0-6898: Estimating Freight Value Moved on TxDOT-Maintained Roadways for Investment Decision-Making

Background

In recent years, state transportation agencies have been encouraged to incorporate freight into their statewide transportation planning program, as highlighted by the Moving Ahead for Progress in the 21st Century Act (MAP-21). Despite recognizing the need for improved freight planning, most states have limited planning tools to address goods movements and are lagging behind the freight industry in terms of technological and logistical advances. Despite advancement in freight planning modeling towards a supply chain and logistics based approach, lack of adequate freight data is a hindrance to developing behavioral models.

Traditional infrastructure investment decisions are usually made based on the condition of the infrastructure and the traffic volume without considering the value of commodities moved on the infrastructure. However, freight values have a more direct effect on the wider economy than simple volume measurements, and thus an important metric to consider when making investment decisions.

This project addresses those two problems by identifying freight data sources and developing a methodology to estimate the value of freight moved on TxDOT-maintained roadways. It provides useful information to TxDOT regarding prioritizing or rank ordering of infrastructure improvement projects, and establishes what would be necessary for a continuous statewide freight data program.

What the Researchers Did

The research team performed an extensive literature review on commodity flow estimation methods. The team decided to pursue a commodity-specific modeling approach using commodity-specific data sources that are tied more closely to each commodity's unique attributes. The researchers then applied this methodology to a list of commodities selected based on weight/value of the commodities' movements within Texas and their importance to the Texas economy in terms of increasing tax revenue and creating employment opportunities.

For each selected commodity, the research team studied its supply chain, available data sources for estimating production and consumption, aand typical truck types used for transportation. The research team then developed methods to estimate county-to-county flows of the selected commodities. The estimation methods developed for each commodity were based on the characteristics of the commodity's movements and available data.

The research team converted the estimated county-to-county flow matrices into truck trip and value matrices based on an assessment of the unit value for each commodity and the typical type of truck used for transporting the commodity. Commodity value estimates were based on prevailing market trends from the time the commodity data came from. The researchers then assigned estimated county-to-county truck trips and value to the Texas primary and secondary freight networks. The assignment results provide link-level truck trips and values for each commodity. These values were then compared with Texas Data Management System (TDMS) and TRANSEARCH data to identify any major discrepancies in aggregated freight tonnage and network flow

patterns. The research team also explored possible ways of incorporating estimated commodity value into the infrastructure investment decision-making process.

Lastly, the report incorporates commodities' seasonal variations and the impacts of congestion in the modeling process by estimating the peak and off-peak movement times of commodities and by using afternoon peak travel-time generated by the Statewide Analysis Model (SAM) to perform user-equilibrium-based traffic assignment.

What They Found

The researchers found that a commodity based approach can use commodity-specific data to develop a flow estimation methodology that is tailored for that commodity and therefore provides an opportunity to perform detailed analysis of that commodity's movements along its supply chain. However, this commodity-specific approach requires detailed study of each commodity and can be both time- and resource consuming if it is applied to all commodities. Therefore, this approach is more suitable for studying key commodities or for a specific commodity targeted for further study. More studies need to be performed to develop a methodology that can be used to estimate the total value of all commodities moved on the roadway at a more spatially disaggregated level (e.g., county-to-county) than exiting databases (e.g., FAF).

The researchers have identified some key Texas corridors for transporting those commodities studied in this project. As mentioned earlier, the commodities studied are important to the state economy and the key corridors identified may therefore merit higher priority for investment. The researchers have also explored ways of incorporating freight value into the infrastructure improvement project selection process.

Another finding is that commodities with significant seasonal variation can cause high truck volume during peak seasonal periods and those trucks'

impact on infrastructure can be underestimated if only annual estimations are used.

It is also notable that congestion can impact commodities' destination and route choices. However, a more thorough understanding of different stakeholders' decision-making processes is required to capture all of the factors that affect commodities' destination, route, and other logistic choices.

What This Means

This research provides an insight into the opportunities and challenges of pursuing a commodity-specific approach to estimate the value of commodities moved on the Texas roadway system. This study approach sought to understand the complexities of the interactions between the key stakeholders in freight distribution. It is especially applicable for detailed logistic chain-based study of a small set of target commodities. This project is meaningful because it shows a methodology for detailed commodity flow analysis, and provides insight into the challenges that would arise from a continuous comprehensive statewide freight data gathering program.

The "Guidebook for Estimating the Value of Freight for Texas Highways" developed in this project provides a tool to guide the process of estimating the value of commodities that are of interest to TxDOT. Another product of this project, the GIS database, provides a clear picture of the movements and value of several key commodities on Texas freight network.

Based on this study, the research team recommends that commodity values to be considered in the investment decision-making process so that those roadways carrying high values of freight can receive commensurate funding for improvements. It is also recommended that peak seasonal periods and daily truck volume during those periods should be identified so that the impact of those commodities' movements on infrastructure can be more accurately evaluated.

For More Information

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