

4.0 Software User Interface

This chapter explains the user interface for the STEAM software. The program is a windows application that can run under Windows 95 or NT. The areas covered in this section include:

- Installing STEAM software
- STEAM program screen
- Creating, loading, and saving scenarios
- Defining market sectors
- Changing parameter values
- Specifying improvement costs
- Specifying transit service changes
- Setting Risk Analysis Ranges
- Checking Input Data Files
- Estimating run time
- Performing investment analysis
- Viewing Output results
- Viewing Risk Analysis Results

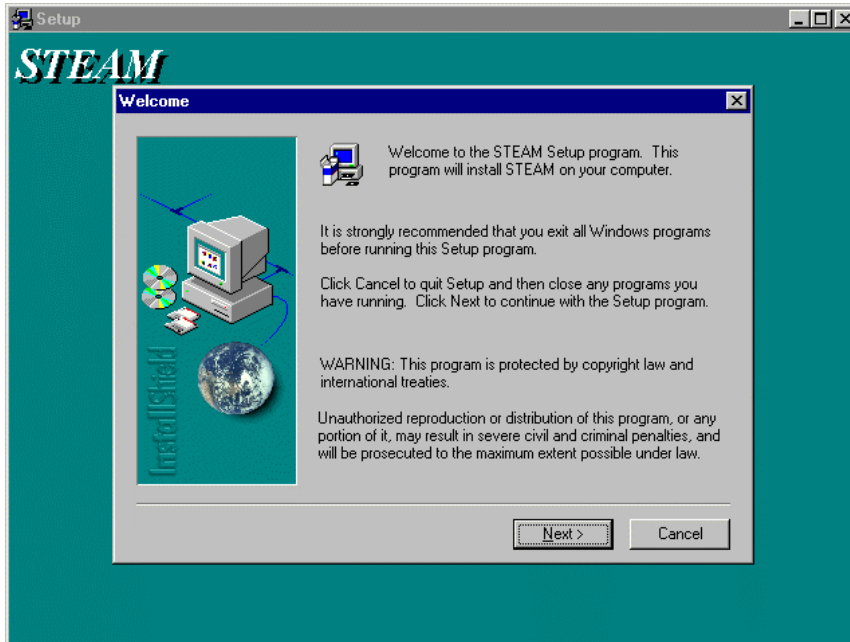
■ 4.1 Installing STEAM Software

The STEAM software has an installation program that installs the proper files on a user's hard drive in order to run the program. The install package is a regular Windows Install-Shield program that is used in the majority of Windows software and is familiar to most Windows users. Close all other programs before beginning the installation process in order to avoid any conflicts with shared files. STEAM Release Version 1.0 will only run under Windows 95 or NT operating systems.

To run the install program, the user executes the "Setup" command from Windows which loads the setup program and prompts the user for specific information. Initially, the setup

program prompts the user to select a directory for the STEAM program with a default directory "C:/STEAM". Exhibit 4.1 shows the screen displayed for the STEAM setup. By selecting the setup button the install package copies the necessary program files into the proper directory and the necessary windows files into the windows directory.

Exhibit 4.1 Install Screen for STEAM Setup



To run the STEAM program, run the "STEAM.exe" file from the windows program.

■ 4.2 STEAM Program Screen

Exhibit 4.2 presents the STEAM program screen which the software user works with in order to run a benefit-cost analysis. The main screen is divided into two large windows: an outline window (on the left) and a display window (on the right). The software user will make a selection from the outline window by clicking or double clicking a specific item which will activate the display window to present information for that selection. The outline window is changed by making a selection from the "Edit Menu".

The program screen has five menu categories: File, Edit, Run, Results, and Help. Exhibit 4.3 shows the full structure of the menu options under the categories. A brief description of each of the options is provided below.

File/New - Creates a new scenario to run the STEAM analysis and sets the input parameters to the default values.

Exhibit 4.2 STEAM Program Screen

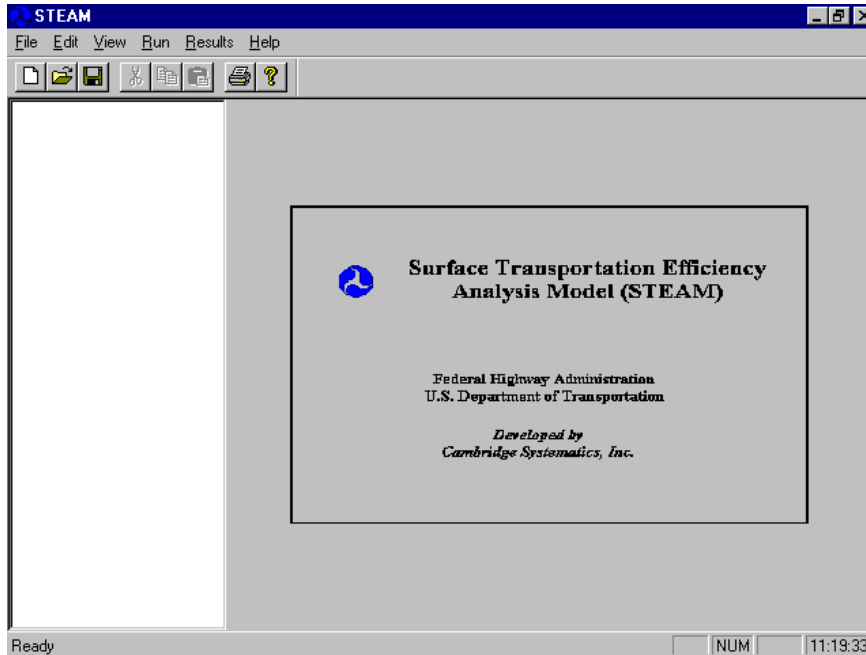
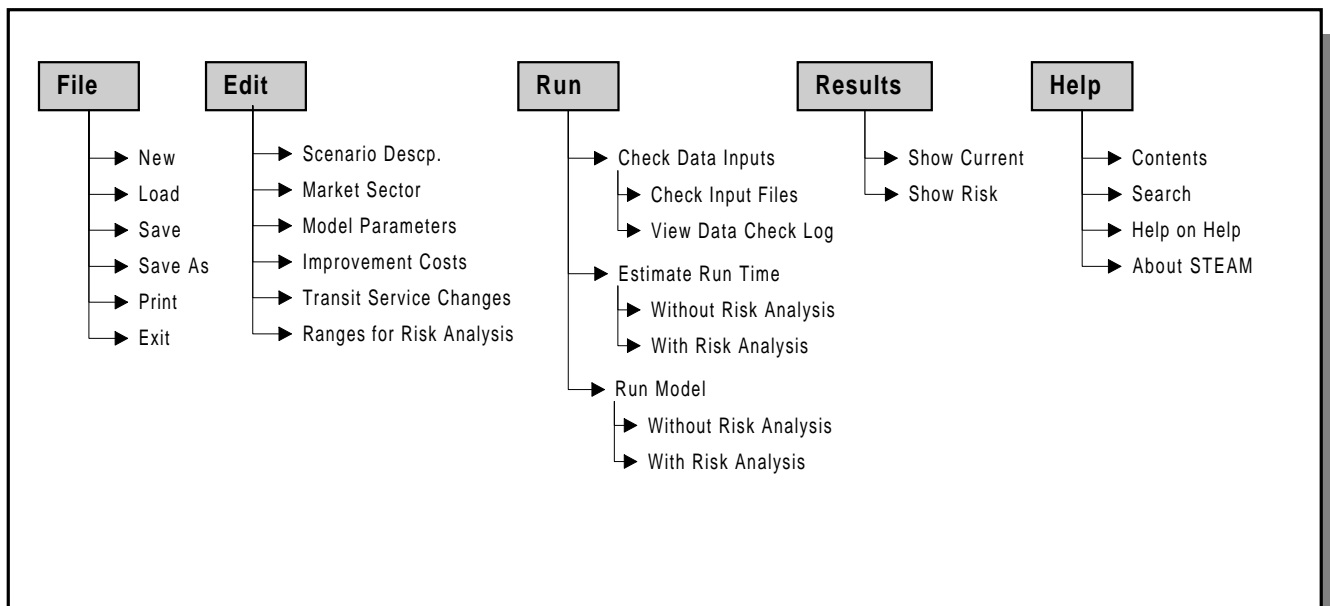


Exhibit 4.3 STEAM Menu Structure



File/Load – Displays the “File Open” dialog box to load an existing scenario file that was created earlier and allows the user to update information or run the analysis.

File/Save – Displays the “File Save” dialog box that saves the current scenario information to a file that can be loaded and used at a later time.

File/Save As – Displays the “File Save As” dialog box and saves the current scenario information under the new file name specified.

File/Print – Prints the scenario file which contains the scenario output, parameter assumptions, and market sector definitions.

File/Exit – Closes the application and returns to the Windows program.

Edit/Scenario Description – Displays the screen to input a descriptive title for the current analysis scenario.

Edit/Market Sector – Displays a “Market Sector” dialog box which lists the existing market sectors in the current scenario and allows the user to add a new market sector, delete a market sector, modify a market sector, or cancel any action.

Edit/Model Parameters – Changes the information displayed in the outline window to a list of model parameters that can be selected and changed by the user.

Edit/Improvement Costs – Changes the information displayed in the outline window to a list of improvement cost categories that the software user can select to input the improvement costs being analyzed in the scenario.

Edit/Transit Service Changes – Changes the information displayed in the outline window to a list of transit service changes that can be input by the user as a result of the proposed improvements.

Edit/Ranges for Risk Analysis – Changes the information displayed in the outline window to a list of variables for which risk analysis ranges can be set by the software user.

Run/Check Data Inputs/Check Input Files – This menu item runs the routine that checks data input files for proper format and valid ranges. The output of the data checking routine is stored in the “Data Check Log” which can be viewed in the next menu selection.

Run/Check Data Inputs/View Data Check Log – This menu item displays the most recent results of the “Check Input Files” routine. Any errors in file formats or in valid ranges will be displayed.

Run/Estimate Run Time/Without Risk Analysis – This menu item estimates the run time necessary to perform the benefit-cost analysis without the risk analysis procedure based on the market sector information contained in the current scenario and the speed of the computer. A dialog box is displayed that presents the time estimation.

Run/Estimate Run Time/With Risk Analysis – This menu item estimates the run time necessary to perform the benefit-cost analysis with the risk analysis procedure based on the market sector information contained in the current scenario and the speed of the computer. A dialog box is displayed that presents the time estimation.

Run/Run Model- Presents a choice of two sub-options: Run Model With Risk Analysis and Run Model Without Risk Analysis.

Run/Run Model/Run Model With Risk Analysis – Runs the risk analysis software with the ranges specified the user.

Run/Run Model/Run Model Without Risk Analysis – Runs the benefit-cost analysis with the market sectors and model parameters specified in the current scenario.

Results/Show Results of Current Scenario – Displays the results contained in the output file specified for the current scenario.

Results/Show Risk Analysis Results – Changes the information displayed in the outline window to a list of scenario results for which the user can examine the probabilities of occurrence of 40 different magnitudes of each result output measure. Result output measures include user benefits, emission costs, accident costs, noise costs, total benefits, total costs, and benefit-cost ratio.

Help/Contents – Displays the “Contents” window of the STEAM help file.

Help/Search – Displays the “Help Search” window that allows the user to search the STEAM help file for specific terms.

Help/Help on Help – Displays the “Using Help” window that provides guidance in using Windows help programs.

Help/About STEAM – Displays the “About STEAM” dialog box that provides information about the program.

■ 4.3 Creating, Loading, and Saving Scenarios

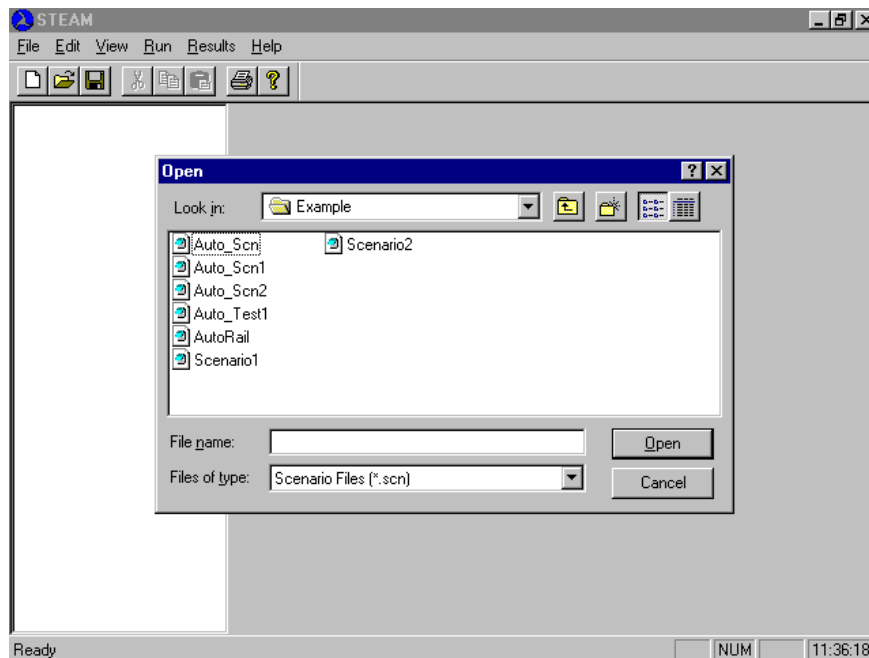
The STEAM software uses the term “scenarios” to define the benefit cost analysis of a given set of transportation system improvements. Users may decide to change specific assumptions and therefore would want to create a different scenario to perform a second

analysis. The STEAM software allows users to create multiple scenarios that can be saved, loaded, and run at later times without going through the entire process of defining market sectors and adjusting input parameters.

The assumptions, output, and input file locations for each scenario are stored in a scenario file. Under the “File” menu, the “New”, “Load”, “Save”, and “Save As” options allow the user to create, load, save, and save the scenario under a different file name. These options work the same as similar options in other Windows programs. Standard Windows file dialog boxes allow the user to locate files in specific directories. Exhibit 4.4 shows the file dialog box that is displayed when one of the options is selected.

The default scenario file extension is “.scn”. However, the file can be saved using any extension that the user chooses.

Exhibit 4.4 STEAM File Dialog Box



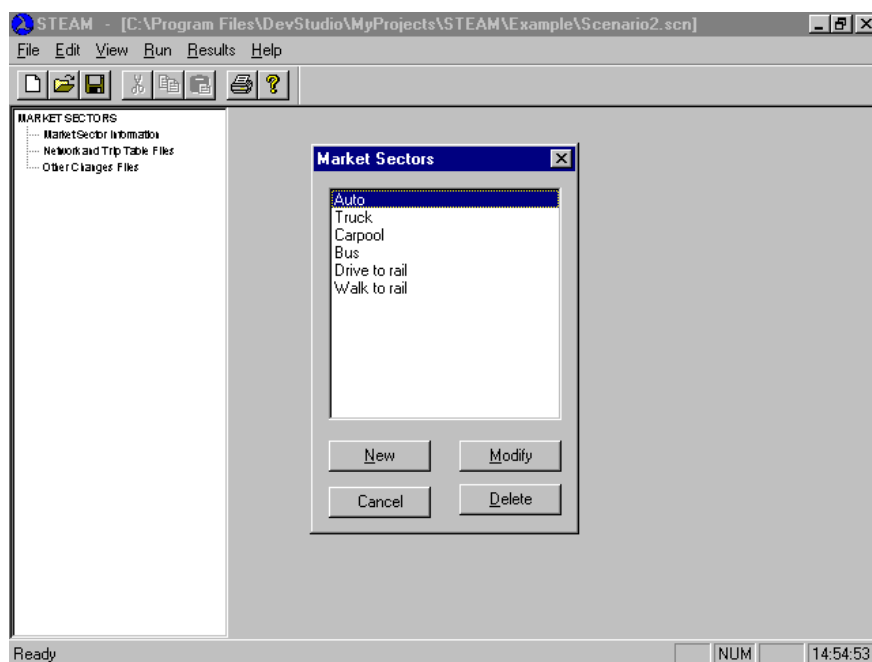
■ 4.4 Defining Market Sectors

The STEAM program analyzes investment decisions by examining individual market sectors that represent portions of the transportation demand on the network. Market sectors can represent travel demand by mode, trip purpose, and time of day, depending on the trip table purpose categories, modes, and time period breakdowns output by the

travel demand model. Thus, a demand model which produces trip tables for 3 trip purposes, 3 modes and 3 time periods could potentially result in a maximum of 27 market sectors, unless some of these potential market sectors are combined with one another.

Initially, a new market sector is defined by selecting the “Market Sector” option under the “Edit” menu. A market sector dialog box is displayed which list the existing market sectors in the current scenario. The dialog box allows the user to add a new market sector, delete an existing market sector, modify an existing market sector, or cancel without any action. The market sector dialog box is shown in Exhibit 4.5.

Exhibit 4.5 Market Sector Dialog Box



Once a market sector is added to the scenario, users select one of the three tree options in the outline window: “Market Sector Information”, “Network and Trip Table Files”, or “Market Sector Other Changes Files” which will display, respectively, the market sector input screens displayed in Exhibit 4.6, 4.7, and 4.8. These screens are used to input market sector information necessary to perform the investment analysis.

Exhibit 4.6 Market Sector Information

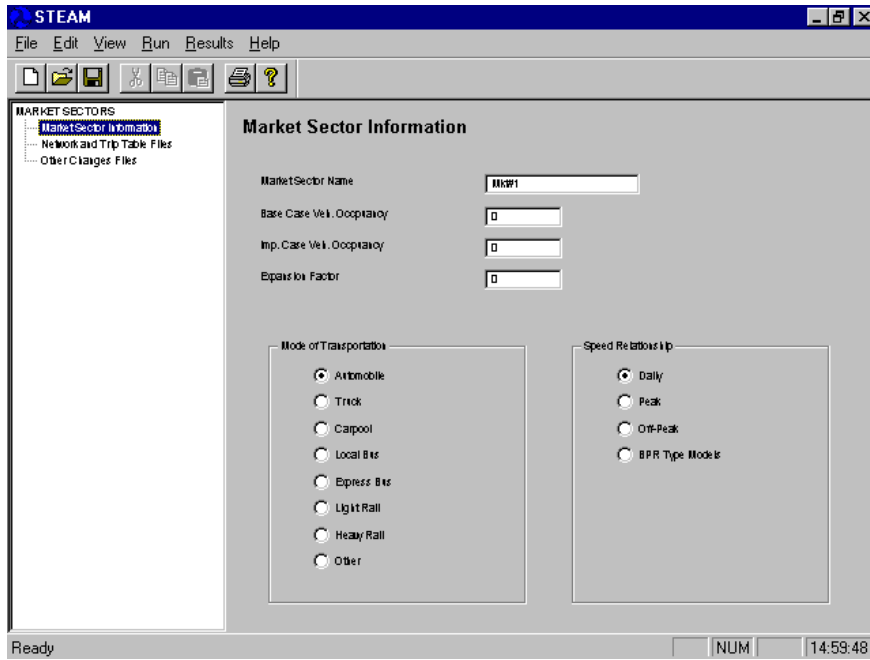


Exhibit 4.7 Market Sector File Locations

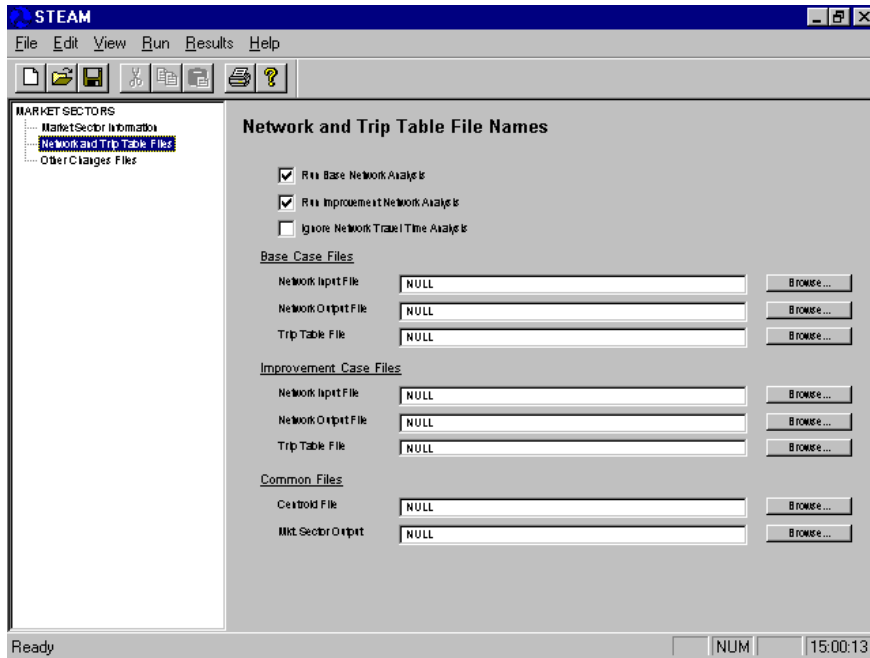
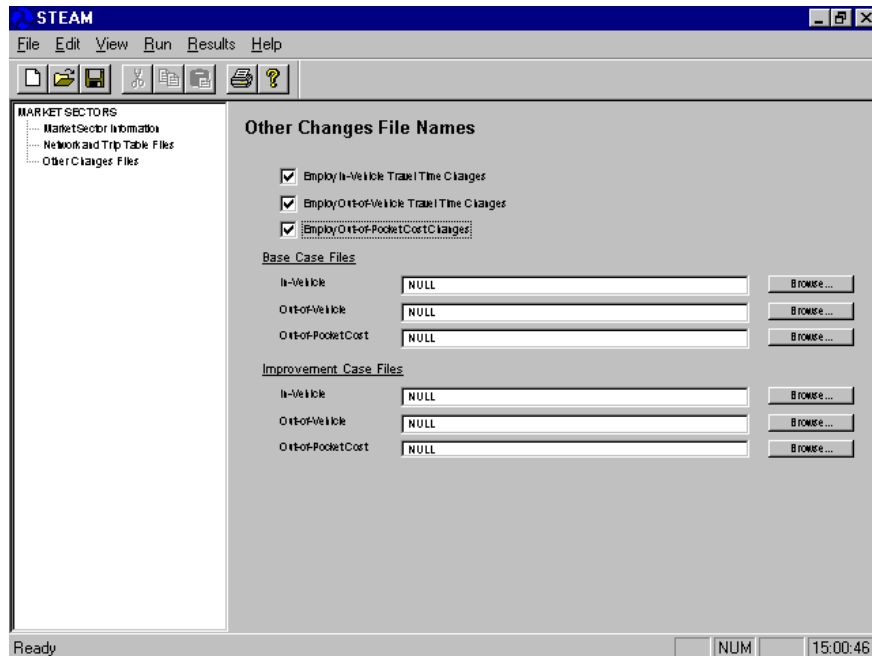


Exhibit 4.8 Market Sector Other Changes Files



The “Market Sector Information” screen allows the user to name the market sector, specify vehicle occupancy and daily-to-annual expansion factor, and select mode of transportation and speed relationship. Each input variable is defined below:

Market Sector Name. The market sector name is used simply to keep track of individual market sectors and can have up to 28 characters.

Vehicle Occupancy. The vehicle occupancy is the average number of people per vehicle and is used to estimate the number of vehicle trips for a given market sector based on the market sector person trip tables. Separate occupancies can be provided for the Base Case and the Improvement Case.

Expansion Factor. The expansion factor is used to expand the trip tables to an annual value. A market sector that represents daily work trips may have an expansion factor of 250 to represent all work days for a given year.

Mode of Transportation. This input option allows the user to select one of eight mode choices that include: auto, truck, carpool, local bus, express bus, light rail, heavy rail, and other. Modes that are not currently defined such as bicycle or walking can be put in the “other” category.

Speed Relationship. Allows the user to select from four speed estimation methods. Three use relationships as a function of AWDT/C (average weekday daily traffic/capacity). They are the choices Daily, Peak, and Off-peak. The fourth method uses the speeds provided by the user in the network files.

The “Network and Trip Table Files” screen allows the user to identify the input file locations for the current market sector, determine whether or not to run the network analysis, and whether or not to use travel time estimations for that market sector. Three check boxes are located at the top of the screen which allow the user to run base or improvement network analysis (if these boxes are not selected the user cannot input file names for the network input files). The “Ignore Network Travel Time Analysis” check box specifies that the market sector will not use any travel time estimation for calculating benefits. This option is generally used for transit market sectors for which the user must provide estimated zone-to-zone travel times in the “Other Changes File” screen. (If this option is selected, the network input and output files become inactive).

An explanation of each of the files and options is provided below:

Run Network/Don't Run Network Option. This option allows the user to select whether or not to run the highway network analysis. Once a network analysis has been performed on a particular network, there is no need to re-run the network analysis unless changes to the network have been made. The STEAM analysis will run significantly faster if the network analysis is not run.

Network Input File. This input box provides the location of the network file. The format of the file is described in the “Input File” section of this report.

Output File. This input box provides the location of the network output file which is used later in the Trip Table analysis for estimating travel time benefits. This file is an intermediate binary file that is only used by the STEAM program.

Trip Table File. This input box provides the location of the trip table file. The trip tables are used in estimating benefits and costs occurring on a particular network. The format of the trip table file is described in the “Input File” section of this report.

Centroid File. This input box provides the location of the centroid file which contains information on the zones specified for the travel time analysis. Each zone is identified with the corresponding node location. Only one centroid file is necessary and is used in both the base and improvement cases. All market sectors require this file.

Market Sector Output File. This input box provides the location of the market sector output file which contains a summary of the output of the market sector which is combined with other market sectors to produce a summary analysis. Each market sector requires a unique market sector output file name.

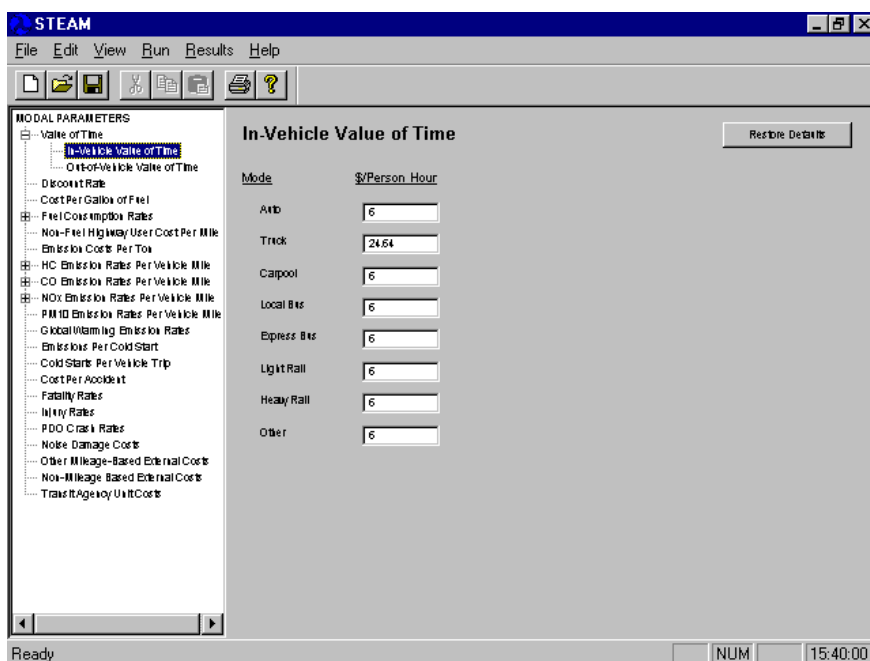
■ 4.5 Changing Parameter Values

The STEAM benefit-cost analysis uses a number of different parameters such as value of time, emission rates, and accident costs to perform the investment analysis. The program has default values for these input parameters; however, software users should change the

input values to reflect the specific year of analysis and the specific location or situation. Appendix D discusses methodology that can be used to update emission factors. All default values in STEAM are based on typical U.S. metropolitan values; they are provided for use in testing the software only, and should not be used for a specific analysis without a thorough review of reasonableness. Sources of these values are described in Appendix C. All parameter values can be changed by the user, and are saved in the scenario input file. However, the default values included with the software cannot be changed by the STEAM user. Therefore, to avoid having to change parameters for each scenario, it is recommended that the user develop an initial “generic” scenario file with local parameters, and use this file as a base to be modified for each new scenario.

To change input parameter values, the user must first select the “Model Parameters” option from the “Edit” menu. This changes the information in the outline window and displays a list of parameter names as shown in Exhibit 4.9. The user needs to click or double click a particular item from the outline window to show the parameter information in the display window. In Exhibit 4.9, the “In-Vehicle Value of Time” parameter has been selected, displaying the values by mode. The user can change these values by overwriting the existing value. New values are saved when the scenario file is saved.

Exhibit 4.9 Model Parameters (In-Vehicle Value of Time)



A restore default button is provided in the top right corner of the display window which will restore the parameters on the current screen to their default values. A list of the model parameters is provided below and full descriptions of each parameter are provided in Appendix B: Glossary of Terms.

Model Parameters

- Value of Time
- In-Vehicle (auto, truck, carpool, local bus, express bus, light rail, heavy rail, and other)
- Out-of-Vehicle (auto, truck, carpool, local bus, express bus, light rail, heavy rail, and other)
- Discount Rate
- Cost Per Gallon of Fuel (auto, truck)
- Fuel Consumption Rates
- Auto and Truck Fuel Consumption Rates (13 MPH categories)
- Transit Fuel Consumption Rates (local bus, express bus, light rail, heavy rail)
- Non-Fuel Highway User Costs Per Vehicle Mile (auto, truck)
- Emission Costs Per Ton (HC, CO, NO_x, PM₁₀)
- HC Emission Rates Per Vehicle Mile
- Auto and Truck HC Emission Rates (13 MPH categories)
- Transit HC Emission Rates (bus, rail)
- CO Emission Rates Per Vehicle Mile
- Auto and Truck CO Emission Rates (13 MPH categories)
- Transit CO Emission Rates (bus, rail)
- NO_x Emission Rates Per Vehicle Mile
- Auto and Truck Nox Emission Rates (13 MPH categories)
- Transit Nox Emission Rates (bus, rail)
- PM₁₀ Emission Rates Per Vehicle Mile
- Auto and Truck PM₁₀ Rates (13 MPH categories)
- Transit PM₁₀ Rates (bus, rail)
- Cost Per Accident (internal and external fatality, injury, and property-damage-only)
- Emissions Per Cold Start (auto and truck HC, CO, NO_x, PM₁₀)
- Cold Start Per Vehicle Trip (auto, truck)
- Fatal Accident Rates (auto and truck by highway class, bus, rail)
- Injury Accident Rates (auto and truck by highway class, bus, rail)
- Property-Damage-Only Accident Rates (auto and truck by highway class, bus, rail)
- Noise Damage Costs (auto and truck by highway class, bus, rail)
- Other Mileage Based External Costs (auto and truck by highway class, bus, rail)
- Non-Mileage Based External Costs
- Transit Agency Unit Costs (\$/vehicle mile, \$/vehicle hour, \$/peak vehicle).
Note that bus fuel costs must be included in these costs, because STEAM does not calculate fuel consumption *costs* separately on the basis of bus VMT, although it does so for fuel consumption itself (in gallons) and for energy equivalents and carbon dioxide emissions.

Examples of non-mileage based external costs include noise, travel delay, and fugitive dust during construction. Also, the STEAM user can use the parameters for other mileage-based external costs to account other external costs.

■ 4.6 Specifying Improvement Costs

Capital cost values are necessary in calculating a benefit-cost ratio for the proposed improvements. The software user enters the capital costs, the midpoint of construction, year of opening, useful life, and salvage value for all improvements being analyzed. STEAM allows each scenario up to 5 different capital investments.

To enter improvement cost information, the software user must select the “Improvement Cost” option from the “Edit” menu. The user then selects “Capital Cost Items” from the outline window. Exhibit 4.10 shows the Improvement Cost screen which is used to enter the capital cost information.

Exhibit 4.10 Improvement Cost Screen

| | Capital Items | | | | |
|-------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| | 1 | 2 | 3 | 4 | 5 |
| Capital Cost (1,000\$) | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| Mid-Point Cost (yr) | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| Year Open (yr) | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| Useful Life (yr) | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| Salvage Value (1,000\$) | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| Ext Cost Cost (1,000\$) | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |

The following information is entered for up to 5 items:

Capital Costs. This is the full cost of the capital improvement, which includes any engineering studies, right-of-way acquisition and all construction expenditures. Alternatively, engineering and right-of-way costs can be treated as separate capital cost items. For multiyear projects, capital costs include all expenditures made from start to completion. This variable is in dollars.

Midpoint of Construction. This is the year that falls in the mid point of the construction period. For single year construction projects the midpoint of construction would be the same as the year of opening.

Year of Opening. This is the year that the improvement project is planned to be completed and opened for use.

Useful Life. Useful life is the estimated number of years that a project can be used without requiring major reconstruction of the facility.

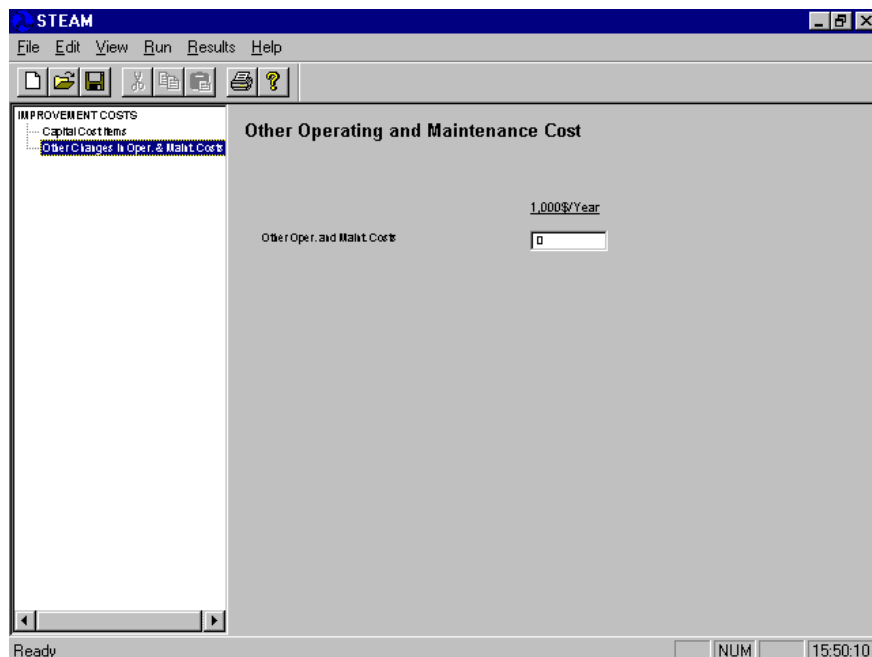
Salvage Value. This is the remaining value of the investment at the end of its useful life.

External Cost of Construction. The external costs to transportation users or non-users that occur as a result of the construction process.

If no capital cost items are specified in the scenario, a benefit analysis is performed that estimates the benefit or costs to highway and transit users.

Other changes in operating and maintenance costs are specified in the second capital cost item screen displayed in Exhibit 4.11. These costs would represent the annual cost of operating and maintaining a new highway if the improvement was to construct a new highway. Also, it could include any transit or other modal costs (e.g., bikeways or travel demand management operations) not covered elsewhere.

Exhibit 4.11 Other Operating and Maintenance Cost Screen



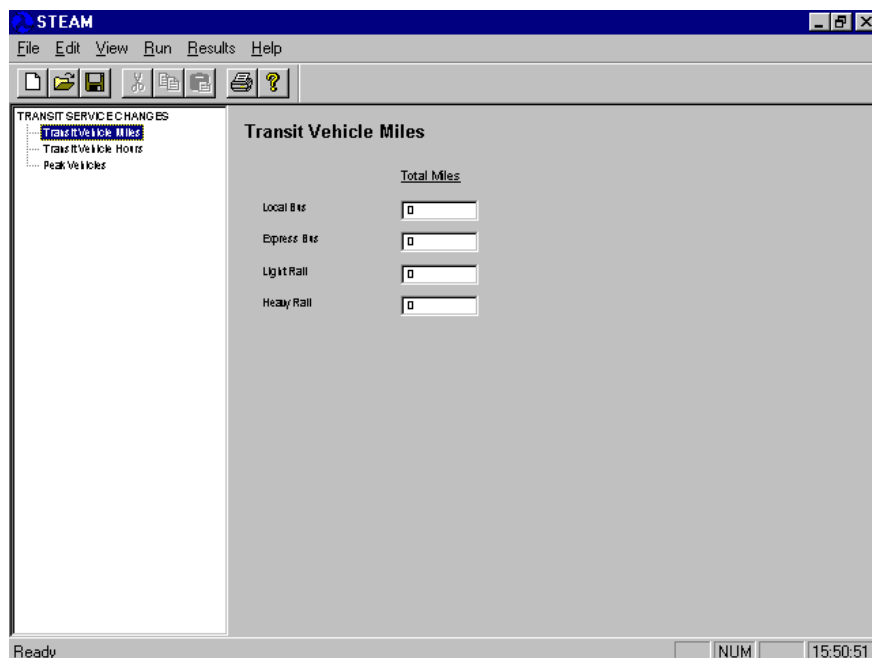
■ 4.7 Transit Service Changes

For the transit modes (local bus, express bus, light rail and heavy rail), the STEAM benefit-cost analysis allows the user to input transit service changes estimated by the user in order to calculate changes in transit costs, and other impacts such as fuel consumption and carbon dioxide and pollutant emissions changes. There are three types of transit service changes that can be specified: Transit VMT, Transit Vehicle Hours, and Transit Peak Vehicles. Exhibit 4.12 shows one of the three screens to enter the transit service changes.

To display the transit service changes screens, the user needs to select the “Transit Service Changes” option from the “Edit” menu and then select either “Transit Vehicle Miles”, “Transit Vehicle Hours”, or “Peak Vehicles” from the outline window.

The user may input only the vehicle mile changes, or both vehicle mile and vehicle hour changes, or all three transit service changes (vehicle miles, vehicle hours, and peak vehicles). While more than one type of change can be specified by the user, the user-provided unit costs associated with the changes must be additive because all three costs will be included in the analysis. Note that vehicle mile changes are also used to estimate fuel consumption, energy, carbon dioxide, and pollutant emissions changes.

Exhibit 4.12 Transit Service Changes



Transit service changes are entered in miles, hours, and vehicles. A description of the three service changes is provided below:

Transit Vehicle Miles. The total annual change in transit vehicle miles that occurs as a result of the highway or transit improvement.

Transit Vehicle Hours. The total annual change in transit vehicle hours that occurs as a result of the highway or transit improvement.

Peak Vehicles. The average change in transit peak vehicles that occurs as a result of the highway or transit improvement.

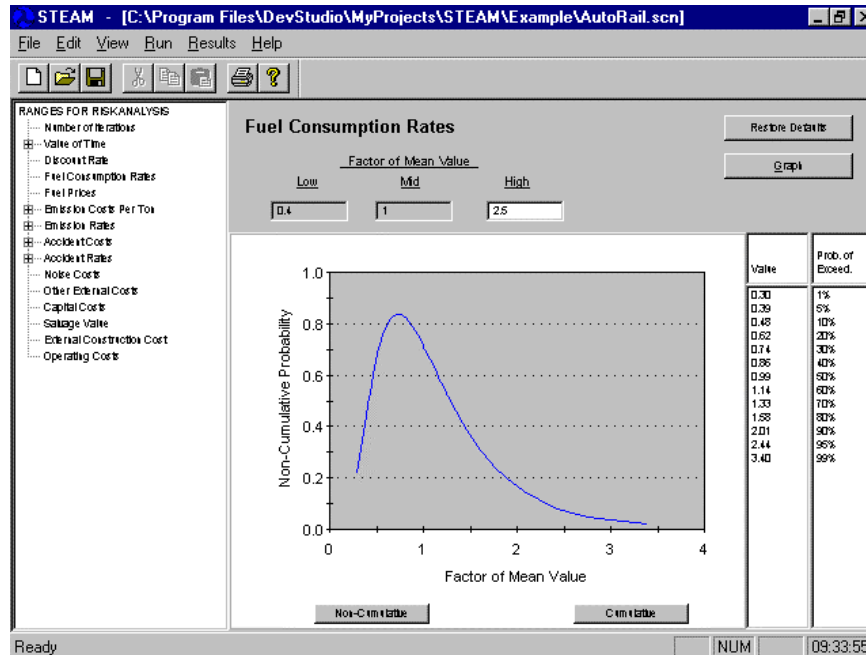
■ 4.8 Defining Risk Analysis Input Ranges

To run the risk analysis procedure on the investment scenario, the user must define ranges for input variables. The input value ranges determine the high (95 percentile) and low (5 percentile) points for the input variable and the shape of the distribution curve between the high and low points. A log normal distribution is used to determine the shape of the curve for all input variables.

In order to set the risk analysis input ranges, the user must select “Ranges for Risk Analysis” option under the “Edit” menu. This will display a list of input variables that risk ranges can be specified in the outline window. By selecting one of the input variables the risk input screen is created in the display window.

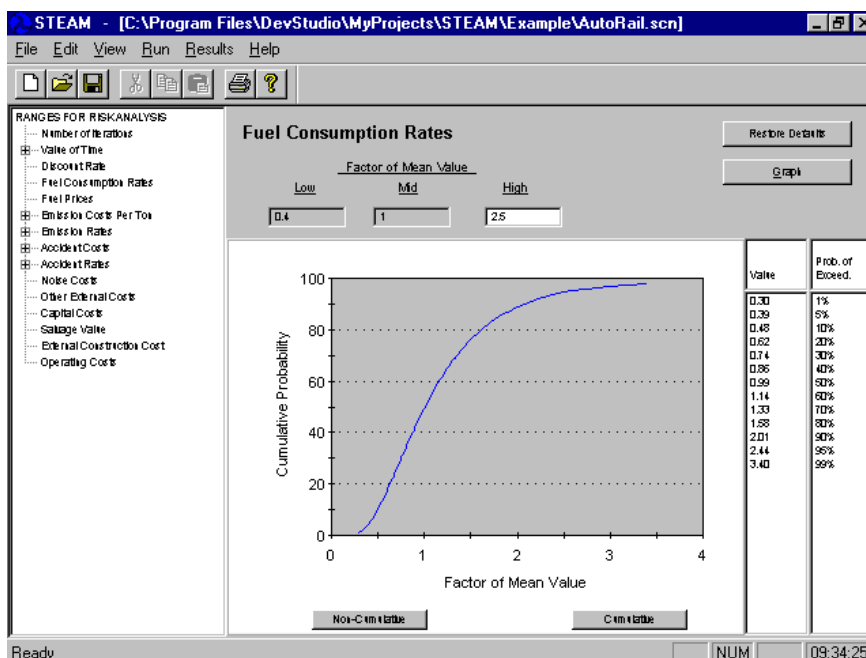
Exhibit 4.13 shows the Input Variable Risk Analysis screen. The user can enter the high value for the input variable. Most of the input variables use a risk factor which is a factor applied to all of the input variables in that category. An example is the HC emission rates. A factor of 2.5 means that the high value for all HC emission rates is 2.5 times the average values specified in the Model Parameter screens. This is applied to all 13 HC emission rates by speed increment. The low value is calculated by the program based on the log normal distribution and the high and mid points.

Exhibit 4.13 Defining Risk Analysis Ranges



To graph the curve of the distribution of the input values, the user must select the "Graph" button. Similar to other input screens, a "Restore Defaults" button is provided that resets the input variable risk range to the default values. In addition, at the bottom of the screen are "Histogram" and "Cumulative" buttons which change the graph from a histogram to a cumulative distribution curve. The cumulative distribution curve is shown in Exhibit 4.14.

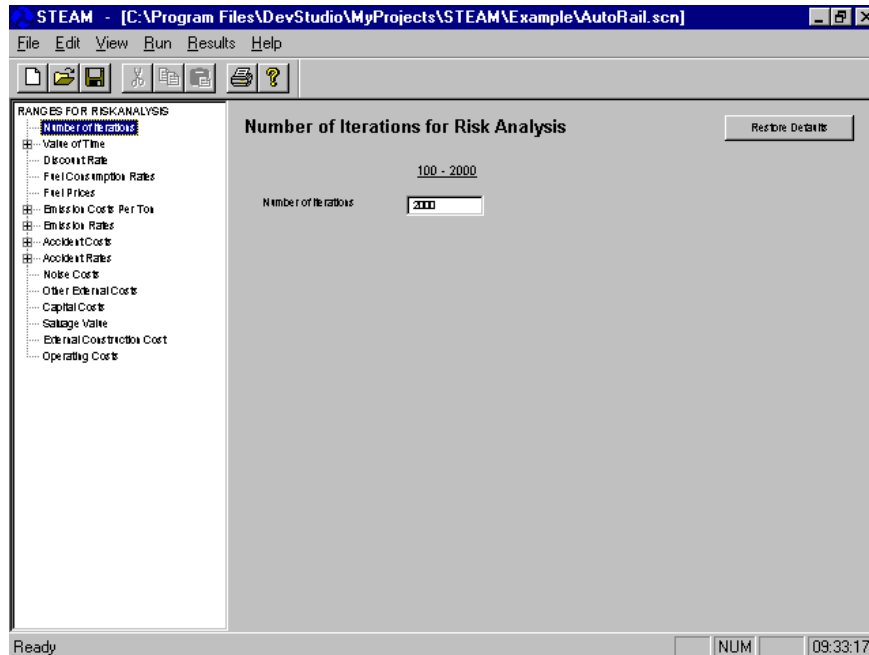
Exhibit 4.14 Cumulative Distribution Curve for Risk Analysis Ranges



Finally, the number of iterations the risk analysis procedure runs must be specified. The “Number of Iterations” is the number of times that the analysis cycles through the benefit cost estimation using different input values determined by the probability curves and a monte carlo simulation.

To set the number of iterations for risk analysis, the user must select “Number of Iterations” in the outline window. Exhibit 4.15 shows the screen for changing the iteration value. Risk analysis iterations can be set from 100 - 2000 with the default value at 2000.

Exhibit 4.15 Number of Iterations for Risk Analysis



■ 4.9 Checking Input Data Files

The STEAM software has a data checking routine that allows the user to check the formats and valid ranges of the data input files specified in the current scenario. This provides important information in identifying where a problem may exist and which file may not be specified correctly.

In order to run the data checking utility, the software user must first create or load the scenario (.scn) file with all the market sectors and input files specified. Once the scenario file is completed, the user can run the data checking utility by selecting the “Check Data Input Files” sub-option under “Check Data Input Files” option of the “Run” menu. The data checking utility may take a minute or two depending on the number of market sectors specified.

Once the data checking utility has been run, the result log can be viewed by selecting the “View Data Check Log (for most recent data check)” sub-option under the “Check Data Input Files” option in the “Run” menu. The log is for the most recent run of the data check which will be overwritten when another data check is performed. The Data Check Log view screen is presented in Exhibit 4.16.

Exhibit 4.17 shows a sample data check log for a scenario that was specified correctly and for which all the input files are in the proper format. The log is for a 6 market sector example. Exhibit 4.18 presents a sample data check log showing the error messages that occur when files cannot be found, if the input file is not in a correct format, or if the number of zones in an input file does not match the number of zones specified in the scenario.

Exhibit 4.16 Viewing Data Check Log

```

STEAM - [C:\Program Files\DevStudio\MyProjects\STEAM\Example\AutoRail.scn]
File Edit View Run Results Help
Input Data File Check Log
DATACHECK LOG OUTPUT - NULL
SCENARIO FILE - C:\Program Files\DevStudio\MyProjects\STEAM\Example\AutoRail.scn
TIME STAMP - Thu Oct 30 09:04:07 AM
OPENING CENTROID FILE - C:\Program Files\DevStudio\MyProjects\STEAM\Example\Cent.ent
EXAMINING IMP. CASE NETWORK DATA
NUMBER OF CENTROIDS SPECIFIED - 565
CLOSING CENTROID FILE - C:\Program Files\DevStudio\MyProjects\STEAM\Example\Cent.ent
OPENING BASE TRIP TABLE FILE - C:\Program Files\DevStudio\MyProjects\STEAM\Example\Auto_
EXAMINING BASE TRIP TABLE DATA
NUMBER OF TRIP ELEMENTS SPECIFIED - 565
CLOSING BASE TRIP TABLE FILE - C:\Program Files\DevStudio\MyProjects\STEAM\Example\Auto_
OPENING IMP. TRIP TABLE FILE - C:\Program Files\DevStudio\MyProjects\STEAM\Example\Auto_
EXAMINING IMP. TRIP TABLE DATA
NUMBER OF TRIP ELEMENTS SPECIFIED - 565
CLOSING IMP. TRIP TABLE FILE - C:\Program Files\DevStudio\MyProjects\STEAM\Example\Auto_
OPENING BASE IN-VEHICLE TRAVEL TIME FILE - C:\Program Files\DevStudio\MyProjects\STEAM\Example\Auto_
EXAMINING BASE IN-VEHICLE TRAVEL TIME DATA
NUMBER OF ELEMENTS SPECIFIED - 565
CLOSING BASE IN-VEHICLE TRAVEL TIME FILE - C:\Program Files\DevStudio\MyProjects\STEAM\Example\Auto_
OPENING IMP. IN-VEHICLE TRAVEL TIME FILE - C:\Program Files\DevStudio\MyProjects\STEAM\Example\Auto_
EXAMINING IMP. IN-VEHICLE TRAVEL TIME DATA
NUMBER OF ELEMENTS SPECIFIED - 565
CLOSING IMP. IN-VEHICLE TRAVEL TIME FILE - C:\Program Files\DevStudio\MyProjects\STEAM\Example\Auto_
OPENING BASE OUT-OF-VEHICLE TRAVEL TIME FILE - C:\Program Files\DevStudio\MyProjects\STEAM\Example\Auto_
EXAMINING BASE OUT-OF-VEHICLE TRAVEL TIME DATA
NUMBER OF ELEMENTS SPECIFIED - 565
CLOSING BASE OUT-OF-VEHICLE TRAVEL TIME FILE - C:\Program Files\DevStudio\MyProjects\STEAM\Example\Auto_
OPENING IMP. OUT-OF-VEHICLE TRAVEL TIME FILE - C:\Program Files\DevStudio\MyProjects\STEAM\Example\Auto_
EXAMINING IMP. OUT-OF-VEHICLE TRAVEL TIME DATA
NUMBER OF ELEMENTS SPECIFIED - 565
CLOSING IMP. OUT-OF-VEHICLE TRAVEL TIME FILE - C:\Program Files\DevStudio\MyProjects\STEAM\Example\Auto_

```

4.10 Estimating Run Time

To estimate run time, a scenario must first be defined and saved with all the market sectors included. Once this has been done, select “Estimate Run Time” from the “Edit” menu. Choose either “Estimate Run Time Without Risk Analysis” or “Estimate Run Time With Risk Analysis” depending on which analysis is desired. STEAM calculates run time based on the number of market sectors, the number of centroids, and the speed of the computer that is running the model. Exhibit 4.19 shows the message box reporting the run time estimation.

Exhibit 4.17 STEAM Data Check Log - Without Errors

```
DATACHECK LOG OUTPUT - NULL

SCENARIO FILE - C:\Program Files\STEAM\Example\AutoRail.scn
TIME STAMP - Thu Oct 30 10:46:44 AM

OPENING CENTROID FILE - C:\Program Files\STEAM\Example\Cent.cnt
EXAMINING IMP. CASE NETWORK DATA
NUMBER OF CENTROIDS SPECIFIED - 565
CLOSING CENTROID FILE - C:\Program Files\STEAM\Example\Cent.cnt

OPENING BASE TRIP TABLE FILE - C:\Program Files\STEAM\Example\Wrail_nb.trp
EXAMINING BASE TRIP TABLE DATA
NUMBER OF TRIP ELEMENTS SPECIFIED - 565
CLOSING BASE TRIP TABLE FILE - C:\Program Files\STEAM\Example\Wrail_nb.trp

OPENING IMP. TRIP TABLE FILE - C:\Program Files\STEAM\Example\Wrail_b.trp
EXAMINING IMP. TRIP TABLE DATA
NUMBER OF TRIP ELEMENTS SPECIFIED - 565
CLOSING IMP. TRIP TABLE FILE - C:\Program Files\STEAM\Example\Wrail_nb.trp

OPENING BASE IN-VEHICLE TRAVEL TIME FILE - C:\Program Files\STEAM\Example\Wrail_nb.ivt
EXAMINING BASE IN-VEHICLE TRAVEL TIME DATA
NUMBER OF ELEMENTS SPECIFIED - 565
CLOSING BASE IN-VEHICLE TRAVEL TIME FILE - C:\Program Files\STEAM\Example\Wrail_nb.ivt

OPENING IMP. IN-VEHICLE TRAVEL TIME FILE - C:\Program Files\STEAM\Example\Wrail_b.ivt
EXAMINING IMP. IN-VEHICLE TRAVEL TIME DATA
NUMBER OF ELEMENTS SPECIFIED - 565
CLOSING IMP. IN-VEHICLE TRAVEL TIME FILE - C:\Program Files\STEAM\Example\Wrail_b.ivt

OPENING BASE OUT-OF-VEHICLE TRAVEL TIME FILE - C:\Program Files\STEAM\EZ\Bs.ovt
EXAMINING BASE OUT-OF-VEHICLE TRAVEL TIME DATA
```

Exhibit 4.18 STEAM Data Check Log - With Errors

```

DATACHECK LOG OUTPUT - NULL

SCENARIO FILE - C:\Program Files\STEAM\Example\AutoRail.scn
TIME STAMP - Thu Oct 30 10:46:44 AM

OPENING CENTROID FILE - C:\Program Files\STEAM\Example\Cent.cnt
EXAMINING IMP. CASE NETWORK DATA
NUMBER OF CENTROIDS SPECIFIED - 565
CLOSING CENTROID FILE - C:\Program Files\STEAM\Example\Cent.cnt

OPENING BASE TRIP TABLE FILE - C:\Program Files\STEAM\Example\Wrail_nb.trp
EXAMINING BASE TRIP TABLE DATA
NUMBER OF TRIP ELEMENTS SPECIFIED - 565
CLOSING BASE TRIP TABLE FILE - C:\Program Files\STEAM\Example\Wrail_nb.trp

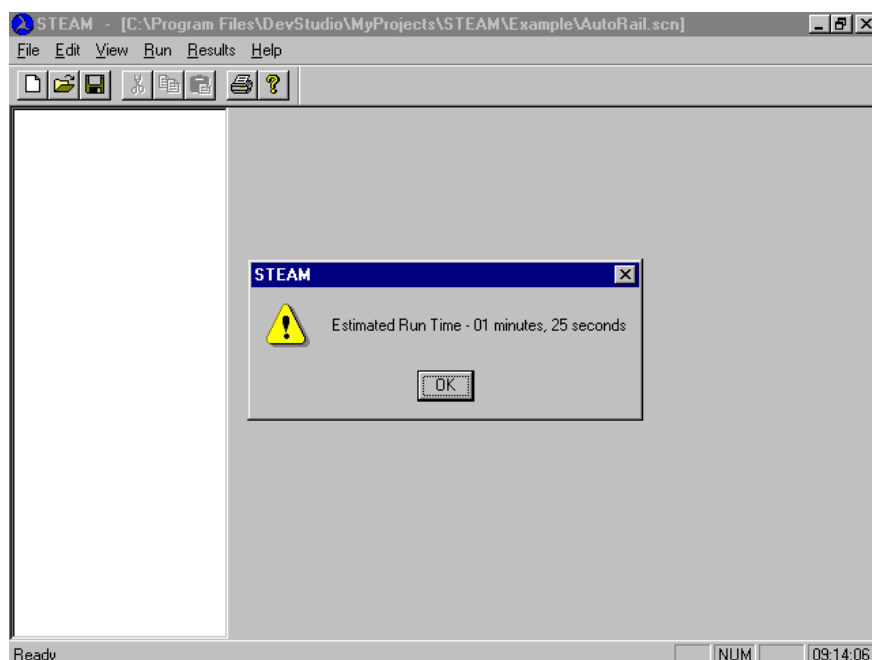
OPENING IMP. TRIP TABLE FILE - C:\Program Files\STEAM\Example\Wrail_b.trp
EXAMINING IMP. TRIP TABLE DATA
NUMBER OF TRIP ELEMENTS SPECIFIED - 565
CLOSING IMP. TRIP TABLE FILE - C:\Program Files\STEAM\Example\Wrail_nb.trp

OPENING BASE IN-VEHICLE TRAVEL TIME FILE - C:\Program Files\STEAM\Example\Wrail_nb.ivt
EXAMINING BASE IN-VEHICLE TRAVEL TIME DATA
NUMBER OF ELEMENTS SPECIFIED - 565
CLOSING BASE IN-VEHICLE TRAVEL TIME FILE - C:\Program Files\STEAM\Example\Wrail_nb.ivt

OPENING IMP. IN-VEHICLE TRAVEL TIME FILE - C:\Program Files\STEAM\Example\Wrail_b.ivt
EXAMINING IMP. IN-VEHICLE TRAVEL TIME DATA
NUMBER OF ELEMENTS SPECIFIED - 565
CLOSING IMP. IN-VEHICLE TRAVEL TIME FILE - C:\Program Files\STEAM\Example\Wrail_b.ivt

OPENING BASE OUT-OF-VEHICLE TRAVEL TIME FILE - C:\Program Files\STEAM\EZ\Bs.ovt
EXAMINING BASE OUT-OF-VEHICLE TRAVEL TIME DATA
```


Exhibit 4.19 Estimating Run Time



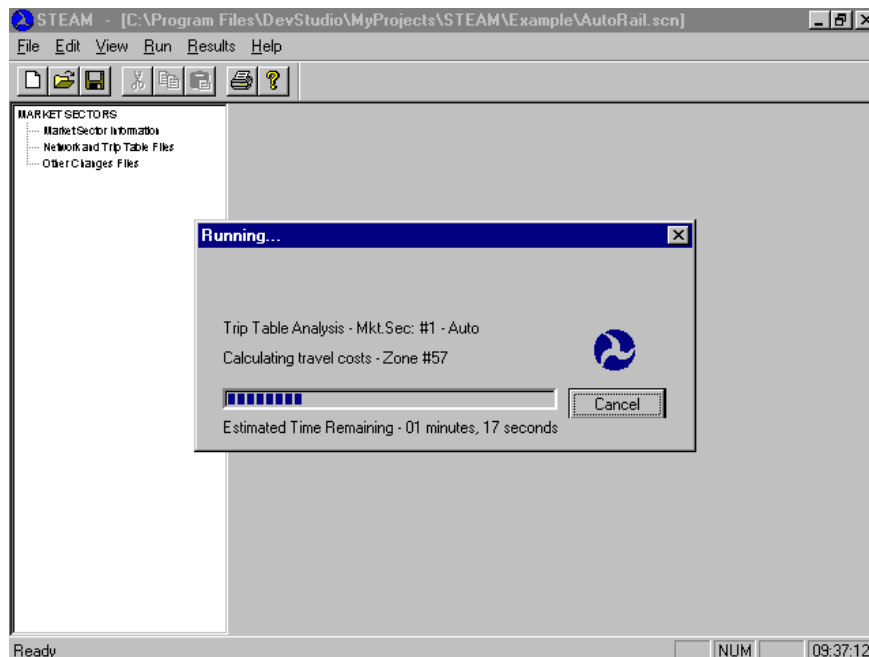
Network travel time estimations are the most time consuming process in the benefit-cost analysis. If the user is re-running a scenario that does not change previous travel time estimations or if the user has market sectors that use the same networks, there is no need to repeat the network travel time estimation procedure. Skipping travel time estimation will significantly reduce the model run time.

■ 4.11 Performing Investment Analysis

To perform an investment analysis, the user must first define the scenario with all the market sectors included and adjust any parameter values that may apply to the run. The scenario file needs to be named prior to running the analysis.

Once the scenario has been properly defined, the user begins the analysis by selecting the "Run Model" option under the "Run" menu item. The user then selects the "Run Model Without Risk Analysis" sub-option, or the "Run Model With Risk Analysis" option. Exhibit 4.20 shows the progress screen displayed when the program is running.

Exhibit 4.20 Running STEAM Analysis



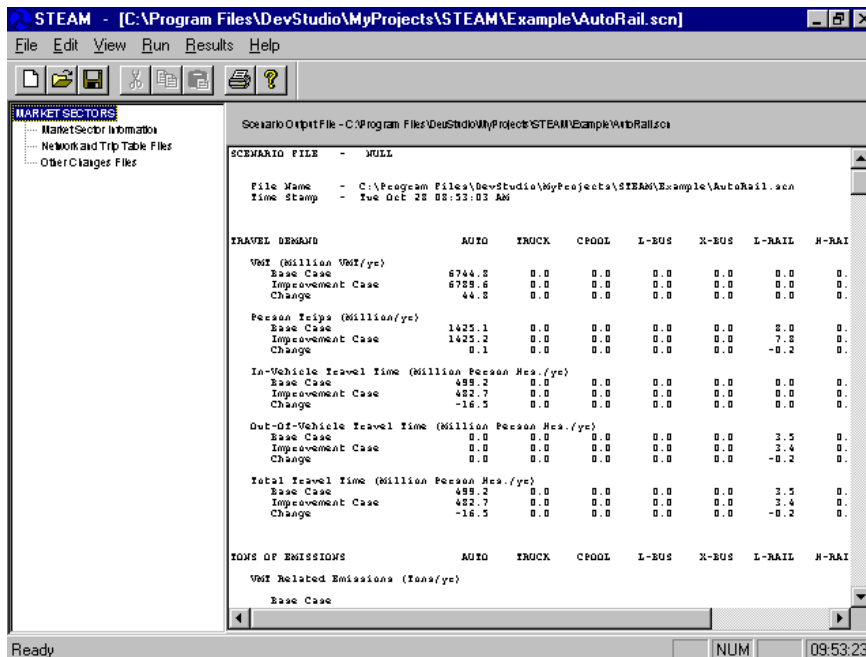
The analysis can be stopped by selecting the “Cancel” button on progress screen. The gauge on the screen indicates the percentage completion of the analysis and the remaining time value gives an estimate of the remaining time until completion.

■ 4.12 Viewing Results

Once the benefit-cost analysis has been performed, the software allows the user to view the output results of the current scenario and the risk analysis output ranges. The output information is saved to the scenario file in an ASCII format that can be imported to most applications including most spreadsheet programs. In addition to output results, the file contains the input assumptions that were used to produce the results.

To view the output file of the current scenario the user must select the “Show Current Scenario Results” option from the “Results” menu item. Exhibit 4.21 shows the screen that displays the output file for a given scenario. Scroll bars allow the user to move vertically and horizontally through the file. The viewer simply displays the contents of the output file but does not allow the user to edit the file.

Exhibit 4.21 Viewing Results



To view the output for selected variables from the risk analysis, the user must select the "Show Risk Analysis Results" option from the "Results" menu. This action displays a list of output items in the outline window. By selecting one of the output items in the outline window, the range of results for that item is graphed in the display window.

The top of the screen displays the mean and median values for the output variable. The right side of the graph presents the probability values. Similar to the input risk range screens, a "Histogram" and a "Cumulative" button is provided to allow the user to switch between the two types of graphs. Exhibit 4.22 shows the non-cumulative graph for the benefit-cost ratio result and Exhibit 4.23 shows the same output in a cumulative format.

Exhibit 4.24 presents the full layout of a scenario file.

Exhibit 4.22 Histogram Benefit Cost Ratio Risk Analysis Results

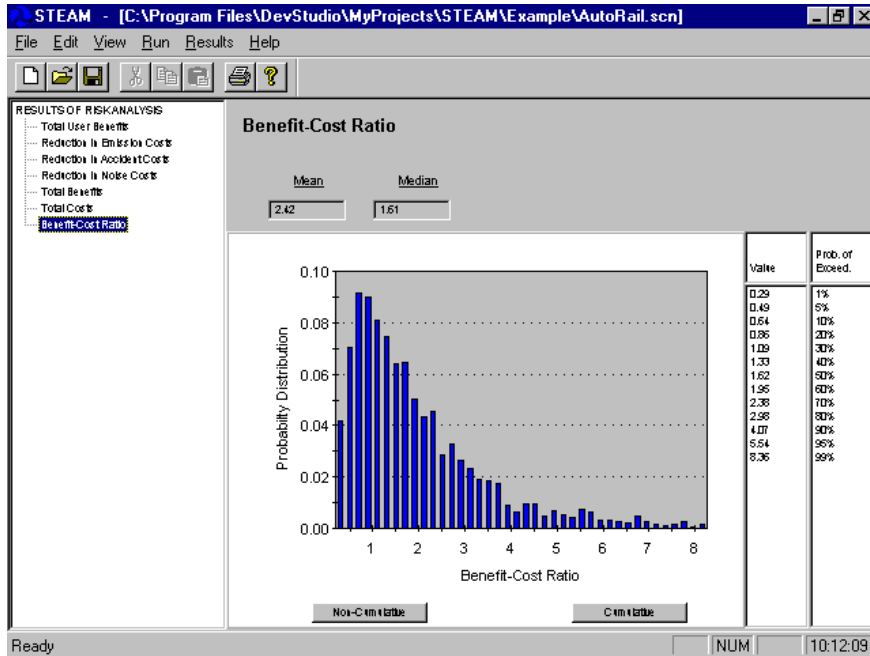


Exhibit 4.23 Cumulative Benefit Cost Ratio Risk Analysis Results

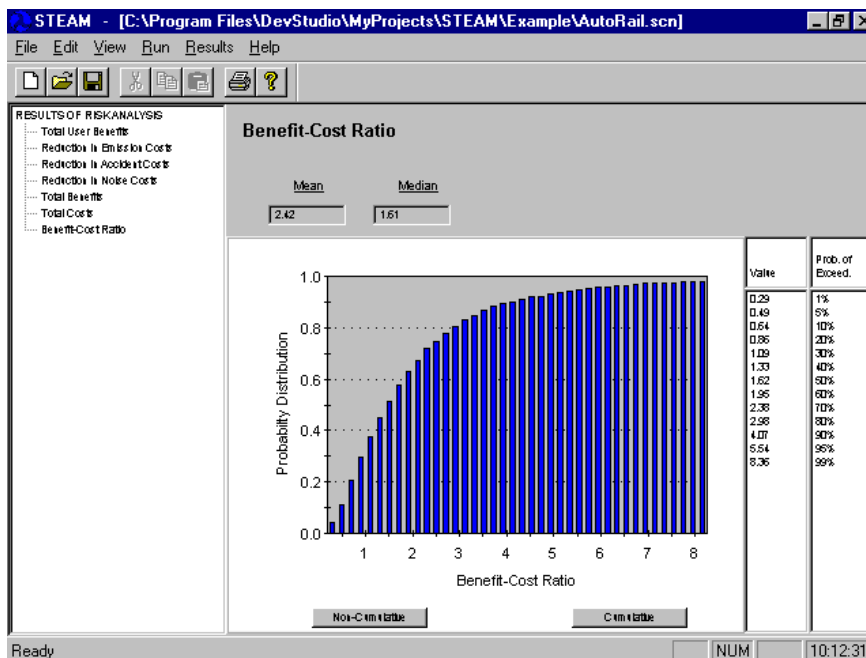


Exhibit 4.24 STEAM Scenario File

SCENARIO FILE - build-all
 File Name - C:\Steamslc\bld-all.scn
 Time Stamp - Tue Dec 23 03:35:28 PM

SCENARIO ANNUAL RESULTS

| 1) TRAVEL DEMAND | AUTO | TRUCK | CPOOL | L-BUS | X-BUS | L-RAIL | H-RAIL | OTHER | TOTAL |
|---|--------|-------|-------|-------|-------|--------|--------|-------|--------|
| VMT (Million VMT/yr) | | | | | | | | | |
| Base Case | 6744.8 | 159.0 | 29.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6933.2 |
| Improvement Case | 6789.6 | 159.8 | 32.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6981.5 |
| Change | 44.8 | 0.7 | 2.8 | -0.0 | 0.0 | -0.0 | 0.0 | 0.0 | 48.3 |
| Person Trips (Million/yr) | | | | | | | | | |
| Base Case | 1425.1 | 4.4 | 4.7 | 12.5 | 0.0 | 10.3 | 0.0 | 0.0 | 1457.0 |
| Improvement Case | 1425.2 | 4.4 | 4.9 | 12.4 | 0.0 | 10.0 | 0.0 | 0.0 | 1457.1 |
| Change | 0.1 | 0.0 | 0.2 | -0.0 | 0.0 | -0.3 | 0.0 | 0.0 | 0.0 |
| In-Vehicle Travel Time (Million Person Hrs./yr) | | | | | | | | | |
| Base Case | 499.2 | 4.7 | 2.9 | 6.4 | 0.0 | 0.9 | 0.0 | 0.0 | 514.1 |
| Improvement Case | 482.7 | 4.4 | 3.0 | 6.0 | 0.0 | 0.9 | 0.0 | 0.0 | 497.0 |
| Change | -16.5 | -0.3 | 0.1 | -0.4 | 0.0 | -0.0 | 0.0 | 0.0 | -17.1 |
| Out-Of-Vehicle Travel Time (Million Person Hrs./yr) | | | | | | | | | |
| Base Case | 0.0 | 0.0 | 0.0 | 4.5 | 0.0 | 0.6 | 0.0 | 0.0 | 5.1 |
| Improvement Case | 0.0 | 0.0 | 0.0 | 4.5 | 0.0 | 0.6 | 0.0 | 0.0 | 5.0 |
| Change | 0.0 | 0.0 | 0.0 | -0.0 | 0.0 | -0.0 | 0.0 | 0.0 | -0.0 |
| Total Travel Time (Million Person Hrs./yr) | | | | | | | | | |
| Base Case | 499.2 | 4.7 | 2.9 | 10.9 | 0.0 | 1.5 | 0.0 | 0.0 | 519.2 |
| Improvement Case | 482.7 | 4.4 | 3.0 | 10.5 | 0.0 | 1.5 | 0.0 | 0.0 | 502.1 |
| Change | -16.5 | -0.3 | 0.1 | -0.4 | 0.0 | -0.1 | 0.0 | 0.0 | -17.1 |

| 2) TONS OF EMISSIONS | AUTO | TRUCK | CPOOL | L-BUS | X-BUS | L-RAIL | H-RAIL | OTHER | TOTAL |
|---------------------------------|------|-------|-------|-------|-------|--------|--------|-------|-------|
| VMT Related Emissions (Tons/yr) | | | | | | | | | |
| Base Case | | | | | | | | | |

STEAM User Manual

| | | | | | | | | | |
|---|----------|--------|--------|-------|-------|--------|--------|-------|----------|
| HC | 6012.5 | 230.0 | 25.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6267.5 |
| CO | 122377.5 | 1105.0 | 470.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 123952.5 |
| NOx | 7157.5 | 1062.5 | 30.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 8250.0 |
| PM10 | 252.5 | 55.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 307.5 |
| Improvement Case | | | | | | | | | |
| HC | 5915.0 | 225.0 | 25.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6165.0 |
| CO | 118722.5 | 1075.0 | 490.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 120287.5 |
| NOx | 7210.0 | 1067.5 | 35.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 8312.5 |
| PM10 | 255.0 | 57.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 312.5 |
| Change | | | | | | | | | |
| HC | -97.5 | -5.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -102.5 |
| CO | -3655.0 | -30.0 | 20.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -3665.0 |
| NOx | 52.5 | 5.0 | 5.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 62.5 |
| PM10 | 2.5 | 2.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5.0 |
| Cold Start Emissions (Tons/yr) | | | | | | | | | |
| Base Case | | | | | | | | | |
| HC | 1452.5 | 0.0 | 2.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1455.0 |
| CO | 42032.5 | 0.0 | 90.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 42122.5 |
| NOx | 600.0 | 0.0 | 2.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 602.5 |
| PM10 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Improvement Case | | | | | | | | | |
| HC | 1452.5 | 0.0 | 2.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1455.0 |
| CO | 42035.0 | 0.0 | 95.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 42130.0 |
| NOx | 600.0 | 0.0 | 2.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 602.5 |
| PM10 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Change | | | | | | | | | |
| HC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| CO | 2.5 | 0.0 | 5.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 7.5 |
| NOx | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| PM10 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Combined VMT and Cold Start Emissions (Tons/yr) | | | | | | | | | |
| Base Case | | | | | | | | | |
| HC | 7465.0 | 230.0 | 27.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 7722.5 |
| CO | 164410.0 | 1105.0 | 560.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 166075.0 |
| NOx | 7757.5 | 1062.5 | 32.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 8852.5 |
| PM10 | 252.5 | 55.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 307.5 |
| Improvement Case | | | | | | | | | |
| HC | 7367.5 | 225.0 | 27.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 7620.0 |
| CO | 160757.5 | 1075.0 | 585.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 162417.5 |
| NOx | 7810.0 | 1067.5 | 37.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 8915.0 |
| PM10 | 255.0 | 57.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 312.5 |
| Change | | | | | | | | | |
| HC | -97.5 | -5.0 | 0.0 | -0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -102.5 |
| CO | -3652.5 | -30.0 | 25.0 | -0.2 | 0.0 | 0.0 | 0.0 | 0.0 | -3657.7 |
| NOx | 52.5 | 5.0 | 5.0 | -0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 62.4 |
| PM10 | 2.5 | 2.5 | 0.0 | -0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5.0 |
| 3)EMISSION COSTS | | | | | | | | | |
| | AUTO | TRUCK | CPOOL | L-BUS | X-BUS | L-RAIL | H-RAIL | OTHER | TOTAL |
| VMT Related Emission Costs (1000\$/yr) | | | | | | | | | |
| Base Case | | | | | | | | | |
| HC | 10666.2 | 408.0 | 44.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 11118.5 |
| CO | 475926.1 | 4297.3 | 1827.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 482051.3 |
| NOx | 26704.6 | 3964.2 | 111.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 30780.8 |
| PM10 | 2794.2 | 608.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3402.8 |
| Improvement Case | | | | | | | | | |
| HC | 10493.2 | 399.2 | 44.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 10936.7 |
| CO | 461711.8 | 4180.7 | 1905.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 467798.1 |
| NOx | 26900.5 | 3982.8 | 130.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 31013.9 |
| PM10 | 2821.8 | 636.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3458.1 |
| Change | | | | | | | | | |
| HC | -173.0 | -8.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -181.8 |
| CO | -14214.3 | -116.7 | 77.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -14253.2 |
| NOx | 195.9 | 18.7 | 18.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 233.2 |
| PM10 | 27.7 | 27.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 55.3 |
| Cold Start Emission Costs (1000\$/yr) | | | | | | | | | |
| Base Case | | | | | | | | | |
| HC | 2576.7 | 0.0 | 4.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2581.2 |
| CO | 163464.4 | 0.0 | 350.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 163814.4 |
| NOx | 2238.6 | 0.0 | 9.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2247.9 |
| PM10 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Improvement Case | | | | | | | | | |
| HC | 2576.7 | 0.0 | 4.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2581.2 |
| CO | 163474.1 | 0.0 | 369.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 163843.6 |
| NOx | 2238.6 | 0.0 | 9.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2247.9 |
| PM10 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

| | | | | | | | | | | |
|--|----------|---------|--------|-------|-------|--------|--------|-------|-------|----------|
| Change | | | | | | | | | | |
| HC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| CO | 9.7 | 0.0 | 19.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 29.2 |
| NOx | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| PM10 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Combined VMT and Cold Start Emission Costs (1000\$/yr) | | | | | | | | | | |
| Base Case | | | | | | | | | | |
| HC | 13242.9 | 408.0 | 48.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 13699.7 |
| CO | 639390.5 | 4297.3 | 2177.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 645865.7 |
| NOx | 28943.2 | 3964.2 | 121.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 33028.7 |
| PM10 | 2794.2 | 608.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3402.8 |
| Improvement Case | | | | | | | | | | |
| HC | 13069.9 | 399.2 | 48.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 13517.9 |
| CO | 625185.9 | 4180.7 | 2275.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 631641.7 |
| NOx | 29139.1 | 3982.8 | 139.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 33261.9 |
| PM10 | 2821.8 | 636.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3458.1 |
| Change | | | | | | | | | | |
| HC | -173.0 | -8.9 | 0.0 | -0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -181.9 |
| CO | -14204.6 | -116.7 | 97.2 | -0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -14224.6 |
| NOx | 195.9 | 18.7 | 18.7 | -0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 232.9 |
| PM10 | 27.7 | 27.7 | 0.0 | -0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 55.3 |
| Total Em. Costs(1000\$/yr) | -14154.0 | -79.2 | 115.9 | -1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -14118.4 |
| 4) GREENHOUSE GAS EMISSIONS | | | | | | | | | | |
| | AUTO | TRUCK | CPOOL | L-BUS | X-BUS | L-RAIL | H-RAIL | OTHER | TOTAL | |
| BTU Energy Consumption(100 Billion BTU/yr) | | | | | | | | | | |
| Base Case | 270.8 | 39.6 | 1.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 311.5 |
| Improvement Case | 265.6 | 39.3 | 1.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 306.0 |
| Change | -5.2 | -0.3 | 0.1 | -0.0 | 0.0 | -0.0 | 0.0 | 0.0 | 0.0 | -5.5 |
| CO2 Emissions (1,000 Tons/yr) | | | | | | | | | | |
| Base Case | 2112.4 | 312.9 | 8.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2433.6 |
| Improvement Case | 2071.6 | 310.5 | 8.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2391.0 |
| Change | -40.8 | -2.4 | 0.6 | -0.3 | 0.0 | -0.0 | 0.0 | 0.0 | 0.0 | -42.9 |
| Greenhouse Gas Emissions Costs(1000\$/yr) | | | | | | | | | | |
| Base Case | 7518.1 | 1113.6 | 29.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 8661.2 |
| Improvement Case | 7372.8 | 1105.1 | 31.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 8509.5 |
| Change | -145.3 | -8.5 | 2.1 | -1.0 | 0.0 | -0.1 | 0.0 | 0.0 | 0.0 | -152.8 |
| 5) ACCIDENTS | | | | | | | | | | |
| | AUTO | TRUCK | CPOOL | L-BUS | X-BUS | L-RAIL | H-RAIL | OTHER | TOTAL | |
| Number of Accidents | | | | | | | | | | |
| Fatalities | | | | | | | | | | |
| Base Case | 57.1 | 1.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 58.4 |
| Improvement Case | 57.4 | 1.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 58.6 |
| Change | 0.2 | 0.0 | 0.0 | -0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 |
| Injuries | | | | | | | | | | |
| Base Case | 7169.8 | 104.2 | 27.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 7300.9 |
| Improvement Case | 7172.0 | 104.2 | 29.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 7305.3 |
| Change | 2.2 | 0.0 | 2.1 | -0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.3 |
| Property-Damage-Only | | | | | | | | | | |
| Base Case | 20504.2 | 289.5 | 89.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 20882.9 |
| Improvement Case | 20640.5 | 290.8 | 97.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 21028.9 |
| Change | 136.3 | 1.3 | 8.4 | -0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 146.0 |
| External Accident Costs | | | | | | | | | | |
| Fatalities (1000\$/yr) | | | | | | | | | | |
| Base Case | 23358.5 | 415.7 | 93.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23867.6 |
| Improvement Case | 23460.6 | 416.7 | 101.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23978.7 |
| Change | 102.0 | 1.0 | 8.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 111.1 |
| Injuries (1000\$/yr) | | | | | | | | | | |
| Base Case | 64226.8 | 933.4 | 241.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 65401.7 |
| Improvement Case | 64246.7 | 933.6 | 260.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 65440.6 |
| Change | 19.9 | 0.2 | 18.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 39.0 |
| Property-Damage-Only (1000\$/yr) | | | | | | | | | | |
| Base Case | 10211.1 | 144.1 | 44.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 10399.7 |
| Improvement Case | 10279.0 | 144.8 | 48.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 10472.4 |
| Change | 67.9 | 0.7 | 4.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 72.7 |
| Total Ext. Acc.(1000\$/yr) | 189.8 | 1.9 | 31.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 222.7 |
| 6) FUEL AND NON-FUEL COSTS | | | | | | | | | | |
| | AUTO | TRUCK | CPOOL | L-BUS | X-BUS | L-RAIL | H-RAIL | OTHER | TOTAL | |
| Gallons or Gallon Equivalent (1000gal./yr) | | | | | | | | | | |
| Base Case | 216658.5 | 28556.0 | 849.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 246064.0 |
| Improvement Case | 212471.2 | 28338.5 | 908.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 241718.6 |
| Change | -4187.2 | -217.4 | 59.2 | -26.5 | 0.0 | -2.7 | 0.0 | 0.0 | 0.0 | -4374.7 |
| Energy Costs (1000\$/yr) | | | | | | | | | | |

STEAM User Manual

| | | | | | | | | | |
|--|----------|---------|--------|--------|-------|----------|--------|-------|----------|
| Base Case | 262156.8 | 32810.8 | 1028.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 295995.6 |
| Improvement Case | 257090.2 | 32561.0 | 1099.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 290750.8 |
| Change | -5066.6 | -249.8 | 71.7 | -30.5 | 0.0 | -3.1 | 0.0 | 0.0 | -5278.3 |
| Non-Fuel Operating Costs (1000\$/yr) *1 | | | | | | | | | |
| Base Case | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Improvement Case | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Change | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 7) EXTERNAL COSTS | | | | | | | | | |
| | AUTO | TRUCK | CPOOL | L-BUS | X-BUS | L-RAIL | H-RAIL | OTHER | TOTAL |
| Noise Costs (1000\$/yr) | | | | | | | | | |
| Base Case | 6744.8 | 2796.4 | 29.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9570.5 |
| Improvement Case | 6789.6 | 2804.3 | 32.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9626.1 |
| Change | 44.8 | 8.0 | 2.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 55.6 |
| Other Mileage Based External Costs (1000\$/yr) | | | | | | | | | |
| Base Case | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Improvement Case | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Change | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Non-Mileage Based External Costs (1000\$/yr) | | | | | | | | | |
| Change | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| External Cost During Construction (1000\$/yr) | | | | | | | | | |
| Change | | | | | | | | | 2636.9 |
| 8) USER BENEFITS | | | | | | | | | |
| | AUTO | TRUCK | CPOOL | L-BUS | X-BUS | L-RAIL | H-RAIL | OTHER | TOTAL |
| Benefits (1000\$/yr) | | | | | | | | | |
| In-Vehicle Travel Time | 171568.3 | 4541.4 | 1444.7 | 4723.3 | 0.0 | 84.2 | 0.0 | 0.0 | 182361.9 |
| Out-of-Veh. Travel Time | 0.0 | 0.0 | 0.0 | 158.1 | 0.0 | -173.6 | 0.0 | 0.0 | -15.4 |
| Fuel Costs *2 | 6715.5 | 249.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6965.3 |
| Non-Fuel Oper. Costs*2 | 194.8 | -72.3 | 3.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 125.6 |
| Out-of-Pocket Costs | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Intern. Accident Cst.*2 | 1960.3 | -10.6 | 12.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1962.3 |
| Total | 180438.9 | 4708.4 | 1460.3 | 4881.5 | 0.0 | -89.4 | 0.0 | 0.0 | 191399.7 |
| Revenue Transfers (1000\$/yr) | | | | | | | | | |
| Transfers *2 | -1569.4 | -92.6 | 22.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -1639.8 |
| 9) PUBLIC VEHICLE OPER. COSTS | | | | | | | | | |
| | AUTO | TRUCK | CPOOL | L-BUS | X-BUS | L-RAIL | H-RAIL | OTHER | TOTAL |
| Operating Costs(1000\$/yr) | 0.0 | 0.0 | 0.0 | -50.0 | 0.0 | -100.0 | 0.0 | 0.0 | -150.0 |
| 10) CAPITAL COSTS | | | | | | | | | |
| | 1ST | 2ND | 3RD | 4TH | 5TH | TOTAL | | | |
| Capital Cost (1000\$) | 687800.0 | 0.0 | 0.0 | 0.0 | 0.0 | 687800.0 | | | |
| Salvage Value (1000\$) | 24400.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24400.0 | | | |
| Annualized Cost (1000\$) | 73735.7 | 0.0 | 0.0 | 0.0 | 0.0 | 73735.7 | | | |
| Other Op/Maint. Cost (1000\$/yr) | | | | | | 890.0 | | | |
| 11) SUMMARY | | | | | | | | | |
| Benefits (1000\$/yr) | | | | | | | | | |
| | TOTAL | | | | | | | | |
| User Benefits | 191399.7 | | | | | | | | |
| Revenue Transfers | -1639.8 | | | | | | | | |
| Fuel Costs *1 | 0.0 | | | | | | | | |
| Non-Fuel Op. Costs *1 | 0.0 | | | | | | | | |
| Reduction in External Costs | | | | | | | | | |
| Emissions | 14118.4 | | | | | | | | |
| Global Warming | 152.8 | | | | | | | | |
| Noise | -55.6 | | | | | | | | |
| Accident | -222.7 | | | | | | | | |
| Other Mileage Based | 0.0 | | | | | | | | |
| Other Non-Mileage Based | 0.0 | | | | | | | | |
| Construction Period | -2636.9 | | | | | | | | |
| Subtotal | 11203.1 | | | | | | | | |
| Total Benefits | 203750.1 | | | | | | | | |
| Costs To Public Agencies (1000\$/yr) | | | | | | | | | |
| Capital Costs | 73735.7 | | | | | | | | |
| Public Vehicle Oper. Cost | -150.0 | | | | | | | | |
| Other Operating & Maint. Costs | 890.0 | | | | | | | | |
| Total Costs to Public Agencies | 74475.7 | | | | | | | | |
| Net Annual Worth (1000\$/yr) | 129274.4 | | | | | | | | |
| Benefit-Cost Ratio | 2.7 | | | | | | | | |

SCENARIO ASSUMPTIONS

| VALUE OF TIME | AUTO | TRUCK | CPOOL | L-BUS | X-BUS | L-RAIL | H-RAIL | OTHER |
|--|--------|--------|---------|--------|---------------------|--------|--------|-------|
| In-Vehicle (\$/hr.) | 8.90 | 16.50 | 8.90 | 8.90 | 8.90 | 8.90 | 8.90 | 8.90 |
| Out-of-Vehicle (\$/hr.) | 17.00 | 17.00 | 17.00 | 17.00 | 17.00 | 17.00 | 17.00 | 17.00 |
| FUEL COSTS | AUTO | TRUCK | | | | | | |
| Dollars Per Gallon | 1.21 | 1.15 | | | | | | |
| Include Fuel Cost in User Benefits | | | TRUE | | | | | |
| NON FUEL COSTS | AUTO | TRUCK | | | | | | |
| Dollars Per Gallon | 0.034 | 0.100 | | | | | | |
| Include Non-Fuel Op. Cost in User Benefits | | | TRUE | | | | | |
| FUEL CONSUMPTION RATES(g/mile) | AUTO | TRUCK | LOC.BUS | EX.BUS | L.RAIL | H.RAIL | | |
| | | | | | (KWhr/Vehicle Mile) | | | |
| 5 MPH | 0.066 | 0.481 | - | - | - | - | | |
| 10 MPH | 0.042 | 0.314 | - | - | - | - | | |
| 15 MPH | 0.039 | 0.255 | - | - | - | - | | |
| 20 MPH | 0.029 | 0.223 | - | - | - | - | | |
| 25 MPH | 0.027 | 0.203 | - | - | - | - | | |
| 30 MPH | 0.025 | 0.189 | - | - | - | - | | |
| 35 MPH | 0.024 | 0.179 | - | - | - | - | | |
| 40 MPH | 0.023 | 0.171 | - | - | - | - | | |
| 45 MPH | 0.023 | 0.165 | - | - | - | - | | |
| 50 MPH | 0.022 | 0.160 | - | - | - | - | | |
| 55 MPH | 0.021 | 0.157 | - | - | - | - | | |
| 60 MPH | 0.020 | 0.153 | - | - | - | - | | |
| 65 MPH | 0.019 | 0.150 | - | - | - | - | | |
| Average | - | - | 0.377 | 0.235 | 11.090 | 7.630 | | |
| HC EMISSION RATES (gr./mile) | AUTO | TRUCK | BUS | RAIL | | | | |
| 5 MPH | 1.700 | 4.000 | - | - | | | | |
| 10 MPH | 1.100 | 3.140 | - | - | | | | |
| 15 MPH | 0.900 | 2.520 | - | - | | | | |
| 20 MPH | 0.790 | 2.070 | - | - | | | | |
| 25 MPH | 0.690 | 1.730 | - | - | | | | |
| 30 MPH | 0.620 | 1.490 | - | - | | | | |
| 35 MPH | 0.570 | 1.300 | - | - | | | | |
| 40 MPH | 0.530 | 1.170 | - | - | | | | |
| 45 MPH | 0.490 | 1.070 | - | - | | | | |
| 50 MPH | 0.480 | 1.000 | - | - | | | | |
| 55 MPH | 0.480 | 0.960 | - | - | | | | |
| 60 MPH | 0.510 | 0.940 | - | - | | | | |
| 65 MPH | 0.550 | 0.940 | - | - | | | | |
| Average | - | - | 2.520 | 0.000 | | | | |
| CO EMISSION RATES (gr./mile) | AUTO | TRUCK | BUS | RAIL | | | | |
| 5 MPH | 40.940 | 29.160 | - | - | | | | |
| 10 MPH | 24.810 | 20.110 | - | - | | | | |
| 15 MPH | 19.430 | 14.510 | - | - | | | | |
| 20 MPH | 16.440 | 10.960 | - | - | | | | |
| 25 MPH | 12.540 | 8.660 | - | - | | | | |
| 30 MPH | 9.940 | 7.160 | - | - | | | | |
| 35 MPH | 8.080 | 6.200 | - | - | | | | |
| 40 MPH | 6.680 | 5.620 | - | - | | | | |
| 45 MPH | 5.600 | 5.330 | - | - | | | | |
| 50 MPH | 5.060 | 5.290 | - | - | | | | |
| 55 MPH | 5.060 | 5.490 | - | - | | | | |
| 60 MPH | 7.390 | 5.970 | - | - | | | | |
| 65 MPH | 9.710 | 6.790 | - | - | | | | |
| Average | - | - | 14.590 | 0.000 | | | | |
| NO EMISSION RATES (gr./mile) | AUTO | TRUCK | BUS | RAIL | | | | |
| 5 MPH | 1.140 | 10.800 | - | - | | | | |
| 10 MPH | 1.000 | 8.960 | - | - | | | | |
| 15 MPH | 0.960 | 7.700 | - | - | | | | |
| 20 MPH | 0.940 | 6.860 | - | - | | | | |
| 25 MPH | 0.970 | 6.330 | - | - | | | | |
| 30 MPH | 0.980 | 6.050 | - | - | | | | |
| 35 MPH | 0.990 | 6.000 | - | - | | | | |
| 40 MPH | 1.000 | 6.160 | - | - | | | | |
| 45 MPH | 1.010 | 6.550 | - | - | | | | |
| 50 MPH | 1.070 | 7.220 | - | - | | | | |
| 55 MPH | 1.220 | 8.240 | - | - | | | | |
| 60 MPH | 1.360 | 9.750 | - | - | | | | |
| 65 MPH | 1.510 | 11.960 | - | - | | | | |
| Average | - | - | 7.700 | 0.000 | | | | |
| PM10 EMISSION RATES (gr./mile) | AUTO | TRUCK | BUS | RAIL | | | | |
| Average | 0.034 | 0.320 | 0.320 | 0.000 | | | | |

STEAM User Manual

| | | | | | | | | | |
|-----------------------------------|------------|--------|---------|---------|-------|--------|--------|-------|--|
| COST PER TON OF EMISSIONS(\$/Ton) | HC | CO | NOx | PM10 | | | | | |
| Average | 1774.0 | 3889.0 | 3731.0 | 11066.0 | | | | | |
| EMISSIONS PER COLD START | HC | CO | NOx | PM10 | | | | | |
| Auto (gr./start) | 2.080 | 60.200 | 0.860 | 0.000 | | | | | |
| Truck (gr./start) | 0.000 | 0.000 | 0.000 | 0.000 | | | | | |
| COLD STARTS PER VEHICLE TRIP | STARTS | | | | | | | | |
| Auto (starts/trip) | 0.60 | | | | | | | | |
| Truck (starts/trip) | 0.00 | | | | | | | | |
| GREENHOUSE GAS EMIS. RATES | TONS/M.BTU | | | | | | | | |
| Auto (CO2 tons/mill.BTU) | 0.07800 | | | | | | | | |
| Truck (CO2 tons/mill.BTU) | 0.07900 | | | | | | | | |
| Bus (CO2 tons/mill.BTU) | 0.07900 | | | | | | | | |
| Rail (CO2 tons/mill.BTU) | 0.06400 | | | | | | | | |
| GREENHOUSE GAS EMIS. COSTS | \$/Ton | | | | | | | | |
| CO2 Emissions | 3.56 | | | | | | | | |
| COST PER ACCIDENT (\$/accident) | FATAL | INJURY | PDO | | | | | | |
| Internal Accident Cost | 2317398 | 50760 | 2824 | | | | | | |
| External Accident Cost | 408952 | 8958 | 498 | | | | | | |
| FATALITY RATES (fat/100 mil.VMT) | AUTO | TRUCK | BUS | RAIL | | | | | |
| 1st Highway Class | 0.62 | 0.62 | - | - | | | | | |
| 2nd Highway Class | 0.84 | 0.84 | - | - | | | | | |
| 3rd Highway Class | 1.65 | 1.65 | - | - | | | | | |
| 4th Highway Class | 1.21 | 1.21 | - | - | | | | | |
| 5th Highway Class | 0.94 | 0.94 | - | - | | | | | |
| 6th Highway Class | 1.78 | 1.78 | - | - | | | | | |
| Average | - | - | 1.210 | 0.000 | | | | | |
| INJURY RATES (inj/100 mil.VMT) | AUTO | TRUCK | BUS | RAIL | | | | | |
| 1st Highway Class | 61.60 | 61.60 | - | - | | | | | |
| 2nd Highway Class | 101.11 | 101.11 | - | - | | | | | |
| 3rd Highway Class | 227.09 | 227.09 | - | - | | | | | |
| 4th Highway Class | 219.17 | 219.17 | - | - | | | | | |
| 5th Highway Class | 178.78 | 178.78 | - | - | | | | | |
| 6th Highway Class | 278.91 | 278.91 | - | - | | | | | |
| Average | - | - | 179.440 | 0.000 | | | | | |
| PDO CRASH RATES (pdo/100 mil.VMT) | AUTO | TRUCK | BUS | RAIL | | | | | |
| 1st Highway Class | 304.00 | 182.00 | - | - | | | | | |
| 2nd Highway Class | 304.00 | 182.00 | - | - | | | | | |
| 3rd Highway Class | 304.00 | 182.00 | - | - | | | | | |
| 4th Highway Class | 304.00 | 182.00 | - | - | | | | | |
| 5th Highway Class | 304.00 | 182.00 | - | - | | | | | |
| 6th Highway Class | 304.00 | 182.00 | - | - | | | | | |
| Average | - | - | 182.000 | 0.000 | | | | | |
| NOISE COSTS (\$/mile) | AUTO | TRUCK | BUS | RAIL | | | | | |
| 1st Highway Class | 0.001 | 0.017 | - | - | | | | | |
| 2nd Highway Class | 0.001 | 0.018 | - | - | | | | | |
| 3rd Highway Class | 0.001 | 0.037 | - | - | | | | | |
| 4th Highway Class | 0.001 | 0.043 | - | - | | | | | |
| 5th Highway Class | 0.001 | 0.054 | - | - | | | | | |
| 6th Highway Class | 0.001 | 0.054 | - | - | | | | | |
| Average | - | - | 0.014 | 0.000 | | | | | |
| OTHER MILEAGE EXT.COST (\$/mile) | AUTO | TRUCK | BUS | RAIL | | | | | |
| 1st Highway Class | 0.000 | 0.000 | - | - | | | | | |
| 2nd Highway Class | 0.000 | 0.000 | - | - | | | | | |
| 3rd Highway Class | 0.000 | 0.000 | - | - | | | | | |
| 4th Highway Class | 0.000 | 0.000 | - | - | | | | | |
| 5th Highway Class | 0.000 | 0.000 | - | - | | | | | |
| 6th Highway Class | 0.000 | 0.000 | - | - | | | | | |
| Average | - | - | 0.000 | 0.000 | | | | | |
| NON-MILEAGE EXTERNAL COSTS | AUTO | TRUCK | CPOOL | L-BUS | X-BUS | L-RAIL | H-RAIL | OTHER | |
| Total (\$) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| TRANSIT AGENCY UNIT COSTS | L.BUS | EX.BUS | L.RAIL | H.RAIL | | | | | |
| \$/Vehicle Mile | 5.000 | 0.000 | 10.000 | 0.000 | | | | | |
| \$/Vehicle Hour | 0.000 | 0.000 | 0.000 | 0.000 | | | | | |
| \$/Peak Vehicle | 0.000 | 0.000 | 0.000 | 0.000 | | | | | |
| TRANSIT DEMAND | L.BUS | EX.BUS | L.RAIL | H.RAIL | | | | | |
| Vehicle Miles (1,000) | -10.00 | 0.00 | -10.00 | 0.00 | | | | | |
| Vehicle Hours (1,000) | 0.00 | 0.00 | 0.00 | 0.00 | | | | | |

| | | | | | | |
|---|--------|-------|------|------|-----|--------|
| Peak Vehicles (1,000) | 0.00 | 0.00 | 0.00 | 0.00 | | |
| DISCOUNT RATE | | VALUE | | | | |
| Discount Rate | 0.0700 | | | | | |
| INVESTMENT COSTS | 1ST | 2ND | 3RD | 4TH | 5TH | TOTAL |
| Capital Costs (1,000\$) | 687800 | 0 | 0 | 0 | 0 | 687800 |
| Mid Point Construction | 1998 | 0 | 0 | 0 | 0 | - |
| Year Opening | 2000 | 0 | 0 | 0 | 0 | - |
| Useful Life | 20 | 0 | 0 | 0 | 0 | - |
| Salvage Value (1,000\$) | 24400 | 0 | 0 | 0 | 0 | - |
| Ext. Const. Cost (1,000\$) | 24400 | 0 | 0 | 0 | 0 | - |
| Other Operating and Maintenance Costs (1,000\$) | | | | | | 890 |

MARKET SECTORS - TOTAL # 6

Market Sector # 1

```

Name auto
Mode Auto
Base Vehicle Occupancy 1.350
Imp. Vehicle Occupancy 1.350
Expansion Factor 250.0
Speed Equation Daily
Run Base Network TRUE
Run Imp. Network TRUE
Ignore Travel Times FALSE
Base Network Input File C:\Steamslc\Nbld_net.nwk
Base Network Output File C:\Steamslc\nBLD_NET.ttf
Imp. Network Input File C:\Steamslc\Bld_net.nwk
Imp. Network Output File C:\Steamslc\BLD_NET.ttf
Centroid File C:\Steamslc\Cent.cnt
Base Trip Table C:\Steamslc\Auto_nbd.trp
Imp. Trip Table C:\Steamslc\Auto_bld.trp
Use In-Vehicle File FALSE
Use Out-of-Vehicle File FALSE
Use Out-of-Pocket Cost FALSE
Base In-Vehicle Time NULL
Base Out-of-Vehicle Time NULL
Base Out-of-Pocket Costs NULL
Imp. In-Vehicle Time NULL
Imp. Out-of-Vehicle Time NULL
Imp. Out-of-Pocket Costs NULL
Market Sector Output File C:\Steamslc\auto.mkt
    
```

Market Sector # 2

```

Name pool
Mode Carpool
Base Vehicle Occupancy 2.100
Imp. Vehicle Occupancy 2.100
Expansion Factor 250.0
Speed Equation Daily
Run Base Network FALSE
Run Imp. Network FALSE
Ignore Travel Times FALSE
Base Network Input File NULL
Base Network Output File C:\Steamslc\nBLD_NET.ttf
Imp. Network Input File NULL
Imp. Network Output File C:\Steamslc\BLD_NET.ttf
Centroid File C:\Steamslc\Cent.cnt
Base Trip Table C:\Steamslc\Pool_nbd.trp
Imp. Trip Table C:\Steamslc\Pool_bld.trp
Use In-Vehicle File FALSE
Use Out-of-Vehicle File FALSE
Use Out-of-Pocket Cost FALSE
Base In-Vehicle Time NULL
Base Out-of-Vehicle Time NULL
Base Out-of-Pocket Costs NULL
Imp. In-Vehicle Time NULL
Imp. Out-of-Vehicle Time NULL
Imp. Out-of-Pocket Costs NULL
Market Sector Output File C:\Steamslc\pool.mkt
    
```

Market Sector # 3

```

Name truck
Mode Truck
Base Vehicle Occupancy 1.000
Imp. Vehicle Occupancy 1.000
Expansion Factor 250.0
Speed Equation Daily
Run Base Network FALSE
Run Imp. Network FALSE
Ignore Travel Times FALSE
Base Network Input File NULL
Base Network Output File C:\Steamslc\nBLD_NET.ttf
Imp. Network Input File NULL
    
```

```

Imp. Network Output File C:\Steamslc\BLD_NET.ttf
Centroid File C:\Steamslc\Cent.cnt
Base Trip Table C:\Steamslc\Cm_nbd.trp
Imp. Trip Table C:\Steamslc\Cm_bd.trp
Use In-Vehicle File FALSE
Use Out-of-Vehicle File FALSE
Use Out-of-Pocket Cost FALSE
Base In-Vehicle Time NULL
Base Out-of-Vehicle Time NULL
Base Out-of-Pocket Costs NULL
Imp. In-Vehicle Time NULL
Imp. Out-of-Vehicle Time NULL
Imp. Out-of-Pocket Costs NULL
Market Sector Output File C:\Steamslc\truck.mkt

```

Market Sector # 4

```

Name bus
Mode Local Bus
Base Vehicle Occupancy 18.000
Imp. Vehicle Occupancy 18.000
Expansion Factor 250.0
Speed Equation Daily
Run Base Network FALSE
Run Imp. Network FALSE
Ignore Travel Times TRUE
Base Network Input File NULL
Base Network Output File NULL
Imp. Network Input File NULL
Imp. Network Output File NULL
Centroid File C:\Steamslc\Cent.cnt
Base Trip Table C:\Steamslc\Bus_nbd.trp
Imp. Trip Table C:\Steamslc\Bus_bd.trp
Use In-Vehicle File TRUE
Use Out-of-Vehicle File TRUE
Use Out-of-Pocket Cost FALSE
Base In-Vehicle Time C:\Steamslc\Bus_nbd.ivt
Base Out-of-Vehicle Time C:\Steamslc\Bus_nbd.ovt
Base Out-of-Pocket Costs NULL
Imp. In-Vehicle Time C:\Steamslc\Bus_bd.ivt
Imp. Out-of-Vehicle Time C:\Steamslc\Bus_bd.ovt
Imp. Out-of-Pocket Costs NULL
Market Sector Output File C:\Steamslc\bus.mkt

```

Market Sector # 5

```

Name drive to rail
Mode Light Rail
Base Vehicle Occupancy 25.000
Imp. Vehicle Occupancy 25.000
Expansion Factor 250.0
Speed Equation Daily
Run Base Network FALSE
Run Imp. Network FALSE
Ignore Travel Times TRUE
Base Network Input File NULL
Base Network Output File NULL
Imp. Network Input File NULL
Imp. Network Output File NULL
Centroid File C:\Steamslc\Cent.cnt
Base Trip Table C:\Steamslc\Dr1_nbd.trp
Imp. Trip Table C:\Steamslc\Dr1_bd.trp
Use In-Vehicle File TRUE
Use Out-of-Vehicle File TRUE
Use Out-of-Pocket Cost FALSE
Base In-Vehicle Time C:\Steamslc\Rdv_nbd.ivt
Base Out-of-Vehicle Time C:\Steamslc\Rdv_nbd.ovt
Base Out-of-Pocket Costs NULL
Imp. In-Vehicle Time C:\Steamslc\Rdv_bd.ivt
Imp. Out-of-Vehicle Time C:\Steamslc\Rdv_bd.ovt
Imp. Out-of-Pocket Costs NULL
Market Sector Output File C:\Steamslc\drail.mkt

```

Market Sector # 6

```

Name walk to rail
Mode Light Rail
Base Vehicle Occupancy 25.000
Imp. Vehicle Occupancy 25.000
Expansion Factor 250.0
Speed Equation Daily
Run Base Network FALSE
Run Imp. Network FALSE
Ignore Travel Times TRUE
Base Network Input File NULL
Base Network Output File NULL
Imp. Network Input File NULL
Imp. Network Output File NULL
Centroid File C:\Steamslc\Cent.cnt
Base Trip Table C:\Steamslc\Wrl_nbd.trp
Imp. Trip Table C:\Steamslc\Wrail_bd.trp
Use In-Vehicle File FALSE
Use Out-of-Vehicle File FALSE
Use Out-of-Pocket Cost FALSE

```

Base In-Vehicle Time NULL
 Base Out-of-Vehicle Time NULL
 Base Out-of-Pocket Costs NULL
 Imp. In-Vehicle Time NULL
 Imp. Out-of-Vehicle Time NULL
 Imp. Out-of-Pocket Costs NULL
 Market Sector Output File C:\Steamslc\wrail.mkt

| RISK ANALYSIS INPUT VARIABLES | LOW | HIGH |
|---|-------|---------|
| In-Veh. Value of Time - Auto (Factor) | 0.0 | 1.5 |
| In-Veh. Value of Time - Truck (Factor) | 0.0 | 1.5 |
| In-Veh. Value of Time - Transit (Factor) | 0.0 | 1.5 |
| Out-Veh. Value of Time - Auto (Factor) | 0.0 | 1.5 |
| Out-Veh. Value of Time - Truck (Factor) | 0.0 | 1.5 |
| Out-Veh. Value of Time - Transit (Factor) | 0.0 | 1.5 |
| Discount Rate (Factor) | 0.000 | 0.105 |
| Fuel Consumption Rate Factor (Factor) | 0.0 | 1.5 |
| Fuel Prices Factor (Factor) | 0.0 | 1.5 |
| HC Cost Per Ton (\$/Ton) | 0.0 | 8075.0 |
| CO Cost Per Ton (\$/Ton) | 0.0 | 17700.0 |
| NOx Cost Per Ton (\$/Ton) | 0.0 | 16985.0 |
| PM10 Cost Per Ton (\$/Ton) | 0.0 | 39990.5 |
| HC Rate Factor (Factor)) | 0.0 | 5.0 |
| CO Rate Factor (Factor) | 0.0 | 5.0 |
| NOx Rate Factor (Factor)) | 0.0 | 5.0 |
| PM10 Rate Factor (Factor) | 0.0 | 5.0 |
| Fatalty Cost Factor (Factor) | 0.0 | 3.0 |
| Injury Cost Factor (Factor) | 0.0 | 3.0 |
| PDO Cost Factor (Factor) | 0.0 | 3.0 |
| Fatalty Rate Factor (Factor) | 0.0 | 2.0 |
| Injury Rate Factor (Factor) | 0.0 | 2.0 |
| PDO Rate Factor (Factor) | 0.0 | 2.0 |
| Noise Cost Factor (Factor) | 0.0 | 5.0 |
| Other External Cost Factor (Factor) | 0.0 | 5.0 |
| Capital Cost Factor (Factor) | 0.0 | 1.5 |
| Salvage Value Factor (Factor) | 0.0 | 1.5 |
| Operating Cost Factor (Factor) | 0.0 | 1.5 |

| RISK OUTPUT(PERCENTILES) | 1ST | 5TH | 10TH | 20TH | 30TH | 40TH | 50TH | 60TH | 70TH | 80TH | 90TH | 95TH | 99TH |
|--------------------------|---------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| User Benefit(\$M) | 112.62 | 133.66 | 144.01 | 159.72 | 173.61 | 184.11 | 194.65 | 206.71 | 221.51 | 238.27 | 266.01 | 286.35 | 339.69 |
| Emission Costs(\$M) | -326.10 | -130.96 | -80.23 | -44.17 | -28.40 | -20.03 | -14.43 | -10.32 | -7.01 | -4.51 | -2.48 | -1.38 | 0.44 |
| Accident Costs(\$M) | 0.09 | 0.12 | 0.14 | 0.17 | 0.20 | 0.23 | 0.26 | 0.29 | 0.34 | 0.40 | 0.50 | 0.62 | 0.92 |
| Noise Costs(\$M) | 0.01 | 0.01 | 0.02 | 0.02 | 0.03 | 0.04 | 0.06 | 0.07 | 0.10 | 0.13 | 0.20 | 0.28 | 0.54 |
| Total Benefits(\$M) | 123.10 | 144.24 | 157.77 | 177.93 | 190.54 | 203.31 | 217.58 | 233.73 | 252.52 | 275.40 | 316.23 | 368.42 | 550.15 |
| Total Costs(\$M) | 38.41 | 46.45 | 51.73 | 58.94 | 64.77 | 70.24 | 76.01 | 81.64 | 88.44 | 98.12 | 112.01 | 125.58 | 150.52 |
| Benefit Cost Ratio | 1.12 | 1.51 | 1.75 | 2.09 | 2.37 | 2.61 | 2.88 | 3.23 | 3.57 | 4.14 | 4.97 | 5.96 | 8.24 |

RISK OUTPUT(BAR HGHTS)*3 USER_BEN EMISS ACCID NOISE TOT_BEN TOT_CST BC_RATIO

Intervals

| | | | | | | | |
|------|--------|--------|--------|--------|--------|--------|--------|
| 1 - | 0.0075 | 0.0010 | 0.0420 | 0.1431 | 0.0255 | 0.0155 | 0.0185 |
| 2 - | 0.0135 | 0.0000 | 0.0515 | 0.1311 | 0.0355 | 0.0195 | 0.0370 |
| 3 - | 0.0205 | 0.0000 | 0.0570 | 0.1071 | 0.0485 | 0.0250 | 0.0445 |
| 4 - | 0.0255 | 0.0015 | 0.0740 | 0.0830 | 0.0565 | 0.0300 | 0.0540 |
| 5 - | 0.0350 | 0.0000 | 0.0790 | 0.0630 | 0.0775 | 0.0390 | 0.0565 |
| 6 - | 0.0330 | 0.0010 | 0.0695 | 0.0500 | 0.0930 | 0.0375 | 0.0650 |
| 7 - | 0.0340 | 0.0005 | 0.0765 | 0.0420 | 0.0780 | 0.0510 | 0.0745 |
| 8 - | 0.0445 | 0.0005 | 0.0615 | 0.0370 | 0.0705 | 0.0455 | 0.0725 |
| 9 - | 0.0385 | 0.0010 | 0.0615 | 0.0260 | 0.0695 | 0.0490 | 0.0645 |
| 10 - | 0.0410 | 0.0015 | 0.0435 | 0.0260 | 0.0600 | 0.0520 | 0.0535 |
| 11 - | 0.0535 | 0.0005 | 0.0430 | 0.0220 | 0.0560 | 0.0465 | 0.0490 |
| 12 - | 0.0600 | 0.0010 | 0.0370 | 0.0165 | 0.0450 | 0.0500 | 0.0490 |
| 13 - | 0.0530 | 0.0010 | 0.0375 | 0.0140 | 0.0475 | 0.0480 | 0.0505 |
| 14 - | 0.0570 | 0.0030 | 0.0255 | 0.0090 | 0.0410 | 0.0525 | 0.0325 |
| 15 - | 0.0395 | 0.0005 | 0.0230 | 0.0050 | 0.0260 | 0.0445 | 0.0285 |
| 16 - | 0.0455 | 0.0020 | 0.0220 | 0.0095 | 0.0235 | 0.0440 | 0.0320 |
| 17 - | 0.0355 | 0.0020 | 0.0245 | 0.0105 | 0.0190 | 0.0365 | 0.0245 |
| 18 - | 0.0370 | 0.0025 | 0.0175 | 0.0055 | 0.0195 | 0.0345 | 0.0240 |
| 19 - | 0.0395 | 0.0035 | 0.0185 | 0.0080 | 0.0110 | 0.0310 | 0.0190 |
| 20 - | 0.0315 | 0.0020 | 0.0145 | 0.0045 | 0.0105 | 0.0220 | 0.0195 |
| 21 - | 0.0330 | 0.0025 | 0.0100 | 0.0035 | 0.0070 | 0.0245 | 0.0140 |
| 22 - | 0.0285 | 0.0060 | 0.0110 | 0.0080 | 0.0050 | 0.0300 | 0.0145 |
| 23 - | 0.0200 | 0.0085 | 0.0065 | 0.0025 | 0.0055 | 0.0175 | 0.0065 |
| 24 - | 0.0205 | 0.0025 | 0.0050 | 0.0035 | 0.0050 | 0.0170 | 0.0095 |
| 25 - | 0.0205 | 0.0080 | 0.0040 | 0.0025 | 0.0050 | 0.0150 | 0.0080 |
| 26 - | 0.0150 | 0.0090 | 0.0060 | 0.0035 | 0.0045 | 0.0115 | 0.0065 |
| 27 - | 0.0215 | 0.0090 | 0.0035 | 0.0010 | 0.0015 | 0.0095 | 0.0035 |
| 28 - | 0.0100 | 0.0080 | 0.0025 | 0.0005 | 0.0015 | 0.0120 | 0.0040 |
| 29 - | 0.0110 | 0.0095 | 0.0050 | 0.0020 | 0.0025 | 0.0100 | 0.0065 |
| 30 - | 0.0110 | 0.0135 | 0.0050 | 0.0015 | 0.0020 | 0.0095 | 0.0055 |

| | | | | | | | |
|------|--------|--------|--------|--------|--------|--------|--------|
| 31 - | 0.0080 | 0.0160 | 0.0030 | 0.0005 | 0.0020 | 0.0050 | 0.0030 |
| 32 - | 0.0075 | 0.0215 | 0.0025 | 0.0015 | 0.0025 | 0.0075 | 0.0020 |
| 33 - | 0.0040 | 0.0280 | 0.0020 | 0.0020 | 0.0015 | 0.0095 | 0.0045 |
| 34 - | 0.0040 | 0.0380 | 0.0015 | 0.0015 | 0.0010 | 0.0055 | 0.0020 |
| 35 - | 0.0035 | 0.0475 | 0.0010 | 0.0015 | 0.0005 | 0.0030 | 0.0020 |
| 36 - | 0.0040 | 0.0895 | 0.0010 | 0.0015 | 0.0000 | 0.0020 | 0.0010 |
| 37 - | 0.0035 | 0.1171 | 0.0005 | 0.0015 | 0.0010 | 0.0025 | 0.0025 |
| 38 - | 0.0015 | 0.2021 | 0.0030 | 0.0005 | 0.0010 | 0.0025 | 0.0015 |
| 39 - | 0.0015 | 0.3181 | 0.0010 | 0.0000 | 0.0020 | 0.0025 | 0.0025 |
| 40 - | 0.0010 | 0.0265 | 0.1281 | 0.0150 | 0.0095 | 0.0110 | 0.0000 |

NOTES

- *1 These sections are not relevant if costs were considered in User Benefits
- *2 These values may differ from those in Section 5 & 6;
Please refer to the User's Guide for explanation of internal benefits computations.
- *3 Bar Heights are 40 evenly spaced intervals from the 1st to the 99th percentile value with the percentage of observations falling into each interval. This information is used to graph the risk analysis results.