



*This research initiative is funded under the auspices of the CFIRE Tier 1 University Transportation Center.*

**Title:** A Multi-Modal Freight Safety, Security, and Environmental Routing Tool

**Description:**

Every day, freight shipments in the United States use a network comprised of multiple modes. These shipments often transport large volumes of dangerous cargo that pose significant health and environmental risks. Incidents may cause severe consequences in the form of human casualties, property and environmental damage, community disruption, economic loss, and damaged reputation.

In making risk-based shipping decisions, carriers desire to select routes that are safe, secure and sensitive to the environment. However, attempts to select a preferred route often present conflicting objectives, not only among risk factors but also when considering tradeoffs with transportation cost and reliability. The challenge, therefore, is to identify those freight routes that are efficient while taking safety, security, and environmental considerations into account.

This research initiative will develop an integrated method for assessing freight transport safety, security, and environmental risk on a network of multimodal transport segments such that high-risk “hot spots” can be identified and then avoided, if desired. In addition, the method will be capable of identifying and evaluating route options between specific origins and destinations based on selection and weighting of various efficiency, safety, security, and environmental criteria.

This integrated approach will be developed using geographic information systems (GIS) data and technology to assess and provide routing information. This research area will build upon previous work in route risk assessment and in identifying factors that influence incident likelihood and severity. It is anticipated that these factors will vary by mode and location. The developed tool and techniques will be demonstrated using a case study area comprised of all states located in the CFIRE area and will include representation of all surface freight modes (truck, rail, and marine).

**Outcomes:**

The research will produce a GIS framework to identify and categorize safety, security, and environmental risk along multimodal transportation networks. The categories will be useful for situational awareness analysis and risk assessment. The project will develop GIS routing algorithms with enhanced capability to minimize risks associated with freight transport while taking efficiency and cost into consideration. This area represents a significant contribution to both the state-of-the-art and industry practice, and serves as a foundation for future comprehensive transportation planning.

**Deliverables:**

A final report will be prepared that summarizes significant research findings and implications, in addition to presentations at professional conferences and submittal of a paper for publication consideration in a refereed journal. It is also anticipated that the routing tool will be made available as a web-based application.

**Industry Impact:**

Shippers, carriers, regulators, and non-government organizations will have an opportunity to analyze and visualize the impact on freight transportation trip patterns by imposing various criteria on route selection. This is particularly important in addressing the transport of hazardous cargo, such as flammable, explosive, toxic-by-inhalation, and radioactive materials, that have proven to be contentious among various stakeholders. It is hoped that the availability and use of this tool can be utilized in achieving consensus solutions.

**Research Team:**

- Mark Abkowitz, Vanderbilt University (Executive Committee Representative)
- Jimmy Dobbins, Vanderbilt University (Project Coordinator)
- Mike Anderson, University of Alabama in Huntsville
- Troy Liu, University of Wisconsin-Milwaukee
- MD Sarder, University of Southern Mississippi
- Richard Stewart, University of Wisconsin-Superior

**Funding:**

- Total: \$301,465
- UTC Funds: \$150,734

**Duration:**

- 15 months

**Student Involvement**

- University of Southern Mississippi: One graduate student for one semester
- University of Alabama in Huntsville: One student for three semesters