

# Impact of Multimodal Freight Network on Private Sector Global Distribution - Project 4

Deliverables and Reporting Requirements for UTC Grants Awarded in 2023 (June 2023)

## Exhibit D

**Recipient/Grant (Contract) Number:** The University of Tennessee; Oregon State University, Grant No. 69-A3552348338

**Center Name:** Center for Freight Transportation for Efficient and Resilient Supply Chain

**Research Priority:** Improving Mobility of People and Goods

**Principal Investigator(s):** Hector Vergara (OSU) and Salvador Hernandez (OSU)

**Project Partners:** Oregon DOT, EROAD (Robinsight)

We have welcomed several partners to the FERSC advisory board. We are committed to scheduling regular meetings with these partners, keeping them informed about our progress, and actively soliciting their feedback.

**Research Project Funding:** \$80,000 Federal and \$40,000 Non-Federal Funding

**Project Start and End Date:** 10/01/2023 - 09/30/2024

**Project Description:** At the strategic level, private sector companies develop their distribution systems through the location of manufacturing plants, distribution centers, and warehouses, largely based on the established multimodal network infrastructure. In many cases, private distribution systems function in the context of global or national supply chains, which adds complexity to their planning and decision making. Accordingly, the private sector's distribution system efficiency depends on the inherent resiliency and efficiency of the multimodal network. For this reason, it is important to develop a framework to quantify the impact of the multimodal freight transportation network on the efficiency of private distribution systems.

This research project will develop network models to quantify the impact of multimodal network components on private sector efficiencies in terms of operational cost. This is envisioned as a project to be completed in phases, with the first phase focusing on the development and testing of a network model for multimodal freight transportation that would be used to assess performance metrics that are relevant for the planning and operation of distribution systems.

To achieve the aims of this research, the following tasks are anticipated for a first phase:

1. Develop network model of multimodal freight transportation system that incorporates network components (e.g., facilities, multimodal terminals, roads, rail segments, etc.), their placement, and their relationships.
2. Implementation of network model with test data to identify network components that affect distribution system performance metrics such as travel times, delays (congestion/queues), and operational cost.
3. Explore valid approaches for deriving shipper behavior for selection of routes and modes of transportation for incorporation in network model.
4. Chart the research paths forward for subsequent phases of this project and external funds.

**US DOT Priorities:** This project supports the US DOT strategic goal of Economic Strength and Global Competitiveness by improving understanding of the impact of multimodal networks on the performance of distribution systems so better decisions can be made by shippers at strategic, tactical and operational levels when planning their global logistics systems. Also, this project is aligned with the US DOT strategic goal of Climate and Sustainability by providing performance metrics to evaluate the performance of multimodal networks so efficiencies can be obtained for multimodal operations that will eventually reduce emissions and improve resilience. The project also supports the US DOT Research, Development & Technology research priorities of Resilient Supply Chains, System Performance and Sustainable and Resilient Infrastructure by providing metrics and evaluation models that can be used to generate recommendations for the design, planning and operation of distribution systems that are efficient and resilient.

In particular, this project will focus on understanding how the interactions between different components in a multimodal network will affect the performance of distribution systems and this information will be very valuable for stakeholders when making long term strategic decisions about their distribution systems as well as other decisions at tactical and operational levels. Developing novel and relevant metrics and evaluation models via network models using data from public sources requires a multidisciplinary approach from Industrial Engineering and Civil Engineering.

**Outputs:** This research project will result in several outputs: 1) a new set of relevant performance metrics to evaluate the impact of multimodal networks on distribution systems, 2) a network model for the evaluation of metrics, 3) recommendations for use of research results to improve planning of distribution systems, 4) a summary of research tasks and potential extensions to incorporate shipper behavior on future models. All of these outputs will be summarized in a final report. A summary of the research methodology, developed models, solutions, and analysis results will be published in a journal paper and presented at conferences.

**Outcomes/Impacts:** The outputs of this research project will be disseminated via final report, journal paper publication, and conference presentations. If the outputs of this research are applied, they have the potential to help shippers have a better understanding of how different multimodal network components affect the performance of their distribution system which would benefit their strategic, tactical, and operational decision making. Better decision making will allow for global optimal solutions that will improve the efficiency and resilience of the multimodal transportation network.

U.S. Department of Transportation

**Office of the Secretary of Transportation**