SHRP2 SOLUTIONS
TOOLS FOR THE ROAD AHEAD

Intra-Local Distribution Model:

How Regional Tour-Based Truck Movement Fits Within Statewide Flows


Source: Thinkstock

BACKGROUND AND CHALLENGE

Estimating and forecasting freight movements in today's heavily congested Baltimore-Washington metropolitan area demands sophisticated models and analytics well beyond the capability of traditional tools. The Baltimore region contains many major freight facilities serving all modes, including the nation's sixth largest port, the Port of Baltimore, two Class I and three regional railroads, as well as the Baltimore/Washington International Thurgood Marshall Airport. Situated at the midpoint on the eastern seaboard, the heavily congested Baltimore-Washington region has an extensive roadway and highway network but dense urban development offers limited infrastructure expansion options. The Maryland Department of Transportation State Highway Administration (MDOT SHA), Baltimore Region Transportation Board (BRTB), and the Baltimore Metropolitan Council (BMC), understood that these factors as well as the intricacies of international supply chains and the need to account for trip-chaining behavior of commercial truck drivers in urban areas presented complexities for which they needed innovative data models.

Project Type:	**Behavior-Based Freight Demand Model**
Grant Recipient Agency:	**Maryland State Highway Administration and the Baltimore Metropolitan Council**
Location:	**Maryland**
Duration of Activity:	**2014 to 2017**
Budget:	**$350,000**

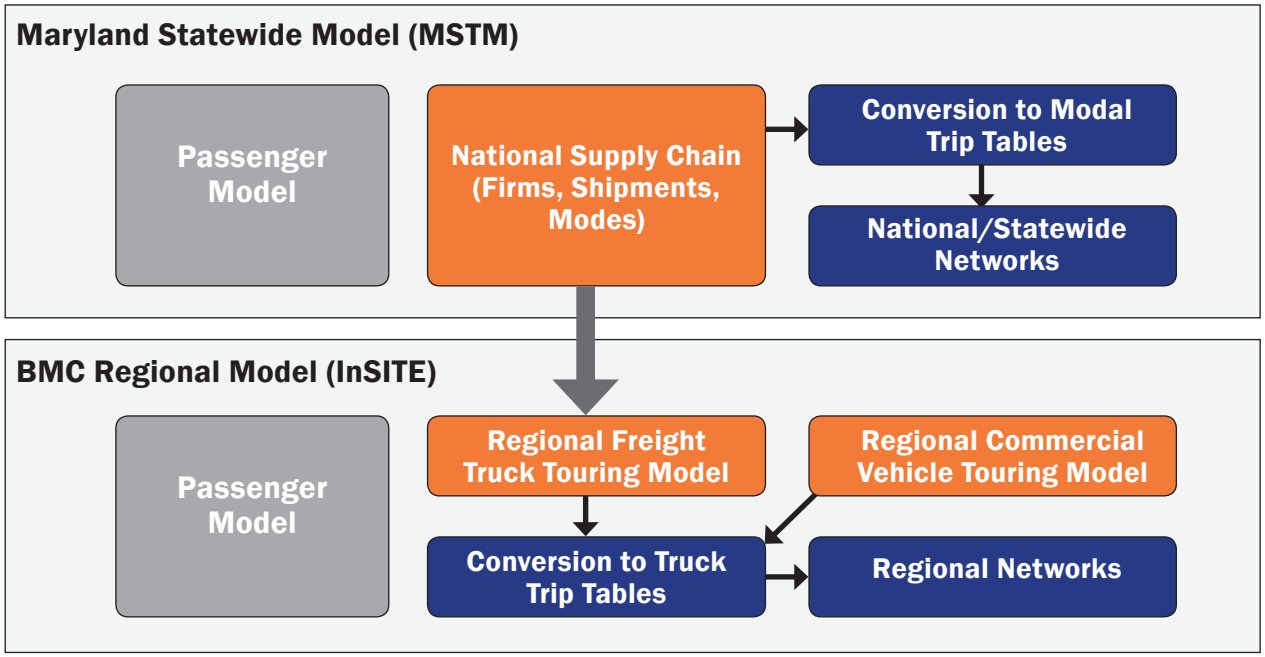
APPROACH

In recent years, the MDOT SHA, BRTB, and BMC had worked together to advance their collective transportation modeling capabilities. Building on this partnership, the group developed an operational behavior-based freight model sensitive to both long-distance freight flows and short-distance urban truck tours. The model resulting from this project met a number of criteria useful to both the MDOT SHA and BMC, including:

- Support for decisionmaking by MDOT SHA (statewide) and BMC (regional).
- Sensitivity to different performance measures and policy questions each agency may have.
- Modular design and model construction, allowing flexibility for data, analysis, and integration options.

To ensure success of the new behavior-based model, the project delivered both hands-on training and staff capacity-building. It also produced a documented plan to guide the agencies through the initial years of model use.

The model provides three levels of geographic coverage: urban shipments within the BMC's region, shipments across the State, and shipments into or out of Maryland to or from the rest of the world. The model estimates movements by all major freight modes (truck, rail, water, and air). For goods moved by truck, the model includes light, medium, and heavy-duty vehicles. To accomplish this ambitious agenda, the project team designed the new model to be integrated with two existing passenger demand models: the Maryland Statewide Model (MSTM) and BMC's regional model (InSITE). The overall model design, components, and integration between the MSTM and InSITE is shown in **Figure 1**.



Source: Resource Systems Group, Inc.

Figure 1. Diagram. Overall model design.

BENEFITS AND IMPACTS

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

- An existing working relationship between project partners.
- Existing relationships with relevant freight stakeholders in the region.
- Collaboration between the public and private sectors.
- Expertise in freight data collection and modeling.

Resources generated by the project include:

- All project data assembled into a complete package (i.e., a documented, organized set of folders of data, files, analysis outputs, and scripts).
- A fully-validated freight model system ready to use in the statewide and regional transportation planning process.
- Freight Model System Plan covering schedule and phased incremental enhancements.
- On-site training activities to build MDOT SHA and BMC staff capabilities for use of the new product.

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
Well-documented, new, and consolidated freight data.	The project improved freight data maintained by MDOT SHA and BMC in two distinct ways. First, the project team identified and collected more than a dozen datasets for use in the model. Second, before the start of this project, freight knowledge was spread across different staff and data was spread across different locations and networks. Now, MDOT SHA and BMC can access consolidated freight data in a single location with documentation to guide future use.
Improved public and private sector collaboration.	A stakeholder workshop was among the first steps of the project. The workshop focused on outreach to modelers and potential users of model results. Stakeholders included representatives from: BMC, United Parcel Service (UPS), Federal Highway Administration, MDOT Office of Freight and Multimodalism, MDOT SHA, Maryland Port Administration, Baltimore City Department of Transportation, Baltimore County Office of Economic Development, Norfolk Southern Corporation, CSX Railroad, and Brookings Institute.
Better understanding of freight shipments in Maryland.	The new model provides insight into supply chain decisions, including distribution channels, models, and shipment sizes. This allows planners to gain a better understanding of potential mode shift scenarios, such as the development of a new regional distribution center. Changes to levels of imports and exports can be incorporated to show impacts on truck traffic near Maryland's major airports, seaports, and railyards.
Ability to conduct more fine-grained analysis.	The new model allows MDOT SHA and BMC to understand vehicle movement on the micro-level. Examining truck touring behavior, both spatially and temporally, helps MDOT SHA and BMC ask many different questions and investigate a variety of scenarios (e.g., activities such as bridge maintenance that might be prioritized based on truck concentrations at specific times of the day). Detailing commodity movements allows MDOT SHA and BMC to understand the freight transportation network and complete analyses such as identifying high-value commodity corridors or determining what commodities are most affected by (or contributing to) bottlenecks.

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. Specific impacts from this project include:

Impact	Application
Advances the state of the practice for behavior-based freight modeling.	The behavior-based freight model implemented in this project builds from previous iterations of similar models by including truck touring behavior from non-freight hauling trucks in the service sector (e.g., construction vehicles).
Possibilities for planned future model improvements.	The new models have been designed to facilitate expansion of the truck touring models to cover the entire State of Maryland as MDOT SHA transitions to a more complex statewide model. They also support integration with a new BMC regional model under development. The agencies are engaged in a SHRP2 C10 implementation project, for which the truck touring models produce trip roster outputs that can be assigned using a dynamic traffic assignment model.

Impacts (continued)

Impact	Application
Development of a five-year plan.	The freight model system plan developed for this project serves as a five-year guide informing model development and use. This helps the project team ensure that the model can stay at the forefront of research in the years ahead and identifies a number of valuable action items.
Growth in number of agencies with similar freight models.	The core code for the new model is now in use by other States and MPOs nationwide. An on-line repository has been established in which users and designated stakeholders can collaborate to maintain and improve the model code in an efficient and consistent manner. This repository is also used to report software bugs and their fixes and allows users to download the latest version. Because all users are linked to a central repository, any software fixes or added functionality requested by one agency can be downloaded for use by another.

PARTNERSHIPS

Maryland Department of Transportation State Highway Administration (MDOT SHA) – Led overall project management.

Baltimore Metropolitan Council (BMC) – Oversaw project consultant.

Baltimore Region Transportation Board (BTRB) Freight Movement Task Force – Provided stakeholder input.

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/

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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