SHRP2 SOLUTIONS
TOOLS FOR THE ROAD AHEAD

Comparing the Models:

Insights from Freight Behavior Data Improve Wisconsin's Freight Models

BACKGROUND AND CHALLENGE

In 2013, the Wisconsin Department of Transportation (WisDOT) began updating the passenger component of its statewide travel demand model, while also updating the model's conventional, trip-based freight element. As a result of significant advances in the state of the practice for behavior-based freight modeling, planners within WisDOT wanted to explore the benefits the State might realize from using a behavior-based model versus a traditional model.

Source: Drivewyze-Barole Trucking by TruckPR/CC BY 2.0.

APPROACH

To identify how a more advanced behavior-based freight model could support transportation planning and decisionmaking, WisDOT applied for and was awarded funding from the Strategic Highway Research Program 2 (SHRP2) C20 Implementation Assistance Program to develop a proof-of-concept behavior-based freight demand model and compare it against the conventional model. The project team based the new model on one previously implemented in the Chicago metropolitan area. Six real-world scenarios were developed to compare the two models.

Project Type:	**Behavior-Based Freight Demand Model**
Grant Recipient Agency:	**Wisconsin Department of Transportation**
Location:	**Wisconsin**
Duration of Activity:	**2014 to 2016**
Budget:	**$350,000**

The main objective of this project was to develop a framework to:

- Address deficiencies in WisDOT's current statewide freight forecasting practice.
- Represent characteristics of firms, shipments, supply chains, and distribution channels.
- Describe trip chaining that occurs in the delivery of goods.

Secondary objectives were to improve and expand WisDOT's knowledge of freight activity in the State, standardize analysis through tools and models, and serve as a channel for discussion of freight-related policies, needs, and issues with freight stakeholders.

The six scenarios chosen to compare with the traditional model were developed from actual events and circumstances brought to WisDOT's attention in recent years. Results of the model comparisons are shown in **Table 1**.

Table 1. Model Comparison Results

Scenario	Advantage	Rationale
Truck Size and Weight Increase	Neither	A number of assumptions were needed to use both models for this scenario, and as such model results were not expected to be precise. Further, neither model can address the legal, environmental, safety, nor other impacts of this policy change as these models were not designed to address those issues. Neither model has an advantage when addressing this scenario.
Construction of a Fulfillment Center	Existing Statewide Model	The behavior-based model can forecast mode shift, but does not do well forecasting changes in truck volume. As such, results of the behavior-based model provide no significant improvement over the existing model in analyzing a new fulfillment center.
Reintroduction of Intermodal Rail Terminal	Behavior-based Model	The behavior-based model can forecast mode shift, including usage at other intermodal rail terminals in Wisconsin.
Construction of a Transload Facility	Existing Statewide Model	The scenario selected includes adding a second transload facility in a county that currently has only one. Because the behavior-based model's analysis is no finer than the county level, and the additional transload facility does not change the supply chain's utility, forecasts from the behavior-based model are not affected by the development of this facility. The Statewide model allows users to enter a special generator for the new facility.
Construction of a Distribution Center	Existing Statewide Model	The behavior-based model can forecast mode shift, but does not prove any better in forecasting changes in truck volume. As such, results of the behavior-based model are not especially useful in analyzing a new distribution center.
Track Abandonment	Neither	While the behavior-based model did show a reduction in rail mode share (and an increase in truck mode share), the Statewide model indicated rail demand that was not being assigned given the absence of the track. These are equivalent conditions, as one could assume that the unassigned rail tons would shift to truck transport.

BENEFITS AND IMPACTS

Key elements that contributed to project outcomes and subsequent impacts include:

- Access to the model code developed as part of the Federal Highway Administration's (FHWA) Broad Agency Announcement behavior-based freight modeling project implemented by the Chicago Metropolitan Agency for Planning for the Chicago region.
- Input from representatives of Wisconsin metropolitan and regional planning organizations.
- Expertise in freight data collection and modeling.

Resources generated by the project include:

- A comprehensive review of freight data sources.
- Data collection, data acquisitions, and data analysis.
- A proof-of-concept modeling framework that represents the full supply chain for specific commodities shipped from the supplier to the customer.
- Updated and more transferable freight model code.

Benefits

Benefits realized from this project include the ongoing use of the resources it created as well as the changes it may influence in stakeholder behavior. Specific outcomes are listed below:

Outcome	Evidence
Better understanding of applications for behavior-based freight models.	Comparison of the two options showed that behavior-based models excelled at evaluating mode shifts given a change in transportation system intermodality, but that these models, as currently implemented, do not provide much advantage over traditional models in evaluating changes in truck volume.
Tools and models developed/enhanced.	A supply chain model was developed that can provide estimated mode shifts given changes in transportation system intermodality.
Improved transferability of freight model code.	During implementation, the project team determined that several components of the Chicago region code that served as the foundation for this model needed to be modified for the Wisconsin implementation and other portions needed to be rewritten. This produced updated code that is portable and can be passed to other agencies that wish to develop and implement behavior-based freight models.
New insight into how freight trucking operated within Wisconsin.	The behavior-based model provided additional insight into freight shipments and suggested that nearly half of the truck tons analyzed moved through a regional distribution center. While these truck-to-truck transfers are likely accounted for, this linkage was not specifically identified in trip-based model output.
Confirmation of available freight data.	Before developing the behavior-based model, the project team needed to determine whether or not the required data was available for the model. Between public and agency data sources, the team confirmed the availability of sufficient data.

Source: Pixabay

Impacts

Impact measures are the ultimate benefits of using a product. These are longer term, value-added impacts of the product related to saving time, money, and lives.

Impact	Application
Guidance for the future of WisDOT freight modeling.	A better understanding of the behavior-based model's capabilities allows WisDOT to focus funding on maintaining and improving its existing trip-based freight model.
Advancement in the state of the practice for behavior-based freight modeling.	The behavior-based freight model implemented in this project builds from a previous model developed by the Chicago Metropolitan Agency for Planning and includes updated and more transferable code that can assist other agencies in implementing a similar evaluation.

PARTNERSHIPS

Wisconsin Department of Transportation (WisDOT) – Led overall project management.

Representatives from the Milwaukee, Eau Claire and Fox Cities Metropolitan Planning Organizations, as well as a representative of the North Central Wisconsin Regional Planning Commission – Participated on a Technical Advisory Committee.

Federal Highway Administration (FHWA) – Provided coordination support as well as technical and administrative guidance.

FOR MORE INFORMATION

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Learn more about the SHRP2 program, its Capacity focus area, and Freight Demand Modeling and Data Improvement (C20) products at www.fhwa.dot.gov/GoSHRP2/

SHRP2 SOLUTIONS

The second Strategic Highway Research Program (SHRP2) is a partnership of the Federal Highway Administration (FHWA), the American Association of State Highway and Transportation Officials (AASHTO), and the Transportation Research Board (TRB). TRB completed the research, and now FHWA and AASHTO are jointly implementing the resulting SHRP2 Solutions that will help the transportation community enhance productivity, boost efficiency, increase safety, and improve the reliability of the Nation's highway system.

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