

Exhibit D – Research Project Requirement Template

Characterizing Operational Disruptions in Urban Freight Networks: Patterns, Propagation, and Recovery Behaviors in Atlanta

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): Sofía Pérez-Guzmán

Project Partners: N/A

Research Project Funding: \$110,388 Federal and \$110,388 non-Federal (in-kind match)

Project Start and End Date: 06/01/2026 – 05/31/2027

Project Description: Urban freight systems are subject to recurring disruptions that can degrade travel time reliability and operational efficiency. Despite their cumulative effects on freight movement and supply chain performance, these disruptions remain relatively understudied at the network level, particularly when only publicly funded and openly accessible data are used. This project develops a data-driven analytical framework to detect, characterize, attribute, and model recurring freight-relevant disruptions and assess their impacts on urban network performance. The research combines truck travel times, vehicle counts and classifications, congestion imagery, crash records, and street-network data to create an integrated representation of freight system conditions. Machine learning methods are used to detect and classify disruption events, while graph-based analysis and survival modeling examine their propagation and recovery dynamics. The resulting analyses distinguish disruptions that may be amenable to public-sector intervention from those that are largely exogenous and translate these patterns into freight-relevant performance measures. A proof-of-concept analytical prototype will demonstrate how the methods can support freight system assessment and performance-based planning. The Atlanta metropolitan area serves as the testbed, and the methods are designed to transfer to other regions using comparable public data.

US DOT Priorities: The project supports the U.S. Department of Transportation's priority of improving the mobility of people and goods, as well as the Department's research, development, and technology strategic goals, by helping public agencies better measure and manage the reliability of freight movement. The project contributes to the Center's Data Collection Mechanisms thrust by integrating multiple public data sources and to the Data/Technology Systems objective by developing a documented workflow and proof-of-concept analytical prototype that can be replicated in other regions. It also advances Novel Data/Technology Approaches by applying machine learning, graph-based network analysis, and survival modeling to freight system performance assessment. The research is advanced in that it seeks to characterize recurring, lower-severity freight disruptions and their propagation and recovery at the network level using only non-proprietary data, an area that prior freight studies, which rely largely on aggregated measures or proprietary carrier data, appear to have left comparatively unexplored.

Outputs: The project is expected to produce a documented workflow for identifying, characterizing, and assessing recurring freight disruptions using publicly available data. The workflow will describe procedures for integrating public datasets, detecting and classifying disruptions, analyzing propagation and recovery dynamics, and assessing the impacts on freight reliability. Anticipated outputs include: (1) a documented dataset integrating publicly funded and openly accessible data for freight disruption analysis; (2) a reproducible methodology for detecting, classifying, and attributing recurring disruptions using machine learning and statistical techniques; (3) analytical models of disruption propagation and recovery; and (4)

freight-relevant performance measures linking disruptions to reliability and cost impacts. The project will also deliver a proof-of-concept analytical prototype demonstrating the application of the proposed methods to freight system performance assessment. Additional outputs include a journal article, conference presentations, a publicly accessible technical report, and supporting documentation describing the workflow, methods, and potential applications. No new partnerships outside the consortium are anticipated at this time.

Outcomes/Impacts: As a tangible, implementation-oriented product, the project will provide transportation agencies with a documented workflow for incorporating recurring freight disruption and reliability analyses into planning and performance monitoring activities. By identifying when, where, and how recurring disruptions affect freight reliability, the resulting methods and analyses may support more targeted and cost-effective infrastructure and operational decision-making. Because the approach relies on publicly available data, it lowers adoption barriers and facilitates transfer to other regions. The project will provide a documented workflow for identifying, characterizing, and assessing recurring freight disruptions using publicly available data. The workflow, associated methodologies, and analytical prototype are intended to support agencies seeking to incorporate freight disruption and reliability analysis into planning and performance-monitoring activities. The project will also contribute to scientific knowledge on freight network dynamics and workforce development through graduate student training in data fusion, machine learning, and transportation analytics.

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