

Exhibit D – Research Project Requirement Template

Does AI based synthetic travel behavior data replicate human cognitive biases?

Recipient/Grant (Contract) Number: The University of Texas at Austin/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): Don MacKenzie

Project Partners: N/A

Research Project Funding: \$150,000 (Federal and non-Federal funding amounts.)

Project Start and End Date: 9/16/26 – 9/15/27

Project Description: This project will develop methods to test for cognitive biases in AI-generated synthetic data used as substitutes for human survey responses in travel behavior analyses. Moving beyond recent benchmarking and prompt engineering work, this project will ask: even when synthetic data look statistically reasonable, do they reproduce canonical cognitive biases that influence travel choices? In other words, we test whether synthetic data are behaviorally realistic, not merely statistically plausible. We will implement a compact, transportation-specific battery of experimentally controlled stated-choice and judgment tasks to test for biases such as status quo bias, reference dependence and loss aversion around time/cost changes, framing, anchoring, and zero-price effects in toll/parking/fare presentation, and ambiguity aversion in travel-time reliability. We will field this battery in parallel to (i) a commercial synthetic panel product (e.g., Qualtrics) and (ii) LLM-based agents under multiple prompting/persona strategies, comparing each to a modest human reference data set. The human data may comprise existing data sets or data newly collected from known human respondents, as long as question wording is consistent with the AI data collection. The direction and magnitude of any cognitive biases demonstrated in the synthetic data will be compared with those in the human reference data.

US DOT Priorities: This research aligns with the Innovation strategic goal of the USDOT Strategic Plan for FY2026-2030, specifically Strategic Objective 3.3 (Invest in Transformative Technologies), which calls for "promoting beneficial and responsible transportation uses of artificial intelligence" and "leveraging new and emerging data sources". By developing a framework for evaluating whether AI-generated synthetic data reproduces human decision-making processes, this project directly advances DOT's commitment to understanding both the potential and the limitations of AI tools in transportation contexts.

Outputs: Research outputs will include: (1) a publicly available survey instrument for testing cognitive biases in transportation decision-making; (2) a unique dataset comparing human, LLM-based, and commercial synthetic survey responses; (3) a workflow comprising archived prompts with Python code that administers the bias battery to future LLMs, retrieves the synthetic responses, and compares them against human and prior synthetic data; and (4) a final report and a technical paper documenting the findings, which we anticipate submitting to a peer-reviewed journal and a conference.

Outcomes/Impacts: Anticipated outcomes include an improved understanding of LLM-based survey methods in transportation. By comparing LLM-based approaches with traditional surveys in their ability to capture human behavioral processes, it will identify when AI tools are appropriate for use in transportation contexts. By developing a publicly available survey instrument, the project will enable future studies to

extend this work as LLM technologies continue to evolve. By creating an automated workflow, the project will enable other researchers and practitioners to quickly and consistently evaluate cognitive biases in future LLM versions.

The greatest potential impacts of this work lie in future transportation data collection practices and the decision-making processes that depend on data collection. By identifying whether LLM-based survey methods can serve as reliable substitutes for human responses, the project will clarify opportunities to reduce survey costs, improve efficiency, and enable more scalable data collection. These advances can help agencies and policymakers gather timely and behaviorally accurate data, improving their ability to understand traveler decision-making and design more effective transportation policies and interventions. Equally important, by showing where synthetic respondents do and do not reproduce human decision-making, the project will help the transportation community judge whether confidence in AI-generated data is warranted, protecting the credibility of analyses and recommendations that rely on it.

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