



TranSight 2.1

User's Guide
&
Model Documentation

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User's Guide

Introduction

Welcome to REMI TranSight, the most powerful tool for assessing the total economic implications of transportation-system improvements. REMI has created a custom model based on your specifications and has installed the software at your offices. You are probably anxious to start learning how to use the model. That's where this guide comes in.

This guide is intended to teach you how to use the various functions of REMI TranSight. We've written this guide assuming that you have a working knowledge of the Windows environment, your own transportation model, and basic economic theory and terminology. If you feel that you need more time learning Windows, you'll probably want to do that before tackling TranSight. You can direct questions about your transportation model or the economic theory underlying TranSight to REMI's staff of supporting economists or to the Model Documentation that is included with this guide.

We've used some standard conventions throughout this guide. They are as follows:

- **Boldface**-Used to denote the first mention of an important term, screen, or command. Boldface is also used in instructions to highlight a menu item or button, or a key you need to press.
- **Click**-refers to a single click of the left mouse button, usually on an on-screen button. If an operation requires a double-click or a right click, the guide explicitly says so.
- **Select**-refers to using a mouse click to move the cursor to a specific point on screen.
- **Press**-refers to the use of the keyboard. When a command is written as a compound word (e.g., Ctrl-V), press and hold the first key indicated, and then press the second key.

The text of this guide is also available as context-sensitive help in the TranSight application. To access the context-sensitive help, right-click on a button or selection and select  from the pop-up menu.

Release Notes for TranSight 2.1

TranSight 2.1 includes several new features that make the software more versatile and easier to use:

- The Travel Editor now offers two different options for entering data: Daily Values, End Year Only and Annual Values, Full Year Series. The first option allows you to enter the projected travel data for a single day during the end year of your simulation; it does not require a full set of projections for every year of the simulation. The second option allows you to enter the projected annual travel data for each year of the simulation; this option provides for greater precision in your forecast if you have year-by-year travel projections.
- Both the Daily Values and the Annual Values versions of the Travel Editor include Import and Export functions that allow you to load previously created travel data files and save your changes to a new or existing travel data file.
- When you are viewing the Baseline Simulation, Adjusted Simulation, or Computed Difference windows accessible from the Travel Data tab, you can view the data in graph form as well as table form.
- Policy Insight now includes a new transportation-related alternative model option, Instantaneous Product Market Clearing. If you choose to apply Instantaneous Product Market Clearing, the product prices in each model region will react immediately to product prices in neighboring regions if the transportation system changes.
- The Simulation Options tab now includes an Auto-Run checkbox. If the box is not checked when you click on the Go! Button, Policy Insight will open to the Policy Variable Values tab, allowing you to examine and change the inputs generated by TranSight and to add your own non-transportation inputs if you wish. If the box is checked, Policy Insight will skip over the Policy Variable Values and Simulation tabs and run the simulation directly.

Chapter 1: The Main Screen

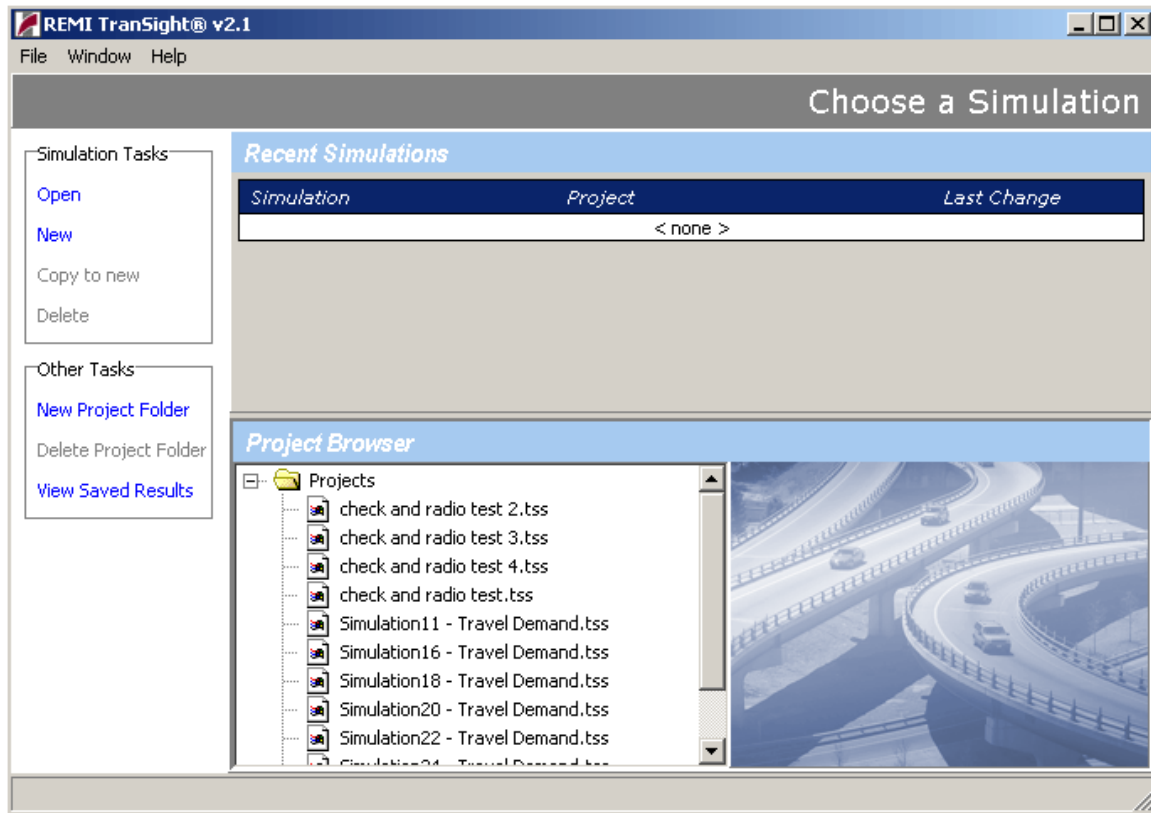


Figure 1: The Main Screen

When you start TranSight, the first window you see is the **Main Screen**. This screen is the starting point for everything TranSight does.

The **Simulation Tasks** panel on the left displays the following options:

- **Open** – Allows you to select an existing simulation to work with.
- **New** – Allows you to create a new simulation.
- **Copy to New** – Allows you to duplicate an existing simulation so that you can adjust the inputs and view the results without modifying the original simulation.
- **Delete** – Removes the selected simulation.

Below the Simulation Tasks panel is the **Other Tasks** panel. The options in this area allow you to modify the file tree in the Project Browser panel and view the results from a previous simulation run. To the right of the Simulation Tasks panel is the **Recent Simulations** panel. This list remains blank until you run a simulation. After you run a simulation, TranSight adds it to the list so that you can open it again easily. Below the Recent Simulations panel is the **Project Browser**. Use the file tree in this panel to quickly navigate to your existing simulations.

Now that we know where to find everything on the Main Screen, let's start learning how to use it.

Opening Existing Simulations

Before you begin creating your own simulations, let's look at the simulations included with your model. REMI has prepared a small selection of simulations based on information about projects your organization is studying. There are four ways to open existing simulations:

- The Simulation Tasks Panel
- The File Menu
- The Project Browser Panel
- The Recent Simulations Panel

Using the Simulation Tasks Panel

1. Click **Open** on the Simulation Tasks panel (Figure 2).

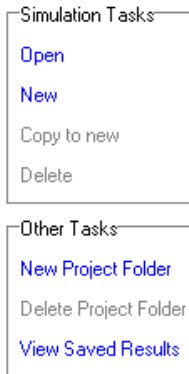


Figure 2. The Simulation Tasks Panel

The **Open a Simulation** window appears (Figure 3).

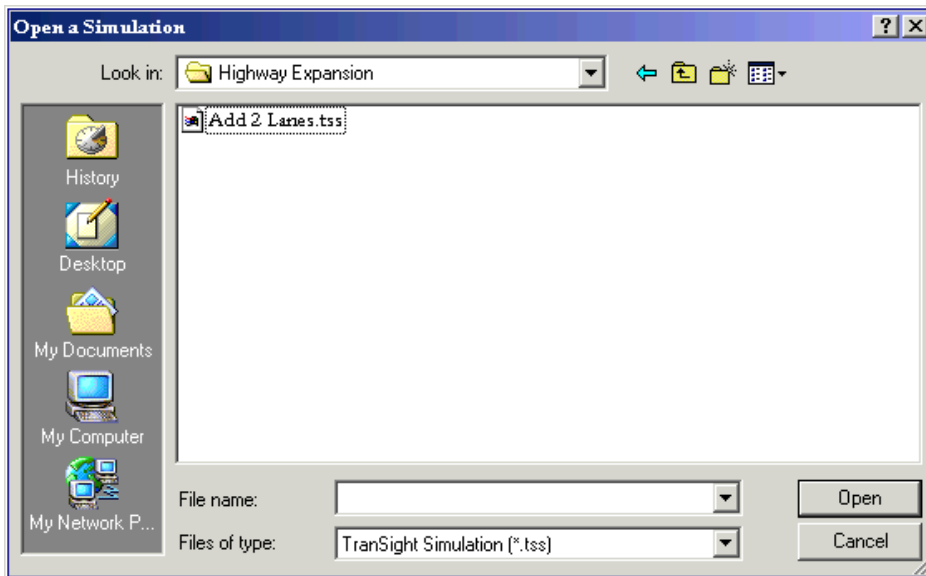


Figure 3. The **Open a Simulation** Window

2. Navigate to the desired simulation and double-click the filename. The Simulation Window opens with the desired data ready for analysis.

Using the File Menu

1. Click **File** on the Menu Bar. The menu shown in Figure 4 appears.

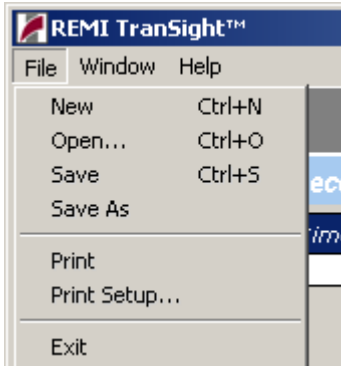


Figure 4. The Main Screen File Menu

2. Select **Open** from the menu. The **Open a Simulation** window opens (see Figure 3 above).
3. Navigate to the desired simulation and double-click the filename. The Simulation Window opens with the desired data ready for analysis.

Using the Project Browser

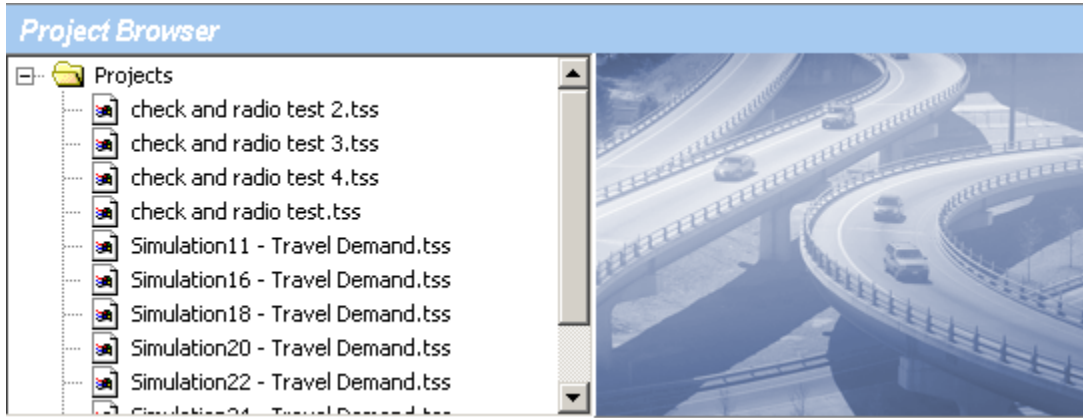


Figure 5. The Project Browser

The Project Browser allows you to circumvent the **Open a Simulation** window. Use the Project Browser to navigate directly to the desired simulation and double-click to open it. Only simulations saved in the “Projects” sub-folder of the “TranSight” directory are accessible through the Project Browser.

To add a folder to the Project Browser, select the folder in the Project Browser into which you want to place the new folder and click **New Project Folder** in the Other Tasks panel. A new folder appears in the Project Browser.

Deleting folders is just as easy; however, there is one caveat: **when you delete a folder you also delete any simulations stored in that folder.** To delete a folder, select the folder and click **Delete Project Folder** in the Other Tasks panel or simply press the **Delete** key. A confirmation box opens. Click the button or press the **Enter** key to delete the folder.

Using the Recent Simulations Panel

When we started working with TranSight, this list was blank. Have a look at it now that we’ve opened a simulation or two. It should look something like Figure 6:

Recent Simulations		
Simulation	Project	Last Change
Expand Light Rail	Transit Studies	1/2/2004 9:07:52 AM
Add 2 Lanes	Highway Expansion	1/2/2004 9:07:36 AM

Figure 6. The Recent Simulations Panel

The simulations you’ve opened in the course of these instructions should now be listed in the Recent Simulations panel. To re-open one of these simulations, click the name of the simulation. Clicking the project type expands the corresponding folder in the Project Browser panel. To change the width of the Simulation and Project columns (perhaps because a simulation or project name is too long to read), click and drag the Project heading left or right.

Starting a New Simulation

Creating new simulations is even easier than opening existing ones. There are two ways to create a new simulation:

- Click **New** in the Simulation Tasks panel (Figure 2 above).
- Or
- Use the **New** command on the File Menu (Figure 4 above).

In both cases, the New Simulation Window (Figure 7) opens as soon as you issue the command.

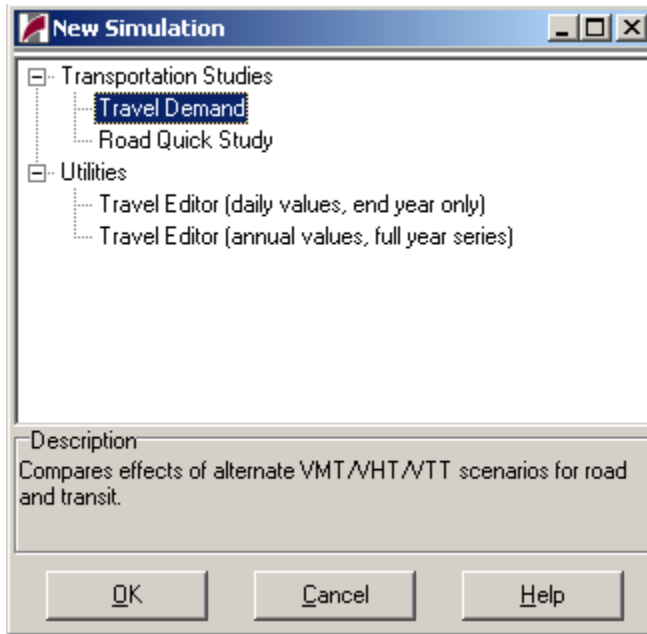


Figure 7. The New Simulation Window

From the New Simulation Window, you can choose from three different options:

Under Transportation:

- **Travel Demand:** This option allows you to perform a standard simulation examining the effects of specific transportation project(s) using data from a travel-demand model.
- **Road Quick Study:** This option allows you to perform a quick, five-step “what if?” study on a hypothetical transportation project.

Under Utilities:

- **Travel Editor:** These options allow you to develop travel-data input files from scratch, instead of using output from a travel-demand model. You can then use these files to perform a simulation of a transportation project. Use one of these options if you intend to enter your own data.
 - **Travel Editor (daily values, end year only):**

Road Quick Study

Simulation1 - Road Quick Study - REMI TranSight™ v2.1

File Window Help

Quick Study

Region: Cherokee County

Project Spending (2000 US \$M)

	2005	2006	2007	2008	2009	2010	2
Construction	0	0	0	0	0	0	0
Operation & Maintenance	0	0	0	0	0	0	0

% Of funding from non-federal, non-dedicated sources: 0

% Change in average network speed: 0

Average minutes saved per commute trip: 0

Phase in benefits from: 2005 to 2009

Go! >>> Calculate to year 2025

Figure 8. The Road Quick Study Window

The Road Quick Study provides a quick analysis of the effects of a transportation network improvement. The methodology of the Road Quick Study is identical to the methodology behind TranSight. Road Quick Study captures the efficiency of the transportation network after improvements, as well as construction spending and financing. It does not capture amenity changes, such as emissions and safety values. Enter key inputs into Road Quick Study to perform a “blue sky” analysis of the effects of a transportation project. There is no travel-demand model required for this process.

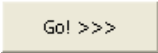
Enter educated assumptions about the transportation project into the boxes. Road Quick Study translates these assumptions into real economic effects of the transportation project on the economy. Again, you need no data sources, and the simulation is quick and easy. Use this feature if you do not have a travel-demand model, or if you want to perform a quick hypothetical study.

Select the region name from the drop-down menu for each region that will be affected by the project, and follow the steps below:

1. Enter projected spending on construction, operations, and maintenance by year.
2. Enter the percentage of the project spending that must be financed from non-federal, non-dedicated sources. This value refers to the amount of funding that has a real opportunity cost

to the state or local government. It should exclude both federal funds and money previously allocated to finance transportation upgrades.

3. Enter the expected percentage change in average network speed relative to the baseline conditions.
4. Enter the expected minutes of savings for the average commuter trip. A positive number means that the average commuter's trip is shorter by that number of minutes.
5. Enter the **Phase-In Period**. The "phase-in from" year represents when the travel-related benefits from the project begin to accrue. The "phase-in to" year represents when the benefits predicted by the travel-demand model are fully realized; after this year, the benefits remain in place for the rest of the model period. Road Quick Study will perform a linear distribution for the years in between the "from" year and the "to" year.
6. Enter the last year that you want your results calculated in the **Calculate to Year** box.

When you have finished entering data for all the regions, click  to run the simulation. TranSight then uses the Policy Insight analysis engine to generate the results. When this process is complete, TranSight opens the Policy Insight results view. You can then view all the data that are available in the Results tab of Policy Insight.

Travel Editor

If you do not have access to a travel-demand model, use the Travel Editor utility to manually create input files with information on VMTs, VHTs, and trips. The Travel Editor (Figure 9) allows you to input your own data from spreadsheets, or modify an existing data file, to use instead of travel-demand model data in the simulation. The resulting file must be named 'travel.mcs'. Once you create your files, choose **TS Travel Editor** in the Model Type drop-down menu on the Travel Data tab of the Simulation window (see page 17) for your data to be input into TranSight.

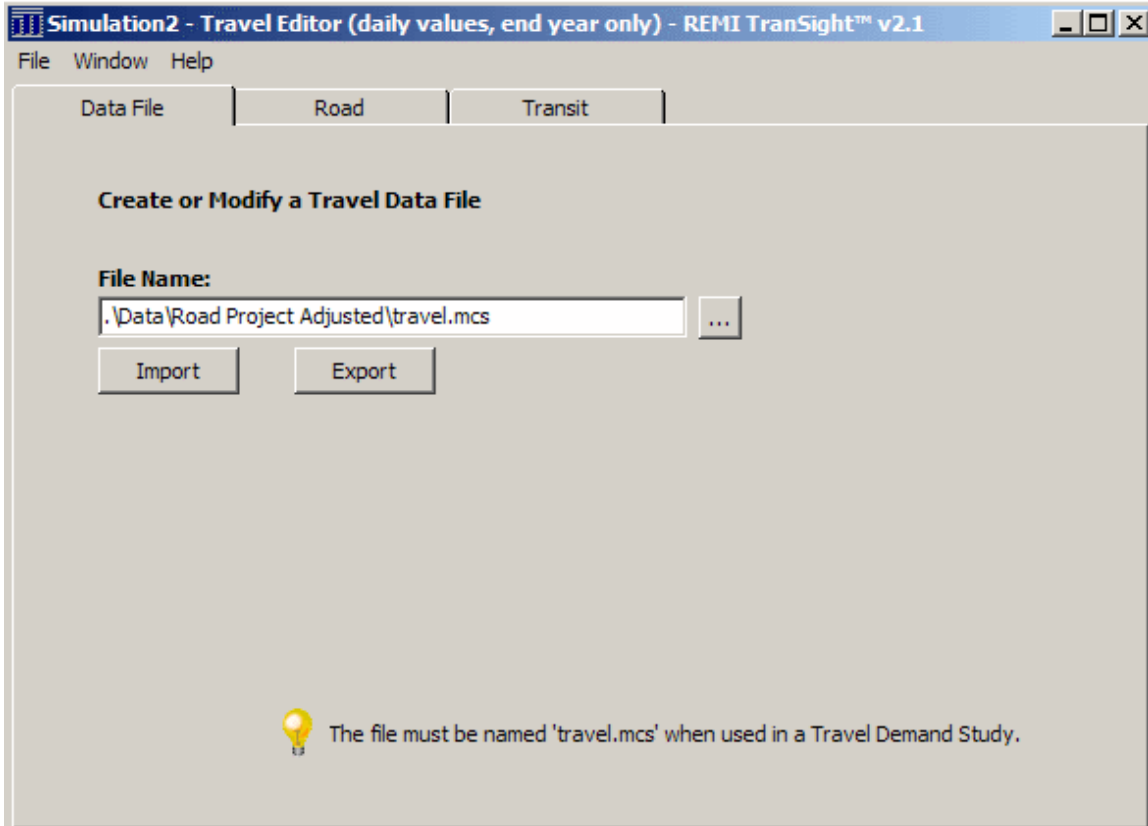
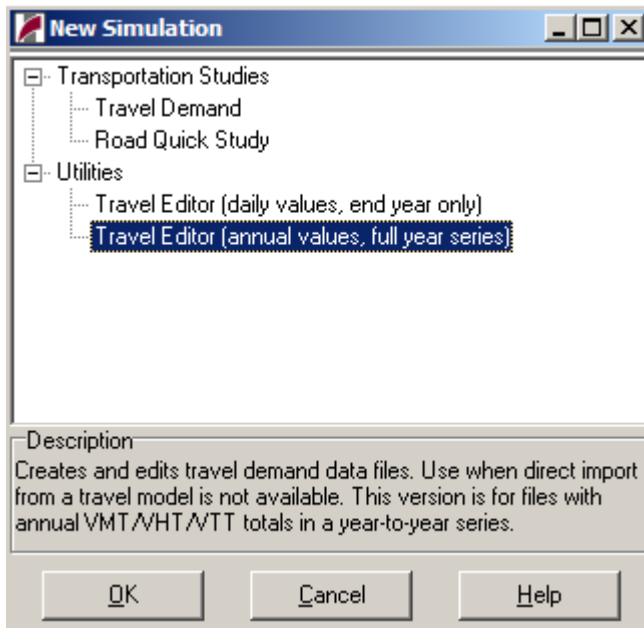


Figure 9. The Travel Editor Window

Before you start, create a folder for each simulation you intend to run, including one for your baseline (or no-build) case. You must create different folders because every Travel Editor file must have the same name (travel.mcs). After you enter the data for a particular simulation into the Travel Editor, save it to the corresponding folder, with the filename 'travel.mcs'.


There are two versions of the Travel Editor; both appear as options on the window that appears when you choose New from the Main Screen, as shown below.





Choosing Travel Editor (annual values, full year series) from the New Simulation window

Travel Editor (daily values, end year only) allows you to enter daily VMT (vehicle miles traveled), VHT (vehicle hours traveled), and VTT (vehicle trips traveled) projected during the final year of the simulation if no changes are made to the transportation network. Travel Editor allows you to enter annual VMT, VHT, and VTT for the entire series of years in the simulation, if you have a full year series of projected data; this option provides a more detailed and more precise travel demand file.

Perform the following steps for both your baseline and adjusted simulation(s):

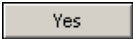
1. Enter the full path and name of the data file you wish to modify on the Data File tab, or use the **Browse** button () to select one from the simulation folder you want to use. The file *must* be named travel.mcs.
2. If you would like to modify previously existing data in your travel.mcs file rather than starting a new one, click on **Import** on the Data File tab.
3. Select the **Road** tab or the **Transit** tab.
4. Paste or type in the miles, hours, and trips for each region-to-region combination, time period, and mode. If you are using the Daily Values version of the Travel Editor, you are entering the miles, hours, and trips per day; the origin region in each table is the row and the destination region is the column. If you are using the Annual Values version of the Travel Editor, you are entering the miles, hours, and trips per year for each year of the simulation; the origin region in each table is the row and the year is the column, and the “To Region” combo box near the top of the window is used to select a destination region.
5. Repeat step 2 in both the Road and Transit tabs if you have data for both roads and public transit.

6. Make sure the filename and folder where you want to save the data are displayed under File Name on the Data File Tab. To change folders, click on the  button to open the file browser.
7. Click the  button on the Data File Tab. Your data is now saved to the chosen file.
8. Close the Travel Editor window.
9. Click on **New** from the Main Screen to create a new simulation using your data.
10. Click on **Travel Demand** in the New Simulation window.
11. Choose **TS Travel Editor** from the Model Type drop-down menu on the Travel Data Tab. The TranSight simulation proceeds as usual with the data you entered.

If you wish to modify an existing travel-data file, make sure the name and folder of the file are displayed under File Name on the Data File Tab of the Travel Editor window, and click the Import button. Make the changes you want, and Export again.

Copying and Deleting Simulations

To create a copy of an existing simulation, simply select the simulation in the Project Browser and click **Copy to new** in the Simulation Tasks panel. A new simulation is added to the list under the same project folder with the words “Copy of” appended to the beginning of the original filename.

To delete a simulation, select it in the Project Browser and click **Delete** in the Simulation Tasks panel. A confirmation box appears. Click the  button or press the **Enter** key to delete the file.

Moving On

Now that we know how to use the Main Screen, let’s look at the Simulation Window. Select one of the simulations listed in the Recent Simulations panel to open the Simulation Window, which starts on the **Travel Data Tab**.

Chapter 2: The Travel Data Tab

The **Travel Data Tab** (Figure 10) imports and converts the data from travel-demand models (or from the files you created with the Travel Editor) for use in TranSight. You can view Baseline and Adjusted Simulation data from this tab; the Baseline Simulation is the “no-build” scenario forecasting what will happen without the proposed changes, and the Adjusted Simulation is the “build” scenario forecasting what will happen if the changes occur. You can use this tab to choose the Phase-In Period for benefits from the Adjusted Simulation; benefits may take effect gradually, as in the case of a transit line being expanded station by station, or all at once in the last year of the simulation, as in the case of a new bridge being built. You can also view the Computed Difference between the Adjusted Simulation and the Baseline Simulation, and choose your desired approach for calculating Accessibility Costs.

The screenshot shows the 'Travel Data' tab in a software interface. It features three sub-tabs: 'Travel Data', 'User Inputs', and 'Simulation Options'. The 'Travel Data' tab is active and contains the following elements:

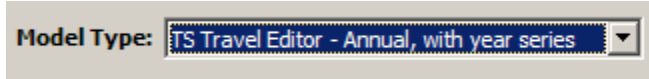
- Model Type:** A dropdown menu set to 'TransCAD'.
- Baseline Simulation:** A text field containing the path '.\Data\Road Project Baseline' with a browse button (...). Below it is a 'View' button.
- Adjusted Simulation:** A text field containing the path '.\Data\Road Project Adjusted' with a browse button (...). Below it is a 'View' button.
- Phase-In Period:** Two radio buttons: 'Linear from' (selected) and 'Custom'. The 'Linear from' option has two input fields for years, '2005' and '2009', with a 'View / Edit' button to the right.
- Computed Difference:** A 'View' button.
- Next »** button at the bottom right.

Figure 10. The Travel Data Tab

Importing Data

TranSight links travel-demand models to the Policy Insight engine. Importing travel-demand model information is easy, because TranSight automatically converts all the data into Policy Insight policy variables.

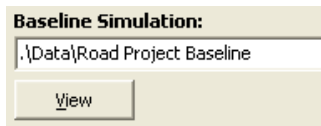
The first step is to select your travel-demand model in the drop-down box.




If you want to use data files that you created in the Travel Editor, choose **TS Travel Editor**.

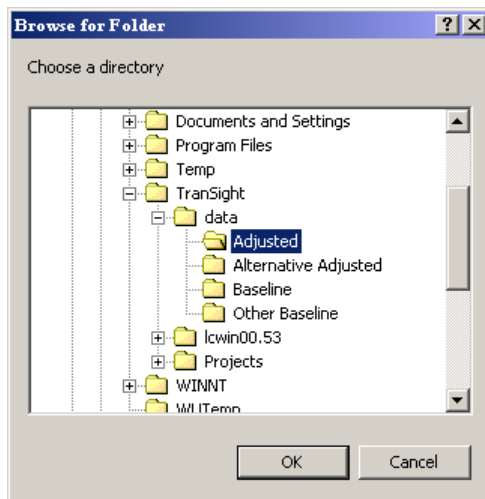
Note: You can only choose TS Travel Editor if you have already used the Travel Editor to create data files for a baseline and an adjusted simulation. See “Travel Editor” in Chapter 1, and *Appendix B: Integration with Travel Demand Models*.


Next, we need to make sure that TranSight is using the correct data set from your travel-demand model. Look at the file paths in the Adjusted and Baseline simulations. They should look something like this:



If this is the correct file path, you don't need to do anything. If it's not, you'll need to find the folder containing the desired data set. Here's how:

1. Click the  button at the right of the file path box to open the Browse for Folder window.



2. Navigate to the folder containing your simulation data.
3. Select it and click the  button. TranSight converts the data.

Now, set the Phase-in Period (the years during which the benefits from the adjusted simulation will enter the model run). The **Phase-in From** year represents when the travel-related benefits from the project begin to accrue. The **Phase-in To** year represents when the benefits predicted by the travel-demand model are fully realized; after this year, the benefits remain in place for the rest of the

model period. The Phase-in Period's relationship to the construction period depends on the nature of the project under analysis. In some cases (such as the extension of a commuter-rail line to multiple stations), benefits begin during construction (as each station opens). In other cases (such as a new bridge), benefits aren't realized until after the construction period (when the new bridge opens). You should set the Phase-in Period with these considerations in mind.

Phase-In Period: Linear from 2005 to 2009 Custom

There are two ways to enter the phase-in period in the Travel Data Tab:

- Linear: Use this option when the benefits realized follow a linear pattern of growth/decline.
- Custom: Use this option when the benefits realized vary depending on the year, and do not follow a linear pattern. (You can also use this option when the benefits are all realized at once, as in the case of the bridge given above.)

Customize Phase-In

The **Customize Phase-In** window (Figure 11) allows you to customize the phase-in period of the transportation project's benefits (i.e. if the phase-in is not linear). To open the Customize Phase-in window, click the radio button next to "Custom" on the Travel Data Tab and then click the button.

The screenshot shows a window titled "Customize Phase-In" with two tabs: "Road" and "Transit". Below the tabs is a section titled "Base to Adjusted Phase-In" with a subtitle "(Percent, 0 = no change, 100 = complete)". A table is displayed with the following data:

	2005	2006	2007	2008	2009	2010	2011
Hampshire County	0	0	20	40	60	80	100
Franklin County	0	0	20	40	60	80	100

At the bottom of the window is a "Close" button.

Figure 11. The Customize Phase-in Window

For each year of the phase-in, as well as for each region, enter the percentage of benefits that will have been realized to date. You can use the Row Calculator (see page 28) to automatically create exponential phase-ins, or manually enter values as desired. Click between the Road and Transit tabs to enter phase-in values for the type of project you are modeling.

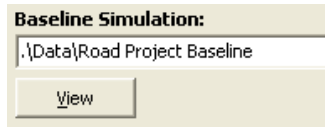
Once the phase-in is complete, be sure to enter 100 for all subsequent years in the table.

Baseline and Adjusted Simulations

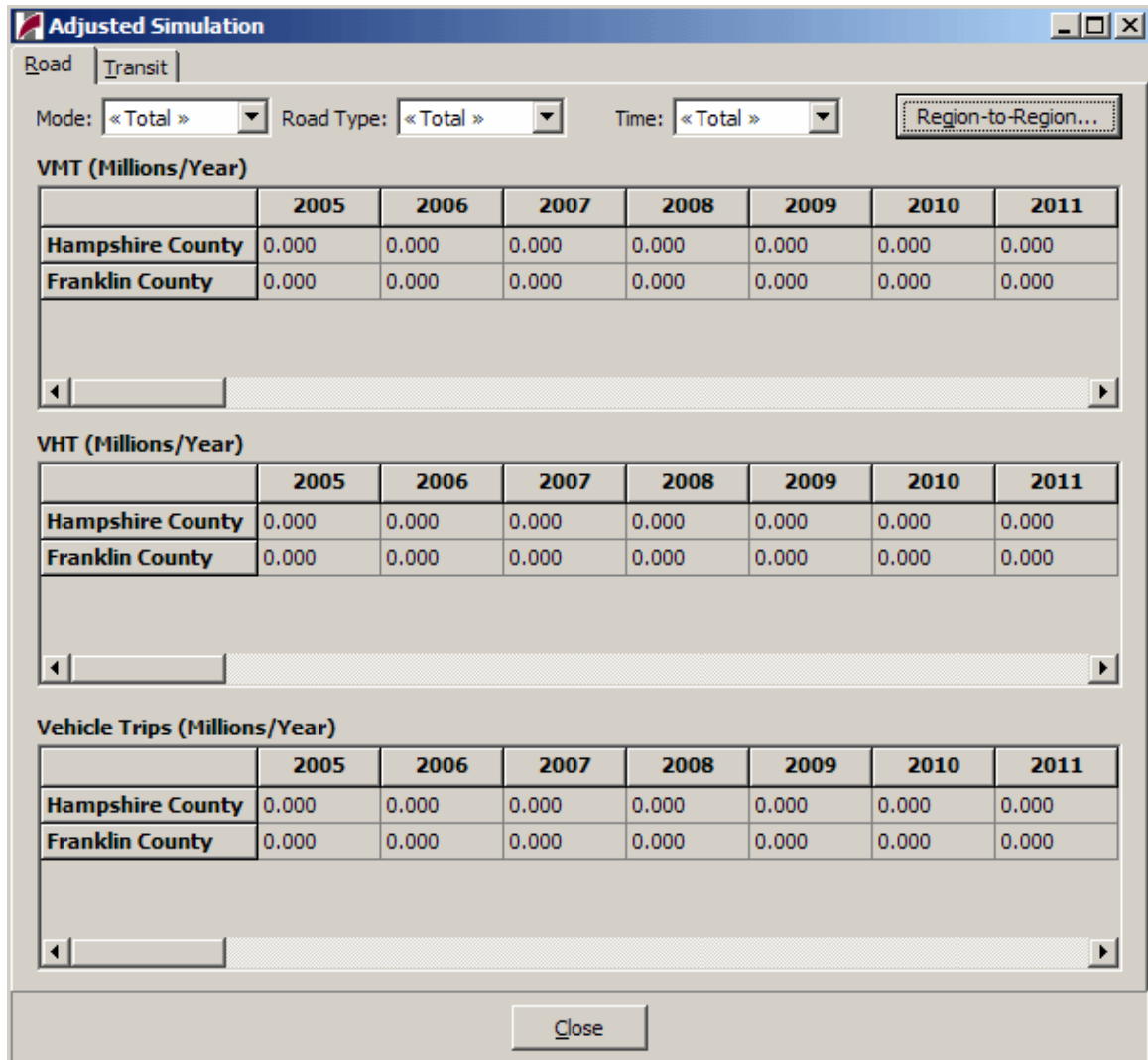
TranSight takes the data for the Baseline and Adjusted Simulations directly from your travel-demand model. The Baseline data should normally come from a travel-demand model simulation that includes no transportation projects, or otherwise represents a reference case against which comparisons are made to alternative scenarios. The Adjusted data should normally come from a travel-demand model simulation that incorporates one or more upgrades to the transportation network.

You can view this information from the Travel Data Tab. To make any changes to the data, you must do so in your travel-demand model before importing it into TranSight. Here's how to view the data:

1. Click the View button beneath the Adjusted or Baseline simulation to view your imported data.

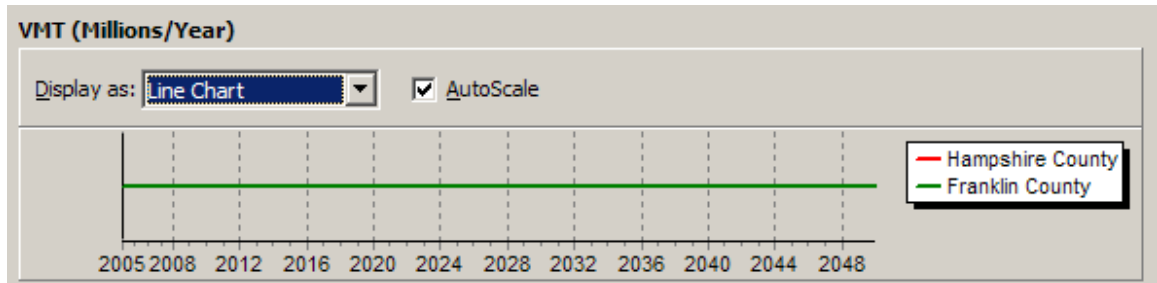


- TranSight transforms the data into a TranSight-ready format and the Adjusted (or Baseline) Simulation window appears (the two windows are cosmetically and functionally identical).



- Click the tabs to switch between the Road and Transit views.
- Use the drop-down menus to see the data broken down by specific dimensions (such as time periods). Select **Total** to view the sum of VMTs, VHTs, and trips for that particular dimension.
- To copy data from any of the tables to the Clipboard (so that you can paste it into another program, such as a spreadsheet), select the cells you wish to copy, right-click on the table, and choose **Copy** or **Copy with Names** from the menu that appears. Copy with Names copies both the cells and the names of their rows and columns.
- To see more or fewer decimal digits of detail, right-click and select **Show Detailed** from the menu that appears. The default is three decimal places; choosing this option once will show six places, choosing it twice will show nine places, choosing it three times will show zero places, and choosing it four times will show three places again.

- If you wish to see any of the tables as a chart, right-click and select **View as Chart** from the menu that appears. A line chart will appear, showing the change over time in the number of VMT, VHT, or VTT. The x-axis corresponds to the columns of the table (years), and each line shown corresponds to a row (origin region). The y-axis represents the number of VMT, VHT, or VTT.



If AutoScale is checked, choosing a different mode of travel, road type, or time of day will automatically scale the new graph to fit. If AutoScale is not checked, the graph does not automatically scale; this provides a better view of the differences between the travel patterns in one mode of travel, road type, or time of day.

To see a pie chart instead, select **Pie Chart** from the **Display As** combo box. Each piece of the pie chart represents an origin region; its slice of the pie represents its share of total VMT, VHT, or VTT. Use the slider to display the shares for a different year; select **Line Chart** from the **Display As** combo box to return to the line chart.

Right-click on either chart and select **Copy** to copy an image of the chart to the Clipboard; you can paste it into a graphics program such as Paint or Photoshop. Right-click and select **Display as Table** to return to the default table view.

Please note that you may have to enlarge your TranSight simulation window to see the chart well, particularly if it is a pie chart. Do this by dragging the edges of the window outward with your mouse until it is the size you want.

- Click the **Close** button to close the window.

Computed Difference

The Computed Difference is the calculated difference in VMT, VHT, and VTT between the Adjusted Simulation and the Baseline Simulation. Viewing this information is easy from the Travel Data Tab.

1. Click on the View button beneath Computed Difference. TranSight calculates the difference between Alternative and Baseline values and the Computed Difference window opens.

VMT (Millions/Year)

	2005	2006	2007	2008	2009	2010	2011
Hampshire County	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Franklin County	0.000	0.000	0.000	0.000	0.000	0.000	0.000

VHT (Millions/Year)

	2005	2006	2007	2008	2009	2010	2011
Hampshire County	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Franklin County	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Vehicle Trips (Millions/Year)


	2005	2006	2007	2008	2009	2010	2011
Hampshire County	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Franklin County	0.000	0.000	0.000	0.000	0.000	0.000	0.000

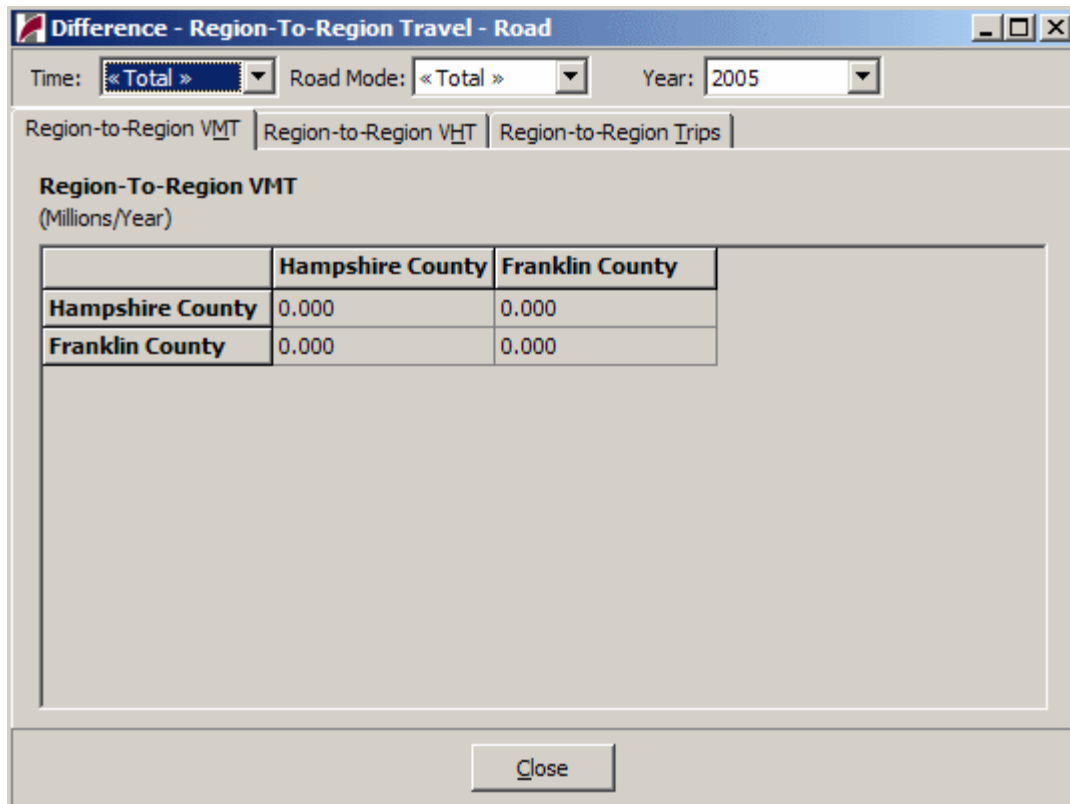
2. Click the tabs to switch between the Road and Transit views.
3. To examine breakdowns of the data across different dimensions (e.g., autos vs. trucks), select different options from the drop-down menus.
4. To see the sum of travel data across a particular dimension, choose **Total** in the drop-down menu. This is a sum of all the data, which gives an aggregated view of the information (e.g., autos and trucks together).

5. To copy data from any of the tables to the Clipboard (so that you can paste it into another program, such as a spreadsheet), select the cells you wish to copy, right-click on the table, and choose **Copy** or **Copy with Names** from the menu that appears. Copy with Names copies both the cells and the names of their rows and columns.
6. To see more or fewer decimal digits of detail, right-click and select **Show Detailed** from the menu that appears. The default is three decimal places; choosing this option once will show six places, choosing it twice will show nine places, choosing it three times will show zero places, and choosing it four times will show three places again.
7. You can view the Computed Difference tables as charts; this works the same way as described under *Baseline and Adjusted Simulations*, above.
8. Click the Close button when you are done viewing to return to the Travel Data Tab.

Region-to-Region Spread

Travel-demand models are limited in terms of how they show data. TranSight enables you to view not only the VMT and VHT data for each region, but also to see vehicle miles, hours, and trips within each region and between each pair of regions. TranSight breaks the information down in terms of trips to and from each region in the model (including trips within regions), and displays the percent of VMT and VHT for each. Access the Region-to-Region Spread from the Adjusted and Baseline Simulation windows and the Computed Difference window.

1. Click the  button, located at the upper right of the Adjusted or Baseline Simulation, or Computed Difference, windows. The Region-to-Region Spread window opens.



2. Click the different tabs to view the data for VMTs, VHTs, and trips. In each table, the origin region is the row and the destination region is the column.
3. To examine breakdowns of the data across different dimensions (e.g., autos vs. trucks), select different options from the drop-down menus.
4. To see the sum of travel data across a particular dimension, choose Total in the drop-down menu. This number is a sum of all the data, which gives a combined view of the information (e.g., autos and trucks together).
5. To copy data from any of the tables to the Clipboard (so that you can paste it into another program, such as a spreadsheet), select the cells you wish to copy, right-click on the table, and choose **Copy** or **Copy with Names** from the menu that appears. Copy with Names copies both the cells and the names of their rows and columns.
6. To see more or fewer decimal digits of detail, right-click and select **Show Detailed** from the menu that appears. The default is three decimal places; choosing this option once will show six places, choosing it twice will show nine places, choosing it three times will show zero places, and choosing it four times will show three places again.
7. You can view the Region-to-Region tables as charts; this works the same way as described under *Baseline and Adjusted Simulations*, above, only with destination regions rather than years as

the x-axis of the line chart and the slider on the pie chart controlling destination regions rather than years.

8. Click the Close button to return to the Adjusted or Baseline Simulation window.

Moving On

Once you've finished reviewing and modifying the options on the Travel Data tab, click the



button or the



tab to move on to the User Inputs tab.

Chapter 3: The User Inputs Tab

The User Inputs Tab allows you to view and modify project-specific simulation data. There are three categories of data accessible on this tab:

- Construction
- Government Funding
- Tax Changes

Access these categories by clicking the appropriate icon on the Icon Bar at the left of the window.

The Icon Bar

Simulation2 - Travel Demand - REMI TranSight® v2.1

File Window Help Debug

Travel Data User Inputs Simulation Options

Region: Hampshire County

Construction Spending
(2000 US \$M)

	2005	2006	2007	2008	2009	2010	2011	2012
Road	0	0	0	0	0	0	0	0
Transit	0	0	0	0	0	0	0	0

Operation and Maintenance Spending
(2000 US \$M)

	2005	2006	2007	2008	2009	2010	2011	2012
Road	0	0	0	0	0	0	0	0
Transit	0	0	0	0	0	0	0	0

<< Back Next >>

The User Input Tab

User Input Categories

The User Input categories include the following:

Construction

- **Construction Spending** (2000 U.S. \$M)
Enter annual spending on construction for the road or transit projects you're analyzing.
- **Operation and Maintenance Spending** (2000 U.S. \$M)
Enter annual spending on operations and maintenance for the road or transit projects you're analyzing.

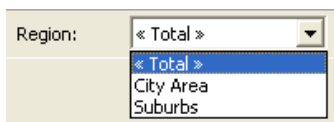
Government Funding

- **Reduction in non-government funding** (2000 U.S. \$M)
Enter the annual amount of project funding that will be financed through reductions in non-dedicated spending by state and local governments. This amount should exclude federal funds (which are costless from the state's perspective), as well as funds already budgeted or dedicated to transportation. Ultimately, the dollars you enter for Government Funding should have a true opportunity cost in terms of foregone spending on other priorities. Use the Row Calculator (see page 28) to help enter numbers such as bond payments.

Tax Changes

- **Tax Amount Change** (enter as a total amount in 2000 U.S. \$M)
Enter the annual amount that the state or local government must collect from tax increases to help finance the transportation project in question. Enter increases for any of four types of taxes: Sales tax, Residential Property tax, Fuel tax, and Income tax.

For all three categories, use the drop-down box at the upper right of the window to switch the view among the regions in the model. Doing so allows you to model spending and funding in multiple regions.



For in-depth information about the variables accessible on the User Inputs tab, please see the Model Documentation starting on page 43.

Using the User Input Tables

Using the Tables in TranSight

The tables on the User Inputs tab function just like a spreadsheet. To change a cell's value, first select the name of a region from the drop-down box at the upper right. Then, simply select a cell and enter the new value. Changing multiple cells to the same value is just as easy. Here's how:

1. Enter the new value in a cell.

2. Select the new value.
3. Press Ctrl-C (or right-click and select **Copy**) to copy the selection.
4. Select the other cells in which you want to enter the new value.
5. Press Ctrl-V (or right-click and select **Paste**) to paste the new value into the selected cells.

The Row Calculator

To help you enter and adjust values on the User Inputs tab, TranSight includes a calculator that can perform several common operations. The functions in the Row Calculation window enable you to alter data in several cells in one step. This ability is especially useful on the Government Funding screen, where it can convert the parameters of a bond into spending on annualized payments. Here's how to access the calculator from any of the tables on the User Inputs tab:

1. Select two or more cells (the Calculator is only available if multiple cells are selected).

Construction Spending (2000 US \$M)					
	2005	2006	2007	2008	2009
Road	2.2	4.2	4.8	5.2	5.5
Transit	0.4	0.7	1.1	1.3	1.6

2. Right-click on one of the selected cells. A menu pops up.

Copy	Ctrl+C
Paste	Ctrl+V
Copy With Names	Ctrl+N
Select All	Ctrl+A
Calculator	Ctrl+L
Show Detailed	Ctrl+P

3. Select **Calculator** from the menu. The **Row Calculation** window opens.

The Row Calculation Window

4. Select the function you wish to use by clicking on the appropriate tab.
5. Enter the values for the given calculation type.

6. Click on OK, and the numbers in the selected cells change accordingly.

The Row Calculation tabs are defined below.

- **Fill Range**—Enters the same number in each of the selected cells. For example, if you enter 50, then the number 50 would appear in each cell in your selection.
- **% Change**—Changes the selected cells by the percentage that you enter.
- **± Value**—Changes the selected cells by the number you indicate. For example, if you entered 10, the program adds 10 to the number in each cell.
- **Linear (Interpolate Rows)**—Select this option to have the system work with your beginning and endpoint values for a particular row. For example, suppose that for a particular TranSight variable you have target values for every fifth year. Use this option to assign yearly values linearly interpolated between the five-year targets.
- **Exponential (Interpolate Rows)**—Select this option to have the system work with your beginning and endpoint values for a particular row. Unlike linear interpolation, the function determines a geometrical growth rate between the endpoints, and distributes the change between those two points geometrically.
- **Annualize**—Calculates the annualized payments required to pay the amount borrowed at a given interest rate for a fixed number of years. To use this option you need to enter the number of years over which the payments are to be made (or choose “Selected Years” if the highlighted range reflects this number), the value being financed, and the interest rate. The rate is entered as a percent.

Moving the Tables to a Spreadsheet

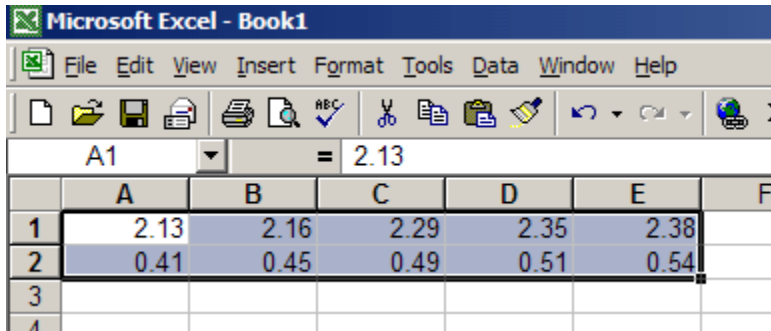
To make more complex adjustments to several cells, move the data to a spreadsheet application.

1. Open your spreadsheet application (we use Microsoft Excel for demonstration purposes).
2. Switch to TranSight.
3. Select the cells you want to work with.

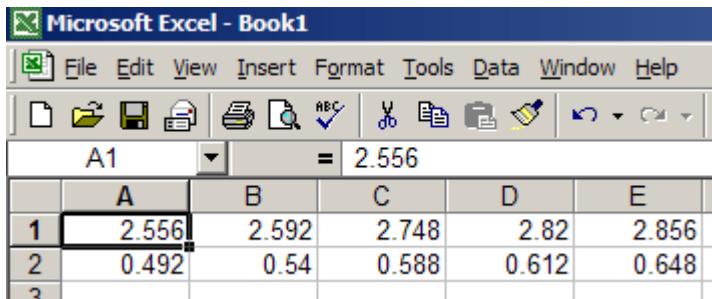
Operation and Maintenance Spending (2000 US \$M)					
	2005	2006	2007	2008	2009
Road	2.13	2.16	2.29	2.35	2.38
Transit	0.41	0.45	0.49	0.51	0.54

4. Press Ctrl-C (or right-click and select **Copy**) to copy the cells.
5. Switch to Excel.

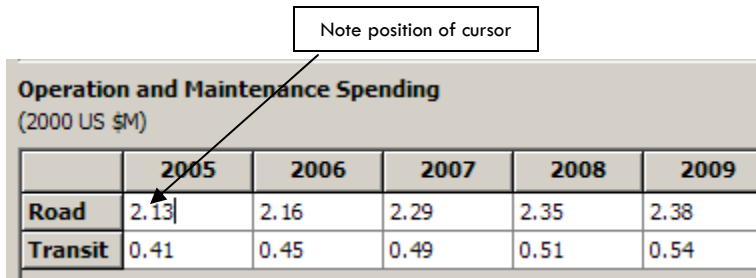
- Press Ctrl-V (or right-click and select **Paste**) to paste the cells into Excel.



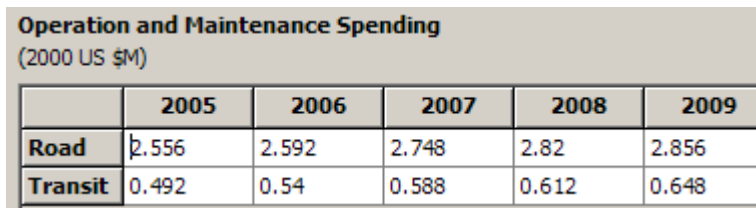
- Modify the cells as needed.



- Select the cells in Excel.
- Press Ctrl-C to copy the cells.
- Switch to TranSight.
- Place the cursor in the topmost or leftmost of the cells you moved to Excel.



- Press Ctrl-V or right-click and select **Paste** to paste the cells back into TranSight.



Moving On

Once you've finished reviewing and modifying the values on the User Inputs tab, click the



Chapter 4: The Simulation Options Tab

On the Simulation Options Tab (Figure 14) you can:

- choose the years included in the simulation
- view and edit simulation parameters like emissions, safety, and value of time
- select which variables you want included in your simulation
- choose which of the cost matrices you want included in your simulation
- choose a control forecast for your simulation
- choose whether or not to automatically run the simulation as soon as you export your transportation data to Policy Insight, and
- tell TranSight to run your simulation.

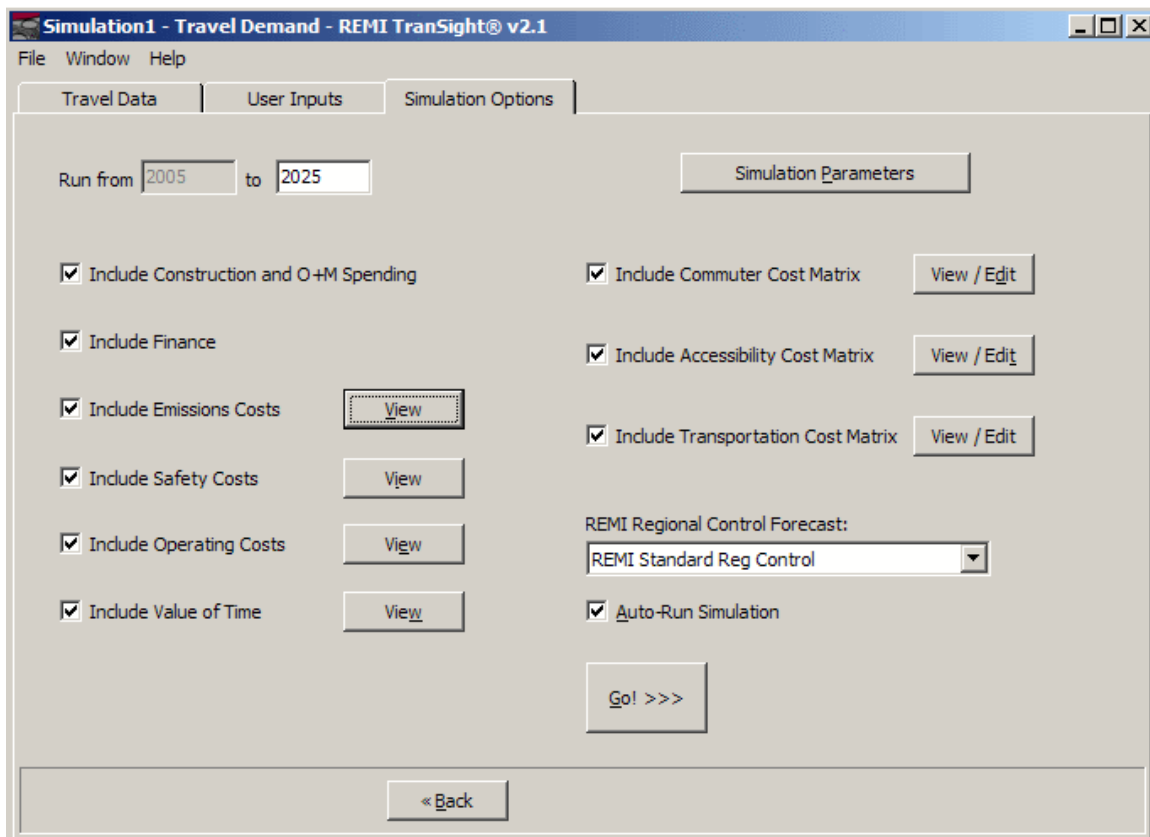


Figure 14. The Simulation Options Tab

Simulation Years


To set the years included in the simulation, enter the end year of the simulation into the “Run to” field at the top left of the window. The “Run from” field cannot be changed.

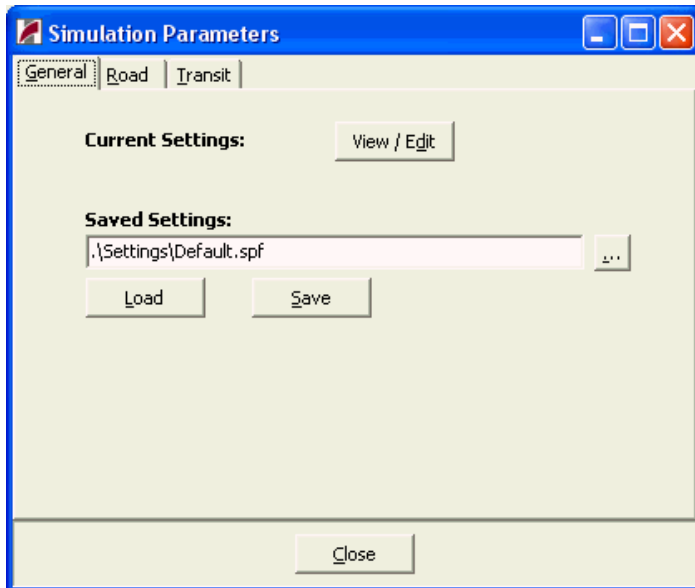
Simulation Parameters

For a number of costs affected by transportation projects, TranSight includes data derived from national sources. This data includes:

- Emissions Rates and Costs
- Value of Time
- Fuel Efficiency
- Accident Rates and Costs
- Fuel and Non-Fuel Operating Costs.

Usually you won't need to change these values, but, if you have more accurate local data, TranSight allows you the option to enter it.

To view and edit this data click the  button, which opens the Main Simulation Parameters window.



The Main Simulation Parameters Window

TranSight groups the available parameters under the following three tabs:

- General – Emissions (Cost/Gram), Value of Time (Value of Leisure Time), and Government Funding (Amenity Loss from Use of Non-dedicated Government Funding as Wage-equivalent Reduction in Government Services).
- Road – Emissions (Grams/Mile), Fuel Efficiency (Average MPG), Safety (Accidents/Million VMT & Accident Value in \$US), Operating Costs (Fuel in \$/Gallon & Non-fuel in \$/Mile), and Vehicle Occupancy (Passengers/Vehicle)
- Transit – Emissions (Grams/Mile), Safety (Accidents/Million VMT & Accident Value in \$US), and Vehicle Occupancy (Passengers/Vehicle)

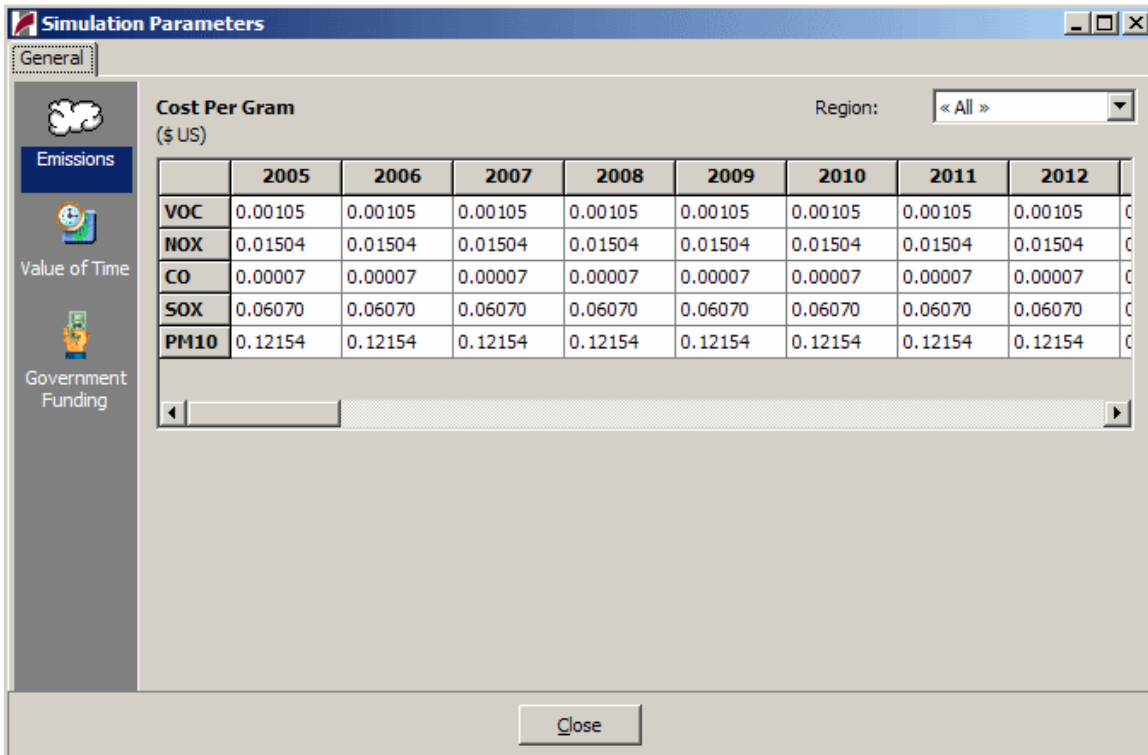
To view or edit these values, select the appropriate tab and click the  button.

The “Region” Combo Boxes

Most of the selections in the various Simulation Parameters windows feature a “Region” combo box. In your customized model, this combo box should display the regions specific to your model, along with the “All” option. There are two important things to know about these options:

- The Region combo box is global. This means that if you select “Suburbs” on the Emissions panel of the Road tab, and then switch to the Fuel Efficiency panel, “Suburbs” remains selected.
- The “All” setting is designed to allow you to set all regions to the same value. It is **not** an average or sum of the values in all of the regions. If the value for a particular cell is different in the two areas, the cell displays “N/A” when you select “All” from the region combo box.

The General Tab



The General Simulation Parameters Window

The General Simulation Options window allows you to view or edit three sets of parameters. Click the icon on the left to select the following panels:

- Emissions – Cost/gram for five pollutants (Volatile Organic Compounds, Nitrogen Oxides, Carbon Monoxide, Sulfur Oxides, and Particulate Matter) for each model region.
- Value of Time – Value of Leisure Time (\$US) for each model region.
- Government Funding – Percent amenity loss due to the reduction in other government services needed to fund the transportation project. For example, if you reduced non-dedicated

funding by \$40 million to pay for a project, a 75% parameter would imply a loss of \$30 million in valued government services.

The Road Tab

Simulation Parameters

Road

Region: All

Grams Per Mile Type: VOC Vehicle Mode: Auto

@ 0-80 MPH

	2005	2006	2007	2008	2009	2010	2011	2012
0 MPH	2.73390	2.73390	2.73390	2.73390	2.73390	2.73390	2.73390	2.73390
1 MPH	2.66371	2.66371	2.66371	2.66371	2.66371	2.66371	2.66371	2.66371
2 MPH	2.59352	2.59352	2.59352	2.59352	2.59352	2.59352	2.59352	2.59352
3 MPH	2.52333	2.52333	2.52333	2.52333	2.52333	2.52333	2.52333	2.52333
4 MPH	2.45314	2.45314	2.45314	2.45314	2.45314	2.45314	2.45314	2.45314
5 MPH	2.38295	2.38295	2.38295	2.38295	2.38295	2.38295	2.38295	2.38295
6 MPH	2.32429	2.32429	2.32429	2.32429	2.32429	2.32429	2.32429	2.32429
7 MPH	2.25986	2.25986	2.25986	2.25986	2.25986	2.25986	2.25986	2.25986
8 MPH	2.18967	2.18967	2.18967	2.18967	2.18967	2.18967	2.18967	2.18967
9 MPH	2.11372	2.11372	2.11372	2.11372	2.11372	2.11372	2.11372	2.11372
10 MPH	2.03200	2.03200	2.03200	2.03200	2.03200	2.03200	2.03200	2.03200
11 MPH	1.94020	1.94020	1.94020	1.94020	1.94020	1.94020	1.94020	1.94020

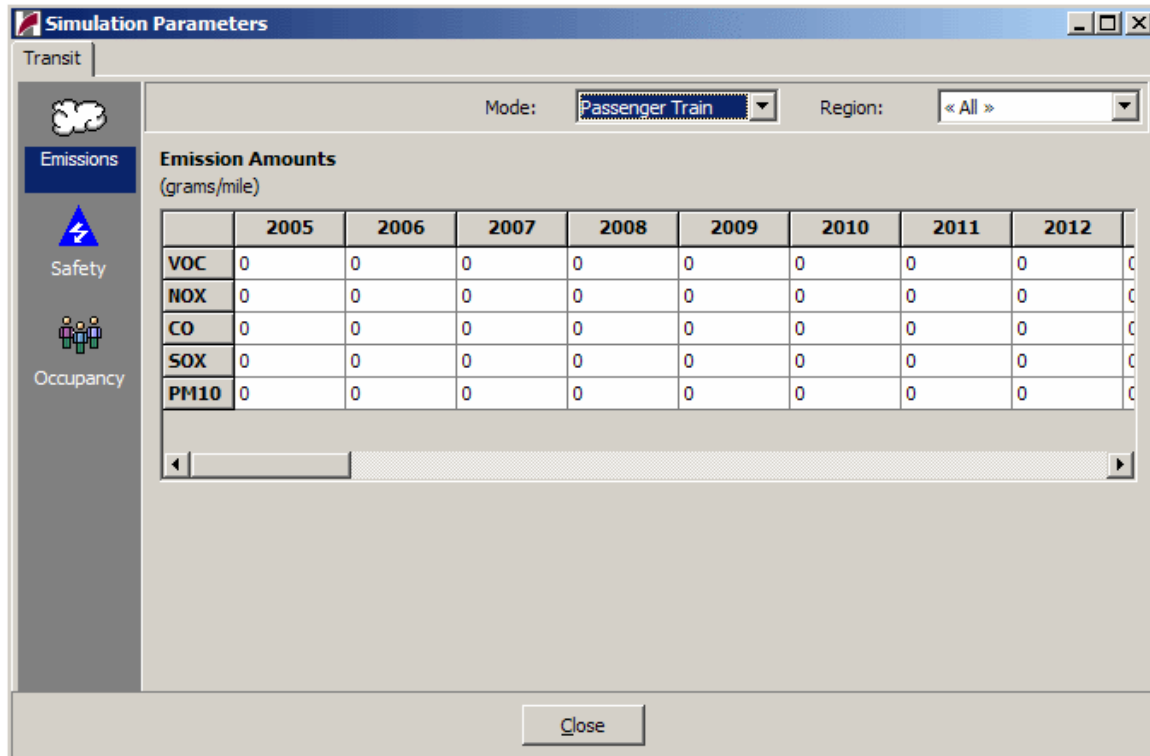
Close

The Road Simulation Parameters Window

The Road Simulation Parameters window allows you to view or edit five sets of parameters. Click the icon on the left to select the following panels:

- Emissions – Grams per mile @ 0-80 mph for five pollutants (Volatile Organic Compounds, Nitrogen Oxides, Carbon Monoxide, Sulfur Oxides, and Particulate Matter) by region and by vehicle mode (Auto or Truck).
- Fuel Efficiency – Average mpg @ 0-80 mph by region and by vehicle mode (Auto or Truck).
- Safety – Accidents per million VMT and Accident value in \$US, both by region and by time of day (AM peak, PM peak, AM non-peak, PM non-peak) categorized by Fatalities, Injuries, and PDO (Property Damage Only).
- Operating Costs – Fuel costs in \$ per gallon by region and by vehicle mode (Auto or Truck) categorized by Pre-tax Fuel Price, Federal Excise Tax, State Excise Tax; and Total Non-fuel costs in \$ per mile (Non-fuel costs represent mileage-related vehicle maintenance).
- Occupancy – Vehicle Occupancy in all regions categorized by Auto and Truck.

The Transit Tab



The Transit Simulation Parameters Window

The Transit Simulation Parameters window allows you to view or edit three sets of parameters. Click the icon on the left to select the following panels:

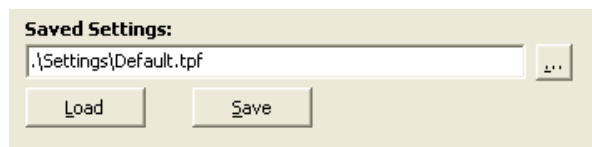
- Emissions – Emission Amounts in Grams per mile by region and for three vehicle modes (Passenger Train, Light Rail, and Bus) categorized by five pollutants (Volatile Organic Compounds, Nitrogen Oxides, Carbon Monoxide, Sulfur Oxides, and Particulate Matter).
- Safety – Accidents per million VMT and Accident value in \$US, both by region and for three vehicle modes (Passenger Train, Light Rail, and Bus) categorized by Fatalities, Injuries, and PDO (Property Damage Only).
- Occupancy – Vehicle Occupancy in all regions categorized by Passenger Train, Light Rail, and Bus.

Saving and Restoring Parameters

Saving the changes that you make in the various Simulation Parameters windows is not strictly necessary. When you change the values in these windows, TranSight uses these values until you change them again. However, sometimes you may want to compare results based on two or more sets of values. To make this process easy, TranSight lets you save the Simulation Parameters to a file for later recall. The original settings for each tab are stored in the “Default” file. Each tab uses a different filename extension:


- General: “.spf”
- Road: “.rpf”
- Transit: “.tpf”

To save the changes you make to the values in the various Simulation Parameters windows, use the **Saved Settings** section of the main Simulation Parameters window.


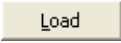


The Saved Settings Option

After you make changes to the Simulation Parameters, enter a new filename in the Saved Settings text field. **Important: Do not save your changes to the “Default” file. The Default file allows you to reset the Simulation Parameters to their original values.**

Once you’ve entered a new filename, simply click the  button. TranSight saves your new settings in an easily retrieved file.

If you have several datasets that you’ve saved, you can select one using the following steps:

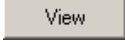
1. Click the Browse () button at the right of the file path field. TranSight opens an **Open** window.
2. Navigate to the desired parameter file and double-click it. TranSight enters the file into the Saved Settings file path field.
3. Click the  button. TranSight automatically loads the saved parameter values into the Simulation Parameter tables.

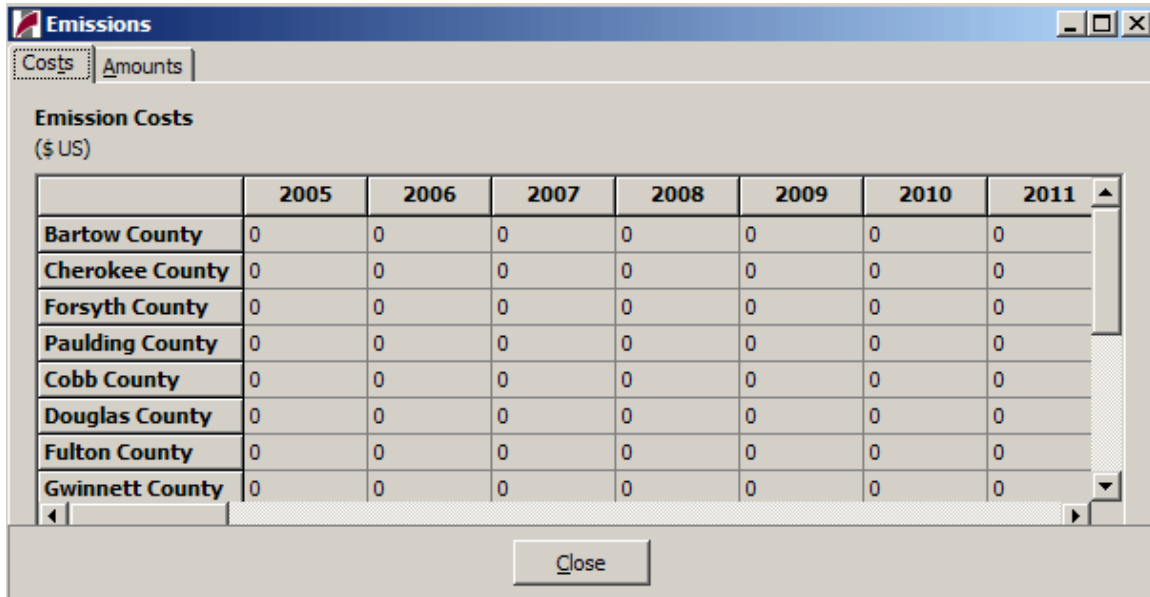
To restore the values to their original settings, select the file named “Default” in step two above.

Input Variables

TranSight enables you to choose which input variables you want included in your simulation. This option makes it easy to run multiple simulations with different combinations of variables included. Doing so isolates the direct impact of individual variables. Select variables for inclusion by ensuring that the checkbox to the left of the variable name displays a checkmark.

To run your simulation for a specific time period, change the year in the **Run To** box (the **Run From** box cannot be changed).

The values input on the User Inputs tab for Construction, Government Funding, and Tax Changes enter the simulation as displayed on that tab. However, the values for the other inputs on the User Inputs tab undergo some initial calculations before they enter the model. The Simulation Options tab allows you to view (but not edit) the calculated values. To do so, click the  button to the right of the input name (e.g. Emissions Costs). TranSight performs the appropriate calculations and a separate window opens to display the resulting values.



The screenshot shows a window titled "Emissions" with two tabs: "Costs" (selected) and "Amounts". Below the tabs, the text "Emission Costs (\$ US)" is displayed. A table follows with columns for the years 2005 through 2011 and rows for Bartow County, Cherokee County, Forsyth County, Paulding County, Cobb County, Douglas County, Fulton County, and Gwinnett County. All cells in the table contain the value "0". A "Close" button is located at the bottom center of the window.

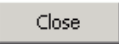
	2005	2006	2007	2008	2009	2010	2011
Bartow County	0	0	0	0	0	0	0
Cherokee County	0	0	0	0	0	0	0
Forsyth County	0	0	0	0	0	0	0
Paulding County	0	0	0	0	0	0	0
Cobb County	0	0	0	0	0	0	0
Douglas County	0	0	0	0	0	0	0
Fulton County	0	0	0	0	0	0	0
Gwinnett County	0	0	0	0	0	0	0

The View Emissions Cost Window

The values displayed include the following:

- **Construction and O+M Spending:** This includes the cost of construction on the project, as well as the costs of operating and maintaining it.
- **Finance:** This includes the cost of financing the construction.
- **Emissions Costs:** The Costs tab shows the change in pollution-related health costs (summed across the five major motor-vehicle pollutants) due to the change in VMTs caused by the transportation project. The Amounts tab shows the change in grams of emissions (for each of the five pollutants) due to the change in VMTs.
- **Safety Costs:** Shows the change in accident-related costs (including health and the value of lost life) due to the change in VMTs caused by the transportation project.
- **Operating Costs:** Shows the change in fuel costs and non-fuel costs due to the change in VMTs caused by the transportation project (non-fuel costs include such factors as vehicle maintenance).


- **Value of Time:** Shows the value of leisure time either saved or lost due to the change in VHTs caused by the transportation project. A negative number on this table represents time (and cost) savings for that region.

When you're finished reviewing the values, click the  button to return to the Simulation Options tab.

Cost Matrices

You can also choose the cost matrices that you would like included in your simulation. There are three cost matrices available for inclusion:

- Accessibility Cost Matrix
- Commuter Cost Matrix
- Transportation Cost Matrix

These matrices are used to calculate the amount of cost savings induced by improvements in the transportation network. Click the  button next to the matrix name. A window appears in which you can view and modify the information. The numbers in the table represent the percentage of savings across the transportation system for specific pairs of regions (including within each region), relative to the baseline:

- 1 = no change from the baseline
- Below 1 = cost savings relative to the baseline
- Above 1 = cost increases relative to the baseline (e.g., during a construction period)

For example, 0.99 represents a 1% cost savings across the transportation system for that region or pair of regions.

In all three matrix windows, you have two options for viewing the data.


- Click the **By Year** tab to see every year's matrix values for the origin region selected in the combo box.
- Click the **By Region** tab to see the matrix values for all pairings of regions for the year selected in the combo box.

The Commuter Cost Matrix

The Commuter Cost Matrix describes the amount of commuter time savings within or between modeled regions over the average workday.

To include this matrix in your simulation, make sure there is a check in the checkbox next to Include Commuter Cost Matrix in the Simulation Options Tab.



To view or edit the data in this matrix, click on the  button next to Include Commuter Cost Matrix. TranSight calculates the cost savings, and the information appears in the Commuter Cost Matrix window.

	Hampshire Co	Franklin Count	Rest of Nation
Hampshire County	1.00000000	1.00000000	1.00000000
Franklin County	1.00000000	1.00000000	1.00000000
Rest of Nation	1.00000000	1.00000000	1.00000000

The Accessibility Cost Matrix

The Accessibility Cost Matrix describes access to more diverse consumer goods and services by households, as well as access to a broader array of intermediate inputs by employers.

To include this matrix in your simulation, make sure there is a check in the checkbox next to Include Accessibility Cost Matrix in the Simulation Options Tab.



To view or edit the data in this matrix, click on the **View / Edit** button next to Include Accessibility Cost Matrix. TranSight calculates the cost savings, and the information appears in the Accessibility

Cost Matrix window.

	Hampshire Co	Franklin Count	Rest of Nation
Hampshire County	1.00000000	1.00000000	1.00000000
Franklin County	1.00000000	1.00000000	1.00000000
Rest of Nation	1.00000000	1.00000000	1.00000000

The Transportation Cost Matrix

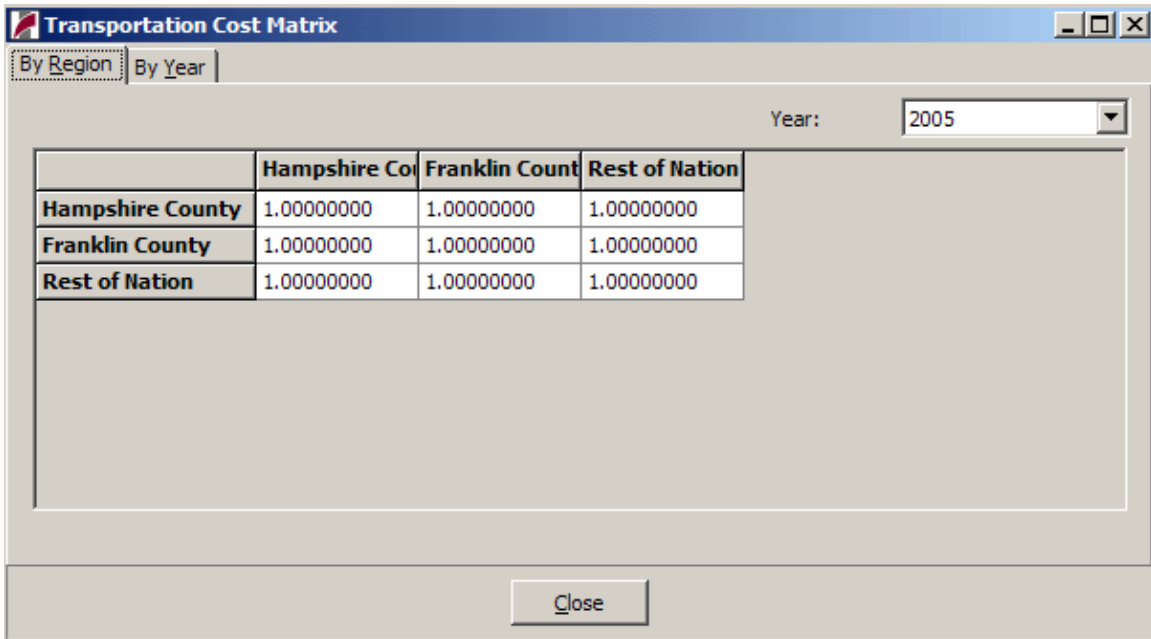
The Transportation Cost Matrix describes the amount of cost savings in transporting goods and services due to an increase in transportation efficiency.

To include this matrix in your simulation, make sure there is a check in the checkbox next to Include Transportation Cost Matrix in the Simulation Options Tab.

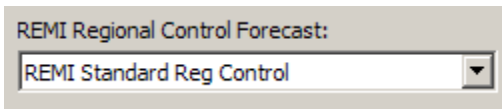


To view or edit the data in this matrix, click on the button next to Include Transportation Cost Matrix. TranSight calculates the cost savings, and the information appears in the

Transportation Cost Matrix window.

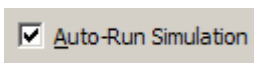


REMI Regional Control Forecast




Use this combo box to choose a control forecast (an unchanged, “business as usual” projection of the region’s economy without any transportation changes) to use as a basis for your TranSight simulation. Policy Insight will compare the results of your simulation to the results of this forecast and show the differences and percentage changes between them on the Results tab. See the Policy Insight documentation for more information.

Auto-Run Simulation



The Auto-Run Simulation checkbox determines what Policy Insight does after you export your data from TranSight by clicking on the Go button. If you leave the **Auto-Run Simulation** box checked, Policy Insight will run the simulation as soon as you click on **Go**. If you click on the Auto-Run Simulation box to uncheck it, Policy Insight will open to the Policy Variable Values tab, allowing you to examine the inputs you entered and to enter further data into Policy Insight. Unchecking the Auto-Run Simulation box is a good idea if you have additional inputs to the simulation which TranSight does not include.

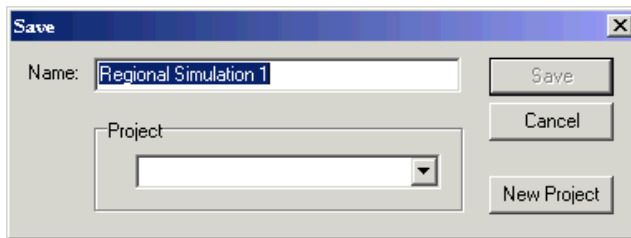
The Go Button


When you're ready to run your simulation, click the  button. TranSight then uses the Policy Insight analysis engine to generate the results. When this process is complete, TranSight opens the Policy Insight results view. You can then view all the data that are available in the Results tab of the Policy Insight results view.

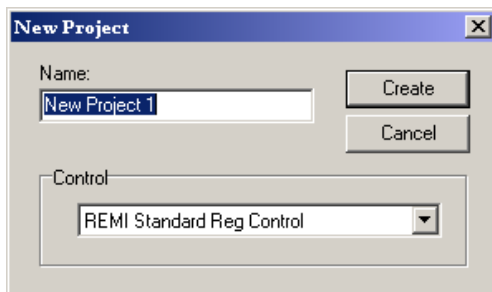
Saving the Simulation in Policy Insight

Saving the simulation in Policy Insight makes the results available from the TranSight Main Screen (using the View Saved Results option on the Other Tasks panel). The simulation results will also be available in Policy Insight for comparison with other simulation (using the Compare To drop-down box). When you're finished looking over the results in Policy Insight, save the simulation. Here's how:

1. On the Menu bar, click **File**→**Save As...** The Save window opens.



2. Click the  button. The New Project window opens.



3. Enter a project name in the **Name** field and click **Create**. The Save window reappears.
4. Enter a filename in the **Name** field and click **Save**.



Model Documentation

Overview of the Model

REMI TranSight integrates leading travel-demand and transportation forecasting models (such as TranPlan, TransCAD, TP Plus, EMME/2, and HERS) with REMI Policy Insight. While stand-alone transportation models produce forecasts of travel-demand response to a proposed transportation project, TranSight provides a more complete perspective by predicting the full array of economic and demographic effects that will result from completing the project. It translates the key outputs generated by the transportation models into a series of cost and amenity variables that can be incorporated into a single-region or multi-region impact analysis, as driven by the powerful Policy Insight engine, which is also the core of REMI's Policy Insight model. The output of this process shows such key economic indicators as employment by industry, output, and value added by industry, personal income, population, and many more.

TranSight allows the user to specify the financial dimensions of an upgrade to the transportation infrastructure, including expected construction costs, financing, and annual operation/maintenance costs. In addition, it calculates several *indirect* types of costs and benefits that may ensue from the project, including changes in safety, emissions, operating costs, and transportation costs. Some of these computations require user input regarding construction, finance, and operations, while others use the output from travel-demand model scenarios. Collectively, this information is transferred into Policy Insight, which produces multi-year forecasts of economic and demographic trends under the transportation upgrade, and compares them with a baseline forecast. In capturing the full effects of the project, TranSight can assist governments in determining whether allocating funds to a particular transportation upgrade is a winning proposition relative to funding other policy initiatives.

The model structure is represented pictorially in Figure 1 below, which reveals both the components of the model and the manner in which information flows between them. Outputs from the transportation model are combined with built-in cost parameters and project-specific information to produce values for policy variables designed to simulate the project's direct impact. The Policy Insight engine processes these results to generate comprehensive forecasts of the project's macroeconomic effects.

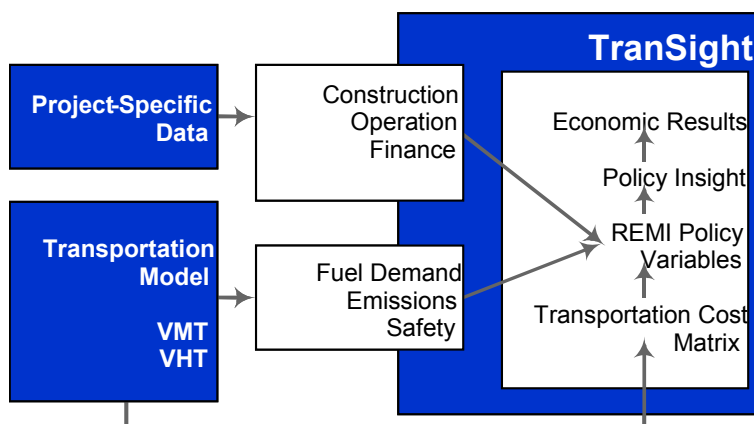


Figure 1. Model structure of TranSight

Detailed Model Description

This section first describes the mechanism by which TranSight receives and processes its input. Following this are subsections that describe the various costs and benefits that are incorporated into TranSight's assessment of a transportation project.

Model Input

The inputs to the modeling process stem from three sources:

- output from travel-demand model simulations
- project-specific information
- nationwide studies by government agencies and localized studies specific to the regions being modeled (as available)

Although transportation models vary significantly in structure and content, they all produce estimates of vehicle miles traveled (VMTs), vehicle hours traveled (VHTs), and vehicle trips under different scenarios involving modifications to one or more elements of the transportation network. Models that handle multiple modes of transportation will produce VMT and VHT by mode, as well as vehicle trips for each defined highway and public transit mode. Other models may report miles and hours traveled within each of several geographic areas, which can be incorporated into TranSight's multi-regional framework. Because transportation-model outputs often vary (for example, highway VMTs may be subdivided across different road types, vehicle types, and/or times of day), TranSight was designed with sufficient flexibility to handle a diverse range of data dimensions, which allows REMI to customize the model for individual clients. Much of this variation is due to differences across the various travel-demand models, but various transportation departments or other users may configure the same modeling package differently. Please see Appendix B for details on how TranSight transforms each travel-demand model's output into the VMT, VHT, and vehicle trip figures used in the analysis of transportation improvements.

Since the highway travel data are derived directly from individual scenario runs of your travel-demand model, they are not editable from within TranSight. However, since transit mode data are typically not included in travel-demand model output, TranSight allows users to directly enter and modify VHT, VMT, and trips by transit mode. Additionally, TranSight permits some degree of flexibility in how the data are applied to the forecast timeframe and across the specified regions. First, entering a "Phase in from" year and "Phase in to" year establishes a time period during which VMT, VHT, and vehicle trips gradually ramp from their baseline values toward the adjusted levels predicted by the travel demand model. The default assumption is that this progression is linear, so the costs and benefits that depend on miles and hours traveled are steadily realized over time. However, you may also specify a customized, non-linear phase-in process by entering the percentage of project benefits realized during each year of the forecast. Depending upon the project's specification, the start year of transportation benefits might occur during the construction phase (such as a light-rail extension in which stations are activated incrementally) or might be deferred until the culmination of construction (such as a new artery that remains unusable until completion).

For multi-regional models, TranSight also spreads VMTs, VHTs, and trips among every possible pairing of defined regions. TranSight regions can correspond to states, counties, user-specified subcounty areas, or aggregations thereof, provided that travel-demand data is available for each desired region. While the travel-data tables display the number of vehicle miles and hours traveled within each region, they often provide no indication of the percentage of trips that originate in one region and terminate in another. This information is necessary as a basis for quantifying the improvements in commuter, transportation, and accessibility costs that result from the decrease in “effective distance” achieved by the transportation upgrade. The concept of effective distance essentially captures the distance decay effect through which the frequency of trips between regions A and B is inversely related to the distance between them.

Even though the vast majority of trips begin and end within the same region, cross-regional trips involve a greater number of hours and miles per trip. If the travel-demand model produces region-to-region breakdowns of hours, miles and trips, these data are directly transferred into TranSight to calculate the change in effective distance between each pair of regions. If the transportation model is not equipped to yield such information, TranSight applies available information on miles or hours of regional trips to develop a percentage allocation of total system VMTs and VHTs to each pair of regions (including different values for A to B versus B to A, to reflect asymmetric traffic flows). You can adjust these pre-set percentages or introduce changes over time to capture expected shifts in traffic patterns over the forecast time period (perhaps due to predicted spatial disparities in economic or residential development).

Among inputs not derived from travel demand models or public transit data, many parameters (such as pollutant emission rates and accident costs) are assigned default values from national sources such as the Institute of Transportation Studies and Federal Highway Administration, although the client can revise these with locality-specific estimates. While in certain cases the national figures are reasonable proxies for localized regions, the geographic variability of other factors such as accident rates and fuel prices makes local customization more vital. You must enter other TranSight inputs, such as those characterizing construction expenses and project financing, because of their specificity to the simulation.

Costs and Benefits

Each of the following subsections focuses on a direct effect, describing the cost calculation performed by TranSight and the manner in which the cost enters the Policy Insight analysis. Note that one or more of these costs may be excluded from the simulation prior to running TranSight, at the user’s discretion. For greater discussion of the theoretical underpinnings of modeling these costs in TranSight, please consult Appendix A.

Construction Costs

Governments incur the costs of building, financing, and maintaining a transportation upgrade over the lifetime of the project. While the construction process represents an expense from the government’s perspective, it also represents demand that stimulates increased employment and production of intermediate inputs by the private sector. Both of these aspects are included in

TranSight’s modeling framework. In TranSight, the user enters projected construction costs and projected operation and maintenance (O&M) costs by mode in dollar form for each of the forecast years, in accordance with the annual work schedule of the transportation upgrade under consideration. The operation and maintenance costs heavily depend upon the nature of the undertaking. Public transit requires significant operating costs and replacement of depreciated equipment, as contrasted with road improvements that may only require periodic pavement and shoulder maintenance.

TranSight translates these expenditures into demand policy variables within Policy Insight. First, contracts with construction firms to implement the transportation project are reflected in increased final demand for the construction industry, which naturally flows through into sales, employment, demand for intermediate inputs (based on the I-O table), and other variables. TranSight also passes operations and maintenance spending into final demand for construction. The model uses endogenous trade-flow shares (based on a gravity-model approach) to allocate this demand to increased sales by the construction industry in both the specified region and other defined regions, including residual regions comprising the “rest of US” and the “rest of world.”

Finance

Governments may utilize a number of different mechanisms to finance transportation projects. The instruments they choose (whether a single funding source or a “cocktail” of sources) can have varying effects on the region’s economy, depending on market characteristics and the demand responsiveness of the individuals bearing the burden of the tax or spending changes. From a regional fiscal-balancing standpoint, some sources (such as previously budgeted transportation spending and federal highway grants) can be regarded as essentially costless. In contrast, targeted tax hikes, spending reallocations, and bonds directly alter the government’s bottom line, in addition to producing indirect fiscal effects through inducing dynamic behavioral responses by households and firms. To perform a comprehensive assessment of a project’s impact, it is imperative to balance the economic benefits the project generates with the costs (both direct and indirect) borne by the region’s taxpayers and businesses. TranSight is designed with such a holistic perspective in mind.

TranSight enables you to invoke several different sources of funding for the transportation project under consideration. Any of four taxes—sales, residential property, fuel, and income taxes—may be hiked relative to their baseline levels. These increases are entered as changes in amounts collected (i.e., incrementing total tax receipts by a specified dollar amount). The tax changes can vary by region (for multi-regional models) and year to capture their real-world timing and geographic incidence.

On the spending side, when project-related outlays (excluding those funded by federal money) exceed the budgeted allotment for transportation construction, obtaining the additional funds from other budget categories carries an opportunity cost. To capture this, TranSight enables you to input the reductions in non-dedicated government spending (i.e., not budgeted for transportation) necessitated by funding the project. These reductions may be entered on a yearly basis for both the state and local levels, since funding may be shared across the two levels of government. They can also vary by region (in multi-regional models) since financial responsibilities for large projects may be

apportioned differentially across regions. In case the spending takes the form of annual payments against a bond, TranSight provides a built-in calculator that can convert the bond's parameters (amount, interest rate, and maturity) into annualized payment obligations.

When entering spending figures, you should omit any project expenditures drawn from the existing transportation budget. TranSight assumes that those funds would have been spent on other transportation-related projects, making them costless for any specific transportation project from a governmental accounting perspective. Similarly, the user should exclude from the analysis any federal grants allocated to the project since they are viewed as exogenous and non-transferable (hence, there is no opportunity cost associated with applying them to the transportation upgrade). Land acquisition costs are excluded from construction spending because economic value stems from improvements to land, not from portfolio transactions involving land. However, these acquisition costs must be included in the financial tabulation to the extent that the associated funding derives from non-dedicated, non-federal sources.

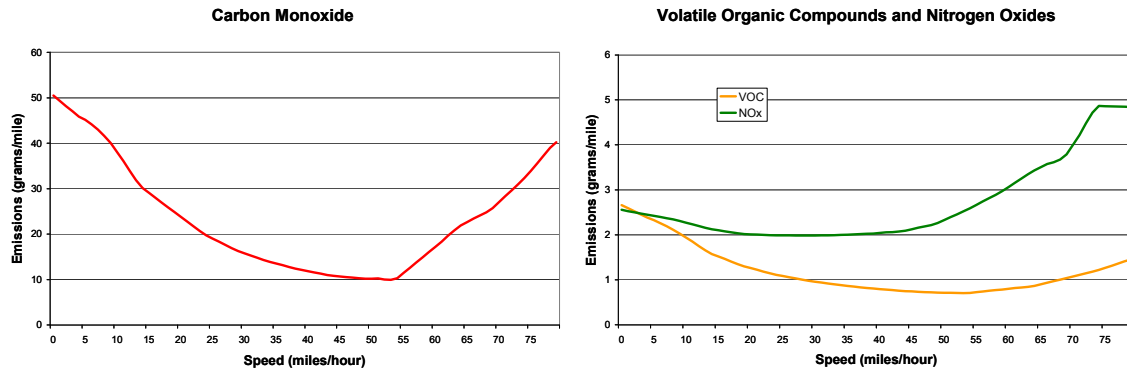
TranSight transfers all project financing instruments into Policy Insight in the form of the most suitable economic policy variables, where the tax and spending changes they represent produce indirect effects on the region's economy and population. Changes in TranSight tax variables map to Policy Insight policy variables as follows: income tax as "personal taxes," sales tax as the "inflation-reduced consumer purchasing power," property tax as the "consumer price" for housing, and fuel tax as the "consumer price" for gasoline and oil. The non-dedicated government spending diverted to transportation construction is modeled as reduced general government expenditure at the state and local levels, consistent with the state/local breakdown entered in TranSight.

Emissions Costs

While transit upgrades can reduce emissions by drawing motor vehicles off the road, highway enhancements typically induce increased traffic, which causes greater emissions of harmful pollutants. In TranSight, changes in emissions costs are computed from three sets of inputs. First, for each of five primary pollutants (carbon monoxide, nitrogen oxides, sulfur oxides, particulate matter, and volatile organic compounds), TranSight specifies rates per vehicle-mile. We assume constant emissions rates for transit modes, but for motor vehicles (autos and trucks) we assume variable rates for each potential vehicle speed from 0 to 80 miles/hour. The emissions rate for some motor vehicle pollutants depends on travel speed, and declines up to a certain threshold speed, at which point emissions begin to increase (see Figure 2 below). For other pollutants, the emissions rate remains fairly constant over all speeds. The rates are differentiated across each mode of transport.

TranSight uses motor vehicle emissions rates obtained from two prominent models developed by the EPA: PART5 (for SO_x and PM) and MOBILE6b (for CO, NO_x, and VOCs). These models rely on assumptions regarding the age distribution of the US motor vehicle fleet, fuel characteristics, locally relevant operating conditions, and the effects of inspection and maintenance programs to establish average emission rates for each multiple-of-five speed between 10 and 65 mph. To derive rates for all speeds from 0 to 80 mph, the process of Lagrange interpolation was applied to the EPA's rates. Figure 2 illustrates for three of the five pollutants (CO, NO_x, and VOCs) how emission

rates progressively improve and then worsen as travel speed increases. For the remaining two pollutants under consideration (SOx and PM), emissions rates remain constant over all speeds at the levels estimated by the EPA. Given the likelihood of tightening emissions regulations, technological improvements, and gradual conversions from internal combustion to electric engines, TranSight enables the user to enter differing (likely lower) emissions rates for each forecast year.



Emissions rates for various speeds (source: EPA's PART5 and MOBILE6b)

The second matrix of inputs represents the cost per gram of each of the five pollutants under consideration, which, like the emission rates, can vary from year to year. TranSight is packaged with default emissions costs that are based on a study by McCubbin and Delucchi, who quantify the health effects of vehicle pollution per VMT in the average urban area and the nation as a whole.¹ These costs are used for both motor vehicle and public transit modes, as the health impacts of a gram of pollutant are identical regardless of the source. The user may modify these cost parameters based on conditions endemic to the region being modeled; for example, emissions costs tend to be higher in congested urban areas since pollutants tend to have more potent health effects nearer the source. The final set of inputs is simply total vehicle miles traveled under the baseline and alternative (i.e., with the transportation project in place) scenarios, disaggregated by mode of travel. Combining the three inputs produces total emissions cost figures for each of the five pollutants, as illustrated in the following equation. TranSight performs this calculation separately for each mode specified in the model.

$$\Delta EC = \sum_j ER_j \times CPG_j \times (VMT_{alt} - VMT_{base})$$

where

- ΔEC = Change in total emissions cost (\$)
- ER_j = Emissions rate for pollutant j (gram/mile)
- CPG_j = Emissions cost per gram for pollutant j (\$/gram)
- VMT_{alt} = Vehicle miles traveled under the alternative scenario

¹ McCubbin, Donald, and Mark Delucchi, "The Social Cost of the Health Effects of Motor Vehicle Air Pollution." Report 11 from *The Annualized Social Cost of Motor-Vehicle Use in the United States*. Institute of Transportation Studies. University of California-Davis. 1996.

VMT_{base} = Vehicle miles traveled under the baseline scenario

The change in emissions cost relative to baseline levels enters into Policy Insight as a non-pecuniary amenity that accrues to workers and their dependents.² These costs then proceed to influence private decision-making by households in accordance with the tenets of the new economic geography, as articulated by Fujita et al.³ and applied to regional macroeconomic modeling by Fan, Treyz and Treyz.⁴ This theory emphasizes the geographic location decisions of firms, demonstrating how improved access to intermediate inputs and a diversely skilled labor force can provide incentives for industries to cluster and agglomerate. But in addition to these business effects, households may be motivated to migrate closer to cities, where access to a broader array of consumer goods and potential employers may counterbalance disamenities such as higher crime rates, traffic, and air pollution. As a consequence, a transportation project that effectively reduces emissions costs may stimulate in-migration to urban regions, and Policy Insight will capture this dynamic over the course of the forecast period.

Safety Costs

Upgrading a highway or transit line can improve safety on the transportation network, but to the extent that usage increases, the frequency of accidents can increase. Since the number of accidents is directly proportionate to vehicle miles traveled, the transportation model's role in assessing net VMT changes is pivotal for TranSight's computation of cost impacts. TranSight permits annual mode-specific rates for each of three accident consequences: fatalities, injuries, and property damage only (PDO). The model is pre-packaged with default highway accident rates based on national averages reported by the Federal Highway Administration; the user can modify these rates if local-specific data are available. For transit modes, the model includes default accident rates that are derived from nationwide US Department of Transportation data.⁵

TranSight also provides default cost-per-accident figures for each transportation mode, broken down by accident consequence. These are based on National Safety Council figures that incorporate wage and productivity losses, medical and administrative expenses, motor vehicle damage, and a willingness to pay to reduce safety risks.⁶ Additionally, a different set of costs can be entered for each forecast year, for example, to reflect rising insurance premiums or health care costs. The cost calculation mirrors that performed for emissions costs, taking the following form for each mode:

$$\Delta SC = \sum_j AR_j * CPA_j * (VMT_{alt} - VMT_{base})$$

where

ΔSC = Change in total safety cost (\$)

² Lieu, Sue and G. I. Treyz, "Estimating the Economic and Demographic Effects of an Air Quality Management Plan: The Case of Southern California." *Environment and Planning*, 24 (1992): 1799-1811.

³ Fujita, Masahisa, Paul Krugman, and Anthony J. Venables, *The Spatial Economy: Cities, Regions, and International Trade*. Cambridge, MA: MIT Press, 1999.

⁴ Fan, Wei, Frederick Treyz, and George Treyz "An Evolutionary New Economic Geography Model." *Journal of Regional Science* 4 (2000): 671-695.

⁵ Bureau of Transportation Statistics, *National Transportation Statistics 2001*.

⁶ National Safety Council, *Estimating the Cost of Unintentional Injuries*.

AR_j = Accident rate for accident consequence j (accident/mile)

CPA_j = Safety cost per accident for accident consequence j (\$/accident)

VMT_{alt} = Vehicle miles traveled under the alternative scenario

VMT_{base} = Vehicle miles traveled under the baseline scenario

As with emissions costs, changes in safety costs are transferred into Policy Insight as adjustments to the non-pecuniary amenities that impact individual welfare. Even for people not involved in accidents, the prevailing local accident rate along with associated insurance and medical costs can influence the relative attractiveness of living and/or working in a particular region. Changes in these variables may stimulate migration into or out of the region. But the migratory impact of safety costs might conceivably be outweighed by other factors set in motion by the transportation project; for example, a new highway might make driving less safe, but it also improves access to attractive commodities and employers, which might trigger in-migration despite the attendant risks. By computing the magnitude of all these costs, TranSight can predict how they balance out to yield a net impact on economic migration and other economic factors.

Operating Costs

Increased travel stimulated by a highway upgrade forces increased out-of-pocket spending on vehicle operation and maintenance. In TranSight, vehicle operating expenditures represent an opportunity cost in the form of foregone spending on other consumption goods and services. TranSight comes packaged with default pre-tax fuel prices based on recent region-specific historical trends (as reported by the Energy Information Administration), and both federal and state excise tax rates applicable in the modeling region. You can modify these prices and tax rates for each region in each forecast year, in case you anticipate a particular time trend, tax change, or geographic variation.

The total post-tax fuel price is applied to a miles-per-gallon figure that is appropriate to the average speed prevailing on the region's transportation network. TranSight contains a table of speed-specific mpg parameters (for speeds from 0 to 80 mph), which allows for variation in gas mileage from year to year. While tightening fuel efficiency regulations and improving technology should increase average mpg over time, the increasing prevalence of trucks and sport-utility vehicles may dampen this trend somewhat. Finally, TranSight multiplies per-mile fuel spending by the change in VMT's predicted by the selected transportation model, to compute total expenditures on gasoline. The fuel cost parameters can vary by motor vehicle type (i.e., cars versus trucks) in order to reflect three important phenomena: the price differential between regular gasoline and diesel fuel, the difference in the federal excise tax on regular versus diesel, and the considerably different fuel efficiency exhibited by cars and trucks over the range of possible average network speeds.

The change in fuel expenditures is computed for each vehicle mode as follows:

$$\Delta FE_i = (FP_i + FEDTAX + STATETAX_i) * \frac{1}{MPG_s} * (VMT_{alt} - VMT_{base})$$

where

ΔFE_i	= Change in fuel expenditures for region i (\$)
FP_i	= Pre-tax fuel price for region i (\$/gallon)
FEDTAX	= Federal excise tax (\$/gallon)
STATETAX $_i$	= State excise tax for region i (\$/gallon)
MPG $_s$	= Typical fuel efficiency at speed s (miles/gallon)
VMT $_{alt}$	= Vehicle miles traveled under the alternative scenario
VMT $_{base}$	= Vehicle miles traveled under the baseline scenario

In addition to these fuel-related expenditures, TranSight contains a non-fuel operating cost parameter that captures maintenance and repair costs associated with vehicle “wear-and-tear.” As with fuel costs, non-fuel operating costs can differ between cars and trucks; default values based on analogous parameters in other travel demand models are included in TranSight. The change in non-fuel expenditures is calculated for each vehicle mode as follows:

$$\Delta NFE_i = NF_i * (VMT_{alt} - VMT_{base})$$

where

ΔNFE_i	= Change in non-fuel expenditures for region i (\$)
NF $_i$	= Non-fuel spending per mile for region i (\$/mile)

In Policy Insight, the change in fuel costs is modeled as a change in Consumer Spending on Gasoline and Oil, while the change in non-fuel operating costs is captured as a change in Consumer Spending on Transportation services. In both cases, the spending change has an equal and opposite effect on household expenditures on other goods and services. For example, decreased expenditures on gas or auto maintenance due to declining vehicle miles traveled allows for shifting of personal disposable income toward other consumption commodities. The reallocation of the savings by consumer category is proportionate to baseline consumer spending on those categories of goods and services. By providing households more latitude on how to spend their income, projects that reduce vehicle operating costs ultimately benefit consumers in the model.

Value of Time

Time spent in transit has an opportunity cost in terms of the more desirable or productive activities foregone by the traveler. In this respect, a transportation network improvement benefits individuals to the extent that it reduces average travel time per trip. For each mode, TranSight bases the value of leisure time saved by the transportation upgrade on the resulting reduction in hours per vehicle-trip multiplied by the average vehicle occupancy rate. Accounting for vehicle occupancy rates is critical since all passengers reap the benefits of shortened travel times. It is particularly important when examining substitution between public transit and motor vehicles, since transit vehicles naturally have considerably higher passenger capacity. The average time savings are then multiplied by the portion of trips under the alternative simulation conducted for leisure purposes. For convenience, TranSight

is packaged with default leisure percentages⁷ and vehicle occupancy rates⁸ culled from federal surveys.

Finally, these total time savings are multiplied by a dollar valuation of leisure hours, which is benchmarked to 50% of the average wage rate to be consistent with methodology recommended by the U.S. Department of Transportation. REMI tailors this figure to the modeled region’s wage and applies it to both peak and off-peak hours, which again accords with standard DOT procedure despite overlooking time-differential rates of congestion.⁹ The same dollar valuation is applied to leisure time in all modes, since there is no justification for valuing leisure time spent in buses or trains differently than leisure time in cars. Mathematically, TranSight calculates the savings in leisure time for each mode as follows:

$$\Delta LT_i = \left(\frac{VHT_i^{alt}}{trips_i^{alt}} - \frac{VHT_i^{base}}{trips_i^{base}} \right) * trips_i^{alt} * VOR_i * \%L_i * VL_i$$

where

- ΔLT_i = Change in leisure time value for mode i (\$)
- VHT_i^j = Vehicle hours traveled on mode i under scenario j
- $trips_i^j$ = Vehicle trips on mode i under scenario j
- VOR_i = Vehicle occupancy rate for mode i (persons/vehicle)
- $\%L_i$ = Percentage of trips for leisure purposes on mode i
- VL_i = Value of leisure time on mode i (\$/hour)

As with other cost changes described above, these time savings enter Policy Insight in the form of increased non-pecuniary amenities to individuals. Even though leisure travel time reductions produced by transportation projects rarely translate into direct financial benefits for households, they do enhance the comparative attractiveness of a region, which is likely to stimulate in-migration. People will be drawn to an area that has diminished its transportation network congestion in relation to neighboring areas, all else being equal. Improved commuting efficiency may also entice workers by providing access to a greater cross-section of potential employment opportunities, thereby further encouraging inward migration.

The Transportation Cost Matrices

Transportation upgrades can reduce the “effective distance” between two locations by facilitating a more efficient flow of labor and goods between them. Within the TranSight framework, the effective

⁷ *Highlights of the 2001 National Household Travel Survey*, Bureau of Transportation Statistics, U.S. Department of Transportation, BTS-0305, 2003.

⁸; *Summary of Travel Trends: 1995 Nationwide Personal Transportation Survey*, Federal Highway Administration, U.S. Department of Transportation, 1999; *2001 National Transit Database*.

⁹ *The Value of Saving Travel Time: Departmental Guidance for Conducting Economic Evaluation*. U.S. Department of Transportation. April 19, 1997.

distance implicitly enters the calculation in three distinct matrices: commuter costs, transportation costs, and accessibility costs. The commuter cost matrix reflects changes in commuting time (measured in hours per commuter trip) between and within modeling regions, which result from completion of the transportation improvement. Since infrastructure expansions should unambiguously reduce travel time by increasing route and mode options, these savings can be translated into an economic impact based on the change in network-wide travel speed and the resulting reduction in average commute time. These savings are assumed to accrue entirely to firms.

TranSight derives the region-to-region changes in commuter time from transportation model output of changes in the VHT/trip ratio for each mode. Since the cost matrix expects a single coefficient value, TranSight calculates a weighted average of time savings across all modes, where each mode's weight is its percentage of total system vehicle hours traveled. Finally, this average time savings is divided by 8 hours to scale them to the length of a typical workday. Note that the commuting time changes with respect to the baseline simulation can vary across forecast years, to allow for dynamic response to the transportation improvement over time. The model calculates commuter cost savings for each combination of regions i and j (with $i=j$ implying within-region savings) via the following formula. It should be noted that the transportation cost change is calculated relative to a baseline value of 1, with a positive ΔCC actually representing an *increase* in commuter costs and a negative value indicating a cost decline.

$$\Delta CC_{ij} = 1 + \frac{1}{8} * \sum_k \%H_k * \left[\frac{VHT_i^{alt}}{trips_i^{alt}} - \frac{VHT_i^{base}}{trips_i^{base}} \right]$$

where

ΔCC_{ij} = Change in commuter costs between regions i and j (hours)

$\%H_k$ = Percent of VHT between i and j traveled on mode k

VHT_k^{base} = Vehicle hours traveled between i and j on mode k : base scenario

$trip_k^{base}$ = Vehicle trips traveled between i and j on mode k : base scenario

VHT_k^{alt} = Vehicle hours traveled between i and j on mode k : alternative scenario

$trip_k^{alt}$ = Vehicle trips traveled between i and j on mode k : alternative scenario

Whereas the commuter cost matrix captures time savings for off-the-clock work-related trips, the transportation cost matrix displays time savings for on-the-clock business travel and transport of goods. As with commuter costs, transportation costs can vary among regions as well as across forecast years. Thus, a new or expanded highway connecting two regions may have substantial impacts on transport costs between them, but also smaller secondary effects on costs between other regions as traffic patterns shift in response to the new alternative. The intertemporal differences can capture the cumulative impact of business development that occurs along the new highway or near a

new public transit station, which may steadily increase congestion and thereby increase average travel times.

TranSight contains two alternative approaches to quantifying transportation cost savings. The first derives from the difference between the alternative and baseline scenarios in the ratio of VMT to VHT. This approach captures the offset between shorter travel times and additional miles traveled, both of which are likely consequences of an upgraded transportation infrastructure. In other words, the principal driver of cost savings is the change in average travel velocities on the region's road network, which reduces the effective distance between sellers and their markets. TranSight computes the transportation cost savings parameters as follows. Because the baseline values are in the numerator, a cost change parameter greater than 1 implies a cost increase relative to the baseline case, whereas ΔTC_{ij} less than 1 suggests cost savings to the commercial and industrial sectors due to the transportation project. Thus, the value of 1 would indicate that the transportation improvement has a neutral impact on transportation costs, with the degree of deviation from 1 being associated with the magnitude of the cost effect. The formula applies exclusively to miles and hours of road-based travel, under the simplifying assumption that goods and services are not transported on public transit modes such as light rail and buses.

$$\Delta TC_{ij} = \frac{(VMT_{ij}^{base} / VHT_{ij}^{base})}{(VMT_{ij}^{alt} / VHT_{ij}^{alt})}$$

where

VMT_{ij}^{base} = Vehicle miles traveled between i and j : base scenario

VHT_{ij}^{base} = Vehicle hours traveled between i and j : base scenario

VMT_{ij}^{alt} = Vehicle miles traveled between i and j : alternative scenario

VHT_{ij}^{alt} = Vehicle hours traveled between i and j : alternative scenario

The second approach involves tabulating the economic costs per trip incurred by commercial truck deliveries of goods and services under the baseline and adjusted scenarios. Using truck VMTs and VHTs from each simulation, TranSight computes three key elements of delivery costs: driver wages, fuel, and wear-and-tear. These calculations are based on default parameters for average hourly driver wage, gasoline price, fuel efficiency, and vehicle wear-and-tear per mile that can be modified as desired. After dividing total transportation cost by the number of trips for normalization purposes, TranSight takes the ratio of the resulting costs per trip between the adjusted and baseline scenarios. This approach reflects a conception of transportation costs as the quantifiable costs of delivery, as illustrated in the formula below:

$$\Delta TC_{ij} = \frac{(Wage * VHT_{ij}^{alt} + FP * (1 / MPG) * VMT_{ij}^{alt} + NF * VMT_{ij}^{alt}) / Trip_{ij}^{alt}}{(Wage * VHT_{ij}^{base} + FP * (1 / MPG) * VMT_{ij}^{base} + NF * VMT_{ij}^{base}) / Trip_{ij}^{base}}$$

where

VMT_{ij}^S = Vehicle miles traveled between i and j : scenario S

VHT_{ij}^S = Vehicle hours traveled between i and j : scenario S

$Trip_{ij}^S$ = Vehicle trips traveled between i and j : scenario S

Wage = Average wage of commercial truck drivers (\$/hour)

FP = Diesel fuel price (\$/gallon)

MPG = Typical truck fuel efficiency (miles/gallon)

NF = Non-fuel spending per mile (\$/mile)

The final cost matrix bridges business and consumer interests by reflecting the value of increased accessibility to intermediate inputs and consumer goods afforded by the upgraded transportation system. While widened roads may only marginally improve accessibility, other infrastructure upgrades such as new bus routes, highways, or commuter rail lines may yield notable decreases in accessibility costs. In particular, expansions of network capacity facilitate greater flow of inputs to production, which augments the variety of available goods and thereby enhances regional productivity, particularly for industries with heavy dependence on intermediate inputs and transportation.

As with the preceding two cost matrices, accessibility costs are entered for each pair of modeled regions in each forecast year. TranSight contains two approaches to measuring these costs, which are difficult to quantify by nature of their intangibility. The first assumes that accessibility costs explain the residual bias toward local purchases that cannot be accounted for by the transportation cost differential between local suppliers and their more distant competition. From this perspective, accessibility further shrinks the effective distance beyond what transportation costs might suggest, which can be measured in terms of increased speed on the network. Thus, accessibility cost changes are merely a scaled-down additive counterpart to the transportation cost changes calculated via the formula above. The second approach assumes that increased accessibility results from a greater number of delivery trips within a given time period, which allows firms to access a more diverse array of potential inputs to production. This interpretation is embodied in the equation below, which draws upon road vehicle data exclusively (under the assumption that public transit does not serve as a channel for transporting intermediate inputs):

$$\Delta AC_{ij} = \frac{(Trip_{ij}^{base} / VHT_{ij}^{base})}{(Trip_{ij}^{alt} / VHT_{ij}^{alt})}$$

where

$Trip_{ij}^{base}$ = Vehicle trips between i and j : base scenario

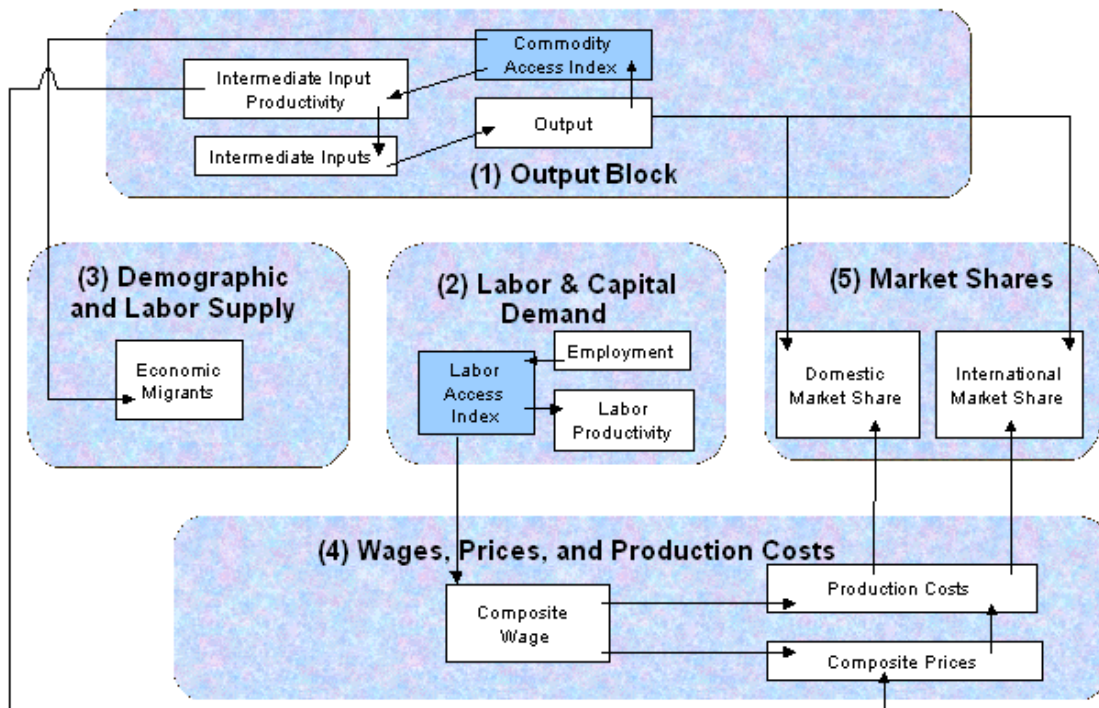
VHT_{ij}^{base} = Vehicle hours traveled between i and j : base scenario

$Trip_{ij}^{alt}$ = Vehicle trips between i and j : alternative scenario

$$VHT_{ij}^{alt} = \text{Vehicle hours traveled between } i \text{ and } j \text{ alternative scenario}$$

As these three matrices already have counterparts in Policy Insight, TranSight passes them directly into Policy Insight, where they impact economic and demographic trends through different channels. Reduced commuting times are assumed to improve labor productivity, since firms can access more suitable employees from the widened labor pool, while individuals can find jobs that are better matches for their specific attributes. This ultimately decreases production costs, while influencing economic migration by altering relative wage rates by region. Decreases in transportation costs lower the delivered prices of products, which are computed as the sum of the commodity's cost at its origin and the distance-related cost of transferring the commodity to its destination. These price changes translate into lower input costs for producers and into benefits for consumers. Finally, improved accessibility costs diminish production costs due to improved access to well-suited factor inputs, and also indirectly influence the location decisions of households via the economic migration module.

All of these effects cascade into other macroeconomic variables because of the interlinkages built into the model, as illustrated in Figure 3 below. As a consequence of affecting commodity and labor access indices, transportation projects can have secondary effects on regional wages, employment, delivered prices, and market shares, among other variables. Importantly, an improvement in a region's transportation infrastructure can yield localized benefits in costs and productivity which can increase its competitive position vis-à-vis surrounding regions. But at the same time, the project can create spillover effects in those neighboring regions, particularly on labor and capital inputs that are drawn from those areas.



Impact of economic geography within Policy Insight

Appendix A: Theoretical Foundations

This Appendix discusses the economic theory of modeling the effects of transportation infrastructure improvements. It includes greater depth of detail on the theoretical considerations underlying TranSight, as well as some description of alternative approaches not incorporated into TranSight's methodology. For ease of reference, the Appendix is subdivided into topics that correspond to sections in the main body of the document.

Emissions Costs

Transportation expansions such as lane additions or new roads can produce two countervailing effects on the amount of pollutants emitted by motor vehicles. The increased capacity of the road network is likely to increase traffic volumes, thereby raising vehicle miles and (by logical extension) emissions. But studies have demonstrated that emission rates for many pollutants decline up to a certain speed (a threshold which is different for each polluting chemical), meaning that if the upgrade increases average traffic speed to a level that remains below the threshold, emissions among cars that would have traveled in absence of the upgrade may decrease.¹⁰ By contrast, for highway projects, this emission rate effect generally produces *higher* emission levels since the prevailing speed exceeds the threshold at which pollution rates begin to worsen, so the volume and rate effects reinforce one another.¹¹ A balancing of these effects depends critically upon the average speeds before and after the project's completion, and upon the proportion of induced additional cars infused into the system following the upgrade.

Substitution effects must also be addressed, particularly when the transmission project involves the development or improvement of alternative forms of transportation, such as commuter rail or buses. New train or bus lines may, for matters of convenience or expense, entice drivers to switch modes of transportation and thereby reduce total emissions. A complete analysis of demand for marginal quantities of public transit requires consideration of relative prices, attitudes toward transit, and distance from proposed station locations to population and business centers, among other factors. To the degree that individuals respond to their alternatives and switch from private cars to public transit, emissions will be correspondingly reduced.

Ideally, an analysis of a transportation project's effect on emissions would quantify changes from three sources: direct emissions in motor vehicle exhaust, road-dust particulate matter, and pollutants released by gasoline stations, refineries, vehicle manufacturers, and other businesses impacted by changes in vehicle miles or the number of vehicles on the road. But the bulk of health effects from transportation improvements are attributable to five pollutants: carbon monoxide (CO), nitrogen oxides (NO_x), sulfur oxides (SO_x), particulate matter (PM), and volatile organic compounds (VOCs). Therefore for purposes of simplicity, TranSight focuses on quantifying the emissions rates and associated health costs of these pollutants, which is consistent with the EPA's approach.

¹⁰ Note that emission rates may also vary by fuel type (e.g., premium, regular, or diesel) and engine size, but speed appears to be the principal determinant.

¹¹ U.S. Environmental Protection Agency. *Mobile5b, fleet average, low altitude, including NLEV and Heavy Duty Vehicle (2004) Standards*. 14 September 1996.

As described by Delucchi, there are three steps to obtaining estimates of health cost impacts from motor-vehicle emissions: 1) converting changes in emissions to changes in air quality, 2) converting these air quality changes to changes in physical health effects, and 3) converting health effects to changes in economic welfare.¹² The first step typically involves invoking models of atmospheric dispersion and chemistry to test the effect of a marginal change in emissions. The second stage of the process requires development of exposure-response functions for each pollutant and for each potential health effect (ranging from asthma and headaches to mortality). These functions measure the change in incidence of adverse health effects with respect to changing doses of a particular pollutant, and have been estimated in a number of epidemiological and clinical studies.

The final step is to place monetary valuations on the incidence of the various health maladies caused by motor-vehicle emissions. Ideally, this would involve evaluating all potential impacts of emissions-induced health problems, such as lost work days and leisure activities, lower productivity, medical expenses oriented toward treating the illness, and pain and discomfort. Because these can be difficult to measure, many studies concentrate on mortality impacts and attempt to quantify the value of life. This valuation of life can entail surveying people about their willingness to pay for alternative levels of safety (i.e., reduced risk of mortality) or examining wage differentials between occupations regarded as equal other than the associated risk of injury or death.¹³ These studies often use discount rates that place greater weight on near-term deaths resulting from emissions, and also may assign lesser “value of life” to the elderly people who have greater probability of dying from pollution-related maladies.

Safety Costs

As with emissions costs, the net impact on safety costs of an expansion in transportation infrastructure is indeterminate. Additional road capacity will induce a combination of incremental demand (i.e., trips that would not have been taken in absence of the upgrade) and shifts in existing demand (i.e., trips that are re-routed onto new roads, which may decrease travel distance). The tradeoff between these two phenomena partially depends on the nature of the project. For example, a one-lane expansion of an arterial road may just induce re-routing of trips onto the newly widened road, whereas a two-lane widening of a previously underused bypass highway may increase trips by delivery vehicles. As another example, adding carpool lanes to existing highways may decrease vehicle miles despite the additional car-carrying capacity. Finally, new or upgraded public transit induces substitution away from private motor vehicles and thereby unambiguously reduces accident volumes, although transit vehicle accidents can have severe consequences.

The principal travel-demand models generate vehicle miles traveled and vehicle hours traveled across multiple dimensions, including time period (e.g., peak versus off-peak and A.M. versus P.M.) and year. This array of output enables differential, user-specified accident rates across these dimensions, which allows the modeling to better reflect real-world conditions in which per-mile accidents are more numerous during rush periods. Incorporating the time dimension permits accident rates to move over time in response to

¹² Delucchi, Mark. *The Annualized Social Cost of Motor-Vehicle Use in the U.S., 1990-1991: Summary of Theory Data, Methods, and Results*. Institute of Transportation Studies. June 1996. Publication No. UCD-ITS-RR-96-03(01).

¹³ Greenwood, M. J, G.L. Hunt, D.S. Rickman, and G.I. Treyz “Migration, Regional Equilibrium, and the Estimation of Compensating Differentials.” *American Economic Review* 81, (1991): 1382-1390.

anticipated changes in traffic congestion, perhaps due to projected regional shifts in population or business development.

Because of the vastly divergent costs associated with accidents that produce fatalities, injuries, or merely property damage, it is important to obtain accident rates broken down by the accident's consequences. Disaggregating by accident type captures the significantly higher incidence of "property damage only" (PDO) accidents relative to more serious types, thereby translating into a more accurate tallying of true cost changes. Ideally, accident rates by type would be subdivided further by road type and by speed of travel; for example, widening a highway may facilitate smoother traffic flow at higher speeds, which typically lowers aggregate accident rates but increases the percentage of higher-cost fatality-causing accidents. However, these data are rarely available in practice.

Converting accident rates into costs requires a full valuation of the economic consequences. This may incorporate a variety of items, including medical expenses, lost productivity at work, vehicle repair and replacement costs, police and emergency response expenses, the cost to society of uninsured motorists, and pain and suffering inflicted upon the victims. Although related to accidents, the opportunity costs for drivers delayed by other peoples' accidents are discussed in the section concerning the value of time. While many accident costs are monetary and easily tabulated (such as repair costs and lost production at work), others (such as "pain and suffering" and lost participation in non-market activities) may be more difficult to quantify. Because not all harm is compensated by the culpable driver (or his insurance company), some costs can be regarded as externalities--for example, increased insurance premiums to cover the damage caused by uninsured drivers.

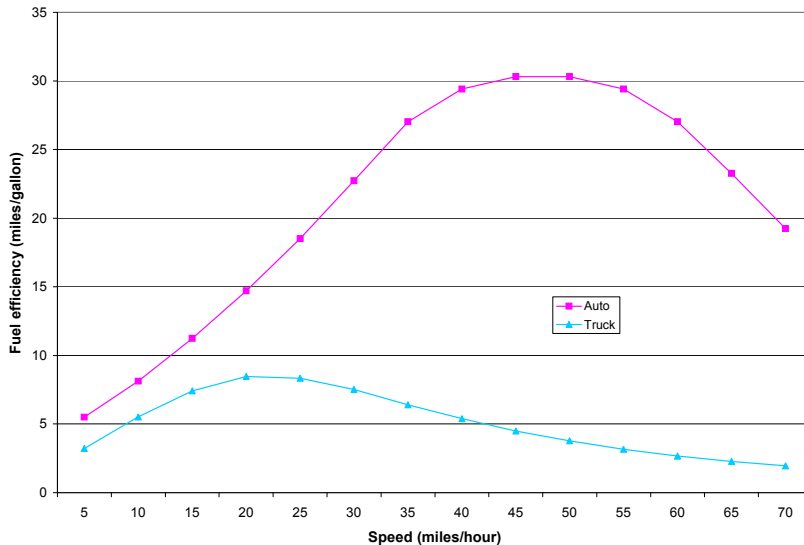
Operating Costs

Improvements to the transportation infrastructure produce indirect effects on spending by households and businesses to operate and maintain motor vehicles. In particular, construction of major new roads in growing population centers can induce increased fuel consumption, to the extent that the additional VMTs derive from incremental trips rather than re-routings of existing trips. Similarly, the added miles necessitate additional spending on vehicle maintenance and repair, since cars and trucks endure greater "wear-and-tear" within a given timeframe. These higher out-of-pocket expenses represent opportunity costs, since less disposable income is available for discretionary spending on desired goods and services.

In contrast, mass transit projects cause expenditures on vehicle operation to decrease as individuals substitute car trips with bus and train trips for both commuting and leisure purposes. Naturally, the magnitude of this effect hinges upon elasticities of substitution between private vehicles and public transit. The introduction or extension of high-occupancy vehicle lanes also reduces vehicle operation costs as car depreciation is diluted across participants in a carpool. Regardless of the type of transportation upgrade under consideration, the valuation of changes in vehicle operation costs is straightforward since the commodities being consumed are priced in the marketplace—namely, the retail price of gasoline, and the cost of vehicle maintenance that is contingent upon mileage.

Just as with the other costs associated with transportation projects, the directionality of the response of fuel and maintenance expenditures may be ambiguous. Widening a road is likely to increase demand, which would suggest increased fuel consumption. However, the upgrade increases the average speed of vehicles that

would have utilized the road regardless, which (depending upon the speed levels in question) may diminish fuel consumption since miles/gallon for automobiles tends to improve up to a threshold of around 50 miles per hour. On the other hand, fuel efficiency for trucks tends to peak at much lower speeds, meaning that increased traffic velocities would induce greater fuel consumption by trucks for the majority of road types. These facts are demonstrated below in Figure 4, which shows fuel mileage at various travel speeds for cars and trucks. Clearly, the proportional breakdown of road use by vehicle type (cars, trucks, and buses), along with the proportion of new travelers relative to ones who would have traveled in absence of the project, are critical in assessing the aggregate impact on operating expenditures.



Fuel efficiency of autos and trucks at various speeds (source: Los Angeles MTA)

Value of Time

While more difficult to measure than other benefits of transportation projects, the gains in personal utility associated with reductions in “vehicle hours traveled” (VHTs) can be substantial. For commuters traveling to work, improvements in the efficiency of the transportation network cause time savings as well as a reduction in traffic-induced stress. These benefits may be particularly significant when commuter-oriented upgrades such as high-occupancy lanes or light rail lines are installed, although merely widening an existing highway also yields savings by expediting traffic flow toward business centers. Naturally, the upgrade can also shorten travel times for leisure trips, which effectively makes the surplus time available for other activities. Although leisure trips may be less valued from a productive standpoint, they comprise a large portion of total travel, meaning that projects that boost average speeds can furnish considerable savings across all households in the region.

The total value of travel time can be conceptualized in several different ways. At the most fundamental level, it can be regarded as the willingness to pay to not spend the necessary minutes in transit—that is, to have travel time reduced to zero. The desire to minimize travel distance (and the associated time) is an important component of the location decision for both households and firms, as they consider various potential commuting or delivery distances in light of their time allocation preferences and comparative

valuation of various activities. But while real estate costs are generally higher in major population centers (where access to consumer goods and clients is greater) than in less dense areas, this differential is naturally not only a function of the “price of convenience” but also of other factors such as land scarcity; thus, the value of travel time cannot be obtained directly from such disparities.¹⁴

Taking another approach, as adopted by Delucchi, the process of valuing travel time can be subdivided into two aspects: the opportunity cost (in terms of the value of foregone activities) and the hedonic cost (the pleasure or displeasure derived by the individual from the driving experience itself). In terms of opportunity costs, those that are priced in the private sector may be valued monetarily. For example, savings in truck rental costs, fuel, and driver wages due to quicker completion of deliveries can be tabulated in a straightforward manner, while productivity gains associated with less time spent in traffic may also be estimated.¹⁵ These savings can be quantified with the aid of the Transportation Satellite Accounts (produced by the U.S. Bureau of Economic Analysis), which estimate the value of transportation activities by industry and commodity.

More difficult to ascertain are non-monetary externalities that accrue from both commuter and (especially) leisure travel. Such costs include the hedonic utility of travel (whether positive or negative) as well as unpaid activities foregone and the risks of involvement in an accident. As these cannot be valued directly, most researchers have relied upon surveys in which people are presented with hypothetical choice situations through which they can indicate their willingness to pay to decrease travel time. In general, the non-monetary costs associated with travel time (and particularly with delays due to traffic congestion and nearby accidents) can be treated as a function of vehicle occupancy, the opportunity cost of time, average speed, and the hedonic attributes of travel (that is, the pleasure or discomfort derived from driving or riding).

Another important issue is that accessing public transit may require both traveling to the station and waiting for a transit vehicle to arrive. Therefore, a full characterization of the time savings yielded by shifting from automobiles to public transit should not neglect consideration of the time spent prior to finally entering the transit vehicle, which can be non-trivial, even though the transit travel itself is significantly faster. The U.S. Department of Transportation proposes that transit travel be disaggregated into waiting and traveling time, with the latter assigned lesser cost since passengers are comparatively comfortable and can engage in productive activities while seated in a bus or train.¹⁶

The Transportation Cost Matrices

“Effective distance” is the mechanism through which the theory of economic geography enters the decision-making processes of economic agents in TranSight. It can be imagined as the geographic distance between two centers of economic activity, adjusted for the efficiency of multi-modal transportation between them. Hence, improvements in the transportation infrastructure reduce effective distance between two locations and consequently increase their interaction, in terms of the flows of labor, intermediate inputs, and end-use commodities. In general, as effective distance increases, the costs that deter economic activity rise through an exponential process called “distance decay.” The rate of change by economic sector of the distance decay

¹⁴ Transportation Research Board – National Research Council. *Economic Implications of Congestion: NCHRP Report 463*; Glen Weisbrod, Donald Vary, George Treyz, 2001.

¹⁵ Delucchi, *ibid.*

¹⁶ *The Value of Saving Travel Time: Departmental Guidance for Conducting Economic Evaluation*. U.S. Department of Transportation. April 19, 1997.

curve (known as the distance decay parameter, β) captures both the increased deterrence and the variable impact on flows by sector.

For businesses involved in transporting goods, shorter travel times for their delivery vehicles translate into savings on fuel, wages, and perhaps vehicle and inventory costs. Furthermore, traveling sales personnel can potentially reach more clients during business hours. Although these savings can stem directly from additional roads, which provide quicker alternative routes between popular destinations, they can also result from widened roads, public transit networks, or enhanced traffic control systems, which can diminish congestion and lower accident rates.

As stipulated by the theory of economic geography (which is integrated into the Policy Insight model), both firms and households obtain benefits from policies that expand their access to variety in labor, intermediate inputs, and end-use goods. Transportation upgrades may facilitate the commute of workers to a more distant job whose characteristics are more closely aligned with the worker's personal attributes. From the perspective of firms, the project can provide access to a broader and more diverse labor market, enabling the hiring of more suitable workers. Thus the project may induce over time a better match between employers and employees, by expanding the pool of preferred jobs accessible to a given commuter, and the pool of preferred workers accessible by firms.¹⁷

Economic geography also assumes that markets are characterized by monopolistic competition, meaning that goods and services are non-homogeneous. Therefore, all economic agents derive incremental utility from the ability to choose from a wider array of alternatives. By facilitating interactions among a more diverse set of buyers and sellers, transportation upgrades can broaden the scope for market transactions. Businesses can find better matches for their needs in the intermediate input markets, while households can purchase more varied goods and services.

¹⁷ Weisbrod, Glen, and Frederick Treyz "Productivity and Accessibility: Bridging Project-Specific and Macroeconomic Analyses of Transportation Investments." *Journal Of Transportation And Statistics*, 1.3, 1998: 65-79.

Appendix B: Integration with Travel Demand Models

TranPlan

As described by its publisher, Citilabs, TranPlan (TRANsportation PLANning) is a series of integrated programs designed to support the transportation planning process. It contains a travel-demand model that involves four stages: trip generation, trip distribution, mode choice, and trip assignment for both highway and transit systems. Among TranPlan's array of outputs are estimates of vehicle miles traveled (VMTs) and vehicle hours traveled (VHTs), both of which are reported at the daily level. Depending upon the user's configuration, it is also capable of breaking down VMTs, VHTs and trips across dimensions such as road type (e.g., freeway and primary arterial), time of day (e.g., AM/PM and peak/off-peak), and region.

The VMTs and VHTs generated by TranPlan require some degree of transformation and elaboration to create the variables required by TranSight. Regarding VMTs, the main relevant TranPlan output is vehicle miles traveled on an average weekday by "private" vehicles (which TranPlan defines as automobiles). In order to translate these figures into annual VMTs for *all* motor vehicles (including light and heavy trucks), TranSight must perform a multiple-step process as documented in the equations below. All parameters employed in this procedure are obtained from Hallenback, et al, "Vehicle Volume Distribution by Classification", Chaparelle Systems Corporation, for LTPP Division of FHWA, June 1997.

Starting with private-vehicle VMTs for the average weekday, TranSight uses parameters for the percentage of trips by non-commercial vehicles and light vehicles (commercial and non-commercial) to determine what percentage of total miles those private-vehicle VMTs represent. Having a full percentage breakdown of trips by the four vehicle types (private, light truck non-commercial, light truck commercial, and heavy truck) enables the computation of average weekday VMTs for each vehicle type. Analogous numbers are then derived for the average weekend day, using a scalar that describes the typical ratio of weekend day to weekday traffic volumes. Finally, VMTs are summed across vehicle types and day types (i.e., weekend and weekday) to yield total annual VMTs, in proportion to the typical number of weekdays and weekends in a year.

The following shows the full derivation. The process for obtaining TranSight-ready VHTs and vehicle trips is essentially identical. Note that "WD" indicates weekday while "WE" indicates weekend; the rest of the notation is self-explanatory.

Inputs:

$VMT_{WD\ Private}$ (the output from TranPlan)

Calculate Missing Percentages of Weekday VMTs by Vehicle Type:

$$\begin{aligned} \%_{Light\ Non-Commercial\ Vehicle\ Trips} &= \%_{Light-Commercial\ Vehicle\ Trips} \times (1 / \%_{Commercial\ of\ Light\ Duty}) \times (1 - \%_{Commercial\ of\ Light\ Duty}) \\ \%_{Private\ Vehicle\ Trips} &= \%_{Non-Commercial\ Vehicle\ Trips} - \%_{Light\ Non-Commercial\ Vehicle\ Trips} \end{aligned}$$

Calculate Weekday Totals:

$$VMT_{WD\ Heavy\ Truck} = (VMT_{WD\ Private} \times (1 / \%_{Private\ Vehicle\ Trips})) \times (\%_{Heavy-Commercial\ Vehicle\ Trips})$$

$$\begin{aligned} \text{VMT}_{\text{WD Light Truck Commercial}} &= (\text{VMT}_{\text{WD Private}} \times (1 / \%_{\text{Private Vehicle Trips}})) \times (\%_{\text{Light-Commercial Vehicle Trips}}) \\ \text{VMT}_{\text{WD Light Truck Non-Commercial}} &= (\text{VMT}_{\text{WD Private}} \times (1 / \%_{\text{Private Vehicle Trips}})) \times (\%_{\text{Light Non-Commercial Vehicle Trips}}) \\ \text{VMT}_{\text{WD Light Truck}} &= \text{VMT}_{\text{WD Light Truck Commercial}} + \text{VMT}_{\text{WD Light Truck Non-Commercial}} \end{aligned}$$

Calculate Weekend Totals:

$$\begin{aligned} \text{VMT}_{\text{WE Private}} &= \text{VMT}_{\text{WD Private}} \times \%_{\text{Weekend of Weekday Traffic}} \\ \text{VMT}_{\text{WE Light Truck}} &= \text{VMT}_{\text{WD Light Truck}} \times \%_{\text{Light Truck Weekday of Weekend}} \\ \text{VMT}_{\text{WE Heavy Truck}} &= \text{VMT}_{\text{WD Heavy Truck}} \times \%_{\text{Heavy Truck Weekday of Weekend}} \\ \text{VMT}_{\text{WE Light Truck Commercial}} &= (\%_{\text{Commercial of Light Duty}}) \times \text{VMT}_{\text{WE Light Truck}} \\ \text{VMT}_{\text{WE Light Truck Non-Commercial}} &= (1 - \%_{\text{Commercial of Light Duty}}) \times \text{VMT}_{\text{WE Light Truck}} \end{aligned}$$

Calculate Commercial and Non-Commercial Annual Totals:

$$\begin{aligned} \text{VMT}_{\text{WD Commercial}} &= \text{VMT}_{\text{WD Heavy Truck}} + \text{VMT}_{\text{WD Light Truck Commercial}} \\ \text{VMT}_{\text{WD Non-Commercial}} &= \text{VMT}_{\text{WD Private}} + \text{VMT}_{\text{WD Light Truck Non-Commercial}} \\ \text{VMT}_{\text{WE Commercial}} &= \text{VMT}_{\text{WE Heavy Truck}} + \text{VMT}_{\text{WE Light Truck Commercial}} \\ \text{VMT}_{\text{WE Non-Commercial}} &= \text{VMT}_{\text{WE Private}} + \text{VMT}_{\text{WE Light Truck Non-Commercial}} \\ \text{VMT}_{\text{Week Commercial}} &= (5 \times \text{VMT}_{\text{WD Commercial}}) + (2 \times \text{VMT}_{\text{WE Commercial}}) \\ \text{VMT}_{\text{Week Non-Commercial}} &= (5 \times \text{VMT}_{\text{WD Non-Commercial}}) + (2 \times \text{VMT}_{\text{WE Non-Commercial}}) \\ \text{VMT}_{\text{Annual Commercial}} &= 52 \times \text{VMT}_{\text{Week Commercial}} \\ \text{VMT}_{\text{Annual Non-Commercial}} &= 52 \times \text{VMT}_{\text{Week Non-Commercial}} \\ \text{VMT}_{\text{Annual}} &= \text{VMT}_{\text{Annual Commercial}} + \text{VMT}_{\text{Annual Non-Commercial}} \end{aligned}$$

Outputs:

$\text{VMT}_{\text{Annual}}$ (obtained for each time period, road type, and region)

Exogenous Parameters:

$\%_{\text{Non-Commercial Vehicle Trips}}$	89.8%
$\%_{\text{Heavy-Commercial Vehicle Trips}}$	6.2%
$\%_{\text{Light-Commercial Vehicle Trips}}$	4.0%
$\%_{\text{Commercial of Light Duty}}$	33.0%
$\%_{\text{Weekend of Weekday Traffic}}$	93.0%
$\%_{\text{Light Truck Weekday of Weekend}}$	74.6%
$\%_{\text{Heavy Truck Weekday of Weekend}}$	48.9%

Parameters Obtained in Process Above:

$\%_{\text{Private Vehicle Trips}}$	81.7%
$\%_{\text{Light Non-Commercial Vehicle Trips}}$	8.1%

TransCAD

As described by its publisher, Caliper Corporation, TransCAD is the first Geographic Information System (GIS) designed specifically for use by transportation professionals to store, display, manage, and analyze transportation data. TransCAD combines GIS and transportation modeling capabilities in a single integrated platform, and can be used for all modes of transportation, at any scale or level of detail. Network distances and travel times are based on the actual shape of the road network and a correct representation of highway interchanges. Among TransCAD's array of outputs are daily estimates of vehicle miles traveled (VMTs) vehicle hours traveled (VHTs), vehicle trip counts, and average distance and time between defined regions. This information can be reported at the level of individual transportation network links. Depending upon the user's configuration, it is also capable of breaking down VMTs, VHTs, and trips across dimensions such as road type, vehicle type (e.g., commercial truck and private car) and time of day (e.g., AM/PM and peak/off-peak).

The outputs generated by TransCAD require some degree of transformation and elaboration to create the variables required by TranSight. Because it produces data at the network link level, the data must be aggregated by the user to each combination of regions desired for the TranSight model configuration. TransCAD can perform this aggregation automatically and report results at the region-to-region level (including within-region travel). Regarding VMTs, the main relevant TransCAD output is vehicle miles traveled on an average weekday, with the possibility of reporting VMTs by multiple vehicle types (such as commercial and private) or in the aggregate. In order to translate these figures into annual VMTs that factor in weekend/weekday differentials, TranSight must scale up the outputs as documented in the equations below. All parameters employed in this procedure are obtained from Hallenback, et al, "Vehicle Volume Distribution by Classification", Chaparelle Systems Corporation, for LTPP Division of FHWA, June 1997.

For each vehicle type, TranSight uses the TransCAD VMT outputs for the average weekday to derive VMTs for the average weekend day, applying a scalar that describes the typical ratio of weekend day to weekday traffic volumes. These VMTs are summed across day types (i.e., weekend and weekday) to yield total annual VMTs, in proportion to the typical number of weekdays and weekends in a year. This sequence of calculations is repeated for each vehicle type within each origin-destination combination of regions defined in the model. By "origin-destination combination," we refer to vehicle miles traveled from each region A to each region B, including travel in which the origin and destination region are the same.

The following shows the full derivation for a given vehicle type. The process for obtaining TranSight-ready VHTs and vehicle trips is essentially identical. Note that "WD" indicates weekday while "WE" indicates weekend; the rest of the notation is self-explanatory.

Inputs:

VMT_{WD} (the output from TransCAD)

Calculate Weekend Totals:

$$VMT_{WE} = VMT_{WD} \times \%_{\text{Weekend of Weekday Traffic}}$$

Calculate Annual Totals:

$$VMT_{\text{Week}} = (5 \times VMT_{\text{WD}}) + (2 \times VMT_{\text{WE}})$$

$$VMT_{\text{Annual}} = 52 \times VMT_{\text{Week}}$$

Outputs:

VMT_{Annual} (obtained for each vehicle type, time period, road type, and region-to-region combination)

Exogenous Parameters:

$\%_{\text{Weekend of Weekday Traffic}}$ 93.0%

TS Travel Editor

TranSight comes packaged with a utility program called TS Travel Editor, which enables users to generate travel data input files in the format required by TranSight. This allows users without access to a transportation demand model to directly input the information on vehicle miles, hours and trips necessary to estimate the long-term benefits of a transportation project. Additionally, it provides a convenient alternative for performing sensitivity analysis. Rather than configuring and running multiple simulations in a transportation model, the user can simply make scalar adjustments to VMTs or VHTs in the TS Travel Editor grid, save the resulting files, and run them through TranSight. TS Travel Editor also facilitates quick transfer of data between TranSight and spreadsheet programs such as Microsoft Excel, through its copy and paste capabilities.

TS Travel Editor can be customized to handle several dimensions for which the user may have travel data, including time periods and vehicle modes. For each available dimension, the user enters average weekday VMTs, VHTs, and trips for each origin-destination combination of regions defined in the model. By “origin-destination combination,” we refer to vehicle miles traveled from each region A to each region B, including travel in which the origin and destination region are the same. TS Travel Editor uses the VMT inputs for the average weekday to derive VMTs for the average weekend day, applying a scalar that describes the typical ratio of weekend day to weekday traffic volumes. These VMTs are summed across day types (i.e., weekend and weekday) to yield total annual VMTs, in proportion to the typical number of weekdays and weekends in a year.

The following shows the full derivation for a given vehicle type. The process for generating TranSight-ready VHTs and vehicle trips is essentially identical. Note that “WD” indicates weekday while “WE” indicates weekend; the rest of the notation is self-explanatory. The files created in TS Travel Editor can then be loaded into new TranSight simulations as though they were output files from a transportation demand model. At minimum, users relying on the TS Travel Editor need to create a baseline (or no-build) case and a second case that reflects the regional travel impacts of a transportation network enhancement. The numbers should be generated for the same forecast year, such that all factors other than the transportation project itself (such as population growth) are held constant.

Inputs:

VMT_{WD} (for each region-to-region combination, across specified dimensions)

Calculate Weekend Totals:

$$VMT_{WE} = VMT_{WD} \times \% \text{Weekend of Weekday Traffic}$$

Calculate Annual Totals:

$$VMT_{Week} = (5 \times VMT_{WD}) + (2 \times VMT_{WE})$$
$$VMT_{Annual} = 52 \times VMT_{Week}$$

Outputs:

VMT_{Annual} (for each region-to-region combination, across specified dimensions)