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Technical Guidance on the Use of MOBILE6.2 for Emission Inventory Preparation

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

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 an exchange of technical information and to inform the public of technical developments.

CONTENTS

1.0 Introduction 1

2.0 External conditions 2
2.1 Calendar year of evaluation 3
2.2 Month of Evaluation 3
2.2.1 Guidance 3
2.2.2 Description 4
2.3 Altitude 5
2.4 Temperature 5
2.4.1 Guidance 5
2.4.2 Description 5
2.4.3 Methods 6
2.4.3.1 Methods for assigning values for minimum and maximum temperature 6
2.4.3.2 Methods for hourly temperature input 7
2.4.4 MOBILE6.2 Commands 7
2.5 Humidity 8
2.5.1 Guidance 8
2.5.2 Description 8
2.5.3 Methods 9
2.5.3.1 Methods 9
2.5.3.1 Methods 10
2.5.4 MOBILE6.2 Command 11
2.6 Other air-conditioning related input options 11
2.6.1 Guidance 11
2.6.2 MOBILE6.2 Commands 11

3.0 Vehicle Fleet Characteristics 12
3.1 Age Distribution of Vehicle Registrations 13
3.1.1 Guidance 13
3.1.2 Description 13
3.1.3 Methods 13
3.1.4 MOBILE6.2 Command 15
3.2 Annual mileage accumulation rates 15
3.2.1 Guidance 15
3.2.2 Description 16
3.2.3 Methods 16
3.2.4 MOBILE6.2 Command 18
3.3 Diesel Fractions 18
3.3.1 Guidance 18
3.3.2 Description 18
3.3.3 Methods 18
3.3.4 MOBILE6.2 Command 19

3.4 Natural Gas Vehicles 19

4.0 Vehicle Activity 20
4.1 Vehicle Miles Traveled Fraction by Vehicle Class 20
4.1.1 Guidance 20
4.1.2 Description 21
4.1.3 Methods 21
4.1.4 Disaggregation of Local Information 22
4.1.5 HPMS or TIUS Data 23
4.1.4 MOBILE6.2 Commands 25
4.2 Vehicle Miles Traveled Fraction by Highway Functional System 28
4.2.1 Guidance 28
4.2.2 Description 28
4.2.3 Method 31
4.2.4 MOBILE6.2 Commands 36
4.3 Vehicle Miles Traveled Fraction by Hour of the Day 36
4.3.1 Guidance 36
4.3.2 Description 36
4.3.3 Method 37
4.3.4 MOBILE6.2 Commands 39
4.4 Vehicle Miles Traveled Fraction by Average Speed 39
4.4.1 Guidance 39
4.4.2 Description 39
4.4.3 Method 40
4.4.4 Idling Emission Rates 44
4.4.5 MOBILE6.2 Commands 45
4.5 Vehicle Engine Starts Per Day 46
4.5.1 Guidance 46
4.5.2 Description 46
4.5.3 Method 47
4.5.4 MOBILE6.2 Commands 47
4.6 Vehicle Engine Starts by Hour of the Day 48
4.6.1 Guidance 48
4.6.2 Description 48
4.6.3 Method 48
4.6.4 MOBILE6.2 Commands 49
4.7 Vehicle Soak Time between Engine Starts 49
4.7.1 Guidance 49
4.7.2 Description 50
4.7.3 Method 50
4.7.4 MOBILE6.2 Commands 50
4.8 Vehicle Hot Soak Time After Engine Shut Down 51
4.8.1 Guidance 51
4.8.2 Description 51
4.8.3 Method 52
4.8.4 MOBILE6.2 Commands 52

4.9 Vehicle Diurnal Soak Time 53
4.9.1 Guidance 53
4.9.2 Description 53
4.9.3 Method 53
4.9.4 MOBILE6.2 Commands 54
4.10 Vehicle Trip Length (Duration) Distributions 55
4.10.1 Guidance 55
4.10.2 Description 55
4.10.3 Method 56
4.10.4 MOBILE6.2 Commands 56
4.11 Weekday and Weekend Day Activity 56
4.11.1 Guidance 56
4.11.2 Description 57
4.11.3 Method 57
4.11.4 MOBILE6.2 Commands 57

5.0 Vehicle Gasoline Specifications 57
5.1 Gasoline Volatility 58
5.1.1 Guidance 58
5.1.2 Description 58
5.1.3 Method 58
5.1.4 MOBILE6.2 Commands 58
5.2 Reformulated Gasoline 59
5.2.1 Guidance 59
5.2.2 Description 59
5.2.3 Method 59
5.2.4 MOBILE6.2 Commands 60
5.3 Gasoline Oxygen Content 60
5.3.1 Guidance 60
5.3.2 Description 60
5.3.3 Method 61
5.3.4 MOBILE6.2 Commands 62
5.4 Gasoline Sulfur Content 62
5.4.1 Guidance 62
5.4.2 Description 63
5.4.3 Method 63
5.4.4 MOBILE6.2 Commands 63
5.5 Diesel Sulfur Content 64
5.5.1 Guidance 64
5.5.2 Description 64
5.5.3 Method 64
5.5.4 MOBILE6.2 Commands 65

6.0 Inspection and Maintenance Programs and Anti-Tampering Programs 65
6.1 Inspection Type, Test Frequency, and Network Type 65
6.2 Model Years 68

6.3 Vehicles 68
6.4 Stringency 69
6.5 Compliance Rate 69
6.6 Waiver Rates 70
6.7 Cutpoints 70
6.8 Exemption Age 70
6.9 Grace Period 71
6.10 Technician Training Credits 71
6.11 I/M Effectiveness 71
6.12 Anti-Tampering Programs 71

7.0 Alternative emission regulations and control measures 72
7.1 Disablement of 1990 Clean Air Act Requirements 72
7.2 Heavy-Duty Diesel Vehicle NOx Off-Cycle Emissions Effects 72
7.3 2007 Heavy Duty Standards 73
7.4 Alternative Emission Factors for Passenger Cars and Light-Duty Trucks 73
7.4.1 Guidance for Modeling Alternative NLEV Implementation and Adoption of California Standards 73

Appendix: References 76

1.0 Introduction

MOBILE6 is a software program designed by the U.S. Environmental Protection Agency to estimate emission rates for the highway motor vehicle fleet under a range of conditions. MOBILE6.0 was released in January, 2002. This was the latest in a series of MOBILE models dating back to 1978 and was the first update in MOBILE since the release on MOBILE5b in 1996 and the first major update since the release of MOBILE5 in 1992.

MOBILE6.2 is the first and latest update to MOBILE6 and adds the capability to estimate particulate matter (PM) and mobile source air toxics emissions. MOBILE6.2 contains very minor modifications to MOBILE6 for the parts of the model that estimate emissions of hydrocarbons (HC), nitrogen oxides (NOx), and carbon monoxide (CO).

The original technical guidance for MOBILE6 was released in 2002. Changes to the model have necessitated an update to the technical guide. Most of this version of the technical guidance is unchanged from the 2002 version. The following sections have been changed or added:

Section 2.1 - Calendar Year of Evaluation - Modified to refer to changes in Section 2.2
Section 2.2 - Month of Evaluation - Modified to add method used by EPA in the National Emission Inventory (NEI) annual inventory calculations
Section 2.4 - Temperature - Modified to be consistent with temperature guidance for other sources. Users can enter average temperatures for months during the ozone or CO seasons, rather than temperatures for the 10 highest ozone or CO days.
Section 2.5 - Humidity - Added guidance for new RELATIVE HUMIDITY command in MOBILE6.2. Modified humidity guidance to be consistent with new temperature guidance.
Section 4.2 - Vehicle Miles Traveled Fraction by Highway Functional System - In Table 4.2.1, changed MOBILE6.2 driving cycle for rural local roadways from "local roadway" to "arterial/collector".
Section 5.5 - Diesel Sulfur Content - Added guidance for new DIESEL SULFUR command in MOBILE6.2 required for particulate modeling.

The technical guidance in this document can be applied to either MOBILE6 or MOBILE6.2, with the exception of guidance that applies only to the particulate emissions functions in MOBILE6.2. This Technical Guidance document does not address use of MOBILE6.2 for air toxics emissions estimation. Guidance for mobile air toxics is in a separate document, "Technical Description of the Toxics Module for MOBILE6.2 and Guidance on Its Use for Inventory Preparation", which can be found at http://www.epa.gov/otaq/models/mobile6/r02029.pdf.

One of the primary uses of the MOBILE model is to develop emission inventories for State Implementation Plans (SIPs) and for conformity determinations. These emission inventories are estimates of total emissions from the highway motor vehicle fleet on a regional level. MOBILE is also used increasingly for other kinds of analysis ranging from estimating the national impacts

of motor vehicle emissions control strategies to estimating human exposure to pollutants at a specific intersection.

As described in the MOBILE6.2 User's Guide and in MOBILE6.2 technical documents, the latest versions in the MOBILE series (MOBILE6 and MOBILE6.2) are based on substantial new test data and accounts for changes in vehicle technology and regulations as well as improved understanding of in-use emission levels and the factors that influence them. They also incorporate many new features compared to versions prior to MOBILE6, including many new input and output options. Most of these features were designed to make MOBILE6 and MOBILE6.2 more flexible and more capable of being used effectively over the range of uses mentioned above.

New input options in the MOBILE6 series (MOBILE6 and MOBILE6.2) and changes in the way the MOBILE6 series handles existing information (for example; changes in the way MOBILE6 handles vehicle classification) may appear to create significant new information burdens for states preparing submissions for SIP and conformity related purposes. However, many of the new input options in the MOBILE6 series were designed for very specialized types of analysis and are not necessary for more general uses in SIP and conformity submissions. The remainder of this document provides further guidance on the necessity of using particular input options. This document also provides guidance on how existing local information can be combined with national default information in cases where local information is not available for all aspects of a particular command in the MOBILE6 series.

As a general rule, states that have not yet worked with the MOBILE6 series should start with updated versions of existing local information developed for MOBILE5 or PART5. If MOBILE6 or MOBILE6.2 requires new local information and that new local information is not readily available, states can use national default information using the methods described in this document. For some of the input options, states should plan over the long term to develop new local information for SIP and conformity submissions. EPA will work with the states and other agencies to develop methods and tools to accomplish this goal.

This document covers most of the input options available in MOBILE6.2. If the guidance here does not address a particular topic, the most recent previous guidance on the subject will still apply. MOBILE6.2 users should always check with EPA if there is any question about the applicability of guidance to any specific situation. The appendix to this document lists previous sources of guidance on MOBILE modeling for SIP and conformity related purposes.

2.0 External conditions

There are several conditions external to the highway vehicle fleet and the transportation network which have an impact on emissions. The year and month of evaluation affect the expected fuel characteristics and composition of the fleet with respect to the phase-in and fleet turnover of new emission standards. The emissions of vehicles are affected by the local altitude, as well as by weather conditions such as temperature and humidity. Temperature, humidity, and solar load

conditions such as cloud cover and time of peak sun also affect the amount of air conditioning usage, which in turn affects emissions. In MOBILE6.2, only the year and month of evaluation affect direct particulate matter (PM) emissions, through the impact of fuel characteristics and fleet composition. Altitude, temperature, humidity, and air conditioning usage have no impact on direct PM emissions in MOBILE6.2.

2.1 Calendar year of evaluation

The value used for calendar year of evaluation in MOBILE6.2 reflects the year for which emission factors are calculated. MOBILE6.2 can model emission factors for the calendar year 1952 to 2050 inclusive. There is no significant change in this input from MOBILE5 to MOBILE6.2 and no change in existing guidance on the use of this input option. Users should select the calendar year that corresponds to the date needed for the current evaluation. Selection of the appropriate calendar year may be affected if the user intends to model the months of October, November and/or December. See section 2.2 of the MOBILE6.2 User's Guide for more discussion of the interaction between the chosen evaluation month and calendar year. The calendar year of evaluation is specified in MOBILE6.2 using the CALENDAR YEAR command, which is required in every MOBILE6.2 input file. See section 2.8.6.1 of the MOBILE6.2 User's Guide for more information on the use of this command.

2.2 Month of Evaluation

2.2.1 Guidance

MOBILE6.2 allows users to calculate emission factors for January 1 or July 1 of the year of evaluation. Users should choose the evaluation month most appropriate to the pollutant of concern. For example, users estimating summer day emissions of VOC and NOx should use July as the evaluation month. For winter CO emissions, January is more appropriate. Other months can be estimated by mathematical interpolation between January and July results or using the method described later in this section, but this type of analysis is not typically needed for SIP submissions and conformity determinations for ozone or CO.

Users estimating annual particulate matter emissions could develop emissions factors for January and July and interpolate emission factors for the other ten months of the year, or they could use the method described later in this section. Emissions for all months should then be summed to estimate annual emissions. Users should review final regulations and guidance for particulate matter standards before developing particulate matter inventories.

Users should review the MOBILE6.2 User's Guide for additional information on estimating emissions in other months.

2.2.2 Description

The month of evaluation in MOBILE6.2 is specified using the EVALUATION MONTH command, described in Section 2.8.6.2 of the MOBILE6.2 User's Guide. As described in the MOBILE6.2 User's Guide, this command only affects the composition of the fleet (July 1 has six additional months of replacement of older vehicles by the current model year) and the effects of reformulated gasoline (RFG). By default, July 1 uses summer season RFG rules and January 1 uses winter season RFG rules. Other factors which might change between January and July, such as temperature and fuel volatility, are not affected by this command and must be specified separately by users.

If interpolation is necessary, use the SEASON command, as described in the MOBILE6.2 User's Guide to ensure that both points in the interpolation assume the same RFG parameters.

Another method to determine emission rates for months other than January and July has been used for the National Emission Inventory (NEI) annual inventory calculations by EPA. In this method, a separate MOBILE6.2 run is done representing each of the 12 months of the year. Under this approach, no interpolation is required. The EVALUATION MONTH and CALENDAR YEAR used for each month is shown in Table 2.2.2.1.

Table 2.2.2.1
Selecting Evaluation Month and Calendar Year for Annual Inventory Calculations

Month		EVALUATION MONTH	CALENDAR YEAR
January	1	1	Current Year
February	2	1	Current Year
March	3	1	Current Year
April	4	7	Current Year
May	5	7	Current Year
June	6	7	Current Year
July	7	7	Current Year
August	8	7	Current Year
September	9	7	Current Year
October	10	1	Current Year + 1
November	11	1	Current Year + 1
December	12	1	Current Year + 1

Note that the calendar year used for the months of October, November and December is not the current calendar year, but the following calendar year. This makes the emission rates calculated for these months more closely resemble the emission rates for January of the following calendar year, rather than January or July of the current calendar year. Care must be taken using this approach to make the other input parameters match as closely as possible the conditions being modeled. In particular, it may be necessary to use the SEASON, as described in the MOBILE6.2 User's Guide, to ensure that the appropriate RFG parameters (summer or winter) are used. Using this method will most closely match the results obtained by EPA for the NEI.

Both methods described for modeling months other than January or July are approximations. Other rational methods to approximate emission rates for months other than January or July may be used, but must be properly documented and explained.

2.3 Altitude

In MOBILE6.2, users can estimate emissions for either a low-altitude area or a high-altitude area using the ALTITUDE command, which is described in Section 2.8.6.5 of the MOBILE6.2 User's Guide. Guidance for the use of this command is unchanged from MOBILE5. For the majority of applications, low-altitude is the appropriate choice. For those areas designated as high-altitude by EPA for mobile source regulatory purposes only (generally those counties that lie "substantially" above +4000 ft MSL), high-altitude should be selected. A list of those counties EPA has designated as high-altitude appears in §86.091-30, paragraphs (a)(5) (ii) and (iv), Code of Federal Regulations (July 1, 2001).

2.4 Temperature

2.4.1 Guidance

Ambient temperature is key to estimating emission rates for highway vehicles and States must use local temperatures that are consistent with conditions during an ozone or CO exceedance episode. The use of minimum and maximum daily temperatures is the recommended approach for analyses of average summer or winter day conditions that will not be used as input into an air quality or dispersion model. The use of hourly temperatures is necessary for inventories that will be used for air quality analysis of specific exceedance episodes. Temperature assumptions used for transportation conformity analyses should be consistent with those used in the SIP as required in the transportation conformity rule, §93.122 (a)(6), Code of Federal Regulations (July 1, 2001).
In MOBILE6.2, temperature has no effect on direct PM emissions. However, temperature does affect emissions of some PM precursors. Users should review final regulations and guidance for PM standards and consult with their EPA Regional Office to determine what PM precursors may need to be included in local emission inventories.

2.4.2 Description

When a user specifies minimum and maximum daily temperatures, MOBILE6.2 takes those temperatures and creates a daily temperature profile in which the low temperature is assumed to occur at 6 a.m. and the high temperature at 3 p.m. The hourly temperature option allows the user to enter hourly temperatures and thereby specify a different temperature profile than MOBILE6.2 would create.

The hourly temperature option was designed to give users who want to do detailed air quality analyses of specific exceedance episodes finer control over the hourly temperatures used by

MOBILE6.2. For SIP and conformity purposes that do not involve air quality modeling, the hourly temperature option is not required.

2.4.3 Methods

Sources of information on minimum and maximum temperatures and methods for determining appropriate temperatures for SIP and conformity modeling have not changed substantially from previous guidance. States that wish to use hourly temperatures must document that the hourly temperatures used are consistent with existing temperature guidance. Sources of temperature data and any methods used to adjust them to fit the requirements of MOBILE6.2 must be documented in any official SIP or conformity-related submission.

2.4.3.1 Methods for assigning values for minimum and maximum temperature

Users who wish to model a specific ozone or CO exceedance episode can use the actual minimum and maximum temperatures that occurred during that episode. For more generic modeling of average summer or winter day ozone or CO conditions for SIP or conformity purposes, average minimum and maximum temperatures during the months when ozone or CO exceedances typically occur should be used. For ozone season analysis, users can enter the local average minimum and maximum temperatures for July, or for the three month period that best represents the area's ozone season (typically June, July and August; or July, August, and September). For CO season analysis, users can enter the local average minimum and maximum temperatures for January, or for the three month period that best represents the CO season (typically December, January, and February, with December being that of the same or previous year).

For any analysis of PM precursors as part of an annual PM standard, users should model each month using the methods described in Section 2.2 and using average minimum and maximum temperatures for each month. Users should review final regulations and guidance for particulate matter standards before developing particulate matter inventories.

Official minimum and maximum temperature information is contained in the Local Climatological Data Monthly Summary for the inventory area and is available from:

National Climatic Data Center
Federal Building
Asheville, NC 28801-2696
Telephone: (828) 271-4300

It is also available online at the following website:

www.ncdc.noaa.gov

All requests must be prepaid. Checks should be made out to the U.S. Department of Commerce. Data are available either in digital format or as paper copy. Please note that the NCDC stores electronic data only for approximately 3-4 years. Older data is either stored in hardcopy or in

microfiche. Data are no longer available in the 1440 format from NCDC. This format is available from Trinity Consultants, in Dallas, Texas. They may be contacted at: 1-800-229-6655 or at their website: www.trinityconsultants.com

Data are also available from several other data sources. The Federal Depository Library System has branches in many larger cities. These branches have a document entitled "Climatological Data" for the area. Daily extremes in temperature on the designated days may be obtained from that document. There is also a document entitled "Local Climatological Data" with the same information as well as temperature data collected every three hours at 300 airports around the country. Additionally, the Regional Depository Library System has branches in many medium and large cities and can make available the same documents. Hourly data are usually not available from either the NCDC or the two library systems noted above. Sources of temperature data and any methods used for calculating average minimum and maximum temperatures must be documented in any official SIP or conformity related submission.

2.4.3.2 Methods for hourly temperature input

The use of hourly temperature input is only necessary in cases where the user is trying to model a specific exceedance episode for air quality or dispersion analysis and needs more control over the daily temperature profile used by MOBILE6.2 by using the actual hourly temperatures during the episode. Users need not attempt to estimate average hourly temperatures for more generic modeling of average summer or winter day ozone or CO exceedance conditions. Average minimum and maximum temperatures are sufficient for that kind of analysis.

Temperatures at three-hour intervals are available from the National Climatic Data Center (see reference information above). Users who want to model a specific episode using these temperatures could interpolate intermediate hourly temperatures. However, use of this data alone might cause the user to miss the daily extreme minimum and maximum temperatures. Users could adjust for this problem by substituting the maximum and minimum daily recorded temperatures for the highest and lowest three-hour temperatures. However, an approach that used actual recorded hourly temperatures would be preferable. Sources of temperature data and any methods used to adjust them to fit the requirements of MOBILE6.2 must be documented in any official SIP or conformity related submission.

2.4.4 MOBILE6.2 Commands

The two temperature command options in MOBILE6.2 (MIN/MAX TEMPERATURE and HOURLY TEMPERATURE) are used to specify daily temperatures used by MOBILE to estimate exhaust and evaporative emissions. Temperature is a mandatory input for MOBILE6.2 and users must specify either minimum and maximum temperatures or hourly temperatures for each scenario. Both commands are described in detail in Section 2.8.6.3 and Section 2.8.6.4 of the MOBILE6.2 User's Guide.

2.5 Humidity

2.5.1 Guidance

MOBILE6 and MOBILE6.2 incorporate important new information on air conditioning effects that was not available for MOBILE5. This information indicates that air conditioning use can have a significant impact on HC, NOx, and CO emissions. High humidity increases air conditioning use in hot weather. In addition, humidity has an important impact on NOx emissions at all temperatures due to the quenching effect of water vapor in the air on combustion chamber temperatures. Because of these effects, EPA now recommends and encourages states to use local humidity as an input in MOBILE6.2 for estimates of summer day emissions that will be used for SIP or conformity purposes, and for estimates of NOx emissions any time of year, including analysis of secondary nitrate formation for dispersion modeling of particulate matter.

In MOBILE6.2, humidity has no effect on direct PM emissions. Users should review final regulations and guidance for PM standards and consult with their EPA Regional Office to determine what PM precursors may need to be estimated included in local emission inventories.

Humidity assumptions used for transportation conformity analyses should be consistent with those used in the SIP as required in the transportation conformity rule, §93.122 (a)(6), Code of Federal Regulations (July 1, 2001). If the SIP did not include humidity input, states can use this input for conformity analysis as determined through the interagency consultation process as described in §93.105 (c)(1)(i), Code of Federal Regulations (July 1, 2001).

2.5.2 Description

In MOBILE6.2, the humidity input is used to adjust the estimate of NOx production during the combustion process and determine emissions from additional engine loading with air conditioner usage. Humidity has its largest effects on NOx emissions. Humidity effects on HC and CO emissions are smaller.

The humidity input is used directly to correct for humidity's impact on NOx emissions. Water vapor absorbs some of the heat of combustion in the engine, which in turn results in a reduction in NOx formation. Humidity effects on HC and CO emissions are indirect. High humidity on hot days increases air conditioning usage which increases HC and CO emissions. MOBILE6.2 incorporates both of these effects using the humidity input. For air conditioning effects, humidity and temperature are combined internally in the model to create a heat index which in turn is used to estimate air conditioning usage.

There are two methods for entering humidity values in MOBILE6.2: RELATIVE HUMIDITY, which requires the user to enter hourly relative humidity values, or ABSOLUTE HUMIDITY, which requires just a single absolute humidity value to represent an entire day. Either approach can be used, but the RELATIVE HUMIDITY command has advantages. Humidity can vary substantially over the course of a day and use of the RELATIVE HUMIDITY command will

allow a much more accurate estimation of air conditioning usage and the quenching effect on NOx emissions throughout the day. Use of the ABSOLUTE HUMIDITY command requires less data but can result in problems if the absolute humidity value used is inconsistent with the minimum or maximum temperatures used (this is discussed more fully in Sec. 2.5.3).

The RELATIVE HUMIDITY command has been added to MOBILE6.2 to allow the user to specify hourly relative humidity values and relate these relative humidity values directly to the hourly temperature values. In the past, users were limited to entering one absolute humidity value for the 24 hour period. The model then used the temperature range for the day, along with the barometric pressure to calculate a series of relative humidity values for the day. This resulted in two problems. First, it did not allow for the fact that both relative humidity and absolute humidity vary throughout the day. Second, it could result in internal calculations of relative humidity that exceeded 100%. The addition of the RELATIVE HUMIDITY command solves both of those problems.

2.5.3 Methods

Methods will vary depending on whether the user will enter humidity as relative humidity or absolute humidity. Under either approach, users who wish to model a specific ozone, CO, or PM exceedance episode should use actual humidity values recorded during that episode. For more generic modeling of average day ozone or CO conditions for SIP or conformity purposes, average humidity values during the months when ozone, CO, or PM exceedances typically occur should be used. For ozone season analysis, users can enter the local average minimum and maximum temperatures for July, or for the three month period that best represents the area's ozone season (typically June, July and August; or July, August, and September). For CO season analysis, humidity will typically not be a factor, unless CO exceedances occur in hot months when air conditioning is used. In that case, users should enter local average humidity values for a month when exceedances occur.

Users should fully document the relative or absolute humidity values, as well as any temperature or barometric pressure data used to adjust those values to meet MOBILE6.2 requirements for any SIP or conformity-related submission.

2.5.3.1 Methods for relative humidity input

The use of the RELATIVE HUMIDITY command requires the user to enter 24 hourly relative humidity values. It also requires the use of the BAROMETRIC PRESSURE command in order to internally calculate the NOx quenching effect. The hourly relative humidity values together with hourly temperature values and barometric pressure are used to calculate hourly absolute humidity values. Subsequently, hourly humidity effects on NOx emissions can be determined. Also, the hourly relative humidity values are used directly to determine hourly heat indices which are used to determine the air conditioning effects on HC, CO, and NOx emissions.

Relative humidity and barometric pressure information at three-hour intervals are available from the National Climatic Data Center (see reference information in Section 2.4.3). Users who want to model a specific episode using these humidity values could interpolate intermediate hourly humidity values. However, use of this data alone might cause the user to miss the daily extreme minimum and maximum humidity values. Users could adjust for this problem by substituting the maximum and minimum daily recorded relative humidity for the highest and lowest three-hour humidity values.

2.5.3.1 Methods for absolute humidity input

The alternate input for humidity in MOBILE6.2 is referred to as absolute humidity, but it might more accurately be called a humidity ratio. This is defined as the mass of water vapor per unit mass of dry air. For MOBILE6.2 users who are developing inventories for air quality modeling purposes, humidity ratios may be available as output from a meteorological model (e.g., Fifth-Generation NCAR / Penn State Mesoscale Model (MM5)). For MOBILE6.2, the humidity ratio input needs to be calculated in terms of grains of water per pound of dry air. This will likely require unit conversion of the meteorological model output.

For users without access to humidity ratios for the exceedance days being modeled, the humidity ratio can be calculated from temperature, relative humidity, and barometric pressure. A spreadsheet and a computer program that perform this calculation are available at the MOBILE6.2 website. Relative humidity and barometric pressure information at three-hour intervals are available from the National Climatic Data Center (see reference information above). Users should take care to ensure that the inputs are converted to the proper units needed to calculate the humidity ratio in grains of water per pound of dry air.

Whether users are using humidity ratios values produced by a meteorological model or calculating humidity ratios from relative humidity information, input for the ABSOLUTE HUMIDITY command in the model should always be the lowest humidity ratio that occurred during the exceedance day. MOBILE6.2 currently only allows input of a single absolute humidity value for an entire day, while temperature varies across the range of values entered by the user. Because both relative and absolute humidity can change significantly during the day, users need to carefully choose the absolute humidity value used in the model. Absolute humidity values that are reasonable at one temperature, can produce unreasonable relative humidity values (i.e., greater than 100%) at a different temperature during the same day. Using the lowest humidity ratio of the day should prevent this problem. An acceptable alternative approach would be to use the highest humidity ratio that does not result in a relative humidity value greater than 100%. Users should fully document the temperatures, barometric pressures, relative humidity values, and methods used to calculate humidity ratios for any SIP or conformity related submission.

2.5.4 MOBILE6.2 Commands

Relative humidity is specified by using the RELATIVE HUMIDITY command described in section 1.3.4 of the MOBILE6.2 User's Guide. There is no default value for this command. Values between 0% and 100% may be entered. If the RELATIVE HUMIDITY command is used, the BAROMETRIC PRESSURE command must also be used. This command has default value of 29.92 inches of mercury (Hg).

Absolute humidity is specified using the ABSOLUTE HUMIDITY command which is described in detail in Section 2.8.6.6 of the MOBILE6.2 User's Guide. The default value used in the model is 75 grains of water per pound of dry air. MOBILE6.2 allows users to enter values between 20.0 and 528.0 grains of water per pound of dry air.

2.6 Other air-conditioning related input options

2.6.1 Guidance

MOBILE6.2 incorporates three additional factors that affect air conditioning usage: average percent cloud cover, period of peak sun, and sunrise/sunset times. These three factors affect the timing and magnitude of solar loading, which in turn affect the amount of air conditioning use.

MOBILE6.2 allows users to supply local information for all three factors. However, EPA recommends that users use the MOBILE6.2 default values for most typical SIP or conformity applications. The default values are consistent with conditions for ozone formation. The impact of reasonable changes in the default values is likely to be small, and may not justify the burden of developing and incorporating additional data into the modeling process.

These input options might be of interest to air quality modelers who are analyzing specific ozone exceedance episodes and wish to have more control over the detailed environmental conditions assumed in MOBILE6.2. Even in these cases, use of local data for these input options is not required. States or local agencies who do want to include local inputs for these options in an official submission must fully document the sources of those inputs including showing that they are consistent with data used for temperature and humidity input in the model.

2.6.2 MOBILE6.2 Commands

The three commands covered by this section are called CLOUD COVER, PEAK SUN, and SUNRISE/SUNSET in MOBILE6.2. They are described in detail in Section 2.8.6.7 of the MOBILE6.2 User's Guide.

3.0 Vehicle Fleet Characteristics

Certain characteristics of the highway vehicle fleet can have a significant impact on overall emissions from these sources. The age distribution and the average annual mileage

accumulation of vehicles in the fleet affect estimates of the deterioration of vehicle emission control effectiveness. The age distribution of the fleet also determines the fractions of the fleet that meet different emission standards. The relative fractions of gasoline and diesel-powered vehicles are important because gasoline and diesel engines have different emissions characteristics.

The relative activity of different vehicle classes (i.e., fractions of VMT for cars, light duty trucks, heavy duty trucks, and motorcycles) is also important, but is discussed separately in Section 4.

MOBILE6.2 incorporates a new vehicle classification system that more accurately reflects the way vehicles are classified for emissions standards than previous versions of MOBILE. The following table shows how the vehicle classes in MOBILE6.2 correspond to the classes defined in MOBILE5. The table shows that the vehicle classification used in MOBILE6.2 is simply a finer subdivision of the vehicle classes used in MOBILE5. In many cases, methodologies used to develop fleet characteristic input for MOBILE5 can still be used in for MOBILE6.2 with simple modifications.

Table 3.0.1
Comparison of MOBILE5 and MOBILE6.2 Vehicle Classifications

MOBILE5	MOBILE6.2	Description
LDV	LDV	Light-Duty Vehicles (Passenger Cars)
LDT1	LDT1	Light-Duty Trucks 1 (0-6,000 lbs. GVWR, 0-3750 lbs. LVW)
	LDT2	Light Duty Trucks 2 (0-6,001 lbs. GVWR, 3751-5750 lbs. LVW)
LDT2	LDT3	Light Duty Trucks 3 (6,001-8500 lbs. GVWR, 0-5750 lbs. ALVW)
	LDT4	Light Duty Trucks 4 (6,001-8500 lbs. GVWR, >5750 lbs. ALVW)
HDV	HDV2B	Class 2b Heavy Duty Vehicles (8501-10,000 lbs. GVWR)
	HDV3	Class 3 Heavy Duty Vehicles (10,001-14,000 lbs. GVWR)
	HDV4	Class 4 Heavy Duty Vehicles (14,001-16,000 lbs. GVWR)
	HDV5	Class 5 Heavy Duty Vehicles (16,001-19,500 lbs. GVWR)
	HDV6	Class 6 Heavy Duty Vehicles (19,501-26,000 lbs. GVWR)
	HDV7	Class 7 Heavy Duty Vehicles (26,001-33,000 lbs. GVWR)
	HDV8A	Class 8a Heavy Duty Vehicles (33,001-60,000 lbs. GVWR)
	HDV8B	Class 8b Heavy Duty Vehicles (>60,000 lbs. GVWR)
	HDBS	School Buses
	HDBT	Transit and Urban Buses
MC	MC	Motorcycles (All)

The gross vehicle weight rating (GVWR) is a value defined by the vehicle manufacturer which indicates the total weight of the vehicle including it's curb (empty) weight, fluids, driver and the maximum recommended payload. The adjusted loaded vehicle weight (ALVW) is the numerical average of the vehicle curb weight and the gross vehicle weight rating (GVWR). The loaded vehicle weight (LVW) is the curb (empty) weight of the vehicle plus 300 lbs., representing the driver and incidental payload weight.

3.1 Age Distribution of Vehicle Registrations

3.1.1 Guidance

The age distribution of vehicle fleets can vary significantly from area to area. For SIP and conformity related purposes, EPA recommends and encourages states to develop local age distributions. This basic guidance is unchanged from past guidance. However, MOBILE6.2 breaks down the vehicle fleet into many more classes than previous versions of MOBILE. EPA encourages States to work to develop local age distributions for all of the vehicle classes over the long-term and EPA will work with the Department of Transportation and with the States to identify or develop tools, such as vehicle identification number (VIN) decoders to do this. Until States have this information, for SIP and conformity related submissions there is no alternative but to assume that the new subclasses of vehicles in MOBILE6.2 will have the same age distribution as the previous classes they were derived from.

If local registration age distributions are used, they normally should not change across calendar years. In particular, EPA will not accept SIP or conformity related modeling that includes assumptions that the vehicle fleet will be newer (have a lower average age) in the future than is reflected in the latest registration age distribution information currently available. States must fully document the sources of data and methods used to develop local age distributions used in modeling for SIP and conformity related purposes.

3.1.2 Description

A typical vehicle fleet includes a mix of vehicles of different ages. MOBILE6.2 covers a 25 year range of vehicle ages, with vehicles 25 years and older grouped together. MOBILE6.2 allows the user to specify the fraction of vehicles in each of 25 vehicle ages for each of the 16 vehicle classes (combined gasoline and diesel) in the model.

Fleets with a higher percentage of older vehicles will have higher emissions for two reasons. Older vehicles have typically been driven more miles and have experienced more deterioration in emission control systems. A higher percentage of older vehicles also means that there are more vehicles in the fleet that do not meet newer, more stringent emissions standards. Surveys of registration data indicate considerable local variability in vehicle age distributions.

3.1.3 Methods

Local age distributions can be estimated from local registration data or from an analysis of local inspection and maintenance program data. Methods for estimating registration distributions by age are described in the reports "Techniques for Estimating MOBILE2 Variables" and "Additional Techniques for Estimating MOBILE2 Variables" (Energy and Environmental Analysis, Inc. for EPA Contract Number 68-03-2888). Methods for estimating age distributions from I/M program data are given in the report "Methodology for Gathering Locality-Specific Emission Inventory Data" which is incorporated in "Volume IV: Chapter 1, Preferred and

Alternative Methods for Gathering and Locating Specific Emission Inventory Data" (June 1996, Emission Inventory Improvement Program).

In the absence of new information on the age distribution of new vehicle classes in MOBILE6.2, age distributions for the equivalent MOBILE5 vehicle classes can be applied. For example, based on registration data, a state has developed methods for determining age distributions for vehicles in the LDGT1 category as defined in MOBILE5. In the absence of new information, this age distribution could be applied to all vehicles in the new LDGT1 and LDGT2 categories as defined in MOBILE6.2. Likewise, age distributions calculated for vehicles in the LDGT2 category in MOBILE5 could be applied to the new LDGT3 and LDGT4 categories in MOBILE6.2.

A similar approach can used to estimate age distributions for new heavy duty vehicle classes as defined in MOBILE6.2. However, an additional adjustment will be necessary here to account for the fact that MOBILE6.2 requires a single age distribution for both gasoline and diesel heavy duty trucks while MOBILE5 allowed for two separate age distributions. Chapter 5 of the MOBILE6.2 User's Guide includes a method for weighting separate heavy duty gasoline and diesel age distributions to develop a single composite age distribution. This age distribution could then be applied to all of the new classes of heavy duty vehicles in MOBILE6.2 except for the heavy duty transit bus category, which is assumed to be all diesel-fueled.

Having the same age distribution for both gasoline and diesel fueled vehicles of the same class assumes that the scrappage rate for these two fuel types will be the same within a class. If the user wishes the age distributions for gasoline and diesel fueled vehicles to be different, each fuel type will need to be modeled with a separate MOBILE6.2 run using diesel sales fractions that do not vary by model year or age and with the appropriate age distribution for the fuel type to be modeled.

The following table summarizes how age distributions developed for MOBILE5 could be adapted to MOBILE6.2. However, areas are encouraged to determine separate age distributions for as many of the new vehicle classes as possible from the available data.

Table 3.1.3.1 Matching MOBILE6.2 Vehicle Classes to MOBILE5 Age Distributions	
MOBILE6.2 Vehicle Class	**MOBILE5 Age Distribution**
LDV	LDV
LDT1	LDGT1
LDT2	
LDT3	LDGT2
LDT4	
HDV2B	Weighted Combination of HDGV and HDDV
HDV3	
HDV4	
HDV5	
HDV6	
HDV7	
HDV8A	
HDV8B	
HDBS	
HDBT	HDDV
MC	MC

3.1.4 MOBILE6.2 Command

The age distribution of vehicle registrations is specified in MOBILE6.2 using the REG DIST command, which is described in detail in Section 2.8.7.1 of the MOBILE6.2 User's Guide. Users must create an external data file which contains fractions for each of the 25 model years for each vehicle type specified by the user.

3.2 Annual mileage accumulation rates

3.2.1 Guidance

EPA continues to recommend that States use national default mileage accumulation rates built into MOBILE6.2. Most local sources of mileage accumulation rate by age are subject to sampling bias or data entry errors, and the use of such data should be approached with caution. In the development of highway vehicle emission inventories for SIP or conformity related purposes, States should obtain prior approval of alternate mileage accumulation rates and their derivation from EPA before using such rates in their modeling. States that wish to develop local mileage accumulation rates must fully document data collection and analysis methodologies. States that have developed approved local mileage accumulation rates based on MOBILE5 vehicle classes could apply those rates to the corresponding MOBILE6.2 vehicle classes.

If local mileage accumulation rates are used they normally should not change across calendar years. In particular, EPA will not accept SIP or conformity related modeling that assumes that vehicles in the future will accumulate mileage at a different rate than current vehicles.

3.2.2 Description

Vehicles accumulate mileage at different rates depending on the type and age of the vehicle. Trucks tend to be driven more miles per year than cars. Older vehicles tend to be driven fewer miles per year than newer ones. Annual mileage accumulation affects the rate at which vehicle emission controls deteriorate and affect the relative emissions contributions of newer and older vehicles.

MOBILE6.2 assigns separate default mileage accumulation rates and allows user input for all vehicle classes. For annual mileage accumulation rates, MOBILE6.2 treats gasoline and diesel vehicles separately for a total of 28 separate vehicle types. MOBILE6.2 allows users to specify the vehicle classes for which new annual mileage accumulation rates are entered. All other classes are assumed to have the default rates.

3.2.3 Methods

Methods for estimating annual mileage accumulations from I/M program data are given in the report "Methodology for Gathering Locality-Specific Emission Inventory Data" which is incorporated in "Volume IV: Chapter 1, Preferred and Alternative Methods for Gathering and Locating Specific Emission Inventory Data" (June 1996, Emission Inventory Improvement Program).

Chapter 5 of the MOBILE6.2 User's Guide includes a description of how to apply local annual mileage accumulation rates based on MOBILE5 vehicle classes to the new vehicle classes in MOBILE6.2. The following table summarizes how annual mileage accumulations developed using MOBILE5 vehicle classes could be applied to the MOBILE6.2 vehicle classes. Unlike the REG DIST command used to enter the registration age distribution, the MILE ACCUM RATE command used to enter annual mileage accumulation rates separates the fleet into gasoline and diesel vehicles. This makes the use of MOBILE5 based rates simpler since it is not necessary to combine gasoline and diesel numbers. In addition, the MILE ACCUM RATE allows the user to specify mileage accumulation rates only for the vehicle classes the user wishes to change from the default. As a result users could easily choose to enter local annual mileage accumulation rates only for the vehicle classes for which they have local data, and use national defaults for the rest.

Table 3.2.3.1 Matching MOBILE6.2 Vehicle Classes to MOBILE5 Classes for Annual Mileage Accumulation		
MOBILE6.2 Class	**Description**	**MOBILE5 Class**
LDGV	Light-Duty Gasoline Vehicles (Passenger Cars)	LDGV
LDGT1	Light-Duty Gasoline Trucks 1 (0-6,000 lbs. GVWR, 0-3750 lbs. LVW)	LDGT1
LDGT2	Light-Duty Gasoline Trucks 2 (0-6,000 lbs. GVWR, 3751-5750 lbs. LVW)	
LDGT3	Light-Duty Gasoline Trucks 3 (6,001-8,500 lbs. GVWR, 0-5750 lbs. ALVW)	LDGT2
LDGT4	Light-Duty Gasoline Trucks 4 (6,001-8,500 lbs. GVWR, 5751 lbs. and greater ALVW)	
HDGV2B	Class 2b Heavy-Duty Gasoline Vehicles (8501-10,000 lbs. GVWR)	HDGV
HDGV3	Class 3 Heavy-Duty Gasoline Vehicles (10,001-14,000 lbs. GVWR)	
HDGV4	Class 4 Heavy-Duty Gasoline Vehicles (14,001-16,000 lbs. GVWR)	
HDGV5	Class 5 Heavy-Duty Gasoline Vehicles (16,001-19,500 lbs. GVWR)	
HDGV6	Class 6 Heavy-Duty Gasoline Vehicles (19,501-26,000 lbs. GVWR)	
HDGV7	Class 7 Heavy-Duty Gasoline Vehicles (26,001-33,000 lbs. GVWR)	
HDGV8A	Class 8a Heavy-Duty Gasoline Vehicles (33,001-60,000 lbs. GVWR)	
HDGV8B	Class 8b Heavy-Duty Gasoline Vehicles (>60,000 lbs. GVWR)	
LDDV	Light-Duty Diesel Vehicles (Passenger Cars)	LDDV
LDDT12	Light-Duty Diesel Trucks 1 and 2 (0-6,000 lbs. GVWR)	LDDT
HDDV2B	Class 2b Heavy-Duty Diesel Vehicles (8501-10,000 lbs. GVWR)	HDDV
HDDV3	Class 3 Heavy-Duty Diesel Vehicles (10,001-14,000 lbs. GVWR)	
HDDV4	Class 4 Heavy-Duty Diesel Vehicles (14,001-16,000 lbs. GVWR)	
HDDV5	Class 5 Heavy-Duty Diesel Vehicles (16,001-19,500 lbs. GVWR)	
HDDV6	Class 6 Heavy-Duty Diesel Vehicles (19,501-26,000 lbs. GVWR)	
HDDV7	Class 7 Heavy-Duty Diesel Vehicles (26,001-33,000 lbs. GVWR)	
HDDV8A	Class 8a Heavy-Duty Diesel Vehicles (33,001-60,000 lbs. GVWR)	
HDDV8B	Class 8b Heavy-Duty Diesel Vehicles (>60,000 lbs. GVWR)	
MC	Motorcycles (Gasoline)	MC
HDGB	Gasoline Buses (School, Transit and Urban)	HDGV
HDDBT	Diesel Transit and Urban Buses	HDDV
HDDBS	Diesel School Buses	
LDDT34	Light-Duty Diesel Trucks 3 and 4 (6,001-8,500 lbs. GVWR)	LDDT

The annual mileage accumulation rates are used to determine the number of miles per day driven by vehicles assumed by MOBILE6.2 by dividing the annual mileage accumulation rate by 365 days. Changing the annual mileage accumulation rate will change the assumed number of miles driven each day. However, changing the annual mileage accumulation rate will affect the "age" of vehicles, since the basic emission rates (and many other estimates) are based on total mileage accumulation. Users should not attempt to affect the estimate of miles per day by altering the annual mileage accumulation rates. The MOBILE6.2 database output options include data fields, such as the assumed miles per day estimates, which can be used in a spreadsheet or other application to adjust gram per mile estimates to reflect different assumptions regarding the number of miles driven each day.

3.2.4 MOBILE6.2 Command

More details on the use of the command MILE ACCUM RATE can be found in Section 2.8.7.3 of the MOBILE6.2 User's Guide.

3.3 Diesel Fractions

3.3.1 Guidance

Use of local estimates of fractions of diesel vehicles by vehicle class is optional for SIP and conformity related purposes. Diesel sales fractions may vary from area to area. In addition, diesel sales fractions do not equate directly with the diesel VMT fraction, since diesel fueled vehicles tend to have a higher mileage accumulation rate than gasoline fueled vehicles of the same class. However, local information for all of the MOBILE6.2 vehicle classes is unlikely to be readily available. Because diesel fractions vary considerable among the heavy duty vehicle classes in MOBILE6.2, default MOBILE6.2 fractions should be used for any vehicle category for which there is no direct information. For example, the fraction of diesel heavy duty trucks in the entire heavy duty fleet cannot be used as a substitute for the fractions of diesel heavy duty trucks in each of the MOBILE6.2 heavy duty classes (i.e., HDV2b, HDV3, etc.).

MOBILE6.2 projects future diesel fractions as constant beginning in 1996. If no local data are available for years after 1995, States should use the 1996 and later default values in MOBILE6.2 for all years after 1996. If more recent data are available, States must use the estimate of diesel fractions for the most recent year available as the projected fractions for future years for SIP and conformity related submissions.

Methods and data sources for diesel fractions used in any SIP or conformity related submission must be fully documented.

3.3.2 Description

Within any vehicle class, diesel and gasoline vehicles have distinctly different emission rates. Diesel fractions allow the model to separate gasoline and diesel vehicles within a vehicle class MOBILE6.2 includes default diesel sales fractions for 14 of the 16 composite vehicle classes - all except urban/transit busses, which are assumed to be all diesel-fueled, and motorcycles, which are assumed to be all gasoline-fueled. Users can enter alternative diesel fractions for these 14 vehicle classes for each of 25 vehicle ages.

3.3.3 Methods

Vehicle registration data are the most likely source for diesel fraction information. Diesel sales fractions developed for MOBILE5 vehicle class LDV may be applied directly in MOBILE6.2 to the same class. Diesel sales fractions for MOBILE5 vehicle class LDT1 can be applied to the new MOBILE6.2 vehicle classes LDT1 and LDT2. For all other MOBILE6.2 vehicle classes,

users need to either develop diesel fractions specific to the class or use the national defaults estimates. Diesel fractions for all vehicle classes (including those for which national defaults are assumed) need to be entered if the DIESEL FRACTIONS command is used. Chapter 5 of the MOBILE6.2 User's Guide includes a description of how to do this. Appendix E of the MOBILE6.2 User's Guide gives the national default diesel fractions used in the model.

3.3.4 MOBILE6.2 Command

More detail on the use of the DIESEL FRACTIONS command is given in Section 2.8.7.2 of the MOBILE6.2 User's Guide.

3.4 Natural Gas Vehicles

MOBILE6.2 allows users to specify the fraction of the vehicle fleet by vehicle class (for all vehicle classes, including urban busses) that consists of vehicles certified to operate on either compressed or liquefied natural gas and to enter alternative emission rates for those vehicles. Use of these commands is primarily limited to analyses of the effects of natural gas vehicles on a small subset of a typical area-wide fleet. For example, they could be used to analyze the emission effects of changing a small fleet of vehicles to natural gas vehicles (NGVs). Under normal circumstances for SIP and conformity modeling, in which the fraction of natural gas vehicles in an area-wide fleet is extremely small, use of these commands may not be necessary. However areas with a significant population of NGVs as the result of a specific control program might use this feature to quantify emission reductions from that program.

Two commands affect the emissions associated with NGVs. The NGV FRACTION command is used to specify the fraction of NGVs in the fleet. When this command alone is used, MOBILE6.2 relies on a set of default NGV emission rates built into the model. However, these default emission rates do not include NGV emission rates for vehicles meeting Tier 2 emission standards. NGVs in model years 2004 and later are assumed to continue to meet ULEV standards rather than Tier 2 standards. To change this, users must enter the NGV EF command along with a set of alternate NGV emission factors. EPA does not currently have a set of approved alternate emission factors for NGVs meeting Tier 2 standards. Further details on the MOBILE6.2 commands described here are in Section 2.8.7.5 and Section 2.8.7.6 of the MOBILE6.2 User's Guide.

Use of these commands in any official submission for SIP or conformity related purposes must be fully documented. Documentation should include Any use of the alternative emission factor option should be approved by EPA before submission. These commands should only be used for vehicles originally certified as NGVs and should not be used for retrofits or dual-fueled (gasoline and natural gas) vehicles.

4.0 Vehicle Activity

Travel demand forecasting models (TDFMs) are often the source of information used by MPOs and State DOTs to estimate VMT. Traffic demand modelers for MPOs and State DOTs traditionally have had to adjust estimates of vehicle miles of travel generated through the TDFM process in order to match the Highway Performance Monitoring System (HPMS) estimates of VMT based on actual vehicle counts. These procedures are required in order to generate consistent VMT estimates from TDFMs for roadway functional classes within HPMS for use in regional emissions and air quality analysis. Section 3, "Developing Locality-Specific Inputs from Travel Demand Models," of the EPA document, "Volume IV: Chapter 2, Use of Locality-Specific Transportation Data for the Development of Mobile Source Emission Inventories," (September 1996), discusses how to reconcile traffic demand model results with HPMS VMT estimates. However, these methods may not be appropriate for all areas. EPA can be consulted to determine if other HPMS factoring schemes may be acceptable.

In some cases, MPOs and State DOTs will not have the detailed activity information needed for emission modeling. In these cases, EPA should be consulted to determine whether other sources of the data are available or whether national average default values can be used.

In those cases where the default MOBILE6.2 values are not used and are replaced by local information, the activity estimates used in the inventory modeling should be consistent, where possible, with assumptions used in other highway vehicle related planning. Some care must be taken to assure that each local activity estimate is consistent with other local estimates used and, as much as possible, consistent with MOBILE6.2 defaults that will be used in the inventory modeling. MOBILE6.2 will not always recognize when conflicting information is provided by the user.

4.1 Vehicle Miles Traveled Fraction by Vehicle Class

4.1.1 Guidance

The fraction of vehicle miles traveled (VMT) by vehicle class varies from area to area and can have a significant effect on overall emissions from highway mobile sources. For SIP-related highway vehicle emission inventory development in moderate and above non-attainment areas, EPA expects states to develop and use their own specific estimates of VMT by vehicle class.

The VMT fractions by vehicle class used in inventory modeling should be consistent, where possible, with assumptions used in other highway vehicle related planning. Metropolitan Planning Organizations (MPOs) and state Departments of Transportation (DOTs) should be consulted for information to determine the proportion of passenger vehicles and light duty trucks relative to heavy duty trucks by time of day and facility class.

4.1.2 Description

The VMT fractions specify the fractions of total highway VMT that are accumulated by each of 16 combined vehicle classes. The VMT fractions are used in MOBILE6.2 to calculate emission factor estimates that involve further aggregations of these vehicle classes. These include many of the emission results found in the default descriptive output. MOBILE6.2 calculates the default VMT fractions based on national average data characterizing vehicle age distributions and annual mileage accumulation rates by age for each vehicle class, and the total number of vehicles of each vehicle class nationally. MOBILE6.2 allows this default distribution to be replaced by local values.

If the user intends only to use the MOBILE6.2 emission results separately for each of the 28 individual vehicle classes, and will not be using any composite vehicle class results, then the VMT fractions used by the model will not affect the results and the user is not required to enter local VMT fractions for the MOBILE6.2 runs. However to appropriately determine inventory tons from the separate vehicle class emission rates produced by the MOBILE6.2 model, the estimates of total highway vehicle miles traveled must still be divided by vehicle class using the methods described in this section.

4.1.3 Methods

MOBILE6.2 requires that local VMT fractions by vehicle class be supplied separately for 16 vehicle class definitions. These vehicle classes are determined by the regulations under which the vehicles are certified for sale. The sixteen vehicle classes are:

Table 4.1.1
MOBILE6.2 Vehicle Classifications

Number	Abbreviation	Description
1	LDV	Light-Duty Vehicles (Passenger Cars)
2	LDT1	Light-Duty Trucks 1 (0-6,000 lbs. GVWR, 0-3750 lbs. LVW)
3	LDT2	Light Duty Trucks 2 (0-6,001 lbs. GVWR, 3751-5750 lbs. LVW)
4	LDT3	Light Duty Trucks 3 (6,001-8500 lbs. GVWR, 0-5750 lbs. ALVW)
5	LDT4	Light Duty Trucks 4 (6,001-8500 lbs. GVWR, >5750 lbs. ALVW)
6	HDV2B	Class 2b Heavy Duty Vehicles (8501-10,000 lbs. GVWR)
7	HDV3	Class 3 Heavy Duty Vehicles (10,001-14,000 lbs. GVWR)
8	HDV4	Class 4 Heavy Duty Vehicles (14,001-16,000 lbs. GVWR)
9	HDV5	Class 5 Heavy Duty Vehicles (16,001-19,500 lbs. GVWR)
10	HDV6	Class 6 Heavy Duty Vehicles (19,501-26,000 lbs. GVWR)
11	HDV7	Class 7 Heavy Duty Vehicles (26,001-33,000 lbs. GVWR)
12	HDV8A	Class 8a Heavy Duty Vehicles (33,001-60,000 lbs. GVWR)
13	HDV8B	Class 8b Heavy Duty Vehicles (>60,000 lbs. GVWR)
14	HDBS	School Buses
15	HDBT	Transit and Urban Buses
16	MC	Motorcycles (All)

The vehicle classes used for entry of the VMT fractions do not differentiate between vehicles by the type of fuel used (i.e., diesel versus gasoline). The emission certification categories used by MOBILE6.2 do not easily map into other vehicle classification systems, such as those used by the US Department of Transportation, which use different criteria (i.e., the number of axles) to determine vehicle class.

If the available information obtained from Metropolitan Planning Organizations (MPOs) or state Departments of Transportation (DOTs) has VMT already separated into the sixteen vehicle classes used in MOBILE6.2, and these values are consistent with assumptions used in other highway vehicle related planning, then no adjustments need to be made and the values can be used directly. However, it is likely that the local VMT information obtained will not be detailed enough to directly determine the VMT of the sixteen vehicle class categories needed.

4.1.4 Disaggregation of Local Information

The default VMT distribution of vehicle classes used in MOBILE6.2 can be used to separate the available local combined VMT information into the sixteen vehicle classifications needed for use in MOBILE6.2. This general method is also described in Section 5.3.2 in the MOBILE6.2 User Guide, which describes how to use the set of 8 vehicle class VMT distribution values used in MOBILE5 to estimate the 16 MOBILE6.2 categories. In this method, the MOBILE6.2 national average distribution values are used to determine the proportions of each subgroup in a more aggregate classification and these proportions are used to split the VMT for the aggregate class into the needed subgroup VMT estimates.

For example, an area determines that 20% of the total VMT in calendar year 2000 is from heavy duty vehicles (HDV) and the remainder (80%) is light duty vehicles (LDV), including motorcycles. The national average default value is 11.80% for HDV (vehicle classes 6 through 15) and 88.2% for LDV (vehicle classes 1 through 5 and 16). Each default LDV fraction is multiplied by the ratio of the local total LDV VMT fraction estimate divided by the national total LDV VMT fraction estimate. Each default HDV fraction is multiplied by the ratio of the local total HDV VMT fraction estimate divided by the national total HDV VMT fraction estimate. The calculations needed for this hypothetical example follow:

1. LDV = 0.4858 * (0.80/0.882) = 0.4406
2. LDT1 = 0.0671 * (0.80/0.882) = 0.0608
3. LDT2 = 0.2230 * (0.80/0.882) = 0.2022
4. LDT3 = 0.0690 * (0.80/0.882) = 0.0626
5. LDT4 = 0.0321 * (0.80/0.882) = 0.0291
6. HDV2b = 0.0383 * (0.20/0.118) = 0.0649
7. HDV3 = 0.0038 * (0.20/0.118) = 0.0065
8. HDV4 = 0.0029 * (0.20/0.118) = 0.0049
9. HDV5 = 0.0022 * (0.20/0.118) = 0.0037
10. HDV6 = 0.0083 * (0.20/0.118) = 0.0141
11. HDV7 = 0.0099 * (0.20/0.118) = 0.0168

12. HDV8a = 0.0109 * (0.20/0.118) = 0.0185
13. HDV8b = 0.0389 * (0.20/0.118) = 0.0659
14. HDBS = 0.0019 * (0.20/0.118) = 0.0033
15. HDBT = 0.0009 * (0.20/0.118) = 0.0015
16. MC = 0.0051 * (0.80/0.882) = 0.0046

The new set of sixteen values for the VMT fractions must still add to one. If a more detailed breakout of vehicle class VMT is available, such as a breakout of light-duty truck VMT from passenger car and motorcycle VMT, then only the portions of the local VMT estimate that need to be disaggregated will need to be adjusted. In this example, the VMT fractions for each of the four light-duty truck classes would be estimated by using the default VMT fraction times the local VMT fraction for all light-duty trucks divided by the sum of the default VMT fractions for the four light-duty truck classes. The local fractions for passenger cars and motorcycles would be used directly. The description of this method in Section 5.3.2 in the MOBILE6.2 User Guide shows an example of how more detailed information (such as values used for MOBILE5) can be used with this method.

Since MOBILE6.2 VMT fractions combine gasoline and diesel vehicle driving, local information about the fraction of diesel and gasoline VMT must be summed before using the methodology described in this section. The user cannot enter separate VMT fractions for diesel and gasoline fueled vehicles as in MOBILE5. The combined VMT of gasoline and diesel vehicles are split internally in the MOBILE6.2 model using the diesel sales fractions, age distributions and annual mileage accumulation rates. These values may be provided by the user using the DIESEL FRACTIONS, REG DIST and MILE ACCUM RATE commands in MOBILE6.2.

The VMT by vehicle class in MOBILE6.2 is a calculated value and varies from calendar year to calendar year due to uneven growth in the vehicle sales by vehicle class. The default VMT distribution used in the calculation must be taken from the calendar year that coincides with the calendar year of the local data used. Table 4.1.2 shows VMT by vehicle class calculated by MOBILE6.2 for all calendar years using the default national average values. If the user intends to use non-default values for annual mileage accumulation rates, age distributions or diesel sales fractions, then MOBILE6.2 can be run with the non-default values to determine the calculated value for the VMT distribution by vehicle class using the non-default values.

4.1.5 HPMS or TIUS Data

If the local VMT data is obtained using Highway Performance Monitoring System (HPMS) data or Census Truck Inventory and Use Survey (TIUS) data, then the methods described in the EPA document, "Volume IV: Chapter 2, Use of Locality-Specific Transportation Data for the Development of Mobile Source Emission Inventories," (September 1996), must be used to develop MOBILE5-style VMT fractions. However, the HPMS estimates for passenger cars and light duty trucks are not always a reliable estimate of the split between passenger cars and light trucks, since many HPMS traffic counting systems cannot properly distinguish between these

light duty categories. These two estimates should be combined into a total "light duty" category. The light duty and heavy duty VMT fractions can then be expanded to the sixteen vehicle classes needed for MOBILE6.2 using the preferred method described above.

In some cases (such as for heavy duty vehicles) it will be necessary to combine VMT fractions based on local data before splitting the VMT into the sixteen MOBILE6.2 vehicle classifications. For example, since MOBILE6.2 VMT fractions combine gasoline and diesel vehicle driving, local information about the fraction of diesel and gasoline VMT must be summed before using the methodology described in this section. The combined VMT of gasoline and diesel vehicles are split internally in the MOBILE6.2 model using the diesel sales fractions, age distributions and annual mileage accumulation rates. These values may be provided by the user using the DIESEL FRACTIONS, REG DIST and MILE ACCUM RATE commands in MOBILE6.2.

Table 4.1.2 below shows an example mapping of the HPMS vehicle categories to general vehicle class categories. These general class categories would then be split into the 16 MOBILE6.2 vehicle class categories using the methodology described above.

Table 4.1.1
MOBILE6.2 Vehicle Classifications

HPMS Category	General Category
Motorcycle	Motorcycle (MC)
Passenger Car	Passenger car (LDV)
Other 2-Axel, 4-Tire Vehicles	Light Truck (LDT)
Buses	Bus (HDB)
All Other Trucks: Single Unit, 2-Axel, 6-Tire Single Unit, 3-Axel Single Unit, 4 or More Axel Single Trailer, 4 or Fewer Axel Single Trailer, 5-Axel Single Trailer, 6 or More Axel Multi-Trailer, 5 or Fewer Axel Multi-Trailer, 6 Axel Multi-Trailer, 7 or More Axel	Heavy Duty Truck (HDV)

For example, using the same default MOBILE6.2 national average VMT distribution from calendar year 2000 used in the example above, the calculations needed would be:

1. LDV = LDV
2. LDT1 = 0.0671 * (LDT/0.3912)
3. LDT2 = 0.2230 * (LDT/0.3912)
4. LDT3 = 0.0690 * (LDT/0.3912)
5. LDT4 = 0.0321 * (LDT/0.3912)
6. HDV2b = 0.0383 * (HDV/0.1152)
7. HDV3 = 0.0038 * (HDV/0.1152)
8. HDV4 = 0.0029 * (HDV/0.1152)
9. HDV5 = 0.0022 * (HDV/0.1152)
10. HDV6 = 0.0083 * (HDV/0.1152)
11. HDV7 = 0.0099 * (HDV/0.1152)
12. HDV8a = 0.0109 * (HDV/0.1152)
13. HDV8b = 0.0389 * (HDV/0.1152)
14. HDBS = 0.0019 * (HDB/0.0028)
15. HDBT = 0.0009 * (HDB/0.0028)
16. MC = MC

Where the values LDV, LDT, HDV, HDB and MC are the general category VMT fractions from HPMS. These five values must sum to one. The value 0.3912 is the sum of the LDT1, LDT2, LDT3 and LDT4 default values. The value 0.1152 is the sum of the HDV2b, HDV3, HDV4, HDV5, HDV6, HDV7, HDV8a and HDV8b default values. The value 0.0028 is the sum of the HDBS and HDBT default values. These default values are from calendar year 2000.

The VMT by vehicle class in MOBILE6.2 varies from calendar year to calendar year due to uneven growth in the vehicle sales by vehicle class. The default VMT distribution used in the calculation must be taken from the calendar year that coincides with the calendar year of the local data used. Table 4.1.2 shows the default national average VMT by vehicle class calculated by MOBILE6.2 for all calendar years.

4.1.4 MOBILE6.2 Commands

The local fraction of vehicle miles traveled by each vehicle class is provided to MOBILE6.2 using the VMT FRACTIONS command. This command requires that the user supply the sixteen values which represent the fraction of all VMT accumulated by all highway motor vehicles which is accumulated by each of sixteen vehicle classes. All values must be between zero and one, and the sixteen values must sum to one. See Section 2.8.8.1 of the MOBILE6.2 User Guide for more information on how to use this command.

Table 4.1.2

National Average Vehicle Miles Traveled Fractions By Vehicle Class Using MOBILE6.2 (Part 1)

Calendar Year	LDV 1	LDT1 2	LDT2 3	LDT3 4	LDT4 5	HDV2B 6	HDV3 7	HDV4 8	HDV5 9	HDV6 10	HDV7 11	HDV8A 12	HDV8B 13	HDBS 14	HDBT 15	MC 16
1952 - 1972	0.6833	0.0374	0.1245	0.0517	0.0237	0.0238	0.0021	0.0013	0.0012	0.0038	0.0042	0.0069	0.0252	0.0012	0.0006	0.0092
1973	0.6833	0.0374	0.1245	0.0517	0.0237	0.0238	0.0021	0.0013	0.0012	0.0038	0.0042	0.0069	0.0252	0.0012	0.0006	0.0092
1974	0.6833	0.0374	0.1245	0.0517	0.0237	0.0238	0.0021	0.0013	0.0012	0.0038	0.0042	0.0069	0.0252	0.0012	0.0006	0.0092
1975	0.6833	0.0374	0.1245	0.0517	0.0237	0.0238	0.0021	0.0013	0.0012	0.0038	0.0042	0.0069	0.0252	0.0012	0.0006	0.0092
1976	0.6834	0.0373	0.1243	0.0517	0.0238	0.0238	0.0021	0.0013	0.0012	0.0038	0.0042	0.0070	0.0252	0.0012	0.0006	0.0092
1977	0.6839	0.0372	0.1238	0.0517	0.0238	0.0238	0.0021	0.0013	0.0012	0.0038	0.0042	0.0070	0.0252	0.0012	0.0006	0.0092
1978	0.6843	0.0371	0.1234	0.0517	0.0238	0.0238	0.0021	0.0013	0.0012	0.0038	0.0043	0.0070	0.0252	0.0012	0.0006	0.0092
1979	0.6844	0.0370	0.1232	0.0517	0.0238	0.0238	0.0021	0.0013	0.0012	0.0039	0.0044	0.0070	0.0252	0.0013	0.0006	0.0092
1980	0.6843	0.0370	0.1231	0.0517	0.0238	0.0238	0.0021	0.0013	0.0012	0.0039	0.0046	0.0070	0.0252	0.0012	0.0006	0.0092
1981	0.6841	0.0370	0.1230	0.0517	0.0238	0.0238	0.0021	0.0013	0.0012	0.0040	0.0048	0.0070	0.0252	0.0013	0.0006	0.0092
1982	0.6837	0.0370	0.1231	0.0517	0.0238	0.0238	0.0021	0.0013	0.0012	0.0042	0.0050	0.0070	0.0252	0.0012	0.0006	0.0092
1983	0.6813	0.0367	0.1222	0.0517	0.0238	0.0251	0.0023	0.0014	0.0012	0.0045	0.0054	0.0073	0.0262	0.0013	0.0006	0.0091
1984	0.6764	0.0365	0.1216	0.0520	0.0239	0.0270	0.0025	0.0015	0.0013	0.0049	0.0059	0.0078	0.0279	0.0014	0.0007	0.0088
1985	0.6695	0.0369	0.1228	0.0520	0.0239	0.0290	0.0027	0.0016	0.0014	0.0053	0.0064	0.0083	0.0296	0.0015	0.0007	0.0085
1986	0.6621	0.0377	0.1255	0.0524	0.0241	0.0302	0.0029	0.0017	0.0015	0.0056	0.0068	0.0086	0.0307	0.0015	0.0007	0.0082
1987	0.6548	0.0387	0.1287	0.0533	0.0245	0.0309	0.0031	0.0017	0.0015	0.0058	0.0070	0.0088	0.0313	0.0015	0.0007	0.0079
1988	0.6460	0.0396	0.1317	0.0548	0.0252	0.0317	0.0032	0.0018	0.0015	0.0060	0.0074	0.0090	0.0321	0.0016	0.0008	0.0077
1989	0.6357	0.0408	0.1358	0.0565	0.0260	0.0325	0.0033	0.0019	0.0016	0.0062	0.0076	0.0092	0.0329	0.0016	0.0008	0.0075
1990	0.6284	0.0420	0.1397	0.0566	0.0260	0.0332	0.0034	0.0020	0.0016	0.0064	0.0079	0.0094	0.0337	0.0017	0.0008	0.0073
1991	0.6212	0.0435	0.1448	0.0560	0.0257	0.0336	0.0035	0.0021	0.0017	0.0066	0.0081	0.0095	0.0341	0.0017	0.0008	0.0072
1992	0.6109	0.0456	0.1518	0.0555	0.0255	0.0342	0.0036	0.0022	0.0017	0.0068	0.0083	0.0097	0.0346	0.0017	0.0008	0.0071
1993	0.6009	0.0477	0.1587	0.0551	0.0253	0.0348	0.0036	0.0023	0.0018	0.0070	0.0085	0.0098	0.0350	0.0017	0.0008	0.0070
1994	0.5910	0.0497	0.1655	0.0546	0.0251	0.0354	0.0037	0.0024	0.0018	0.0072	0.0087	0.0100	0.0355	0.0018	0.0008	0.0070
1995	0.5815	0.0517	0.1721	0.0542	0.0249	0.0358	0.0037	0.0025	0.0019	0.0073	0.0089	0.0101	0.0360	0.0018	0.0009	0.0069
1996	0.5721	0.0534	0.1776	0.0547	0.0252	0.0362	0.0037	0.0025	0.0019	0.0075	0.0090	0.0102	0.0364	0.0018	0.0009	0.0068

Table 4.1.2

National Average Vehicle Miles Traveled Fractions By Vehicle Class Using MOBILE6.2 (Part 2)

1997	0.5569	0.0557	0.1853	0.0571	0.0263	0.0367	0.0037	0.0026	0.0020	0.0077	0.0092	0.0104	0.0370	0.0018	0.0009	0.0067
1998	0.5360	0.0590	0.1963	0.0605	0.0278	0.0372	0.0038	0.0027	0.0021	0.0079	0.0095	0.0106	0.0376	0.0019	0.0009	0.0065
1999	0.5153	0.0622	0.2071	0.0638	0.0294	0.0377	0.0038	0.0028	0.0021	0.0081	0.0097	0.0107	0.0382	0.0019	0.0009	0.0064
2000	0.4953	0.0655	0.2179	0.0672	0.0309	0.0380	0.0038	0.0029	0.0022	0.0082	0.0098	0.0108	0.0386	0.0019	0.0009	0.0062
2001	0.4785	0.0683	0.2273	0.0700	0.0322	0.0381	0.0038	0.0029	0.0022	0.0083	0.0099	0.0109	0.0388	0.0019	0.0009	0.0061
2002	0.4646	0.0706	0.2349	0.0724	0.0333	0.0382	0.0038	0.0030	0.0022	0.0084	0.0100	0.0109	0.0390	0.0019	0.0009	0.0060
2003	0.4507	0.0729	0.2425	0.0748	0.0344	0.0384	0.0038	0.0030	0.0023	0.0085	0.0100	0.0110	0.0392	0.0019	0.0009	0.0059
2004	0.4365	0.0752	0.2503	0.0771	0.0355	0.0386	0.0038	0.0030	0.0023	0.0085	0.0101	0.0111	0.0394	0.0019	0.0009	0.0058
2005	0.4231	0.0774	0.2577	0.0794	0.0365	0.0387	0.0038	0.0031	0.0023	0.0086	0.0102	0.0111	0.0395	0.0020	0.0009	0.0057
2006	0.4096	0.0797	0.2654	0.0818	0.0376	0.0387	0.0038	0.0031	0.0023	0.0086	0.0102	0.0111	0.0396	0.0020	0.0009	0.0056
2007	0.3952	0.0822	0.2735	0.0843	0.0388	0.0387	0.0038	0.0031	0.0023	0.0086	0.0102	0.0111	0.0396	0.0020	0.0009	0.0056
2008	0.3807	0.0846	0.2817	0.0868	0.0399	0.0388	0.0038	0.0031	0.0024	0.0087	0.0102	0.0111	0.0397	0.0020	0.0009	0.0055
2009	0.3669	0.0869	0.2894	0.0892	0.0410	0.0389	0.0038	0.0032	0.0024	0.0087	0.0103	0.0112	0.0398	0.0020	0.0010	0.0054
2010	0.3544	0.0891	0.2965	0.0914	0.0420	0.0390	0.0038	0.0032	0.0024	0.0087	0.0103	0.0112	0.0399	0.0020	0.0010	0.0054
2011	0.3428	0.0911	0.3031	0.0934	0.0430	0.0390	0.0038	0.0032	0.0024	0.0087	0.0103	0.0112	0.0398	0.0020	0.0010	0.0053
2012	0.3325	0.0928	0.3090	0.0952	0.0438	0.0390	0.0038	0.0032	0.0024	0.0087	0.0103	0.0112	0.0399	0.0020	0.0010	0.0053
2013	0.3231	0.0944	0.3143	0.0969	0.0445	0.0390	0.0038	0.0032	0.0024	0.0087	0.0103	0.0112	0.0399	0.0020	0.0010	0.0053
2014	0.3145	0.0959	0.3191	0.0983	0.0452	0.0391	0.0038	0.0032	0.0024	0.0088	0.0103	0.0112	0.0400	0.0020	0.0010	0.0052
2015	0.3071	0.0971	0.3233	0.0996	0.0458	0.0391	0.0039	0.0032	0.0024	0.0088	0.0104	0.0112	0.0400	0.0020	0.0010	0.0052
2016	0.3004	0.0982	0.3270	0.1008	0.0463	0.0392	0.0039	0.0033	0.0024	0.0088	0.0104	0.0112	0.0400	0.0020	0.0010	0.0052
2017	0.2944	0.0992	0.3304	0.1018	0.0468	0.0392	0.0039	0.0033	0.0024	0.0088	0.0104	0.0113	0.0401	0.0020	0.0010	0.0051
2018	0.2892	0.1001	0.3332	0.1027	0.0472	0.0393	0.0039	0.0033	0.0024	0.0088	0.0104	0.0113	0.0402	0.0020	0.0010	0.0051
2019	0.2846	0.1008	0.3357	0.1035	0.0476	0.0394	0.0039	0.0033	0.0025	0.0088	0.0104	0.0113	0.0403	0.0020	0.0010	0.0051
2020 - 2050	0.2793	0.1017	0.3384	0.1043	0.0480	0.0396	0.0039	0.0033	0.0025	0.0089	0.0105	0.0114	0.0405	0.0020	0.0010	0.0051

4.2 Vehicle Miles Traveled Fraction by Highway Functional System

4.2.1 Guidance

The fraction of vehicle miles traveled (VMT) by highway functional system (also called "roadway type" or "facility type") varies from area to area and can have a significant effect on overall emissions from highway mobile sources. For SIP-related highway vehicle emission inventory development in moderate and above non-attainment areas, EPA expects states to develop and use their own specific estimates of VMT by highway functional system.

The VMT fractions by highway functional system used in inventory modeling should be consistent, where possible, with assumptions used in other highway vehicle related planning. Metropolitan Planning Organizations (MPOs) and state Departments of Transportation (DOTs) should be consulted for information to determine the proportion of vehicle VMT by time of day and facility class.

4.2.2 Description

Often different groups will use different terms to describe the same highway functional system (or roadway type or facility). As a result, states should take care in determining the proper allocation of VMT among the driving cycles available in MOBILE6.2. The release of MOBILE6.2 is not intended to redefine roadway types or to change any reporting requirements of EPA or other organizations. MOBILE6.2, however, does estimate different emission levels for a limited range of driving cycles. These differences must be accounted for in SIP-related highway vehicle emission inventory development.

There are four sets of driving cycles that are modeled separately in MOBILE6.2. States may choose to run each driving cycle set separately and combine the results outside the MOBILE6.2 model, or they may use the ability of MOBILE6.2 to combine the results into a single emission rate. In either case, states will need to determine which of the four driving cycles available in MOBILE6.2 will be used to model each portion of the total VMT. The four driving cycle sets available in MOBILE6.2 are (using the MOBILE6.2 terminology):

Freeway Driving Cycles
Arterial/collector Driving Cycles
Local roadway Driving Cycle
Freeway ramp Driving Cycle

These driving cycles are intended to include all VMT by all highway motor vehicles. Each driving cycle set implies different assumptions about vehicle activity and different emission estimates in MOBILE6.2.

Freeway Driving Cycles

In MOBILE6.2, "freeway" VMT refers to driving that occurs on roadways that do not have traffic signals, that usually have limited access (via converging ramps) and have free flow speeds greater than 50 miles per hour. These roadways are usually divided and have more than one lane in each direction. This definition does not include short sections (less than two miles) of a roadway between signals, but could include longer roadway segments that effectively act as freeways. Driving on roadways of this sort normally include no vehicle stops except in the most extreme congested conditions. VMT associated with freeway-type roadways are best modeled in MOBILE6.2 using the freeway set of driving cycles.

The freeway driving cycles in MOBILE6.2 do not include the special VMT that occurs on freeway ramps. Driving activity that occurs on freeway ramps is modeled separately as another separate driving cycle. Determining what portion of overall freeway VMT is considered freeway ramp VMT for MOBILE6.2 is discussed later in this section.

Arterial/Collector Driving Cycles

In MOBILE6.2, "arterial/collector" VMT refers to driving that occurs on roadways that have signalized traffic control. These roadways are not freeways, because they have traffic signals, but they may be divided, multiple lanes, one-way and have high free flow speeds. However, traffic will be stopped periodically by traffic signals and will be further affected by access to the roadway by driveways and un-signalized intersections. Even in free flow, the driving on arterial/collector roadways will be characterized by cruising periods interrupted by traffic signals. VMT associated with arterial/collector-type roadways are best modeled in MOBILE6.2 using the arterial/collector set of driving cycles.

Standard USDOT definitions of arterial and collector roadways may include some roadways which are more characteristic of freeways for purposes of MOBILE6.2 emission modeling. Areas should consider if some VMT assigned to arterial and collector roadways would be better modeled as freeways in MOBILE6.2.

Local Roadway Driving Cycle

In MOBILE6.2, "local roadway" VMT refers to driving on roadways which are not normally considered as part of the traffic network. These roadways do not have traffic lights and rarely have more than one lane in each direction. They usually allow vehicle parking on the roadway surface and traffic control is handled via stop/yield signs. Speed limits are normally 30 miles per hour or less. The driving cycle used in MOBILE6.2 to model local roadways is fixed at an average speed of 12.9 miles per hour. Driving on local roadways is characterized by extremely low speeds and frequent stops at intersections. Most local roadways will likely be in residential areas. VMT associated with local-type roadways are best modeled in MOBILE6.2 using the local roadway driving cycle.

Note that the MOBILE6.2 driving cycle used for local roadways may differ from the range of activity on the roadways defined as local by USDOT Publication No. FHWA-ED-90-006 revised March 1989 (Highway Functional Classification) for both rural and urban local VMT. The local roadway driving cycle used in MOBILE6.2 likely constitutes only a small subset of urban local VMT as defined by FHWA. When in doubt, EPA recommends that any roadway VMT that does not clearly match the MOBILE6.2 driving cycle for local roadways be included with MOBILE6.2 arterial/collector VMT rather than included with MOBILE6.2 local roadway VMT.

Freeway Ramp

In MOBILE6.2, "freeway ramp" VMT refer to the activity on access roadways for freeways. It includes both traffic entering the freeway and exiting. Driving on freeway ramps is characterized by rapid acceleration from stop or low speeds to freeway speeds and decelerations from freeway speeds to low speeds or stop.

Freeway ramp activity is not included in the MOBILE6.2 the freeway driving cycle set. Therefore, all "freeway" VMT in MOBILE6.2 must include a corresponding amount of freeway ramp VMT in MOBILE6.2 to account for acceleration and deceleration to and from freeway speeds. VMT associated with freeway ramp-type activity are best modeled in MOBILE6.2 using the freeway ramp driving cycle.

Most areas do not explicitly account for freeway ramp VMT separately. If this is the case, then the default fraction used in MOBILE6.2 should be used. MOBILE6.2 models freeway ramp VMT based on the assumption that freeway ramps are 8% of all VMT assigned to both freeways and freeway ramps. MOBILE6.2 models all freeway ramps at a fixed average speed of 34.6 miles per hour. If the freeway ramp VMT is accounted for in other driving cycle sets (i.e., collector roadways), then the VMT in those roadways must be reduced by the amount of VMT assigned to the freeway and freeway ramp combination. In the following parts of this section, it is assumed that all freeway ramp VMT is originally assigned only to freeway groupings.

The emission estimates based on the freeway ramp driving cycle do not include the effects of roadway grade on emissions. This means that any driving activity that involves rapid acceleration from stop or low speeds to freeway speeds and decelerations from freeway speeds to low speeds or stop can be considered as ramp activity for purposes of emission modeling, since it does not matter whether such accelerations and decelerations occur on graded ramps or on flat roadways themselves. Any roadways with freeway-like speeds (greater than 50 miles per hour), even if they do not have limited access, will have accelerations and decelerations that could be considered as ramp activity.

For purposes of emission modeling, VMT assigned to classes of roadways used by states, regardless of the terminology used, should be carefully matched to the driving cycle sets available in MOBILE6.2 which best matches the characteristics of the roadway links in that class.

4.2.3 Method

It was not necessary for previous versions of the MOBILE model to differentiate between roadway classes. By design, these earlier models were not intended to evaluate the differences between the vehicle activity on different roadway types. MOBILE6.2 was designed to account for differences in vehicle activity on different roadway types and allow for more precise modeling of emissions for individual roadway links.

At a minimum, the Highway Performance Monitoring System (HPMS) provides vehicle count data by roadway type representative of urban areas in each state ("Highway Performance Monitoring System Field Manual," December 2000, OMB No. 21250028, Office of Highway Policy Information, Federal Highway Administration). However, Metropolitan Planning Organizations (MPOs) and state Departments of Transportation (DOTs) should be consulted for information to determine the proportion of vehicle VMT by time of day and facility class. The VMT fractions by highway functional system used in inventory modeling should be consistent, where possible, with assumptions used in other highway vehicle related planning. The report, "Guidance for the Development of Facility Type VMT and Speed Distributions," Systems Applications International, Inc., September 1998 (EPA 420-P-99-004, M6.SPD.004), provides some discussion of obtaining and using data for this purpose.

MOBILE6.2 does not require the creation of new roadway classifications or change the definition of existing roadway classifications. States will be expected to carefully match the roadway type classifications that they use with the driving cycle sets available in MOBILE6.2. The descriptions of the MOBILE6.2 driving cycle sets are discussed in Section 4.2.2, above.

The U.S. Department of Transportation Federal Highway Administration (FHWA) has a set of standard roadway (highway functional system) groupings. These 12 categories are used for many of FHWA reporting requirements and state DOT's usually report to US DOT in these categories. However, state air agencies, and DOT's that have to do air inventories, may develop other categorizations that serve their needs or may have different terminology for these same classifications.

If we consider MOBILE6.2 driving cycles used for freeways and freeway ramps as a single driving cycle set, the resulting three classifications can be matched in general to each of the 12 types used by FHWA, described in the following table:

Table 4.2.1 Matching FHWA Roadways to MOBILE6.2	
FHWA Highway Functional System	MOBILE6.2 Driving Cycle Set
rural interstate	freeway and freeway ramp
rural other principle arterial	freeway and freeway ramp
rural minor arterial	arterial/collector
rural major collector	arterial/collector
rural minor collector	arterial/collector
rural local	arterial/collector
urban interstate	freeway and freeway ramp
urban other freeways	freeway and freeway ramp
urban other principle arterial	arterial/collector
urban minor arterial	arterial/collector
urban collector	arterial/collector
urban local	local roadway

By default in MOBILE6.2, 8% of VMT in any freeway and freeway ramp category will be the freeway ramp VMT. For example, if the urban interstate category has a VMT fraction of 10%, a MOBILE6.2 VMT for this roadway grouping would be 0.8% (8% of the 10%) freeway ramp and 9.2% (10%-0.8%) freeway without ramps. If the VMT for freeway ramps is accounted for explicitly in additional highway functional systems provided by the state, then this approximation method is not needed.

This mapping of FHWA standard roadway groupings to MOBILE6.2 driving cycle sets is presented as an example. Users should critically consider the actual roadway segments that are classified into the FHWA system and compare their characteristics with the descriptions of the MOBILE6.2 driving cycle sets in Section 4.2.2 above before making a final determination of the VMT distribution by driving cycle set in MOBILE6.2. The criteria used for mapping of any roadway system to the MOBILE6.2 driving cycle sets must be clearly documented.

If results for each of the driving cycle sets are needed separately, then the database output option of MOBILE6.2 can be used to determine the results for each of the four driving cycle sets available in MOBILE6.2 from a single MOBILE6.2 run. A separate MOBILE6.2 run for each driving cycle set can also be used. This approach may be necessary if a more detailed breakout of roadways (i.e., the FHWA classifications) is needed. This can be done by assigning all VMT (100%) to the driving cycle set in MOBILE6.2 corresponding to the roadway grouping. For freeways, which include freeway ramps, a fraction of freeway VMT without ramps and the freeway ramp fraction must both be entered. However, the sum of both fractions (freeway and freeway ramp) must equal 100%.

If only an overall result is needed, then the VMT assigned to each MOBILE6.2 driving cycle set can be divided by the total VMT to give a fraction for each of the four MOBILE6.2 driving cycle

sets. These four values must equal 100%. Then a single MOBILE6.2 run, including a VMT distribution for all driving cycle sets, can be done to give the overall result.

Hourly VMT by Highway Functional System

The data obtained from Metropolitan Planning Organizations (MPOs) and state Departments of Transportation (DOTs) may be available on an hourly, or at least peak/off peak basis. MOBILE6.2 requires an estimate for each hour of the day. If hourly results are not available, states must distribute the known daily or peak/off peak results to the individual hours of the day. If no information is available regarding the temporal distribution of vehicle travel, EPA should be consulted before using national average values.

The default national average VMT distribution by MOBILE6.2 driving cycle set (roadway) is different for each hour of the day. The derivation of these default values is described in the report, "Development of Methodology for Estimating VMT Weighting by Facility Type," Systems Applications International, Inc., September 1998 (EPA 420-P-99-006, M6.SPD.003). The results are shown in the table below:

Table 4.2.2
MOBILE6.2 Default Distribution of VMT
By Driving Cycle Set in Each Hour

		Distribution by Driving Cycle Set in Each Hour				
Hour	Description	Non-Ramp Freeway	Arterial/ Collector	Local Roadway	Freeway Ramp	All Roadways
1	6 a.m. through 6:59 a.m.	0.427	0.418	0.118	0.037	1.000
2	7 a.m. through 7:59 a.m.	0.443	0.403	0.115	0.039	1.000
3	8 a.m. through 8:59 a.m.	0.457	0.394	0.109	0.040	1.000
4	9 a.m. through 9:59 a.m.	0.461	0.392	0.107	0.040	1.000
5	10 a.m. through 10:59 a.m.	0.453	0.400	0.108	0.039	1.000
6	11 a.m. through 11:59 a.m.	0.418	0.434	0.112	0.036	1.000
7	12 Noon through 12:59 p.m.	0.392	0.457	0.117	0.034	1.000
8	1 p.m. through 1:59 p.m.	0.344	0.497	0.129	0.030	1.000
9	2 p.m. through 2:59 p.m.	0.338	0.497	0.135	0.030	1.000
10	3 p.m. through 3:59 p.m.	0.349	0.492	0.129	0.030	1.000
11	4 p.m. through 4:59 p.m.	0.346	0.497	0.127	0.030	1.000
12	5 p.m. through 5:59 p.m.	0.333	0.509	0.129	0.029	1.000
13	6 p.m. through 6:59 p.m.	0.324	0.516	0.132	0.028	1.000
14	7 p.m. through 7:59 p.m.	0.334	0.506	0.131	0.029	1.000
15	8 p.m. through 8:59 p.m.	0.334	0.506	0.131	0.029	1.000
16	9 p.m. through 9:59 p.m.	0.320	0.518	0.134	0.028	1.000
17	10 p.m. through 10:59 p.m.	0.330	0.506	0.135	0.029	1.000
18	11 p.m. through 11:59 p.m.	0.312	0.521	0.140	0.027	1.000
19	12 Midnight through 12:59 a.m.	0.295	0.538	0.141	0.026	1.000
20	1 a.m. through 1:59 a.m.	0.310	0.527	0.136	0.027	1.000
21	2 a.m. through 2:59 a.m.	0.329	0.510	0.133	0.028	1.000
22	3 a.m. through 3:59 a.m.	0.343	0.497	0.130	0.030	1.000
23	4 a.m. through 4:59 a.m.	0.381	0.460	0.126	0.033	1.000
24	5 a.m. through 5:59 a.m.	0.405	0.437	0.123	0.035	1.000

If hourly values are not available, but the full daily VMT distribution by the MOBILE6.2 driving cycle set is known, the known distribution should be used for every hour of the day. For example, we might assume that it is known that on a daily basis that:

40% of VMT occurs on non-ramp freeways
40% of VMT occurs on arterial/collector roadways
15% of VMT occurs on local roadways
5% of VMT occurs on freeway ramps

In this case, every hour of the day would use the same distribution of VMT by MOBILE6.2 driving cycle set. Similarly, if the full VMT distribution by the MOBILE6.2 driving cycle set is known for certain periods of the day, such as peak and off-peak, then those same distributions should be used for each hour of the day within the time periods.

In the case where the proportions of VMT assigned to arterial/collector and local roadway driving cycle sets is known, however, the proportion of total freeway VMT which is freeway ramps is not known, the MOBILE6.2 default value of 8% may be used to determine the freeway ramp VMT proportion. For example, if the freeway category (including freeway ramps) has a VMT fraction of 40%, a MOBILE6.2 VMT for this roadway grouping would be 3.2% (8% of the 40%) freeway ramp and 36.8% (40%-3.2%) freeway without ramps. Once the full distribution is known, the same distribution would be used for all hours of the day (for daily values) or within the time period (for peak/off-peak values).

If hourly values are not available and the proportions of VMT assigned to arterial/collector and local roadway driving cycle sets is not known, the daily VMT values for each MOBILE6.2 driving cycle set can be distributed in each hour using the proportions in Table 4.2.2 above. Similarly, peak and off peak averages can be redistributed to the corresponding individual hours using the proportions in those hours shown in the table. For example, it is known that 40% of the VMT occurs on freeways (including ramps) and the remaining 60% of the VMT occurs on non-freeways on a daily basis. Between 6:00 and 6:59 a.m., the Table 4.2.2 shows that 41.8% of total VMT occurs on arterial/collector roadways and 11.8% of total VMT occurs on local roadways. These values can be used to distribute the known proportion of VMT which does not occur on freeways (60%):

Arterial/Collectors : $60\% * (0.418 / (0.418 + 0.118)) = 46.8\%$
Local Roadways : $60\% * (0.118 / (0.418 + 0.118)) = 13.2\%$

The sum of the two fractions must still equal 60%. This calculation is repeated for each hour of the day. The known proportion of total freeway VMT is divided into freeway ramp and non-ramp freeway values using the MOBILE6.2 default value of 8% as described above. Similarly, cases where there are peak/off-peak estimates, the proportions can be determined within each time period.

If the distribution of VMT by vehicle class in each hour of the day is known, but the proportion of freeway ramp VMT is not known and/or the proportions of arterial/collector and local roadways is not known, then, the appropriate distribution of total VMT in each of the four driving cycle sets needed for input to MOBILE6.2 can be determined using the methods described above for each individual hour.

After the VMT for assigned to each MOBILE6.2 driving cycle set has been determined, the four values must sum to one in each hour of the day.

VMT by Vehicle Class and Highway Functional System

MOBILE6.2 does not have different values for the VMT by driving cycle set (roadway) for each vehicle class. The same VMT by driving cycle set may be used for every vehicle class. However, MOBILE6.2 will allow the use of different estimates for the VMT by driving cycle set for each vehicle class if the data is available. The methods described above can be used for each vehicle class (or for groupings of vehicle classes) independently. Separate VMT by driving cycle set for each vehicle class is preferred. This will only be possible if the information regarding VMT on each roadway class is split by vehicle class as well.

4.2.4 MOBILE6.2 Commands

The VMT by driving cycle set is entered into MOBILE6.2 using the VMT BY FACILITY command. This command requires that the user supply the 2,688 values which represent the fraction of all VMT accumulated by all highway motor vehicles in each hour of the day (24 hours) which is accumulated on each of the four driving cycle sets by each of the 28 vehicle classes. MOBILE6.2 does not require that values for all vehicle classes be entered, so that only the vehicle classes that need to be changed must be entered. All values must be between zero and one, and the four values in each hour for each vehicle class must sum to one. See Section 2.8.8.2a of the MOBILE6.2 User Guide for more information on how to use this command.

This command is closely related to the VMT BY HOUR and SPEED VMT commands, which are used to provide the temporal distribution of VMT and the average speed distributions for each driving cycle set. Determination of VMT by hour and average speeds are discussed in Sections 4.3 and 4.4 below.

4.3 Vehicle Miles Traveled Fraction by Hour of the Day

4.3.1 Guidance

The fraction of vehicle miles traveled (VMT) by hour of the day varies from area to area, but for most purposes, this variation has a negligible effect on overall daily emissions from highway mobile sources. States may choose to use the default values for VMT by hour of the day instead of developing local values. However, results from photochemical models are sensitive to differences in the estimated inventory by time of day. For SIP-related highway vehicle emission

inventory development in moderate and above non-attainment areas, where photochemical modeling is needed, EPA encourages states to develop and use their own specific estimates of VMT by hour of the day.

The VMT fractions by hour used in inventory modeling should be consistent, where possible, with assumptions used in other highway vehicle related planning. Metropolitan Planning Organizations (MPOs) and state Departments of Transportation (DOTs) should be consulted for information to determine the proportion of vehicle VMT by time of day.

4.3.2 Description

The amount of vehicle travel varies significantly during the day. MOBILE6.2 has a national average default distribution for the daily VMT. States may choose to use the default values for VMT by hour of the day instead of developing local values. The distribution is simply the fraction of all daily VMT by all vehicle classes which occurs in each hour of the day.

4.3.3 Method

Development of an estimate for the VMT by hour of day is optional. However, results from photochemical models are sensitive to differences in the estimated inventory by time of day. The report, "Guidance for the Development of Facility Type VMT and Speed Distributions," Systems Applications International, Inc., September 1998 (EPA 420-P-99-004, M6.SPD.004), provides some discussion of obtaining and using data for this purpose. The VMT fractions by hour of the day used in inventory modeling should be consistent, where possible, with assumptions used in other highway vehicle related planning.

If available data on the temporal distribution of VMT is not hourly specific (i.e., peak and off peak), the data may be disaggregated into hourly estimates using the MOBILE6.2 default values. These values are shown in Table 4.3.1 below.

Table 4.3.1 MOBILE6.2 Default Distribution of VMT By Hour of Day		
Hour	Description	Fraction of Total VMT
1	6 a.m. through 6:59 a.m.	0.0569
2	7 a.m. through 7:59 a.m.	0.0740
3	8 a.m. through 8:59 a.m.	0.0656
4	9 a.m. through 9:59 a.m.	0.0555
5	10 a.m. through 10:59 a.m.	0.0540
6	11 a.m. through 11:59 a.m.	0.0582
7	12 Noon through 12:59 p.m.	0.0608
8	1 p.m. through 1:59 p.m.	0.0571
9	2 p.m. through 2:59 p.m.	0.0598
10	3 p.m. through 3:59 p.m.	0.0636
11	4 p.m. through 4:59 p.m.	0.0777
12	5 p.m. through 5:59 p.m.	0.0730
13	6 p.m. through 6:59 p.m.	0.0501
14	7 p.m. through 7:59 p.m.	0.0389
15	8 p.m. through 8:59 p.m.	0.0308
16	9 p.m. through 9:59 p.m.	0.0264
17	10 p.m. through 10:59 p.m.	0.0194
18	11 p.m. through 11:59 p.m.	0.0144
19	12 Midnight through 12:59 a.m.	0.0108
20	1 a.m. through 1:59 a.m.	0.0086
21	2 a.m. through 2:59 a.m.	0.0081
22	3 a.m. through 3:59 a.m.	0.0080
23	4 a.m. through 4:59 a.m.	0.0098
24	5 a.m. through 5:59 a.m.	0.0186
	Total	1.0000

Peak and off peak averages can be redistributed to individual hours using the proportions shown in the table. For example, if 30% of the VMT occurs between 7 a.m and 9:59 a.m., then using the default fractions the distribution of the 30% would be:

7 a.m. - 7:59 a.m. : 30% * (0.0740 / (0.0740 + 0.0656 + 0.0555)) = 11.4%
8 a.m. - 8:59 a.m. : 30% * (0.0656 / (0.0740 + 0.0656 + 0.0555)) = 10.1%
9 a.m. - 9:59 a.m. : 30% * (0.0555 / (0.0740 + 0.0656 + 0.0555)) = 8.5%

Similarly, the off peak values can be distributed. The sum of all 24 values must still add to one (100%).

4.3.4 MOBILE6.2 Commands

The VMT by hour is entered into MOBILE6.2 using the VMT BY HOUR command. This command requires that the user supply 24 values which represent the fraction of all VMT accumulated by all highway motor vehicles in each hour of the day (24 hours). All values must be between zero and one, and the 24 values must sum to one. See Section 2.8.8.2b of the MOBILE6.2 User Guide for more information on how to use this command.

This command is closely related to the VMT BY FACILITY and SPEED VMT commands, which is used to provide the driving cycle set distribution of VMT and the average speed distributions for each driving cycle set. Determination of VMT by driving cycle set and average speeds is discussed in Sections 4.2 and 4.4, respectively.

4.4 Vehicle Miles Traveled Fraction by Average Speed

4.4.1 Guidance

The transient behavior of vehicles as they travel has a significant effect on vehicle emissions. This effect is captured in the MOBILE6.2 model using average speed (for particular roadway types) as a surrogate for the transient driving behavior. For this reason, the distribution of vehicle miles traveled (VMT) by average speed has a significant effect on overall daily emissions from highway mobile sources. For SIP and conformity related highway vehicle emission inventory development in moderate and above non-attainment areas, EPA expects states to develop and use their own specific estimates of VMT by average speed.

Results from photochemical models are sensitive to differences in the estimated inventory by time of day. For SIP related highway vehicle emission inventory development in moderate and above non-attainment areas, where photochemical modeling is needed, EPA encourages states to develop and use their own specific estimates of VMT by average speed by hour of the day. However, hourly estimates are not required.

The VMT fractions by average speed used in inventory modeling should be consistent, where possible, with assumptions used in other highway vehicle related planning. Metropolitan Planning Organizations (MPOs) and state Departments of Transportation (DOTs) should be consulted for information used to determine the proportion of vehicle VMT by average speed.

4.4.2 Description

Average speed, as defined for use in MOBILE6.2, is the distance traveled (in miles) divided by the time (in hours). This is not the same as the instantaneous velocity of vehicles or the nominal speed limit on the roadway link. The MOBILE6.2 definition of speed includes all operation of vehicles including intersections and other obstacles to travel which may result in stopping and idling. As a result, average speeds, as used in MOBILE6.2, will tend to be less than nominal speed limits for individual roadway links.

Selection of vehicle speeds is a difficult and complex process. Although it is appropriate for some purposes to use an average speed for all vehicle trips and vehicle types within urban areas as a whole, such an approach is not suitable for SIP inventory preparation. Instead, VMT fractions should be estimated for similar roadway segments that have roughly equal average speeds. At a minimum, speeds should be estimated separately by roadway functional class. MOBILE6.2 has been designed to allow the entry of VMT associated with roadways with roughly equal average speeds separated by roadway functional class and, by default, will aggregate the emission results into an area wide emission estimate. However, MOBILE6.2 can also be used to generate emission estimate separately by average speed and roadway type (i.e., emissions by roadway link), if post-processing of the emission estimates outside of MOBILE6.2 is preferred.

4.4.3 Method

The recommended approach to estimating average speeds is to post-process the output from a local travel demand network model. Travel demand models that do not meet the performance and validation requirements for use in forecasting VMT growth may nevertheless be suitable for deriving speed estimates. However, reasonable efforts and success in validating the model are still required. In most transportation models, speed is estimated primarily to allocate travel across the roadway network. Speed is used as a measure of impedance to travel rather than as a prediction of accurate travel times. For this reason, speed results from most travel demand models must be adjusted to properly estimate actual average speeds.

Average speed estimates for calendar years other than the calendar year on which the average speed estimates are based must be logically related to the current year methodology and estimates, with no arbitrary or unsupported assumptions of changes in average speeds. Future average speed estimates should account for the effect of growth in overall fleet VMT on roadway congestion and average speeds.

Section 3.3, "Speed Estimation Methods," of the EPA document, "Volume IV: Chapter 2, Use of Locality-Specific Transportation Data for the Development of Mobile Source Emission Inventories," (September 1996), discusses the methods used to determine average speeds for roadways. Additionally, the report, "Guidance for the Development of Facility Type VMT and Speed Distributions," Systems Applications International, Inc., September 1998 (EPA 420-P-99-004, M6.SPD.004), provides some discussion of obtaining and using data for this purpose. The average speeds and VMT estimates used in inventory modeling should be consistent, where possible, with assumptions used in other highway vehicle related planning.

MOBILE6.2 uses average speed distributions to represent the driving on all of the roadway links within the area to be modeled for each hour of the day. The average speed distributions have fourteen values which represent the fraction of all VMT which occurs at 2.5 miles per hour (MPH), and 5 to 65 mph in 5 mph increments. Each of the fourteen values must be within the range of zero through one and the sum of the fourteen values must equal one. There is a separate

speed distribution for roadways classified as freeways and for roadways classified as arterial/collectors. The definition of roadway classifications is discussed in Section 4.2 above.

Table 4.4.1
Definition of MOBILE6.2 Speed Bins

Number	Abbreviation	Description
1	2.5 mph	Miles with average speed 0-2.5 mph
2	5 mph	Miles with average speed 2.5-7.5 mph
3	10 mph	Miles with average speed 7.5-12.5 mph
4	15 mph	Miles with average speed 12.5-17.5 mph
5	20 mph	Miles with average speed 17.5-22.5 mph
6	25 mph	Miles with average speed 22.5-27.5 mph
7	30 mph	Miles with average speed 27.5-32.5 mph
8	35 mph	Miles with average speed 32.5-37.5 mph
9	40 mph	Miles with average speed 37.5-42.5 mph
10	45 mph	Miles with average speed 42.5-47.5 mph
11	50 mph	Miles with average speed 47.5-52.5 mph
12	55 mph	Miles with average speed 52.5-57.5 mph
13	60 mph	Miles with average speed 57.5-62.5 mph
14	65 mph	Miles with average speed >62.5 mph

Once the average speed is determined for each roadway segment in the area to be modeled, the VMT for each segment can be assigned to one of the average speed bins described in the Table 4.4.1 above.

The average speed VMT distributions are constructed from the average speed estimates made for each roadway segment. Knowing the traffic volume and segment length, the VMT (miles traveled by vehicles on the link) can be calculated.

VMT = Roadway segment length (miles) * Roadway segment volume (number of vehicles)

The VMT from each roadway segment is then added to the appropriate MOBILE6.2 average speed "bin" for the appropriate driving cycle set. Once the VMT for all of the roadway network segments had been placed in bins, the VMT in each bin would be divided by the total VMT for that driving cycle set (the sum of all of the bins) to give the fraction of VMT in that bin. The sum of the fractions must be one.

MOBILE6.2 input will require a speed distribution for each hour of the day. If available average speed data is not hourly specific (i.e., peak and off peak or daily average), the same values may be used for multiple hours in order to make a complete set of hourly values. However, in MOBILE6.2, average speed by hour accounts for the effects of congestion on emissions and results from photochemical models are sensitive to differences in the estimated inventory by time

of day. EPA encourages states to develop and use their own specific estimates of VMT by average speed by hour of the day.

Freeway Average Speed

MOBILE6.2 requires a freeway average speed distribution which does not include VMT which occurs on freeway ramps. If the calculation of average speed for freeways does not include the effects of activity on freeway ramps, then no further adjustment is necessary. EPA recommends that states separate the activity on freeway ramps from the remaining activity on freeways for this reason. Users may, however, use the EPA default VMT fractions for freeway ramp activity instead.

If the average speed distribution to be used for freeways includes freeway ramp activity, the VMT associated with freeway ramps must be removed from the freeway average speed distribution before it can be used in MOBILE6.2.

First, the fraction of all freeway VMT which occurs on ramps must be determined. If freeway ramp VMT has been included in total freeway VMT, this may indicate that a separate estimate of freeway ramp VMT is not available. Areas which cannot separate freeway ramp VMT from non-ramp freeway travel may assign freeway ramp VMT using the default national average of eight percent (8%) of total freeway VMT.

Using the default fraction of freeway ramp VMT and the default national average freeway ramp speed of 34.6 mph, the average speed of non-ramp freeway travel can be calculated from the total freeway average speed value for each freeway segment.

Since the average speed on freeway ramps is not a user input, the appropriate average speed for non-ramp segments can be determined once the ramp VMT fractions (and thus, non-ramp VMT) are known.

Non-Ramp Speed = (1-Ramp VMT fraction)/(1/Freeway Speed - Ramp VMT fraction/Average Ramp Speed)

Because ramp speed is a constant (34.6 miles per hour), if the default ramp VMT fraction is used (8 percent), this calculation simplifies to:

Non-Ramp Speed = 0.92/(1/Freeway Speed - 0.00231)

For example, if my average speed on a freeway segment (including ramps) is 40.0 mph, and I am using the default ramp VMT fraction of 8 percent, the non-ramp freeway speed is:

Non-Ramp Speed = 0.92/(1/40 - 0.00231) = 40.6 mph

Freeway average speeds which are greater than 34.6 mph will tend to be increased and freeway average speeds less than 34.6 mph will tend to be decreased using this method to remove the influence of freeway ramps on average speed. Since the average speed for freeway ramps is fixed at 34.6 mph and since the maximum allowed value for freeway average speeds is 65 mph, the theoretical maximum combined non-ramp and ramp average speed in MOBILE6.2 is 60.73 mph, using the default ramp VMT fraction of 8 percent. All combined freeway speeds above the theoretical level should have the same emission results as for 60.73 mph. For this reason, average speeds above 60.73 mph should not be entered using the AVERAGE SPEED command with the FREEWAY option when using MOBILE6.2.

After the average speed for each freeway segment has been adjusted to account for freeway ramps, the VMT associated with each segment must be reduced by the ramp VMT fraction as well. This VMT is then assigned to the freeway ramp category. See Section 4.2 above. Using this method, the overall fraction of freeway ramp VMT (as a fraction of the combined freeway and freeway ramp VMT) will be the same as the value (i.e., default 8% or the user supplied value) used in this method.

Arterial/Collector Roadways

MOBILE6.2 has a separate roadway classification for the arterial/collector roadway functional class with their own distribution of average speeds. No adjustment is needed to the average speeds estimated for arterial/collector roadway links before they are used in MOBILE6.2.

Individual Roadway Estimates

MOBILE6.2 is designed to estimate emissions for regions, including a variety of roadway links. If the user wishes to estimate emissions of an individual roadway link (or obtain separate results for a set of individual roadway links for use in a table), a single average speed estimate for each particular link or roadway segment must be used for each model run, instead of an average speed distribution. Modeling of individual roadway segments in MOBILE6.2 should not use more than one average speed bin in the speed distribution input, other than to interpolate between average speed bins used in the model. MOBILE6.2 assumes a default speed distribution for each average speed input and cannot be used to model the observed speed distribution of individual roadway links. For modeling purposes, each roadway link has only a single average speed in any hour of the day.

MOBILE6.2 has an "AVERAGE SPEED" command which is intended specifically to assist users in modeling individual roadway links. This command can automatically make the necessary interpolations to get specific average speed values and will automatically restrict driving cycle sets to those intended by the user. EPA recommends that users consider using the AVERAGE SPEED command when modeling individual roadway links for specific time periods less than a day. Since daily emission estimates usually require that the average speed vary, the AVERAGE SPEED command may not be appropriate for estimating daily emission rates for individual roadway links.

The results of individual roadway segments may be later combined outside the MOBILE6.2 model to generate area wide emission estimates, if desired. The average speeds used for individual roadways must be consistent with values used to generate average speed distributions used for related area wide estimates. If the average speeds and VMT estimates are consistent, summing the emission results from individual roadway segments or running a single MOBILE6.2 run using VMT distributions by average speed will result in the same overall emission estimate.

Freeway Ramps and Local Roadways

Freeway ramps and local roadways do not have user inputs for average speeds. The default national average speeds for freeway ramps and local roadways is 34.6 mph and 12.9 mph, respectively. The local VMT weighted average speed for freeway ramps and local roadways should resemble the national averages used in MOBILE6.2.

If the VMT for local roadways is a significant fraction of total VMT and the average speed on those roadways does not resemble the default national average of 12.9 mph, it may be necessary to model local roadways as arterial/collector roadways. However, users should first check to assure that the local roadway links have been properly matched to MOBILE6.2 driving cycle sets.
See Section 4.2 for a description of local roadways as they are used in MOBILE6.2. States should consult with EPA before defining all local roadways as arterial/collector roadways for modeling.

MOBILE6.2 cannot model freeway ramp conditions with average speeds significantly different from the national average default speed of 34.6 mph. Users should use the MOBILE6.2 freeway ramp emission estimates for any necessary freeway ramp modeling.

4.4.4 Idling Emission Rates

Idle emission rates are a special case for vehicle emission modeling. Idle emission rates are not normally needed to model area wide emission inventories, since the MOBILE6.2 emission rates already include vehicle idling in proportion to normal driving. However, in some special cases, such as intersection modeling, it is necessary to estimate the emissions from idling explicitly.

MOBILE6.2 does not directly model idle emission rates except for PM idle emissions for heavy duty diesel trucks as described later in this section. However, as with MOBILE5, idling emission rates (in grams per hour) are assumed to be the same as for driving at 2.5 mph. MOBILE6.2 is run using an average speed distribution which assigns all VMT to the 2.5 mph average speed bin and the arterial/collector driving cycle set. The resulting emission rate (in grams per mile) is multiplied by the average speed (2.5 miles per hour) to give the idling emission rate (in grams per hour).

Idling emission rate = Emissions at 2.5 mph * Average speed (2.5 mph)

All other inputs should be selected to best model the idling situation to be modeled. These conditions must be consistent with the values used for inventory modeling generally and for the time of day specifically.

Idle emission rates, in some cases, may include effects from an engine start. However, accounting for the effects of engine starts on exhaust emissions during vehicle operation (such as at intersections) is very difficult. Since the effects of engine starts diminish rapidly with the time since the engine start, all of the effects of an engine start on exhaust emissions will disappear within about two minutes from the engine start time on most vehicles. In addition, most of the effects of an engine start on exhaust emissions will occur in the first minute. For this reason, EPA recommends that the calculation of idling emissions at intersections not include any effects from engine starts.

Special modeling situations (such as parking lots) may require the modeling of the effects of engine starts. In these cases, the engine start emissions must be modeled separately from idling emission rates and can be converted from units of grams per hour to grams per engine start using the database output option available in MOBILE6.2. In some cases, it may be necessary to combine the contribution of engine start emissions from parking with vehicle operation emissions in the evaluation of intersections near parking to properly estimate ambient emission levels.

Special handling of idle emissions may also be required if temperatures go below 20 degrees Fahrenheit. If significant idle emissions occur below 20 degrees Fahrenheit, States should consult with their EPA regional offices.

MOBILE6.2 provides an option for producing PM idle emissions for HD trucks in its output. Instructions for this can be found in section 2.8.4.1.f in the MOBILE6.2.2 User's Guide. This option is available for PM only, and should be used if separate PM idle emission factors are needed for inventory analysis. It is important to note that the idle emission factors derived using the methods described here are only applicable to short-duration idling. If guidance is needed to estimate emission reductions associated with reductions in long-duration idling the user should contact EPA.

4.4.5 MOBILE6.2 Commands

The distribution of VMT by average speed is entered into MOBILE6.2 using the SPEED VMT command. This command requires that the user supply 14 values which represent the fraction of all VMT accumulated by all highway motor vehicles in each average speed bin for each hour of the day (24 hours) for freeways and arterial/collector roadways, a total of 672 values. All values must be between zero and one, and the 14 values for each hour and driving cycle set must sum to one. See Section 2.8.8.2c of the MOBILE6.2 User Guide for more information on how to use this command. This command is closely related to the VMT BY FACILITY command, which is

used to provide the distribution of VMT by driving cycle set. Determination of VMT by driving cycle set is discussed in Sections 4.2 above.

The AVERAGE SPEED command is used to enter a single average speed, instead of an average speed distribution. This command is discussed in Section 2.8.8.2d of the MOBILE6.2 User Guide. Average speed for a single roadway segment can also be entered using the SPEED VMT command by determining the weighting necessary for two adjacent average speed bins available in the MOBILE6.2 average speed bin distribution and restricting the results to a single driving cycle set. This method allows a different average speed to be used for each hour of the day. The method for determining the weighting factors and restricting the driving cycle set is described in Chapter 5 of the MOBILE6.2 User Guide.

Idling emission rates are best calculated using the AVERAGE SPEED command for the arterial/collector driving cycle set with the average speed set to 2.5 miles per hour. Only the "running" exhaust emission results (not including engine start emissions) are used to calculate the idle emission rates. These are obtained using the EXPAND EXHAUST command or the database output option.

4.5 Vehicle Engine Starts Per Day

4.5.1 Guidance

The number of vehicle engine starts per day will vary from area to area, but for most purposes, EPA will not expect States to develop local estimates. States may choose to use the default values for engine starts per day instead of developing local values.

Small scale and "hot spot" analysis of specific locations may require specific local estimates be used. EPA should be consulted when planning small scale analysis to determine if the use of national average default values is still appropriate for the emission modeling.

If the default values are not used, the number of vehicle engine starts per day used by states in inventory modeling should be consistent, where possible, with assumptions used in other highway vehicle related planning. Metropolitan Planning Organizations (MPOs) and state Departments of Transportation (DOTs) should be consulted for information to determine the number of vehicle engine starts per day.

4.5.2 Description

The nearly uncontrolled exhaust emissions that occur immediately after a cold engine start can account for a significant fraction of the emissions that occur during a vehicle trip. MOBILE6.2 contains default values for the number of engine starts that occur each day by vehicle class (but not by vehicle age). There will be at least one engine start for each vehicle trip. Any intermediate destination, which results in an engine shut down, will add another engine start to a

total trip. For this reason, caution must be used in interpreting traffic demand model counts of trips when determining the number of engine starts.

Only light duty vehicles (passenger cars), light duty trucks and motorcycles account for engine starts separately. The emission rates for heavy duty vehicles and busses include engine starts and the number of engine starts and the soak time distribution cannot be adjusted by the user.

Accounting for engine starts separately from vehicle miles traveled in MOBILE6.2 allows changes in both parameters independently. The effect of engine soak time between trips on engine start emissions is also accounted for separately from the raw count of engine starts.

4.5.3 Method

Development of an estimate for the number of engine starts per day is optional. If the default MOBILE6.2 values are not used, the number of engine starts per day used in inventory modeling should be consistent, where possible, with assumptions used in other highway vehicle related planning.

EPA recommends that states base their estimate of the average number of engine starts per day by vehicle class and vehicle age on instrumented vehicle data. Although travel demand forecasting models and trip diaries can account for the number of trips, instrumented vehicles best account for the effect of intermediate destinations which add engine starts to each source/destination trip. Care should be taken in the design and implementation of an instrumented vehicle study to assure that a representative sampling of vehicles are recruited for instrumentation. States should consult with EPA before attempting an instrumented vehicle study.

States should consult with EPA before using any data (traffic demand modeling results, trip diaries or instrumented vehicle data) to change the default values of the average number of engine starts per day by vehicle class and vehicle age in MOBILE6.2 for use in SIP-related highway vehicle emission inventory development.

4.5.4 MOBILE6.2 Commands

The number of engine starts per day is entered into MOBILE6.2 using the STARTS PER DAY command. This command requires that the user supply 25 values which represent the average number of engine starts that occur each day for each vehicle class. Only vehicle classes for which new values are provided need to be included. The default values for all 28 vehicles classes (a total of 700 values) may be entered. All values must be greater than zero and may be fractional values. See Section 2.8.8.3 of the MOBILE6.2 User Guide for more information on how to use this command.

This command is closely related to the START DIST and SOAK DISTRIBUTION commands, which are used to provide the distribution of engine starts by hour of the day and the distribution

of engine starts by engine soak time between engine starts. The engine start temporal distribution and soak distribution are discussed in Sections 4.6 and 4.7 below.

4.6 Vehicle Engine Starts by Hour of the Day

4.6.1 Guidance

The distribution of the number of vehicle engine starts by hour of the day will vary from area to area, but for most purposes, it is expected that this variation has a negligible effect on overall daily emissions from highway mobile sources. States may choose to use the default values for the distribution of the engine starts by hour of the day instead of developing local values.

However, results from photochemical models are sensitive to differences in the estimated inventory by time of day. For SIP-related highway vehicle emission inventory development in moderate and above non-attainment areas, where photochemical modeling is needed, EPA encourages states to develop and use their own specific estimates for the distribution of the engine starts by hour of the day.

Small scale and "hot spot" analysis of specific locations may require specific local estimates be used. EPA should be consulted when planning small scale analysis to determine if the use of national average default values is still appropriate for the emission modeling.

If the default values are not used, the distribution of the engine starts by hour of the day used by states in inventory modeling should be consistent, where possible, with assumptions used in other highway vehicle related planning. Metropolitan Planning Organizations (MPOs) and state Departments of Transportation (DOTs) should be consulted for information to determine the distribution of the engine starts by hour of the day.

4.6.2 Description

The nearly uncontrolled exhaust emissions that occur immediately after a cold engine start can account for a significant fraction of the emissions that occur during a vehicle trip. MOBILE6.2 contains default values for the distribution of the engine starts by hour of the day for a weekday and a weekend day.

Only light duty vehicles (passenger cars), light duty trucks and motorcycles account for engine starts separately. The emission rates for heavy duty vehicles and busses include engine starts and the number of engine starts and the soak time distribution cannot be adjusted by the user.

4.6.3 Method

Development of an estimate for the distribution of the engine starts by hour of the day is optional. If the default MOBILE6.2 values are not used, the distribution of the engine starts by

hour of the day used in inventory modeling should be consistent, where possible, with assumptions used in other highway vehicle related planning.

Metropolitan Planning Organizations (MPOs) and state Departments of Transportation (DOTs) should be consulted for information to determine the distribution of the engine starts by hour of the day. A distribution of trip starts by hour of the day may be part of the results from traffic demand modeling. The distribution of trip starts by hour of the day used for highway vehicle related planning may be used to distribute the engine starts per day in MOBILE6.2.

4.6.4 MOBILE6.2 Commands

The distribution of the engine starts by hour of the day is entered into MOBILE6.2 using the STARTS DIST command. This command requires that the user supply 48 values which represent the fraction of engine starts that occur in each hour of the day (24 values) for average week days and weekend days. The same distribution is used for all light duty vehicle classes and motorcycles. All values must be greater than zero and less than one. The sum of the first 24 values (week days) must equal one and the sum of the last 24 values (weekend days) must equal one. See Section 2.8.8.4 of the MOBILE6.2 User Guide for more information on how to use this command.

This command is closely related to the STARTS PER DAY and SOAK DISTRIBUTION commands, which is used to provide the number of engine starts and the distribution of engine starts by engine soak time between engine starts. The number of engine starts and the engine start soak distribution are discussed in Section 4.5 above and Section 4.7 below.

4.7 Vehicle Soak Time between Engine Starts

4.7.1 Guidance

The distribution of the soak times before an engine start will vary from area to area, but for most purposes, it is expected that this variation has a negligible effect on overall daily emissions from highway mobile sources. States may choose to use the default values for the distribution of the soak times before an engine start instead of developing local values.

Small scale and "hot spot" analysis of specific locations may require specific local estimates be used. EPA should be consulted when planning small scale analysis to determine if the use of national average default values is still appropriate for the emission modeling.

If the default values are not used, the distribution of the soak times before an engine start used by states in inventory modeling should be consistent, where possible, with assumptions used in other highway vehicle related planning. Metropolitan Planning Organizations (MPOs) and state Departments of Transportation (DOTs) should be consulted for information to determine the distribution of the soak times before an engine start.

4.7.2 Description

The nearly uncontrolled exhaust emissions that occur immediately after a cold engine start can account for a significant fraction of the emissions that occur during a vehicle trip. However, not all engine starts occur on cold engines. Soak time is defined as the time between when the engine is turned off to the next time it is restarted. The soak time can have a significant effect on the emissions associated with an engine start. MOBILE6.2 contains default values for the distribution of the soak times before an engine start by hour of the day.

Only light duty vehicles (passenger cars), light duty trucks and motorcycles account for engine starts separately. The emission rates for heavy duty vehicles and busses include engine starts and the number of engine starts and the soak time distribution cannot be adjusted by the user.

4.7.3 Method

Development of an estimate for the distribution of the soak times before an engine start is optional. If the default MOBILE6.2 values are not used, the distribution of the soak times before an engine start used in inventory modeling should be consistent, where possible, with assumptions used in other highway vehicle related planning.

EPA recommends that states base their estimate of the distribution of the soak times before an engine start by hour of the day on instrumented vehicle data. Although travel demand forecasting models can account for the number of trips, in many cases it is not possible to account for the soak time of individual vehicles. Trip diaries and surveys could be used, but these rely on vehicle owners correctly reporting values and may exclude starts that occur at intermediate destinations during trips. Section 3.5, "Cold Start/Hot Start/Hot Stabilized Weighting Factors," of the EPA document, "Volume IV: Chapter 2, Use of Locality-Specific Transportation Data for the Development of Mobile Source Emission Inventories," (September 1996), discusses methods for using travel demand forecasting models and surveys to obtain information about soak distributions.

Care should be taken in the design and implementation of an instrumented vehicle study to assure that a representative sampling of vehicles are recruited for instrumentation. States should consult with EPA before attempting an instrumented vehicle study.

States should consult with EPA before using any data (traffic demand modeling results, trip diaries or instrumented vehicle data) before changing the default values in MOBILE6.2 for the distribution of the soak times for use in SIP-related highway vehicle emission inventory development.

4.7.4 MOBILE6.2 Commands

The distribution of the soak times before an engine start is entered into MOBILE6.2 using the SOAK DISTRIBUTION command. This command requires that the user supply 3,360 values

which represent the 70 soak time periods for each hour of the day (24 values) for average week days and weekend days. The same distributions are used for all vehicle classes. All values must be greater than zero and less than one. The sum of each set of 70 values must equal one. See Section 2.8.8.5 of the MOBILE6.2 User Guide for more information on how to use this command.

This command is closely related to the STARTS PER DAY and START DIST commands, which is used to provide the number of engine starts and the distribution of engine starts by hour of the day. The number of engine starts and the engine starts by hour of the day is discussed in Section 4.5 and Section 4.6 above.

4.8 Vehicle Hot Soak Time After Engine Shut Down

4.8.1 Guidance

The distribution of the hot soak time after an engine shut down will vary from area to area, but for most purposes, it is expected that this variation has a negligible effect on overall daily emissions from highway mobile sources. States may choose to use the default values for the distribution of the hot soak time after an engine shut down instead of developing local values.

Small scale and "hot spot" analysis of specific locations may require specific local estimates be used. EPA should be consulted when planning small scale analysis to determine if the use of national average default values is still appropriate for the emission modeling.

If the default values are not used, the distribution of the hot soak time after an engine shut down used by states in inventory modeling should be consistent, where possible, with assumptions used in other highway vehicle related planning. Metropolitan Planning Organizations (MPOs) and state Departments of Transportation (DOTs) should be consulted for information to determine the distribution of the hot soak time after an engine shut down.

4.8.2 Description

Immediately after an engine is shut down (key off), while the engine is still hot, fuel vapors in the intake manifold and other locations in the fuel system are driven off the vehicle by the heat of the engine. These hydrocarbon losses are referred to as hot soak emissions. If the vehicle is restarted, the active emission control systems begin again and the full hot soak effect is interrupted, resulting in fewer hot soak emissions. MOBILE6.2 contains default values for the distribution of the hot soak time after an engine shut down by hour of the day.

The actual number of hot soaks that occur is a function of the number of engine starts per day that occur. Changing the number of engine starts per day will automatically change the number of hot soaks in a day. The number of engine starts per day is discussed in Section 4.5 above.

Only gasoline fueled vehicles are affected by the hot soak activity. Diesel vehicles and natural gasoline vehicles are assumed to have negligible hot soak evaporative emissions. The same distribution of hot soak times is used for all vehicle classes.

4.8.3 Method

Development of an estimate for the distribution of the hot soak time after an engine shut down is optional. If the default MOBILE6.2 values are not used, the distribution of the hot soak time after an engine shut down used in inventory modeling should be consistent, where possible, with assumptions used in other highway vehicle related planning.

EPA recommends that states base their estimate of the distribution of the hot soak time after an engine shut down by hour of the day on instrumented vehicle data. Since hot soak distributions are a measure of time between engine shut down and the next engine start, this information is the same as information gathered for engine start soak times and diurnal activity. Although travel demand forecasting models can account for the number of trips, in many cases it is not possible to account for the soak time of individual vehicles. Trip diaries and surveys could be used, but these rely on vehicle owners correctly reporting values and may exclude starts and hot soaks that occur at intermediate destinations during trips. Section 3.5, "Cold Start/Hot Start/Hot Stabilized Weighting Factors," of the EPA document, "Volume IV: Chapter 2, Use of Locality-Specific Transportation Data for the Development of Mobile Source Emission Inventories," (September 1996), discusses methods for using travel demand forecasting models and surveys to obtain information about soak distributions.

Care should be taken in the design and implementation of an instrumented vehicle study to assure that a representative sampling of vehicles are recruited for instrumentation. States should consult with EPA before attempting an instrumented vehicle study.

States should consult with EPA before using any data (traffic demand modeling results, trip diaries or instrumented vehicle data) before changing the default values in MOBILE6.2 for the distribution of the soak times for use in SIP-related highway vehicle emission inventory development.

4.8.4 MOBILE6.2 Commands

The distribution of the hot soak time after an engine shut down is entered into MOBILE6.2 using the HOT SOAK ACTIVITY command. This command requires that the user supply 840 values which represent the 60 possible one minute soak time periods for each of 14 hours of the day for average week days and weekend days. The hours between 7 p.m. and 5 a.m. the next day are assumed to have the same hot soak time distribution. The same distributions are used for all vehicle classes. All values must be greater than zero and less than one. The sum of each set of 60 values must equal one. See Section 2.8.8.6 of the MOBILE6.2 User Guide for more information on how to use this command.

This command is closely related to the STARTS PER DAY, SOAK DISTRIBUTION and DIURN SOAK ACTIVITY commands, which is used to provide the number of engine starts, the distribution of soak times before engine starts and the distribution of soak time between engine starts. The number of engine starts, soak times before engine starts and the diurnal soak distribution are discussed in Section 4.5 and Section 4.7 above and Section 4.9 below.

4.9 Vehicle Diurnal Soak Time

4.9.1 Guidance

The distribution of the diurnal soak time will vary from area to area, but for most purposes, it is expected that this variation has a negligible effect on overall daily emissions from highway mobile sources. States may choose to use the default values for the distribution of the diurnal soak time instead of developing local values.

Small scale and "hot spot" analysis of specific locations may require specific local estimates be used. EPA should be consulted when planning small scale analysis to determine if the use of national average default values is still appropriate for the emission modeling.

If the default values are not used, the distribution of the diurnal soak time used by states in inventory modeling should be consistent, where possible, with assumptions used in other highway vehicle related planning. Metropolitan Planning Organizations (MPOs) and state Departments of Transportation (DOTs) should be consulted for information to determine the distribution of the diurnal soak time.

4.9.2 Description

While the engine is shut down (key off) and during times of day when the ambient temperature is rising, fuel vapors will be driven off the vehicle from the increasing temperature of the fuel in the tank and other locations on the vehicle. The ability of the vehicle emission control components to adsorb these vapors depends on how long the vehicle has been subjected to diurnal emission generation. The resulting hydrocarbon losses are referred to as diurnal emissions. If the vehicle is restarted, the active emission control systems begin again and the full diurnal effect is interrupted, resulting in fewer diurnal emissions. MOBILE6.2 contains default values for the distribution of the diurnal soak time by hour of the day.

Only gasoline fueled vehicles are affected by the diurnal soak activity. Diesel vehicles and natural gas vehicles are assumed to have negligible diurnal evaporative emissions. The same distribution of diurnal soak times is used for all vehicle classes.

4.9.3 Method

Development of an estimate for the distribution of the diurnal soak time is optional. If the default MOBILE6.2 values are not used, the distribution of the diurnal soak time used in

inventory modeling should be consistent, where possible, with assumptions used in other highway vehicle related planning.

EPA recommends strongly that states base their estimate of the distribution of the diurnal soak time by hour of the day on instrumented vehicle data. Since diurnal soak distributions are partially a measure of time between engine shut down and the next engine start, this information is the same as information gathered for engine start soak times and hot soak activity. Although travel demand forecasting models can account for the number of trips, in many cases it is not possible to account for the soak time of individual vehicles. Trip diaries and surveys could be used, but these rely on vehicle owners correctly reporting values and may exclude starts and soaks that occur at intermediate destinations during trips. Section 3.5, "Cold Start/Hot Start/Hot Stabilized Weighting Factors," of the EPA document, "Volume IV: Chapter 2, Use of Locality-Specific Transportation Data for the Development of Mobile Source Emission Inventories," (September 1996), discusses methods for using travel demand forecasting models and surveys to obtain information about soak distributions.

Diurnal soak distributions do not need to add to one, since the distribution is of all vehicles within an hour and not all vehicles are experiencing a diurnal soak. Some vehicles will be driving and some vehicles will be experiencing a hot soak. However, a consistent distribution of diurnal soak activity will have the total fraction of vehicles soaking in a given hour that is less than one (indicating vehicles that are driving or in hot soak mode). The diurnal activity will also have an equal or decreasing fraction of vehicles soaking in the next hour at the next soak time increment. This shows the reduction in soaking vehicles as they are started and begin to operate in subsequent hours of the day. The EPA report, "Soak Length Activity Factors for Diurnal Emissions," March 1999 (EPA 420-P-98-019, M6.FLT.006) discusses how EPA used instrumented vehicle data to derive the national average default values for MOBILE6.2.

Care should be taken in the design and implementation of an instrumented vehicle study to assure that a representative sampling of vehicles are recruited for instrumentation. States should consult with EPA before attempting an instrumented vehicle study.

States should consult with EPA before using any data (traffic demand modeling results, trip diaries or instrumented vehicle data) before changing the default values in MOBILE6.2 for the distribution of the soak times for use in SIP-related highway vehicle emission inventory development.

4.9.4 MOBILE6.2 Commands

The distribution of the diurnal soak time is entered into MOBILE6.2 using the DIURN SOAK ACTIVITY command. This command requires that the user supply 1,296 values which represent the 72 possible one hour soak time periods for each of 18 hours of the day. The hours between 11 p.m. and 6 a.m. the next day are assumed to have the same diurnal soak time distribution. The same distributions are used for all vehicle classes. All values must be greater than zero and less than one. The sum of each set of 72 values, representing the fraction of

vehicles within an hour which are experiencing a diurnal soak, do not need to add to one, but must be less than one. See Section 2.8.8.7 of the MOBILE6.2 User Guide for more information on how to use this command.

This command is closely related to the SOAK DISTRIBUTION and HOT SOAK ACTIVITY commands, which is used to provide distributions of the soak times before engine starts and the distribution of soak time after engine starts. The number of engine starts and the diurnal soak distribution are discussed in Section 4.7 and Section 4.8 above.

4.10 Vehicle Trip Length (Duration) Distributions

4.10.1 Guidance

The distribution of the vehicle trip duration (lengths) will vary from area to area, but for most purposes, it is expected that this variation has a negligible effect on overall daily emissions from highway mobile sources. States may choose to use the default values for the distribution of the vehicle trip lengths instead of developing local values.

Small scale and "hot spot" analysis of specific locations may require specific local estimates be used. EPA should be consulted when planning small scale analysis to determine if the use of national average default values is still appropriate for the emission modeling.

If the default values are not used, the distribution of the vehicle trip lengths used by states in inventory modeling should be consistent, where possible, with assumptions used in other highway vehicle related planning. Metropolitan Planning Organizations (MPOs) and state Departments of Transportation (DOTs) should be consulted for information to determine the distribution of the vehicle trip lengths.

4.10.2 Description

Fuel evaporation occurs during trips due to the heating of the fuel system, especially including the fuel tank. These emissions are affected by the length of time the vehicle has been in operation. Longer trips mean more evaporative running loss emissions due to increased fuel system temperatures. The EPA report, "Trip Length Activity Factors for Running Loss and Exhaust Running Emissions," February 1998 (M6.FLT.005) defines trip lengths in more detail. MOBILE6.2 contains default values for the distribution of the vehicle trip lengths by hour of the day.

Only gasoline fueled vehicles (not including motorcycles) are affected by the distribution of trip lengths in MOBILE6.2. Diesel vehicles and natural gas vehicles are assumed to have negligible evaporative running loss emissions. The same distribution of vehicle trip lengths is used for all vehicle classes.

4.10.3 Method

Development of an estimate for the distribution of the vehicle trip lengths is optional. If the default MOBILE6.2 values are not used, the distribution of the vehicle trip lengths used in inventory modeling should be consistent, where possible, with assumptions used in other highway vehicle related planning. MOBILE6.2 default values for the distribution of trip lengths assume the same distribution for each hour of the day.

Section 3.6, "Trip Duration," of the EPA document, "Volume IV: Chapter 2, Use of Locality-Specific Transportation Data for the Development of Mobile Source Emission Inventories," (September 1996), discusses methods for using travel demand forecasting models and surveys to obtain information about trip length distributions. MOBILE6.2 default values for the distribution of trip lengths assume the same distribution for each hour of the day.

States should consult with EPA before using any data (traffic demand modeling results, trip diaries or instrumented vehicle data) before changing the default values in MOBILE6.2 for the distribution of the trip lengths for use in SIP-related highway vehicle emission inventory development.

4.10.4 MOBILE6.2 Commands

The distribution of the vehicle trip lengths is entered into MOBILE6.2 using the WE DA TRI LEN DI and WE EN TRI LEN DI commands for week days and weekend days, respectively. Each command requires that the user supply 84 values which represent the six possible trip lengths for each of 14 hours of the day. The hours between 7 p.m. and 6 a.m. the next day are assumed to have the same vehicle trip length distribution. The same distributions are used for all vehicle classes. All values must be greater than zero and less than one. The sum of each set of six values, representing the fraction of vehicles within an hour within each trip length bin, must equal one. See Section 2.8.8.10 and Section 2.8.8.9 of the MOBILE6.2 User Guide for more information on how to use these commands.

The command, WE VEH US, is used to determine whether the week day or weekend day values are to be used. Use of weekend values is discussed in Section 4.11 below.

4.11 Weekday and Weekend Day Activity

4.11.1 Guidance

The distribution of the vehicle activity will vary from day to day during the week, but for most purposes, EPA will not expect States do develop local estimates that vary by day of the week. States may choose to use a single set of vehicle activity values instead of developing separate local values by day of the week.

Small scale and "hot spot" analysis of specific locations may require specific local estimates be used. EPA should be consulted when planning small scale analysis to determine if the use of national average default values is still appropriate for the emission modeling.

The vehicle activity values used by states in inventory modeling should be consistent, where possible, with assumptions used in other highway vehicle related planning. Metropolitan Planning Organizations (MPOs) and state Departments of Transportation (DOTs) should be consulted for information to determine whether local vehicle activity information is based on an average week day or weekend day values. If the local data is not week day or weekend day specific, then default MOBILE6.2 week day values should be used.

4.11.2 Description

The number of engine starts per day, the distribution of engine starts by hour of the day, the distribution of hot soak times and the distribution of the vehicle trip duration (lengths) have MOBILE6.2 separate default values for both week days and weekend days. This means that choosing to model a week day will give different daily values than choosing to model a weekend day. Users are allowed to replace the MOBILE6.2 default values with local data.

The default MOBILE6.2 condition is a week day case. If users are modeling weekend days, then these runs should explicitly choose the weekend day values for modeling.

4.11.3 Method

Development of separate local values for vehicle activity by day of the week is optional. In any case (default or local), the vehicle activity data used in inventory modeling should be consistent, where possible, with assumptions used in other highway vehicle related planning regarding the use of week day or weekend day values. In some cases, MOBILE6.2 has separate default values depending on the day of the week. The user should select week day or weekend day consistent with the other local data supplied for MOBILE6.2 modeling. If the local data is not week day or weekend day specific, then default MOBILE6.2 week day values should be used.

4.11.4 MOBILE6.2 Commands

The selection of week day or weekend day values for use in MOBILE6.2 is indicated using the WE VEH US command. The default condition in MOBILE6.2 is week day. Using this command, default (or user supplied) weekend day values will be used. See Section 2.8.8.10 of the MOBILE6.2 User Guide for more information on how to use this command.

5.0 Vehicle Gasoline Specifications

The MOBILE6.2 model does not currently include commands that would allow States to vary the fuel properties of diesel fuel for purposes of modeling emissions from highway mobile

sources. However, states must specify the gasoline fuel properties for areas being modeled for SIP-related highway vehicle emission inventory development.

5.1 Gasoline Volatility

5.1.1 Guidance

The volatility of gasoline has a significant effect on overall daily emissions from highway mobile sources. States must determine the appropriate average gasoline volatility for gasoline used by the highway mobile sources for the areas to be modeled.

5.1.2 Description

The volatility of gasoline in MOBILE6.2 is indicated by the Reid Vapor Pressure (RVP) of the dispensed fuel. The RVP of the fuel is a commonly reported statistic for gasoline. One average RVP value is used for all gasoline fueled vehicles for all hours of the day for each MOBILE6.2 run. There is no default value for gasoline RVP in MOBILE6.2. MOBILE6.2 cannot be run without providing an estimate of average gasoline RVP.

5.1.3 Method

The EPA report, "Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources," 1992 (EPA 450-4-81-026d, Revised) describes how States choose appropriate values for RVP for use in SIP-related highway vehicle emission inventory development. See 40CFR80.27(a) and 40CFR80.27(b) for RVP values.

The nominal value for gasoline RVP provided to MOBILE6.2 should not include the effects of oxygenates added, since these effects are determined within MOBILE6.2. See Section 5.3 below for the discussion of added oxygenates to gasoline.

User supplied values for RVP in evaluations done for the month of July (or when the season is summer) for areas which have opted into the federal Reformulated Gasoline (RFG) program (beginning in the 1995 calendar year) will be overridden by default RFG values for RVP. However, an RVP value must be supplied to MOBILE6.2, even if it is not used in this case.

5.1.4 MOBILE6.2 Commands

The average RVP value for use in MOBILE6.2 is indicated using the FUEL RVP command. A MOBILE6.2 input file will not work if it does not contain this command. See Section 2.8.10.4 of the MOBILE6.2 User Guide for more information on how to use this command.

The gasoline RVP used by the model may be affected when the user specifies Reformulated Gasoline. Reformulated Gasoline is discussed in Section 5.2 below.

5.2 Reformulated Gasoline

5.2.1 Guidance

Areas which have opted into or are part of the federal Reformulated Gasoline program must include this fact in MOBILE6.2 runs for use in SIP-related highway vehicle emission inventory development.

5.2.2 Description

Reformulated Gasoline (RFG) is a federal fuel emission performance specification program. RFG programs may include a wide variety of fuel specifications within the RFG area. However, every one of these fuels must have specific fuel properties and must meet the same emission performance specifications. MOBILE6.2 models a single representative set of fuel properties that meets these specifications to represent all formulations for RFG. The user only needs to specify the season of the year (winter or summer) and the RFG region (North or South) and MOBILE6.2 will select the appropriate fuel formulation.

Winter time RFG emission results will be affected by the user supplied values for the fuel sulfur content, oxygen content and Reid Vapor Pressure (RVP) of gasoline.

5.2.3 Method

Reformulated Gasoline only affects emissions in calendar years 1995 and later. The Clean Air Act defines the RFG "Summer" as May 1 through September 15. "Winter" is the rest of the year. In the summer season, user supplied values for gasoline sulfur content, gasoline RVP and gasoline oxygen content are overridden by MOBILE6.2 default RFG values. In the winter season, users must supply appropriate values for gasoline sulfur content (See Section 5.5), gasoline RVP (See Section 5.1) and gasoline oxygen content (See Section 5.3). Since season is an important parameter for RFG, although MOBILE6.2 will choose the appropriate season based on the user supplied value for month, we recommend users specify season as well as month when modeling RFG.

It is not appropriate to use the RFG command option in MOBILE6.2 for calendar year 2000 or later for RFG programs in western states (i.e., Alaska, Colorado, Idaho, Montana, New Mexico, North Dakota, Utah, Wyoming and bordering counties in other states) in the Tier 2 geographic phase-in area. See *66 FR 19306*, April 13, 2001, for a full list of the relevant counties and Federal Indian reservations. Users wishing to model RFG in these western states will need to specify all of the appropriate gasoline parameters (sulfur content, oxygen content and RVP) separately for each calendar year they wish to evaluate. The MOBILE6.2 User Guide and EPA should be consulted for further guidance on how to model RFG in these western states.

5.2.4 MOBILE6.2 Commands

A Reformulated Gasoline program in MOBILE6.2 is indicated using the FUEL PROGRAM command. See Section 2.8.10.1 of the MOBILE6.2 User Guide for more information on how to use this command. The SEASON command is used to precisely determine the appropriate effects of RFG. See Section 2.8.10.5 of the MOBILE6.2 User Guide for more information on how to use this command.

The effects of Reformulated Gasoline may be affected by user specified values for gasoline sulfur content, gasoline Reid Vapor Pressure and gasoline oxygen content using the SULFUR CONTENT, FUEL RVP and OXYGENATED FUELS commands. See Sections 5.1, 5.3 and 5.4 for more information on these parameters.

5.3 Gasoline Oxygen Content

5.3.1 Guidance

The addition of oxygenates to gasoline has a significant effect on overall daily HC and CO emissions from highway mobile sources.

Areas that are known to have significant market penetration of ether blends and/or alcohol blends should characterize the relative market shares and oxygen content of these fuel blends and account for them in their mobile source emission inventory. If, together, ethanol blends account for less than 2% of total gasoline sales within an inventory area, and if there is no mandatory or locally endorsed voluntary program for ether blends, oxygenated fuels need not be explicitly modeled. There must also have been no significant sales of other oxygenated blend types (e.g., methanol).

Areas which have opted into or are part of the federal Reformulated Gasoline (RFG) program do not need to explicitly account for oxygenated fuels in their mobile source inventory estimates. When RFG is indicated, MOBILE6.2 will automatically account for oxygenated gasoline as part of the RFG gasoline formulation. However, if areas have additional gasoline oxygen content requirements that supercede RFG regulations, these requirements must be accounted for explicitly in the mobile source emission inventory modeling.

5.3.2 Description

There are a variety of compounds that are added to gasoline in order to add oxygen to engine during combustion. These compounds fall into two general categories, ethers and alcohols. The added oxygen in the gasoline will moderate rich fuel/air operation modes and can reduce emissions. However, adding alcohol to gasoline also affects the volatility of the gasoline. This will affect emissions, both from engine combustion and from vehicle evaporative hydrocarbon losses. To estimate emissions correctly, it is important to know the proper amount of oxygen

added to gasoline and the market share of both ether and alcohol blends in areas to be modeled. The default value for gasoline oxygen content in MOBILE6.2 is zero.

Since adding alcohol to gasoline increases the fuel volatility, unless fuel volatility is explicitly limited (as it is in most nonattainment areas in the summer), it must be assumed that the added alcohol will increase the nominal Reid Vapor Pressure (RVP) of the dispensed gasoline. In addition, EPA allows waivers for gasoline volatility limits in some areas, which allow the addition of alcohol to gasoline to increase RVP. It is important to know whether volatility limits are in place and whether waivers have been allowed in order to properly model oxygenated gasoline. Gasoline/ether blends are assumed to have the same nominal RVP value as non-oxygenated gasoline.

5.3.3 Method

MOBILE6.2 models the effects of two types of oxygenated fuels, gasoline/alcohol blends and gasoline/ether blends. States must provide the following information:

- Ether blend market share (as a fraction of all gasoline sold);
- Average oxygen content of ether blend fuels (percent weight of oxygen, expressed as a fraction);
- Alcohol blend market share (as a fraction of all gasoline sold);
- Average oxygen content of alcohol blend fuels (percent weight of oxygen, expressed as a fraction);
- Presence of any volatility waivers.

MOBILE6.2 assumes a 1 psi increase in RVP from alcohol blends if the presence of a volatility waiver is indicated in the input file. Scenarios where volatility waivers are allowed must indicate the presence of volatility waivers. Because areas where volatility limits are not in place (i.e., some winter scenarios) would also expect a 1 psi increase in RVP from alcohol blends, users modeling such areas should model as if a volatility waiver were in place. This will affect the nominal RVP levels supplied by the user. Market shares for ethanol blends are readily available by state.

EPA should be contacted for assistance in modeling the effects of oxygenated fuels if any of the following situations apply:

- the fuels available in an area include blends containing both ether(s) and alcohol(s) in the same fuel;
- an RVP waiver greater than 1.0 psi is applicable to oxygenated fuels in an area;
- no RVP waiver is in effect, but the volatility of base gasoline is currently below the regulated limit (in this situation, the practical effect may be same as if a waiver were in.effect);

- if two or more types of alcohol blends are marketed under different RVP waiver treatment (for example, gasoline/methanol blends might not be given the same waiver as gasoline/ethanol blends).

These requirements and procedures are essentially identical to those in the EPA report, "Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources," 1992 (EPA 450-4-81-026d, Revised) used for earlier models.

5.3.4 MOBILE6.2 Commands

The oxygen content of gasoline for use in MOBILE6.2 is indicated using the OXYGENATED FUELS command. See Section 2.8.10.34 of the MOBILE6.2 User Guide for more information on how to use this command.

Oxygenated fuels are required as part of Reformulated Gasoline (RFG). User supplied values of gasoline oxygen content in RFG areas may be affected by RFG rules. See Section 2.8.10.1 in the MOBILE6.2 User Guide for more information on the interactions between gasoline oxygen content and RFG in MOBILE6.2. Also, Reformulated Gasoline is discussed in Section 5.2 above.

5.4 Gasoline Sulfur Content

5.4.1 Guidance

The sulfur content of gasoline has a significant effect on overall daily emissions from modern highway mobile sources. States must determine the appropriate average gasoline sulfur content of gasoline used by the highway mobile sources for the areas to be modeled.

Areas which have opted to participate in, or are part of, the federal Reformulated Gasoline (RFG) program do not need to explicitly account for gasoline sulfur content in their mobile source inventory estimates after the 1995 calendar year in summertime (July) scenarios. When RFG is indicated and the season is summer, MOBILE6.2 will automatically account for gasoline sulfur content as part of the RFG gasoline formulation. However, RFG does not control sulfur levels in years 1999 and earlier when the season is winter (January). In the winter season states must determine the appropriate average gasoline sulfur content for gasoline and account for this gasoline sulfur content in the mobile source emission inventory modeling.

Beginning with the 2000 calendar year, local gasoline sulfur content will be affected by federal controls on gasoline sulfur content. If there are no local fuel control programs which supercede the federal gasoline regulations for the gasoline sulfur content of fuel, states may opt to use the appropriate default gasoline sulfur content values for their area instead of developing specific local gasoline sulfur content levels.

5.4.2 Description

Sulfur is a naturally occurring contaminant in petroleum used to refine gasoline. Sulfur has been shown to reduce the ability of the catalytic convertors used on all modern highway mobile sources to reduce tailpipe emissions of controlled pollutants. This effect has become increasingly important as vehicles depend more on catalytic convertors to obtain the low exhaust emission levels demanded by the latest emission certification standards for highway mobile sources. MOBILE6.2 explicitly accounts for the effects of the sulfur content of gasoline on the emission estimates for gasoline fueled highway mobile sources. The default value for gasoline sulfur content in MOBILE6.2 before calendar year 2000 is 300 parts per million (ppm).

Since calendar year 2000, federal regulations have controlled the amount of sulfur that can occur in gasoline sold in the United States. These regulations are intended to reduce the sulfur content of gasoline to levels appropriate for the introduction of Tier 2 exhaust emission standards in the 2004 model year. There are two sulfur control regions, eastern and western, defined by Tier 2 regulations. The western Tier 2 sulfur content phase in states (i.e., Alaska, Colorado, Idaho, Montana, New Mexico, North Dakota, Utah, Wyoming) and bordering counties in other states, have a longer phase in than the eastern areas. See *66 FR 19306*, April 13, 2001, for a full list of the relevant counties and Federal Indian reservations. MOBILE6.2 has default values for eastern and western Tier 2 sulfur content phase in areas for each calendar year, beginning with 2000.

5.4.3 Method

Methods used for obtaining information about the specific local formulation of gasolines are described in the EPA report, "Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources," 1992 (EPA 450-4-81-026d, Revised) used for earlier models. MOBILE6.2 does contain default values for gasoline sulfur content. If local gasoline sulfur content is not known, EPA should be consulted for guidance on whether default sulfur values may be used for calendar years before 2000.

Beginning with the 2000 calendar year, states may choose to use the default values for gasoline sulfur content. However, states must determine the appropriate Tier 2 sulfur content phase in area applies to their scenario. It is possible, however, for states to override the default values and enter local gasoline sulfur content levels. For calendar year 2000 or later scenarios, EPA should be consulted before non-default values for gasoline sulfur content are used.

5.4.4 MOBILE6.2 Commands

The sulfur content of gasoline for use in MOBILE6.2 is indicated using the SULFUR CONTENT and FUEL PROGRAM commands. See Section 2.8.10.2 and Section 2.8.10.1 of the MOBILE6.2 User Guide for more information on how to use these commands.

The sulfur content of gasoline is affected by the use of Reformulated Gasoline (RFG). User supplied values of gasoline sulfur content in RFG areas may be affected by RFG rules. See

Section 2.8.10.1 in the MOBILE6.2 User Guide for more information on the interactions between gasoline sulfur content and RFG in MOBILE6.2. Also, Reformulated Gasoline is discussed in Section 5.2 above.

5.5 Diesel Sulfur Content

5.5.1 Guidance

The sulfur content of diesel fuel has a significant effect on emissions of particulates from diesel vehicles. Input of proper diesel fuel sulfur levels is essential to accurate PM calculations. Diesel sulfur content information will be required for past year modeling as well as for present and future years. Diesel sulfur content for past and present years may be determined from local fuel survey data or using information in an EPA spreadsheet described in Section 5.5.3.1 below. Diesel sulfur content for future years should be drawn from the table in Section 5.5.3.2 below.

5.5.2 Description

Sulfur is a naturally occurring contaminant in the petroleum from which diesel fuel is refined. Most sulfur in fuels is emitted as sulfur dioxide and eventually converted to sulfates in the atmosphere. A small amount of fuel sulfur is emitted directly as sulfates (generally hydrated sulfuric acid). Sulfates are a significant precursor for the formation of secondary particulates, particularly $PM_{2.5}$.

Sulfur in fuels has also been shown to reduce the ability of the catalytic convertors to reduce tailpipe emissions of controlled pollutants. This effect has become increasingly important as diesel vehicles depend more on catalytic convertors to obtain the low exhaust emission levels demanded by the latest emission certification standards for highway mobile sources.

5.5.3 Method

The most accurate method for determining diesel sulfur levels for past and present values is the use of survey data. Fuel sulfur levels for past years are available from various surveys (e.g., Alliance of Automobile Manufactures, Northrup Grumman Mission Systems). This data generally covers several metropolitan areas and goes back several years. Areas modeling future diesel sulfur levels should assume that the most recent fule survey values apply through May 2006.

If areas are implementing local fuel programs it is expected that local fuel survey data will be required as a part of this program. In order to implement a local program and take credit for its benefits, it will be necessary to have baseline data as well as ongoing data regarding average diesel sulfur levels in the program area. Where applicable, this data should be used as inputs when modeling particulates with MOBILE6.2.

In the absence of survey data, EPA recommends that past data be taken from an EPA spreadsheet called "Diesel Sulfur Levels by County" located at

http://www.epa.gov/otaq/m6.htm. This data is arranged by county and contains diesel sulfur levels for summer and winter, going back to 1999 and forward through May 2006.

Beginning during the 2006 calendar year, federal controls on highway diesel sulfur content will become more stringent. Sulfur content will change from a current average of 500 ppm to 15 ppm. This rule will be phased in between June, 2006 through 2010. Modelers should use the 49-state average sulfur values listed below as future year values. For years that are no longer in the future, past year guidance from above should be followed.

Period	Highway Diesel Sulfur Level (ppm)
June, 2006 - May, 2010	43
June, 2010 - 2015	11

Note that areas modeling calendar years 2006 and 2010 will need to use different values for sulfur depending on the month of evaluation.

5.5.4 MOBILE6.2 Commands

The sulfur content of diesel for use in MOBILE6.2 is indicated using the DIESEL SULFUR command. See Section 2.8.10.3 of the MOBILE6.2 User Guide for more information on how to use these commands. The value is specified in units of parts per million. This value can range from 0.01 ppm to 5000 ppm.

6.0 Inspection and Maintenance Programs and Anti-Tampering Programs

During the 1990's, the number and variety of inspection and maintenance programs increased significantly. MOBILE6.2 includes a number of new features that will increase the flexibility and ease of use compared to MOBILE5 when modeling the range of I/M program options currently being implemented. MOBILE6.2 has the ability to model up to seven separate I/M programs simultaneously, which simplifies the modeling of programs in which different model years are subject to different requirements. It includes new program options including OBD exhaust and evaporative I/M checks. It also adds the ability to specify grace periods and exemption ages.

MOBILE6.2 also allows for the modeling of anti-tampering programs. However, there is little change in this input option compared to MOBILE5. Users should note that anti-tampering programs are treated separately from I/M programs in MOBILE6.2 and do not count against the seven separate I/M programs that can be modeled simultaneously.

6.1 Inspection Type, Test Frequency, and Network Type

The command I/M PROGRAM is used to define the start and end years, the inspection type, test frequency, and network type of the local I/M program. Details on the use of this command are given in Section 2.8.9.4.a of the MOBILE6.2 User's Guide.

MOBILE6.2 users can choose from eleven different types of exhaust I/M inspections and four different types of evaporative I/M inspections. The following table summarizes the exhaust and evaporative program options:

Table 6.1.1 I/M Inspection Test Types in MOBILE6.2	
Exhaust I/M Inspections	**Description**
IDLE	Test performed while vehicle idles in park or neutral.
2500/IDLE	Test performed while vehicles idles and at 2500 rpm.
LOADED IDLE	Test performed while vehicle operates on a chassis dynamometer at constant load.
IM240	Test performed on a dynamometer, under load, through a pre-defined "transient" driving cycle of up to 240 seconds.
ASM 2525 PHASE-IN	Test performed on a dynamometer, under load, through a defined "steady state" driving cycle at 25 mph and 25% load, at phase-in cutpoints.
ASM 2525 FINAL	Test performed on a dynamometer, under load, through a defined "steady state" driving cycle at 25 mph and 25% load, at final cutpoints.
ASM 5015 PHASE-IN	Test performed on a dynamometer, under load, through a defined "steady state" driving cycle at 15 mph and 50% load, at phase-in cutpoints.
ASM 5015 FINAL	Test performed on a dynamometer, under load, through a defined "steady state" driving cycle at 15 mph and 50% load, at final cutpoints.
ASM 2525/5015 PHASE-IN	Test performed on a dynamometer, under load, through two defined "steady state" driving cycles at 25 mph and 25% load, and 15 mph and 50% load, at phase-in cutpoints.
ASM 2525/5015 FINAL	Test performed on an inertia-weighted dynamometer through two defined "steady state" driving cycles at 25 mph and 25% load, and 15 mph and 50% load, at final cutpoints.
OBD I/M	Test of exhaust-related systems and components performed by visual check of Malfunction Indicator Light (MIL) and scan of on-board (OBD) computer for system readiness, MIL status and stored trouble codes, on 1996 and newer OBD-equipped vehicles only.
Evap I/M Inspections	**Description**
EVAP OBD	Test of the evaporative emission related systems and components performed by visual check of the MIL and scan of the OBD computer system for readiness, MIL status, and stored trouble codes, on 1996 and newer, OBD-equipped vehicles.
EVAP OBD & GC	The evap OBD test performed in conjunction with a separate check of the gas cap (GC) for the purpose of identifying leaks in the gas cap not otherwise identified by the evap OBD check. This combination of tests can only be conducted on 1996 and newer, OBD-equipped vehicles. The gas cap pressure test is the only test that can be conducted in addition to the OBD-I/M test for additional credit under MOBILE6.2.
FP & GC	A pair of tests to identify leaks in the gas cap (GC) and the rest of the vehicle's evaporative system. The latter test is conducted by pressuring the evaporative system by way of the fuel tank's fillneck and is referred to as the fillneck pressure (FP) test.
GC	A test conducted by pressurizing the gas cap for the purpose of identifying leaks in the gas cap.

MOBILE6.2 allows users to enter either annual or biennial inspection frequencies. Users must also define the network type for the I/M program. Options for network type are:

TRC Computerized Test and Repair program

TRM Manual Test and Repair program
T/O Test only Program
Users can modify the effectiveness assumed in MOBILE6.2 for the TRC and TRM options using the I/M EFFECTIVENESS command discussed below.

States must model the start and end years, inspection type, test frequency, and network type that matches the local I/M program. In cases where there is any question of which MOBILE6.2 inspection type matches the local program, states should consult with EPA for further guidance.

MOBILE6.2 assumes that an I/M program starts on January 1 of the start year entered by the user. Users modeling programs that start on other dates should consult with EPA for further guidance.

In MOBILE6.2, I/M programs that have both exhaust and evaporative inspection components, including OBD programs, are modeled as two separate, simultaneous programs identified using different I/M program numbers in separate I/M PROGRAM command lines. Users should be careful to include both the exhaust and evaporative components to ensure proper credit for the program. Likewise, an I/M program that applies different tests to different vehicles (e.g., an idle program that applies to early model years together with an IM240 program that applies to later model years) is also modeled as two separate, simultaneous programs identified using different I/M program numbers in separate I/M PROGRAM command lines and using the I/M MODEL YEARS command to differentiate which program covers what model years.

6.2 Model Years

Whenever an I/M program is modeled in MOBILE6.2, users must enter the vehicle model years covered by that program. Users cannot model exhaust or evaporative OBD programs on vehicles prior to the 1996 model year. Users modeling programs that exempt vehicles older than a certain calendar age or provide a grace period for vehicles less than a certain calendar age should use the I/M EXEMPTION AGE and I/M GRACE PERIOD commands, described in sections 6.8 and 6.9 respectively.

Vehicle model year coverage for I/M programs is entered using the command I/M MODEL YEARS which is described in Section 2.8.9.4.b of the MOBILE6.2 User's Guide.

6.3 Vehicles

MOBILE6.2 requires that users specify the vehicle classes covered by the I/M program. Only I/M programs that affect gasoline vehicles are modeled in MOBILE6.2. A total of 14 gasoline vehicle types are covered. Vehicle classes covered by the I/M program are specified using the I/M VEHICLES command, which is described in Section 2.8.9.4.b of the MOBILE6.2 User's Guide. The vehicle classes are described in the following table:

Table 6.3.1 MOBILE6.2 Vehicle Classes Covered by I/M	
MOBILE6.2 Class	**Description**
LDGV	Light-Duty Gasoline Vehicles (Passenger Cars)
LDGT1	Light-Duty Gasoline Trucks 1 (0-6,000 lbs. GVWR, 0-3750 lbs. LVW)
LDGT2	Light-Duty Gasoline Trucks 2 (0-6,000 lbs. GVWR, 3751-5750 lbs. LVW)
LDGT3	Light-Duty Gasoline Trucks 3 (6,001-8,500 lbs. GVWR, 0-5750 lbs. ALVW)
LDGT4	Light-Duty Gasoline Trucks 4 (6,001-8,500 lbs. GVWR, 5751 lbs. and greater ALVW)
HDGV2B	Class 2b Heavy-Duty Gasoline Vehicles (8501-10,000 lbs. GVWR)
HDGV3	Class 3 Heavy-Duty Gasoline Vehicles (10,001-14,000 lbs. GVWR)
HDGV4	Class 4 Heavy-Duty Gasoline Vehicles (14,001-16,000 lbs. GVWR)
HDGV5	Class 5 Heavy-Duty Gasoline Vehicles (16,001-19,500 lbs. GVWR)
HDGV6	Class 6 Heavy-Duty Gasoline Vehicles (19,501-26,000 lbs. GVWR)
HDGV7	Class 7 Heavy-Duty Gasoline Vehicles (26,001-33,000 lbs. GVWR)
HDGV8A	Class 8a Heavy-Duty Gasoline Vehicles (33,001-60,000 lbs. GVWR)
HDGV8B	Class 8b Heavy-Duty Gasoline Vehicles (>60,000 lbs. GVWR)
HDGB	Gasoline Buses (School, Transit and Urban)

6.4 Stringency

For exhaust I/M programs, MOBILE6.2 users must specify a stringency rate which is defined as the expected exhaust inspection failure rate among pre-1981 model year vehicles. This is required by MOBILE6.2 for exhaust I/M programs regardless of model year coverage. Failure rates for these vehicles should be based on actual failure rates reported by a program. For I/M programs that do not affect pre-1981 vehicles, users can enter any value for stringency that is within the acceptable range allowed by MOBILE6.2. For I/M programs that do not affect pre-1981 vehicles, the stringency value entered will have no effect on model results. The command I/M STRINGENCY is described in Section 2.8.9.4.d of the MOBILE6.2 User's Guide.

6.5 Compliance Rate

The compliance rate is the percentage of vehicles in the fleet that complete the I/M program and receive either a certificate of compliance or a waiver. Historical compliance should be determined by sticker surveys, license plate surveys, or a comparison of the number of final tests to the number of vehicles subject to the I/M requirement. Planners should not assume a compliance rate of 100%. An area planning to implement an I/M program using a registration denial system that automatically generates compliance documents that uniquely identify the complying vehicle and that are serially numbered and accounted for, that relies on centralized processing by government clerks with management oversight, may assume a 96% rate for modeling purposes prior to program implementation. Once the program begins implementation, however, the compliance rate should be based on operating program data.

The I/M COMPLIANCE command is described in Section 2.8.9.4.e of the MOBILE6.2 User's Guide. MOBILE6.2 requires that a compliance rate be entered for exhaust I/M programs, but compliance rates are optional for evaporative I/M programs. If an exhaust compliance rate is entered, MOBILE6.2 will assume that same rate for an evaporative program that covers the same vehicle classes and model years. We strongly recommend entering a separate compliance rate for any evaporative I/M program, even if the compliance rate is identical to the exhaust program, to avoid confusion about what was assumed in MOBILE6.2 based on the input file.

6.6 Waiver Rates

The waiver rate is the percentage of vehicles that fail an initial I/M test and do not pass a retest, but do receive a certificate of compliance. Actual historical waiver rates should be used as the basis for estimating future waiver rates.

The I/M WAIVER RATES command is described in Section 2.8.9.4.f of the MOBILE6.2 User's Guide. MOBILE6.2 requires that a wavier rate be entered for exhaust I/M programs, but waiver rates are optional for evaporative I/M programs. If an exhaust waiver rate is entered, MOBILE6.2 will assume that same rate for an evaporative program that covers the same vehicle classes and model years. We strongly recommend entering a separate waiver rate for any evaporative I/M program, even if the waiver rate is identical to the exhaust program, to avoid confusion about what was assumed in MOBILE6.2 based on the input file.

6.7 Cutpoints

If the I/M program inspection type is IM240, MOBILE6.2 users must enter the I/M cutpoints used for the IM240 program. Cutpoints are specified with the I/M CUTPOINTS command and entered using an external file as described in Section 2.8.9.4.g of the MOBILE6.2 User's Guide. States should consult with EPA if there is any question about appropriate cutpoints to use in modeling an IM240 program. Users should specify the cutpoints that will apply to Tier 0 vehicles (i.e., model years prior to 1996) to all ages of the vehicle fleet. When the Tier 0 cuptoints are entered, MOBILE6.2 will apply the proper credit for equivalently stringent cutpoints on Tier 1 and later vehicles. The I/M CUTPOINTS command only affects IM240 programs. Cutpoints for ASM programs are determined by the particular ASM test selected with the I/M PROGRAM command. Users cannot enter separate ASM cutpoints.

6.8 Exemption Age

Some I/M programs provide exemptions for all vehicles over a specified age. The command I/M EXEMPTION AGE, described in Section 2.8.9.4.h of the MOBILE6.2 User's Guide, provides a simple mechanism for specifying at what age vehicles are exempt from an I/M program. Users enter the age at which vehicles are no longer subject to mandatory I/M requirements. The exemption age entered for an exhaust I/M program will also apply to an evaporative I/M program that covers the same vehicle classes and model years. However, we strongly recommend entering a separate exemption age for any evaporative I/M program, even if the

exemption age is identical to the exhaust program, to avoid confusion about what was assumed in MOBILE6.2 based on the input file.

6.9 Grace Period

Some I/M programs provide a grace period for newer vehicles during which they are exempt from the program. The command I/M GRACE PERIOD, described in Section 2.8.9.4.i of the MOBILE6.2 User's Guide provides a simple mechanism for specifying how long the grace period applies to newer vehicles. Users enter the age at which vehicles first become subject to mandatory I/M requirements. For example, if a user enters "2", MOBILE6.2 assumes that vehicles first become subject to I/M two years after purchase.

The grace period entered for an exhaust I/M program will also apply to an evaporative I/M program that covers the same vehicle classes and model years. However, we strongly recommend entering a separate grace period for any evaporative I/M program, even if the grace period is identical to the exhaust program, to avoid confusion about what was assumed in MOBILE6.2 based on the input file.

6.10 Technician Training Credits

As a default assumption, MOBILE6.2 assigns full I/M credit for technician training. States that do not conduct, and have no plans to conduct, a technician training program should use the command NO I/M TTC CREDITS (Section 2.8.9.4.j of the MOBILE6.2 User's Guide) to eliminate credits for this program. This command has no effect on the benefits of an evaporative I/M program.

6.11 I/M Effectiveness

For I/M programs with a test and repair network type, states must specify effectiveness rates for the program. Separate effectiveness rates are entered for HC, CO, and NOx. Because the 1995 National Highway Systems Designation Act allows for states to make a demonstration of network effectiveness, states should consult with EPA on the appropriate effectiveness level given the specifics of the local I/M program. Program effectiveness is specified using the I/M EFFECTIVENESS command described in Section 2.8.9.4.k of the MOBILE6.2 User's Guide.

6.12 Anti-Tampering Programs

Anti-tampering programs are treated separately from I/M programs and are not counted against the seven I/M program limit in MOBILE6.2. Basic guidance on appropriate inputs for anti-tampering programs is unchanged from previous MOBILE5 guidance with the exception of the wider range of vehicle weight classes covered in MOBILE6.2. Users can refer to the MOBILE5 User's Guide and to Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources (EPA, 1992, reference number EPA-450/4-81-026d) for further information. The command ANTI-TAMP PROG (Section 2.8.9.3 of the MOBILE6.2 User's Guide) is used specify the

details of the anti-tampering program. Users should note that there is not tampering effect or tampering reduction benefit on 1996 or newer vehicles in MOBILE6.2.

7.0 Alternative emission regulations and control measures

MOBILE6.2 contains a number of commands that allow the user to turn off or change the effects of national motor vehicle standards and regulations. These commands have very specific applications such as estimating baseline emissions for rate of progress calculations, estimating incremental benefits of federal motor vehicle standards, and estimating the impacts of adopting California vehicle standards in other states. These commands should not be used outside of these specific applications.

7.1 Disablement of 1990 Clean Air Act Requirements

The Clean Air Act Amendments of 1990 include provisions known as rate of progress requirements that call for regular incremental reductions in VOC emissions over the time period prior to the attainment deadline for an ozone nonattainment area. Proper implementation of these provisions requires the estimation of an adjusted base year emission inventory, which is essentially an estimation of what motor vehicle emissions would have been in the absence of any motor vehicle standards, fuel standards, or state or local motor vehicle programs required by the Clean Air Act Amendments of 1990. Details of the methodology for calculating adjusted base year emissions and the incremental reductions needed to meet the rate of progress requirements are given in "Guidance on the Adjusted Base Year Emission Inventory and the 1996 Target for the 15 Percent Rate of Progress Plans" (October 1992, US EPA, Office of Air Quality Planning and Standards, reference number EPA-452/R-92-005).

The command NO CLEAN AIR ACT in MOBILE6.2 is used to disable all motor vehicle requirements of the 1990 Clean Air Act Amendments. Details of the motor vehicle requirements affected by this command are given in Sect. 2.8.11.1 of the MOBILE6.2 User's Guide. States using MOBILE6.2 to generate rate of progress plans will need to use this command to estimate adjusted base year emissions. More generally, comparing MOBILE6.2 runs with and without this command can also be used for estimating the total benefits of all control programs required by the Clean Air Act Amendments of 1990.

7.2 Heavy-Duty Diesel Vehicle NOx Off-Cycle Emissions Effects

MOBILE6.2 includes estimates of excess emissions of heavy-duty diesel engines produced in the late 1980's through most of the 1990's that implement engine control strategies that caused engine emissions to be higher in-use than over the Federal Test Procedure. MOBILE6.2 also includes offsets of those emissions achieved through early pull-ahead of 2004 heavy duty diesel emission standards and through low emission rebuilds of existing engines.

MOBILE6.2 includes several commands that allow users to change the effects of these excess emissions and the programs put in place to offset them. These commands are called NO

DEFEAT DEVICE, NO NOX PULL AHEAD, NO REBUILD, and REBUILD EFFECTS. These commands are described in detail in Section 2.8.11.2 of the MOBILE6.2 User's Guide. EPA is currently developing separate guidance on the use of these commands.

7.3 2007 Heavy Duty Standards.

MOBILE6.2 assumes the implementation of new standards for heavy duty vehicles beginning in 2007. The command NO 2007 HDDV RULE (Section 2.8.11.5 of the MOBILE6.2 User's Guide) can be used to override effects of these standards in order to estimate their incremental benefits. This command should not be used in inventories estimate for SIP or conformity related submissions.

7.4 Alternative Emission Factors for Passenger Cars and Light-Duty Trucks

MOBILE6.2 assumes that emissions standards for passenger cars and light-duty trucks phase in according to schedules specified in the Tier 1, NLEV, and Tier 2 regulations. MOBILE6.2 also provides five commands (NO TIER2, T2 EXH PHASE-IN, T2 EVAP PHASE-IN, T2 CERT, and 94+ LDG IMPLEMENTATION) that allow users to analyze the impacts of alternate standards and implementation schedules or to analyze the incremental benefits of federal standards. For most states, no adjustments to these standards or schedules are necessary and these commands should not be used for typical SIP and conformity related submissions. States that have adopted or plan to adopt California standards and states in the Northeast that had an earlier phase-in of NLEV standards will need to use these commands following guidance in the next section of this document. Details on the commands discussed in this section are given in Section 2.8.11.3 and Section 2.8.11.4 of the MOBILE6.2 User's Guide.

7.4.1 Guidance for Modeling Alternative NLEV Implementation and Adoption of California Standards

The MOBILE6.2 default case for post-Tier 1 emission control programs assumes that the National LEV program applicable to the non-Northeastern states is implemented in model year 2001, and that the Federal Tier 2 program begins implementation in model year 2004. Users who wish to use MOBILE6.2 with alternate control program scenarios will need to invoke additional input features as described in this guidance.

The earlier phase-in NLEV would be modeled using an alternate input file in conjunction with the 94+ LDG IMP command, detailed in the MOBILE6.2 User's Guide. An alternate data file (NLEVNE.D), developed by EPA and provided with the final model release, reflects the appropriate phase-in of NLEV standards in the 1999 and 2000 models years. Northeastern states subject to the earlier phase-in provisions on NLEV should use the NLEVNE.D file instead of the MOBILE6.2 default for accurate representation of the NLEV program in their area.

Under Section 177 of the Clean Air Act, states have the option to adopt California emission control programs instead of the federal program if the California programs will help achieve the

air quality goals of that state. The focus of this option has been the evaluation of programs which are alternatives to the Federal Tier 1 and Tier 2 programs. California's emission control program for light-duty vehicles consists of the LEV I and LEV II programs, which are considered separate programs for states outside of California, and in MOBILE6.2's modeling approach.

California's LEV I program affects light-duty vehicles from model year 1994 through the implementation of the LEV II program starting in 2004. Some northeastern states adopted California's LEV I program as an alternative to the Federal Tier 1 and NLEV programs. Because the specific implementation schedules of the LEV I program vary from state to state, users wishing to model the LEV I program in a specific non-California state will need to develop a custom input file to be used in conjunction with the 94+ LDG IMP command. This custom file should be based on the default file P94IMP.D provided with the final model release, modified as appropriate to reflect the appropriate phase-in schedule of vehicles under the LEV I program (i.e. TLEV, LEV, ULEV and ZEV) for that state. The modified phase-in schedule should only affect model years 1994 through 2003; beginning in model year 2004, the model assumes implementation of the Tier 2 program.

Beginning in 2004, the MOBILE6.2 default case is the federal Tier 2 program under the phase-in presented in the MOBILE6.2 report M6.EXH.004, "Accounting for the Tier 2 and Heavy-Duty 2005/2007 requirements in MOBILE6". States have the option of adopting California's LEV II program, which also begins implementation in 2004. Because the LEV II program has separate provisions for the required number of vehicles complying with zero-exhaust emissions and zero evaporative emission standards, exhaust VOC emissions and evaporative VOC must be calculated using separate MOBILE6.2 runs. The "EXPAND EVAP" command must be used in order to separate out the exhaust and evaporative VOC emission components. For exhaust VOC and all other pollutants, analysis of the LEV II option in MOBILE6.2 should be performed using alternative input files in conjunction with three commands:

T2 EXH PHASE-IN, which provides phase-in percentages by exhaust certification bin, vehicle class and pollutant.
T2 CERT, which defines the 50,000 mile standard levels by exhaust certification bin, vehicle class and pollutant.
94+ LDG IMP, which is used only to establish the fraction of zero-emitting exhaust vehicles (ZEVs). The remainder of vehicles are categorized as "Tier 2" and allocated according to the bin phase-in fractions provided with the T2 EXH PHASE-IN command. Users who would like to model the LEV I or northeastern NLEV and LEV II programs in conjunction can create a single input file for this command which reflects the phase-in for the appropriate programs from 1994 onward. Users must contact EPA for alternative input files and guidance on how to modify them to reflect local conditions.

For evaporative (non-exhaust) VOC emissions, analysis of the LEV II option in MOBILE6.2 must be performed with a different input file used in conjunction with 94+ LDG IMP command.

A single input file cannot accurately reflect the impact of zero-emitting vehicles on both exhaust and evaporative emissions. Analysis of the evaporative VOC emissions under the LEV II option in MOBILE6.2 should therefore be performed using alternative input files in conjunction with two commands. The command T2 EVAP PHASE-IN provides phase-in percentages for evaporative standards by vehicle class. The command 94+ LDG IMP is used only to establish the fraction of zero-emitting evaporative vehicles (ZEVs and Partial ZEVs). The remainder of vehicles are categorized as "Tier 2" and allocated according to the phase-in fractions provided with the T2 EVAP PHASE-IN commands. Users must contact EPA for alternative input files and guidance on how to modify them to reflect local conditions.

Appendix: References

This guidance is not intended to explain fully how to use MOBILE6.2. While reading this document, MOBILE6.2 users should refer to the User's Guide to MOBILE6.2 (US EPA Office of Air an Radiation, 2001, EPA420-D-01-003) for details on each of the commands discussed here. This document is available at:

http://www.epa.gov/otaq/m6.htm

The technical reports created to document MOBILE6.2 will be helpful in understanding how EPA developed national default estimates for many of the factors that states may want or need to modify. The following technical reports may be of most interest:

Guidance for the Development of Facility Type VMT and Speed Distributions, Systems Applications International, Inc., September 1998 (EPA 420-P-99-004, M6.SPD.004).

Trip Length Activity Factors for Running Loss and Exhaust Running Emissions, April 2001 (EPA 420-R-01-013, M6.FLT.005).

Fleet Characterization Data for MOBILE6.2: Development and Use of Age Distributions, Average Mileage Accumulation Rates and Projected Vehicle Counts for Use in MOBILE6.2, September 2001 (EPA 420-R-01-047, M6.FLT.007).

All of these reports are available on the EPA web site at:

http://www.epa.gov/otaq/models/MOBILE6/m6tech.htm

The primary sources of past guidance on the use of MOBILE for estimating highway vehicle inventories for SIP and conformity related purposes are the following documents:

Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources, US EPA Office of Air and Radiation, 1992, EPA-450/4-81-026d (Revised).
(http://www.epa.gov/otaq/models.htm)

User's Guide to MOBILE5, US EPA Office of Air and Radiation, 1994, EPA-AA-AQAB-94-01.
(http://www.epa.gov/otaq/m5.htm)

Preferred and Alternative Methods for Gathering and Locating Specific Emission Inventory Data: Methodology for Gathering Locality-Specific Emission Inventory Data, Report prepared for US EPA, June 19, 1996.
(http://www.epa.gov/ttnchie1/eiip/techreport/volume04/)

Use of Locality-Specific Transportation Data for the Development of Mobile Source Emission Inventories, Report prepared for US EPA, September, 1996. (http://www.epa.gov/ttn/chief/eiip/techreport/volume04/index.html)

Techniques for Estimating MOBILE2 Variables, Energy and Environmental Analysis, Inc. for EPA Contract Number 68-03-2888. (ORA0022.PDF at http://www.epa.gov/OMS/models/mob-arch/)

Additional Techniques for Estimating MOBILE2 Variables, Energy and Environmental Analysis, Inc. for EPA Contract Number 68-03-2888. (ORA0023.PDF at http://www.epa.gov/OMS/models/mob-arch/)

An additional source of information about roadways is:

The Highway Performance Monitoring System Field Manual, December 2000, OMB No. 21250028, Office of Highway Policy Information, Federal Highway Administration. (http://www.fhwa.dot.gov/ohim/hpmsmanl/hpms.htm)

Additional information about the Highway Performance Monitoring System can be found at:

http://www.fhwa.dot.gov/ohim/hpmspage.htm

U.S. Environmental Protection Agency

Modeling and Inventories

Mobile Source Emissions - Past, Present, and Future

MOBILE Model (On-road Vehicles)

NONROAD Model (Nonroad Engines, Equipment, and Vehicles)

NMIM (National Mobile Inventory Model)

MOVES (Motor Vehicle Emission Simulator)

Fuels Models

MOBILE6 Vehicle Emission Modeling Software

This Web page provides the MOBILE6 Vehicle Emission Modeling Software and related presentations and training resources. MOBILE6 is an emission factor model for predicting gram per mile emissions of Hydrocarbons (HC), Carbon Monoxide (CO), Nitrogen Oxides (NOx), Carbon Dioxide (CO_2), Particulate Matter (PM), and toxics from cars, trucks, and motorcycles under various conditions.

For further information or assistance regarding this web page or MOBILE6:

- MOBILE Model Information Contact: fax: (734) 214-4939 or email: Mobile (mobile@epa.gov)
- EPA-MOBILENEWS Listserver: Full description and subscription information 2K TXT

NOTE: You will need Adobe Acrobat Reader, available as a free download, to view some of the files on this page. See EPA's PDF page to learn more about PDF, and for a link to the free Acrobat Reader.

- MOBILE6 Model
- Presentations
- Training
- Technical Documentation
- Workshop Documents
- Plans
- Main mobile sources modeling page
- Related Links

Key Topics: Transportation and Air Quality

Overview: Pollutants and Programs

Consumer Information

On-road Vehicles and Engines

Nonroad Engines, Equipment, and Vehicles

Fuels and Fuel Additives

Voluntary Programs

Transportation and Air Quality Planning

Modeling, Testing, and Research

MOBILE6 Model

- MOBILE62.ZIP -- This zipped file allows users to download the MOBILE6.2 model, including HC, CO, NOx, PM air toxics, user guide, supporting documentation, a "frequently asked questions" list, source code, and sample input and output files. This file includes the updated PM emission factors for heavy duty diesel vehicles. The file can be unzipped with standard software such as WinZip. A "read-me" file explains the next steps for setting up and using the model. (March 2006) 3.4M ZIP (Free zip software is available at

http://www.download.com EXIT Disclaimer) If you already have the current MOBILE6 model, but need the new PM emission factors, you can download and use just the updated PM emission factors here, (TXT, 14K)

- MOBILE6 User Guide (PDF, 262 pages, 846K) (EPA420-R-03-010, August 2003) This guide (also in MOBILE62.ZIP) provides detailed instructions for setting up and running MOBILE6 emission scenarios.

- MOBILE6.2 Policy Guidance (PDF, 13 pages, 672K) (February 24, 2004) This guidance clarifies how and when the current version of MOBILE6.2 can be used for SIPs and conformity purposes.

- Federal Register Notice of Availability: Official Release of MOBILE6.2 Motor Vehicle Emissions Factor Model, (also available as a PDF file, 3 pages, 45K) (published May 19, 2004)

- Policy Guidance on when MOBILE6 must be used for State Implementation Plans and Conformity (PDF, 14 pages, 105K) This document lists questions and answers on how and when to use MOBILE6 in SIP development and transportation conformity decisions.
    - Clarification of Policy Guidance for MOBILE6 SIPs in Mid-Course Review Areas. (PDF, 2 pages, 112K)

- Technical Guidance on the Use of MOBILE6.2 for Emission Inventory Preparation -- This document provides EPA guidance on appropriate input assumptions and sources of data for the use of MOBILE6.2 in SIP and conformity related submissions.
    - Cover Memo (PDF, 1 page, 43K)
    - Technical Guidance (PDF, 82 pages, 358K) (EPA420-R-04-013, August 2004)
    - Diesel sulfur levels by county (PDF, 634 pages, 1.3M) (see section 5.5 of the Technical Guidance document, above.)

- Technical Description of the Toxics Module for MOBILE6.2 and Guidance on Its Use for Emission Inventory Preparation - This document describes the methodology used to estimate air toxic emission rates in the toxics module for MOBILE6.2, describes the sources of data used, and provides users with guidance on how to obtain data required as input parameters for the model. The document also compares some MOBILE6.2 results to results using a previous highway mobile source toxics emission factor model, MOBTOX5b.
    - Technical Guidance (PDF, 34 pages, 589K) (EPA420-R-029, November 2002)
    - Workbook for making MOBILE6.2 and

MOBTOX5b comparisons by vehicle class and model year: 4.2M ZIP XLS

- Sensitivity Analysis of MOBILE6.0 (PDF, 64 pages, 1.3M) (EPA420-R-02-035, December 2002). This report presents a systematic study of the relative importance of various MOBILE6 input parameters.

- Frequently Asked Questions (PDF, 42 pages, 140K) (EPA420-B-03-013, November 2003). This document (an October 2003 version is also in MOBILE62.ZIP) lists questions from MOBILE6 users and answers from EPA staff.

- Excel spreadsheet and Windows program to calculate the humidity ratio in grains of water per pound of dry air using relative humidity, barometric pressure, and ambient temperature as input. (February 2002) 16K XLS

- Federal Register Notice of Availability: Official Release of the MOBILE6 Motor Vehicle Emissions Factor Model (also available as a PDF file, 4 pages, 48K) (published January 29, 2002)

top of page

MOBILE6 Presentations:

- MOBILE6 Presentations, April 4, 2001, North American Motor Vehicle Emissions Control Conference (NAMVECC), Atlanta.
  - Overview and Comparison to MOBILE5 (PDF, 15 pages, 113K)
  - Input/Modeling Guidance and SIP/Conformity Policy (PDF, 18 pages, 19K)

- MOBILE6 Presentation, March 26, 2001, Coordinating Research Council On-Road Vehicle Emissions Workshop, San Diego. (PDF, 13 pages, 106K)

- MOBILE6 Presentation, March 27, 2000, Coordinating Research Council On-Road Vehicle Emissions Workshop, San Diego. (PDF, 17 pages, 110K)

- MOBILE6 Presentation, December 9, 1998, Air and Waste Management Association meeting, New Orleans
  - Slides (PDF, 11 pages, 38K)
  - Paper (PDF, 18 pages, 70K)

top of page

MOBILE6 Training

EPA is developing a variety of training opportunities for MOBILE6 users. Information on this training will be posted as available. Also see the MOBILE6 user guide above.

- 5-Day Training presented in Seattle, September 2001
  - ReadMe 2K TXT
  - PowerPoint presentation given on the first day of the course. (PDF, 195 pages, 2.4M). This is a basic introduction to on-road emissions modeling and MOBILE6. It can serve as a stand-alone class for managers and others who will not perform analyses using the model.
  - Training Manual for the five day course:
    - Day 1 (PDF, 200 pages, 1.3M)
    - Day 2 (PDF, 70 pages, 255K)
    - Day 3 (PDF, 127 pages, 780K)
    - Day 4 (PDF, 59 pages, 275K)
    - Day 5 (PDF, 99 pages, 300K)
  - During the second through fifth days of the training, numerous examples were worked in class. The examples are given in the training manual. The solutions to those examples are given in these four files:
    - Day 2 (PDF, 90 pages, 260K)
    - Day 3 (PDF, 12 pages, 160K)
    - Day 4 (PDF, 54 pages, 250K)
    - Day 5 (PDF, 10 pages, 90K)

- Computer-based training 1.9M ZIP.
  After unzipping, please see the "ReadmeCD.txt" file for instructions.

- Third-Party MOBILE6 Model Training

Comments and questions should be sent by email to Mobile (mobile@epa.gov). Please make sure to include your name and organizational affiliation on any comments.

top of page

Related Links:

- Technical Background
- Workshop Documents
- Evaluation of the U.S. EPA MOBILE6 Highway Vehicle Emission Factor Model, Coordinated Research Council Project E-64 (PDF, 186 pages, 3.8M) (published March 2004)

top of page

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