (TMD)** – an open-source platform designed to provide insights into travel episodes and patterns captured in the American Time Use Survey (ATUS). In the previous reporting periods, the ASU team also developed the **Time Use, Travel, and Telework Dashboard (T3D)** and made it publicly available. Additionally, the team maintains and periodically updates two of their existing tools, which are made available to the public: the **synthetic population generator software PopGen** and the **Wellbeing Estimator for Activities and Travel (WBEAT) Dashboard**. During this reporting period, the newly released 2024 ATUS data was integrated into the three open-source dashboards (TMD, T3D, and WBEAT). While [PopGen](#) and [WBEAT](#) are not described in detail here, interested readers are encouraged to visit the hyperlinked websites for further information. Additionally, R and Python code developed as part of TBD's transportation model estimation, implementation efforts, and data fusion procedures are being documented in various publications. When possible, these codes and methods are shared publicly through repositories such as GitHub (e.g., see the ASU team's GitHub [page](#)). At the University of Texas, researchers have developed a code library as a supplement to the GAUSS matrix programming language. This code library will be presented at the 2026 Transportation Research Board annual meeting and will be publicly released in the next reporting period.

Furthermore, the TBD team at the University of Washington continues to maintain and enhance the **Mobility Analysis Workflow (MAW)** tool by adding functions to detect travel modes and infer home and work locations at the census block group level. The MAW tool is publicly available on [GitHub](#) with detailed documentation. Additionally, the team maintains a public [dashboard](#), which was developed in previous reporting periods using NREL OpenPATH data that displays travel metrics such as trip counts, trip lengths, and trip purposes over time. The **Project #44** team at UW has also developed and released an open-source **computer vision (CV) pipeline** for disability parking recognition, available on GitHub at [AccessParkCV](#). Moreover, the TBD team at the University of Texas at Austin continues to develop a prototype open-source port simulation model in Python, which will be made publicly available upon completion of **Project #32**.

Databases and Research Materials

In a number of TBD projects, integrated datasets have been developed (or are under development), using data fusion techniques to study the impact of attitudes on different transportation-related choices such as residential location choice, mode choice, vehicle ownership, and adoption of emerging mobility services and technologies. While some of the datasets are based on native survey data collection efforts undertaken by the TBD team, others have been assembled by integrating and fusing data that is already available in the public domain. All datasets assembled by TBD are being made publicly available (without personally identifiable information) via the TBD website. In the meantime, findings from the surveys have been disseminated to the community through webinars and research papers. Also, many TBD publications include applicable model specifications that can be used by practitioners to better model the recent changes in traveler behavior and values.

A few specific instances of database and research materials development are as follows. The TBD team at Georgia Institute of Technology has published several datasets called ASPED (Audio Sensing for PEdestrian Detection). It is a compilation of large-scale audio and video data prepared for pedestrian detection using sound and video. ASPED consists of almost 2,600 hours of audio, more than 3.4 million continuous frames in video, and corresponding annotation of pedestrian count for each audio and video. More information is available [here](#), [here](#), and [here](#). Project #21 team also posted its dataset for replication and research purposes on [Harvard Dataverse](#). Project #44 team at the University of Washington publicly hosts its training dataset on [Hugging Face](#), corresponding to their open-source computer vision (CV) pipeline for disability parking recognition. Additionally, the THA Survey data will also be made publicly accessible through a new dashboard integrated into the TBD Hub. This dashboard is planned to be developed in the upcoming periods to expand the reach and impact of this important dataset. Finally, Table 4 provides a summary of the TBD metrics on software/data/models and the number of journal publications.

Table 4. TBD Metrics on Products

Metric	Annual Target	Previous Period	This Period	Annual Total	Assessment
Number of software/data/models	2	1	3	4	Datasets are being cleaned, weighted, and documented. The codes are in beta versions.
Number of journal publications	15	14	22	36	Greatly exceeded the annual target.

4. OUTCOMES

During this reporting period, the TBD Center made substantial progress across multiple fronts, advancing transportation knowledge, improving analytical methods, developing new research tools, and contributing to the education and development of the next generation of transportation professionals. TBD projects expanded understanding of key transportation issues with direct implications for policy and practice.

Some key examples are as follows. At **Arizona State University**, outcomes centered on enhancing the Center’s data infrastructure and policy relevance. The newly released Mobility Dashboard (TMD) became a cornerstone of the TBD Hub, enabling open, user-friendly access to national travel behavior data from the American Time Use Survey (ATUS). Complementary updates were also made to other existing dashboards (T3D and WBEAT), which now incorporate 2024 ATUS data. Together, these platforms provide planners, researchers, and policymakers with up-to-date insights into time use, travel, telework, and wellbeing. In addition, ongoing projects yielded policy-relevant findings on telecommuting, transit use, household vehicle dynamics, and the future of mobility, culminating in new policy briefs and analytical frameworks to inform decision-making. At the **City College of New York**, key outcomes included new behavioral evidence linking telecommuting and household characteristics to home delivery demand, and a successful demonstration of blockchain’s potential to enable secure, transparent mobility payment systems. These findings contribute to better integration of emerging technologies in urban freight and passenger systems. At **Cal Poly Pomona**, the development of LiDAR-based roadway monitoring and vehicle edge computing frameworks demonstrated practical applications of artificial intelligence and real-time analytics for system performance and safety management. At the **Georgia Institute of Technology**, research advanced the integration of attitudinal factors into travel demand models, offering new tools to improve behavioral realism and forecasting accuracy. The GT team also focused on behavioral interventions and emerging mobility solutions that promote sustainable and multimodal travel and enhance understanding of traveler decision-making in evolving transportation contexts. At the **University of Michigan**, projects generated methodological advances in assessing travel survey representativeness and bias, offering agencies guidance to enhance data quality and reduce inefficiencies in survey deployment. At the **University of Texas at Austin**, research outcomes spanned multiple domains of national significance. Insights from the first wave of the THA Survey advanced understanding of contemporary transportation issues, including congestion pricing fairness, public perceptions of the mileage-based fee concept, transportation insecurity, and household vehicle fleet evolution. Other UT-led projects contributed to improved understanding of port resilience to frequent but underexplored weather disruptions such as fog

events, generating actionable findings for maritime freight operations and network recovery. Research on emerging vehicle technologies provided new perspectives on the evolving electric vehicle market, including technological advances, charging infrastructure needs, and factors influencing consumer adoption. At the **University of Washington**, outcomes focused on open-source data tools and human-centered analytics. In addition to the efforts to advance and maintain the **Mobility Analysis Workflow (MAW)** tool and a public dashboard using NREL OpenPATH data to visualize trip metrics over time, the UW team also released an open-source computer vision pipeline, AccessParkCV, for automated disability parking recognition, along with an accompanying training dataset publicly hosted on Hugging Face. These efforts demonstrate the Center's strong commitment to open science, accessibility, and inclusive design in mobility research.

Overall, the TBD Center continued to play a national leadership role in shaping discussions on travel behavior, emerging technologies, and data-driven decision-making – advancing topics at the forefront of the nation's transportation research agenda and aligned with the U.S. DOT's priorities. The Center's commitment to open science and workforce development remained strong, with undergraduate, graduate, and postdoctoral researchers across partner institutions actively engaged in data analysis, model development, dashboard design, and dissemination activities. Through the release and maintenance of open-source tools, dashboards, and curated datasets, TBD continued to democratize access to transportation data and strengthen collaboration across academia, government, and industry. Collectively, these efforts underscore the Center's ongoing role in informing policy, enhancing behavioral understanding, and preparing the next generation of transportation professionals to address the nation's mobility challenges.

5. IMPACTS

What is the impact on the effectiveness of the transportation system?

TBD's research activities have generated significant insights and tools that are enhancing the operations and effectiveness of the transportation system. The TBD Hub has expanded access to critical national datasets through open, interactive dashboards such as T3D and TMD, which now include the 2024 American Time Use Survey data. These platforms provide policymakers, planners, and researchers with user-friendly tools to monitor evolving trends in time use, travel, telework, and wellbeing, thereby supporting more informed, data-driven decisions. The first wave of the THA Survey has produced a nationally representative dataset capturing changing attitudes, values, and behaviors, offering early insights to guide investment and policy strategies. In addition, several TBD projects have demonstrated system-level applications of emerging technologies and analytical methods. For example, research on vehicle edge computing and LiDAR-based roadway monitoring has advanced the use of artificial intelligence for real-time safety and infrastructure assessment, while blockchain simulation research has shown the potential for secure, transparent mobility payment systems. Other studies have explored port resilience to weather disruptions, telecommuting's influence on transit and delivery demand, and attitudinal integration in travel demand modeling, all of which contribute to improving planning, forecasting, and management strategies. Taken together, these outcomes are strengthening the nation's capacity to anticipate behavioral shifts, optimize operations, and plan for a more adaptive, resilient, and efficient transportation future.

What is the 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?

TBD's research outcomes continue to influence industry practices and government applications across survey design, data sharing, policy development, and system management. **TBD Hub**, which hosts open dashboards such as T3D and TMD, has become a valuable resource for planners, policymakers, and researchers seeking actionable insights on national time use, travel, telework, and wellbeing trends. By democratizing access to integrated datasets and models, the Hub supports evidence-based decision-making and strengthens collaboration across agencies and institutions. In addition, the standardized attitudinal components developed for the **THA Survey** have been adopted in some major data collection efforts, including the Georgia add-on to the NextGen National Household Travel Survey (NHTS) and the Puget Sound Regional Household Travel Survey. This adoption across multiple regions ensures that future

regional travel models will better integrate behavioral and attitudinal factors, strengthening the connection between research and practice. Several TBD projects also demonstrated significant technology transfer and practical application. **Project #28** fostered collaboration among researchers, consultants, and regional planning agencies, including Resource Systems Group, the Metropolitan Council, the Southeast Michigan Council of Governments, and the Puget Sound Regional Council. Together, they developed a practical and theoretically grounded framework for evaluating travel survey representativeness and bias. The resulting guidance document, being prepared in collaboration with the Graham Institute, will assist practitioners and policymakers in improving survey design and data interpretation. Similarly, **Project #32** contributed transferable methods for assessing port resilience to recurring weather disruptions, offering metrics that can be applied to other ports with similar configurations. These methods provide agencies with tools for more data-informed resilience planning and operational decision-making. **Project #21** advanced behavioral intervention tools that promote sustainable travel through app-based systems integrating trip tracking, gamification, and targeted messaging, creating a replicable platform for future field experiments. Finally, **Project #5** expanded TBD’s public engagement through media commentary, the *Modem Futura* podcast, and *The Future of Being Human* Substack platform, increasing awareness of transformative mobility trends and their broader societal implications. Overall, these initiatives demonstrate TBD’s growing role in bridging research and practice by translating academic insights into data tools, policy guidance, and applied methods that enhance transportation planning and management capabilities nationwide.

What is the impact on the body of scientific knowledge?

TBD’s research is making important contributions to advancing the body of scientific knowledge in travel behavior, travel demand, urban analytics, and mobility systems research. Through the **TBD Hub**, which integrates multiple large-scale national datasets such as ATUS, NHTS, ACS, CES, and VIUS into a unified suite of open dashboards, the Center has established a new model for democratizing access to comprehensive travel behavior and mobility data. Each dashboard independently processes, analyzes, and visualizes specific aspects of these datasets, providing tools to explore patterns in time use, travel behaviors, household transportation expenditures, socio-demographic characteristics, and freight movements. Complementary to these efforts, the **THA Survey** continues to produce fresh empirical evidence on evolving post-pandemic trends in travel behaviors, attitudes and values, and accessibility patterns across diverse population groups. As such, these initiatives are strengthening the empirical and analytical foundations needed to understand contemporary transportation challenges and opportunities. By making these resources publicly accessible, TBD supports interdisciplinary research that advances understanding of accessibility, travel behavior dynamics, and system efficiency, laying a stronger foundation for improved demand modeling, infrastructure investment decisions, and evidence-based policy development.

Beyond these flagship initiatives, research conducted across TBD institutions has advanced theoretical and methodological frontiers in several areas. Recent work has expanded the application of artificial intelligence and data fusion techniques in transportation modeling, developed new frameworks to assess how remote work influences accessibility and mode choice, and refined approaches for incorporating attitudinal and behavioral data into traditional travel demand models. In addition, novel analytical frameworks have also been introduced to better understand logistics system resilience, particularly regarding how frequent yet understudied disruptions such as fog closures affect port operations and vessel queuing. These insights contribute to filling critical knowledge gaps in the literature and improving the broader understanding of transportation system resilience and reliability. Finally, Table 6 provides TBD metrics on the Center’s broader impacts, including the number of new agencies adopting TBD data and tools, as well as Google Scholar citation counts for all publications by core researchers from 2023 to date.

Table 6. TBD Metrics on Impacts

Metric	2023	2024	2025 (+)	Total
Number of new agencies adopting TBD data/tools	0	2	2	4
Citations of TBD Publications (Google Scholar)	8,100	8,870	6,878	23,848

What is the impact on transportation workforce development?

TBD has continued to play a vital role in developing the future transportation workforce by providing students and early-career researchers with meaningful, hands-on research and training opportunities. Across consortium universities, undergraduate and graduate students have engaged in a wide range of activities – from survey design and data collection to machine learning applications, dashboard development, and GPS mobility analysis. Students working on flagship projects (i.e., the THA Survey and TBD Hub) have gained valuable skills in transportation research, statistical modeling, and public engagement. In addition, projects at the City College of New York have engaged students from civil engineering, data science, and computer science programs, helping build a multidisciplinary workforce equipped with transportation and computing expertise. At Cal Poly Pomona, Project #20 involved both undergraduate and graduate students in system development and data analysis and hosted 37 high school students through the National Summer Transportation Institute, inspiring interest in transportation engineering. The University of Michigan team also expanded outreach by mentoring a high school intern and new undergraduate researchers, while at the University of Washington, Project #43 provided graduate students with advanced training in data science and transportation analytics through collaborations with the Puget Sound Regional Council and international research partners. Furthermore, through webinars, seminars, internships, and agency collaborations, TBD has created a pipeline of early-career transportation researchers and practitioners, emphasizing interdisciplinary thinking, technical skills, and sensitivity to behavioral, sustainability, and accessibility issues. Multiple students supported by TBD received national awards and presented their work at major venues such as TRB and the International Society for Transport Survey Methods Conference (ISCTSC), demonstrating the Center’s strong impact on shaping future transportation leaders.

6. CHANGES/PROBLEMS

Changes in approach and reasons for change

During this reporting period, the TBD Center adjusted the scopes and directions of all projects and activities to ensure alignment with the priorities of the new U.S. DOT administration. In addition, during previous reporting periods, Project #29 expanded and evolved from a primarily descriptive and diagnostic effort into the development and implementation of a practice-ready framework for evaluating travel survey interventions. This evolution reflects a natural progression of the work, enabled by additional support from the University of Michigan, and extends well beyond the project’s original scope to enhance its practical applicability and long-term impact.

Actual or anticipated problems or delays and actions or plans to resolve them

Progress on Project #13 was delayed during Summer 2025 due to a temporary gap in student availability following a transition from the M.S. in Data Science program to the Ph.D. in Civil Engineering program. Using the remaining project funds, a second student was appointed in Fall 2025 to ensure timely completion of the final report by the end of the year.

Changes that have a significant impact on expenditures

Nothing to report.

Significant changes in use or care of human subjects, vertebrate animals, and/or biohazards

Nothing to report.

Change of primary performance site location from that originally proposed

Nothing to report.