

COMMUTER Model v2.0 User Manual

COMMUTER Model v2.0 User Manual

Transportation and Regional Programs Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Prepared for EPA by
Thomas R. Carlson, Sierra Research, Inc.
Robert G. Dulla, Sierra Research, Inc.
J. Richard Kuzmyak

Updated by
Christopher D. Porter
Cambridge Systematics, Inc.
EPA Contract No. GS-10F-0198N

NOTICE

*This technical report does not necessarily represent final EPA decisions or positions.
It is intended to present technical analysis of issues using data that are currently available.*

*The purpose in the release of such reports is to facilitate the exchange of
technical information and to inform the public of technical developments which
may form the basis for a final EPA decision, position, or regulatory action.*

Table of Contents

	<u>page</u>
1. INTRODUCTION	1
1.1 What is the COMMUTER model?	1
1.2 Who will use COMMUTER?	1
1.3 Why was COMMUTER created?	1
1.4 What Programs can I evaluate with COMMUTER?	2
1.5 What methodology does COMMUTER use?	2
1.6 When can I use COMMUTER, and when should I not use it?	3
1.7 What do I need to do to get started?	4
1.8 What other documentation is available?	5
1.9 What has Changed Compared to COMMUTER Version 1.0?	5
2. USING THE MODEL	7
2.1 What type of computer equipment and software do I need?	7
2.2 How do I install and operate COMMUTER?	7
2.3 How do I begin once the program is installed?	10
2.4 How do I input data?	11
2.5 Is there help available when inputting data?	14
2.6 Can I save my inputs to use in another analysis?	16
2.7 Can I use my own emission factors?	16
2.8 How do I view the results?	18
2.9 How do I print my data and results?	19
2.10 Can I tell the model to remember where my files are stored?	21
2.11 What do I do when I'm finished?	22
3. GENERAL INPUT SCREENS	23
3.1 Scenario Information	23
3.2 Local Data	28
3.3 Edit Coefficients	32
4. TCM-SPECIFIC DATA	35
4.1 Site Access and Transit Service Improvement Programs	35
4.2 Financial Incentive and Parking Cost Programs	39
4.3 Site-Specific Employer Support Programs	41
4.4 Area-Wide Employer Support Programs	45
4.5 Alternative Work Schedule Programs	46
5. EMISSIONS-RELATED INPUT SCREENS	50
5.1 Fleet Emissions Information	50
5.2 Other Emissions-Related Data	55
6. REFERENCES	59

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 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 COMMUTER Model v2.0.*"^{1*}

1.9 What has Changed Compared to COMMUTER Version 1.0?

COMMUTER Model version 1.0 was originally released in 2000. Version 2.0, released in 2005, incorporates a number of updates and changes to calculation procedures, to make use of the most recently available travel and emissions data and to expand the model's capabilities. Significant changes include the following:

- The default travel parameters (e.g., mode shares, trip lengths) have been updated using data from the 2000 U.S. Census, the 2001 Nationwide Household Transportation Survey, and other recent sources.
- The default and area-specific mode choice coefficients have been updated based on a review of current national practice. Default coefficients are no longer provided for different area sizes, since a review of the coefficients did not find significant differences among urban areas of different sizes.
- Some of the TCM impact values embedded in the model have been updated, based on recent research. These include the mode share impacts for "level 3" and "level 4" carpooling and vanpooling support, and default participation level for telecommuting programs.
- Emissions are now calculated using MOBILE6.2, EPA's most current version of the MOBILE emission factor model, rather than MOBILE5b.
- Emissions are reported for seven additional pollutants, including particulate matter (PM2.5, users can get PM10 output by importing their own MOBILE6.2 runs with PM10 output) and six air toxics, as well as for the four pollutants originally reported by COMMUTER - volatile organic compounds (VOC), carbon monoxide (CO), oxides of nitrogen (NOx), and carbon dioxide (CO2). Emissions for some pollutants are now reported in pounds per day as well as in tons per day.

* Superscripts denote references provided in Section 6.

**Figure 3
Model Layout Screen**

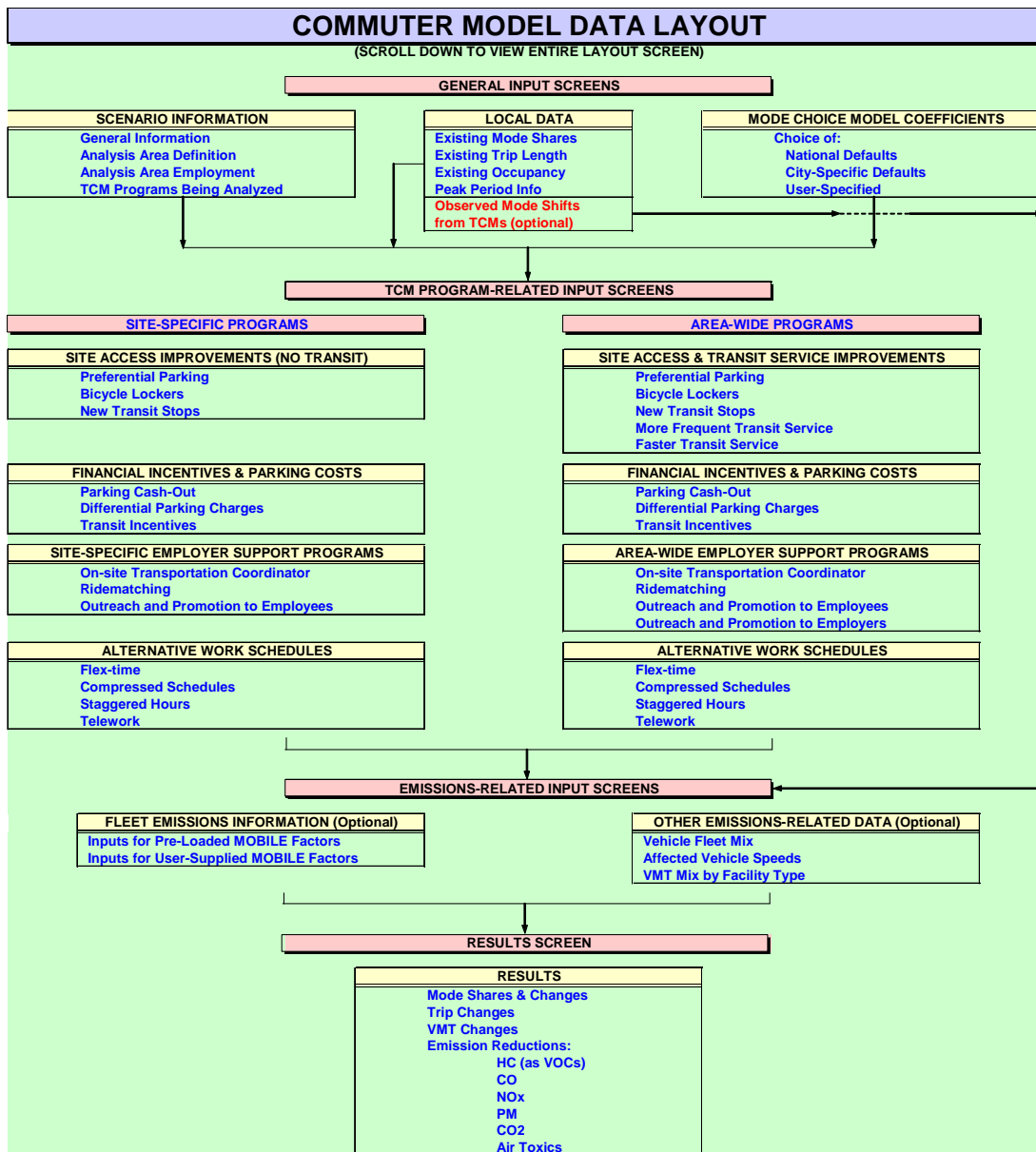


Figure 4

COMMUTER MODEL RESULTS

SCENARIO INFORMATION

Description	
Scenario Filename	
Emission Factor File	
Performing Agency	
Analyst	
Metropolitan Area	
Area Size	
Analysis Scope	
Analysis Area/Site	
Total Employment	

PROGRAMS EVALUATED

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

- User-Supplied Final Mode Shares

MODE SHARE IMPACTS

Mode	Baseline	Final	%Change
Drive Alone			
Carpool			
Vanpool			
Transit			
Bicycle			
Pedestrian			
Other			
No Trip			
Total			

Shifted from Peak to Off-Peak	
-------------------------------	--

TRAVEL IMPACTS (relative to affected employment)

Quantity	Peak	Off-Peak	Total
Baseline VMT			
Final VMT			
VMT Reduction			
% VMT Reduction			
Baseline Trips			
Final Trips			
Trip Reduction			
% Trip Reduction			

EMISSION REDUCTIONS (positive values are decreases)

lbs/day:

Pollutant	Peak	Off-Peak	Total
HC			
CO			
NOx			
PM2.5			
Toxics			
Acetaldehyde			
Acrolein			
Benzene			
1, 3-Butadiene			
Formaldehyde			
MTBE			
CO2			

tons/day:

Pollutant	Peak	Off-Peak	Total
HC			
CO			
NOx			
CO2			

Figure 7
Edit Coefficients Input Screen

MODE CHOICE MODEL COEFFICIENTS

Check	DEFAULTS BY AREA SIZE	IVTT (min)	OVTT (min)		Cost (cents)	
		All Modes	Walk Time	Transit -- Wait	Auto - Parking	Transit - Fare
	All Areas	-0.0253	-0.0473	-0.0466	-0.0056	-0.0040
	User-Specified					
	Coefficients Used: Boston	-0.0314	-0.0330	-0.0550	-0.0173	-0.0083

Mode choice model coefficients are entered in this screen. The program retrieves default coefficients based on national average from numerous cities' models. However, these defaults are typically 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 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.

Note to previous COMMUTER users: In COMMUTER Version 2.0, metropolitan area size is no longer used to select the default mode choice coefficients. A review of recently developed coefficients found that these coefficients do not show a significant variation by area size.

Check	CITY-SPECIFIC DEFAULTS		IVTT	OVTT		Cost	
	City	Year	All Modes	Walk Time	Transit -- Wait	Auto - Parking	Transit - Fare
	Albuquerque	1992	-0.0209	-0.0219	-0.0978	-0.0031	-0.0031
	Atlanta	2002	-0.0256	-0.0639	-0.0256	-0.0031	-0.0013
	Baltimore	1993	-0.0300	-0.0750	-0.0750	-0.0043	-0.0043
	Boston	1991	-0.0314	-0.0330	-0.0550	-0.0173	-0.0083
	Chicago	1990	-0.0282	-0.0440	-0.0960	-0.0021	-0.0008
	Cleveland	1994	-0.0178	-0.0444	-0.0378	-0.0034	-0.0024
	Columbus	1999	-0.0213	-0.0640	-0.0465	-0.0016	-0.0016
	Dallas	1996	-0.0544	-0.0640	-0.0640	-0.0056	-0.0055
	Denver	1997	-0.0180	-0.0540	-0.0180	-0.0014	-0.0012
	Detroit	1996	-0.0512	-0.0186	-0.0186	-0.0041	-0.0041
	Houston	1985	-0.0220	-0.0568	-0.0568	-0.0154	-0.0061
	Los Angeles	1996	-0.0450	-0.1073	-0.0423	-0.0025	-0.0025
	Milwaukee	1991	-0.0157	-0.0412	-0.0412	-0.0045	-0.0045
	New York	1996	-0.0113	-0.0380	-0.0554	-0.0004	-0.0004
	Philadelphia	1986	-0.0391	-0.0316	-0.0511	-0.0026	-0.0012
	Phoenix	1991	-0.0167	-0.0206	-0.0304	-0.0053	-0.0053
	Portland	1994	-0.0394	-0.0646	-0.0397	-0.0135	-0.0135
	Reno	1991	-0.0275	-0.0550	-0.0550	-0.0167	-0.0067
	Sacramento	2001	-0.0250	-0.0380	-0.0380	-0.0026	-0.0026
	San Diego	1995	-0.0250	-0.0500	-0.0250	-0.0069	-0.0026
	San Francisco	1990	-0.0333	-0.0931	-0.0523	-0.0021	-0.0021
	San Juan	1990	-0.0366	-0.0717	-0.0752	-0.0066	-0.0066
	Santa Cruz	1990	-0.0163	-0.0325	-0.0325	-0.0045	-0.0036
	Seattle	1990	-0.0176	-0.0206	-0.0155	-0.0024	-0.0024
	Tucson	2000	-0.0178	-0.0400	-0.0200	-0.0018	-0.0018
	Washington D.C.	1994	-0.0300	-0.0750	-0.0750	-0.0043	-0.0043

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%.)

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: Entry option (2) should only be utilized if the user has evidence, such as survey data, suggesting 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.

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.

Figure 13a Fleet Emissions Information Input Screen (p. 1)

FLEET EMISSIONS INFORMATION		
Field	Data	Notes
MOBILE Scenario Inputs		
Calendar Year of Analysis		Enter either 2007, 2009, 2010, 2013, 2019, or 2021
Season		S = Summer, W = Winter
Climate Type		1 = Mild, 2 = Moderate, 3 = Severe
I/M Program Type		0 (zero) = none, 1 = Basic I/M, 2 = Enhanced I/M, 3 = OBD Only
Fuel Type		C = Conventional, R = RFG
PADD		1, 2, 3, 4, or 5 (based on state - see below)
<p>The "MOBILE Scenario" inputs are used by the program to select a specific set of MOBILE6.2 emission factors from a series of stored tables that best represent local conditions and emission control programs being modeled. These inputs are familiar to MOBILE6.2 users. Further clarification of these inputs for users less familiar with the MOBILE6.2 emission factor model is provided below. Once the user has entered all scenario inputs, or changed an input, he or she must import the scenario emission factors using the "Import Default Emission Factors" command from the File menu.</p> <p>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.</p> <p>Season - This input affects the temperature range for which emissions are modeled (emissions characteristics of vehicles vary depending upon the temperature range in which the vehicle is being operated.) The choice of season may depend upon which pollutants are of greatest interest. Since ozone is typically a summer problem and carbon monoxide (CO) is typically a winter problem, summer should generally be used if ozone is of primary interest, while winter should be used if reducing CO is of primary interest. The seasonal importance of other pollutants may vary regionally.</p> <p>Climate Type - This input is used on conjunction with the "season" input to determine default temperature ranges for the model. Choose the climate type (1 = mild, 2 = moderate, 3 = severe) that most closely matches the average daily minimum and maximum temperatures in your area (in deg F) as specified below:</p> <ul style="list-style-type: none"> Summer - Mild: min 55/max 75 Summer - Moderate: min 65/max 85 Summer - Severe: min 75/max 95 Winter - Mild: min 52/max 72 Winter - Moderate: min 32/max 52 Winter - Severe: min 12/max 32 <p>If the user is interested, monthly normal temperatures for 250 cities can be looked up through the National Climatic Data Center, http://www.ncdc.noaa.gov/oa/ncdc.html.</p> <p>I/M Program Type - The type of Inspection and Maintenance (I/M) 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. OBD Only represents programs in which vehicles are not subject to an annual or biennial inspection, but instead emissions malfunctions are identified by a vehicle's on-board diagnostics (OBD) system.</p> <p>Fuel Type - 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. A map and list of counties in which RFG is required is provided on the EPA's web site, http://www.epa.gov/OMSWWW/rfg/wherelive.htm.</p> <p>PADD - (Petroleum Administration for Defense District) - PADD's were delineated during World War II to facilitate oil allocation. The characteristics of refined fuels, and therefore the emissions characteristics of vehicles, vary generally by PADD. The most significant effect is on emissions of air toxics. Select the appropriate PADD (1 – 5) based on your analysis state:</p> <ul style="list-style-type: none"> 1 - East Coast: Connecticut, Delaware, District of Columbia, Florida, Georgia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, South Carolina, Vermont, Virginia, West Virginia. 2 - Midwest: Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, North Dakota, South Dakota, Ohio, Oklahoma, Tennessee, Wisconsin. 3 - Gulf Coast: Alabama, Arkansas, Louisiana, Mississippi, New Mexico, Texas. 4 - Rocky Mountain: Colorado, Idaho, Montana, Utah, Wyoming. 5 - West Coast: Alaska, Arizona, California, Hawaii, Nevada, Oregon, Washington. <p>For a map of PADDs, see: http://www.eia.doe.gov/pub/oil_gas/petroleum/analysis_publications/oil_market_basics/paddmap.htm.</p>		

**Figure 14
Other Emissions-Related Data Input Screen**

	Use	Data		Explanatory Notes
		Default	Local	
Vehicle Fleet VMT Mix	<input type="checkbox"/>			Percentages of total VMT by vehicle type
LDGV - Light-Duty Gas Vehicles			#N/A	Passenger Cars
LDGT1 - Light-Duty Gas Trucks 1			#N/A	0-6,000 lbs. GVWR, 0-3,750 lbs. LVW
LDGT2 - Light-Duty Gas Trucks 2			#N/A	0-6,000 lbs. GVWR, 3,750-3,750 lbs. LVW
LDGT3 - Light-Duty Gas Trucks 3			#N/A	6,000-8,500 lbs. GVWR, 0-5,750 lbs. ALVW
LDGT4 - Light-Duty Gas Trucks 4			#N/A	6,000-8,500 lbs. GVWR, over 5,750 lbs. ALVW
LDDV - Light-Duty Diesel Vehicles			#N/A	Passenger Cars
LDDT12 - Light-Duty Diesel Trucks 1 & 2			#N/A	0-6,000 lbs. GVWR
LDDT34 - Light-Duty Diesel Trucks 3 & 4			#N/A	6,000-8,500 lbs. GVWR
MC - Motorcycles			#N/A	Gasoline
TOTAL		0.0%	#N/A	If not 100%, model will normalize
Affected Vehicle Speed (mph)	<input type="checkbox"/>			Average speed (mph) of TCM-affected trips
Peak Period Average Speed - Freeways			50.5	
Off-Peak Period Average Speed - Freeways			56.4	
Peak Period Average Speed - Arterials			24.2	
Off-Peak Period Average Speed - Arterials			26.0	
Percent of VMT by Facility Type	<input type="checkbox"/>			
Freeway			34.2%	
Arterial			49.8%	
Local Road			13.1%	
Ramp			3.0%	
TOTAL (must add to 100%)		0.0%	100.0%	

Vehicle Fleet VMT Mix

MOBILE6 generates emission factors for each of the nine 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 MOBILE6 national default values. These defaults are calendar year specific; **you must enter a calendar year under the Fleet Emissions Information screen before the defaults will appear.** If you are using user-supplied emission factors, the emissions factor import routine will automatically generate and look up a VMT mix from your MOBILE6 output file. If you are using default emission factors and do not enter local data for a VMT mix, the model will use the default MOBILE6 VMT mix.

Only the light-duty vehicle mix (vehicles <8,500 lb.) is required, since the strategies analyzed by COMMUTER are not intended to affect travel by heavy-duty vehicles (trucks). The user may specify the VMT mix either as a percentage of all vehicles, or as a percentage of light-duty vehicles. If the total of the light-duty vehicle categories entered is less than 100%, the model will assume that the user is entering the percentage of all vehicles (including heavy-duty) and will normalize these percentages to total 100% (representing the fraction of light-duty vehicles).

Note: GVWR = Gross Vehicle Weight Rating; LVW = Loaded Vehicle Weight; ALVW = Adjusted Loaded Vehicle Weight.

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 Performance Monitoring System) averages compiled by urban area size.

Percent of VMT by Facility Type

Vehicle emissions vary by roadway facility type because of the different traffic operating characteristics on different facilities (e.g., freeway travel typically involves less starting and stopping than travel on other roads). MOBILE6 defines four facility types: freeways, arterials, local roads, and freeway ramps. If user-supplied emission factors are provided, the facility mix will be read from the user-supplied MOBILE output files and the user does not need to specify the mix. If default emissions factors provided with the COMMUTER model are used, you may either specify a local facility mix or use the default mix that is provided with the model.

