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DECISION SUPPORT SYSTEM: USER'S GUIDE

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Abstract: The Texas Department of Transportation (TxDOT) contracted with The University of Texas at Austin's Center for Transportation Research in 2002 to explore the competitiveness of alternative transportation modes. Specifically, the main objective of the research was to document those factors and policies that have a significant impact on freight and passenger mode shares. To achieve this objective the research team developed a Decision Support System (DSS) to assist TxDOT and local metropolitan planning agencies in planning for an efficient and balanced multi-modal transportation system for Texas. This user's guide briefly explains some of the concepts behind the DSS components and provides detailed step-by-step instructions on its use.	Keywords: Decision Support System, passenger mode share, freight mode share, user's guide	No. of Pages: 28

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Introduction

The Decision Support System (DSS) was developed by The University of Texas at Austin for the Texas Department of Transportation (TxDOT) as part of Research Project 0-4013 entitled “Competitiveness of Alternative Transportation Modes.” The software is a custom add-in to Microsoft Access and consists of a Windows-based interface between the analyst and the assembled knowledge base. The objective of the DSS is to provide the analyst with a framework to qualitatively and quantitatively assess the impacts of various factors on mode shares. The capabilities of the DSS are summarized in Table 1. This user’s guide briefly explains some of the concepts behind the DSS components and provides detailed step-by-step instructions on its use.

Table 1. Capabilities of the DSS

	Qualitative Tool	Quantitative Tool/Baseline Assessment
Passenger	<ul style="list-style-type: none"> ▪ Assess the impact of a specific factor on mode utilization ▪ Determine which factors have the desired directional impact on a specified mode share 	<ul style="list-style-type: none"> ▪ Get information on current modal utilization in Texas
Freight	<ul style="list-style-type: none"> ▪ Assess the impact of a specific factor on mode utilization ▪ Determine which factors have the desired directional impact on a specific mode share ▪ Examine the impact of a specific factor on mode utilization based on the results of the Delphi expert freight panel survey 	<ul style="list-style-type: none"> ▪ Analyze modal and socioeconomic trends using interactive tables and charts ▪ Examine the impact of user-defined scenarios on Texas mode utilization ▪ Access the future truck and rail utilization for Texas given various scenarios

The remainder of this section describes the basic concepts behind the DSS, and concludes with the installation procedure. Chapter 2 provides step-by-step instructions on how to use the qualitative component of the DSS. Chapter 3 provides detailed instructions for viewing the results and the summary charts that resulted from the Delphi expert freight panel survey. Chapters 4 and 5 provide step-by-step instructions on how to view the baseline data and use the freight mode split model of the DSS, respectively.

1.1 Concepts

A factor was defined as a policy pertaining to a metropolitan area, state, or to the whole nation, or a general development relating to the economic, demographic, logistic, or technological environment in which the transportation system operates. To facilitate the assimilation of the results, the list of factors supported by the software has been grouped into a few broad categories called the “primary factors” (Table 2). The display sorts the results in terms of these primary factors.

Table 2. Primary Factors for Passenger and Freight Transport

Passenger	Freight
Land Use	Infrastructure Provision
Demographics	Logistic Trends
Economy	Technology
Technology	Legislation
Legislation	
Transportation System	

1.2 Installation Instructions

Prerequisites:

- 1) Microsoft Access 2002 has to be installed on the PC.
- 2) More than 260MB of free disk space should be available on the hard disk.

Installation:

Copy the folder named “TxDot4013” from the CD to any directory on the hard disk.

Execution

- Step 1: Open the folder “TxDot4013” from the directory to which it was copied.
Step 2: Double click on the file “TxDot4013.”
Step 3: Disregard the security warning that may appear and choose **Open**.

Warning!

While working with the DSS, if the debugger (VB code) appears at any time, close the project and copy the files provided on the CD to the computer. The steps involved are as follows:

- Go to C:\Program Files\Microsoft Office on the computer.
- Determine whether the Office10 and Office11 folders are present.
- If both these folders are present, copy the files in the Office 10 folder from the CD to the Office10 folder on the computer and the files in the Office11 folder from the CD to the Office11 folder on the computer.
- If one or both of these folders are not on the computer, copy the required folder(s) from the CD to C:\Program Files\Microsoft Office.
- Open the project again.

The start-up screen of the software is shown in Figure 1.

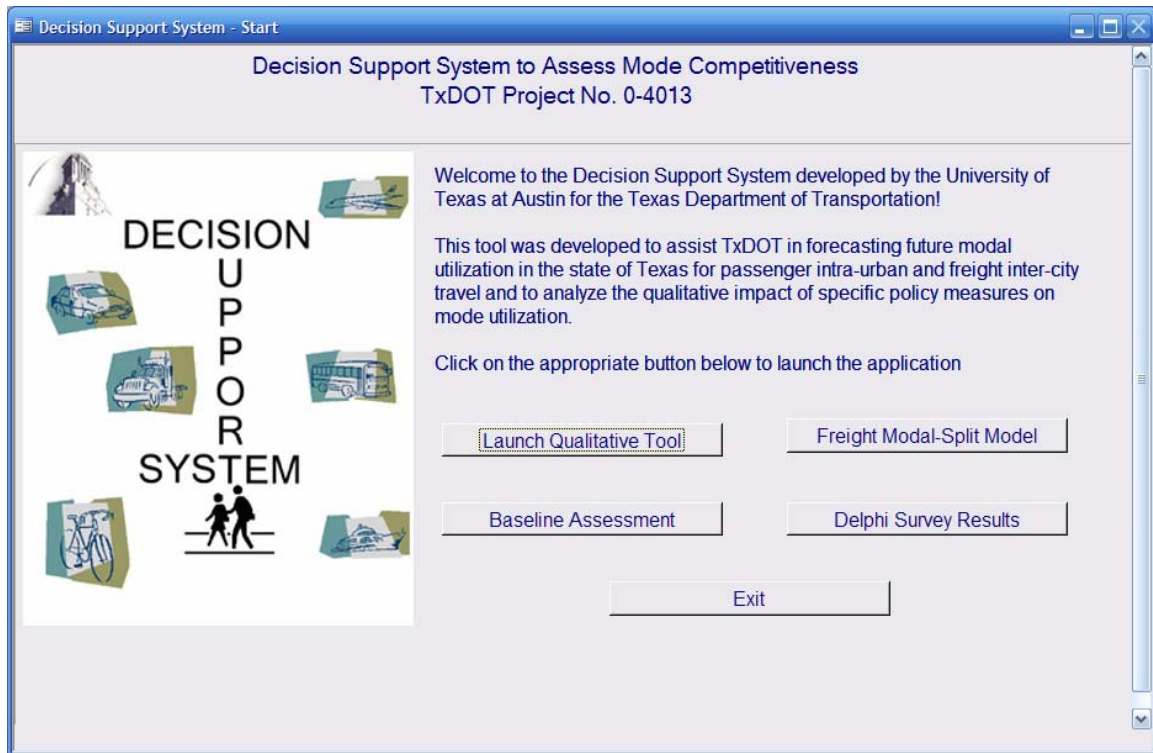


Figure 1. Start-Up Screen

Additional Help:

If you experience any difficulties or have comments or suggestions, please contact either Dr. Chandra Bhat at bhat@mail.utexas.edu or Jolanda Prozzi at jprozzi@mail.utexas.edu.

Qualitative Tool

The Decision Support System (DSS) includes a knowledge base of recent published impacts of various factors on passenger and freight modal utilization. The tool enables the analyst to query the knowledge base and conduct:

- Objective Oriented Analysis: Determine which factors have a specified directional impact on a specific mode.
- Policy Oriented Analysis: Assess the impact of a specific factor on mode utilization.

The qualitative tool can be accessed through the start-up screen presented in Figure 1 by clicking on **Launch Qualitative Tool**. The following sections present detailed instructions and examples on how to perform objective oriented analysis and policy oriented analysis.

Step 1: On the start-up screen click on **Launch Qualitative Tool**. The form depicted in Figure 2 will appear. The analyst can either select to perform objective oriented analysis (choose an objective and view all possible factors that are likely to contribute towards its fulfillment) or policy oriented analysis (select a factor and view its likely effects on mode shares).

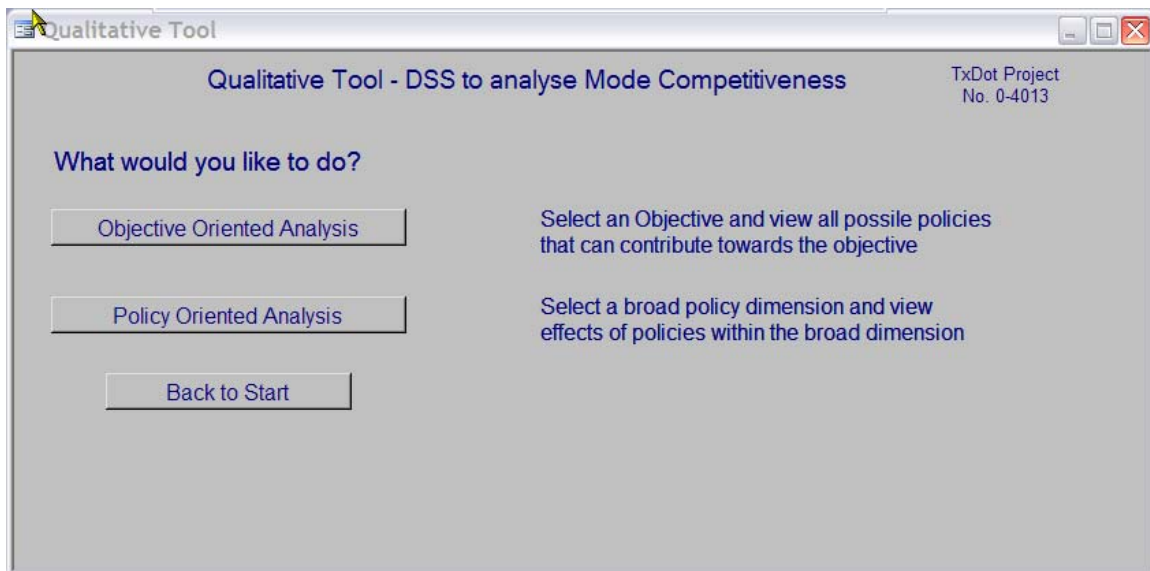


Figure 2. Qualitative Tool

1.3 Objective Oriented Analysis

The objective oriented analysis component of the qualitative tool allows the analyst to view possible factors/policies that can contribute towards achieving a specified objective. The objectives are specified in terms of an increase or decrease in the mode share of the different modes supported by the software.

Step 1: Click on the **Objective Oriented Analysis** button in the form depicted in Figure 2. The form depicted in Figure 3 will appear.

The screenshot shows a software window titled "Qualitative Tool - Objective Oriented Analysis". The window content includes a title "Qualitative Tool - DSS to analyse Mode Competitiveness" and a subtitle "TxDot Project No. 0-4013". There are two radio button options under the heading "Sector": "Freight Transportation" and "Passenger Transportation", with the latter being selected. Below this is a section titled "Specify Objective for Analysis" containing two dropdown menus: "Choose One:" (set to "Increase") and "Choose Mode:" (set to "Transit"). At the bottom of the window are three buttons: "Back To Start", "Back", and "View Results".

Figure 3. Objective Oriented Analysis

Step 2: Select the appropriate **Sector**, i.e., Freight or Passenger Transportation, by clicking on the corresponding option button.

Step 3: Specify the **Objective for Analysis**, i.e., Increase or Decrease, in the drop-down list box provided.

Step 4: Select a mode by clicking one of the available modes in the **Choose Mode** drop-down list box and then click on the **View Results** button. A new form will appear showing the policies or factors that have been documented in the knowledge base to have the specified directional impact on the chosen mode. For example, if the analyst has specified his/her objective to be an increase in transit mode share, the form depicted in Figure 4 will appear. In this form, each policy or factor that has been documented to increase transit mode share is presented in a row. The analyst can use the scroll bar on the right of the form to view all the factors associated with the specified objective.

The **Number of Studies** field provides the number of studies in the knowledge base that have reported that the corresponding policy or factor has the impact specified in Steps 3 and 4.

Policies/Factors Resulting in an Increase in Transit Share (Passenger)			
Policy/Factor	Primary Factor	Number of Studies	References
Accessibility - Services	Land use	1	References
Aesthetic surroundings	Land use	1	References
Automatic vehicle (bus) location	Technology	2	References
Commuter checks	Economic	1	References
Discount transit passes	Economic	1	References

Record: 1 of 19

Figure 4. Policies/Factors Resulting in an Increase in Transit Share

Step 5: Click on the **References** hyperlink to view the references for the studies in the knowledge base that have reported the impact specified in Steps 3 and 4.

Warning!

All forms that display results do not have a “back” button. The analyst can close or minimize these forms by clicking on the corresponding buttons on the top right corner of these forms. In addition, the analyst can click on any form shown in the **Windows Task Bar** to display it.

1.4 Policy Oriented Analysis

The policy oriented analysis component of the qualitative tool allows the analyst to select a factor which can be a policy or an external development and view the associated directional impact on modal utilization.

Step 1: Click on the **Policy Oriented Analysis** button in the form depicted in Figure 2. The form in Figure 5 will appear:

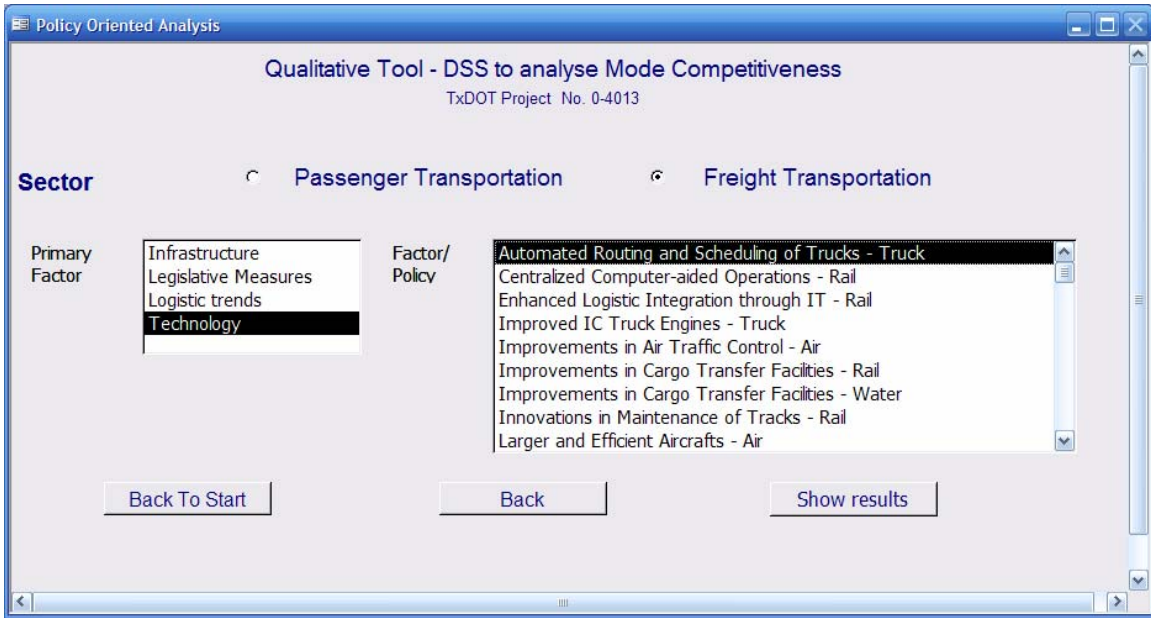


Figure 5. Policy Oriented Analysis

Step 2: Select the appropriate **Sector**, i.e., Passenger or Freight Transportation, by clicking on the corresponding option button.

Step 3: Specify the **Primary Factor** in the list box provided.

Step 4: Choose a **Factor/Policy** in the list box provided and click **Show Results**. A new form will appear showing the impact of the specified factor or policy on mode shares. A positive number in a mode share field, e.g., in the truck mode share field, indicates that the specified factor/policy has a positive impact on the particular mode share, while the opposite holds for a negative number. The absolute magnitude of the number in the mode share field indicates the number of studies in the knowledge base that have reported that the chosen policy/factor will have an impact on the mode share. For example, if the analyst has chosen the **Freight Transportation** sector (Step 2), **Technology** as the primary factor (Step 3), and **Automated Routing and Scheduling of Trucks-Truck** (Step 4), then the form in Figure 6 will appear:

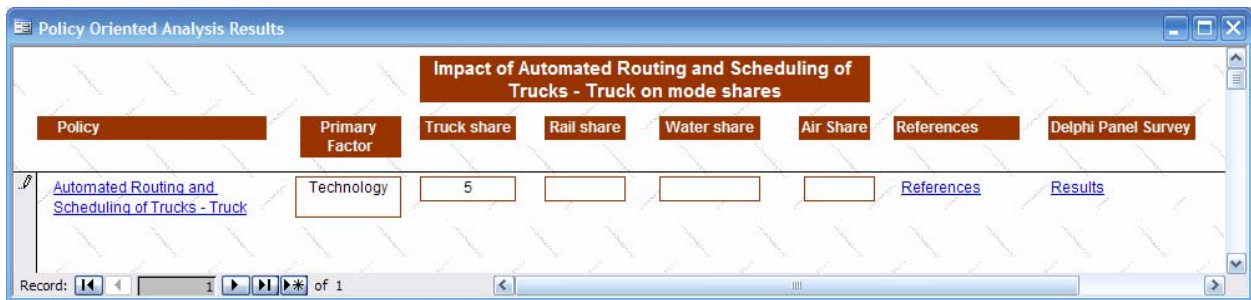


Figure 6. Impact of Automated Routing and Scheduling of Trucks on Truck Mode Share

From Figure 6 it is evident that five studies in the knowledge base have indicated a positive impact of “Automated Routing and Scheduling of Trucks” on truck mode share. If the analyst clicks on **References**, the references for the studies in the knowledge base that have indicated the directional impact described in Step 4 can be viewed. If the analyst clicks on **Results** in the **Delphi Panel Survey** field, he/she can view a chart with the distribution of votes of the expert panel on this particular policy or factor (see Chapter 3).

Delphi Expert Panel Freight Survey Results

This section describes how the analyst can access the Delphi expert panel freight survey results embedded in the Decision Support System (DSS). For more information about the Delphi expert panel survey, the reader is referred to Xyntarakis *et al.* (2004).

Step 1: On the start-up screen (see Figure 1) click on **Delphi Survey Results**.

Step 2: Click on the **Select Section** drop-down list box to select one of the sections of the survey. Under the **Select Question** list boxes a list of all questions pertaining to the selected section will be shown. At the end of each question the mode name will appear if the particular question was mode specific.

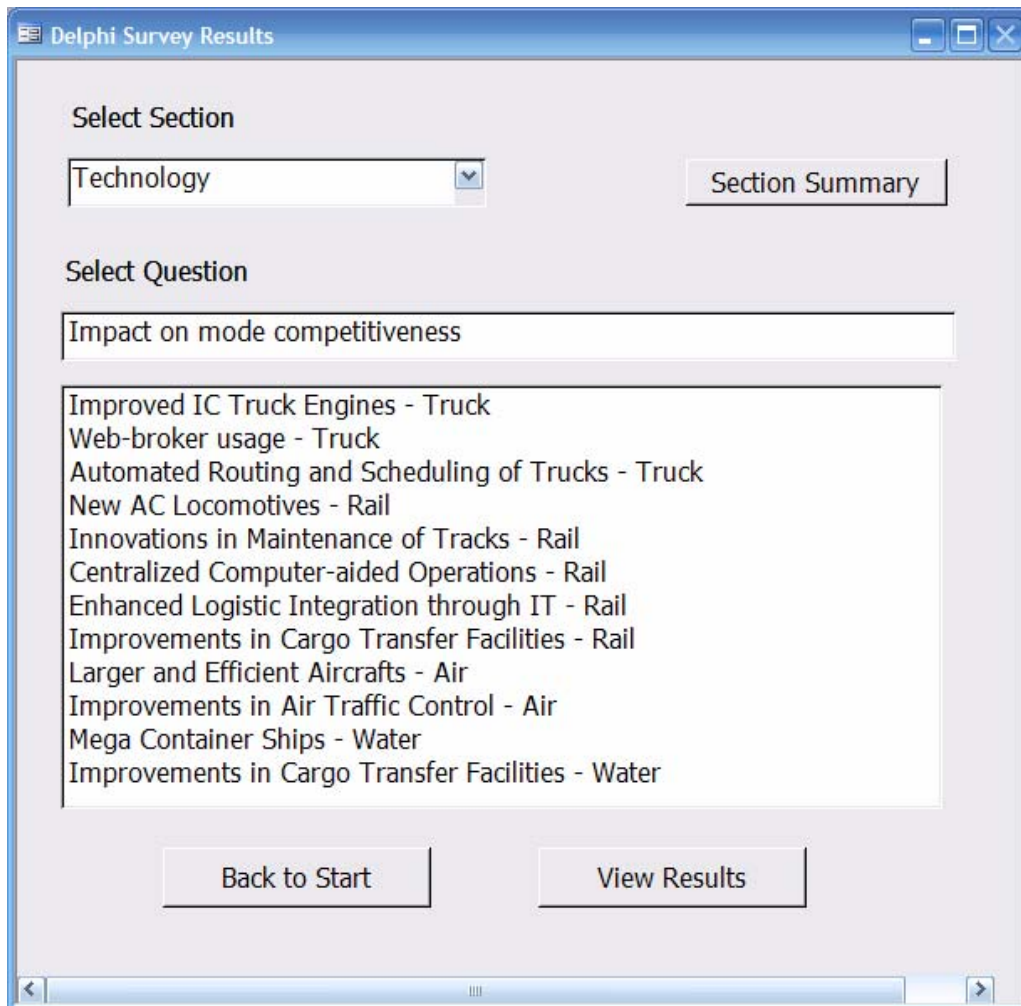


Figure 7. Delphi Survey Results

Step 3: Select one of the questions asked and click **View Results**. For example, if the analyst selected “Automated Routing and Scheduling of Trucks - Truck” in the technology section, the chart depicted in Figure 8 will appear showing the distribution of the panel’s votes for this particular question.

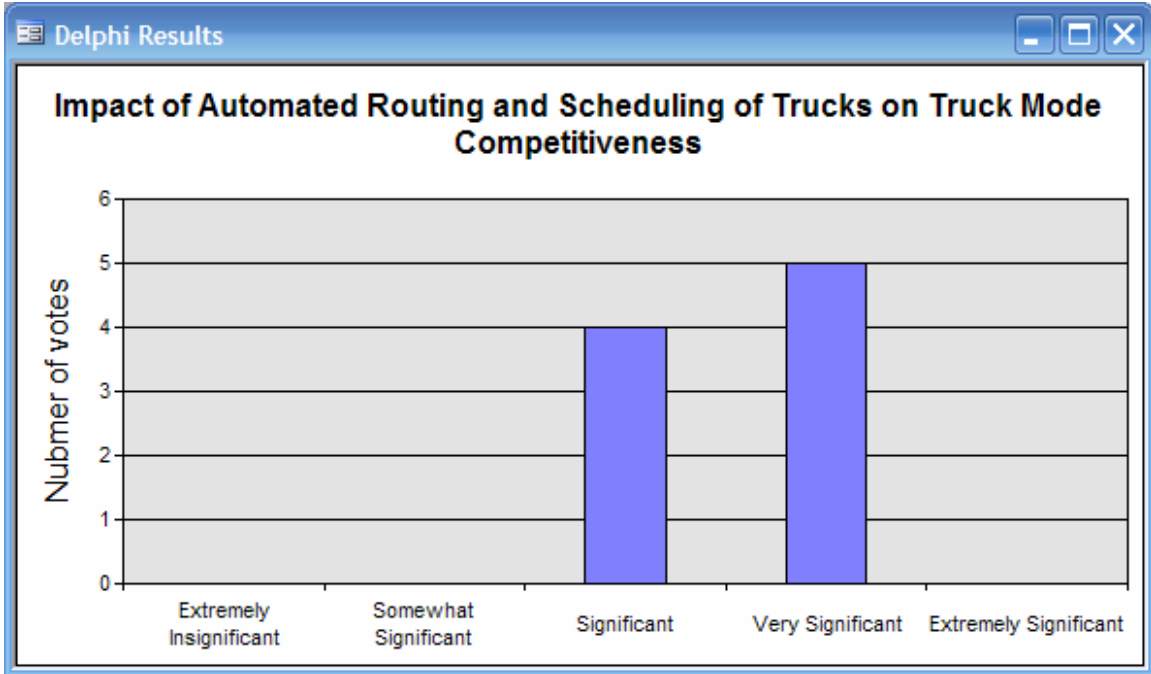


Figure 8. Delphi Survey Results: Impact of Automated Routing and Scheduling of Trucks on Truck Mode Competitiveness

Step 4: The analyst can also view summary statistics for an entire section of the Delphi survey. This query provides the analyst the average ratings (averaged across the responses of the nine panelists) for all the questions/issues discussed under the corresponding section. Select the section of interest as described in Step 2 and then click on the **Section Summary** button. A sample output display is presented in Figure 9. This enables the analyst to compare the relative effects of different scenarios on the competitiveness of a particular mode as ranked by the Delphi panel participants. The answer scale for all questions involving a policy/factor was from one to five. The numbers shown on the x-axis of the chart depicted in Figure 9 are the average ranking by the panel participants.

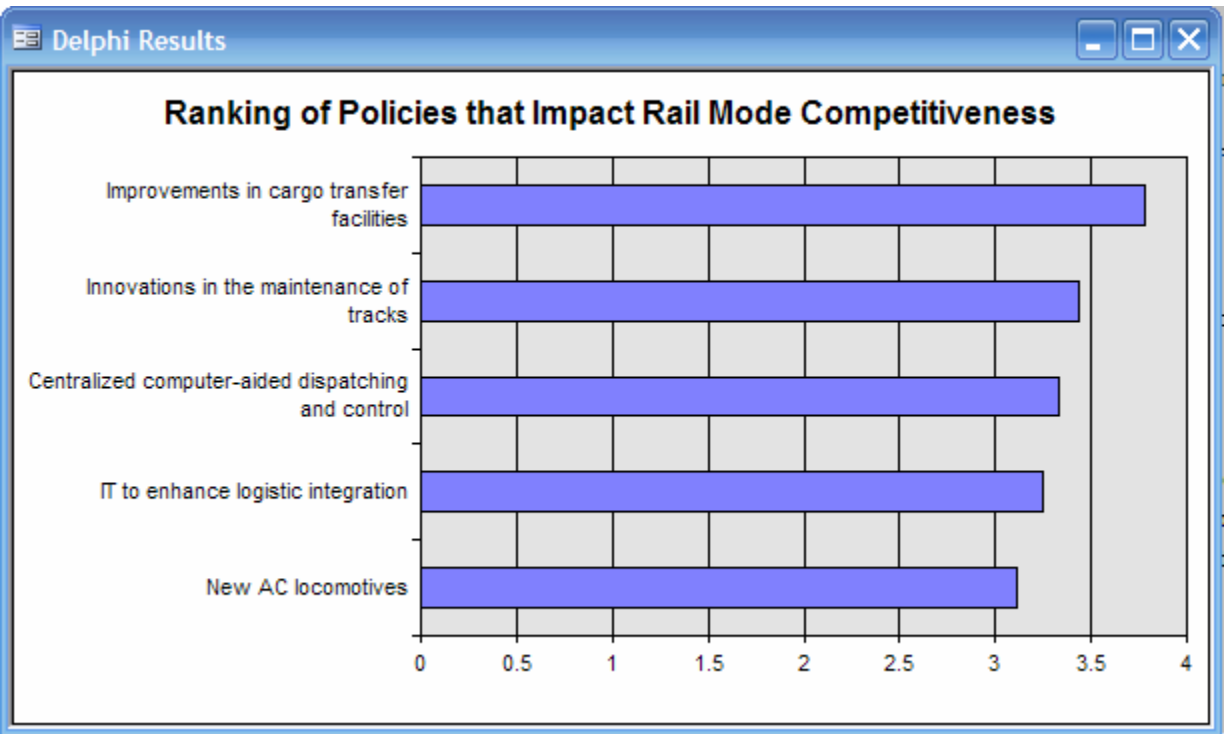


Figure 9. Delphi Survey Results: Ranking of Policies that Impact Rail Mode Competitiveness

Baseline Assessment

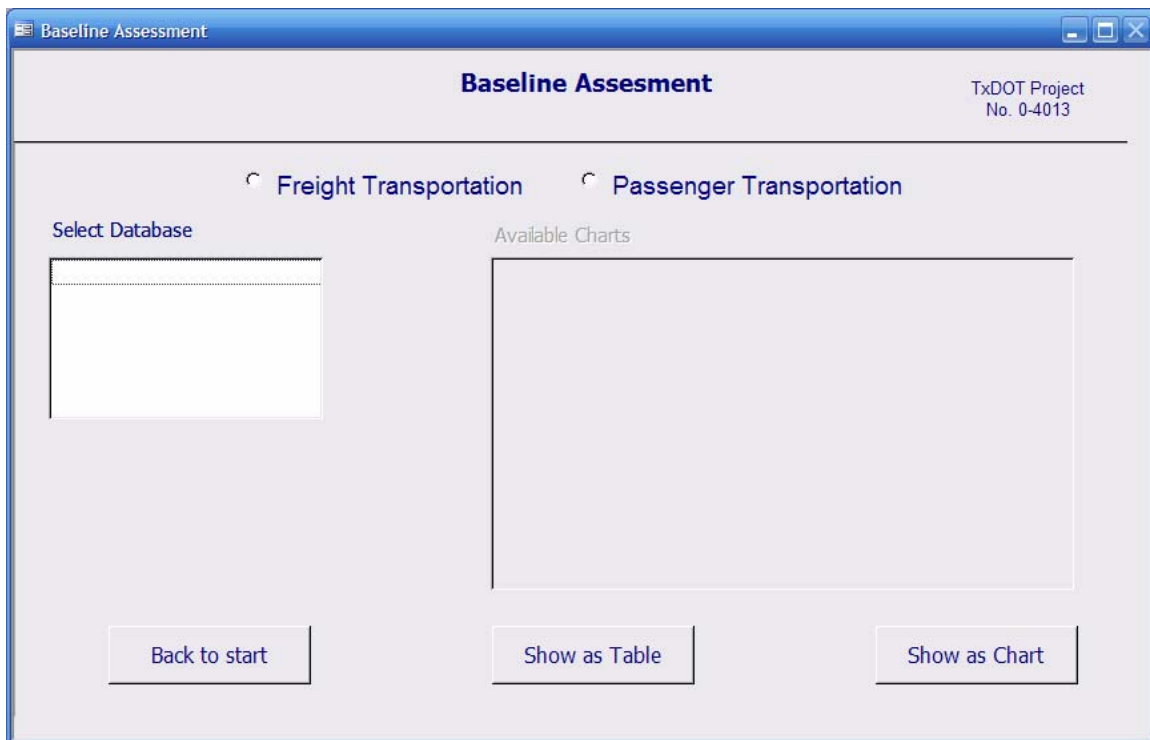
The Baseline Assessment component of the Decision Support System (DSS) provides the analyst with cross-section and longitudinal mode utilization graphs and tables compiled from a number of public and private data sources. Many of the tables and graphs have interactive features allowing the analyst to customize them to his/her specific needs.

Step 1: In the start-up screen (see Figure 1) select **Baseline Assessment**. The form in Figure 10 will appear.

Step 2: Select the appropriate **Sector**, i.e., Freight or Passenger Transportation by clicking on the corresponding option button.

Step 3: Select one of the databases in the **Select Database** list box.

Step 4: Select one of the **Available Charts** in the list box and click on either the **Show as Table** or **Show as Chart** button. A new form will appear containing the chosen table or chart.



The screenshot shows a software window titled "Baseline Assessment" with a standard Windows-style title bar. The window content is divided into several sections. At the top center, the title "Baseline Assessment" is displayed in a bold blue font. In the top right corner, the text "TxDOT Project No. 0-4013" is visible. Below the title, there are two radio button options: "Freight Transportation" (which is selected) and "Passenger Transportation". Underneath these options, there are two main areas: "Select Database" on the left and "Available Charts" on the right. Each of these areas contains a large, empty rectangular box, likely representing a list or selection area. At the bottom of the window, there are three buttons: "Back to start" on the left, "Show as Table" in the center, and "Show as Chart" on the right.

Figure 10. Baseline Assessment

For example, if the analyst selects the **Freight Transportation** sector (Step 2), the **Transborder** database (Step 3), and view the **Mode Shares for Imports from Mexico by Weight** as a chart (Step 4) then the interactive chart in Figure 11 will appear.

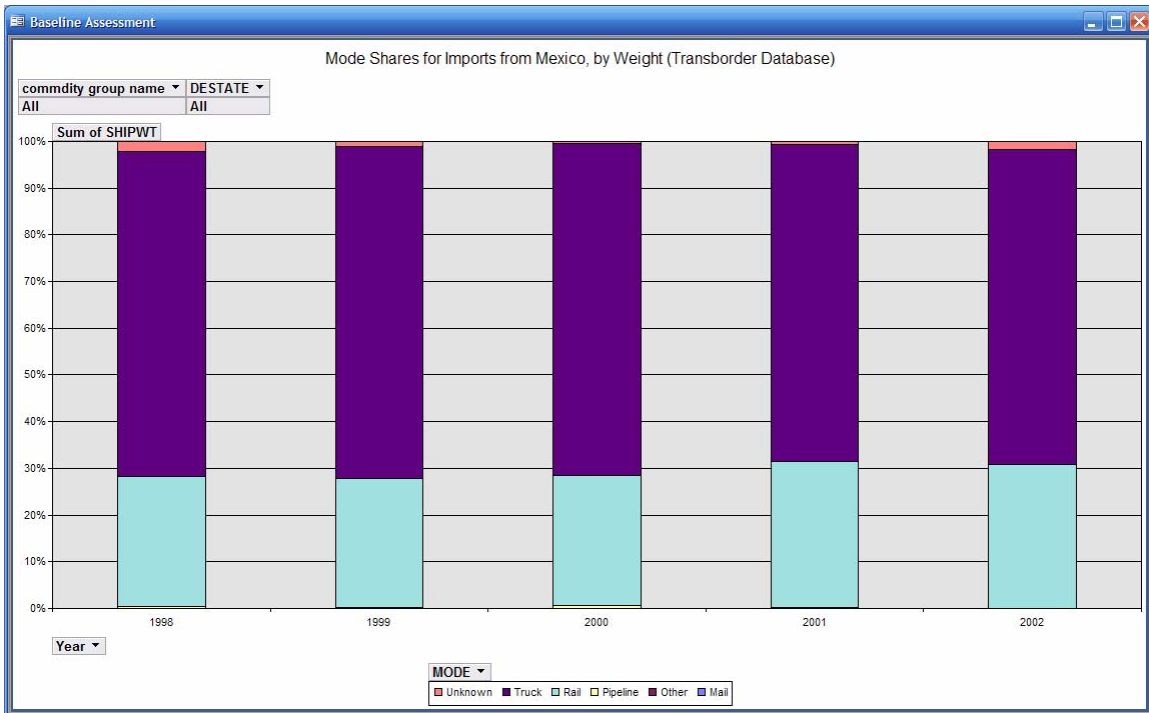


Figure 11. Baseline Assessment: Mode Shares for Imports from Mexico by Weight

The chart in Figure 11 illustrates mode shares for imports from Mexico to the U.S. in terms of weight for five consecutive years starting in 1998. This particular chart can be easily customized to present mode shares pertaining to a commodity group or to any combination of commodity groups. This can be achieved by clicking on the arrow next to the **commodity group name** and selecting any combination of the commodity groups shown in the drop-down list box. Similarly, the analyst is able to view the mode share of freight moving to a particular state, or any combination of states, by clicking on the arrow next to **DESTATE** and selecting the states of his/her choice. Figure 12 displays the chart that will appear if the analyst selected **Food and related products** from the commodity groups and **Texas** from the destination states.

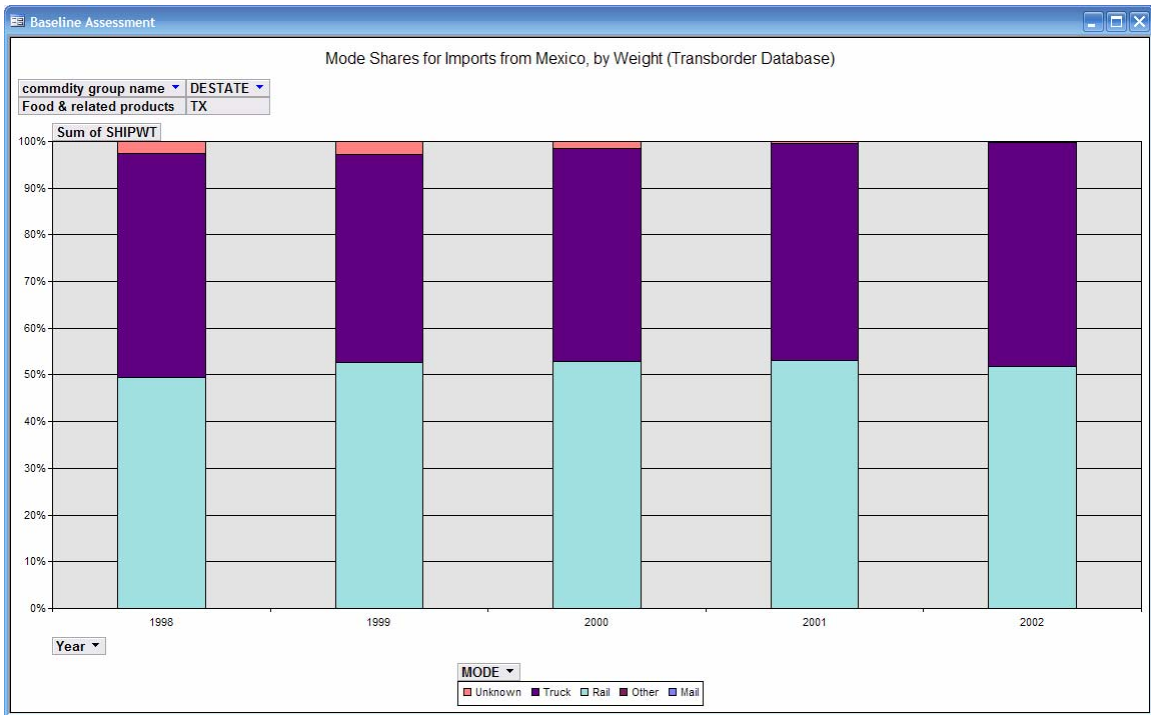


Figure 12. Mode Shares for Food and Related Products Imported from Mexico to Texas

Alternatively, the analyst can view the information in a table format by clicking on the **Show as Table** button in Step 4 and making the same selections in terms of commodity group name and destination state.

The Freight Mode Choice Prediction Model

This chapter describes the interface of the freight mode choice prediction model embedded within the Decision Support System (DSS). This component enables the analyst to determine the mode split between truck and rail for intra-state, i.e., county-to-county, freight movements. Specifically, the analyst can use the embedded model to determine the mode shares (rail and truck) for the following five commodities: (a) agricultural and related products, (b) hazardous materials, (c) construction materials, (d) food and related products, (e) manufacturing products.

The software allows the analyst to specify a set of origin counties and a set of destination counties rather than restricting the analyst to specifying a single origin or destination county. If a set of origin and/or destination counties are specified, the mode shares for the entire corridor, i.e., comprising all the selected origin and destination counties, are predicted. This is achieved by first determining the mode shares for each of the individual origin-destination (OD) county pairs, and subsequently computing a weighted average (weighted by the total freight movements between each OD county pair).

Step 1: Click on the **Freight Modal-Split Model** in the start-up screen (see Figure 1) to access the freight mode choice prediction model.

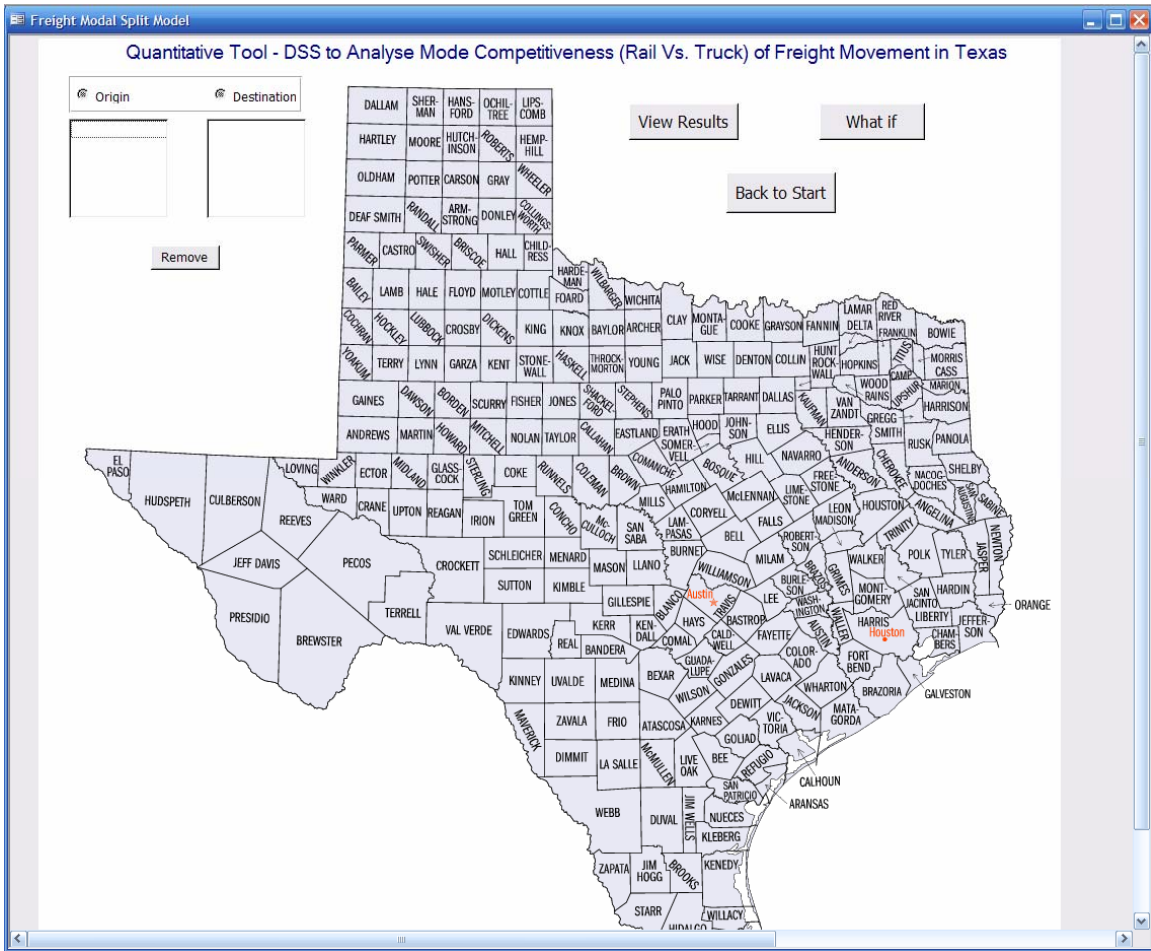


Figure 13. Freight Modal-Split Model

Step 2: Click on the **Origin** option button and then click any number of county names on the Texas map. Each county selected will be added to the **Origin** county list box. Next click the **Destination** option button and click on the name of each destination county on the Texas map to be added to the **Destination** county list box. To remove a county either from the **Origin** or the **Destination** list box, highlight the county and click on the **Remove** button. A message box will appear confirming that the chosen county has been removed. After specifying all origin and destination counties click on the **View Results** button. A chart depicting the rail mode share for each one of the five commodity groups will appear. Figure 14 presents the estimated mode share for a corridor comprising Val Verde, Edwards, and Kinney counties as the origins and Travis, Williamson, and Bastrop counties as the destinations.

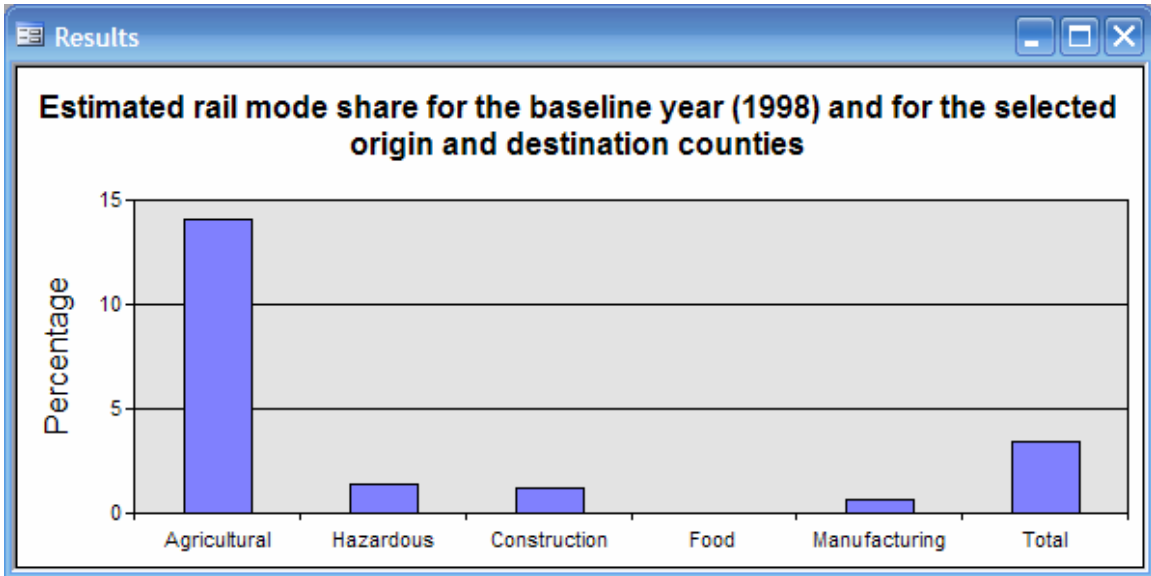


Figure 14. Estimated Rail Mode Share for a Randomly Selected Corridor

Step 4: Click on the **What if** button to evaluate the rail mode share specified for the origin and destination counties under different scenarios. The form depicted in Figure 15 will appear in which the analyst can specify a future scenario by defining the changes (as percentages) to the socio-economic characteristics of the origin and destination counties. After specifying the desired changes in the origin and destination socio-economic variables click on the **View Results** button. A new form will appear displaying the results as a chart.

Origin socioeconomics		Destination socioeconomics	
Population	20	Population	15
Personal income	0	Personal income	20
Payroll	0	Payroll	0
Employee count	0	Employee count	0
# of establishments by employment size		# of establishments by employer	
1 to 500	0	1 to 500	0
500 to 1000	0	500 to 1000	0
more than 1000	0	more than 1000	0

Buttons: Back to Start, Back, View Results

Figure 15. Input Screen for Scenario Definition

The analyst can construct various future scenarios and examine the effect on the mode split between rail and truck. To illustrate, the future mode shares predicted for the corridor comprising Val Verde, Edwards, and Kinney counties as the origins and Travis, Williamson, and Bastrop counties as the destinations is presented in Figure 16 assuming a future-year scenario with a 20 percent increase in the population of the origin counties, a 15 percent increase in the population of the destination counties, and a 20 percent increase in the personal income of the destination counties.

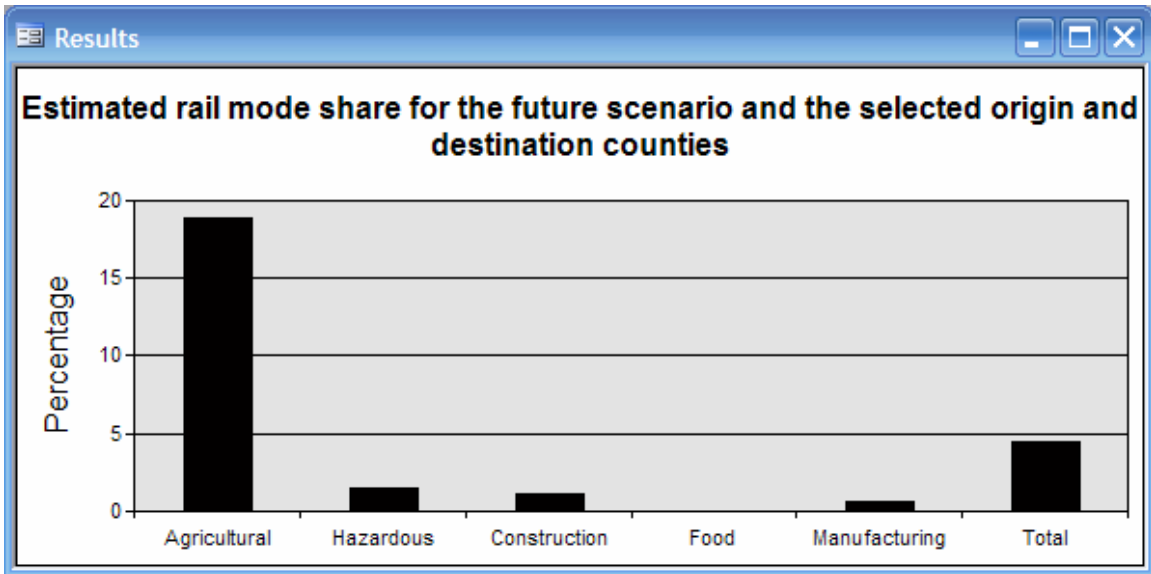


Figure 16. Estimated Rail Mode Share for the Future Scenario

References

Xyntarakis, M., Bhat, C.R., J. Prozzi, S. Sen, and A. Yeraguntla, (2004) "Workshop on Freight Model Competitiveness," Report 4013-2, prepared for the Texas Department of Transportation.