

I. Title

Methods For Forecasting Statewide Freight Movement

II. Research Problem Statement

The volume of freight moved within the United States has risen rapidly over the past three decades. Those movements are now straining the ability of many states' multimodal transportation infrastructures to accommodate them. The spatial pattern of those movements has also seen significant changes. Some of those changes are due to new product markets opening up while others reflect changes in mode specific transportation costs. Analytic methods are needed to help states forecast what such future mode and commodity specific freight movement patterns are likely to be. Without such forecasts it will be difficult for states to anticipate their needs for location- and mode-specific transportation infrastructure investments. Nor will a state be as effective in assessing what the economic and environmental impacts of proposed infrastructure investments will be. Currently there exist numerous gaps in the empirical data needed to develop the necessary origin-to-destination (O-D) freight movement forecasts. This is especially true in the case of truck-only as well as truck-inclusive freight movements. Analytic methods are needed to fill these data gaps and to use the resulting traffic flow matrices to forecast origin-to-destination freight movement patterns a number of years into the future. These include freight movements both within and between a state's major urban systems as well as freight crossing its borders.

III. Research Objective

The objective of this project is to review both current and potentially novel ways of generating both base year and forecast origin-to-destination, statewide freight movement matrices. On the basis of this review, the project should recommend, and where possible demonstrate, the value of using one or more analytic methods for creating such trip matrices. These matrices should be capable of being disaggregated to a county-to-county or finer level of spatial resolution for specific modes and commodity classes. A major task of the project is to determine the most effective methods for doing so, with reasonable statistical accuracy, given commonly available data sources.

IV. Major Tasks

1.Reasons For Making Forecasts. The study should begin by establishing the major uses states have for both base-line and forecast freight movement matrices, on both a commodity and vehicle/mode specific basis. The study will determine how much detail is useful in terms of a) commodities moved, b) modes used and c) types of vehicle equipment involved. The study should also begin by considering how far into the future such forecasts are useful, and how often updates to forecasts are warranted.

2. *Generating Base Year Movement Matrices.* The study should review freight trip matrix generation methods and supporting data sources. The review should consider and critique the pros and cons associated with the following complimentary approaches to this problem: a) methods for extracting more information from currently under-utilized sources of information, and b) statistically sound methods for merging data from different sources in ways that allow both gap filling and disaggregation within freight movement matrices.

2.1 The review should highlight successful efforts by states to develop mode and commodity specific vehicle-based and/or commodity-based freight movement matrices, as well as point out the weaknesses in past efforts to do so. This includes use by states of the data on commodity and vehicle movements available in federally supported modal and multimodal databases. The study should include successful examples of how states have used existing data sources and also employed GIS technology to store, display and analyze such matrices.

2.2 The review should identify and assess critically the pros and cons of statistically based methods for i) generating synthetic O-D matrices, ii) methods for filling missing elements in existing freight movement matrices, and iii) methods for allowing further spatial and commodity class disaggregations of existing movement matrices. This includes the use of log-linear modeling of categorical data, the use of spatial interaction models, the use of inter-regional input-output models, and enhancement of synthetic O-D tables using location-specific commodity or freight-vehicle specific measures of freight activity (for example, data from electronically generated roadside traffic counts, bar-coded containers, shipment manifests, and government reports of border crossing activity).

2.3 A critical review of the traffic analysis geographic zone systems available for, and most suited to, state freight movement planning applications is needed. Practitioners should be contacted to identify needs, issues, problems encountered, lessons learned, and the state of practice. The review should provide recommendations for how to design new or adapt existing traffic zone systems to accommodate mode and commodity class specific freight movement matrices. The possibility of merging a state's Metropolitan Planning Organizations' (MPOs) zoning systems with zones designed to cover the non-metropolitan areas within a state needs to be addressed. Special attention should be given to zoning for high activity freight generators and attractors. The study needs to demonstrate how, in practice, traffic zone system design is bound up with the problem of data availability. The study should also demonstrate the applicability of the above data sources and modeling techniques for estimating cross-boundary or external freight movements. These are movements that enter or leave a state from or to other states or countries. These movements also need to be recognized in the design of the supporting system of traffic analysis zones.

The study should demonstrate, by numerical examples, the pros and cons of specific freight movement matrix generation techniques. It should also do the same for alternative traffic analysis zone system designs.

2.4. The study should address the issue of translating commodity flows into mode specific vehicular flows, including the problems of estimating the number of partial or entirely empty vehicle backhauls.

2.5 The issue of estimating intermodal commodity movements needs to be addressed. The study will examine what are the best ways to model these flows for planning purposes?

3. *Forecasting.* The study should review the methods available for projecting base year commodity based freight movement matrices into future years, and recommend useful techniques for doing so. The review should address the issue of how often and how easily forecasts can be generated, and for how many years ahead such forecasts should be possible, recognizing the data requirements for doing so. The statistical accuracy of such forecasts should be investigated and reported.

V. Anticipated Budget

The project is expected to cost \$300,000.

VI. Time Required

It is anticipated that the project will require 2 years.