Exhibit D – Research Project Requirement Template

Multimodal Freight Network Capacity and Resilience Under Demand Shifts

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): Stephen D. Boyles

Project Partners: N/A

Research Project Funding: $240,000 ($120,000 Federal + $120,000 matching funds)

Project Start and End Date: 9/1/25-8/31/27

Project Description: This project will develop methods for identifying bottlenecks in multimodal maritime freight systems as demand patterns shift. Examples of such changes are increased demand due to onshoring of manufacturing industries; competition from alternative shipping modes (rail, overland); and demand changes during natural or man-made disruptions (which may simultaneously cause capacity changes). To address this goal, the project objectives are to: 1) integrate data sets from different transportation modes; 2) develop a definition for the capacity and resilience of multimodal port systems; and 3) explore the relationship between capacity and resilience in these networks. The investigation into these objectives will rely on a discrete-event simulation environment developed for the maritime freight transportation network of Houston, Texas. Identifying bottlenecks requires clear definitions for "capacity" and "resilience" in maritime freight systems. To this end, the project will include extensive processing and statistical analysis of standard transportation system datasets, derive the input parameters needed for the simulation, and validate the model output. The simulation environment will be constructed for the Port of Houston freight network, and model the waterway navigation channel, port terminals, and hinterland connections to landside transport modes. The base scenario will reveal current bottlenecks in the integrated system. A series of "what if?" scenarios representing capacity increases or decreases will be simulated to understand the effects of demand changes and system disruptions.

US DOT Priorities: The project is engaged in advanced research, bridging fundamental transportation science and operations research (network resiliency) with applications in multimodal maritime freight systems. In particular, the project will identify ways to improve efficiency and resiliency of inland waterway and port systems, taking into account potential changes in demand (manufacturing re-shoring), in line with US DOT's "transformation: design for the future" priority.

Outputs: The anticipated outputs of the project are novel multimodal network models and optimization models for resource allocation. These will be reported in a project report; in presentations at center workshops, professional conferences, and/or invited lectures; and in one or more peer-reviewed articles submitted for publication in a premier venue such as *Transportation Research Part B* or *Transportation Science*. These publications will be accompanied by code implementing these algorithms, and data used for analysis.

Outcomes/Impacts: The anticipated outcomes of the project are increased understanding of the interdependence between capacity and resilience in the context of multimodal port systems, as both demand and supply change. Potential applications of this understanding are to guide infrastructure policy as freight demand changes (e.g., increased waterway usage due to manufacturing onshoring) or to vulnerabilities due

to system disruptions, for instance, proactively identifying alternative ports or routes should demand increase, or contingency plans during a disruption. The anticipated impacts are improved allocation of infrastructure investments to improve port capacity and resiliency, particularly considering these factors in the context of potential demand changes. The discrete-event simulation and specific analysis of the tradeoffs between capacity and resilience will provide a more comprehensive perspective that leads to a more efficient use of resources. This project is aligned with the center's focus on advancing research in travel behavior and demand by incorporating potential demand changes into maritime capacity research (which to date has focused exclusively on supply-side considerations).

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