Exhibit D – Research Project Requirement Template

Enhancing the Use of Attitudinal Marker Variables in Travel Behavior Models: Evaluation of Latent Class Modeling Approaches Using a Nationwide Travel Survey

Recipient/Grant (Contract) Number: The University of Texas at Austin; Georgia Institute of Technology/Grant # 69A3552344815 and 69A3552348320

Center Name: National Center for Understanding Future Travel Behavior and Demand (TBD)

Research Priority: Improving Mobility of People and Goods

Principal Investigator(s): Patricia Mokhtarian

Project Partners: N/A

Research Project Funding: $100,773 (Federal share); $146,767 (matching funds)

Project Start and End Date: 06/01/2025 – 05/31/2026

Project Description: Recent studies have shown that an *abbreviated* set of attitudinal *marker variables* (MVs) can serve as proxies for attitudinal factor scores from the *full* set of attitudinal variables, either directly or through machine learning-based imputation. Compared to models without attitudes, these MVs enhance model fit, identify additional significant explanatory variables, and improve prediction of less-often chosen alternatives. Building on these findings, this study examines the potential improvement that using latent class (LC) modeling could bring to travel behavior (TB) models with attitudinal MVs incorporated. Using data from the 2024 Transportation Heartbeat of America (THA) Survey (N ≈ 8,200), the project compares four models for each of several TB variables: non-LC models with and without MVs, and LC models with MVs in either the membership or outcome component. The results will provide empirical evidence on (1) which MVs are most useful for specific TB variables, (2) how much incremental value MVs offer in the non-LC and LC models, and (3) how to specify LC models to best leverage attitudinal information. Overall, this study is expected to guide travel demand modeling practitioners and researchers in evaluating the benefits of including attitudinal variables in travel surveys and help them make well-informed decisions regarding measurement strategies and model development. These anticipated contributions are both essential and timely given that a few recent government-funded household travel surveys have started including attitudinal MVs.

US DOT Priorities: The proposed research addresses the *data-driven insight* priority in the US DOT Research, Development and Technology (RD&T) document (fiscal years 2022 – 2026), focusing on the *data science* objective. Specifically, the research "[h]arness[es] advanced data collection and data processing capabilities to create timely, accurate, credible, and accessible information to support transportation operations and decision-making" (p. 50). Especially, it "[c]onduct[s] exploratory research on transformational mobility data analytics" in keeping with the *data science* objective on p. 59.

The proposed research clearly supports U.S. DOT['s] encourage[ment of] UTCs to engage in research. It further supports education and workforce development (p. 68) through the involvement and close mentoring of a PhD student.

Outputs: Using data from the 2024 Transportation Heartbeat of America (THA) Survey, administered by the TBD Center, the proposed project aims to enhance the understanding of both the benefits of measuring attitudinal marker variables (MVs) and the effective ways to incorporate MVs into travel behavior models. The results from this project will provide empirical evidence that helps assess the value of the proposed MV approach and guidance on how to make the most of measured attitudinal information.

The methods and results will be appropriately documented for replicability in future studies. However, it is probably premature to consider "codifying" this study's processes as definitive, given that this line of inquiry is still in exploratory stages. In the meantime, however, the project is expected to generate one or more conference presentations, and ultimately at least one peer-reviewed journal article.

Outcomes/Impacts: The proposed project is expected to contribute to an increase in our knowledge with respect to attitudinal measurement and the effective use of attitudinal information in travel behavior models, which can lead to more effective transportation planning and decision-making.

The ambitious longer-term goal of this line of research is to influence regional planning agencies to incorporate attitudes into their (a) household travel survey instruments, and (b) travel demand forecasting models in an impactful manner. If successful in doing so, the outcomes will be an increased understanding of travel behavior, and an improved ability to predict behavioral responses to societal trends, new technologies, infrastructure changes, and proposed or implemented policies.

A nearer-term goal is to train young transportation professionals through offering them caring professional mentorship; engaging them in rigorous and meaningful research; providing them opportunities for, and coaching them on, technical written and verbal communication; and helping them develop a broad and deep professional network.

Final Research Report: A URL link to the final report will be provided upon completion of the project.