Research Note

Development of a Truck Freight Economic Impact Methodology for Project Planning and Prioritization

From the WSDOT Research Office
June 2013

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Truck freight US 101; WSDOT photo.

Background

How do we know if public investments in freight systems improve economic growth? Moving Ahead for Progress in the 21st Century Act

The cornerstone of the 2012 federal reauthorization of the surface transportation act, Moving Ahead for Progress in the 21st Century (MAP-21), is the transition to a **performance and outcome-based program.** The Washington State Department of Transportation (WSDOT) commissioned this research to develop a quantitative analysis method to evaluate the freight benefits of proposed truck freight highway projects. To prioritize public investments in freight systems and to ensure consideration of the contribution of freight to the overall transportation system performance, states and regions need an improved method to analyze freight benefits associated with proposed highway and truck intermodal improvements. This approach was developed and tested as part of the Washington State Freight Mobility Plan. The goals of the Freight Plan are to enhance trade and sustainable economic growth; and to improve safety, environmental quality, and goods delivery in Washington State.

What We Did

This research developed an agency friendly, data supported framework to prioritize investment in freight systems.

This research integrates two ongoing research projects: one to create methods to calculate the value of truck and truck-intermodal infrastructure projects and the other to collect truck probe data from commercial GPS devices to create a statewide Freight Performance Measures (FPM) program. This integration enables the development of a framework that allows public agencies to quantify freight investment benefits in specific areas such as major freight highway corridors. The following page identifies issues addressed in development of the framework.

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Advancing beyond commuter and transit centric economic analyses and performance metrics

- While the value of time for freight transportation is often estimated based on the hourly wage of the truck driver, the driver's wage reveals only a fraction of the true value of time in a freight operation. Freight transport typically involves multiple actors, consisting at least of shippers (the customer) and carriers (the trucking firms). The value placed on a reduction in travel time differs considerably across shippers of different products based in part on the value of the product, as well as attributes like perishability. Other factors affecting the value of time include distances involved in point-to-point shipments, transport mode connectivity, logistic reorganization, as well as opportunity costs.

- Benefits and impacts extend beyond the roadway and the carriers on it. As carriers experience increased efficiencies on the roadway, shippers may adjust long run scale, scheduling, and logistics plans. The markets and industries involved similarly may witness changes to production patterns in distribution or supply regions. Increased efficiency may then lead to economic development and ensuring public benefits.

- More than simply a consideration of time on the roadway, freight users experience a potentially greater benefit of infrastructure improvement through increased reliability of the time necessary to traverse a roadway or route. In today's just-in-time marketplace, consistent and reliable travel time estimation directly impacts the bottom line of freight dependent industries.

The importance of implementing the right model(s) for the job

- **Regional Travel Demand models (TDM):** Washington doesn't have a statewide travel demand model, so WSDOT used existing regional travel demand models from the state's Metropolitan Planning Organizations (MPOs). These models were chosen because of their ability to compute changes in network travel times—an improvement over many sketch-planning tools that only estimate link-level travel time changes.

- **Benefit Cost Analyses (BCA)** such as those developed in this research and those widely used by transportation agencies, provide a necessary first step in understanding whether society is better off under a proposed investment, 'build scenario'. The build scenario is compared to the condition in which the investment is not made ('no-build') or under other investment alternatives. However, a standalone BCA falls short in allowing an agency to consider the increases in productivity and economic efficiency resulting from an infrastructure investment. To respond to MAP-21 and state requirements, WSDOT must provide an analysis of change on the economy due to proposed investments.

- Industry responses to the increased transportation efficiencies may include job creation, wage level changes, business activity, and tax base expansion resulting from increased accessibility and connectivity. These responses may be captured via an **Economic Impact Analysis (EIA)** that enables the enumeration of the likely change in the economy as a result of the benefits identified previously. In this research the team identified and compared two models of analysis of the economic impacts: (1) Input-Output (I-O) Model, and (2) Computable General Equilibrium (CGE) Model.

- The choice of economic impact model becomes a critical consideration where infrastructure projects are potentially large enough and trucking productivity is increased to the point that fewer trucks – and therefore fewer drivers – can meet demand needs. The nature of the I-O model structure does not pick up this effect. However, the more robust CGE is able to directly model increased productivity of an industry and is thus able to model the entire economy-wide reaction to the infrastructure improvement that is a result of decreased operating cost and travel time.

    - Despite some loss of employment in the trucking industry, the gain to employment of other industries more than offsets the loss.

    - It is for this specific ability to model productivity changes that a regional CGE model should be incorporated into the prioritization process as a complementary tool to the BCA.

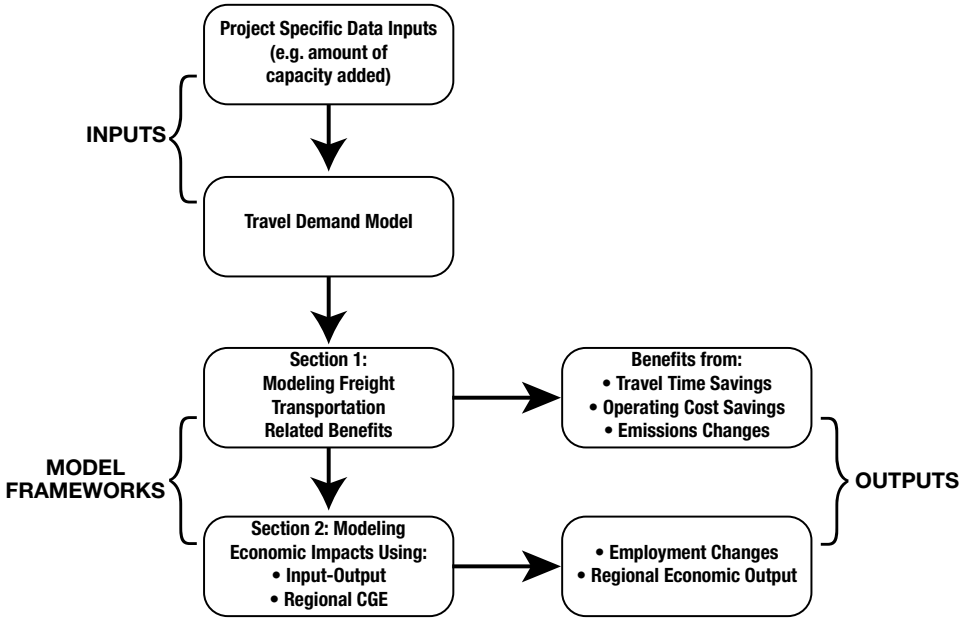
What We Learned

Engaging knowledgeable stakeholders produces a robust benefit understanding

This research sought to support the development of the Washington State Freight Mobility Plan mandated by state law. The process to develop and identify the benefits that stem from infrastructure investment projects included WSDOT facilitated discussions with key stakeholders throughout the state. These stakeholders, divided into three Technical Teams (Urban Goods Movement, Global Gateways, and Rural Economy), were tasked with providing the research team with measurable benefits and potential data sources that are important to shippers, freight carriers, air quality stakeholders, labor, and federal, state, regional and local governments including ports. After substantial consideration, the Technical Teams' list of prioritized, measurable, and implementable benefits included: Improved travel times; Improved travel time reliability; Reduced truck operating cost; Improved air quality: truck emissions; and Economic output.

Based on the available data and modeling tools described above, and compatible with regional Travel Demand Models in the state, benefits associated with travel time, truck operating costs, and emissions (using the Motor Vehicle Emissions Simulator (MOVES 2010)) were incorporated into the BCA and evaluated on two case studies in distinctive parts of the state, and located on the state's truck freight economic corridors. As shown in the figure below, the benefits were then used as inputs to the Economic Impact Models.

Summary of Truck Freight Direct Benefit and Economic Impact Methodology Process



Lessons Learned

The Case-Study examinations produced several valuable take-home lessons for future WSDOT efforts to fully incorporate freight related benefits and impacts from freight corridor projects:

- Regional assumptions about the geographic scale of potential impacts should be considered. Scale not only impacts benefit estimation as it is generated by land use, household, and employment assumptions, but it also effects the economy wide impacts based on the industrial make-up and subsequent trucking demands of a region.
- DOTs must evaluate both the passenger and truck freight economic impacts of large highway projects. Future efforts should be made to develop feedback loops that will permit forecasting capabilities through combined use of the TDMs and CGEs.

The Importance of Accounting for Reliability

Noticeably absent from inclusion here is an accounting for the improved reliability that results from an investment. Through coordination with a second WSDOT supported probe-data study, researchers have been able to suggest the manner by which consideration of reliability may be able to be further included. This effort has identified a bimodal approach, capable of operating even with sparse data, to characterize roadway segments as reliably fast, reliably slow, or unreliable.

Implementation

This research is a deliverable of the Washington State Freight Mobility Plan. This Plan will develop and prioritize freight transportation system improvement strategies and support and enhance trade and sustainable economic growth, safety,

the environment, and goods delivery needs in Washington State. The estimation of truck freight benefits and economic impact analysis are designed to be additional factors that can be taken into account in WSDOT's project prioritization process. Further refinement and incorporation of truck freight benefit and economic impact modeling methodology into existing WSDOT processes is ongoing.

Truck freight US 101; WSDOT photo.

Contact Information

Report Title and Number
Development of a Truck Freight Benefit / Cost Methodology for Project Planning
WA-RD 815.1

www.wsdot.wa.gov/Research/Reports/800/815.1.htm

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Funding
$45,000 State
$355,000 Federal

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13-10-0002174