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COMMUTER Model User Manual for Analysis of Voluntary Mobile Source Emission Reduction and Commuter Choice Incentive Programs

COMMUTER Model User Manual for Analysis of Voluntary Mobile Source Emission Reduction and Commuter Choice Incentive Programs

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1. INTRODUCTION

1.1 What is the COMMUTER model?

The COMMUTER model (subsequently referred to as simply "COMMUTER") is a spreadsheet-based computer model that estimates the travel and emissions impacts of transportation air quality programs. The model is particularly useful for programs that fall under the EPA's Voluntary Mobile Source Emission Reduction Programs and for Commuter Choice Programs.

1.2 Who will use COMMUTER?

EPA and its subcontractor Sierra Research designed COMMUTER for two types of users:

- Metropolitan Planning Organizations (MPOs) and state Departments of Transportation (DOTs) who are assessing emissions impacts of various Transportation Control Measure Strategies. These impacts can be incorporated into State Implementation Plan (SIP) analyses.

- Individual employers who are assessing the likely effectiveness of Commuter Choice Programs and voluntary programs in general.

MPOs and DOTs can also provide guidance and assistance to employers participating in voluntary programs on the application of this tool.

1.3 Why was COMMUTER created?

COMMUTER was designed to help simplify the effort required by air quality planners to estimate travel and emission effects resulting from Transportation Control Measures. The model can also be used to estimate the benefits of site-specific Commuter Choice (employer-based transportation) programs to assist employers in designing a program appropriate for them.

The 1990 Clean Air Act Amendments mandated that the EPA and DOT provide guidance on "the formulation and emission reduction potential of transportation control measures related to criteria pollutants and their precursors" (Section 108(f)). In the early 1990s, EPA

developed a number of tools and guidance documents to assist communities in developing these measures and taking credit for the resulting emission reductions. Because the effects of TCMs on travel activity and emissions can be very complex, the guidance included many aspects of vehicle operation and other factors that affect emissions. The guidance documents were often very detailed and difficult to use.

COMMUTER consolidates existing TCM guidance, and is based on "state-of- practice" methodologies and data. COMMUTER will reduce the time required to calculate the benefits of regional and employer-based TCMs. It will also save regional government resources, since these governments will have less need to develop their own models and tools.

1.4 What Programs can I evaluate with COMMUTER?

You can use COMMUTER to evaluate these types of programs, either on the regional scale, or for individual employers:

- Transit fare decreases or other incentives that reduce the cost of using transit;
- Transit service improvements (faster or more frequent service);
- Ridesharing programs, in which employers support carpooling and/or vanpooling through on-site programs, financial incentives, or preferential parking;
- Other actions, such as increased parking charges or cash-out programs, that change the time and/or cost of traveling by any particular mode;
- Non-motorized (e.g., bicycle and pedestrian) commuting programs;
- Alternative work schedules, including flex-time, compressed work weeks, and staggered work hours; and
- Telecommuting.

1.5 What methodology does COMMUTER use?

COMMUTER is broken down into two components: travel impacts and emissions impacts.

The travel impacts component uses a logit mode-choice model referred to as the "pivot point" approach. This approach allows you to analyze the effects of several strategies simultaneously. Mode choice models have been developed for many cities and regions nationwide, so you can often use coefficients that have already been developed to reflect local characteristics. This component will calculate the impact of the mode share changes from these programs and translate the mode share changes into changes in trips and vehicle miles traveled (VMT). In addition, COMMUTER contains an input option that allows you to enter

mode share changes directly (such as might be obtained from employee survey data) as an alternative to the pivot point-based calculation performed internally by the model.

The emissions component is based on EPA's MOBILE5b model. MOBILE5b emission factors were generated and loaded into COMMUTER for several sets of local conditions. You can select the conditions most appropriate for your area, and the model will apply the corresponding emission factors in calculating and outputting emission reduction impacts (in tons of VOC, CO, and NOx per day). If you are an experienced MOBILE5b user, you can also generate your own set of MOBILE5b emission factors (reflecting your exact local conditions) that can be imported into COMMUTER.

1.6 When can I use COMMUTER, and when should I not use it?

COMMUTER is particularly useful for smaller Transportation Control Measures that will fit under the context of the Voluntary Measures Policy, and the model can be used for the purpose of calculating State Implementation Plan (SIP) credit. The model will not perform as well for larger programs, particularly those large enough to impact travel speeds throughout an area. If your program is likely to significantly impact travel patterns and speed in your region, you will need to perform a more complete analysis using your regional travel demand modeling in order to claim SIP credit. You should consult with your regional EPA office if you believe your program can have these impacts. In this case, you can still use COMMUTER to calculate an initial estimate of a potential program. You may want to do this to help you select a program and determine if you want to further consider particular options.

In some cases, you may also use COMMUTER to calculate the VMT impacts of projects for transportation conformity. You should not use the emissions estimates of the model in this cases. Areas that are subject to transportation conformity must estimate the VMT and emissions impacts of the projects in their transportation plans and transportation improvement programs. For projects that are not regionally significant (as defined in 40 CFR 93.101), you may estimate the VMT effects using off-model techniques, in accordance with reasonable professional practice. This means you do not need to determine the VMT impacts of the program using a travel demand network model. Through the interagency consultation process, you can discuss whether COMMUTER is an appropriate off-model method to estimate VMT reductions. You will still need to combine the estimated VMT impacts of the program with the impacts of other programs to determine the overall emissions impacts in the area.

1.7 What do I need to do to get started?

In order to get the most accurate results with the model, you will need to gather background information about the travel characteristics in your area. COMMUTER does have data on national average travel patterns available as default settings. However, using local data will yield more accurate results. This greater accuracy is required if COMMUTER results are to be used as a part of a State Implementation Plan or other regional air quality management

***IMPORTANT**: COMMUTER is not designed to quantify baseline travel or emissions. Instead, its purpose is to estimate travel and emission changes associated with specific measures, based on inputs you provide. Thus, although COMMUTER may be used to calculated SIP credits for these measures, the baseline travel or emissions estimates it generates will not exactly match your baseline SIP inventory.*

plan. MPOs or Councils of Government (COGs) generally compile this information for an area. Regional COGs are local government organizations designed to study and recommend solutions to problems facing an individual region and to help their local government members apply effective, coordinated regional planning. MPOs are similar organizations that focus on transportation-related planning.

If you are an employer or other non-MPO user of this model, you should contact the MPO or COG in your area. The National Association of Regional Councils (NARC) maintains an Internet website at http://www.narc.org. From the NARC home page, you can access information about the Association of Metropolitan Planning Organizations (AMPO) and lists of COG and MPO links by state (http://www.narc.org/links/member.html). If you are unsure of the appropriate source, you should consult with your regional EPA office to find the appropriate source of information. The locations of EPA regional offices can be found at http://www.epa.gov/epahome/locate2.htm.

You will also need specific background information for your particular program. This user manual will assist you in determining the appropriate inputs into the model. Again, if you have any further questions, you can consult with your regional EPA office.

1.8 What other documentation is available?

This user manual presents the key instructions needed for you to effectively develop inputs and run COMMUTER. Although it attempts to provide you with enough information to understand how to develop inputs and operate the model, it is intentionally not exhaustive in detail. If you are interested in further understanding the theory behind the modeling calculations, please consult the companion document to this user manual, *"Procedures Manual for the Analysis of Voluntary Mobile Source Emission Reduction and Commuter Choice Incentive Programs*."[1*]

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[*] Superscripts denote references provided in Section 6.

2. USING THE MODEL

This section explains how to install COMMUTER and provides a general overview of how to run each element of the program, as well as how to view and save your results. Further details on the type of data required are provided in Section 3 (for general existing condition inputs), Section 4 (TCM-specific information), and Section 5 (emissions-related information).

2.1 What type of computer equipment and software do I need?

COMMUTER runs on personal computers using Microsoft's Windows 95/98 or Windows NT 3.5/4.0 operating systems.* You must also have Microsoft Excel 95 (i.e., Excel 7.0), Excel 97, or Excel 2000 installed. If your computer allows you to run these programs, you can use COMMUTER. (However, if you have a Pentium-class CPU with less than 150 MHz or a 486 CPU, moving through the input screens may be slow at times.)

COMMUTER will work at 640 x 480, 800 x 600, and 1,024 x 768 display resolutions at both 250-color and 16-bit (Hi-Color) depths, and should run at any available video display setting.

COMMUTER requires a minimum of 2.5 MB of disk space. You must also have enough space for saving data on different scenarios that you want to analyze and if you want to import locally-generated emission factors into the model. You should allow 85 KB of disk space for each scenario that you expect to save and another 500 KB if you plan to import separate emission factors into the model. (Further details on saving scenario data and importing emission factors will be explained in the next section.)

2.2 How do I install and operate COMMUTER?

Installing the Program

Installing COMMUTER is quite simple. The model, along with some sample files, is contained in the **COMM1.EXE** self-extracting archive file (which can be downloaded from EPA's web site at http://www.epa.gov/otaq/transp.htm). Step-by-step installation instructions are given as follows.

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* The COMMUTER application should also be able to run under Windows NT 4.0, but it has not been tested under that operating system.

Step 1 - Create a new folder or directory on your computer where you want to install and operate COMMUTER (e.g., C:\COMMUTER). (When you run COMMUTER, it can create and re-use "scenario" files that store your data and assumptions for a particular analysis case or scenario. Thus, it is highly recommended that you create a separate folder for COMMUTER so these files don't get mixed up with others.)

Step 2 - Download or copy the **COMM1.EXE** installation file to the folder or directory you just created.

Step 3 - Execute the **COMM1.EXE** program (e.g., double-click the **COMM1.EXE** file from the Explorer window). This executable file is a self-extracting compressed archive that contains following files:

- **COMMUTER.XLS** - the COMMUTER program;
- **AREAWIDE.VME** - an "area-wide" sample scenario file;
- **ONEEMP.VME** - a single-employer sample scenario file;
- **USERTMPL.INP** - a sample template input file for creating local MOBILE5b emission factors for use in COMMUTER; and
- **USERTMPL.PRN** - a sample MOBILE5b output file for emission factor import into COMMUTER.

After you have run the COMM1.EXE installation program, the five files listed above should now appear in your "COMMUTER" folder. You are now ready to run COMMUTER.

Running the Program

Once you have installed the program, there are several different ways that you can run the program. These will be familiar to you if you already use Windows 95/98 or Windows NT.

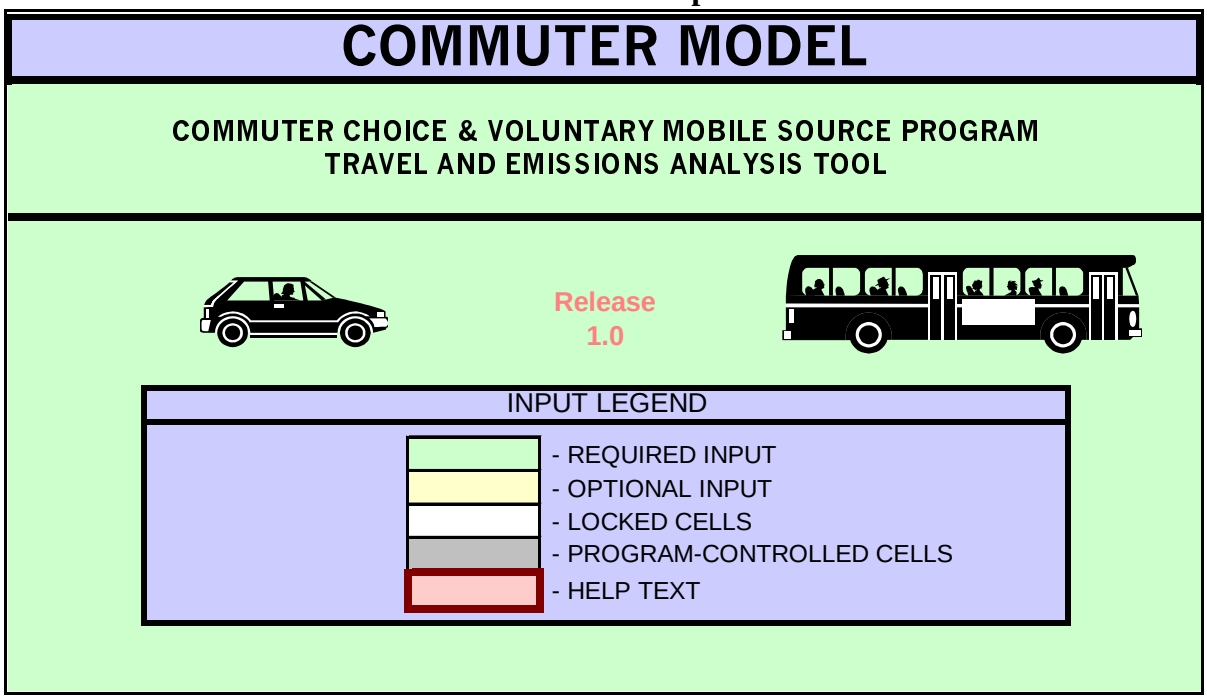
- Create and launch a shortcut to the application;
- Double-click* the **COMMUTER.XLS** file from within the Windows Explorer or Internet Explorer window (assuming Excel has been installed and associated with .XLS file types);
- Right-click the **COMMUTER.XLS** file and click "Open" from the pop-up menu; or

* If the Windows Explorer has been replaced by Internet Explorer (e.g., in Windows 98), Internet Explorer can be configured to launch programs with a single mouse click instead of a double-click.

- Click the Start button at the bottom left of Windows 95/98/NT desktop, select "Documents" from the pop-up menu, and then click the **COMMUTER.XLS** file from the pop-up list of documents. (This method will work only if you have recently opened the **COMMUTER.XLS** file and it still appears in your "Recent Documents" list.)

As the program loads, you will see a startup screen like the one shown below in Figure 1.

Figure 1
COMMUTER Startup Screen



The startup screen includes an "input legend" showing the colors that are used to identify the different types of cell ranges that you will see on the data entry screens. Different colors are used to identify cells that you type inputs into and to highlight on-screen help boxes as listed below:

- light green - required input cells;
- yellow - optional input cells;
- white - locked (i.e., non-editable) cells;
- gray - program-controlled cells; and
- red - help text boxes.

Required inputs must be typed into all light-green cells shown in the edit screens. You can also supply inputs in the yellow shaded cells, but the program will run if they are left blank. (However, it is a good idea to use these optional input cells to supply more information about the analysis scenario you are constructing.) White and gray cells are locked from editing and are used to display information. Finally, red cells highlight help boxes containing brief instructions for the inputs being entered on each screen.

> ***NOTE**: When the program has finished loading, you will see a "Ready" indicator at the bottom left of the application window.*

The user interface for COMMUTER has been programmed to display on your entire screen (i.e., in "full" screen). If you need to temporarily minimize the COMMUTER application to the Windows taskbar (located at the bottom of the Windows desktop by default), type "*Ctrl-m*" (i.e., hold down the Ctrl key and type "m"). To restore the COMMUTER application to the full screen, just click its button in the Windows taskbar.

2.3 How do I begin once the program is installed?

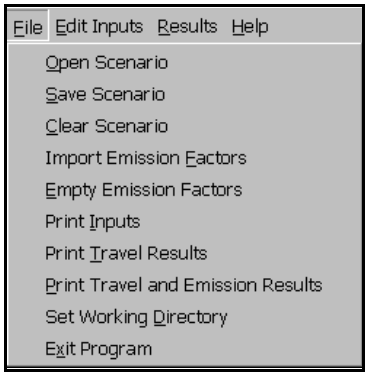
Once the program finishes loading, you can select from four main menus listed at the top of the screen: the File menu, the Edit Inputs menu, the Results menu, and the Help menu. These menus will be available at the start of every session, and will allow you to enter data (Edit Inputs menu), view results (Results menu), print results (File menu), get help (Help menu), and retrieve or save data and results for a specific analysis (referred to as a "scenario", accessed through the File Menu).

Figure 2 shows the structure of the main menu, which includes the "File," "Edit Inputs," "Results," and "Help" menus, and each of the sub-menu elements.

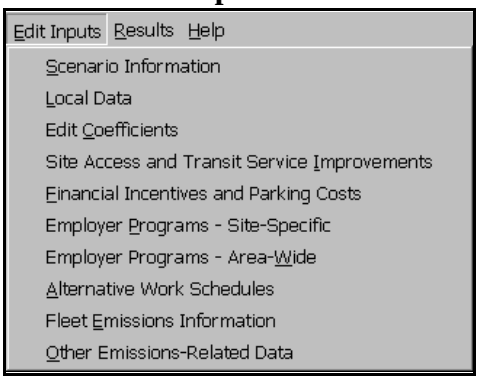
You will generally begin an analysis by clicking through the data entry elements in the Edit Inputs menu in the order in which they are listed in the menu. (Once you have defined an analysis, you can later load and edit a scenario from the File menu; this will be discussed later in Section 2.6.) Each of the elements in the Edit Inputs menu corresponds to the input screens for entering specific data required by COMMUTER. (Detailed information on the data required for these screens is provided in Sections 3-5.)

Figure 2
Menu Structure

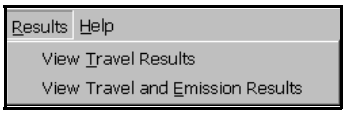
File Menu



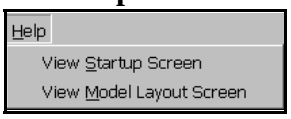
Edit Inputs Menu



Results Menu



Help Menu



When the program is first loaded, some of the sub-menu elements shown in the Edit Inputs menu will be shown as gray shaded-out text, which indicates that you have not yet selected any TCM programs for analysis. (As explained below, you will make these selections by using the check boxes at the bottom of the Scenario Information screen.)

2.4 How do I input data?

The Edit Inputs menu lists each of the input screens available. Some of the screens are for inputting baseline (i.e., existing condition) information needed regardless of the type of TCM being analyzed; others will be used only when analyzing a particular measure.

***IMPORTANT**: The program will automatically size the width of the data entry screens to the width of your monitor. However, the length of some of the screens will exceed the monitor's vertical display dimension. Therefore, for some input screens (such as the Scenario Information and Local Data screens), you must scroll to the bottom of the screen to complete the data entry required in that screen by using the vertical scroll bar or the "Down Arrow" or "Page Down" keys.*

The information that must be entered in each input screen is listed in Table 1. The data required in the first three screens ("Scenario Information," "Local Data," and "Edit Coefficients") consist of general information, background travel data, and mode-choice coefficients.

Table 1
Summary of COMMUTER Data Inputs

Input Screen	Data Required
Scenario Information	General information, including area size and scope (i.e., regional vs. site-specific) being analyzed and the TCM programs being evaluated
Local Data	Background travel data such as existing mode shares, trip lengths, occupancy levels, baseline vehicle miles traveled, baseline speeds, and option to provide final mode shares (after TCMs)
Edit Coefficients	Provides default mode choice coefficients as a function of the area size entered earlier and for selected cities, which can be edited by the user
Site Access & Transit Service Improvements	Data required for analysis of either site access or transit service improvement TCMs, including changes in site access walk times and employer participation rates, and transit headway and route travel time changes
Financial Incentives & Parking Costs	Inputs for analysis of financial and parking incentive programs consisting of changes in parking, transit fare, or other costs by travel mode
Site-Specific Employer Support Programs	Parameters that specify either the program participation level or expected mode share increase resulting from the implementation of an employer (i.e., site) specific commuter choice program
Area-Wide Employer Support Programs	Employer participation level inputs required for area-wide analysis of commuter choice programs being implemented across a metropolitan area

Table 1 Summary of COMMUTER Data Inputs	
Alternative Work Schedules	Existing and expected eligibility or participation rates for alternative work schedule programs being evaluated, such as flex time, compressed work weeks, staggered hours, and telecommuting
Fleet Emissions Information	Inputs required by the program in order to either apply a pre-generated set of MOBILE5b fleet emission factors or to utilize locally generated MOBILE5b emission factors imported into the model
Other Emissions-Related Data	Fleet travel mix (e.g., fraction of travel by vehicle class) and start fraction inputs required by the program to calculate TCM emission reductions that are specific to the local conditions being modeled

If you have not yet done any analyses or want to analyze a new scenario, you will start with the Scenario Information screen to enter general background information and to select the type(s) of TCM programs being evaluated. This selection is made by checking the appropriate boxes shown at the bottom of the Scenario Information screen. You can enter any non-blank character in the check boxes to activate analysis of the specific TCMs.

Travel data should be entered using the Local Data screen, and you can use the Edit Coefficients screen to edit the default mode choice coefficients provided with the program. (Images of these screens and details on the data required are provided in Section 3.) By default, COMMUTER calculates changes in mode share due to the types and extent of specific TCM programs being modeled. If , however, you have estimates of changes in mode share due to modeled programs, you can optionally enter the final mode shares (resulting from changes to existing shares) in the Local Data screen.

Data for the specific TCM program(s) being evaluated are entered in the next five screens. *You will have access to only those screens that were selected (checked off) for analysis in the Scenario Information screen.* Detailed information on these screens is provided in Section 4.

> ***NOTE**: If you have chosen to enter your own final mode share estimates in the Local Data screen, you do not need to enter information in any of the TCM-specific program screens. In this case, the inputs in these screens are bypassed and the final mode shares you have entered are used to compute VMT and trip impacts.*

Finally, you will enter emission-related data in the last two data screens (addressed in Section 5). This will include either vehicle fleet parameters that allow the program to find and apply a specific set of previously generated MOBILE5b emission factors that approximate local conditions being modeled, or selection of MOBILE5b emission factors that you have generated to more precisely reflect local conditions.

> ***NOTE**: You may see a "Calculate" annunciator on the status bar at the bottom of the application window while you are entering data. This is normal. During data entry, the program recalculates only specific portions of the underlying spreadsheets in order to speed up performance. Later, when you view or print results or save the scenario data, all underlying sheets are recalculated.*

If you are only interested in computing travel impacts, you do not need to enter any emissions-related inputs in these last two screens.

2.5 Is there help available when inputting data?

From the Help menu, you can view a "Model Layout" screen that provides an overview of the layout and data flow of COMMUTER. The Model Layout screen also identifies the input screens that apply to specific voluntary measures and commuter choice programs. Figure 3 shows the Model Layout screen. Note that on smaller monitors, you may need to scroll down to view the entire screen.

You can also return to the Startup screen from the Help menu. (This is handy if you need to refer to the cell coloring conventions used to guide you in entering model inputs.)

In addition, many of the input screens offer additional guidance on the specific data that must be entered. In some screens, explanatory notes are shown next to the input cell. In other screens, "help boxes" displayed with light red backgrounds provide more extensive descriptions of key data inputs.

Once you've finished inputting all the required data for each screen (remember that in some cases you may need to scroll down your screen to complete data entry), that screen will appear with a checkmark (✓) beside it the next time the Edit Inputs menu is accessed. You can use the presence or absence of checkmarks as an easy visual reference of additional data that must still be entered.

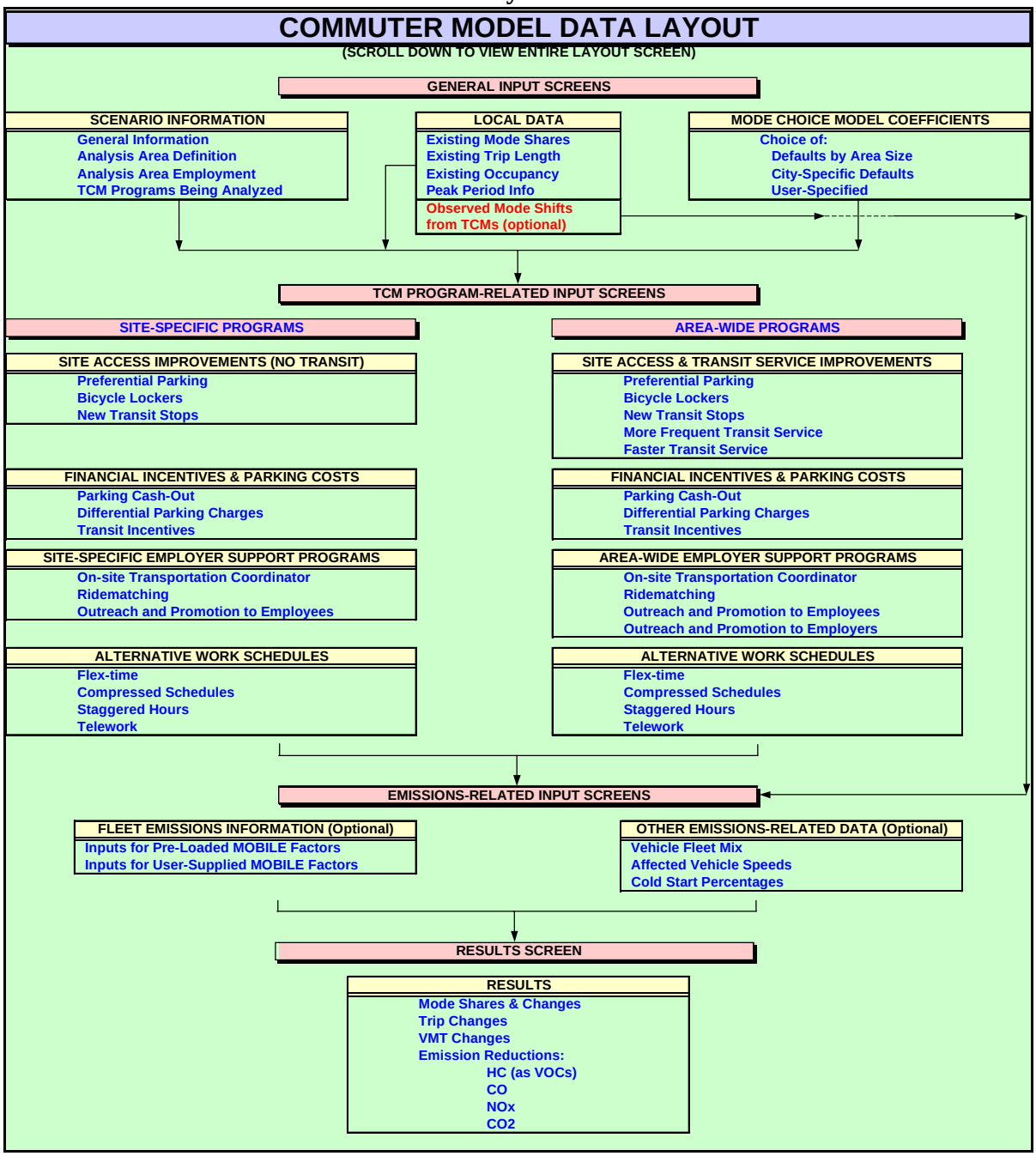
2.6 Can I save my inputs to use in another analysis?

Saving Scenarios - To make repeated use of COMMUTER quicker and easier, you can save a complete set of analysis inputs and re-use them later as a template for evaluating other scenarios. This avoids having to type in complete data from scratch for each analysis, but still allows you to modify selected data to evaluate alternatives.

After inputting data for a specific analysis case, save the information to a "scenario file" (indicated by a ".VME" file extension). First click on the "File" menu and select "Save Scenario." This will bring up a dialog box that allows you to save the file to disk for later use. Click the arrow to the right of the "Save in" box to select the directory where you want to save the file, then type a file name for the scenario to be saved in the "File name" box, using the .VME suffix.

Loading Saved Scenarios - When you want to load and re-use a saved scenario file, click the "Load Scenario" item from the File menu. Then, select the directory and the specific scenario file you saved earlier to be loaded into the application. Re-using existing scenarios and making minor changes to their inputs is a more efficient way to create a series of related scenarios than typing in all the data for each scenario.

Figure 3
Model Layout Screen



Clearing Scenarios - If for some reason you have loaded a scenario or have typed in data for all the input cells and want to delete the data from all the input cells and start over, you can click the "Clear Scenario" item on the File menu. This initializes the program by erasing the data currently contained in the input cells if you want to start re-entering all new data without

having to exit and reload COMMUTER. It does not delete saved scenario files from your hard disk.

2.7 Can I use my own emission factors?

COMMUTER has been pre-loaded with 24 sets of MOBILE5b emission factors that encompass a range of input conditions reflecting "typical" summer and winter conditions throughout the country. Each of these pre-loaded sets contains emission factors for five specific calendar years: 2000, 2002, 2005, 2010, and 2020. Under general circumstances when COMMUTER is used as a screening model, selecting the set of pre-loaded emission factors that best matches your local conditions is adequate. However, if you want to use COMMUTER to produce SIP-consistent emission reductions and are an experienced MOBILE5b user, you can use your own locally generated MOBILE5b emission factors to calculate emission reductions in COMMUTER. The steps for using your own emission factors are explained below.

Step 1 - Create Properly Formatted Emission Factor Output File - Although you can specify your exact local input conditions, your MOBILE5b output emission factors must be generated in a specific format expected by COMMUTER. The sample MOBILE5b template input file **USERTMPL.INP**, which was installed in your "COMMUTER" directory, identifies how specific program control flags in the MOBILE5b input file must be set to produce output emission factors in this COMMUTER-required format. In addition, it contains a series of 55 "Scenario Descriptive" records that produce emission factors over a range of speeds and operating mode fractions expected by COMMUTER. These scenario records can be edited to reflect the altitude, calendar year, local ambient temperature and season of interest. However, if you change the speed or operating mode input values in these scenario records, the resulting output emission factors will not work properly with COMMUTER.

> ***IMPORTANT**: Once you've edited the 55 scenario records to reflect your own altitude, temperature, and season inputs, you can copy and paste this block of records to create emission factors for multiple calendar years.*

Depending on your local conditions, you may also need to create additional scenario records, inserting one after each of the 55 Scenario Descriptive records, to model a Low-Emission Vehicles (LEV) program.

You cannot assemble a series of separate MOBILE5b emission factor runs in a single input file (e.g., containing separate sets of program control flag and scenario records).

Although this is allowed by MOBILE5b, these types of embedded runs cannot be read correctly by COMMUTER. If you need to model different sets of local conditions (e.g., two levels of an inspection and maintenance program), you will need to create a separate MOBILE5b input file.

Once you have set up your MOBILE5b input file as described above and in accordance with the required program control flag values listed in the **USERTMPL.INP** file, run MOBILE5b. You can name the MOBILE5b input and output files as you choose.

Step 2 - Import Emission Factors - Once you've created your properly formatted MOBILE5b emission factor output file(s), they can be imported into COMMUTER. This is done by clicking "Import Emission Factors" from the File menu. A window will be displayed that allows you to point to and open a specific file. You will then choose the output, or .PRN file resulting from running MOBILE5b with the input file you created. It may take a minute of two for COMMUTER to incorporate the new output file into its data structure. A message will appear telling you the file has been successfully copied when it is done. If you have not set up your input file formatting properly as described in Step 1, an error message will be displayed when you try to import the resulting MOBILE5b output file. In this case, carefully check and edit your MOBILE5b input file in accordance with the guidance in Step 1 and re-run MOBILE5b.

Step 3 - Activate User-Supplied Emission Factors Option - After you've successfully imported your own emission factors into COMMUTER, you can direct the model to use them in the emission reduction calculations by marking the "User-Supplied Emission Factors" box (with an "X") near the bottom of the "Fleet Emissions Information" screen and entering the specific calendar year of interest below that box. (Further details on information entered in the Fleet Emissions Information screen are provided in Section 5.1.)

Once you have imported your own emission factors into COMMUTER, they are internally saved and made available each time you launch the COMMUTER program or until you import a different set of factors as described in Step 2 above. If you import a set of emission factors for a large number of calendar years (e.g., each year from 2000 to 2020), the size of the COMMUTER program will become much larger than 2.5 MB. If you are short on disk space, the "Empty Emission Factors" command from the File menu can be used to delete your internally stored local emission factors until you need to use them again. (At that time, you can simply re-import them.)

2.8 How do I view the results?

Once you have provided all of the required inputs (or selected default values), COMMUTER will automatically calculate TCM travel impacts and, if you've entered emission factor inputs, emission reductions. To view the results, all you need to do is simply click either of the two command items on the Results menu. "View Travel Results" displays travel impacts

only. "View Travel and Emission Results" shows both travel impacts and emission reductions (assuming you've entered emission factor inputs). You can then scroll down the tabular summary to see the calculated results. Key outputs include the following:

- Baseline and final mode shares for each mode, including percent of trips eliminated and change in mode share (final minus baseline);
- Percent of trips shifted from the peak to off-peak period;
- Baseline and final peak, off-peak and daily VMT;
- Baseline and final peak, off-peak and daily vehicle trips; and
- Change in total daily emissions for each criteria pollutant, HC (as VOC), CO and NOx (in tons) and CO_2 (in metric tons).

> ***NOTE:*** *If you did not enter all of the necessary input data, an "Incomplete or Inconsistent Input" message box will be displayed when the View Travel Results or View Travel and Emission Results buttons are clicked. The message box indicates which data must still be entered. If you click the OK button in the message box, the program will activate the first entry screen and cell for which missing or invalid data were detected.*

To return to an input screen after viewing the results calculated by COMMUTER, simply click the appropriate item in the Edit Inputs menu at the top of the application window.

2.9 How do I print my data and results?

For each scenario you evaluate, you can print both the detailed input data and the tabulated emission reductions. To do this, click the File menu. Then select "Print Inputs" from the drop-down menu to print a detailed listing of all program inputs. Select either "Print Travel Results" or "Print Travel and Emission Results" from the File menu to print a one-page output report showing travel impacts or travel impacts and emission reductions, respectively.

Figure 4 shows the layout of a sample output report. General scenario information and the specific TCMs evaluated are listed at the top of the report. Included in these items are boxes that indicate whether you have supplied your own final mode shares and emission factors. Below these items, summaries of the combined mode share impacts and travel and emission

reductions from baseline levels for all the TCMs selected are presented. As noted in the table headers, travel and emission reductions are shown as positive numbers.

Figure 4
Sample Output Report

COMMUTER MODEL RESULTS

SCENARIO INFORMATION

Description	Area-Wide Example Scenario
Scenario Filename	AREAWIDE.VME
Emission Factor File	
Performing Agency	EPA
Analyst	John Doe
Metropolitan Area	Anywhere, USA
Area Size	1 - Large (over 2 million)
Analysis Scope	1 - Area-Wide (e.g., MSA, county)
Analysis Area/Site	Downtown
Total Employment	300,000

PROGRAMS EVALUATED

- [X] Site Walk Access Improvements
- [X] Transit Service Improvements
- [X] Financial Incentives
- [X] Employer Support Programs
- [X] Alternative Work Schedules

- [ ] User-Supplied Final Mode Shares

MODE SHARE IMPACTS

Mode	Baseline	Final	%Change
Drive Alone	75.4%	71.8%	-3.6%
Carpool	13.2%	14.3%	+1.0%
Vanpool	0.5%	0.8%	+0.3%
Transit	5.3%	6.3%	+1.1%
Bicycle	0.4%	0.5%	+0.1%
Pedestrian	4.0%	4.3%	+0.3%
Other	1.1%	1.2%	+0.1%
No Trip	-	0.8%	+0.8%
Total	100.0%	100.0%	-

Shifted from Peak to Off-Peak	0.5%

TRAVEL IMPACTS (relative to affected employment)

Quantity	Peak	Off-Peak	Total
Baseline VMT	3,565,457	2,241,476	5,806,934
Final VMT	3,419,176	2,188,857	5,608,033
VMT Reduction	146,281	52,619	198,900
% VMT Reduction	4.1%	2.3%	3.4%
Baseline Trips	300,044	188,627	488,672
Final Trips	286,334	183,695	470,029
Trip Reduction	13,711	4,932	18,643
% Trip Reduction	4.6%	2.6%	3.8%

EMISSION REDUCTIONS (tons/day except CO2 in metric tons/day, positive values are decreases)

Pollutant	Peak	Off-Peak	Total
HC	0.139	0.044	0.183
CO	1.214	0.371	1.585
NOx	0.221	0.084	0.305
CO2	60.3	20.7	81.0

Again, note that the output units for the emission reductions are different. HC, CO, and NOx reductions are given in (short*) tons per day; CO_2 reductions are in metric** tons per day.

* 1 short ton = 2,000 lbs.

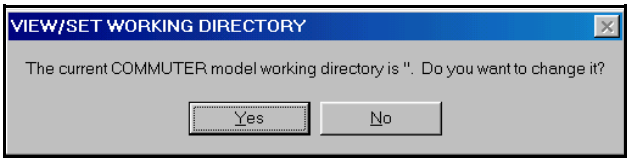
** 1 metric ton = 2,205 lbs.

> ***CAUTION:*** *The program allows you to set up a scenario and produce results for an individual TCM (as opposed to a combination of measures). However, summing the results for measures evaluated individually will not give you an accurate representation of the true impact of a combination of measures.*

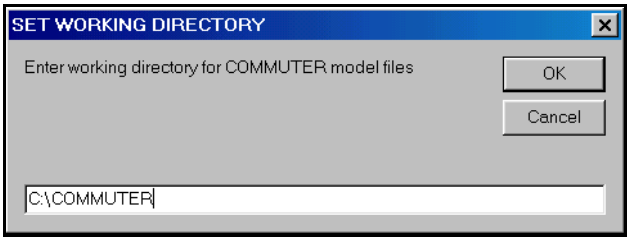
2.10 Can I tell the model to remember where my files are stored?

Depending on how you launch COMMUTER (see Section 2.2), your "default" directory (the directory pointed to when you open or save files) may not be the same as the directory that the model and scenario files are stored in. You can tell the model where to look for your scenario (and emission factor) files so you don't have to click out of the "system" default directory (e.g., C:\My Documents) each time you want to open or save a scenario.

To set your default or "working" directory when you're running COMMUTER, click "Set Working Directory" from the File menu. The first time you do this, COMMUTER will report that the working directory is blank as shown below.



This is normal. Simply click the "Yes" button. Another window, shown below, will be displayed that then allows you to enter the disk drive and directory path where you've installed COMMUTER (e.g., C:\COMMUTER).



Once you have set the working directory, COMMUTER remembers that location and uses it each time you open or save scenario files or import your own emission factors, even if you exit and then re-run the model.

2.11 What do I do when I'm finished?

Before exiting COMMUTER, be sure you have saved the current inputs in a scenario file, as described above, if you plan to re-use them later. When you have completed your analysis session and want to exit COMMUTER, click "Exit Program" from the File menu. The application will then close and exit.

###

3. GENERAL INPUT SCREENS

This and the following two sections guide you step-by-step through the data that must be provided in each of the input screens. This section covers the first three screens, which you use to input general information; Section 4 explains the five input screens that are specific to individual TCMs being analyzed; and Section 5 discusses the two screens you will use to enter information required to calculate emission reductions. Each subsection within these sections corresponds to one of the program's ten input screens. These have been ordered in the sequence in which you would generally enter data for an analysis. To make it easier to find information on specific data inputs, fields have been noted in **bold, underlined** text.

3.1 Scenario Information

Scenario information describes the area you are analyzing and the broad types of commuter choice programs to be analyzed. Figure 5 displays the layout of the Scenario Information screen. Key data items are explained below.

Metropolitan Area Size - This is where you define the size of the metropolitan area you are analyzing, using the following categories:

- Large - more than 2,000,000 in population;
- Medium - 750,000 to 2,000,000 in population; and
- Small - less than 750,000 in population.

Based on the area size you select, the program will retrieve default mode-choice model coefficients. Coefficients have also been developed for selected individual cities and are more accurate than the default coefficients. As discussed later in Section 3.3, you have the option to override the area size default mode choice coefficients in the "Edit Coefficients" screen with either the city-specific defaults supplied in the program or updated values you obtain for your city.

Analysis Scope - The actual analysis can apply to any geographic level. However, you must define the scope of your analysis as being area-wide ("1") or site-specific ("2").

Figure 5
Scenario Information Input Screen

SCENARIO INFORMATION

Field	Data	Notes
Scenario Information		
Scenario Filename		Filename of scenario stored on disk
User EFs Filename		User-supplied MOBILE emission factors (if used)
Description		Title to further identify the scenario (optional)
General Information		
Performing Agency		Name of your organization (optional)
Address		Address of your organization (optional)
Analyst		Your name (optional)
Metropolitan Area		Name of city/area being modeled (optional)
Metropolitan Area Size		1 = Large (Over 2 million) 2 = Medium (750,000 to 2 million) 3 = Small (Under 750,000)

Metropolitan Area Size is a required input. The program retrieves default mode choice model coefficients for the area size input by the user. However, these defaults for Large, Medium and Small metropolitan areas are not as accurate as the coefficients developed for individual cities that are displayed in Tables A-1, A-2 and A-3 in the appendix to the COMMUTER Model User Manual. These default mode coefficients can be overridden in the "Edit Coefficients" screen and the user is encouraged to refer to these tables and to use local coefficients for the specific city being modeled. See the help box in the Edit Coefficients screen and the COMMUTER Model User Manual for additional guidance on supplying local model coefficients.

Definition of Analysis Area		
Analysis Scope		1 = Area-Wide (Metropolitan Area, County, etc) 2 = Site or Employer-Based
Analysis Area/Site		Name of analysis area evaluated (optional)
Analysis Area Type		1 = CBD (Central Business District) 2 = Other High-Density Commercial 3 = Other

The COMMUTER model can be used to evaluate commuter choice programs on both an urban area-wide and individual employer (or site-specific) basis. The Analysis Scope input controls whether the model calculates area-wide or site-specific impacts of commuter choice programs.

Employment in Analysis Area		
Office Employment		Refers to "traditional" professional office space employment
Non-Office Employment		Manufacturing, warehousing, retail, medical, educational, entertainment and other employment-generating land uses
Total Employment	-	

The COMMUTER model may generate abnormally large mode shifts under a regional or area-wide analysis scenario if realistic limits are not applied in estimating the affected employment input above. For site-specific analysis, enter the employment of the workplace being analyzed. For area-wide analysis, the user is encouraged to consult Section 3.1 of the COMMUTER Model User Manual for more detailed guidance on estimating affected employment inputs for region being modeled.

Programs (Mark All Programs Being Analyzed with an "X")		
	1. Site Walk Access Improvements	Includes preferential parking, improved access to transit
	2. Transit Service Improvements	Includes more frequent and/or faster transit service
	3. Financial Incentives	Includes parking costs, transit fare/pass subsidies, or other financial incentives
	4. Employer Support Programs	Includes support programs for carpooling, vanpooling, transit, and/or bicycling
	5. Alternative Work Schedules	Includes flex time, telecommuting, staggered work hours, and/or compressed work weeks

An area-wide analysis evaluates TCM programs for a geographic area such as traffic corridors, subareas (for example, the central business district), activity centers (for example, a large office park complex), or the entire metropolitan region. A site-specific analysis evaluates TCM programs applied only to a single business or employer location. This option can be used when considering either a single place of business for a given employer or a mixed use or multi-purpose place of business for a given employer or employers. *If you are an individual employer using this model to evaluate a company employer support program, you should use the "site-specific" analysis.*

As discussed in Sections 4.3 and 4.4, you will later be asked for further data that are related to the scope you select. For example, if you specify "area-wide," some screens will ask you to specify the percentage of employers in the area participating in the program. If "site-specific" is specified, this percentage will be assumed to be 100 percent. (See Sections 4.3 and 4.4 for detailed instructions for inputting data for both area-wide and site-specific analysis.)

Affected Employment in Analysis Area - The impact or applicability of various programs and strategies is affected by type of employees in an area, which COMMUTER defines according to the land use category of the employer. "Office" employees are those working in land use categories that include traditional professional office space. "Non-office" employees include those working in manufacturing, warehousing, retail, medical, educational, entertainment, and other employment-generating land use activities. You will be asked to enter both the number of office and non-office employees in the area or at the target site that can be affected by the TCM programs being modeled. "Affected" is the keyword in understanding what employment levels you should input here and depends on whether you are performing a site-specific or area-wide analysis, as explained below.

Site-Specific Affected Employment - If you are performing a site-specific or "single employer" analysis (specified by choosing "2" for Analysis Scope), the employment levels you enter should be the total of all employees that are eligible for, or exposed to, any or all of the TCM programs you are evaluating. Most of the time, site-specific affected employment will be the total employment level at the site. In rare cases where employer support, financial incentive, or alternate work schedule programs being evaluated would only be made available to a portion of all employees, enter that portion as the affected employment.

Area-Wide Affected Employment - In an area-wide analysis, affected employment should not be entered as the total employment in the area being considered. You must estimate that subset of the total area employment that will be potentially affected by any or all of the specific TCM programs you are evaluating.

CAUTION: *For area-wide analysis, you should not enter the total employment in the analysis area. You do not want to base the analysis on the total employment in the analysis area because COMMUTER will then generate unrealistically high results for regional scenarios. For example, the number of trips being shifted from one mode of travel to another if all employees for a given region are assumed to participate in a voluntary program would be too high.*

Steps to help you calculate the number of employees that can be affected by the TCM programs you are evaluating under an area-wide analysis are listed below.

1. First, identify the portion of regional employers (and number of employees) that are currently participating in existing programs, and therefore should be excluded from the analysis. You can obtain the percentages of employers (by size and type) from the MPO responsible for transportation and emissions planning in the region. Using the total number of employees for a region is not realistic.

2. Finally, determine that portion of employers of a specific size (based on their number of employees) that will be subjected to, or encouraged to implement, the voluntary programs being evaluated. This percentage will vary by MPO region and could include either office or non-office employers with 1,000, 500, 250, or 100 employees.

3. Next, estimate the portion of employers of each type (office and non-office) who will agree to participate in any of the TCM programs you are evaluating, which will largely be voluntary in nature. This percentage will vary by MPO region and could include office employers only or a combination of office and non-office employers.

The following example is provided to demonstrate how you should use this process to determine the employment levels you need to enter under an area-wide analysis.

Assume total employees for Region X: 1,000,000 employees

1. Estimate portion of total employees currently participating in existing TCM programs: 20% -200,000 employees
   800,000 employees

2. Estimate portion of remaining employees by size of employer targeted by your voluntary programs, using employers of 500+ employees in this example:

   Office (500+ employers): 250,000 employees

Non-office (500+ employers): 50,000 employees

3. Determine portion of remaining employees based on estimated percentage of employers willing to participate in any of the modeled programs:

   (In this example we'll assume 30% office and 10% non-office employer participation)

   Office - 30% participation: 75,000 employees
   Non-Office - 10% participation: 5,000 employees

Using this example, you would enter inputs of 75,000 and 5,000 employees for affected office and non-office employment, respectively.

You should be careful in making assumptions about the number of affected employees in each region. Each region is likely to be significantly different based on the current participation in voluntary programs, employer and employee participation rates, and regional employment characteristics.

As these steps and the example indicate, when inputting the "affected" employment under an area-wide analysis, you should supply estimates of the number of office and non-office employees that are eligible for participation in any of the specific TCM programs you are evaluating.

> ***NOTE:*** *If you are evaluating a scenario that packages multiple programs (e.g., site access improvements, transit improvements, and financial incentives), individual "program" participation rates can also be specified in subsequent input screens for each program. You should not confuse these program-specific participation rates with the employer participation percentage in any program used to estimate affected employment inputs. The program-specific participation rates in subsequently discussed input screens provide you with a means to "weight" the participation of all affected employees within individual programs when analyzing scenarios that combine multiple programs.*

Programs - In this section, you simply check off which types of TCM strategies or programs are to be considered in the scenario being analyzed. There are five possible choices, described below. You simply mark (with an "X") all of the programs being analyzed; you do not have to select only one.

1. Site Walk Access Improvements - Includes preferential parking for employees using carpool and/or vanpool programs and improved access to transit systems.

2. Transit Service Improvements - Includes more frequent and/or faster transit service.

3. Financial Incentives - Includes any project or program that changes the out-of-pocket cost of alternative travel modes relative to automobile travel. Examples include transit fare/pass subsidies, parking costs, or other financial incentives.

4. Employer Support Programs - Includes support programs for carpooling, vanpooling, transit, and/or bicycling that do not result in any changes in direct travel time or cost changes. For example, employers might provide information about ridesharing and transit opportunities, match employees with carpools or vanpools, and offer guaranteed ride home programs.

5. Alternative Work Schedules - Includes flex time, telecommuting, staggered work hours, and/or compressed work weeks.

> ***NOTE:*** *If you are planning to enter your own estimate of final mode shares as described in the Local Data inputs in Section 3.2, COMMUTER will ignore any TCM programs you have selected on the Scenario Information Input screen and will delete your checkmarks from those selection boxes. By inputting your own final mode shares, you are bypassing COMMUTER's final mode share calculations that are based on TCM screen inputs.*

3.2 Local Data

Once you have provided the general information on the scenario you are analyzing, you need to provide data on the existing travel behavior and characteristics of the area or site. Because travel characteristics such as mode shares (for example, transit users) and average travel distances can vary a great deal within a region, you should define separate geographic areas that have distinct and more or less homogenous characteristics for analysis. For example, you may wish to conduct separate analyses for the central business district (CBD) and for the non-CBD portions of a city.

Baseline (i.e., existing) travel data for the region of interest are entered in the Local Data input screen, shown in Figure 6. Each of the data elements in this screen is discussed following Figure 6.

Figure 6
Local Data Input Screen

LOCAL DATA

	Use Default	Baseline (Existing) Data: Local	Baseline (Existing) Data: Default
Work-Trip Mode Shares	☐		
Auto - Drive Alone			75.4%
Auto - Carpool			13.2%
Vanpool			0.5%
Transit			5.3%
Bicycle			0.4%
Walk			4.0%
Other			1.1%
Total		0.0%	100.0%
Work Trip Length (mi)	☐		
Average person-trip length			11.4
Average trip length -- vanpool			17.7
Average trip length -- bicycle			1.8
Average trip length -- walk			1.0
Vehicle Occupancy	☐		
Average Carpool Occupancy			2.2
Average Vanpool Occupancy			6.0
Length of Peak Period (hours)	☐		3.0
Percent of Work Trips in Peak Periods	☐		61.4%

Supply Final Mode Shares? ☐

Baseline mode share, trip length, average occupancy and peak period data representing local conditions are entered in this input screen. From these inputs and data entered in the "Mode Choice Model Coefficients" screen, the COMMUTER model internally calculates final mode shares and travel changes resulting from TCM programs selected. If you want to supply your own estimates of final mode shares (such as might be obtained from employee survey data), mark the box labeled "Supply Final Mode Shares" (with an "X"). When this option is selected, the COMMUTER model displays an additional series of input cells below the box where final mode share inputs can be entered. Remember, these final mode shares should reflect work-trip mode choice after implementation of the TCM programs you're currently analyzing and override the mode share calculations made by the model.

The peak period includes the morning and evening time periods when highways are most congested. These periods may be defined differently in different areas. For the default "percent of work trips in peak period" provided, the AM peak is defined as 6:00 to 9:00 AM and the PM peak as 4:00 to 7:00 PM. The same peak period should be used for reporting percent of work trips in peak period and affected vehicle speeds (which are entered later in the "Other Emissions-Related Data" screen).

"Length of peak period" refers to the length (in hours) of the AM or PM peak period. If the AM and PM peak periods are different lengths, this can be an average of the two lengths.

"Percent of work trips in peak period" should also be reported as an average for the AM and PM peak periods combined. For example, assume there are 200,000 and 300,000 total vehicle trips in the AM and PM peak periods, respectively. If the number of work trips are 150,000 in the AM peak and 250,000 in the PM peak, then the percentage of work trips in peak period is (150,000 + 250,000) / (200,000 + 300,000) = 80%.

Existing Mode Shares, Trip Length, and Occupancy - If you are conducting a site-specific analysis, you may be able to obtain data on existing employee mode shares from employee surveys, if such surveys have been conducted. You can also enter local data on trip lengths and average vehicle occupancy for carpools and vanpools if such data are available.

If you do not have specific data available, you should be able to obtain transportation data for the city, metropolitan area as a whole, or other area of analysis from the regional transportation planning agency. You should work with local or regional transportation planners to identify the most appropriate data for the analysis.

If local data are not available, you may use the default parameters provided in the model. These are shown in Figure 6 under the "Defaults" column. You should indicate which default values to use by checking the appropriate box(es) on this screen.

User-Supplied Final Mode Shares - If you are performing an analysis where you have estimates of "final" mode shares (after implementation of the TCMs being modeled), you can enter these final mode share estimates in the Local Data screen. Under most circumstances, you'll want to let COMMUTER calculate final mode shares based on the inputs you supply in the TCM screens using the pivot-point methodology discussed in Section 1.5. There may be certain situations where you want to enter your own estimate of final mode shares, rather than using COMMUTER's calculations. For example, when you are performing a site-specific analysis for a company, you may have employee survey data available that estimate how mode choice would change in response to a particular program or programs.

For these situations, mark the "Supply Final Mode Shares?" box at the upper right of the Local Data input screen. When you do, a series of cells appears below this box, allowing you to enter final mode shares, reflecting changes from existing shares due to the TCM programs you're modeling.

For example, suppose under existing conditions that "Company A" work-trip mode shares were split at 80% Auto-Drive Alone and 20% Transit. Company A is considering a program in which employees are offered a cash incentive to ride the bus and, from an employee survey, determines that an additional 5% would accept the incentive and ride the bus. The final mode shares are thus split as 75% Auto-Drive Alone and 25% Transit. These values would be entered in the final mode share cells after you marked the "Supply Final Mode Shares?" box.

> ***NOTE:*** *When you enter your own final mode shares in the Local Data input screen as explained above, any TCM programs that you've checked at the bottom of the Scenario Information screen are removed and inputs you've entered in those TCM-specific screens are ignored. By entering your own final mode shares, you're telling COMMUTER not to use the TCM inputs to calculate final mode shares.*

Under most circumstances, you won't know what the final mode shares will be as a result of the TCM programs that you are analyzing. In these cases, leave the "Supply Final Mode Shares?" box blank and allow COMMUTER to calculate final mode share from the TCM program inputs you'll enter in subsequent input screens.

Length of Peak Period - The "peak period" includes the morning and evening time periods when highways are most congested. These periods may be defined differently in different areas. *You should use the same peak period definition when reporting the percent of work trips in a peak period that you use when reporting baseline travel speeds* (see below). You can obtain information on the peak period definition from transportation planning staff at your regional transportation planning agency.

"Length of peak period" refers to the length (in hours) of the AM or PM peak period. If the AM and PM peak periods are different lengths, you should use the average of the two.

Percent of Work Trips in Peak Periods - You need to enter the percent of trips during the peak periods that are work-related, averaging the totals for the AM and PM peak periods combined. For example, assume there are 200,000 and 300,000 total vehicle trips in the AM and PM peak periods, respectively. If the number of work trips are 150,000 in the AM peak and 250,000 in the PM peak, then the percentage of work trips in the peak period is calculated as follows:

$$\frac{150{,}000 + 250{,}000}{200{,}000 + 300{,}000} = 80\%$$

You should enter local or site-specific data if it is available, instead of relying on the default value. The default value provided is based on the national percentage of all work trips that occur in both the AM and PM peak periods. In this program, the default AM peak is defined as 6:00 to 9:00 AM and the default PM peak as 4:00 to 7:00 PM.

3.3 Edit Coefficients

This screen allows you to enter locally available values for mode-choice travel time and cost coefficients, rather than use the default values provided by the model. Figure 7 illustrates the layout of the Edit Coefficients screen.

Mode-choice coefficients are used within COMMUTER to compute changes in travel of each commute mode (e.g., drive-alone, carpool, transit, walk, etc.) under Site Access or Transit Improvement programs and Financial Incentive programs. These coefficients are used in transportation models referred to as "logit mode-choice" models to represent the willingness of commuters to use alternate modes of travel to driving alone when faced with changes in travel time or cost. (Please refer to the accompanying COMMUTER Model Procedures Manual for detailed information on how mode-choice coefficients are developed, tested and applied in transportation modeling.)

Figure 7
Edit Coefficients Input Screen

MODE CHOICE MODEL COEFFICIENTS

☐ Check here to apply local coefficients entered below in "User-Specified" row

	DEFAULTS BY AREA SIZE	IVTT (min)	OVTT (min)		Cost (cents)	
	Metro Area Size	All Modes	Walk Time	Transit -- Wait	Auto - Parking	Transit - Fare
	Large - more than 2,000,000	-0.0281	-0.0521	-0.0584	-0.0094	-0.0065
	Medium - 750,000 to 2,000,000	-0.0241	-0.0472	-0.0468	-0.0071	-0.0064
	Small - less than 750,000	-0.0207	-0.0373	-0.0563	-0.0065	-0.0038
	User-Specified					
	Coefficients Used: User-Specified					

Mode choice model coefficients are entered in this screen. The program retrieves default coefficients for the metropolitan area size input in the Scenario Information screen. However, these defaults for Large, Medium and Small metropolitan areas are not as accurate as city-specific coefficients developed for many communities across the country. City-specific coefficients for a number of cities based on a review of current literature and existing travel demand models are provided for use within the model and can be viewed by scrolling down below this help box. The user is encouraged to utilize these local coefficients for the specific city being modeled (if available) in lieu of the area size defaults by simply checking the box next to the appropriate city. The user is also encouraged to contact their local transportation planning agency to ensure the values cited are up-to-date or to obtain coefficients for cities not listed in these tables.

When applying user-specified values, be aware that most models generally use input travel/wait time coefficients in MINUTES and cost-related coefficients in CENTS. Mode choice models such as the TDM model then internally convert the values of these coefficients to match the units of the travel/wait time or cost inputs. The COMMUTER model has also been programmed to apply a conversion factor to the Auto Parking and Transit Fare cost coefficients (in cents) when used with financial incentive inputs in units of DOLLARS per vehicle per day. When inputting your own coefficients, make sure the travel/wait time coefficients are in MINUTES and the cost-related coefficients are in CENTS.

	CITY-SPECIFIC DEFAULTS			IVTT	OVTT		Cost	
Check	City	Area Size	Year	All Modes	Walk Time	Transit -- Wait	Auto - Parking	Transit - Fare
	Albuquerque	Small	1992	-0.0209	-0.0219	-0.0978	-0.0031	-0.0031
	Boston	Large	1991	-0.0314	-0.0330	-0.0550	-0.0173	-0.0083
	Chicago	Large	1990	-0.0282	-0.0440	-0.0960	-0.0021	-0.0008
	Cincinnati	Medium	1978	-0.0190	-0.0280	-0.0280	-0.0050	-0.0050
	Cleveland	Large	1994	-0.0178	-0.0444	-0.0378	-0.0034	-0.0024
	Dallas	Large	1984	-0.0297	-0.0552	-0.0552	-0.0116	-0.0046
	Denver	Medium	1985	-0.0180	-0.0540	-0.0282	-0.0095	-0.0044
	Detroit	Large	1965	-0.0457	-0.0641	-0.1165	-0.0065	-0.0065
	Houston	Large	1994	-0.0220	-0.0568	-0.0568	-0.0154	-0.0061
	Los Angeles	Large	1991	-0.0210	-0.0530	-0.0530	-0.0030	-0.0030
	Milwaukee	Medium	1991	-0.0160	-0.0410	-0.0410	-0.0045	-0.0045
	Minneapolis	Large	1970	-0.0310	-0.0440	-0.0300	-0.0140	-0.0140
	New Orleans	Medium	1960	-0.0150	-0.0330	-0.0770	-0.0080	-0.0080
	Philadelphia	Large	1986	-0.0420	-0.0320	-0.0510	-0.0026	-0.0012
	Phoenix	Large	1997	-0.0195	-0.0257	-0.0308	-0.0111	-0.0055
	Pittsburg	Large	1978	-0.0632	-0.1507	-0.1507	-0.0210	-0.0210
	Portland	Medium	1985	-0.0390	-0.0650	-0.0400	-0.0135	-0.0135
	Reno	Small	1991	-0.0275	-0.0550	-0.0550	-0.0167	-0.0067
	Sacramento	Medium	1991	-0.0250	-0.0380	-0.0380	-0.0028	-0.0028
	San Francisco	Large	1990	-0.0333	-0.0931	-0.0523	-0.0021	-0.0021
	San Juan	Medium	1990	-0.0366	-0.0717	-0.0752	-0.0066	-0.0066
	Santa Cruz	Small	1990	-0.0163	-0.0325	-0.0325	-0.0045	-0.0036
	St Louis	Large	1965	-0.0228	-0.0570	-0.0570	-0.0117	-0.0117
	Tucson	Small	1993	-0.0180	-0.0400	-0.0400	-0.0018	-0.0018
	Wash DC	Large	1980	-0.0170	-0.0580	-0.0580	-0.0094	-0.0044

The travel and emission impacts calculated by COMMUTER are highly sensitive to the values of these coefficients, especially the cost coefficients. It is recommended that you use local coefficients for mode choice, if they are available and up-to-date. Coefficients have been estimated in many urban areas by the regional transportation planning agency (usually MPOs, Councils of Government, or Associations of Governments). Values of travel time and cost coefficients for many individual cities are incorporated into COMMUTER at the bottom of this input screen. The values of these mode-choice coefficients are based on the travel models currently used by regional transportation planning agencies. You are encouraged to contact your local transportation planning agency to ensure the values cited are up-to-date or to obtain coefficients for cities not listed in the table at the bottom of the input screen. In cases where the survey data underlying the coefficients are more than ten years old, it is recommended that you use the default coefficients for your area size for estimating purposes and consult your local planning agency before using the city-specific coefficients.

###

4. TCM-SPECIFIC DATA

This section discusses the input screens that are used to enter TCM-specific data for each of five different types of programs, with each program having its own input screen. As explained in Section 2, programs can be analyzed individually or in combination.* At this stage, you can edit any of the programs checked under "Programs Analyzed" on the "Scenario Information" screen. (Remember, however, that if you did not select a program from the Scenario Information screen, you will not have access to the data entry screen for that program.)

4.1 Site Access and Transit Service Improvement Programs

This section describes the Site Access and Transit Service Improvement program inputs. Figure 8 shows the single input screen used for these programs.

Site Access Improvements

Site access improvements include such things as preferential parking policies for carpools and vanpools or improvements to the work site or area that make access to transit easier. For example, parking spaces in close proximity to both office building locations and transit station/transit center locations could be provided for ease of access and reduced travel times for carpool and vanpool vehicles. These programs also include improved pedestrian and bicycle infrastructure at transit locations to encourage transit usage. Along with preferential parking spaces, infrastructure improvements could include secure lockers and showers for pedestrians and bicyclists and improved access to transit facilities from the adjacent roadway system.

Walk-Access Time - You will need to specify the change in "walk access time," which is the time required to walk from the parking space or transit stop to the work site. A decrease in walk access time for any particular travel mode is represented as a negative value.

* As noted in Section 2, however, you will not obtain accurate results by analyzing individual measures and then summing the results. Measures that may be implemented together should be analyzed together.

Figure 8
Site Access & Transit Improvements Input Screen

SITE ACCESS & TRANSIT SERVICE IMPROVEMENTS

I. Site Access Improvements

Mode:	Change in Walk Access Time (min)
Drive Alone	
Carpool	
Vanpool	
Transit	
Bicycle	
Pedestrian	

Employer Participation Rate:	

"Change in Walk Access Time" represents the difference in walking time associated with travel to or from the workplace as a result of worksite access changes. Walking time includes the time taken to walk from a parking lot or a bus stop to the actual worksite. Walk access time can be affected through policies such as preferential parking for carpools and vanpools or through improvements to the worksite or area which make access to transit easier. A decrease in walk access time for any particular mode should be entered as a negative value.

"Employer participation rate" refers to the percent of employers in the analysis area implementing the walk access improvements. (This option is not necessary for site-specific analysis because the "participation rate" is 100%.)

II. Transit Service Improvements

IIa. More Frequent Service

Change in avg. headway (min)	
Employment Served	

IIb. Faster Service

Change in route travel time (min)	
Employment Served	

Transit Operating Data

Increase in daily VMT by Transit Vehicles	
Average speed of affected transit vehicles (mph)	
Default average speed	19.6
Check here to use default transit speed	

"Change in average headway" refers to the average change in frequency of service for transit service to the employment center or analysis area. An increase in service frequency is entered as a negative number. For example, if peak period transit service frequency increases from 20-minute to 15-minute intervals, the change in average headway would be entered as "-5.0".

"Change in route travel time" refers to the average change in total route travel time for all transit service to the area. A decrease in travel time is entered as a negative number. For example, if new express bus service decreases the overall route travel time by 5 minutes, this would be entered as "-5.0".

"Employment served" refers to the percent of employment in the analysis area which is served by the improved transit service. (This option is not available for site-specific analysis).

"Increase in daily VMT by transit vehicles" refers to the additional transit vehicle-miles of travel as a result of the improved transit service. Refer to Section 4.1 of the COMMUTER Model User Manual for guidance on how to calculate this parameter.

Employer Participation Rate - If you specified an area-wide analysis scope, you will also need to specify the percent of employers in the analysis area implementing the walk-access improvements.

Remember, as discussed in Section 3.1, that there are two types of participation rates you need to consider in setting up the inputs to COMMUTER. The first type is used in estimating the affected employment inputs and refers to participation in any of the TCM programs being modeled. The second type, the individual program participation rates, are actual model inputs, and are used to further restrict the "eligibility" of all affected employment to individual programs, such as Site Access Improvement programs. Thus, in an area-wide analysis assuming 100,000 affected employees, a 15% Employer Participation Rate for Site Access Improvement programs instructs COMMUTER that 15,000 employees (100,000 × 15%) are eligible or affected by site access improvement strategies. (Note that the model assumes a proportional ratio of employers to employees in determining affected employment for individual programs.)

The employer participation rate is not used in site-specific analysis because it is assumed to be 100%.

Transit Service Improvements

Transit service improvements may include providing more frequent bus or shuttle service to work sites, as well as providing faster transit service through express routes or operational improvements. These improvements may also include implementing new route services resulting from the transit planning process.

If you are analyzing improvements that lead to more frequent service, you will need to enter the "**Change in Average Headway**." This refers to the average change in the frequency of transit service to the employment center or analysis area. An increase in service frequency is entered as a negative number. For example, if peak period transit service frequency increases from every 20 minutes to every 15 minutes, the change in average headway would be represented as -5.0 minutes.

"**Employment Served**" refers to the percent of employment in the analysis area that is served by the improved transit service. As with the Employment Participation Rate input for Site Access Improvement programs, Employment Served should reflect the fraction of all affected employment that are exposed to the transit improvements. As an example, expanding transit service along a single network corridor would affect only the fraction of employment served by this transit corridor. Again, you do not need to enter this input if you are conducting a site-specific analysis.

If you are evaluating faster service improvements, you will need to enter the "**Change in Route Travel Time**." This refers to the average change in the time required to travel the total route for all transit service to the area. A decrease in travel time is represented as a

negative number. For example, if new express bus service decreases the overall route travel time by 5 minutes, this would be represented as -5.0 minutes.

If transit service improvements are implemented, the change in **daily transit vehicle-miles** as a result of increased service must also be considered. For this, you will need to estimate the following items:

- The number of additional daily bus-trips on each route, for routes on which service is increased; and

- The total round-trip route length for each route on which service is increased.

You should be able to obtain information on route-mileage increases from the local transit agency or you can develop estimates from operating plans for the proposed transit service. Estimates of daily mileage increases should take into consideration the distance traveled to and from the storage/maintenance facility to the beginning/end of the route.

In addition, an **average travel speed** for the affected transit service should be estimated. This can be done by dividing the total length of each affected route by the time taken to complete the route.

If transit service improvements are implemented, the change in daily transit vehicle-miles as a result of increased service must also be considered. This requires estimating the following items:

- The number of additional daily bus-trips on each route, for routes on which service is increased; and

- The total round-trip route length for each route on which service is increased.

Information on route-mileage increases can be obtained from the local transit agency or can be estimated from operating plans for the proposed transit service. Estimates of daily mileage increases should take into consideration the distance traveled to and from the storage/maintenance facility to the beginning/end of the route.

In addition, an average travel speed for the affected transit service should be estimated. This can be done by dividing the total length of each affected route by the time taken to complete the route.

4.2 Financial Incentive and Parking Cost Programs

Financial incentives include any policies that affect how much it costs to travel via a particular mode. Some examples of financial incentives are listed below.

- Increased parking charges, especially for single-occupant vehicles.

- Reduced parking fees for carpools and vanpools.
- Transit subsidies such as free monthly passes.

- Parking cash-out programs.

The Financial Incentive and Parking Cost program input screen is shown in Figure 9. A decrease in cost (i.e., an incentive) is entered as a negative number. Changes in **parking cost** are entered on a per-vehicle basis. Changes in other **fare costs** and **other financial costs** are entered based on the change in cost per person per day (i.e., round trip transit fare).

Figure 9
Financial Incentives Input Screen

FINANCIAL INCENTIVES AND PARKING COSTS

	Change In Daily Cost:			
Mode:	Parking Cost ($/vehicle)	Fare Cost ($/ person/RT)	Other Financial Cost ($/ person/RT)	Total Change ($/ person/RT)
Drive Alone				$ -
Carpool				$ -
Vanpool				$ -
Transit				$ -
Bicycle				$ -
Pedestrian				$ -

Employer Participation Rate:	

"Financial incentives and parking costs" may include higher parking charges for single-occupant vehicles, reduced parking fees for carpools or vanpools, transit subsidies such as free monthly passes, or other financial incentives for specific modes. A decrease in cost is entered as a negative number. For example, provision of a transit pass valued at $30 a month would be entered as a change in fare cost of -$1.50 ($30 / 20 days). The cost change inputs are entered on a daily basis.

"Employer participation rate" refers to the percent of employers in the analysis area offering these incentives to their employees. (This option is not required for site-specific analysis because the "participation rate" is 100%.)

As in other screens, "**Employer Participation Rate**" refers to the fraction of all affected employees being offered financial incentives on a percent-of-employers basis. Like the other program-specific "employer participation rate" inputs, COMMUTER applies the proportion of participating employers to determine the fraction of all affected employees being offered financial incentives. It is not used for site-specific analysis.

Two examples are provided below to illustrate how the financial costs should be calculated and entered.

Sample Calculations for Financial Incentives and Parking Cost Programs:

- If parking costs are increased by $2.00 per day for all types of vehicles, you would enter +$2.00 for Auto-Drive Alone, Carpool, and Vanpool. (The model will convert the costs per vehicle to the costs per person by dividing by the assumed average vehicle occupancy as identified in "Local Data.")

- If a transit pass worth $30 per month is provided, you would enter a change in fare cost of -$1.50 ($30 divided by 20 days per month).

Note that you enter these cost inputs in dollars per vehicle per day. COMMUTER internally converts the Parking Cost and Transit Fare mode-choice coefficients that you entered in units of cents in the "Edit Coefficients" screen into dollar units before combining them with the cost inputs entered in this screen in the mode share calculations.

Parking Cash-Out Programs - Parking cash-out programs are modeled in this input screen by treating the cash-out payment as a "subsidy" for use of eligible alternative modes. For example, if the cash value of the parking subsidy were $60 per month or $2 per day, a current Single Occupant Vehicle (SOV) user would see no difference in his/her cost to drive (park), but the transit user would suddenly find it $2 per day cheaper to use transit. The same logic applies to all modes that are eligible alternatives, i.e., bike, walk, or ridesharing (if there is no problem with the cash-out recipient still parking at the site as a carpooler/vanpooler). In this example, you would enter -$2 in the "Transit" row and "Parking Cost" column.

So to handle cash-out programs in COMMUTER, you enter nothing for the SOV mode parking cost, and enter a subsidy for each of the eligible alternative modes. Note that in the rideshare case, each passenger receives the full value of the subsidy, unlike where you give a parking discount to carpools and the savings is split among the number of occupants.

4.3 Site-Specific Employer Support Programs

There are a number of strategies that employers can use that reduce the number of people commuting to work in single-occupancy vehicles (SOVs), but do not result in measurable changes in the time or cost of traveling to work. Research suggests that such "soft" incentives or support programs can change travel behavior by providing encouragement to use other modes of travel, informing travelers of alternatives, or removing impediments. Examples of this type of strategy include selling transit passes at the work site, providing rideshare matches, marketing and promoting alternative modes, providing a guaranteed ride home program, forming and supporting a vanpool, and providing preferential parking for carpools. (Note that these types of programs also apply for an area-wide analysis, discussed in Section 4.4.)

Figure 10 shows the input screen for site-specific analysis of employer support programs. As shown in the figure, the first thing you need to do is specify the **entry format**, which refers to the type of data you will be entering.

Figure 10
Site-Specific Employer Support Programs Input Screen

EMPLOYER SUPPORT PROGRAMS FOR ALTERNATIVE MODES
SITE-SPECIFIC ANALYSIS

Entry Format (check one only):
☐ Specify Program Level
☐ Specify Mode Share Increase

"Program Level" and "Mode Share Increase" input options are mutually exclusive. You enter input data for either one or the other based on which Entry Format box you check to the left. See the help box below for an explanation of each input.

Specify Program Level:

Program	Existing	New
Carpool		
Vanpool		
Transit		
Bicycle		

Specify Mode Share Increase:

Program	Existing	Increase	New
Carpool	0.0%		0.0%
Vanpool	0.0%		0.0%
Transit	0.0%		0.0%
Bicycle	0.0%		0.0%

"Employer Support Programs" include programs such as provision for an on-site transportation coordinator, ridematching, transit information, and other actions aside from time and cost incentives which encourage employees to utilize alternative modes. Two entry options are available for site-specific analysis:

(1) Specify existing and new program levels for Carpool, Vanpool, Transit, and Bicycle program support. A program level of "0" represents no program. Program levels of "1" through "4" indicate varying levels of effort for the programs. These program levels are described in Section 4.3 of the COMMUTER Model User Manual.

(2) Specify an expected mode share increase for each mode. This increase is added to the baseline mode share as specified in the input data.

IMPORTANT: This entry option should not be utilized unless the user has definitive data indicating a likely mode share increase as a result of proposed programs. If a mode share increase is specified, the user should document existing support programs and programs to be implemented, along with survey or other data indicating the basis for the mode share increase estimates.

For a site-based analysis, it is recommended that you specify existing and proposed *program levels*. These refer to the general level of effort spent on the program (which affects its effectiveness) and are explained below, along with the codes used for data entry. They are defined separately for carpooling, vanpooling, transit, and bicycle commuting.

As an alternative, you can specify the expected *mode share increase*. This expected increase in each mode of travel is added to the baseline mode share that was specified in the input data.

> ***CAUTION:*** *You should not use this alternative entry option unless you have good data indicating that a proposed program will lead to a likely mode share increase. If you do specify a mode share increase, you should document existing support programs and the programs to be implemented, along with survey or other data that were used to estimate the mode share increase.*

Definition of Program Levels

The impact of employer support programs and strategies varies depending on the level of effort expended on the program. The level of program effort is a particularly important data input because it defines what is actually meant by, for example, a "carpool support" program. The program level can vary from 0 to 4, with 0 representing no program and 4 representing a program of maximum effort. (These program level definitions will also apply for area-wide analyses, as discussed in Section 4.4.) The following program level descriptions are not requirements for each level, but are intended as suggested guidelines to help you assign a level designation to the support activities you are trying to model. Note that preferential parking or financial incentives offered as part of a support program should be captured on the Site Access and Transit Service Improvement input screen, and the Financial Incentives and Parking Costs input screen, respectively.

Carpool Support Programs

Level 0 - no program

Level 1 - includes carpool information activities (tied in with area-wide matching) and a quarter-time transportation coordinator.

Level 2 - includes an in-house carpool matching service and/or personalized carpool candidate get-togethers (including information activities) and a quarter-time transportation coordinator.

Level 3 - includes in-house carpool matching and information services, a policy of flexible work schedules* to accommodate carpools, and a half-time transportation coordinator.

Level 4 - includes in-house carpool matching and information, flexible work schedules, and a full-time transportation coordinator.

Vanpool Support Programs

Level 0 - no program

Level 1 - includes vanpool information activities (tied in with area-wide vanpool matching and/or third-part vanpool programs), plus a quarter-time transportation coordinator.

Level 2 - includes in-house vanpool matching services and/or personalized vanpool candidate get-togethers, and non-monetary vanpool development, plus a quarter-time transportation coordinator and a policy of flexible work schedules.

Level 3 - includes in-house vanpool matching services; vanpool development and operating assistance, including financial assistance, such as vanpool purchase loan guarantees, consolidated purchase of insurance, and a startup subsidy (note that such assistance is different from offering financial incentives to use vanpools); and additional services such as van washing, plus a half-time transportation coordinator.

Level 4 - includes in-house vanpool matching services; vanpool development and operating assistance, including major financial assistance, such as employer purchase of vans with favorable leaseback (or alternative continuing subsidy, such as free maintenance, free insurance) in addition to startup subsidy; several additional incentives such as van washing, guaranteed ride home, and a full-time transportation coordinator and/or personalized vanpool candidate get-togethers.

Transit Support Programs

Level 0 - no program

* Flexible work schedules as defined under these support programs refers to providing latitude to employees to accommodate slight variations in arrival/departure to participate in these programs. This differs from a formal Flex-Time policy, which is defined and discussed later in Section 4.5.

Level 1 - includes a transit information center plus a quarter-time transportation coordinator.

Level 2 - includes a transit information center and a policy of work hours flexibility to accommodate transit schedules/delays, plus a quarter-time transportation coordinator.

Level 3 - includes a transit information center and a policy of work hours flexibility, on-site transit pass sales, plus a half-time transportation coordinator.

Level 4 - includes a transit information center and a policy of work hours flexibility, on-site transit pass sales, guaranteed ride home, and a full-time transportation coordinator.

Bicycle Support Programs

Level 0 - no program

Level 1 - providing on-site bicycle parking (racks or lockers).

Level 2 - providing bicycle parking (racks or lockers) and shower facilities.

Level 3 - providing secure bicycle parking (storage lockers or indoor storage) and shower facilities, in conjunction with local infrastructure conducive to bicycling. This includes the presence of (a) off-street bike paths, (b) on-street bike lanes, and/or (c) local streets with light traffic by which cyclists can access the workplace.

Level 4 - providing parking, shower, and infrastructure conditions as for Level 3, and also sponsoring workplace promotional activities. These activities should include promoting bicycle commuting, identifying the availability and location of parking and shower facilities, and providing local bicycle route maps, along with other activities to encourage bicycle commuting.

Some employer support programs may have combinations of characteristics different than those shown here. In this case, you should choose the program level that most closely represents the actual program being implemented.

If there is no program level that you feel most closely represents the combination program being offered, you can specify "combinations" of program levels by running the program for an area-wide rather than site-specific analysis. For example, if a carpool program includes all the elements of a Level 3 program except for flexible work schedules, you may want to model this program as halfway between Level 2 and Level 3 in terms of effectiveness. You can do this by setting the analysis scope to "Area-Wide" and specifying that 50 percent of

employers have a Level 2 program and 50 percent have a Level 3 program. Note that if you set the employer participation rate at 100 percent for every program being tested, the area-wide and site-specific analyses will give identical results.

4.4 Area-Wide Employer Support Programs

The discussion in Section 4.3 of the types of employer support programs that may be offered also applies here. Although different input formats are used for site-specific and area-wide employer support programs, the data elements themselves are similar. Figure 11 shows the input screen for area-wide analysis of employer support programs.

Figure 11
Area-Wide Employer Support Programs Input Screen

EMPLOYER SUPPORT PROGRAMS FOR ALTERNATIVE MODES
AREA-WIDE ANALYSIS

Percent of Employers Participating -- Existing

	Program Level					
Program	**None**	**1**	**2**	**3**	**4**	**Total**
Carpool	100%					100%
Vanpool	100%					100%
Transit	100%					100%
Bicycle	100%					100%

Percent of Employers Participating -- New

	Program Level					
Program	**None**	**1**	**2**	**3**	**4**	**Total**
Carpool	100%					100%
Vanpool	100%					100%
Transit	100%					100%
Bicycle	100%					100%

"Employer Support Programs" include programs such as provision of an on-site transportation coordinator, ridematching, transit information, and other actions aside from time and cost incentives which encourage employees to utilize alternative modes.

For an area-wide analysis, the analyst should specify both existing and new (expected) participation rates (percent of employers participating) by program level for each mode. Program levels of "1" through "4" indicate varying levels of effort for the programs which are described in Section 4.4 of the COMMUTER Model User Manual.

You should use the definitions of support **program levels** given in Section 4.3 for area-wide analyses also. *Be sure to read these definitions before proceeding.*

For area-wide analysis of employer support programs, you must specify the **percent of employers participating** in each of the program levels and modes. For each mode (carpool, vanpool, transit, and bicycle), you need to enter the percent of employers in the area participating at each program level. The sum of Levels 0 through 4 for each mode should equal 100%. Employers who are not participating in any program would be included in the

"Level 0" program level. Participation rates should be specified for both the base case (existing conditions) and the proposed program levels being evaluated.

4.5 Alternative Work Schedule Programs

This class of commuter-related TCM strategies is aimed at reducing how often commute trips are made or shifting the timing of the trip out of the peak hour. For example, flex-time and staggered work hour strategies have the effect of merely shifting commute travel to a less-congested time period. These strategies will not affect the number of overall trips or the amount of VMT, but they will change the distribution of trips, VMT, and emissions between the peak and off-peak time periods. They may also affect overall emissions slightly by affecting the average speed in the peak and off-peak periods. Definitions of the various work schedule programs and their likely impacts are discussed later in this section.

Figure 12 shows the input screen for entering information on alternative work schedules and telecommuting programs. As shown, you will first need to choose an **entry format** option, as explained below:

- *Eligibility Rate* - This indicates the percent of all employees in the analysis system* who are offered the program. The model then applies an assumed participation rate to the total number of employees that are eligible. *Note that the employees eligible for each alternative work schedule and those not eligible for any strategy must sum to 100 percent.* In other words, only one alternative work schedule strategy may be offered to an employee at a time. This simplifying assumption is used in the manual and spreadsheet model because employees are unlikely to combine more than one alternative work strategy at a time (for example, those employees working a compressed work week are unlikely to be allowed to telecommute on regularly scheduled work days). This parameter relates mainly to the logic of applying this strategy to different employment segments. For example, manufacturing or retail employees are not reasonable candidates for participation in telecommuting programs. *You should consider the characteristics of the employment base you are analyzing when determining the value to use for this parameter.*

- *Participation Rate* - As an alternative, you can specify existing and expected actual participation rates for each program.

* For an area-wide analysis, this will be the percent in the area-wide employment base; for a site-specific (single employer) analysis, it will be the percent of employees within the firm.

CAUTION: *You should not use the "Participation Rate" entry option unless you have definitive data on the likely participation rate as a result of proposed programs. If you do specify the participation rates, you should document the existing support programs and the programs to be implemented, along with the survey or other data that formed the basis for the participation rate estimates.*

Figure 12
Alternative Work Schedules Input Screen

ALTERNATIVE WORK SCHEDULES

	Use Default	Data Local	Data Default
Alternative Work Schedule Parameters			
Telecommute: Avg. Days/Week	☐		1.8
Flex Time/Staggered Hours: Percent of trips shifted from peak period	☐		

Participation Entry Format (check one only):

☐ Specify Eligibility for Participation
☐ Specify Before/After Participation Rates

A. Eligibility for Participation

	% Eligible	
Program	**Existing**	**New**
Flex Time		
Compressed 4/40		
Compressed 9/80		
Staggered Hours		
Telecommute		
Not Eligible	100%	100%
Total	100%	100%

B. Participation Rates

	% Participating	
Program	**Existing**	**New**
Flex Time		
Compressed 4/40		
Compressed 9/80		
Staggered Hours		
Telecommute		
Not Participating	100%	100%
Total	100%	100%

"Alternative Work Schedules" include the option to allow employees to utilize flex time, compressed work weeks, staggered work hours, or telecommuting. Flex time and staggered hours will have the effect of shifting some trips outside of the peak period, while compressed work weeks and telecommuting will have the effect of eliminating some work trips. Two program entry options are available:

(1) The user can specify the percentage of employees eligible for each program. Both existing and new levels of eligibility should be specified.

(2) The user can specify existing and expected participation rates for each program.

To accomodate instances where employees are eligible for, or participate in multiple programs, the model allows the user to enter rates that exceed 100% when summed across all alternative programs. The model then internally normalizes the rates before using them in the travel calculations. Section 4.5 of the COMMUTER Model User Manual presents an example for this situtation.

IMPORTANT: Entry option (2) should not be utilized unless the user has definitive data indicating a likely participation rate as a result of proposed programs. If participation rates are specified, the employer/analyst should document existing support programs and programs to be implemented, along with survey or other data indicating the basis for the participation rate estimates.

Definition of Alternative Work Schedule Strategies

Flex-Time - In this policy, employees can adjust their work schedule (based on when they arrive at and depart from the work site) in order to travel during the off-peak hours, when there should be less traffic congestion. COMMUTER assumes a formal Flex-Time policy

rather than flexible work schedules. Flexible work schedules are seen as simply allowing employees who would carpool or take transit to arrive or leave with slight variations in order to be compatible with the pool/bus schedule. In contrast, a Flex-Time policy involves formally moving the time of arrival or departure to a set of consistent work hours that are different from the employer's official hours. This type of policy may actually detract from employees' incentive to carpool or take transit as a means of avoiding traffic congestion. The only assumed effect of this strategy is to shift the time of the trips, no vehicle trips are eliminated.

Staggered Work Hours - Under this strategy, employers establish different starting times for groups of employees in order to avoid having the entire workforce arrive or leave at the same time. Some work sites have a large number of employees arriving within a very narrow time period, so staggering starting hours can help reduce localized traffic problems. This strategy is also assumed to affect only the timing of the trips, not the number of vehicle trips.

Compressed Work Week - Under this strategy, employees are allowed to reduce the number of work trips made by working longer hours on fewer days per week. Options include the 4/40 schedule where 40 hours are worked in 4 days with the fifth day off and the 9/80 schedule where 80 hours are worked in 9 days with the tenth day off. COMMUTER assumes that the 4/40 schedule eliminates one round-trip a week (1/5 of a daily trip) and that the 9/80 schedule eliminates one round-trip every two weeks (1/10 of a daily trip) for each participating employee.

Telecommuting - This strategy involves allowing employees to work off-site, usually at home via telecommunications linkups, one or more days per week. Telecommuting thus reduces the demand for travel to the workplace. This is accounted for in COMMUTER by simply removing person trips, along with the equivalent number of vehicle trips, from the total amount of travel. (A more sophisticated analysis would consider how some of the commute trips might be replaced by non-work travel.)

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5. EMISSIONS-RELATED INPUT SCREENS

In the final two input screens, you will supply the information that COMMUTER needs to calculate emission reductions. (If you are only interested in using COMMUTER to compute travel impacts, you don't need to enter any input information these two screens.)

To make this easier, a large matrix of MOBILE5b emission factors was generated for a series of local conditions and pre-loaded into the program. (A total of 24 different sets of emission factors are contained in COMMUTER.) To use these pre-loaded factors, all that you need to do is supply a simple set of vehicle fleet characteristics, and COMMUTER will then look up the appropriate set of MOBILE5b factors and use them to calculate emission reductions from the TCM programs being evaluated. Thus, you do not have to supply detailed, locally generated MOBILE5b emission factors.

If you are an experienced MOBILE5b user, however, and want to use emission factors that exactly match your local conditions, you can optionally direct COMMUTER to import and apply your locally generated factors. (Refer to Section 2.7 for step-by-step details on generating and properly importing your own MOBILE5b emission factors into COMMUTER.)

5.1 Fleet Emissions Information

In the first emissions-related input screen, you will provide the data needed for the program to select the appropriate set of pre-loaded MOBILE5b emission factors or activate the User-Supplied Emission Factors" option if you want to use your own locally generated MOBILE5b factors.

Figure 13 shows the layout of this screen. If you want to use the pre-loaded emission factors contained in COMMUTER, follow the input requirements under "Using Pre-Loaded Factors." To use your own factors, see "Using Locally Generated Factors."

Using Pre-Loaded Factors - To use pre-loaded factors, you must select from the available fleet characteristic options in the **MOBILE Scenario** section at the top of the screen that best match your local conditions. (Leave the "User-Supplied Emission Factors" and "Calendar Year of User EFs" cells toward the bottom of the screen blank.)

Figure 13
Fleet Emissions Information Input Screen

FLEET EMISSIONS INFORMATION

Field	Data	Notes

MOBILE Scenario Inputs

Calendar Year of Analysis		Enter either 2000, 2002, 2005, 2010 or 2020
Season		S = Summer, W = Winter
I/M Program Type		0 (zero) = none, 1 = Basic I/M, 2 = Enhanced I/M
Fuel Volatility Class		B = Class B (Control Rgn 1), C = Class C (Control Rgn 2)
Fuel Control Program		0 = Conventional Gasoline, 1 = Reformulated Gasoline, 2 = Winter Oxygenated Fuel

The "MOBILE Scenario" inputs are used by the program to select a specific set of MOBILE5b emission factors from a series of stored tables that best represent local conditions and emission control programs being modeled. These inputs are familiar to MOBILE5b users. Further clarification of these inputs for users less familiar with the MOBILE5b emission factor model is provided below.

Calendar Year - Because new vehicle emission levels continue to decrease with the introduction of each model year, current and future vehicle fleet emissions will depend on the calendar year being analyzed.

Season - Enter either S for summer or W for winter.

I/M Program Type - The type of Inspection and Maintenance program, if any, being operated. Basic I/M refers to a program where a simple "no-load" idle or 2500 RPM test is performed. Enhanced I/M represents programs in which a loaded IM240 or ASM test are run on a dynamometer.

Fuel Volatility Class - Under EPA rulemaking related to fuel volatility ("Volatility Regulations for Gasoline and Alcohol Blends Sold in Calendar Years 1992 and Beyond, " 55 FR 23658, June 11, 1990), the U.S. has been divided into two VOC Control Regions. Generally speaking, Volatility Class B (Control Region 1) covers the southern U.S.; Volatility Class C encompasses the northern states. If in doubt, contact your EPA Regional Office to identify the correct Fuel Volatility Class.

Fuel Control Program - Under the 1990 amendments to the Clean Air Act, certain areas of the country must use reformulated gasoline (RFG) beginning in 1995. This input allows the user to specify whether RFG is being used and to include benefits of additional wintertime oxygenate blends beyond the level required under RFG.

NOTE TO MOBILE5b USERS: The daily temperature profile used by this program is based upon profiles developed by EPA as a function of season and fuel volatility class in its analysis of RFG benefits using the Complex Model. These profiles are as follows: Summer/Class B - 69 to 94 deg F; Summer/Class C - 72 to 92 deg F; Winter (either class) - 39 to 57 deg F.

User-Supplied MOBILE Emission Factors

User-Supplied Emission Factors	☐	Mark the box to the left (with an "X") to compute emission reductions using alternate MOBILE5b emissions factors instead of the pre-loaded factors already contained in the COMMUTER model
Calendar Year of User EFs		Select the calendar year of the user-supplied emission factors

The COMMUTER model has been designed to use pre-loaded MOBILE5b emission factors for a defined range of input conditions or a set of user-supplied emission factors for specific local conditions. Before user-supplied emission factors can be used, they must be loaded into model using the "Import Emission Factors" command from the File menu. If the box above is marked and no user-supplied factors have been loaded, the model will signal an error when you try to view output results.

The "Calendar Year of User EFs" input identifies the specific calendar year factors from the set of user-supplied factors. You can load user-supplied emission factors for any number of individual calendar years. This input allows you to select and compute emission impacts for any one of the calendar years for which emission factors were supplied. If you enter a calendar year that doesn't match those in the user-supplied factors, an error is signaled.

Note: The VMT mixes (percent of travel by vehicle class) contained in the user-supplied emission factors are automatically loaded into the model and used in the emission calculations. If you are computing impacts with user-supplied emission factors, you cannot change the VMT mix from the "Other Emission-Related Data" input screen. When applying user-supplied emission factors, the VMT mix must be specified in the MOBILE5b runs. However, you must still supply affected vehicle speed and cold start percentage inputs in the "Other Emissions-Related Data" screen, regardless of whether pre-loaded or user-supplied emission factors are being used.

Each of these "pre-loaded" fleet characteristics inputs is explained below.

- **Calendar Year** - Since vehicle fleet emission levels change as new technology improvements are introduced on newer cars, the calendar year that represents the analysis scenario must be entered.

  You can choose either 2000, 2002, 2005, 2010, or 2020. If you are interested in an analysis year between two of those years, the model should be run for both of the surrounding years (for example, if you are interested in 2008, you should run analyses for both 2005 and 2010). You will then need to interpolate the resulting travel and emission impacts to represent impacts in the year of interest.

  When you choose the year, you should keep in mind the time period when the TCM programs being modeled will actually be implemented. For example, in evaluating improved levels of transit service, it may take a couple of years to implement the service improvements.

- **Season** - The choice of vehicle emission factors is affected by the ambient temperature, and, in some areas, fuel controls that are imposed only during certain seasons. You therefore need to enter the season for the analysis of interest, selecting either "S" (summer) or "W" (winter). If you are an air quality planner, you will generally select summer when evaluating ozone or particulate-related emission reductions, and winter for carbon monoxide-triggered evaluations.

- **I/M Program Type** - The presence of an Inspection and Maintenance (I/M) program will affect vehicle fleet emissions. There are three levels of I/M programs for you to choose from:

1. None - no I/M program operating in the region being analyzed;

2. Basic I/M - an I/M program where a simple "no-load" idle or 2500 RPM tailpipe emissions test is performed along with a visual inspection; and

3. Enhanced I/M - I/M programs in which loaded IM240 or ASM emission tests are conducted on a chassis dynamometer in conjunction with a visual and functional emission control system inspection.

   You should select and enter the level of I/M that most closely matches the type of program being operated in the analysis area.

- **Fuel Volatility Class** - You must select either "B" or "C" to represent the gasoline volatility class of the analysis region. These have been assigned under EPA's final volatility control regulations.[2] Under this rulemaking, the U.S. has been divided into two VOC (volatile organic compound) control regions, each of which has certain specifications for reformulated gasoline.

If you are within VOC Control Region 1, you should enter "B." If you are in an area in VOC Control Region 2, you should enter "C."* Generally speaking, volatility class B (Control Region 1) covers the southern part of the U.S., and volatility class C encompasses the northern states. If uncertain about which area the analysis region is in, contact your EPA Regional Office.

- **Fuel Control Program** - Under the 1990 amendments to the Clean Air Act, certain areas must use reformulated gasoline (RFG) beginning in 1995. This parameter allows you to specify if RFG is being used in the analysis region and whether effects of additional wintertime oxygenated blends should be included. You should select and enter one of the following values:

  0 - for conventional gasoline;
  1 - for reformulated gasoline; or
  2 - for wintertime oxygenated fuel.

Using Locally Generated Factors - Once you have successfully imported your own locally generated MOBILE5b emission factors into COMMUTER as described in Section 2.7, you can direct COMMUTER to apply them in the emission reduction calculations by marking the "User-Supplied Emission Factors" box (with an "X") toward the bottom of the screen. Once you activate this option, you must then enter the specific calendar year of the emission factors you've imported in the "Calendar Year of User EFs" input cell. (This input is used to select a specific calendar year from a set of factors you've imported that may encompass multiple calendar years. Even if you've only imported emission factors for a single year, you must enter it into this input cell.)

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Experienced MOBILE5 users should note that the combination of season and fuel volatility class inputs is used to select the daily temperature profile upon which the emission factors are based. These daily temperature profiles as a function of season and volatility class are the same as those used by EPA in its analysis of reformulated gasoline benefits using the Complex Model. These temperature profiles are as follows:

- Summer, Class B - 69°F to 94°F;
- Summer, Class C - 72°F to 92°F; and
- Winter, either class - 39°F to 57°F.

NOTE: *When you activate the "User-Supplied Emission Factors" option, any entries you may have made in the "MOBILE Scenario Inputs" cells at the top of the screen are ignored. In addition, the vehicle fleet mix that you've specific in your locally generated emission factors file is automatically loaded into the appropriate cells in the "Other Emissions-Related Data" screen that follows.*

5.2 Other Emissions-Related Data

In this final input screen, you will provide additional emission-related inputs that COMMUTER will then use in conjunction with the MOBILE5b emission factors discussed in Section 5.1 to calculate "before TCM" (i.e., existing) and "after TCM" daily emissions for the vehicle fleet. It will then determine the resulting emission reductions from the TCMs being evaluated.

Figure 14 shows the Other Emissions-Related Data input screen. Each of the inputs you will be required to enter is described below.

Vehicle Fleet VMT Mix - The vehicle fleet is composed of eight different classes of vehicles, which are listed on the screen. The VMT mix for the vehicle fleet refers to the percent of the total travel (VMT) that is driven by each of the eight vehicle classes. The emission factors in MOBILE5b are based on vehicle class. COMMUTER will calculate emissions for the entire vehicle fleet (referred to as the fleet composite emissions) based on the percentage of VMT in each vehicle class, by weighing the emission factors together according to the fleet mix input.

If known, you should supply local data on fleet mix for the analysis area in the "Local" column. *Be sure that the percentages supplied sum to 100.* If they do not, you will see an error message when you attempt to view, print, or save the analysis results.

If local data are not available, you can check the boxes in the "Use Default" column to use the national default fleet mixes obtained from MOBILE5b. Note that the default fleet mixes vary by calendar year and season.

As indicated in Section 5.1, if you are using your own locally generated emission factors, the VMT mix from your MOBILE5b emission factor file is automatically loaded into these input cells.

Affected Vehicle Speeds - The values you enter here should represent existing average vehicle speeds in your region. You should be able to obtain data on average travel speeds from transportation planning staff at the regional transportation planning agency. Even if you are running a site-specific analysis, enter speeds that represent averages for your urban region.

Figure 14
Other Emissions-Related Data Input Screen

OTHER EMISSIONS-RELATED DATA

	Use Default	Data: Local	Data: Default	Explanatory Notes
Vehicle Fleet VMT Mix	☐			Percentages of total VMT by vehicle type
LDGV - Light-Duty Gas Vehicles				
LDGT1 - Light-Duty Gas Trucks 1				To 6,000 lbs GVW (gross vehicle weight)
LDGT2 - Light-Duty Gas Trucks 2				From 6,001 to 8,500 lbs GVW
HDGV - Heavy-Duty Gas Vehicles				Over 8,500 lbs GVW
LDDV - Light-Duty Diesel Vehicles				
LDDT - Light-Duty Diesel Trucks				To 8,500 lbs GVW
HDDV - Heavy-Duty Diesel Trucks				Over 8,500 lbs GVW
MC - Motorcycles				
TOTAL (must add to 100%)		0.0%		
Affected Vehicle Speed (mph)	☐			Average speed (mph) of TCM-affected trips
Peak Period Average Speed			34.6	
Off-Peak Period Average Speed			39.7	
Cold Start Percentages	☐			Percent of trips that start "cold"
Baseline - Peak Period			48.0%	Peak period trips that start cold
Baseline - Off-Peak Period			40.0%	Off-peak period trips that start cold
Eliminated Trips - Peak			48.0%	TCM-eliminated peak trips that start cold
Eliminated Trips - Off-Peak			40.0%	TCM-eliminated off-peak trips that start cold

Vehicle Fleet VMT Mix

MOBILE5b generates emission factors for each of the eight different vehicle classes listed. Fleet "composite" emission factors are then calculated by weighting these emission factors by the percentage of travel (i.e., VMT) in each vehicle class. The default VMT mixes provided by this program are MOBILE5b national default values. These defaults are calendar year and season specific. This input is required only when you are using the pre-loaded emission factors. If user-supplied factors are used, the VMT mix is obtained automatically from the MOBILE5b runs and these input cells are ignored.

Affected Vehicle Speed

Vehicle emissions vary with speed. The values entered here should represent regional network average speeds during the peak and off-peak periods. Default values supplied are based upon HPMS (Highway Perfermance Monitoring System) averages compiled by urban area size. This input must always be entered whether using either pre-loaded or user-supplied emission factors.

Cold Start Percentages

Emission factor models address the fact that vehicles have higher emission rates when started "cold" before the catalyst and engine are fully warmed up. In MOBILE5b, trips are defined as either cold starts or hot starts, depending on the time the engine was off (referred to as "soak time") prior to the previous trip. A cold start is defined as any start with a soak time of at least 4 hours for non-catalyst vehicles and at least 1 hour for catalyst vehicles. In MOBILE5b, all other starts are hot starts. For example, if the cold start percentage is 80%, the hot start percentage is 20% (100-80). The user must enter the cold start trip percentage of trips for both the baseline trips and for the trips that would be eliminated by TCMs. Note that separate cold start percentages must be entered for both peak and off-peak periods. This input must always be entered whether using either pre-loaded or user-supplied emission factors.

NOTE TO MOBILE5b USERS: The cold start percentage inputs used by this program should not be confused with the operating mode fraction inputs required by MOBILE5. Those fractions include specification of the amount of stabilized (Bag 2) operation. In this program, the amount of stabilized operation is internally calculated from the start percentage inputs and the average trip length.

You will need these values for both peak and off-peak periods.* Peak period travel speed should be the average of travel speeds in the AM and PM peak periods, if these values differ.

> ***CAUTION:*** *Do not specify travel speeds at a geographic area smaller than the county level. Even if you are performing a site-specific analysis, the speed inputs should reflect average regional network travel speeds that employees at the site experience driving to and from work.*

You may also choose to use default travel speeds, shown in Table 2, if local data from the regional MPO are not available. These default values have been estimated from national highway data. Travel speeds will vary depending on metropolitan area size, since larger areas tend to be more congested.

Table 2
Default Speeds (mph) by Area Size

Metropolitan Area Size	Peak Period	Off-Peak
1 - greater than 2 million	31.8	37.1
2 - 750,000 to 2 million	34.6	39.7
3 - less than 750,000	34.8	39.7

Cold Start Percentages - This refers to the percentage of the vehicles trips that are made from a "cold" start.** Vehicles have higher emission rates when started "cold" before the catalyst and engine are fully warmed up. Therefore, emission factor models, including

* In most cases, the MPO for a given region is responsible for both transportation planning and emissions analysis. The MPO maintains local data related to travel demand, speed, and emissions inventories for regional planning purposes. These data are typically available to member agencies (counties, cities, transit operators) and businesses. Metropolitan-level emissions inventory data sets generally provide local data on travel speeds by peak and off-peak periods that are generated from the travel demand modeling process and used in regional air quality conformity analysis.

** MOBILE5b users should not confuse the cold start percentage inputs used by this program with the operating mode fraction inputs required by MOBILE5b. Those fractions include specifying the amount of stabilized (Bag 2) operation. In COMMUTER, the amount of stabilized operation is calculated internally from the start percentage inputs and the average trip length.

MOBILE5b, require that trips be defined as either “cold starts” or “hot starts,” depending on how long the engine has been turned off (referred to as “soak time”) since the previous trip.

A cold start is defined as any start with a soak time of at least four hours for non-catalyst vehicles (in other words, it has been at least four hours since the vehicle was turned off after the previous trip); for vehicles equipped with a catalyst, it refers to any start after a soak time of at least one hour. In MOBILE5b, all other starts are hot starts. For example, if the baseline peak period cold start percentage is 80%, the hot start percentage is 20% (100-80).

You must supply the percentage of all trips under baseline travel conditions (before implementation of the TCMs) that are estimated to start cold, estimating this separately for both the peak and off-peak periods. (These periods were defined earlier in Section 3.2.) Many metropolitan areas that have had to prepare detailed emission inventories have developed estimates of these percentages. You should contact the local air quality or transportation planning agencies for this information

You must also enter the cold-start percentage for the number of trips that would be eliminated by the TCMs being evaluated, again in both the peak and off-peak periods. For example, if 100 trips were being eliminated during the peak period and 90 of those were from a cold start, the cold start percentage would be 90. Because “eliminated trip” cold start percentages are usually not readily available, you may wish to use the default values, as explained below. If you do not want to use defaults for this input, you should consider the types of TCM programs being evaluated and the specific trips that these programs would eliminate. For example, door-to-door carpool/vanpool programs are focused on eliminating morning-evening commute trips, which are almost always (close to 100%) cold start trips.

If local data are not available, you can use the default values supplied by COMMUTER, which are based upon instrumented vehicle measurements collected by EPA. To use the default values, simply check the boxes in the “Use Defaults” column.

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6. REFERENCES

1. J. R. Kuzmyak, et. al., "Procedures Manual for Estimating Emission Reductions from Voluntary Measure and Commuter Choice Incentive Programs", prepared for the U.S. Environmental Protection Agency," Draft Final Report, September 19, 1999.

2. Federal Register, Vol. 55, pg. 23658, June 11, 1990.

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