Estimating the Monetary Benefits of Reducing Delays on Heavily Trafficked Truck Freight Corridors: Thinking (About What’s) Inside the Box

by
Frank Southworth
&
Denise A. Smith

School of Civil & Environmental Engineering
Georgia Institute of Technology
Atlanta, GA 30332

University Transportation Center Conference
Atlanta, GA March 23-24, 2014
**Background:** The July 2012 MAP-21 legislation requires state DOTs to develop performance targets in support of their strategic freight plans, while emphasizing the role played in the economy by strategically significant freight corridors.

We focus here on the following question:

*How do we estimate the monetary value of reducing corridor traffic congestion?* This leads us to ask in turn:

a) **What goods are moving on our major highway corridors** (now and in the future)?

b) **How fast are they moving**?

and,

c) **What do delays to these goods movements cost** (in dollar terms) U.S. industries?

**Objective:** Specifically, **this project aims to develop improved estimates of the value of travel time savings for different classes of truck travel, using a method that can be applied at the level of intercity corridors.**
Project Tasks

**Task 1: Defining a Study Corridor**

**Task 2: Generating a Matrix of Origin-Destination-Commodity-Truck Class (O-D-C-V) Flows based on Location Specific Economic Activity Data.**

**Task 3: Carrying out a Multi-Class, Origin-Based and Congestion Sensitive Assignment of Truck Trips to the Selected Corridor**

**Task 4: Estimating the Dollar Value of Recent and Future Year Truck Travel Time Savings (under different O-D disaggregation, different ton-to-truck conversions, different value of time assumptions)**

**Task 5: Writing the Draft and Final Project Reports**
The Challenge:

**Detail O-D data on commodity flows is very limited** and likely will be difficult to come by for some time. (Surveys too costly, limited IT information on loads)

For planning purposes, **this means creating synthetic, geographically detailed commodity-cum-vehicle class specific O-D Flow matrices from a combination of data sources**

Innovation:

The R&D looks to improve current planning practice through:

- Use of **alternative spatial and industrial sector disaggregation** methods.

- Use **recent advances in origin-based network route assignment modeling** to connect detailed O-D-Commodity specific flow estimates to specific corridor movements.

- Use the latest theoretical developments in **value of time modeling** to produce monetized benefits estimates grounded in travel behavior and spatial economic theory
Progress to Date:  

Task 1: Corridor Selection

Candidate Corridor 1: I-20/I-85 Corridor: Huntsville, AL <-> Atlanta, GA <-> Greenville, NC

Candidate Corridor 2: I-85 Corridor: Montgomery, AL <-> Atlanta, GA <-> Greenville, NC
Modeling at Three (or More) Levels of Spatial Disaggregation

- FAF3 Regions
- Corridor Counties/Zips
- SE Counties
Task 2: Generating a Matrix of Origin-Destination-Commodity-Truck Class (O-D-C-V) Flows (continued...)


- Some 30 Past Studies Reviewed

- Proportional Weighting (based on zonal employment, payrolls, populations, ...)
- Regression Models
- Input-Output (Use & Make) Based Models
- Simultaneous / Structural Equation Models (SEMs)
- Special Freight Generators

- Freight Generation / Attraction (Os & Ds) → O-D Commodity Flows → Ton-to-Truck to-PCE conversion methods (including empty trucks) → Multi-Class Truck to Highway Traffic Assignment

- Bi-Proportional Matrix Balancing Methods
- Spatial Interaction (Gravity, Entropy, ...) Models

- Direct Demand Commodity Flow Models (Os, Ds, and O-Ds)
- All-or-Nothing Route Assignment
- Wardrop User Equilibrium (WUE)
- Stochastic User Equilibrium (SUE)
- Origin-Based (Multi-Class) UE...
Commodity-to-Truck Flow Modeling Using Multiple Data Sources

- FAF3 O-D-C data
- BLS, CBP and ZBP business patterns data
- Data on Special Generators
- FAF3 and ORNL Network Data (Modifiable)

Alternative O-C and D-C Disaggregation Models

Alternative O-D-C Flow Estimation Models

Ton-to-Truck-to-PCE Conversions*

OUE-Based Multi-Class Network Assignment

- Value-of-Time Modeling
- Corridor-Based Freight Performance Measures (FPMs)

Flow/Speed Validation

VOT-Based Travel Costs

ATRI Speed Data

GDOT/HPMS Truck Counts

*Including empty truck trips
County & Zip Code Based Freight-Inducing Industrial Activity — How Useful is Current Data ???
Task 3: Multi-Class, Origin-Based and Congestion Sensitive Assignment of Truck Trips to A Selected Corridor

An Example Commodity -cum-Truck Flow Pattern (Preliminary)

Live Animal/Fish Shipments to & from SE United States, 2007

Origin-Based UE Traffic Assignment based on a simple county O-D disaggregation and a ton-to-truck pce model
Task 4: Estimating the Dollar Value of Recent and Future Year Truck Travel Time Savings

Truck Transport and Logistics Cost Modeling Concept

- Vehicle Type
- Commodity Class
- Average Load (Tons or Units /Vehicle)
- Average Speed (mph)
- Average Fuel Consumption (Gallons/Mile)
- Average Fuel Cost ($/Gallon)
- Average Loading /Unloading Cost ($/Vehicle Load)
- Average Storage Cost ($/Load/Hour)
- Fuel Cost Per Trip ($)
- Storage & Handling Cost Per Trip ($)
- Per Trip Travel Time
- O-D Trip Distance (Miles)*
- Labor Cost Per Trip ($)
- Average Labor Cost (Driving) ($/Hour)
- Vehicle O & M Cost Per Trip ($)
- Average Vehicle O&M* Cost ($/Mile)
- Average $ Cost Per Vehicle Trip
- # of Vehicle Trips Per O-D Pair
- Transport & Handling Costs ($)
- # of O-D Pairs

** From Assignment Algorithm

* Vehicle O&M cost includes costs associated with tires, oil, parts maintenance and replacement, insurance and licenses