Generating reliable freight disruption measures with freight telematics data (Year 2) – Project 2

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; North Carolina A&T, Grant No. 69- A3552348338

Center Name: Center for Freight Transportation for Efficient and Resilient Supply Chain (FERSC)

Research Priority: Improving Mobility of People and Goods

Principal Investigator(s): Salvador Hernandez (OSU), Lee Han (UTK), Steven Jiang (NCAT)

Project Partners: EROAD, Robinsight

Research Project Funding: $137,000 Federal and $68,500 non-Federal funding

Project Start and End Date: 10/01/2024 – 09/30/2025

Project Description: In the aftermath of disasters that challenge the resilience of transportation networks, the urgency for planning for rapid mobility and recovery has been underscored. The primary objective of resilience is to enable transportation agencies to prepare more effectively for such events. In this light, resilience measures serve as a critical tool, providing a means to assess the impact of disruptions and inform strategic investments to mitigate these occurrences. The first year of our research addressed the critical challenges faced by states and agencies in measuring freight network systems: the scarcity of comprehensive data and the inadequacy of analytical methods. While there is substantial data available on the movement of people and passenger vehicles, understanding freight movements—especially under disruptive scenarios—poses distinct challenges. Freight movements, governed by corporate supply chain decisions, are subject to constant change due to various economic conditions and span multiple jurisdictions and transport modes. Moreover, methods to capture and analyze data that encompasses these complex dynamics have been limited. With a focus on these challenges, our initial research presented a novel framework that leveraged Robinsight telematics data to bridge this gap. In the first year, we have delved into the telematics data to explore its capacity for developing robust freight network resiliency measures, with the trucking sector in the Tennessee and Pacific Northwest.

As we embark on the second year, we aim to capitalize on the foundations laid in the initial phase. Our year one findings, which underscored the potential of Robinsight data in generating new and reliable freight network resiliency measures, will be the launchpad for more ambitious objectives. In the upcoming year, we are poised to not only refine these measures but also to expand our analysis to encompass broader data sets and more sophisticated methodologies. This will involve a deeper exploration of freight movement patterns and the variables influencing them. Our goal for year two is to transform this understanding into actionable, reliable freight performance measures that will empower state transportation planners with unprecedented foresight and adaptability. Through the continued evaluation of freight movements across jurisdictions and the rigorous assessment of Robinsight data and other data sources currently being explored by the research team, we aim to deliver insights that will enhance the resilience of freight networks, facilitating a more responsive and robust transportation infrastructure.

Building upon the solid foundation established in the first year of our research, where we conducted a comprehensive state-of-the-art review, mined and analyzed Robinsight data, and performed statistical analyses through case studies in Tennessee and Oregon, we now look at identifying key disruption measures. Our meticulous efforts in year one have not only fortified our understanding of freight network resilience but have also highlighted the transformative potential of freight telematics data. As we transition into the second year of our project, we are poised to leverage the insights gained to evolve our research further. Having identified promising opportunities using the telematics data provided by Robinsight, we are committed to pursuing the development of potential reliable freight performance measures. These measures are envisioned to be both innovative and practical, potentially revolutionizing the current paradigms of freight movement analysis and resiliency planning.
In pursuit of this objective, we will continue to delve deeper into the rich repository of telematics data, extracting information that can be the cornerstone for resilient freight networks. The anticipated outcomes of this year will

significantly contribute to a more resilient and efficient transportation system, one that upholds the vital role of freight networks in regional and national economies.

To achieve the aims of this research, the following tasks are envisaged:

- To refine and validate the freight network resiliency measures developed using Robinsight telematics data, ensuring they are robust and applicable in real-world scenarios.
- To enhance our modeling of freight network disruption scenarios by integrating the refined resiliency measures, thus improving the precision of our predictions and the effectiveness of countermeasure strategies.
- To implement a more comprehensive analysis of freight disruptions, incorporating a wider array of infrastructural data and leveraging advanced crowdsourced data techniques to understand the nuanced impacts of disruptions on freight movement.
- To solidify the research foundation laid in the first year and identify avenues for scaling the application of our findings, as well as securing external funding to support these efforts.

US DOT Priorities: The research project aligns with several key priorities and strategic goals of the U.S. Department of Transportation (USDOT), as outlined in its strategic plan. Here's how the project supports these priorities and engages in advanced and transformative research:

1. Safety: The project directly supports the USDOT's priority of making the transportation system safer. By developing reliable freight network resiliency measures and modeling disruption scenarios, the research contributes to the goal of advancing a future without transportation-related serious injuries and fatalities. Improved understanding and preparedness for disruptions enhance safety.
2. Economic Strength and Global Competitiveness: The project aligns with the goal of growing a sustainable economy. By optimizing freight network operations and reducing the economic impact of disruptions, the research supports job creation, fiscal health, and resilient supply chains, all of which are essential for economic competitiveness.
3. Climate and Sustainability: The project contributes to tackling the climate crisis by improving the resilience of the transportation system. By identifying vulnerabilities and developing strategies to mitigate disruptions, it aligns with the goals of infrastructure resilience and climate justice, reducing the environmental impact of transportation.
4. Transformation: The research engages in transformative and purpose-driven innovation. By utilizing advanced telematics technology and data analysis techniques for assessing freight network resiliency, the project aligns with the USDOT's emphasis on matching research and policy to advance breakthroughs. It represents an innovative and transformative approach to addressing critical transportation challenges.

Outputs: The results of this research will be available to other researchers and practitioners via a GitHub repository including code and test data, a journal paper, and conference presentations. In addition, the results of this research will be integrated into class modules for undergraduate and graduate courses in Civil Engineering and Industrial Engineering at Oregon State University, University of Tennessee and North Carolina A&T State University.

Outcomes/Impacts: The anticipated outcomes of this research are poised to make significant contributions to the field of transportation network resiliency. By refining and validating robust freight network resiliency measures, we expect to provide transportation agencies with reliable tools to assess and mitigate the impacts of disruptions. The enhanced modeling of freight network disruption scenarios will improve the precision of predictions and the effectiveness of countermeasure strategies, facilitating a more responsive and robust transportation infrastructure. Furthermore, the comprehensive analysis of freight disruptions will offer a deeper understanding of the nuanced impacts on freight movement, leveraging advanced crowdsourced data techniques. This will empower state transportation planners with unprecedented foresight and adaptability, enabling them to make strategic investments that enhance the resilience of freight networks.

The research findings will not only benefit regional and national economies by ensuring the continuous flow of goods during disruptions but also pave the way for innovative approaches to freight movement analysis and resiliency planning. The project’s success in identifying and scaling the application of resilient freight performance measures will set a new standard in the field, potentially revolutionizing current paradigms and informing future research and policy-making.