Center for Transportation Research
The University of Texas at Austin

CENTER FOR TRANSPORTATION RESEARCH
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PROJECT SUMMARY REPORT

Project Summary Report 0-4013-S
Project 0-4013: Competitiveness of Alternative Transportation Modes
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Decision Support Framework For The Evaluation Of Modal Competitiveness: A Summary

Introduction

Over the past few decades, the relative competitiveness of specific modes of transportation has changed, as newer technologies have been introduced and as spatial and temporal activity patterns that drive the demand for transportation have changed. For example, since the 1950s, the use of transit has declined as commuters have shifted to automobiles and have made residential location choices on the basis of automobile accessibility. In addition, over the years, freight truck traffic has increased more rapidly than passenger traffic at a time when building additional road capacity has become more and more expensive and in many cases undesirable. As a result, highway congestion has increased dramatically, resulting in concerns about environmental and energy impacts. Decision-makers have thus become increasingly concerned about the negative impacts associated with the growing disparity between transportation demand and supply. In an effort to act proactively, the Texas Department of Transportation (TxDOT) contracted with The University of Texas at Austin's Center for Transportation Research to explore the competitiveness of alternative transportation modes.

What We Did...

The main objective of project 0-4013 was to document the factors and policies that have a significant impact on freight and passenger mode shares. To achieve this objective, the research team has developed a decision support system (DSS) to assist TxDOT and local Metropolitan Planning Organizations (MPOs) in planning for an efficient and balanced multi-modal transportation system for Texas. The DSS is structured to provide a comprehensive and easy-to-use knowledge base to study the competitiveness of alternative modes for passenger and freight transportation. Presented as a prototype software program, it incorporates the results of recent research on the determinants of mode choice as well as lessons learned in practice regarding the effect of specific policies on mode utilization. This software was developed as a relational database in MS Access and it comprises two components: qualitative and quantitative.

Qualitative Analysis Component

The qualitative component enables the analyst to examine the direction of the likely impact of a specific factor on mode utilization,

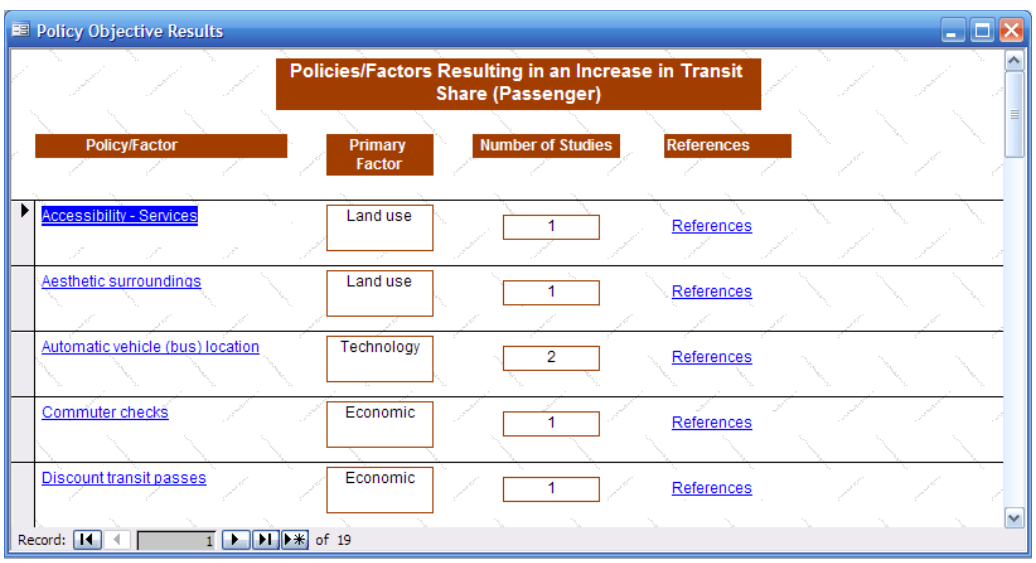

Figure 1: Sample output display for objective-oriented analysis

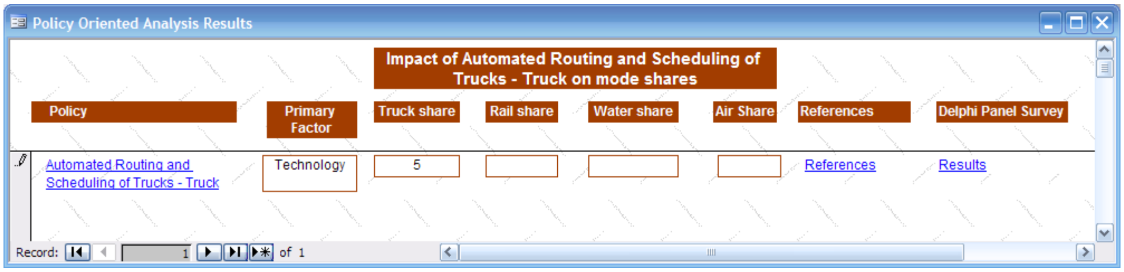

Figure 2: Sample output display for policy-oriented analysis

as well as determine those factors that generate a user-desired change in modal utilization. Accordingly, the analyst can utilize the qualitative component tool in two ways: (1) undertake an objective-oriented analysis, and/or (2) perform a policy-oriented analysis.

The objective-oriented analysis component allows the analyst to identify factors and policies that can cause a desired directional impact on the mode share of any one of the different modes. Figure 1 presents the output display for the objective specified as "to increase the transit mode share." The software displays the list of factors and, for each factor, the number of studies in the knowledge base that report the desired impact (e.g., increase in transit share) associated with the factor or policy.

The policy-oriented analysis component allows the analyst to select a policy and view the directional impact on modal utilization. Figure 2 presents the output display for a policy-oriented analysis that queried the impacts of automated routing and scheduling of trucks on the truck mode share. The output indicates that there are five known studies that indicate a positive impact associated with this policy on truck mode share.

Finally, integrated in the qualitative component are the results of a Delphi freight expert panel survey that was conducted to enhance the freight knowledge base of the tool. The Delphi technique was used to gain a better understanding of the freight sector, and of the factors and policies that impact freight mode choice. The Delphi technique was enhanced using real-time voting technology. The Delphi panel included MPO freight planners, state freight planners, and port, truck, and rail representatives. Figure 3 illustrates how the Delphi panel rated the impact of automated routing and scheduling of trucks on truck mode competitiveness.

Quantitative Analysis Component

The quantitative tool contains (a) interactive charts derived from public and private data that allow the analyst to assess the baseline profiles of mode usage and explore trends and (b) a Texas freight mode choice model that facilitates custom scenario generation and evaluation.

The baseline assessment component provides the analyst with access to longitudinal mode utilization data for both passenger and freight traffic from a number of different public and private data sources. Whenever feasible, the precompiled information is presented in the form of a pivot table or a pivot chart to enable the analyst to explore different aspects of the data.

The freight mode choice model enables the analyst to analyze the truck and rail mode shares for intrastate (county-to-county) freight movements. A graphical interface displays a map of Texas (see Figure 4), from which the analyst can select the desired origin and destination counties—a single county or a group of counties. The model predicts the rail and truck mode shares for five commodity types using the underlying Reebie database and the embedded

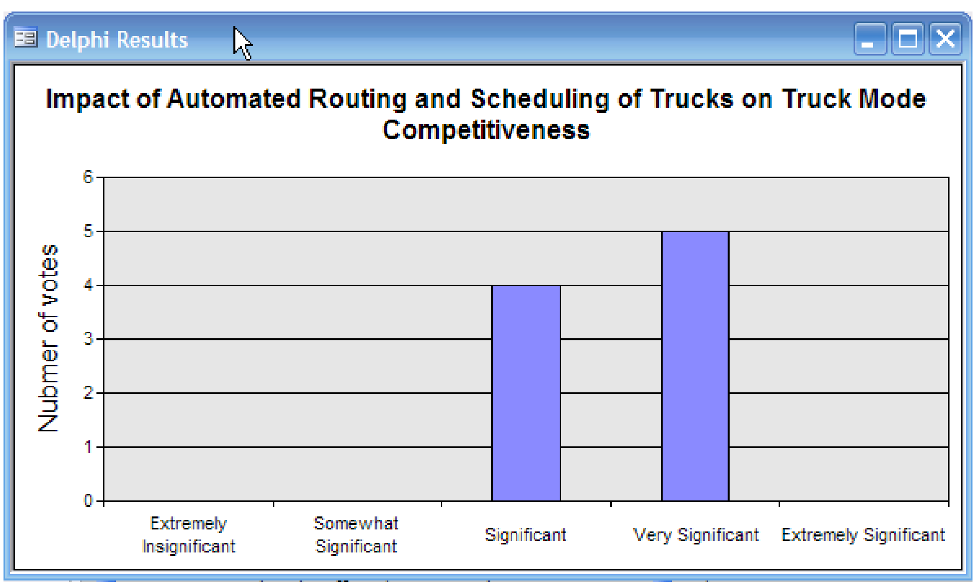

Figure 3: Sample output display for a query on the impact of a specific policy action

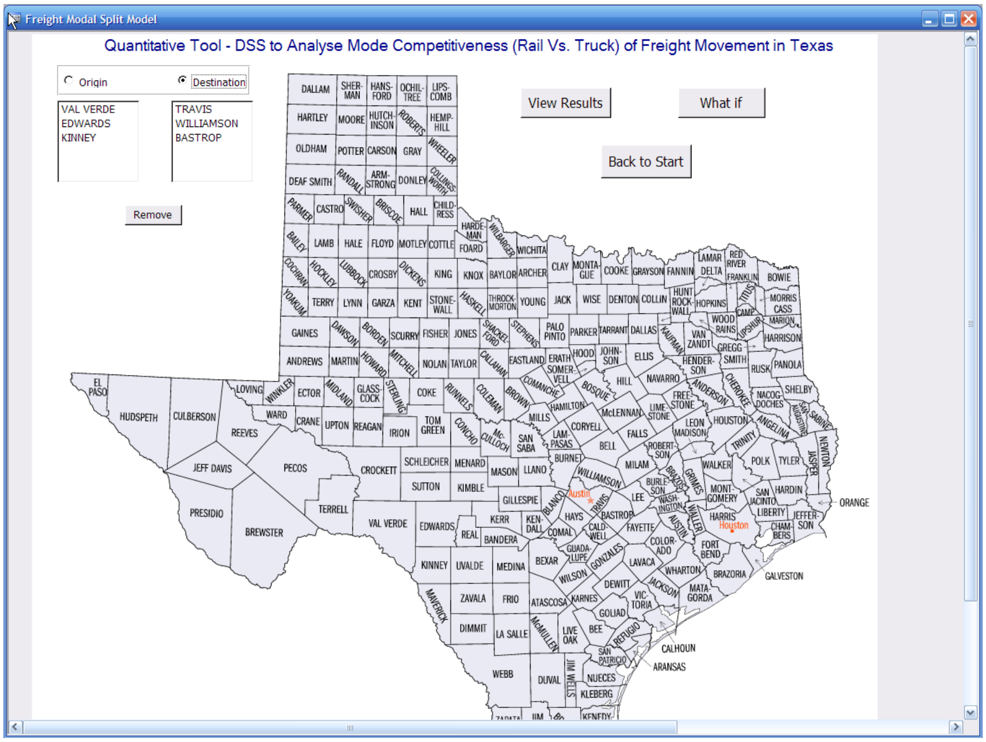

Figure 4: Input screen for freight mode choice forecasting

model parameters. The model also allows the analyst to conduct "what-if" analyses by specifying changes to the socioeconomic characteristics of the origin and destination counties.

What We Found...

The DSS was designed to facilitate transportation planning at the statewide and metropolitan levels. Several observations may be made regarding the DSS.

First, the qualitative analysis component of the DSS can serve as a valuable tool to facilitate planning by documenting a broad range of factors and their impacts on mode shares, as identified by researchers and practitioners. However, it is important for the analyst to realize that the establishment of a direct and unambiguous relationship between factors and mode share is complex and often context-specific. There is often a lack of consensus on the magnitude of the impact of various factors on mode shares. For the majority of the factors included in the DSS, there is a general agreement among researchers and practitioners on the direction of the impact on mode shares. Hence, the DSS can assist the analyst in making well-informed decisions.

Second, the enhanced Delphi survey technique used in this research proved to be a relatively inexpensive and efficient approach to obtain an understanding of the freight sector. Considering the fact that there is a general lack of reliable and robust data and substantive research in the area of freight mode choice modeling, the Delphi survey results enhanced the qualitative freight knowledge base embedded within the DSS.

Third, the quantitative component of the DSS can assist planners in monitoring the performance of the transportation system, identifying trends, and assessing benefits. In addition, the embedded freight mode split model enables planners to predict inter-county rail and truck mode shares for five different commodity groups. Analysts can also evaluate the mode shares under alternative socioeconomic scenarios.

Finally, the structural framework of the DSS was designed to be user-friendly and "easy-to-use" for undertaking both qualitative and quantitative assessments of freight and passenger modal competitiveness. However, the embedded knowledge base, although substantial, is by no means exhaustive. Still, the design of the software provides the analyst with the flexibility to enhance the prototype by including additional literature and data sources.

The Researchers Recommend...

In this project, the research team designed a prototype DSS, which offers the analyst flexibility, versatility, and customization options when conducting qualitative and quantitative assessments of the impacts of a variety of transportation factors and policies on modal shares. The researchers accordingly recommend that the DSS be implemented at the statewide and metropolitan levels as it provides practitioners with a single tool to obtain information on modal utilization and assess policy effects. It is also recommended that the knowledge base and other features of the software be updated periodically to ensure that the latest information is available to users. Finally, TxDOT should consider expanding the scope of the analysis to include intercity passenger and intracity freight movements, as well as additional information on the characteristics and utilization of intermodal facilities and the Texas highway and railway system.

For More Details...

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The research is documented in the following reports:

0-4013-1 *Decision Framework for the Evaluation of Modal Competitiveness*

To obtain copies of a report: CTR Library, Center for Transportation Research,
(512) 232-3126, email: ctrlib@uts.cc.utexas.edu

Your Involvement Is Welcome!

Disclaimer

This research was performed in cooperation with the Texas Department of Transportation and the U. S. Department of Transportation, Federal Highway Administration. The contents of this report reflect the views of the authors, who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of the FHWA or TxDOT. This report does not constitute a standard, specification, or regulation, nor is it intended for construction, bidding, or permit purposes. Trade names were used solely for information and not for product endorsement. The engineer in charge was Chandra Bhat, P.E. (Texas No. 88971).

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