MarTREC UTC Project Information Form
USDOT Tier 1 University Transportation Center
Agency ID or Contract Number 69A3551747130

Project Title: Combining Truck and Vessel Tracking Data to Estimate Performance and Impacts of Inland Ports
Project Abstract (Brief Description): The purpose of this project is to develop a method to fuse truck and marine vessel tracking data to better estimate performance of multi-modal supply chains that use inland waterway ports. The study builds on a growing body of research related to multi-modal freight performance measurement, specifically freight fluidity measures. Freight fluidity measurement attempts to capture freight system performance from a multi-modal supply chain perspective. To date, most freight fluidity measures are not truly multi-modal, and rather capture only one end of the supply chain, i.e. the long haul portion of the trip that uses either truck, rail, or barge. In this study, we will determine how to effectively combine marine Automatic Identification System (AIS) data with truck Global Positioning System (GPS) data. Both data sources track vessel and vehicle movements and can be used to determine measures such as travel times, dwell times, and other freight activity characteristics. By spatially, temporally, and contextually conflating the data sources, it will be possible to measure port throughput, vessel to truck ratios, geographic extents (or "trucksheds") of ports and other multi-modal transfer points, and potentially to monitor each performance measure in a commodity-specific format. Each of these derived performance measures can assist freight planners in identifying critical freight corridors and bottlenecks both on the marine and land side which can ultimately help guide and prioritize investment decisions and develop effective transportation policy.
Describe Implementation of Research Outcomes Fusion of "big data" sources not typically used for freight transportation planning, such as maritime Automatic Identification System (AIS), truck Global Positioning System (GPS), and Lock Performance Monitoring System (LPMS) data, provides a consistent and novel data source for multimodal, long-range freight planning. The methods developed for this work describe, quantify, and characterize commodity-based freight activity on a multimodal transportation system, with focus on inland waterway networks. One of the limitations discovered during this project is the lack of information on the number of barges pushed per tug. To overcome such limitation, it would be desirable to recommend the use of AIS transponders on barges. Practical examples of mandatory AIS transponders of barges can be found in the Port of Antwerp (Port of Antwerp 2012) with its main purpose being safety (collision avoidance). The use of AIS on barges on inland waterways would serve a dual purpose of safety and information to support freight planning. Alternatively, an AIS message to report the number of barges pushed per tug would be desirable, as it is required in Europe (Javor, et al. 2013). However, this reporting method is not ideal due to its manual nature. In future work, we will explore how the GMAP and GMAP+ models can be used as scenario analysis tools. For example, we can use the models or future variants to quantify the impacts of disruptions caused by flooding, port capacity and capability expansions, and investment decisions. While the current models can in some way mimic a scenario such as a port closure, they are not designed to serve as a decision making tool. In future work, we will determine in what ways we can expand the applicability of our models to better serve decision makers from the public and private sectors.
Impacts/Benefits of Implementation To conclude, the data fusion models and methods presented in this work support several long-range multimodal freight transportation planning applications, focusing on the evaluation of performance of inland waterway transportation system components. The methods

developed and applied in this project close critical data gaps, such as throughput by commodity on inland waterway port terminals, and quantity and type of commodities transported per tug-trip, previously unavailable in the public domain. Moreover, this work presents a critical step towards the broader goal of representing robust inland waterway freight activity into multimodal transportation infrastructure management and strategic decision-making. Ubiquitous AIS and truck GPS data permit the transferability of the proposed model to other regions with waterways and aggregated commodity-flow data. Web Links: martrec.uark.edu
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