Development of a Behavioral-Based National Freight Demand Model
and an Innovative Freight Data Collection Method

Exploratory Advanced Research . . . Next Generation Transportation Solutions

Understanding how freight moves now and predicting how it might flow in the future are essential to transportation planning that meets the need for efficient, safe, and economical freight movement. The Federal Highway Administration (FHWA) Exploratory Advanced Research (EAR) Program is supporting freight transportation research that will develop tools to accurately model future freight demands and devise new methods of freight data collection. Resource Systems Group, Inc. (RSG), with research partners at the University of Washington and the University of Toronto, launched the "National Freight Demand Model" project. It will allow decisionmakers to understand better the factors that influence freight movement on scales ranging from interurban commercial deliveries to regional and national infrastructure needs. In a related FHWA-supported project, "Future Freight and Logistics Survey," the Massachusetts Institute of Technology (MIT) is evaluating the use of innovative communication technologies to collect high-resolution and high-frequency data that accurately describe the behavior of choices that underpin freight movement. Together, these EAR Program-funded projects will significantly enhance transportation managers' ability to anticipate and plan freight movement capacity, operation, and infrastructure investment.

Developing New Tools to Forecast Freight Demand and Movement

Private shippers move freight on infrastructure such as highways, airports, and navigable waterways. Public organizations build and operate this infrastructure, while a mix of national, State, local, and regional agencies manage the infrastructure. These agencies must work with one another and with governmental and private-sector partners such as trucking companies. Most existing freight models lack the sensitivity to consider changes in the economy, modal networks, taxes, productivity, or fuel prices. The development of a national freight demand modeling system could address these sensitivities and support the evaluation of national policies affecting the movement of goods.

RSG and its research partners are gathering and integrating available data to develop a national freight model estimation. This research will be the foundation for a modeling framework for next generation behavioral and agent-based predictive tools. These tools will be capable of modeling complex interactions that underlie logistics and transport choices and can be applied at various geographic levels. Models that emerge from the framework will ideally provide users with policy-related analysis of nine key areas: economics, alternative transport modes (e.g., air or pipeline), pricing, environment, technology, safety, regional policy, port and rail policies, and labor force. Other key objectives are to improve the ability to evaluate transportation investments in infrastructure and services and forecast the effect of changes in demographics, buyer behavior, manufacturing practices, and supply chain patterns.

Data limitations represent one of the key challenges for developing the model framework. Researchers will define data-related minimum fields, resolution, accuracy, consistency, and reliability for new "big data" approaches that might be incorporated to support calibration and validation of models developed through the framework.

U.S. Department of Transportation

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Data Collection to Inform Freight Planning Decisions

The behavior of a wide range of agents—consumers, shippers, commercial freight operators, or individual drivers—affect the demand on and the efficiency of the freight transportation system. Before people can understand how these agents acting together influence aggregate behavior, it is essential to know how each acts individually in various circumstances of freight activities in urban, intercity, and interstate environments. Researchers at MIT are investigating ways to incorporate innovative technological approaches into data-gathering activities to support model development and validation.

It is difficult to integrate data about vehicle movements with economic data about what is inside trucks, trains, planes, or pipelines or on ships because much of the valuable freight data collected by shippers and fleet operators cannot be incorporated easily into a public domain model without disclosing information to competitors. To help provide these essential data, MIT researchers are developing freight logistics survey methods that will use smartphones, tablets, Global Positioning System (GPS) loggers, radio frequency identification, mobile sensing, and wireless communication technologies to collect data that accurately describe what freight transportation agents do, while minimizing the burden of data reporting and protecting sensitive business information. The researchers will validate and enhance this trove of observed behavioral data through in-person and Web- or tablet-based recall surveys to reveal underlying decisionmaking and choice among multiple logistics and route variables.

© 2016 Intelligent Transportation Systems Laboratory at the Massachusetts Institute of Technology. Researchers at the Massachusetts Institute of Technology are developing freight logistics survey methods that will integrate data from various agents and devices.

Photo credit, page 1: © 2017 vitpho/iStockphoto. Data from urban and interurban freight delivery patterns will improve methods to model and predict demand.
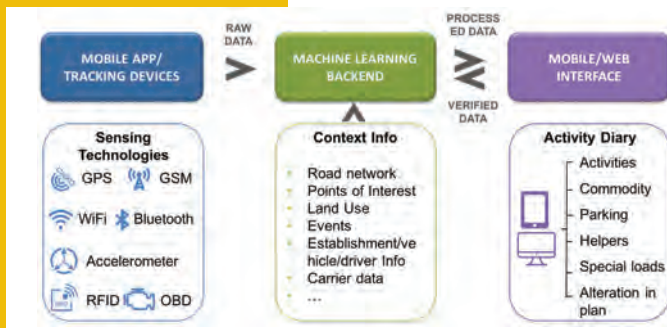
What Is the Exploratory Advanced Research Program?

The EAR Program addresses the need for longer term, higher risk research with the potential for transformative improvements to transportation systems—improvements in planning, building, renewing, and operating safe, congestion-free, and environmentally sound transportation facilities. The EAR Program seeks to leverage advantages in science and engineering that could lead to breakthroughs for critical, current, and emerging issues in highway transportation—where there is a community of experts from different disciplines who likely have the talent and interest in researching solutions and who likely would not do so without EAR Program funding. To learn more about the EAR Program, visit http://www.fhwa.dot.gov/advancedresearch. The website features information on research solicitations, updates on ongoing research, links to published materials, summaries of past EAR Program events, and details on upcoming events.

"FHWA's efforts to develop and refine a complex freight demand modeling framework are still in an exploratory stage, but our research to date shows that the project will be able to identify and resolve the inherent methodological and data-related problems," says Birat Pandey of FHWA's Office of Freight Management and Operations.

Learn More

For more information about this EAR Program project, contact Birat Pandey, FHWA Office of Freight Management and Operations, at 202-366-2842 (email: birat.pandey@dot.gov).