United States
Environmental Protection
Agency

Air and Radiation

EPA420-R-02-001
January 2002

User's Guide to MOBILE6.0

Mobile Source Emission Factor Model

Printed on Recycled Paper

EPA420-R-02-001
January 2002

User's Guide to MOBILE6.0

Mobile Source Emission Factor Model

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

NOTICE

EPA is not responsible for the accuracy of any MOBILE6 files, diskettes, or tapes that were received from sources other than EPA or for the accuracy of any draft MOBILE6 files, diskettes, or tapes released prior to the release of the final MOBILE6 program. Further, EPA is not responsible for the accuracy of MOBILE6 when modified by the user without consulting EPA. Mention of specific products, product or corporate names, or trademarks in no way constitutes endorsement of same by the U.S. Government or by the EPA.

Abstract

This document is the User's Guide to MOBILE6.0, the initial version of MOBILE6 which is now being released in final form following several limited availability draft releases. MOBILE6 is a computer program that estimates hydrocarbon (HC), carbon monoxide (CO), and oxides of nitrogen (NO_x) emission factors for gasoline-fueled and diesel highway motor vehicles, and for certain specialized vehicles such as natural-gas-fueled or electric vehicles that may replace them. The program uses the calculation procedures presented in technical reports posted on EPA's MOBILE6 Web page http://www.epa.gov/otaq/models.htm. MOBILE6 will supercede earlier versions of MOBILE.

MOBILE6 calculates emission factors for 28 individual vehicle types in low- and high-altitude regions of the United States. MOBILE6 emission factor estimates depend on various conditions, such as ambient temperatures, travel speeds, operating modes, fuel volatility, and mileage accrual rates. Many of the variables affecting vehicle emissions can be specified by the user. MOBILE6 will estimate emission factors for any calendar year between 1952 and 2050, inclusive. Vehicles from the 25 most recent model years are considered to be in operation in each calendar year.

Document and Support Availability

The following documents are available on the EPA Web site http://www.epa.gov/otaq/models.htm.

- A README.TXT file
- A compiled, executable version of the program and associated files for DOS
- Source code
- This user's guide
- Example input and output files
- Policy guidance on when MOBILE6 must be used for State Implementation Plans (SIPs)
- A technical policy guidance document
- A frequently asked questions (FAQ) document
- Humidity calculation/conversion tools
- Training and Presentation Materials
- Technical reports explaining the data and calculation methods used in MOBILE6

Requests for hard copies of the MOBILE6 program and questions concerning MOBILE6 or this User's Guide should be directed to:

U.S. EPA National Vehicle and Fuel Emissions Laboratory
Office of Transportation and Air Quality, ASD
2000 Traverwood Drive

Ann Arbor, MI 48105
Attn: MOBILE6 Project

Fax: (734) 214-4939
Email: mobile@epa.gov

Table of Contents

CHAPTER 1

INTRODUCTION ..... -9-
1.0 BACKGROUND ..... -9-
1.1 USER'S GUIDE STRUCTURE ..... -10-
1.2 MOBILE6 SCOPE ..... -11-
1.2.1 MOBILE6 Input Parameters ..... -11-
1.2.2 Adjustments to the Basic Emission Rates ..... -12-
1.2.3 MOBILE6 Vehicle Classifications ..... -13-
1.2.4 MOBILE6 Emission Type Classifications ..... -14-
1.2.5 MOBILE6 Roadway Classifications ..... -14-
1.2.6 MOBILE6 Hydrocarbon Categories ..... -14-
1.3 SOURCES FOR USER SUPPORT AND TRAINING ..... -14-
1.4 COMMENTS ON MOBILE6 ..... -15-

CHAPTER 2

MOBILE6 INPUTS ..... -16-
2.0 INTRODUCTION ..... -16-
2.1 OVERVIEW OF MOBILE6 COMMANDS ..... -17-
2.2 RUNNING MOBILE6: MODEL INTERFACE ..... -25-
2.4 INPUT STRUCTURE ..... -26-
2.4.1 Command Input Files ..... -26-
2.4.2 Batch Input Files ..... -28-
2.5 COMMAND INPUT FILE CONTENT ..... -29-
2.6 INPUT FORMAT ..... -30-
2.6.1 Free Versus Fixed Format Data Entry ..... -31-
2.6.2 How to Read Fortran Format Specifications ..... -32-
2.7 EXTERNAL DATA FILES ..... -33-
2.8 MOBILE6 COMMANDS ..... -34-
2.8.1 Overview ..... -34-
2.8.2 Separator Commands ..... -34-
2.8.2.1 First Record of a Regular Command Input File ..... -35-
2.8.2.2 First Record of a Batch File ..... -35-
2.8.2.3 End of Header Section ..... -36-
2.8.2.4 Scenario Record ..... -37-
2.8.2.5 End of Run ..... -37-
2.8.3 All Output Commands ..... -38-
2.8.3.1 Limiting Which Pollutants are Reported ..... -38-
2.8.3.2 Hydrocarbon (HC) Emissions Speciation ..... -38-
2.8.3.3 No Refueling Emissions ..... -40-

2.8.4 Descriptive Output Commands . . . . . -40-
2.8.4.1 Report (Descriptive Output) File . . . . . -41-
2.8.4.2 No Descriptive Output . . . . . -41-
2.8.4.3 Expanding Vehicle Class Descriptive Output . . . . . -42-
2.8.4.4 Expand Exhaust Emissions Descriptive Output . . . . . -43-
2.8.4.5 Expand Evaporative Emissions Descriptive Output . . -43-
2.8.5 Database Output Commands . . . . . -44-
2.8.5.1 Control of Output in Database Form . . . . . -44-
2.8.5.2 Database Output Files Identification . . . . . -54-
2.8.6. External Condition Commands . . . . . -55-
2.8.6.1 Calendar Year of Evaluation . . . . . -55-
2.8.6.2 Month of Evaluation (January or July) . . . . . -56-
2.8.6.3 Daily Temperature Range . . . . . -57-
2.8.6.4 Ambient Temperature for Each Hour of the Day . . . . . -58-
2.8.6.5 Altitude . . . . . -59-
2.8.6.6 Absolute Humidity . . . . . -60-
2.8.6.7 Environmental Effects on Air Conditioning . . . . . -61-
2.8.7 Vehicle Fleet Characteristic Commands . . . . . -63-
2.8.7.1 Distribution of Vehicle Registrations . . . . . -63-
2.8.7.2 Diesel Fractions . . . . . -64-
2.8.7.3 Annual Mileage Accumulation Rates . . . . . -66-
2.8.7.4 Vehicle Miles Traveled (VMT) Fraction . . . . . -67-
2.8.7.5 Natural Gas Vehicles (NGVs) Fraction . . . . . -67-
2.8.7.6 Alternate Emission Factors for Natural Gas Vehicles (NGVs) . . . . . -68-
2.8.8 Activity Commands . . . . . -70-
2.8.8.1 Fractions of Vehicle Miles Traveled (VMT) . . . . . -70-
2.8.8.2 VMT By Facility, Hour and Speed . . . . . -72-
2.8.8.5 Soak Distribution . . . . . -83-
2.8.8.6 Hot Soak Activity . . . . . -85-
2.8.8.7 Diurnal Soak Activity . . . . . -86-
2.8.8.8 Weekday Trip Length Distribution . . . . . -88-
2.8.8.9 Weekend Trip Length Distribution . . . . . -89-
2.8.8.10 Use Weekend Vehicle Activity . . . . . -91-
2.8.9 State Programs . . . . . -92-
2.8.9.1 Effects of Fuel Program on Emissions . . . . . -92-
2.8.9.2 Effects of Stage II on Refueling Emissions . . . . . -92-
2.8.9.3 Anti-Tampering Programs . . . . . -94-
2.8.9.4 Inspection/Maintenance (I/M) Programs . . . . . -96-
2.8.10 Fuel Commands . . . . . -112-
2.8.10.1 Fuel Program . . . . . -112-
2.8.10.2 Sulfur Content of Gasoline . . . . . -118-
2.8.10.3 Oxygenated Fuels Programs . . . . . -118-

2.8.10.4 Fuel Reid Vapor Pressure (RVP) . . . . . -120-
2.8.10.5 Effective Season for RFGs Calculation . . . . . -122-
2.8.11 Alternative Emission Regulations and Control Measures . . . . . -123-
2.8.11.1 Disablement of the 1990 Clean Air Act Requirements . . . . . -123-
2.8.11.2 Heavy-Duty Diesel Vehicle NOx Off-Cycle Emission Effects . . . . . -125-
2.8.11.3 Tier 2 Emission Standards and Fuel Requirements . . -129-
2.8.11.4 Alterative Schedule for 1994 and Later Model Year Light Duty Gasoline Vehicle Standards . . . . . -133-
2.8.11.5 2007 Heavy Duty Vehicle Emissions Reductions . . . -134-

CHAPTER 3

MOBILE6 OUTPUTS . . . . . -138-
3.0 INTRODUCTION . . . . . -138-
3.1 DATABASE OUTPUT REPORT . . . . . -138-
3.1.1 Database Output Formatting Options . . . . . -138-
3.1.1.1 Key Fields . . . . . -139-
3.1.1.2 Echoed Fields Carried To Output From Input . . . . . -141-
3.1.1.3 Calculated Fields . . . . . -142-
3.1.2 Database Output Structure . . . . . -143-
3.1.3 Restricting the Set of Database Output Records Produced . . . . . -143-
3.2 DESCRIPTIVE OUTPUT . . . . . -144-
3.2.1 Descriptive Output Formatting Options . . . . . -146-
3.2.2 Explanation Of Additional Items in the Descriptive Output . . . . . -147-
3.3 WARNING AND ERROR MESSAGES . . . . . -148-
3.4 USER SCREEN OUTPUT . . . . . -149-

CHAPTER 4

MOBILE6 INSTALLATION AND COMPUTER REQUIREMENTS . . . . . -150-
4.0 INTRODUCTION . . . . . -150-
4.1 GENERAL INFORMATION . . . . . -150-
4.2 PROGRAM AVAILABILITY . . . . . -150-
4.3 SYSTEM REQUIREMENTS . . . . . -151-
4.4 INSTALLATION . . . . . -152-
4.4.1 Basic Installation . . . . . -152-
4.4.1.1 The RUN Subdirectory—The Executable Program . . -153-
4.4.1.2 The Examples Subdirectory . . . . . -153-
4.4.1.3 The UGUIDE Subdirectory . . . . . -154-
4.4.1.4 The SOURCE Subdirectory . . . . . -154-
4.4.2 Advanced Options . . . . . -154-

4.5 RUNNING MOBILE6 . . . . . -155-
4.5.1 Basic Run . . . . . -155-
4.5.2 Input . . . . . -157-
4.5.3 Output . . . . . -157-
4.5.4 Batch Input . . . . . -158-
4.5.5 Input and Output File Names . . . . . -159-
4.5.6 Open Actions . . . . . -161-

CHAPTER 5

CONVERTING MOBILE5 INPUTS TO MOBILE6 . . . . . -166-
5.0 INTRODUCTION . . . . . -166-
5.1 BASIC CONVERSION . . . . . -166-
5.2 FEATURES NO LONGER AVAILABLE . . . . . -167-
5.3 CONVERTING USER-SUPPLIED DATA . . . . . -168-
5.3.1 Hour of the Day . . . . . -168-
5.3.2 Vehicle Class . . . . . -169-
5.3.3 Operating Modes . . . . . -174-
5.3.4 Average Speed . . . . . -178-
5.3.5 Roadway Type . . . . . -182-

Appendix A

Alphabetical List of MOBILE6 Commands . . . . . -184-

Appendix B

MOBILE6 Input Data Format Reference Tables . . . . . -191-

Appendix C

Corresponding MOBILE6 Inputs for MOBILE5 Inputs . . . . . -195-

Appendix D

Vehicle Class Adjustment Factors . . . . . -201-

Appendix E

MOBILE6 Default Diesel Sales Fractions . . . . . -203-

Appendix F

Creating MOBILE6 Average Speed Distributions From Average Speed . . . . . -204-

CHAPTER 1

INTRODUCTION

1.0 BACKGROUND

MOBILE6 is a software application program that provides estimates of current and future emissions from highway motor vehicles. The latest in a series of MOBILE models dating back to 1978, MOBILE6 calculates average in-use fleet emission factors for:

- Three criteria pollutants: hydrocarbons (HC); carbon monoxide (CO); and oxides of nitrogen (NO_x).
- Gas, diesel, and natural-gas-fueled cars, trucks, buses, and motorcycles.
- Calendar years between 1952 and 2050.

MOBILE6 was designed by the U.S. Environmental Protection Agency (EPA) to address a wide variety of air pollution modeling needs. Written in Fortran and compiled for use in the desktop computer environment, the model calculates emission rates under various conditions affecting in-use emission levels (e.g., ambient temperatures, average traffic speeds) as specified by the modeler. MOBILE models have been used by EPA to evaluate highway mobile source control strategies; by states and local and regional planning agencies to develop emission inventories and control strategies for State Implementation Plans under the Clean Air Act; by metropolitan planning organizations and state transportation departments for transportation planning and conformity analysis; by academic and industry investigators conducting research; and in developing environmental impact statements.

Each new version of MOBILE reflects the collection and analysis of new test data. It also incorporates changes in vehicle, engine, and emission control system technologies; changes in applicable regulations, emission standards, and test procedures; and improved understanding of in-use emission levels and the factors that influence them. MOBILE6 represents the first major update to EPA's emission factor model since the release of MOBILE5b in 1996. This latest version of MOBILE differs significantly in both structure and data requirements from previous versions of the model. It incorporates updated information on basic emission rates, more realistic driving patterns, separation of start and running emissions, improved correction factors, and changing fleet composition. It also includes impacts of new regulations promulgated since MOBILE5b and provides users with more sophisticated options for tailoring emission factor estimates to specific times and geographic locations.

EPA has gone to great lengths to assure that MOBILE6 is based on the best data and calculation methodologies available. EPA staff has produced more than 40 technical reports explaining the data analysis behind the MOBILE6 estimates and the methods used in the model. These were posted on the EPA's MOBILE6 website for comment and review. In addition, all papers were extensively reviewed within EPA, and papers reporting major new data analyses

were sent to external experts for an independent peer review. All comments were considered, and MOBILE6 methodologies were revised in response to comments as necessary.

The descriptive output from MOBILE6 reports emission rates in grams of pollutant per vehicle mile traveled (g/mi). Database output can be reported as g/mi or grams per vehicle per unit time (day or hour). The change in emission rates for a given vehicle category over time is due to fleet turnover, through which older vehicles built to less stringent emission standards are replaced by newer vehicles built to comply with more stringent standards. Thus, emission rates from MOBILE can be combined with estimates of travel activity (total vehicle miles traveled, or VMT), which also change over time, to develop highway vehicle emission inventories expressed in terms of tons per hour, day, month, season, or year.

MOBILE6 allows users to calculate and report sub-components of total emissions. For example, non-exhaust (often described as "evaporative") HC emissions from gasoline-fueled vehicles include: diurnal emissions (emissions generated by the rise in temperature during the course of a day when the vehicle is not being driven); hot soak emissions (emissions occurring after the end of a vehicle trip, due to the heating of the fuel, fuel lines, and fuel vapors); running losses (emissions occurring while a vehicle is driven, due to the heating of the fuel and fuel lines); resting losses (small but continuous seepage and minor leakage of gasoline vapor through faulty connections, permeable hoses, and other components of the fuel system); and refueling emissions (vapors that escape into the atmosphere when incoming liquid fuel displaces vapors in the vehicle fuel tank). Similarly, MOBILE6 can break down emissions by roadway type, time of day, vehicle category, and other characteristics that allow for very detailed modeling of specific local situations.

This User's Guide outlines technical requirements for MOBILE6 and describes options for setting up and running the model. It will be of particular assistance to users who wish to model local scenarios that differ from the "national average" conditions that MOBILE6 defaults assume.

1.1 USER'S GUIDE STRUCTURE

The User's Guide is structured into five chapters, plus appendices. The first chapter is this introduction. Chapter 2 describes how to use the model, outlines model input requirements, and provides a description of each command, the required computer syntax, and tips for ease of use. Chapter 3 describes the output and the possible output formats. Chapter 4 describes how to install the program on commonly used computers and describes the minimum computer requirements needed to execute MOBILE6, as well as other technical details. Chapter 5 outlines differences between MOBILE6 and the previous version of the model, MOBILE5. The appendices include an alphabetical list of all MOBILE6 commands and various reference tables. Example input files will be distributed with MOBILE6.

1.2 MOBILE6 SCOPE

MOBILE6 includes default values for a wide range of conditions that affect emissions. These defaults are designed to represent "national average" input data values. Users who desire a more precise estimate of local emissions can substitute information that more specifically reflects local conditions. Use of local input data will be particularly common when the local emission inventory is to be built up from separate estimates of roadways, geographic areas, or times of day, in which fleet or traffic conditions vary considerably. A list of MOBILE6 input parameters is provided below. Most of these inputs are optional because the model will supply default values unless alternate data are provided. At a minimum, users must provide input data for calendar year, minimum and maximum daily temperature, and fuel volatility.

1.2.1 MOBILE6 Input Parameters

- Calendar year
- Month (January, July)
- Hourly Temperature
- Altitude (High, low)
- Weekend/weekday
- Fuel characteristics (Reid vapor pressure, sulfur, Reformulated gasoline)
- Humidity, solar load, and air-conditioning fractions
- Registration (age) distribution by vehicle class
- Annual mileage accumulation by vehicle class
- Diesel sales fractions by vehicle class and model year
- Average speed distribution by hour and roadway
- Distribution of vehicle miles traveled by roadway type
- Engine starts per day and distribution by hour
- Engine start soak time distribution by hour
- Trip end distribution by hour
- Average trip length distribution
- Hot soak duration
- Distribution of vehicle miles traveled by vehicle class
- Full, partial, and multiple diurnal distribution by hour
- Inspection and maintenance (I/M) program description
- Anti-tampering inspection program description
- Stage II refueling emissions inspection program description
- Air-conditioning usage rates
- Natural gas vehicle fractions
- HC species output
- Output format specifications and selections

1.2.2 Adjustments to the Basic Emission Rates

MOBILE6 basic emission rates are derived from emissions tests conducted under standard conditions such as temperature, fuel, and driving cycle. Emission rates further assume a pattern of deterioration in emission performance over time, again based on results of standardized emission tests. MOBILE6 calculates adjustments to basic emission rates for conditions that differ from typical standard testing. Adjustments are used both to reflect how an in-use vehicle population is different from the tested samples and for conditions different from those used in the testing program.

Adjustments are calculated for:

- Average speed by roadway type
- Temperature
- Air conditioning
- Humidity
- Fuel volatility
- Fuel oxygen content
- Fuel sulfur content
- Reformulated gasoline
- Detergent gasoline rule
- Cold CO rule
- Off-cycle driving and Supplemental Federal Test Procedure (SFTP) rule
- Tampering
- Excess emissions (defeat device)
- Inspection and maintenance programs
- Anti-tampering programs
- Stage II refueling control programs
- Onboard diagnostics

Some adjustments do not affect all emission types or all emissions. Some adjustments, such as inspection and maintenance (I/M) programs, require detailed user-supplied information and complex calculation of the effect.

1.2.3 MOBILE6 Vehicle Classifications

	MOBILE6 Vehicle Classifications	
Number	***Abbreviation***	***Description***
1	LDGV	Light-Duty Gasoline Vehicles (Passenger Cars)
2	LDGT1	Light-Duty Gasoline Trucks 1 (0-6,000 lbs. GVWR, 0-3,750 lbs. LVW)
3	LDGT2	Light-Duty Gasoline Trucks 2 (0-6,000 lbs. GVWR, 3,751-5,750 lbs. LVW)
4	LDGT3	Light-Duty Gasoline Trucks 3 (6,001-8,500 lbs. GVWR, 0-5,750 lbs. ALVW)
5	LDGT4	Light-Duty Gasoline Trucks 4 (6,001-8,500 lbs. GVWR, 5,751 lbs. and greater ALVW)
6	HDGV2b	Class 2b Heavy-Duty Gasoline Vehicles (8,501-10,000 lbs. GVWR)
7	HDGV3	Class 3 Heavy-Duty Gasoline Vehicles (10,001-14,000 lbs. GVWR)
8	HDGV4	Class 4 Heavy-Duty Gasoline Vehicles (14,001-16,000 lbs. GVWR)
9	HDGV5	Class 5 Heavy-Duty Gasoline Vehicles (16,001-19,500 lbs. GVWR)
10	HDGV6	Class 6 Heavy-Duty Gasoline Vehicles (19,501-26,000 lbs. GVWR)
11	HDGV7	Class 7 Heavy-Duty Gasoline Vehicles (26,001-33,000 lbs. GVWR)
12	HDGV8a	Class 8a Heavy-Duty Gasoline Vehicles (33,001-60,000 lbs. GVWR)
13	HDGV8b	Class 8b Heavy-Duty Gasoline Vehicles (>60,000 lbs. GVWR)
14	LDDV	Light-Duty Diesel Vehicles (Passenger Cars)
15	LDDT12	Light-Duty Diesel Trucks 1and 2 (0-6,000 lbs. GVWR)
16	HDDV2b	Class 2b Heavy-Duty Diesel Vehicles (8,501-10,000 lbs. GVWR)
17	HDDV3	Class 3 Heavy-Duty Diesel Vehicles (10,001-14,000 lbs. GVWR)
18	HDDV4	Class 4 Heavy-Duty Diesel Vehicles (14,001-16,000 lbs. GVWR)
19	HDDV5	Class 5 Heavy-Duty Diesel Vehicles (16,001-19,500 lbs. GVWR)
20	HDDV6	Class 6 Heavy-Duty Diesel Vehicles (19,501-26,000 lbs. GVWR)
21	HDDV7	Class 7 Heavy-Duty Diesel Vehicles (26,001-33,000 lbs. GVWR)
22	HDDV8a	Class 8a Heavy-Duty Diesel Vehicles (33,001-60,000 lbs. GVWR)
23	HDDV8b	Class 8b Heavy-Duty Diesel Vehicles (>60,000 lbs. GVWR)
24	MC	Motorcycles (Gasoline)
25	HDGB	Gasoline Buses (School, Transit and Urban)
26	HDDBT	Diesel Transit and Urban Buses
27	HDDBS	Diesel School Buses
28	LDDT34	Light-Duty Diesel Trucks 3 and 4 (6,001-8,500 lbs. GVWR)

Many of these individual classes are in pairs: a gasoline-fueled class, and a corresponding diesel-fueled class.

These class divisions are not likely those used in local vehicle registration systems or in reporting VMT data to the Federal Highway Administration's (FHWA) Highway Performance Monitoring System (HPMS), so care must be taken when relating vehicle types across these data sources.

MOBILE6 descriptive output can report results in terms of groups of the previous individual vehicle classes, including emission rates for "all vehicles."

1.2.4 MOBILE6 Emission Type Classifications

MOBILE6 Emission Type Classifications				
Number	***Abbreviation***	***Description***	***Pollutants***	***Vehicle Classes***
1	Running	Exhaust Running Emissions	HC,CO,NO_x	All
2	Start	Exhaust Engine Start Emissions (trip start)	HC,CO,NO_x	LD plus MC
3	Hot Soak	Evaporative Hot Soak Emissions (trip end)	HC	Gas, inc. MC
4	Diurnal	Evaporative Diurnal Emissions (heat rise)	HC	Gas, inc. MC
5	Resting	Evaporative Resting Loss Emissions (leaks and seepage)	HC	Gas, inc. MC
6	Run Loss	Evaporative Running Loss Emissions	HC	Gas, less MC
7	Crankcase	Evaporative Crankcase Emissions (blow-by)	HC	Gas, inc. MC
8	Refueling	Evaporative Refueling Emissions (fuel displacement and spillage)	HC	Gas, less MC

1.2.5 MOBILE6 Roadway Classifications

MOBILE6 Roadway Classifications		
Number	***Abbreviation***	***Description***
1	Freeway	High-Speed, Limited-Access Roadways
2	Arterial	Arterial and Collector Roadways
3	Local	Urban Local Roadways
4	Fwy Ramp	Freeway on and off ramps
5	None	Not Applicable (For start and some evaporative emissions)

1.2.6 MOBILE6 Hydrocarbon Categories

MOBILE6 (FID) Hydrocarbon Categories		
Number	***Abbreviation***	***Description***
1	THC	Total Hydrocarbons
2	NMHC	Non-Methane Hydrocarbons
3	VOC	Volatile Organic Compounds
4	TOG	Total Organic Gases
5	NMOG	Non-Methane Organic Gases

For detailed MOBILE6 definitions of these categories, please see Section 2.8.3.2.

1.3 SOURCES FOR USER SUPPORT AND TRAINING

EPA's Office of Transportation and Air Quality can provide only minimal user support. EPA encourages MOBILE6 users seeking assistance beyond this User's Guide to take advantage of the EPA web site.

The Modeling Page at EPA's Office of Transportation and Air Quality Web

site (www.epa.gov/otaq/models.htm) offers the most complete documentation of MOBILE6 and earlier versions of the model. This includes users' guides, technical reports, fact sheets, presentations, peer review comments, and other materials. Numerous examples of input files for running the model and the corresponding output are also accessible through this site. The Web site offers links to related information such as emissions test data contained in the Mobile Source Observation Database.

1.4 COMMENTS ON MOBILE6

EPA welcomes user comments and especially seeks specific suggestions for future versions of the model. We encourage you to tell us what works in MOBILE6 and what does not, relative to your most significant modeling needs. Please send your comments to the Assessment and Standards Division, U.S. Environmental Protection Agency Office of Transportation and Air Quality, 2000 Traverwood, Ann Arbor, MI 48105, or e-mail your comments to mobile@epa.gov.

CHAPTER 2

MOBILE6 INPUTS

2.0 INTRODUCTION

This chapter explains the input files used to run MOBILE6. Through input files, users can tailor MOBILE6 to best meet their needs. Input command choices allow modelers to specify the format and content of the data that MOBILE6 calculates and reports. Input choices also allow modelers to override MOBILE6 default inputs, which are often designed to automatically produce "national average" emission results. Users can input local data and/or specifically model local conditions via commands that allow users to supply alternate data.

Sections 2.1 through 2.7 present general information about input file structure and command requirements. Section 2.8 discusses each input command, which are grouped by their function in MOBILE6. Section 2.1 provides an overview of MOBILE6 commands in the order that they are presented in this chapter. Appendix A lists all MOBILE6 input commands alphabetically, with cross-references to their function and requirements.

The reader is also encouraged to refer to the sample input files that are included with MOBILE6 when reading this chapter on data input. These examples illustrate the use of MOBILE6 options and data input requirements. However, reference to the examples alone cannot substitute for a thorough reading of this chapter.

2.1 OVERVIEW OF MOBILE6 COMMANDS

Command Name	User's Guide Section	Command Input File Section	Command Parameter Type	Required command?	Command Function
MOBILE6 INPUT FILE	Separators	Header		Yes	Identifies a M6 input file as a regular command input file rather than a batch file.
MOBILE6 BATCH FILE	Separators	Header			Identifies a M6 input file as a batch file as opposed to a regular command input file.
RUN DATA	Separators	End of Header		Yes	Marks end of Header section and beginning of Run section of a regular M6 command input file.
SCENARIO RECORD	Separators	Start of Scenario		Yes	Allows user to label individual scenario results. Marks start of new scenario.
END OF RUN	Separators	End of Run			Required to separate multiple runs in command input files.
POLLUTANTS	All Output	Header	Pollutant Choice		Controls which pollutants will be calculated and output to the database report and descriptive output.
EXPRESS HC AS NMHC	All Output	Run	On/Off		Directs M6 to output exhaust HC as non-methane hydrocarbons.
EXPRESS HC AS NMOG	All Output	Run	On/Off		Directs M6 to output exhaust HC as non-methane organic gases.
EXPRESS HC AS THC	All Output	Run	On/Off		Directs M6 to output exhaust HC as total hydrocarbons.
EXPRESS HC AS TOG	All Output	Run	On/Off		Directs M6 to output exhaust HC as total organic gases.
EXPRESS HC AS VOC	All Output	Run	On/Off		Directs M6 to output exhaust HC as volatile organic compounds.
NO REFUELING	All Output	Run	On/Off		Allows user to exclude refueling (Stage II) emissions from all output values.
REPORT FILE	Descriptive Output	Header	File name		Specifies name for descriptive output file.
NO DESC OUTPUT	Descriptive Output	Header	On/Off		Prevents production of descriptive output.
EXPAND BUS EFS	Descriptive Output	Run	On/Off		Directs M6 to report gas, urban, and school bus categories separately.

Command Name	User's Guide Section	Command Input File Section	Command Parameter Type	Required command?	Command Function
EXPAND EVAPORATIVE	Descriptive Output	Run	On/Off		Display all 6 evaporative emission types in descriptive output.
EXPAND EXHAUST	Descriptive Output	Run	On/Off		Specifies that start, running, and total exhaust EFs be displayed in descriptive output.
EXPAND HDDV EFS	Descriptive Output	Run	On/Off		Directs M6 to display EFs by 8 HDDV classes.
EXPAND HDGV EFS	Descriptive Output	Run	On/Off		Directs M6 to display EFs by 8 HDGV classes.
EXPAND LDT EFS	Descriptive Output	Run	On/Off		Directs M6 to display EFs by 6 LDT classes.
DATABASE OUTPUT	Database Output	Header	On/Off		Specifies M6 to report output in database format.
EMISSIONS TABLE	Database Output	Header	File name		Specifies a file name for the database output file.
WITH FIELDNAMES	Database Output	Header	On/Off		Specifies that a header record of field names is to be generated for the database output.
DATABASE AGES	Database Output	Header	Vehicle age choice		Limits which of the 25 vehicle ages have emissions reported in database output format.
DATABASE EMISSIONS	Database Output	Header	Etype choice		Limits which of 8 types of emissions are reported in database output format.
DATABASE FACILITIES	Database Output	Header	Facility choice		Limits which of 5 roadway types have emissions reported in database output format.
DATABASE HOURS	Database Output	Header	Hours of day choice		Limits which 24 hours of the day have emissions reported in database output format.
DATABASE VEHICLES	Database Output	Header	Vehicle choice		Limits which of 28 vehicle types have emissions reported in database output format.
DATABASE YEARS	Database Output	Header	Model year choice		Limits which of the 25 model years, based on the calendar year chosen, have emissions reported in database output format.
DAILY OUTPUT	Database Output	Header	On/Off		Database output by daily time periods.
AGGREGATED OUTPUT	Database Output	Header	On/Off		Database output by daily time periods aggregated to the level of the description output.

Command Name	User's Guide Section	Command Input File Section	Command Parameter Type	Required command?	Command Function
DATABASE OPTIONS	Database Output	Header	File name		Specifies name for external file holding a set of database output selection records.
CALENDAR YEAR	External Conditions	Scenario	Value	Yes	Calendar year of scenario evaluated.
EVALUATION MONTH	External Conditions	Scenario	Value		Specifies January 1 or July 1 for calendar year of interest.
MIN/MAX TEMP	External Conditions	Run or Scenario	Values	Yes*	Specifies minimum and maximum daily temperatures. * This command is required unless HOURLY TEMPERATURES is used.
HOURLY TEMPERATURES	External Conditions	Run or Scenario	Values	Yes*	Allows entry of 24 hourly temperatures. * This command is required unless MIN/MAX TEMP is used.
ALTITUDE	External Conditions	Scenario	Option		High or low altitude of area evaluated.
ABSOLUTE HUMIDITY	External Conditions	Run or Scenario	Value		Absolute humidity in grains per pound.
CLOUD COVER	External Conditions	Run or Scenario	Value		Allows user to input fraction of cloud cover for a given day.
PEAK SUN	External Conditions	Run or Scenario	Value		Allows input of 2 daily times demarcating period of peak sun.
SUNRISE/SUNSET	External Conditions	Run or Scenario	Values		Specifies times for sunrise and sunset for A/C calculations.
REG DIST	Fleets	Run	External file		Allows user to supply vehicle registration distributions by age for all 16 composite vehicles types.
DIESEL FRACTIONS	Fleets	Run or Scenario	Values		Allows user-supplied alternate diesel sales fractions.
MILE ACCUM RATE	Fleets	Run	External file		Allows user to supply annual accumulation rates by age for each of the 28 vehicle types.
VMT FRACTIONS	Fleets	Run or Scenario	Values		Allows user to apply alternate VMT fractions by each of 16 combined vehicle types.
NGV FRACTION	Fleets	Run	External file		Indicates percentage of natural gas vehicles in each of the 28 vehicles classes.

Command Name	User's Guide Section	Command Input File Section	Command Parameter Type	Required command?	Command Function
NGV EF	Fleets	Run	External file		Allows the user to enter alternate NGV emission factors for each of the 28 vehicle types, for each of the three pollutants, and (where applicable) for running and start emissions. Must be used in conjunction with NGV FRACTION command.
VMT FRACTIONS	Activity	Run or Scenario	Values		Allows user to apply alternate VMT fractions by each of 16 combined vehicle types.
VMT BY HOUR	Activity	Run or Scenario	External file		Allows user to supply alternate hourly distributions of VMT that override M6 defaults for each scenario.
VMT BY FACILITY	Activity	Run or Scenario	External file		Allows user to supply alternate VMT distributions by facility type that override M6 defaults for each scenario.
SPEED VMT	Activity	Run or Scenario	External file		Allows user to enter VMT distribution across 14 preselected average speed ranges for each of the 24 hours of the day for each scenario.
AVERAGE SPEED	Activity	Scenario	Value		Allows user to enter a single average speed value, rather than an average speed distribution.
STARTS PER DAY	Activity	Run	External file		Allows user to change default average number of engine starts per day per vehicle.
START DIST	Activity	Run	External file		Allows user to change the default for the hourly temporal distribution of engine starts (trips) during the day.
SOAK DISTRIBUTION	Activity	Scenario	External file		Allows user to enter soak duration distributions for each hour of day that will override M6 defaults.
HOT SOAK ACTIVITY	Activity	Scenario	External file		Specifies alternative distribution of lengths of hot soaks.
DIURN SOAK ACTIVITY	Activity	Scenario	External		Specifies alternative distribution of diurnal soak

Command Name	User's Guide Section	Command Input File Section	Command Parameter Type	Required command?	Command Function
			file		times.
WE DA TRI LEN DI	Activity	Run or Scenario	External file		Reads the weekday hourly running loss trip length percentages.
WE EN TRI LEN DI	Activity	Run or Scenario	External file		Reads the weekend hourly running loss trip length percentages.
WE VEH US	Activity	Scenario	On/Off		Directs M6 to use the weekend activity fractions in its calculations.
FUEL PROGRAM	State Programs	Run or Scenario	Program description		Designates fuel sulfur level of gasoline and whether reformulated gasoline (RFG) use should be assumed.
STAGE II REFUELING	State Programs	Run	Program description		Allows modeling of impact of Stage II "at-the-pump" vapor recovery system for refueling emissions.
ANTI-TAMP PROG	State Programs	Run	Program description		Anti-tampering programs.
I/M PROGRAM	State Programs	Run	Values		Required record, if I/M program being modeled, indicating program start and end dates, frequency, and test type.
I/M MODEL YEARS	State Programs	Run	Values		Required record, if I/M program being modeled, indicating vehicle model years subject to I/M program.
I/M VEHICLES	State Programs	Run	Vehicle choice		Required record, if I/M program being modeled, indicating vehicle types subject to I/M.
I/M EXEMPTION AGE	State Programs	Run	Value		Optional record indicating age that vehicle automatically becomes exempt from I/M program.
I/M GRACE PERIOD	State Programs	Run	Value		Optional record indicating when vehicle first becomes subject to I/M program.
I/M EFFECTIVENESS	State Programs	Run	Value		Reduce I/M effectiveness to account for Test and Repair losses.

Command Name	User's Guide Section	Command Input File Section	Command Parameter Type	Required command?	Command Function
I/M COMPLIANCE	State Programs	Run	Value		Required input, if I/M program is modeled, indicating percentage of total vehicle fleet certified or waived by I/M program.
I/M WAIVER RATES	State Programs	Run	Values		Required record, if I/M program is modeled, indicating percentage of vehicles failing initial I/M test and do not have to pass a retest.
I/M CUTPOINTS	State Programs	Run	External file		Required record for cutpoints if IM240 used. Do not use with other exhaust or evaporative I/M programs.
NO I/M TTC CREDITS	State Programs	Run	On/Off		Optional record to eliminate credit for a technician training program.
I/M STRINGENCY	State Programs	Run	Values		Required record indicating initial test failure rate (%) for pre-1981 LDGVs and pre-1984 LDGTs.
I/M DESC FILE	State Programs	Run	File name		Optional external input file containing I/M program description records.
FUEL PROGRAM	Fuels	Run or Scenario	Program description		Designates fuel sulfur level of gasoline and whether RFG use should be assumed.
SULFUR CONTENT	Fuels	Scenario	Value		Allows user to enter alternate sulfur content of gasoline (ppm) that overrides M6 default of 300 ppm for year prior to 2000.
OXYGENATED FUELS	Fuels	Run or Scenario	Values		Allows modeling of the effects of oxygenated fuels on exhaust emissions.
FUEL RVP	Fuels	Run or Scenario	Values	Yes	Required input of average fuel Reid vapor pressure.
SEASON	Fuels	Run or Scenario	Value		Allows users to specify winter or summer RFG, independent of evaluation month.
NO CLEAN AIR ACT	Alternative Regulations and Control Programs	Run	On/Off		Allows users to model vehicle emissions as if the Federal Clean Air Act Amendments of 1990 had not been implemented.
NO DEFEAT DEVICE	Alternative Regulations and	Run	On/Off		Allows users to turn off the effects of the heavy-duty diesel vehicle NOx off-cycle

Command Name	User's Guide Section	Command Input File Section	Command Parameter Type	Required command?	Command Function
	Control Programs				emission effects (defeat device emissions).
NO NOX PULL AHEAD	Alternative Regulations and Control Programs	Run	On/Off		Allows the user to turn off the effects of the Pull Ahead mitigation program used to reduce heavy-duty diesel vehicle NOx off-cycle emissions.
NO REBUILD	Alternative Regulations and Control Programs	Run	On/Off		Allows the user to turn off the effects of the Rebuild mitigation program used to reduce heavy-duty diesel vehicle NOx off-cycle emissions.
REBUILD EFFECTS	Alternative Regulations and Control Programs	Run	Value		Allows the user to change the Rebuild program effectiveness rate used to reduce heavy-duty diesel vehicle NOx off-cycle emissions.
NO TIER2	Alternative Regulations and Control Programs	Run	On/Off		Allows the user to disable the Tier 2 emission standards and fuel sulfur requirements.
T2 EXH PHASE-IN	Alternative Regulations and Control Programs	Run	File name		Allows the user to replace the default phase-in fractions (by certification bin) for the Tier 2 exhaust emission standards, allowing different phase-in schedules to be modeled. Also necessary to model the exhaust effects of the California LEV II requirement.
T2 EVAP PHASE-IN	Alternative Regulations and Control Programs	Run	File name		Allows the user to replace the default phase-in fractions (by certification bin) for the Tier 2 evaporative emissions standards, permitting different phase-in schedules to be modeled. Also necessary to model the evaporative effects of California's LEVII requirement.
T2 CERT	Alternative Regulations and Control Programs	Run	File name		Allows the user to specify alternative Tier 2 50,000 mile certification standards. Must be used to model the effects of California's LEV II requirement.
94+ LDG IMP	Alternative Regulations and Control Programs	Run	File name		Allows the user to input optional 1994 and later fleet penetration fractions for light-duty gasoline vehicles under the Tier 1, NLEV (or

Command Name	User's Guide Section	Command Input File Section	Command Parameter Type	Required command?	Command Function
					California LEV 1), and Tier 2 standards.
NO 2007 HDDV RULE	Alternative Regulations and Control Programs	Run	On/Off		Allows the user to disable the 2007 heavy duty vehicle emission standards.

2.2 RUNNING MOBILE6: MODEL INTERFACE

When MOBILE6 is started, the user will be prompted to enter the name of a MOBILE6 input file. The user may then enter a DOS path name followed by a file name. Most users will probably want to place the input file in the same directory as the MOBILE6 executable and have this directory be the current DOS directory, and enter a simple file name.

Another option is to enter a blank line, in which case MOBILE6 uses the default input file name, "MOBILE6.IN", and expects the file to be located in the current DOS directory. In either case, MOBILE6 cannot run without a valid input file at the expected location. If the named input file does not exist, MOBILE6 prompts the user to enter another input file name. If the user enters a blank line in response to this second prompt, the program stops. Otherwise, the program continues prompting until the user enters the name of an existing file. When MOBILE6 finds the input file, it creates a corresponding descriptive output file. (See Chapter 3 for detailed information on MOBILE6 output. See Section 4.5 for detailed information on MOBILE6 input and output file names and extensions.)

MOBILE6 commences the run as soon as the user enters the name of a valid (i.e., existing) input file. Messages indicating that the model is reading input information and performing calculations will appear on the screen. Run duration depends on the complexity of the input file. If there have been no errors, the message, "driver calls completed" will appear, indicating that MOBILE6 has completed the calculations and has produced its output.

EPA is aware that many users would prefer an interactive, menu-driven interface that would construct input files based on selections made by the user. Such an interface is beyond the scope of MOBILE6 but will be considered for future versions of the model.

2.3 HOW TO CREATE AN INPUT FILE

1. Open a software application capable of creating text files (e.g., a text editor such as Notepad or a word processor such as WordPerfect). Create a text file and give it a name. MOBILE6 input file names must follow DOS file naming syntax; they must be limited to eight characters or less, plus an extension (in the form of ".EXT") of up to three characters.

   The user may choose an input file name that either includes or does not include a period with a file name extension. (Users cannot use the extension .txt or .tb1 since those are the default extensions for MOBILE6 output files.) If the input file name contains a period, it will be used by MOBILE6 exactly as written. If the file name does *not* contain a period, the program first searches for a file with the specified name and an extension of ".IN". If that file is not found, the program then searches for a file named exactly as specified.

2. Specify the input commands you wish to enter. A few commands are required.

   Please see Section 2.4: Input Structure, and Section 2.5: Input Content, for command definitions and detailed information on how to create command input files. The model supports the creation of multiple sets of results from within a single command or batch input file.

3. Save the file as an ASCII DOS text file. MOBILE6 cannot recognize other file types.

NOTE: MOBILE6 input files may not contain "tab" characters or non-ASCII characters in any input command line.

2.4 INPUT STRUCTURE

There are three types of MOBILE6 input files: command files, batch files, and external data files. All three types must be ASCII DOS text files and may not contain "tab" characters or non-ASCII characters in any input line. Command input files are the method for users to specify what sort of results are needed from MOBILE6. External data files are associated with some individual commands. The content and format for external data files are discussed in Section 2.7 and 2.8, along with their specific commands.

2.4.1 Command Input Files

All command input files begin with the MOBILE6 INPUT FILE command. Command input files provide program control information and data describing the scenarios for which emission factors are to be estimated. The input information consists of three distinct sections:

- The Header section controls the overall input, output, and execution of the program. For example, the Header section may direct MOBILE6 to output emission factors in a format suitable for visual inspection (descriptive output) and/or in a format suitable as input to another program (database output). Information supplied in the Header section will apply to all runs and scenarios described in the command input file. Commands that may appear in the Header section are indicated in Section 2.1. The RUN DATA command indicates the end of the Header section of the command input file.

- The Run section allows users to define parameter values that localize or customize their MOBILE6 runs. For example, users can specify alternate annual mileage accumulation rates or registration distributions by age for each vehicle type. In addition, the Run section allows users to specify further control program parameters, such as description(s) of inspection and maintenance program(s). Information supplied in the Run section is specified once and applies to all scenarios in that run. Commands which may appear in the Run section are indicated in Section 2.1 above. Some commands may appear in either the Run or Scenario sections. A command

input file may contain multiple runs. The first Run section begins with the RUN DATA command and ends with the first SCENARIO RECORD command. The next Run section begins with the END OF RUN command from the previous run and ends with the next SCENARIO RECORD command.

- The Scenario section details the individual scenarios for which emission factors are to be calculated. For example, the Scenario section must specify the calendar year of evaluation and may also specify other information, such as the month of evaluation and temperatures. Each MOBILE6 run can include many scenarios. Information supplied in the Scenario section is applied to results only from that scenario. Commands that may appear in the scenario section are indicated in Section 2.1 above. Some commands may appear in either the Run or Scenario sections. Each scenario begins with the SCENARIO RECORD command and ends with the next SCENARIO RECORD command or ends with an END OF RUN command (indicating the end of all scenarios within that run).

A MOBILE6 command input file must begin with a Header section and may contain many separate Run sections, or runs. Each command input file must contain at least one run, and each Run section must contain at least one or more scenarios. Any data item entered in the Run section is used for every scenario within the run, unless it is replaced in any scenario by a local value as described below (blank lines represent additional scenarios). The end of the command input file is considered as the end of the last run. The END OF RUN record at the end of the last scenario in the command input file is therefore optional, but recommended. The overall structure of a MOBILE6 command input file is:

- Header Section
  - First Run Data Section
    - First Scenario Data Section
    - Second Scenario Data Section
      .
      .
    - Last Scenario Data Section
  - Second Run Data Section
    - First Scenario Data Section
    - Second Scenario Data Section
      .
      .
    - Last Scenario Data Section
      .

.
Last Run Data Section

First Scenario Data Section
Second Scenario Data Section
.
.
Last Scenario Data Section

MOBILE6 assigns default values for most of the data items that may appear in a MOBILE6 command input file. It is not necessary to enter data for these items if the default value is acceptable for all scenarios in that run. Because all of the input commands that appear in the run sections have default values, it is not necessary to enter any records in the Run section of a MOBILE6 command input file. A run may begin with a SCENARIO RECORD command.

2.4.2 Batch Input Files

All batch input files begin with the MOBILE6 BATCH FILE command, which is the only MOBILE6 command allowed in a batch input file. The purpose of a batch input file is to direct MOBILE6 to execute a series of command input files without involving the user. This allows for a large and complex series of MOBILE6 results to be generated from a single input file. Many users will not need to use this option because the command input file structure allows multiple runs and scenarios (see Section 2.4.1).

The structure of a batch input file is simple: it consists of any number of lines that name command input files to be processed, along with any number of blank and comment lines. Each active line in the file will contain a file name (with or without the DOS path). The file name is expected to be the name of an existing MOBILE6 command input file. MOBILE6 will read and execute the commands in the specified command input file and generate results. After completing each command input file, MOBILE6 will read the file name found on the next line in the batch input file and execute the commands in the next command input file. In this way, a series of separate MOBILE6 command input files can be completed with a single execution of the MOBILE6 application.

After the entry of the MOBILE6 BATCH FILE command, the only other active lines in the file contain file names. No other MOBILE6 commands can appear in a batch input file, other than comments and blank lines. All input file names in the batch input file must be existing MOBILE6 command input files. The indicated file names may not be other batch input files. All the input files indicated in the batch input file will run until all command input files have been completed or an error occurs.

See Section 2.8.2.2 for more details about the MOBILE6 BATCH FILE command.

2.5 COMMAND INPUT FILE CONTENT

This section describes the contents of valid MOBILE6 command input files.

Users specify the type of results by putting "commands" in a standard command input file. Section 2.1 provides an overview of the valid MOBILE6 commands. Section 2.8 presents a detailed discussion of each valid input command.

Most commands are optional in MOBILE6 command input files. The seven commands that are required in every command input file are given in the following table:

Table of Required MOBILE6 Input Records

Command Name (full text)	MOBILE6 Section	User's Guide Section
MOBILE6 INPUT FILE	Header	2.8.2.1
RUN DATA	Header	2.8.2.3
FUEL RVP	Run or Scenario	2.8.10.4
Temperature either as: MIN/MAX TEMPERATURE HOURLY TEMPERATURE	Run or Scenario	2.8.6.3, 2.8.6.4
SCENARIO RECORD	Scenario only	2.8.2.4
CALENDAR YEAR	Scenario only	2.8.6.1
END OF RUN	Scenario only	2.8.2.5

As discussed in Section 2.4, particular commands may appear only in particular sections of the command input file. However, within a section, the order of the commands does not matter. For example, it does not matter whether the FUEL RVP command appears before or after the CALENDAR YEAR command in the Scenario section of the input. If a command appears more than once within a section, only the last occurrence will be used. This should be avoided because it may cause confusion and inappropriate results.

Commands can contain only ASCII characters. MOBILE6 command input files may not contain "tab" characters or non-ASCII characters in any input command or line. However, commands may be entered in upper, lower or mixed case.

Command input files may also contain blank lines and comments; and this is encouraged to make the command input files more easily read and understood. The use of comments is described in Section 2.6.3.

2.6 INPUT FORMAT

There are specific content and format requirements for the commands in a MOBILE6 command input file.

Each command has a unique name that should appear precisely as specified (e.g., MOBILE6 INPUT FILE). In some cases, the command name itself acts as an on/off switch that signals MOBILE6 to perform a specific action. In many cases, however, users must supply additional information. This can take the form of data parameters that follow the command name. Such entries are considered to be "internal" because the information is provided within the command input file. In contrast, many MOBILE6 commands require extensive user-supplied data that users must provide in separate files called "external" data files, which are discussed in Section 3.7.

MOBILE6 reads up to 150 characters of any input line, including comments, commands, and data lines. MOBILE6 allows three types of input lines, which are:

Command lines: these lines give information that controls the calculations or output of MOBILE6 runs and scenarios. Command lines consist of a command name, sometimes followed by a data field.

A command name always appears in columns 1 through 19 of a MOBILE6 command line. The command name may appear in upper or lower case, and any number of blanks may precede the first word of the command or appear between the words of commands that use more than one word.

By convention, a colon (:) appears in column 20 of the command line, but it is not required. Column 21, by convention, is usually left blank to separate the data from the colon. Any data that appears on the command line usually starts in column 22.

Data lines: these lines follow an associated command name and provide data associated with the command.

The data may usually occur in any column, including columns 1 through 19. All data must appear within the 150 characters read by MOBILE6 from each line. Users should consult the specific format requirements for data lines discussed with the associated commands in Section 2.8. Section 2.6.1 discusses the types of data formats used in MOBILE6.

Comment lines: these are optional lines that allow users to document or describe the MOBILE6 scenario or run.

Except within blocks of data, or between a data line and the command that defines it, any number of blank lines or comment lines are allowed anywhere in the

command input file. This allows MOBILE6 command input files to contain documentation so that they are easy to read and understand by those who develop, maintain, and use the files.

2.6.1 Free Versus Fixed Format Data Entry

There are two basic formats that the model uses to read data values provided by the user: "free" and "fixed" column formats. Individual MOBILE6 commands require a particular format. A free column format allows the values to occur in any column in the data space, as long as individual values are separated by a separating character (usually a blank space). In a fixed column format, the data must be located in a specific column or group of columns in the data space. MOBILE6 utilizes both types of user input format. The user must be aware of the differences between these input types and the limitations of each in order to avoid errors when entering data values.

Free format allows the data values to be entered into any column in the data space. If the data follows a command on the same line, the columns following the command can act as the data space, beginning in column 21. For commands which require their data parameters to begin on the following line or which require an external data file, the data values may appear in any column, including columns 1 through 21. No data can ever appear after column 150. File names, including path, are usually limited to 80 characters. Each data value entered must be separated from other values by a separating character, either a blank space or a comma. If blanks are used, as many blank characters may separate values as desired. If a comma is used, only one comma may occur between values. We suggest that only blank spaces be used to separate values when using the free column format. Values that are intended to be integers may be entered including a decimal (e.g., 2.0), but any fractional value included after the decimal will be dropped from the value used by the model. For example, entering the value 1.9 into a field intended to be an integer will result in the value used being 1.0, and the fractional portion of the value (0.9) will not be used. Values that are intended to be real numbers are not required to include a decimal if the value is a whole number. The values may have as many numbers after the decimal as desired, but the use of the values is limited by the precision of the computer itself. If there is a series of values to be entered and the data may follow the command line or the data is located in an external file, the number of lines on which the data is entered may vary. For example, if 24 values are to be entered, they may be on a single line with all 24 values, on two lines with 12 values each, on 6 lines with 4 values each, or in any other combination so long as the total of 24 values appear in the proper sequence.

Fixed format requires that all values be located in specific locations on the command line or other data lines. The locations are specified in the model by a Fortran format statement, which is sometimes included with the description of the data entry. Decoding the Fortran format statement is described in Section 2.6.2. Each value must occur wholly within the columns specified. For example, if an integer value must be entered within two columns, it is impossible to enter a three-digit value because the three-digit character will not be read if it lies outside the two columns. Real values that contain a decimal can alter the default decimal places specified by

the format, but the total number of characters used must fall within the specified columns. If an integer value is expected and the user enters a value that contains a decimal within the specified columns, the model cannot read the value and will give an error message. The values must be entered in the columns, rows, and order specified by the format description.

2.6.2 How to Read Fortran Format Specifications

Some of the descriptors used in Section 2.8 to define and describe the input field specifications are Fortran format specifications. Following is a brief key for interpretation. Additional guidance can be found in any Fortran manual.

Descriptor	Definition and Interpretation
'**Iw**'	The next **w** characters (columns; includes blank spaces) will be read in as an integer value. Leading blanks are ignored, but trailing blanks are read as zeroes; thus, integer input values should be "right-justified" within the input field (e.g, if a value of "2" is to be entered in a field specified as I2, the two columns should be filled in "blank,2", not "2,blank" which will be interpreted as "20").
'**Fw.d**'	The next **w** characters will be read in as a floating-point real number, in which **d** is the number of digits to the right of (following) the decimal point. If the field contains an explicit decimal point, the value will be read as specified, and the implied point specified by **d** in the descriptor will be overridden. The decimal point, if present, is considered a character in the overall field width, **w**. If the field does not contain an explicit decimal point (which is not recommended), then **d** places are considered to be to the right of an "implied" decimal point.
'**Aw**'	The next **w** characters will be interpreted and stored as alphanumeric (i.e., labels or text. Control characters, such as tabs, and non-ASCII characters may not be used.
'**wX**'	The next **w** characters will be ignored; they are not read by MOBILE6.
'/'	The field separator, used to indicate the end of one record (line of input). Input after the '/' will be read from the next record.
'n( )'	The format specification inside the parentheses is repeated 'n' times.

2.6.3 COMMENTS

MOBILE6 has flexible features for adding comments and blank lines to input files. Users are encouraged to use these capabilities to improve the documentation and readability of input files. Certain comments can appear on the monitor screen or in the descriptive output files, and users are encouraged to take advantage of this to improve the documentation in the output files.

Two types of comment lines are supported in MOBILE6 command input files. The first type of comment is a line that has an asterisk (*) in the first column of the line. This type of comment line is ignored by the model, just like a blank line, and does not affect the output in any way. The second type of comment line has a "greater than" symbol (>) in the first column. This type of comment line is read by the model and printed to the output. The "greater than" symbol is changed to an asterisk before the line is displayed, otherwise it is copied exactly as it is found in the command input file. If the comment is in the Header section, the comment appears only on the monitor screen. If the comment containing a "greater than" symbol appears in either the Run or Scenario section of the command input file, the comment is written to the descriptive output file. Comments are never written to the database output file.

In addition to comment lines, blank lines help organize the command input file by providing white space, making the file easier to read.

Comments and blank lines should never be placed within a block of data that follows a command within a command input file, unless this feature is explicitly noted in the description of the command.

2.7 EXTERNAL DATA FILES

MOBILE6 reads certain types of data from external data files. These data include user-supplied tampering rates, mileage accumulation rates, and vehicle registration distributions. In fact, most commands that require significant amounts of user-supplied data rely on external data files.

When external files are employed, MOBILE6 expects to find a file name in the data field to the right of the colon on the command line. File names can be in either upper or lower case; they may include path information; and they may appear anywhere in the data field of the input record starting at or to the right of column 21. MOBILE6 always prints the names of any external data files it uses in the descriptive output report. MOBILE6 accepts file names up to 80 characters in length, including file path information. MOBILE6 assumes that external data file names that do not include path information appear in the same directory as the application.

Blank or comment lines may appear in front of the Header section in the external data file, between the Header section and the data, or at the end of the file after the data is complete. However, no blank or comment lines may appear between the first line and the last line of the data block unless specifically indicated in the description for the command. Blank lines and

comment lines in external data files can provide annotation for internal documentation or provide text that will be echoed to the descriptive output file.

The specific content and format for external data files are described with the commands that require the data. The descriptions for each command are found in the next section.

2.8 MOBILE6 COMMANDS

2.8.1 Overview

By using model inputs, called "commands," MOBILE6 users can tailor modeling results to reflect specific local conditions. MOBILE6 commands also serve certain administrative functions such as marking the beginning or end of a modeling exercise. A complete list of MOBILE6 input commands organized by function appears in Section 2.1. An alphabetical list appears in Appendix A. This section presents each MOBILE6 command in detail. The following general format is used:

Name: Full name and allowable abbreviations.

Status: Required or Optional.

Section: Header, Run, or Scenario.

Description: Brief summary of what the command does.

Default: The action MOBILE6 takes, or value it applies, unless the user supplies alternative information.

Explanation: Detailed "how-to" information for users. Covers user options, model calculations, information requirements, and format specifications.

Example: Example of properly formatted input for the command.

Tips: Suggestions for facilitating MOBILE6 operation.

References to technical documentation occur throughout this section. Sample external data files will be distributed with the model, and MOBILE6 technical reports can be found on the EPA's MOBILE6 Web page http://www.epa.gov/otaq/models.htm.

2.8.2 Separator Commands

As explained in Section 2.4, a MOBILE6 command input file consists of three sections. Separator commands mark the beginning or end of a MOBILE6 command input file, as well as a Header, Run, and/or Scenario section within a MOBILE6 command input file.

2.8.2.1 First Record of a Regular Command Input File

Name: MOBILE6 INPUT FILE

Status: Required for all regular command input files.

Section: Header.

Description: Identifies MOBILE6 command input file as a regular file as opposed to a batch file.

Default: There is no MOBILE6 default. Users must supply this command in all input files except batch files.

Explanation: This command must be the first data record in a MOBILE6 input file. The data field of this record is not used and should be left blank. No additional information is required or allowed.

Example:
```
MOBILE6 INPUT FILE
```

2.8.2.2 First Record of a Batch File

Name: MOBILE6 BATCH FILE

Status: Required for MOBILE6 batch files.

Section: Header.

Description: Identifies a MOBILE6 input file as a list of command input file names as opposed to a standard command input file.

Default: There is no MOBILE6 default. Users must supply this command as the first and only command in all batch input files.

Explanation: This command must be the first record in a MOBILE6 batch input file. The data field of this record is not used and should be left blank. No additional information is required or allowed on the command line.

The MOBILE6 BATCH FILE command is the only command allowed in the batch input file. The remaining lines in the batch file must identify standard command input files, include comments, or be left blank. Nesting of batch input files (listing another batch input file name within a batch input file) is not allowed. All comments using a right caret will be written to the monitor screen during execution.

MOBILE6 expects to find each command input file name in a separate line within the batch input file. Any number of lines containing valid command input file names may appear following the MOBILE6 BATCH FILE command. File names can be given in either upper or lower case; they may include path information; and they may appear anywhere in the input record, beginning with column 1. The actual file names cannot have more than 8 characters before the decimal. MOBILE6 accepts file name entries up to 80 characters, including file path information, and assumes that file names that do not include path information appear in the same directory as the application. MOBILE6 will echo the names of the command input files being processed to the monitor screen during execution.

Additional features for designation of input and output file names in MOBILE6 batch input files are discussed in Section 4.5.

Example:
```
MOBILE6 BATCH FILE
FILE1.IN
FILE2.IN
.
.
.
FILELAST.IN
```

2.8.2.3 End of Header Section

Name: RUN DATA

Status: Required.

Section: Header.

Description: This command marks the end of the Header section and the beginning of the first Run section of a regular MOBILE6 command input file.

Default: There is no MOBILE6 default. Users must supply this information in all command input files.

Explanation: This command has a purely administrative function. No information is required except for the command name.

Example:
```
RUN DATA
```

2.8.2.4 Scenario Record

Name: SCENARIO RECORD

Status: Required.

Section: Scenario.

Description: This command serves two purposes: it marks the beginning of a new scenario, and it allows the user to enter text to be printed at an appropriate location in the descriptive output file.

Default: There is no default. This command must be present.

Explanation: This feature permits the user to specify individual scenario calculations. The only required information is the command name, followed by whatever scenario-identifying text the user wants to appear in the descriptive output. The text must begin in column 22 of the line. At least one SCENARIO RECORD command is required in every regular MOBILE6 command input file. Additional SCENARIO RECORD commands are necessary to generate multiple output results (e.g., multiple calendar years).

Example:
```
SCENARIO RECORD     : Washington DC
```

This input indicates the beginning of a modeling exercise specific to Washington, DC, and causes the text “Washington DC” to appear before results in the output file.

2.8.2.5 End of Run

Name: END OF RUN

Status: Required.

Section: Run.

Description: This command marks the end of each Run section of a MOBILE6 command input file and is used to separate multiple MOBILE6 runs.

Default: There is no MOBILE6 default. This command must be present.

Explanation: This command must appear at the end of the last scenario of each Run section of a command input file.

Example: `END OF RUN :`

2.8.3 All Output Commands

Output commands allow the user to specify the format and content of MOBILE6 report files. The commands in this section apply to both database and descriptive forms of output.

2.8.3.1 Limiting Which Pollutants are Reported

Name: POLLUTANTS

Status: Optional.

Section: Header.

Description: Defines the set of pollutants that MOBILE6 reports.

Default: MOBILE6 calculates three pollutants (HC, CO, NO_x) and writes results for all three to any output files produced.

Explanation: If the user selects this command, at least one pollutant must be specified in the data field. The pollutant types are specified by the character strings HC, CO, and NO_x. The three pollutant types may appear in mixed case, but each value must be separated from the next by one or more blanks. If the users selects this command but does not specify a pollutant, the program will stop.

Example: `POLLUTANTS : NOX CO`

This input specifies that calculations and output will be restricted to the pollutants CO and NO_x.

2.8.3.2 Hydrocarbon (HC) Emissions Speciation

NOTE: This section covers five commands with similar functions and requirements.

Name: (1) EXPRESS HC AS NMHC

(2) EXPRESS HC AS NMOG

(3) EXPRESS HC AS THC

(4) EXPRESS HC AS TOG

(5) EXPRESS HC AS VOC

Status: Optional.

Section: Run.

Description: These commands allow the user to specify the particular HC species that is reported in the exhaust emission output.

Default: If the user does not enter a HC speciation command, MOBILE6 will report the exhaust HC emissions in terms of volatile organic compounds (VOCs).

Explanation: MOBILE6 allows the user to choose one from among five options for reporting HC emissions. These are detailed below:

Species		Includes FID HC	Includes Methane	Includes Ethane	Includes Aldehydes
Total Hydrocarbons	(THC)	Yes	Yes	Yes	No
Non-methane Hydrocarbons	(NMHC)	Yes	No	Yes	No
Volatile Organic Compounds	(VOC)	Yes	No	No	Yes
Total Organic Gases	(TOG)	Yes	Yes	Yes	Yes
Non-methane Organic Gases	(NMOG)	Yes	No	Yes	Yes

In the table above, “FID HC” refers to the HC emissions as measured by the flame ionization detector (FID) used in testing. The FID detects a portion of the aldehydes emitted by the vehicle. Thus, the first two options above (THC and NMHC) account for a portion of aldehyde emissions; the other options include a correction for that portion of aldehyde emissions not registered by the FID. If speciation profiles are being applied to MOBILE6-based emissions, consistency in HC definitions is important.

Only one of the HC speciation commands may be used in a single run. If the user attempts to enter more, MOBILE6 will use the one that appears last. The only required information for each of these five commands is the command name.

Emission testing of gasoline and diesel motor vehicles typically measures only THC and/or NMHC. Natural gas vehicles are typically tested only for NMHC. In order to provide estimates for the other "HC" outputs, MOBILE6 estimates other hydrocarbon species based on

the typical emissions composition of vehicles using gasoline and diesel fuels. Estimates of VOC, THC, and TOG for fleets that include large fractions of natural gasoline fueled vehicles may be imprecise. In particular, the THC and NMHC outputs for natural gas vehicles should not be subtracted from each other to estimate methane emissions, for example to estimate their global warming gas emissions.

Example:
```
EXPRESS HC AS NMHC :
EXPRESS HC AS NMOG :
EXPRESS HC AS THC  :
EXPRESS HC AS TOG  :
EXPRESS HC AS VOC  :
```

2.8.3.3 No Refueling Emissions

Name: NO REFUELING

Status: Optional.

Section: Run.

Description: This command directs MOBILE6 not to calculate the refueling emissions (also referred to as Stage II emissions) from gasoline-fueled vehicles. Thus, the composite hydrocarbon emissions reported to descriptive output will not include refueling emissions.

Default: MOBILE6 reports refueling emissions if this command is not specified.

Explanation: The command name is the only required information.

Example:
```
NO REFUELING       :
```

Tips: The command should not be used if the user wants to model refueling emissions. While the use of AP-42 gram/gallon factors in the past has been an alternative to using MOBILE to calculate refueling emissions, this approach cannot give the correct estimates for calendar years 1994 and later, due to the presence of on-board vapor recovery systems on an increasing percentage of the in-use fleet starting in that year. However, there may be reasons for users to have a separate MOBILE6 run for determining refueling emissions, and excluding refueling emissions from the runs used to determine other emission types.

2.8.4 Descriptive Output Commands

Descriptive output commands allow users to specify the name and content of descriptive output files.

2.8.4.1 Report (Descriptive Output) File

Name: REPORT FILE

Status: Optional.

Section: Header.

Description: This command identifies the descriptive output file.

Default: The output will be written to a descriptive file named with the input file name root plus the extension, ".TXT". The default open action is REPLACE.

Explanation: The file name is the only required data item for this record and can be placed anywhere in the data field of the record. The user may provide a file name with an explicit extension—or with a period as the last non-blank character—if the user wishes to override the default naming convention.

An open action of APPEND or REPLACE may appear following the file name, separated from it by one or more blanks. The APPEND action adds new modeling results to a previously created report file of the same name. The REPLACE action erases old results and replaces them with new ones. The open action may appear in mixed case and may be abbreviated to a single character (e.g., A or R). The default action, if none is specified, is REPLACE.

Example:
```
REPORT FILE        :  feb02.txt
```

This example directs results to a descriptive output file named "feb02.txt". Because no open action is specified, the MOBILE6 default open action would apply, and any previous modeling results in the file would be replaced by the new ones.

2.8.4.2 No Descriptive Output

Name: NO DESC OUTPUT

Status: Optional.

Section: Header.

Description: This command prevents MOBILE6 from producing descriptive output.

Default: MOBILE6 produces descriptive output if this command is not specified.

Explanation: The only required information is the command name. When this command is present, MOBILE6 will produce a text output file containing identifying information (MOBILE6 version, input file, some run and scenario details) and warning messages. However, the text file will not include scenario description (calendar year, temperature, etc.) or emission data.

If the user selects this command but does not request database output, the MOBILE6 run will terminate without generating emission factor output.

Example: `NO DESC OUTPUT :`

2.8.4.3 Expanding Vehicle Class Descriptive Output

NOTE: This section covers four commands with similar functions and requirements.

Name: (1) EXPAND BUS EFS

(2) EXPAND HDDV EFS

(3) EXPAND HDGV EFS

(4) EXPAND LDT EFS

Status: Optional.

Section: Run.

Description: These four commands permit users to expand the descriptive MOBILE6 output to include a more detailed breakdown of truck classes.

Default: MOBILE6 reports emissions only in terms of the eight vehicle category groups used in MOBILE5. These are listed in Section 3.2.2.

Explanation: The command EXPAND BUS EFS causes MOBILE6 to report separate emission results for gas bus, urban diesel bus, and diesel school bus categories.

The command EXPAND HDDV EFS causes MOBILE6 to report emissions produced by heavy-duty diesels (HDDV) for each of the eight distinct HDDV classes (see Section 1.2.3).

The command EXPAND HDGV EFS causes MOBILE6 to report emissions produced by heavy-duty gasoline-fueled vehicles (HDGV) for each of the eight distinct HDGV classes.

The command EXPAND LDT EFS causes MOBILE6 to report emissions produced by light-duty trucks (LDT) for each of the six distinct LDT classes.

NOTE: When the commands that expand vehicle classes are selected along with other expansion commands (e.g., EXPAND EXHAUST), expanded emissions will be reported for each vehicle subcategory as well as for each subcategory of the other expand command. The command name is the only required information for these commands.

Example:
```
EXPAND BUS EFS      :
EXPAND HDDV EFS     :
EXPAND HDGV EFS     :
EXPAND LDT EFS      :
```

2.8.4.4 Expand Exhaust Emissions Descriptive Output

Name: EXPAND EXHAUST

Status: Optional.

Section: Run.

Description: This command directs MOBILE6 to display separate start, running, and total (running + start) exhaust emission factors in the descriptive output, in addition to the composite emission factors.

Default: The default output displays only composite emission factors.

Explanation: Composite emissions are the sum of total exhaust emissions plus evaporative emissions. The only required information for this command is the command name.

Example:
```
EXPAND EXHAUST      :
```

2.8.4.5 Expand Evaporative Emissions Descriptive Output

Name: EXPAND EVAPORATIVE

Status: Optional.

Section: Run.

Description: This command directs MOBILE6 to display total non-exhaust emissions and the six separate types of non-exhaust emissions in the descriptive output, in addition to the composite emission factors.

Default: The default output displays only composite emission factors.

Explanation: When the user selects this command, MOBILE6 will report separate emissions for hot soak, diurnal, resting, running, crankcase, and refueling losses, as well as a total for all those sources. The only requirement for this command is the command name.

Example: `EXPAND EVAPORATIVE :`

2.8.5 Database Output Commands

Database output commands allow the user to specify the name, format, and content of the database output file.

2.8.5.1 Control of Output in Database Form

NOTE: This section describes commands that permit users to obtain MOBILE6 output in a database format and to limit the variables in that database output. These limitations may be critical because the hourly output from a single unlimited scenario will typically produce 217,800 records for exhaust emissions and another 78,000 records for evaporative emissions. This requires about 35 megabytes per scenario. Users are advised to limit their output to only the records necessary for their analyses.

2.8.5.1.a
Name: DATABASE OUTPUT

Status: Optional.

Section: Header.

Description: This command directs MOBILE6 to produce database output for all scenarios of each run in the command input file.

Default: MOBILE6 will not produce database output unless this command is selected.

Explanation: The command name is the only required information. The data field of this record is not used and should be left blank.

Example: `DATABASE OUTPUT :`

2.8.5.1.b
Name: WITH FIELDNAMES

Status: Optional.

Section: Header.

Description: This command directs MOBILE6 to place a row of column names in the first row of the database output table.

Default: The database output will contain only unlabeled values unless this command is selected. This might not be a good outcome for many users.

Explanation: The command name is the only required information. The data field of this record is not used and should be left blank.

Tips: This option is helpful for users who intend to export results to a spreadsheet. It is also helpful for users who intend to export results to database applications capable of handling text fields in the first row of a numerical table.

The WITH FIELDNAMES command should be selected unless users are sure they can do without field names.

Example:
```
WITH FIELDNAMES    :
```

2.8.5.1.c
Name: DATABASE OPTIONS

Status: Optional.

Section: Header.

Description: This command provides an alternate option for specifying content and/or format of database output. It allows users to place the commands listed below in an external file rather than in the command input file.

Default: Database output content and format is specified only through command input file data.

Explanation: This command creates a name for an external file that may contain the following commands. The first record in this external file must restate the name of this command, DATABASE OPTIONS:

DATABASE AGES
DATABASE EMISSIONS
DATABASE FACILITIES
DATABASE HOURS
POLLUTANTS
DATABASE VEHICLES

DATABASE YEARS
DAILY OUTPUT
AGGREGATED OUTPUT
WITH FIELDNAMES

The external file contains the same information that the user would otherwise specify in the command input file.

The only required data are the command name and the file name, which may include its path. The file name can be placed anywhere in the data field of the record.

Example: `DATABASE OPTIONS  : C:\MOBILE\MOBILE6\DATA\DBASE.OPT`

This example directs MOBILE6 to look for a file called “DBASE.OPT”, which contains one or more of the commands listed above.

Tip: This command can be used to avoid having to respecify a frequently used set of database options in multiple command input files.

2.8.5.1.d
Name: DATABASE EMISSIONS

Status: Optional.

Section: Header.

Description: This command limits which of the eight potential types of emissions are reported.

Default: MOBILE6 will report all eight emission types unless this command is selected.

Explanation: MOBILE6 can report separate emissions for the following emission types:

Exhaust Running Emissions
Exhaust Start Emissions
Evaporative Hot Soak Emissions
Evaporative Diurnal Emissions

Evaporative Resting Loss Emissions
Evaporative Running Loss Emissions
Evaporative Crankcase Emissions
Evaporative Refueling Emissions

Users specify whether they want to include each type of emission through an off/on switch indicated by the digits '1' or '2' respectively. A '1' means that the designated emission type should not be included in the output, and a '2' means that it should be included. If the user selects this command, a value (1 or 2) must be entered for each emission type in the order listed above.

The format specification requires values to be entered in two groups of four, and the groups must be separated by one or more blank spaces. The values identifying emission types may be placed anywhere in the data field. The only other requirement is the command name itself.

Example: `DATABASE EMISSIONS : 1221  1111`

This example specifies that database output to the EMISSIONS database output table should be restricted to records pertaining to the exhaust start and evaporative hot soak emission types.

Tip: This option may alternatively be specified using the DATABASE OPTION command described above.

2.8.5.1.e
Name: DATABASE FACILITIES

Status: Optional.

Section: Header.

Description: This command allows users to specify the roadway or facility types for which they wish MOBILE6 to report emissions in the database output table. It is most useful for modelers who wish to analyze facility-specific emissions.

Default: MOBILE6 will report emissions for each facility type.

Explanation: This command directs MOBILE6 to report database output only for user-selected roadway types. The command can take on five values, represented by character strings. Four of the values, ARTERIAL, FREEWAY, LOCAL and RAMP, represent specific facility or roadway types where emissions occur. The fifth value, NONE, does not specify a specific facility type. Rather, it represents emissions that occur independent of roadway type. These include engine start emissions and all evaporative emissions except running losses.

One or more of these values can be listed in the data field of the DATABASE FACILITIES command. The values may be in mixed case, but each value must be separated from the next by one or more blank spaces. No abbreviations are

allowed for these values, and the character strings may appear anywhere in the data field of the command. The only other required data is the command name.

Example: `DATABASE FACILITIES: RAMP freeway None`

This sample input specifies that database output should be restricted to the results for the facility types RAMP and FREEWAY, and for engine start and evaporative (except running loss) emissions.

Tips: This option may alternatively be specified using the DATABASE OPTIONS command described in Section 2.8.5.1.c.

The value "NONE" can be used to suppress reporting of all emission types other than engine start and five of the six evaporative emission types. However, the DATABASE EMISSIONS command offers a more straightforward way to accomplish the same purpose.

This command should not be used in conjunction with the AGGREGATED OUTPUT option.

2.8.5.1.f
Name: DATABASE VEHICLES

Status: Optional.

Section: Header.

Description: This command indicates which of the 28 individual vehicle types are reported.

Default: MOBILE6 reports records for all vehicle types in the database output file.

Explanation: Users can specify whether to include each type of vehicle through an off/on switch indicated by the digits '1' or '2' respectively. A '1' means that the designated vehicle type should not be included in the output, and a '2' means that it should be included. If the user selects this command, a value (1 or 2) must be entered for each vehicle type in the order listed below.

The vehicle types are specified by six groups of values. The first group contains five values for each type of light-duty gasoline vehicles and trucks (LDGVs and LDGTs); the second group contains eight values for the heavy-duty gasoline vehicles (HDGVs); the third group is a single value for motorcycles (MC); the fourth group contains three values for each type of light-duty diesel vehicles and trucks (LDDVs and LDDTs); the fifth contains eight values for the heavy-duty

diesel vehicles (HDDVs); and the last group contains three values for buses. Each group of values must be separated from the next by one or more blank spaces.

Vehicle Types	**Vehicle Class No.**
Light-Duty Gasoline Vehicle	1
Light-Duty Gasoline Truck 1	2
Light-Duty Gasoline Truck 2	3
Light-Duty Gasoline Truck 3	4
Light-Duty Gasoline Truck 4	5
Heavy-Duty Gasoline Vehicle 2B	6
Heavy-Duty Gasoline Vehicle 3	7
Heavy-Duty Gasoline Vehicle 4	8
Heavy-Duty Gasoline Vehicle 5	9
Heavy-Duty Gasoline Vehicle 6	10
Heavy-Duty Gasoline Vehicle 7	11
Heavy-Duty Gasoline Vehicle 8A	12
Heavy-Duty Gasoline Vehicle 8B	13
Motorcycle (MC)	24
Light-Duty Diesel Vehicle	14
Light-Duty Diesel Truck 1 and 2	15
Light-Duty Diesel Truck 3 and 4	28
Heavy-Duty Diesel Vehicle 2B	16
Heavy-Duty Diesel Vehicle 3	17
Heavy-Duty Diesel Vehicle 4	18
Heavy-Duty Diesel Vehicle 5	19
Heavy-Duty Diesel Vehicle 6	20
Heavy-Duty Diesel Vehicle 7	21
Heavy-Duty Diesel Vehicle 8A	22
Heavy-Duty Diesel Vehicle 8B	23
All Gasoline Bus	25
Diesel Commercial Bus	26
Diesel School Bus	27

The only required data for this command are the command name and the string of six groups of vehicle type flags, which can be placed anywhere in the data field.

Example: `DATABASE VEHICLES : 21111 11111111 1 222 11111111 111`

This example specifies that database output should be restricted to records pertaining to LDGVs, LDDVs, and both LDDTs categories.

Tips: This option may alternatively be specified using the DATABASE OPTIONS command described in Section 2.8.5.1.c.

2.8.5.1.g

Name: DATABASE AGES

Status: Optional.

Section: Header.

Description: This command can limit which of the 25 vehicle ages are reported in the hourly or daily database output formats.

Default: Assuming that DATABASE OUTPUT has been requested and that the AGGREGATED OUPUT option has not been specified, MOBILE6 will report emissions for each of the 25 vehicle ages unless this command is selected.

Explanation: The hourly and daily forms of the database output produced by MOBILE6 report emissions for AGE values 0 thru 24. The emissions are reported for yearly AGE values starting with 24-year-old vehicles and ending with the calendar year of the scenario (vehicle age of 0).

The DATABASE AGES command can be used to limit the reporting of emissions to a single vehicle age or a range of vehicle ages.

Users can select a specific AGE value or range of AGE values by specifying a start age and an end age. The order in which these two values are entered does not matter. To specify a single vehicle age of interest, the age should be entered twice.

The format specification requires that the values entered are numbers from 0 through 24. The two numbers must be separated by a blank or a comma. If either or both of the numbers are outside of the set of numbers (0, 2, 3,..., 24), the program will change the upper and/or the lower limiting value(s) to 24 and/or 0, respectively. A warning message is displayed on the screen to notify the user of the change. The only other requirement is the command name itself.

Example: `DATABASE AGES : 5,1`

This example specifies that database output to the daily or hourly database output table should be restricted to records having AGE values of 1, 2, 3, 4, and 5 years old.

Tips: This option may alternatively be specified using the DATABASE OPTION command described in Section 2.8.5.1.c.

This command should not be used in conjunction with the AGGREGATED OUTPUT option.

2.8.5.1.h

Name: DATABASE HOURS

Status: Optional.

Section: Header.

Description: This command can limit which of the 24 hours are reported in the hourly format of the database output.

Default: Assuming that DATABASE OUTPUT has been requested in the default hourly format, MOBILE6 will report emissions for each of the 24 hourly intervals unless this command is used.

Explanation: The hourly database output produced by MOBILE6 reports emissions for each hour of the 24-hour day. (Hour number 1 is 6:00 a.m. to 7:00 am.)

This command can be used to limit which hours are reported by specifying a start and an end value of HOUR. The start and end HOUR values may be specified in either order.

The values entered must be numbers from 1 through 24. The two numbers must be separated by a blank or a comma. If either or both of the numbers are outside of the set of numbers (1, 2, 3,..., 24), MOBILE6 will change the upper and/or the lower limiting value(s) to 24 and/or 1, respectively. A warning message is printed to the screen to notify the user of the change. The only other requirement is the command name itself.

Example:

```
DATABASE HOURS : 2,5
```

This example specifies that database output to the hourly database output table should be restricted to records pertaining to the HOUR values 2, 3, 4, and 5.

Tips: This option may alternatively be specified using the DATABASE OPTION command described above.

This command should not be used in conjunction with the DAILY OUTPUT or the AGGREGATED OUTPUT commands.

2.8.5.1.i
Name: DATABASE YEARS

Status: Optional.

Section: Header.

Description: This command can limit which model years are reported in the hourly or daily database output formats.

Default: Assuming that DATABASE output has been requested and that the AGGREGATED OUTPUT option has not been specified, MOBILE6 will report emissions for a 25 model year range for each scenario, which is determined by the calendar year.

Explanation: The hourly and daily forms of the database output produced by MOBILE6 report emissions for each of 25 model years. This model-year range spans from the calendar year to 24 model years prior to the calendar year. The DATABASE YEARS command can pick out a single or a group of model years from the set of 25 model years that are calculated.

Users can select a specific or a range of model year(s) by specifying a start model year and an end model year. The order in which these two values are entered does not matter.

The format specification requires the values entered be four-digit years that are within the range of allowable model years (1928-2050). Values outside this range are changed by the program to 1928 or 2050. The two numbers must be separated by a blank or a comma. The only other requirement is the command name itself.

Example: `DATABASE YEARS : 1990,1989`

This example specifies that database output to the hourly or daily database output table should be restricted to records pertaining to model years 1989 and 1990.

Tips: This option may alternatively be specified using the DATABASE OPTION command described in Section 2.8.5.1.c.

This command should not be used in conjunction with the AGGREGATED OUTPUT option.

2.8.5.1.j

Name: DAILY OUTPUT

Status: Optional.

Section: Header.

Description: This command specifies that database output will represent daily rather than hourly time periods.

Default: MOBILE6 will report hourly time periods to the database output table.

Explanation: The command name is the only required information. The data field of this record is not used and should be left blank.

Example:
```
DAILY OUTPUT          :
```

Tips: Daily output reduces the volume of reported output by a factor of about 30.

This option may alternatively be specified using the DATABASE OPTIONS command described in Section 2.8.5.1.c.

2.8.5.1.k

Name: AGGREGATED OUTPUT

Status: Optional.

Section: Header.

Description: This command specifies that database output will represent daily rather than hourly time periods and that it will be aggregated over age, facility (roadway) type, and emission type for each vehicle class and pollutant. The emission types included in the aggregation are controlled by user input.

This output option allows the user to obtain most of the aggregated numeric values found in the descriptive output in a database format suitable for electronic processing.

Default: MOBILE6 will report non-aggregated emission factors for hourly time periods to the database output table.

Explanation: The command name is the only required information. The data field of this record is not used and should be left blank.

Unlike the hourly and daily database output formats, the emission values within the output produced by the aggregated format option are affected by other database output options. This allows the user to specify which emission type results are included in the aggregation. The following commands will affect the emission result values:

NO REFUELING
DATABASE EMISSIONS

The NO REFUELING command will prevent the emissions reported from including the portion from refueling. Similarly, the DATABASE EMISSIONS command can eliminate the results for any of the emission type classifications from the reported aggregated results. Because the user may affect the aggregated emission values, caution should be used in selecting desired combinations. For example, selecting only non-exhaust emission types will result in zero emissions for database output lines referring to CO and NO_x.

The DATABASE VEHICLES and POLLUTANTS commands can be used to restrict the number of lines written to the database output file by restricting the vehicle classes and pollutants to be written.

The DATABASE FACILITIES command has no effect on aggregated emissions and will not restrict the emissions by roadway type. This may be done using the VMT BY FACILITY command.

Example: `AGGREGATED OUTPUT :`

Tips: AGGREGATED OUTPUT reduces the volume of reported output to a maximum of 84 lines per scenario.

Heavy-duty vehicles have no separate estimates for running and engine start emissions. Any composite emission results that include running emissions will include all exhaust emissions of heavy-duty vehicles.

2.8.5.2 Database Output Files Identification

Name: EMISSIONS TABLE

Status: Optional.

Section: Header

Description: This command permits the user to name the database output file.

Default: Output will be written to a database table named with the input file name root, plus the extension, ".TB1".

Explanation: The file name is the only required data item for this command and can be placed anywhere in the data field of the record. The user may provide a file name with an explicit extension, or with a period as the last non-blank character, if the user wants to override the default naming convention.

An open action of APPEND or REPLACE may appear following the file name, separated from it by one or more blanks. The APPEND action adds new modeling results to a previously created report file of the same name. The REPLACE action erases old results and replaces them with new ones. The open action may appear in mixed case and may be abbreviated to a single character (e.g., A or R). The default action, if none is specified, is REPLACE.

Example:
```
EMISSIONS TABLE     : C:\MOBILE6\TESTING2\TEST1B.TB1 REPLACE
```

This example directs MOBILE6 to write results to a table called, "TEST1B.TB1", which is found in the C:\MOBILE6\TESTING2 folder. The REPLACE action causes MOBILE6 to overwrite any previous modeling results found in that file.

2.8.6. External Condition Commands

External condition commands allow users to specify the time frame, altitude, and weather conditions they wish to model.

2.8.6.1 Calendar Year of Evaluation

Name: CALENDAR YEAR

Status: Required.

Section: Scenario.

Description: This command identifies the calendar year for which emission factors are to be calculated, often referred to as "calendar year of evaluation."

Default: There is no MOBILE6 default. Users must supply this information.

Explanation: MOBILE6 can model emission factors for the calendar years 1952 to 2050, inclusive. A four-digit value for the calendar year of evaluation must be entered anywhere in the data portion of the record.

Example: `CALENDAR YEAR : 2015`

This input directs MOBILE6 to report emissions for the calendar year 2015.

2.8.6.2 Month of Evaluation (January or July)

Name: EVALUATION MONTH

Status: Optional.

Section: Scenario.

Description: This command provides the option of calculating emission factors for January 1 or July 1 of the calendar year of evaluation.

Default: January or "1".

Explanation: MOBILE6 allows the choice of January 1 or July 1. The specified month will affect emission calculations in two ways: (1) by changing the composition of the fleet (July 1 emission factors will reflect an additional six months of fleet turnover, or replacement of older vehicles by new vehicles), and (2) by changing how the effects of reformulated gasoline (RFG) are modeled. If the user selects January1, MOBILE6 will apply winter season RFG rules. If the user selects July 1, the model will apply summer season RFG rules (see Section 2.8.10).

To select July 1, enter a value of "7" anywhere in the data portion of the record. To select January 1, the user can either enter a value of "1" or simply omit this command. No other information is required except the command name.

Example: `EVALUATION MONTH : 7`

This example directs MOBILE6 to produce emission results for July 1 of the calendar year of evaluation.

Tips: The value of month is independent of temperature, fuel volatility, and other inputs, which users still must select in a way that is consistent with the evaluation month. Section 2.8.10.1 (FUEL PROGRAM) provides additional cautions concerning evaluation month and it's affect on Reformulated Gasoline.

It is possible to estimate the emission results for any evaluation date (month) by mathematical interpolation between two MOBILE6 results. For example, using the same input parameters, two MOBILE6 runs for January and July can be used to estimate May 1st emissions, by weighting the January results by 0.333 and weighting the July results by 0.667. Care should be taken to assure that both the

two runs use the appropriate parameters (i.e., temperature, fuels, etc.) and the in-use programs that would apply on the target evaluation date. This may require the use of the SEASON command if Reformulated Gasoline is being used (see FUEL PROGRAM command).

Here is another example. If the January results are 56 grams/mile and the July results are 50 grams/mile and the user needs results for May, then the user would weight the January results by 2/6 and the July results by 4/6, giving the result of 52 grams/mile. This is intuitively the correct answer, since May is closer to July than January and 52 is closer to 50 than 56.

2.8.6.3 Daily Temperature Range

Name: MIN/MAX TEMPERATURE

Status: Required, unless HOURLY TEMPERATURE command is selected.

Section: Run or Scenario.

Description: This command sets the minimum and maximum daily temperatures the user wishes to model in a given run or scenario.

Default: There is no MOBILE6 default. Users must supply either daily minium and maximum temperatures with this command, or 24 hourly temperatures with the HOURLY TEMPERATURE command.

Explanation: MOBILE6 uses the minimum and maximum daily temperatures to perform several calculations:

Temperature corrections to exhaust HC, CO, and NO_x.
Diurnal, hot soak, running loss, and resting loss portions of evaporative HC.
Temperature of dispensed fuel to calculate refueling emissions.

Users must enter values for the minimum and maximum ambient temperatures that they wish to model in a given run or scenario. The maximum temperature cannot be lower than the minimum temperature, but the two values may be equal, indicating no temperature change occurred during the entire day.

The allowable minium temperature range is 0°F to 100°F (-18°C to 38°C).
The allowable maximum temperature range is 10°F to120°F (-12°C to 49°C).

If the user selects this command, MOBILE6 will calculate hourly temperatures based on a typical pattern of temperatures during the day, given the maximum and minimum values provided. This typical pattern will have the minimum temperature occurring at 6 a.m., and the maximum at 3 p.m. This pattern does not shift seasonally (i.e., no change for Daylight Saving Time).

The format for this command is the command name, followed by the minimum and then the maximum temperatures in degrees Fahrenheit. Numbers representing the temperatures must be separated by a blank space but may appear anywhere in the data field of the record.

Example: `MIN/MAX TEMPERATURE: 60.  84.`

This input models a day in which the low temperature is 60°F and the high temperature is 84°F.

Tips: Do not input separate hourly temperatures if minimum and maximum daily temperatures are supplied. If the user does input both sets of temperatures, MOBILE6 will use the set that appears last in the Scenario (or Run) section of the command input file. If the times of day at which the minimum and maximum temperatures occur are substantially different from the MOBILE6 defaults (6 a.m. and 3 p.m.), then the user is advised to enter the hourly temperatures.

MOBILE6 will not correct for effects of fuel volatility (RVP) at very cold ambient temperatures.

2.8.6.4 Ambient Temperature for Each Hour of the Day

Name: HOURLY TEMPERATURES

Status: Required, unless MIN/MAX TEMPERATURE command is selected.

Section: Run or Scenario.

Description: This command allows users to enter temperatures for each hour of the day.

Default: There is no MOBILE6 default. If this command is not given, then the MIN/MAX TEMPERATURE command must be used so that MOBILE6 can calculate hourly temperatures based on a typical pattern of temperatures during the day.

Explanation: This command directs MOBILE6 to use the 24 values entered by the user to calculate the minimum/maximum daily temperatures. Those temperatures will then be used to calculate the hourly diurnal emissions, as described in Section 2.8.6.3. MOBILE6 will also perform hour-specific calculations with the specified

hourly values rather than with values calculated from a default temperature pattern for all of the non-diurnal emissions described in the previous section.

This command requires the command name followed by the 24 hourly temperatures in the data field. The temperatures must be listed beginning with 6 a.m. and continuing through 5 a.m. the next day (see Table 4, Appendix B). The temperatures for each hour must be separated by a blank space. The first 12 values must be on the same line as the command; the remaining twelve must be on the next line.

Example:
```
HOURLY TEMPERATURES: 75.0 75.0 75.0 75.0 75.0 75.0 75.0 75.0 75.0 75.0 75.0 75.0
75.0 75.0 75.0 75.0 75.0 75.0 75.0 75.0 75.0 75.0 75.0 75.0
```

This example would model a day in which the temperature remained 75°F for every hour between 6 a.m. one day and 5 a.m. the next day.

Tips: Do not input daily minimum and maximum temperatures if hourly temperatures are supplied. If both sets of temperatures are supplied, MOBILE6 will use the set that appears last in the command input file. The value input for a given time (e.g., 8 a.m.) is used by MOBILE6 for the hour beginning at that time.

2.8.6.5 Altitude

Name: ALTITUDE

Status: Optional.

Section: Scenario.

Description: This command indicates whether MOBILE6 will calculate emissions for a high- or a low-altitude region.

Default: Low altitude.

Explanation: MOBILE6 can calculate separate emission rates for high- and low-altitude regions. Low-altitude emission factors are based on conditions representative of approximately 500 feet above mean sea level. High-altitude factors are based on conditions representative of approximately 5,500 feet above mean sea level. When high-altitude region emission factors are requested, MOBILE6 also includes vehicles that were built to meet specific high-altitude emission standards.

To select high altitude, enter a value of “2” anywhere in the data field. To select low altitude, the user can either enter a value of “1” or simply omit this command. No other information is required except the command name.

Example:
```
ALTITUDE              : 2
```

This example models a high-altitude area.

2.8.6.6 Absolute Humidity

Name: ABSOLUTE HUMIDITY

Status: Optional.

Section: Run or Scenario.

Description: This command is used to specify a daily average for humidity.

Default: 75 grains per pound absolute or specific humidity.

Explanation: The humidity value affects NOx emissions. MOBILE6 also converts the specified absolute humidity to relative humidity, which in turn is used to calculate a heat index.

The heat index affects HC and CO emissions of the portion of the vehicle fleet that MOBILE6 determines is using air conditioning.

This command requires one value in the data portion of the record that represents the absolute humidity in grains of water per pound of dry air. The value must be between 20.0 and 528.0.

Example:
```
ABSOLUTE HUMIDITY   : 115.0
```

This example models a day in which the absolute humidity is 115 grains per pound.

Warning: MOBILE6 does not check that the absolute humidity value and the temperature range yield a relative humidity which does not exceed 100 percent.

2.8.6.7 Environmental Effects on Air Conditioning

The information provided by the commands in this section is used by MOBILE6 to model the extent of vehicle air-conditioning usage.

2.8.6.7.a
Name: CLOUD COVER

Status: Optional.

Section: Run or Scenario.

Description: This command allows users to specify an average percent cloud cover for a given day. This feature affects only the air conditioning correction.

Default: Zero percent.

Explanation: The CLOUD COVER command requires one value in the data portion of the record that signifies the average fraction of cloud coverage. This value must be between 0.0 and 1.0, inclusive.

Example:
```
CLOUD COVER          : 0.90
```

This example models a day in which the cloud cover is 90 percent.

2.8.6.7.b
Name: PEAK SUN

Status: Optional.

Section: Run or Scenario.

Description: This command allows users to specify the midday hours when the sun is at peak intensity. This feature only affects the air-conditioning correction.

Default: 10 a.m. for start of peak sun and 4 p.m. for end of peak sun.

Explanation: The PEAK SUN command requires two integers in the data portion of the record. Peak sun is applied as a range by virtue of the fact that the intensity of solar load is roughly within 5 percent of maximum solar load (noon) for several hours throughout mid-day, depending on the season. The default times span the range of this condition for early summer conditions; in considering changes to the default values, the user should evaluate data on direct solar radiation, commonly available through NOAA's Surface Radiation (SURFRAD) monitoring system

(http://www.srrb.noaa.gov/surfrad/surfpage.htm). It is important to note that air conditioning adjustments are also applied at times outside the peak sun range, but at a lesser magnitude per the reduced solar load.

The first peak sun integer represents the beginning of peak sun, and the second integer represents the end of peak sun. The first value (beginning of peak sun) must be no earlier than 9 a.m. The second value (end of peak sun) must be no later than 5 p.m. The integers must be separated by one or more blank spaces.

Example: `PEAK SUN : 10 4`

This example would model a day in which the peak sun occurs between 10 a.m. and 4 p.m. These are also the default hours.

2.8.6.7.c
Name: SUNRISE/SUNSET

Status: Optional.

Section: Run or Scenario.

Description: This command allows users to specify the time of sunrise and sunset. This feature affects only the air-conditioning correction.

Default: 6 a.m. for sunrise and 9 p.m. for sunset.

Explanation: The SUNRISE/SUNSET command requires two integers in the data portion of the record. The first one represents the hour of sunrise, and the second represents the hour of sunset. The first value (sunrise) must be between 5 a.m. and 9 a.m. The second value (sunset) must be between 5 p.m. and 9 p.m. The integers must be separated by one or more blank spaces.

Example: `SUNRISE/SUNSET : 6 9`

This example would model a day in which the sunrise occurs at 6 a.m. and the sunset occurs at 9 p.m. These are also the default hours; thus, alternatively, the modeler need enter only the command name to achieve the same modeling result.

Tip: Although most of the units for time of day (in MOBILE6) count from 6 a.m., both of the preceding commands (SUNRISE/SUNSET and PEAK SUN) use the traditional clock time (counting from midnight).

2.8.7 Vehicle Fleet Characteristic Commands

Fleet characteristic commands allow users to profile a given fleet by vehicle age, power source, and activity level. Several of these commands involve vehicle age. In MOBILE6, vehicle age always involves a 25-year range, with vehicles 25 years and older grouped together. The range may be expressed as 0 to 24 years (age = calendar year - model year); alternatively its values may be considered to range from 1 to 25 years (age = calendar year - model year +1). Calendar year is the year being modeled and may vary by MOBILE6 scenario.

2.8.7.1 Distribution of Vehicle Registrations

Name: REG DIST

Status: Optional.

Section: Run.

Description: This command allows users to supply vehicle registration distributions by vehicle age for any of the 16 composite (combined gas and diesel) vehicle types.

Default: MOBILE6 applies a registration distribution for each of the 16 composite vehicle types based on U.S. vehicle fleet data. Technical report, M6.FLT.007, contains these default age distributions.

Explanation: MOBILE6 users may specify vehicle registration data for each of 25 vehicle ages for one or more of the 16 composite vehicle types listed in Table 1, Appendix B.

This command requires an external data file. The command line in the command input file contains the command and external data file names. The format for the external data file is as follows:

The first line contains the command name.
The next line contains the composite vehicle type followed by 25 age fractions, representing the fraction of vehicles of that age in that composite vehicle class in July. MOBILE6 will use these fractions directly if a July evaluation date is requested or will convert them to January if the user requests that evaluation date.
This line is repeated for any vehicle categories the user wishes to specify (override the MOBILE6 default).
The vehicle type is represented by an integer from 1 to 16. See Table 1, Appendix B for the number associated with each of the 16 composite vehicle types.
The vehicle age fractions are represented by decimals (0.000 through 1.000) for each of the 25 model years, starting with the youngest. The last

fraction represents vehicles aged 25 years and older in the fleet being modeled.

The values may appear in any row with as many characters as needed, as long as 25 values follow the integer value and each value is separated by at least one blank space. Comment lines may not appear within the lines containing the 25 values for each vehicle class. However, comments may occur between the data for each vehicle class. The data for the vehicle classes may occur in any order and not all vehicle classes must be entered. However, all 25 values of the distribution must be entered for any vehicle class.

The sum of the 25 values should equal 1.0. If they do not, MOBILE6 outputs a warning message.

Example:
```
REG DIST            : REGDATA.D
```

In this example, the external file named, "REGDATA.D", contains the user-supplied age distributions. Below is an example of an external data file for this command:

```
REG DIST
* LDV
 1 0.0530 0.0706 0.0706 0.0705 0.0703 0.0698
   0.0689 0.0676 0.0655 0.0627 0.0588 0.0539
   0.0458 0.0363 0.0288 0.0228 0.0181 0.0144
   0.0114 0.0090 0.0072 0.0057 0.0045 0.0036 0.0102
* LDT1
 2 0.0581 0.0774 0.0769 0.0760 0.0745 0.0723
   0.0693 0.0656 0.0610 0.0557 0.0498 0.0436
   0.0372 0.0309 0.0249 0.0195 0.0147 0.0107
   0.0085 0.0081 0.0078 0.0075 0.0072 0.0069 0.0359
```

The sample external data file starts with the REG DIST command name followed by a comment line (denoted by a '*' character). The next four lines contain the 25 registration-by-age fractions—arranged in three lines of six and one line of seven and following the integer '1'—for light-duty vehicles. The last four lines present similar information for the composite vehicle category LDT1.

2.8.7.2 Diesel Fractions

Name: DIESEL FRACTIONS

Status: Optional.

Section: Run or Scenario.

Description: This command permits users to supply locality-specific diesel fractions for 14 of the 16 composite vehicle categories by vehicle age.

Default: MOBILE6 assigns default diesel fractions for all model years. Please see the technical report, M6.FLT.007, for the specific gasoline/diesel splits for 1972 through 1996 model years.

1971 and earlier model years are assumed to have the same diesel fraction as the 1972 model year.
1997 and later model years are assumed to have the same diesel fraction as the 1996 model year.

Explanation: Diesel fractions allow MOBILE6 to perform separate calculations for gas and diesel subcategories, which have distinctly different emission rates. Urban/transit buses are assumed to be all diesel-fueled, and motorcycles are assumed to be all gasoline-fueled, so these two categories do not require a diesel fraction. That leaves 14 composite vehicle categories for which users can specify a diesel fraction.

The diesel fraction represents the percent of diesels in a composite vehicle category for any vehicle age. The model year that MOBILE6 applies to each value depends on the calendar year of evaluation. This means that the user must provide separate input for each calendar year to be modeled. MOBILE6 assumes that all non-diesel vehicle sales are gasoline-fueled vehicles.

If the user selects this command, diesel fractions must be provided by age of vehicle and for each of the 14 composite vehicle types. With 14 vehicle categories and 25 vehicle ages, the user needs to enter 350 separate diesel fractions. The user must provide separate input for each scenario to run multiple calendar years.

The format for this command is as follows:

The 350 diesel fractions immediately follow the command name within the MOBILE6 command input file. The values are entered in free column format, with one or more blank spaces separating each numerical value. The data must be ordered in terms of 14 groups of 25 values (representing vehicle ages) by composite vehicle type in the order presented in Table 2, Appendix B.

Within each vehicle class, MOBILE6 reads the 25 diesel fractions by age in order from the youngest to the oldest. The numbers may appear in as many rows as desired, with as many values in each row as desired, as long as the values appear in the proper sequence. No comments may appear between the rows containing the diesel fraction values. All values entered must be less than or equal 1 and greater than or equal 0.

Example: `DIESEL FRACTIONS :`

The command name would be followed by 350 decimals representing the 25 diesel fractions for each composite vehicle category. The file named, "DIESFRAC.DEF", contains a complete example.

Tip: The data may be included in the Run section if all scenarios have the same calendar year.

2.8.7.3 Annual Mileage Accumulation Rates

Name: MILE ACCUM RATE

Status: Optional.

Section: Run.

Description: This command allows users to supply the annual mileage accumulation rates by vehicle age for any or all of the 28 individual vehicle types.

Default: A default set of rates, based on U.S. fleet data, is described in technical report, M6FLT.007.

Explanation: The mileage accumulation rate represents the total annual travel accumulated per vehicle of a given age and individual vehicle category. The user does not need to enter mileages for all categories. MOBILE6 will apply default values for any vehicle type that the user does not specify.

The format for this command is as follows:

> The first line contains the command name.
> The next lines contain the vehicle type and mileage accumulation data. The vehicle type is represented by the number associated with each of the 28 individual vehicle types listed in Table 3, Appendix B. That value is followed by the mileage accumulations for each of the 25 ages, starting with the youngest. These values are input as miles divided by 100,000 (e.g., 12,000 miles is input as 0.12000).
> The above item is then repeated for each individual vehicle type for which the default distribution will not be used.

Example: `MILE ACCUM RATE : miledat.d`

This example directs MOBILE6 to look for an external file named, “miledat.d”, which contains the command name followed by mileage accumulation rates. A complete example is contained in the file, “MARDATA.DEF”.

2.8.7.4 Vehicle Miles Traveled (VMT) Fraction

Name: VMT FRACTIONS

NOTE: This command is cross-listed below under commands covering activity. Please see Section 2.8.8.1 for detailed information**.**

2.8.7.5 Natural Gas Vehicles (NGVs) Fraction

Name: NGV FRACTION

Status: Optional.

Section: Run.

Description: This command allows the user to indicate the percent of vehicles in the fleet certified to operate on (not retrofitted for) either compressed or liquefied natural gas.

Default: The fraction of NGV vehicles in the fleet is zero.

Explanation: This command allows the user to specify the percent of NGVs in each of the 28 individual vehicle classes beginning with the 1994 model year. If the user enters 100% NGV, MOBILE6 will report the basic NGV emission rate. Any other percentage will simulate a fleet that is part NGV, with gasoline and diesel vehicles comprising the remaining part of the fleet.

The NGV FRACTION command also affects evaporative emissions, which MOBILE6 assumes are zero for NGVs. Thus, if the user enters 5 percent for the NGV penetration of a particular gasoline vehicle class, MOBILE6 will assume that 5 percent of that class will have zero evaporative emissions.

The NGV FRACTION command requires an external file containing the NGV fractions for each vehicle type and model year from 1994 through 2050. The external file must contain the command name NGV FRACTION at the top of the file starting in column 1. The command name must be followed by 28 separate blocks of NGV fractions. Each block contains 57 values of NGV fleet penetration percentages. Each block must contain a value for all 57 calendar years. The values can range from 0.0000 to 100.0000. Each value must be separated from the next value by a blank space. Blank rows and comment rows can be added to the

external NGV data file prior to the data blocks or between data blocks, but not inside the individual data blocks.

Example: `NGV FRACTION : ngvfr.d`

This example directs MOBILE6 to look up NGV fractions in an external file called, “ngvfr.d”. A sample file will be distributed with MOBILE6.

Tips: Although the command name uses the word fraction, the input values must be percentages.

The percentage of NGVs in the fleet is very small. MOBILE6 provides this option for special cases in which it is necessary to model the effects of NGVs on a small percentage of the fleet, or to generate the basic NGV emission factors by entering 100 percent penetration.

2.8.7.6 Alternate Emission Factors for Natural Gas Vehicles (NGVs)

Name: NGV EF

Status: Optional.

Section: Run.

Description: This command allows the user to enter alternate NGV emission factors for each of the 28 vehicle types, for each of the three pollutants, and (where applicable) for running and start emissions. This label can only be entered if the corresponding NGV FRACTION command has also been entered to signal to the MOBILE6 model that the user wants to model the effects of NGV.

Default: None

Explanation: The NGV EF command allows the user to enter separate NGV emission factors for each of the 28 vehicle types, for each of the three pollutants, and (where applicable) for running and start emissions. It does NOT allow the user to specify an NGV emission factor for a particular model year. The NGV emission factor specified by the user for a particular vehicle class and pollutant will be applied to all 1994 model years that are specified to contain natural gas vehicles. Model year specification is accomplished through the use of the NGV FRACTION command.

The NGV basic emission factor data are entered in an attached data file (i.e., ngvef2.d). The external data file must contain the keyword “NGV EF” at the top of the data file starting in column 1. The user is not required to enter a value for

all of the 28 vehicle types. For instance, the user may enter NGV emission factors for only one vehicle type. The format conforms exactly with other MOBILE6 input types. This multi-line input consists of the following two parts:

The first line starting with column 1 contains the label name ("NGV EF").

All subsequent data records contain the following six pieces of information (all numbers):

The first number is the two-digit integer associated with the 28 vehicle types (IVs). The same vehicle class numbering system is used here as in other sections elsewhere in this model.

The second number is the one digit integer (I1) associated with the pollutant. A '1' is entered for HC, a '2' is entered for CO and a '3' is entered for NOx.

The third number on the NGV EF record is the one-digit integer associated with the emissions from the operating modes of running = 1 and start =2 (where applicable). For the eight light-duty vehicle types (IV = 1-5, 14,15, 28), start and running emissions are calculated separately; for the remaining 20 vehicle types, only composite values are calculated.

ISR	**Vehicle Operation**
1	"Running" (only where IV = 1-5, 14, 15, or 28), otherwise "composite."
2	"Start" where applicable (only where IV = 1-5, 14, 15, or 28).

The fourth number is a decimal number indicating the zero-mile emission level (ZML) of the normal emitters.

The fifth number is a decimal number indicating the increase in emissions (deterioration) of the normal emitters per 10,000 miles.

The sixth (and last) number is a decimal number indicating the average emission level of the high emitters. The model only uses this value for the eight light-duty vehicle types; however, the program expects to find all six numbers on each record. The program will crash if this number is missing (even if the number will not be used). For the 20 heavy-duty classes, the user must enter a zero for the sixth value.

Example:
```
NGV EF          : ngvef2.d
```

This example directs MOBILE6 to look up NGV emission factors in an external file called, “ngvef2.d”. A sample file will be distributed with MOBILE6.

Tips: This command was developed to allow users to modify the default NGV emission factors in the MOBILE6.0 model. This might be important because only limited data were available to develop the default NGV emission factors, and because rapidly changing NGV emission technology may make these default settings obsolete in the future.

It should also be noted that the default NGV emission factors for 2004 and later model years are actually higher than the corresponding emission factors for Tier2 gasoline vehicles. This is probably not a realistic assumption; thus, any NGV emission modeling of 2004 later calendar years should probably utilize this command to enter alternate and more accurate NGV emission factors.

2.8.8 Activity Commands

Activity commands allow users to allocate vehicle travel by time of day, day of week, type of road, speed, and other factors that affect emissions.

2.8.8.1 Fractions of Vehicle Miles Traveled (VMT)

Name: VMT FRACTIONS

Status: Optional.

Section: Run or Scenario.

Description: This command and the three that follow, along with the mileage accumulation rate option, allow users to supply vehicle travel data specific to the geographical location they wish to model. The VMT FRACTIONS command allows users to allocate VMT to specific vehicle types. The VMT fractions are used to weight together the emissions of the various vehicle types into the average emissions for groupings of vehicle classes, such as the “HDGV” and “All Veh” categories in the descriptive output.

The VMT FRACTIONS command should be used to properly model any situation in which the local mix of the 16 combined vehicle types differs from the national average.

Default: MOBILE6 calculates a default VMT mileage distribution from national average data and/or user-supplied information, specifically:

1. The calendar year of evaluation.

2. Default vehicle population data for the 16 (See Table 1, Appendix B) composite vehicle classes.
3. Default or user-supplied vehicle registration by age distribution data.
4. Default or user-supplied diesel fractions.
5. Default or user-supplied mileage accumulation data.

The default data for items 2 through 5 are described in technical report, M6.FLT.007. Note that MOBILE6 users are not allowed to change data item 2 as such; this command is provided instead. Note also that the total vehicle population, per se, is not significant in MOBILE6 because all emission results are expressed on a per-vehicle-mile basis. Therefore, only the fraction of vehicles of each age and class actually affects the results.

Explanation: The VMT mix specifies the fraction of total highway VMT that is accumulated by each of the 16 composite vehicle types.

Each VMT mix supplied as input must consist of a set of 16 fractional values, representing the fraction of total highway VMT accumulated by each of 16 combined vehicle types. All values must be between 0 and 1, and the 16 values must add up to 1.0. MOBILE6 produces an error message and does not execute the run if these constraints are not met.

This command requires a free column format consisting of 16 fractions (values from 0.000 to 1.000) with one or more spaces between fractions. The 16 values represent the distribution of all VMT by each of the 16 vehicle classes.

The order in which the numbers are presented is critical. The values must be entered in the order presented in Table 1, Appendix B.

This command must appear in the scenario section if different VMT mixes are to be applied to each scenario, but can appear in the Run section if the same VMT mix is to be applied to all scenarios.

Example:
```
VMT FRACTIONS      :
0.354 0.089 0.297 0.092 0.041 0.040 0.004 0.003
0.002 0.008 0.010 0.012 0.040 0.002 0.001 0.005
```

This example shows the command name plus two lines of data providing VMT fractions for the 16 vehicle categories. Another example is contained in the file called, “VMTMIX.DEF”.

2.8.8.2 VMT By Facility, Hour and Speed

2.8.8.2.a
Name: VMT BY FACILITY

Status: Optional.

Section: Run or Scenario.

Description: This command allows users to allocate VMT to various roadway or facility types by vehicle class.

Default: MOBILE6 uses national estimates of the distribution of VMT by facility type. The default values are the same for every vehicle type. The MOBILE6 technical report, M6.SPD.003, provides an explanation of the methodology used to generate these default values.

Explanation: The VMT BY FACILITY command allows users to enter VMT distributions for each of the 28 vehicle classes across four roadway types for each of the 24 hours of the day. These data must be entered in an external data file, which contains the VMT BY FACILITY command name in the first column of the first row. Following the command name, the user must enter the vehicle class number (ranges from 1 to 28) and the 96 VMT fractions representing the fraction of travel on each roadway type at each hour of the day for that vehicle class. The user is permitted to enter VMT fractions (in blocks of 96 VMT fractions) for any individual vehicle class, or for any number of vehicle classes up to 28 classes. A vehicle class number must precede the block of VMT fractions. If the user chooses to enter VMT fractions for less than all of the 28 vehicle classes, the program will insert default VMT fractions for the vehicle classes unspecified by the user.

For a given vehicle class, the VMT fractions must be entered as 24 values for each successive hour of the day starting with 6 a.m. (see Table 4, Appendix B). There must be four sets of 24 values corresponding to the four facility types, and the four sets must be entered in the following order: freeway, arterial, local, and ramp.

Within the external file, the input may appear in free column format, but at least one space must separate each numerical value. The distributions for each hour must add up to 1. If they do not, MOBILE6 will automatically normalize them.

Example:
```
VMT BY FACILITY    : FVMT.def
```

This example directs MOBILE6 to look up an external file called, “FVMT.def”, which contains the VMT distributions by facility. A sample file by this name will be distributed with MOBILE6.

Tips: The MOBILE6 default for this input is the same for every vehicle type. For example, in default runs, heavy-duty trucks have the same VMT distribution by roadway as passenger cars. If VMT by roadway distribution data is available by vehicle class, this command allows the user to supply the appropriate VMT fractions.

Also, the name used for this command and the two that follow could lead to a misinterpretation of their function. This command requires the user to provide fractional values for the four roadway types at each of the 24 hours of the day for a given vehicle class. Because the total VMT within each hour varies across the day, the input fractions will not add up to the fraction of daily VMT on each roadway type.

The data in this command and the VMT BY HOUR command can be multiplied (outside of MOBILE6) to obtain the distribution of VMT during the 24 hours of the day and for each facility type.

2.8.8.2.b

Name: VMT BY HOUR

Status: Optional.

Section: Run or Scenario.

Description: This command allows users to allocate the fraction of VMT that occurs at each hour of the day.

Default: MOBILE6 uses national data for the default distribution of VMT by hour, as described in technical report, M6.SPD.003.

Explanation: This command permits the user to allocate total VMT among the 24 hours of each day. The values for the command are independent of facility type, that is, the VMT fraction covers all facility types.

The format for this command calls for an external file, which contains the VMT BY HOUR command name as its first entry, starting in the first column of the first row. This must be followed by the 24 VMT fractions, one value for each of the 24 hours of the day. At least one space must separate each numerical value.

The 24 values must add up to 1. If they do not, MOBILE6 will automatically normalize them.

Example: `VMT BY HOUR : HVMT.def`

Where the external file named, “HVMT.def”, has as its first entry: VMT BY HOUR. A sample file by this name will be distributed with MOBILE6.

2.8.8.2.c
Name: SPEED VMT

Status: Optional.

Section: Run or Scenario.

Description: This command allows users to allocate VMT by average speed on freeways and arterial roads.

Default: MOBILE6 uses national fleet data for the default distribution of VMT by average speed for freeways and arterial roadways, as described in technical report, M6.SPD.003.

Explanation: The SPEED VMT command name permits the user to enter the VMT distribution over preselected average speed ranges. MOBILE6 calculates these distributions for each of the 24 hours of the day and for freeways and arterials (producing 48 separate distributions, each containing 14 fractions). The data in this array are not sufficient to estimate either hourly VMT distribution or the VMT distributions by facility type.

This command requires an external data file that must contain the following information in a multiline record:

The first line contains the command name (“SPEED VMT”).
Each of the next 48 lines contain:

-- First, an integer for facility type, where “1”= freeway and “2”= arterial.
-- Second, an integer for hour of the day (1 through 24), with 6 a.m. = “1”.
-- The next 14 numbers represent VMT fractions in each of the 14 average speed categories.

The 14 average speed fractions (0.0000 through 1.0000) must add up to 1. The first of the 14 preset speeds is “idle,” and the other 13 average speeds range from

5 mph to 65 mph in 5 mph increments. Table 5 in Appendix B describes in more detail the average speed ranges represented by each speed bin.

This pattern must be repeated for each combination of roadway type (arterial and freeway) and time of day to create the 48 lines. Distributions must be entered for all facility types and hours.

Example: `SPEED VMT : SVMT.def`

This example references data stored in the external file named, "SVMT.def", which has the SPEED VMT command name as its first entry, followed by the 48 VMT distributions (one for each combination of the two facility cycles and each of the 24 hours of the day). The file will be distributed with MOBILE6.

2.8.8.2.d
Name: AVERAGE SPEED

Status: Optional.

Section: Scenario.

Description: This command allows users to designate a single average speed to use for all freeways and/or arterial/collectors for the entire day.

Default: MOBILE6 uses national fleet data for the default distribution of VMT by average speed for freeways and arterial roadways, as described in technical report, M6.SPD.003, or a user supplied VMT by average speed distribution provided using the SPEED VMT command.

Explanation: The SPEED VMT command permits the user to replace the default values with a VMT distribution over fourteen average speed bins. However, in some modeling situations the user may wish to enter a single value instead of a distribution. For example, the user may need to model roadway links separately, or may not have the VMT distribution information. In these cases, MOBILE6 can be used to calculate results for a single specified average speed. The AVERAGE SPEED command automatically replaces the SPEED VMT and VMT BY FACILITY data files with the appropriate average speed and facility type information for a single average speed. (All of the functions of the AVERAGE SPEED command can be duplicated using the SPEED VMT and VMT BY FACILITY commands, if desired. These calculations are discussed in Chapter 5.)

The AVERAGE SPEED command includes up to six data elements. The first two of the data elements are required. The elements must be entered on the command line. The data elements are:

- Average speed
- Roadway scenario
- Distribution of VMT by facility (4 values)

Each element is described in detail below.

Average speed value (2.5 to 65 miles per hour).

As with all average speed inputs to MOBILE6, the allowed user supplied average speed value may range from 2.5 through 65 miles per hour. Any integer or decimal value in that range may be used.

Indication of the roadway scenario the user wishes to model (choose one):

--	Non-Ramp	All VMT occurs on freeways, not including freeway ramps,
--	Freeway	All VMT occurs on freeways, including freeway ramps,
--	Arterial	All VMT occurs on arterial/collector roadways, or
--	Area Wide	VMT occurs on all roadway types as determined by the VMT BY FACILITY command or the using national average defaults.

The roadway scenario indicates the type of driving that the user intends for the average speed input to model. (Note: the average speed used for local roadways and freeway ramps cannot be changed by the user.)

Non-Ramp

The "Non-Ramp" roadway scenario assigns all VMT to the freeway roadway type, with the VMT automatically distributed among two average speed bins (see Chapter 5) which average to the single average speed indicated by the user. No freeway ramp driving is included in the estimate. The VMT from freeway ramps and all the other roadway types is set to zero for all hours of the day.

Freeway

The "Freeway" roadway scenario assigns all VMT to either the freeway or the freeway ramp roadway types. Freeway ramps have a constant speed of 34.6 mph, which cannot be changed by the user. A single average speed for the non-ramp freeway VMT is calculated using the fixed freeway ramp average speed and the freeway ramp VMT fraction such that the combined average speed matches the average speed value entered by the user. All of

the non-ramp freeway VMT is then automatically distributed among two average speed bins which average to the calculated average non-ramp freeway speed. If the user does not specify the distribution of VMT by facility, the national average fraction of freeway ramp activity (8% freeway ramp and 92% non-ramp freeway) is used.

Since the freeway ramp speed is fixed, depending on the fraction of VMT for freeway ramps, MOBILE6 may not be able to model the average speed indicated by the user. In these cases a calculated maximum speed or a calculated minimum speed is substituted for the user supplied average speed and a warning, indicating the actual average speed used, is written to the descriptive output.

Arterial

The "Arterial" roadway scenario assigns all VMT to the arterial/collector roadway type with a single average speed as indicated by the user. The VMT from the other roadway types is set to zero for all hours of the day.

Area Wide

When the user indicated the "Area Wide" roadway scenario, MOBILE6 selects a single average speed for the freeway roadway type and a single average speed for the arterial/collector roadway type such that the combined average speed for all roadway types (including local roadways and freeway ramps) will match the average speed value entered by the user. If the user does not specify the distribution of VMT by facility (described below), the national default distribution (34.2% freeway, 49.8% arterial/collector, 13% local, 3% freeway ramp) is used. This same distribution of VMT by facility is used for all hours of the day for all vehicle types.

Since the freeway ramp and local roadway speeds are fixed, MOBILE6 may not be able to model the average speed indicated by the user if the average speed desired is too high or too low. In these cases a calculated maximum speed or a calculated minimum speed is substituted for the user supplied average speed and a warning, indicating the actual average speed used, is written to the descriptive output.

Distribution of VMT by facility to be used (optional). Four values:

-- Fraction of VMT which occurs on freeways (non-ramp),
-- Fraction of VMT which occurs on arterial/collector roadways,
-- Fraction of VMT which occurs on local roadways, and

-- Fraction of VMT which occurs on freeway ramps.

The effect of entering an area wide average speed or an average speed on freeways, including ramps, will depend on the distribution of VMT by facility (roadway type). If the user does not specify the distribution of VMT by facility, the national average distribution is used to calculate the appropriate VMT by facility:

34.2% (freeway)
49.8% (arterial/collector)
13.0% (local)
3.0% (freeway ramp)

The user may override these values by entering four new values in the order indicated above. The sum of the four values must equal 1.0 or 100(%). All four values must be entered. The entry of any distribution of VMT by facility values, either using the VMT BY FACILITY command or as part of the AVERAGE SPEED command, has no effect when the user selects either a "freeway" or an "arterial" roadway scenario, since in these cases, all VMT is assigned to either the freeway roadway type or the arterial/collector roadway type, respectively.

Be aware that using the AVERAGE SPEED command will override the default and user supplied distribution of VMT by facility values used to calculate the results. The same distribution of VMT by facility values is used for all hours of the day for all vehicle classes. Similarly, the same average speed is used for every hour of the day. Since other factors, such as temperature, vary across the day, the composite results shown in the descriptive output is the VMT weighted daily average emission rate at that average speed.

Example: `AVERAGE SPEED : 25.3 Arterial`

This example sets the average speed for all arterial/collector roadways at all hours of the day to 25.3 miles per hour and assigns 100% of VMT to the arterial/collector roadway type. This command will override the use of the SPEED VMT and VMT BY FACILITY commands.

Example: `AVERAGE SPEED : 48.3 freeway 92.0 0.0 0.0 8.0`

This example sets the combined average speed of freeways and freeway ramps to 48.3 mph. The four values following the indication of roadway scenario are the distribution of VMT by facility to be used. They show 92% of VMT on freeways and 8% VMT on freeway ramps (the default). (Freeway ramps have a fixed speed

of 34.6 mph in MOBILE6 so the non-ramp freeway average speed is adjusted accordingly, to 50.0 mph.)

Tip: Since the effects of speed on emissions is not linear, using a single average speed will not produce the same emission result as the weighted results of a number of separate MOBILE6 runs with different average speeds. If the composite emissions of multiple roadways with different speeds are to be calculated, a MOBILE6 run using a distribution of average speeds should be used. However, it is appropriate to use the AVERAGE SPEED command to generate a single average speed result to represent similar roadways with similar average speeds (i.e., a lookup table).

Note: The AVERAGE SPEED command does not bypass the MOBILE6 average speed bins. Instead, the model calculates an appropriate distribution of average speeds across two average speed bins to match the user-specified average speed. That is, this command simply automates the methodology described in Chapter 5.

2.8.8.3 Starts Per Day

Name: STARTS PER DAY

Status: Optional.

Section: Run.

Description: This command allows users to specify the average number of engine starts (trips) per vehicle per day for specific vehicle classes for weekend days and/or weekdays.

Default: MOBILE6 assigns each of the 28 individual vehicle classes at each of 25 ages a separate default for number of engine starts per day. The defaults differ for weekdays and weekends. Light duty passenger vehicles use 7.28 starts per day for weekdays and 5.41 starts per day for weekend days. Light trucks use 8.06 starts per day for weekdays and 5.68 starts per day for weekend days. Motorcycles use 1.35 starts per day for both weekend and weekdays. Heavy duty gasoline vehicles and buses use 6.88 starts per day for both weekend and weekdays. Heavy duty diesel vehicles and buses use 6.65 starts per day for both weekend and weekdays. The same default value is used for vehicles of all ages within a vehicle class. Please see the technical report, M6.FLT.003 for more details.

Explanation: The number of starts per day affects engine exhaust start emission estimates for light duty gasoline and diesel passenger cars and trucks and motorcycles. It will also affect the evaporative hot soak losses on all gasoline fueled vehicles, including heavy duty vehicles and buses, which occur at trip ends. The number of trips per day and trip ends per day is calculated from the number of starts per day.

Emission estimates for heavy duty diesel fueled vehicles and buses are not affected by the number of starts per day in MOBILE6. We recommend that users not include engine starts per day values for heavy duty diesel vehicles and busses in their external data files. The following table indicates the vehicle classes affected by the number of engine starts per day and the appropriate vehicle class number. Only these vehicle classes are affected by use of the STARTS PER DAY command in MOBILE6.

Vehicle Classes Affected By the STARTS PER DAY Command

Number	Abbreviation	Description
1	LDGV	Light-Duty Gasoline Vehicles (Passenger Cars)
2	LDGT1	Light-Duty Gasoline Trucks 1 (0-6,000 lbs. GVWR, 0-3750 lbs. LVW)
3	LDGT2	Light-Duty Gasoline Trucks 2 (0-6,000 lbs. GVWR, 3751-5750 lbs. LVW)
4	LDGT3	Light-Duty Gasoline Trucks 3 (6,001-8,500 lbs. GVWR, 0-5750 lbs. ALVW)
5	LDGT4	Light-Duty Gasoline Trucks 4 (6,001-8,500 lbs. GVWR, 5751 lbs. and greater ALVW)
6	HDGV2B	Class 2b Heavy-Duty Gasoline Vehicles (8501-10,000 lbs. GVWR)
7	HDGV3	Class 3 Heavy-Duty Gasoline Vehicles (10,001-14,000 lbs. GVWR)
8	HDGV4	Class 4 Heavy-Duty Gasoline Vehicles (14,001-16,000 lbs. GVWR)
9	HDGV5	Class 5 Heavy-Duty Gasoline Vehicles (16,001-19,500 lbs. GVWR)
10	HDGV6	Class 6 Heavy-Duty Gasoline Vehicles (19,501-26,000 lbs. GVWR)
11	HDGV7	Class 7 Heavy-Duty Gasoline Vehicles (26,001-33,000 lbs. GVWR)
12	HDGV8A	Class 8a Heavy-Duty Gasoline Vehicles (33,001-60,000 lbs. GVWR)
13	HDGV8B	Class 8b Heavy-Duty Gasoline Vehicles (>60,000 lbs. GVWR)
14	LDDV	Light-Duty Diesel Vehicles (Passenger Cars)
15	LDDT12	Light-Duty Diesel Trucks 1 and 2 (0-6,000 lbs. GVWR)
24	MC	Motorcycles (Gasoline)
25	HDGB	Gasoline Buses (School, Transit and Urban)
28	LDDT34	Light-Duty Diesel Trucks 3 and 4 (6,001-8,500 lbs. GVWR)

The user may replace values for as few or as many of these vehicle classes as needed. An external file that includes new engine starts per day values for all of the affected vehicle classes for a given day type will require 450 values (25 ages times 18 vehicle classes), meaning that 900 values are needed to replace all of the affected default values for both weekend and weekdays.

The values for this command must be entered in an external data file. The first entry in the external file must be the command name, “STARTS PER DAY,” starting in the first column of the first row of the file. This entry is followed by an indication of whether the user supplied values are applied to weekend or weekdays, the vehicle class number and a set of 25 starts per day values, one for each vehicle age. A single user supplied external data file may contain both weekend and weekday entries.

The order in which the numbers appear is critical. The first value indicates whether the engine starts per day values apply to weekday (1) or weekend (2)

days. The next value indicates the vehicle class. These are the same values indicated in the above table and in Table 3, Appendix B. The next 25 values are the average number of engine starts per day by vehicle age, beginning with age 0 ending with age 24. Because each value is an average, it may be other than a whole number and may be less than 1. No value for the number of engine starts per day may be less than zero or greater than 100. This set of values may be followed by another set of values for another day type or vehicle class. The vehicle classes and day types do not need to be entered in any particular order. However, if the user inadvertently enters engine starts per day for the same vehicle class and day type twice, only the second entry will be used, without a warning to the user.

As long as the user enters the values in the required order, and each value is separated by a delimiter character such as a blank space, any format may be used. For example, the user may enter all 27 values (day type, vehicle class and 25 age values) on one line, divide them into two lines of 14 and 13 values, and so on.

User entry of values for starts per day is invoked using the STARTS PER DAY command in the input file, including the name (and directory path) for the data file containing the starts per day values.

Example: `STARTS PER DAY : STARTSPD.D`

Where the user supplies an external data file named, "STARTSPD.D". An example external data file for the STARTS PER DAY command might be:

```
STARTS PER DAY
 1  1  10.3 9.8 9.3 8.9 8.4 8.0 7.6 7.2 6.9 6.5
        6.2 5.9 5.6 5.3 5.1 4.8 4.6 4.4 4.2 3.9
        3.8 3.6 3.4 3.2 3.1
 1  2  10.3 9.8 9.3 8.9 8.4 8.0 7.6 7.2 6.9 6.5
        6.2 5.9 5.6 5.3 5.1 4.8 4.6 4.4 4.2 3.9
        3.8 3.6 3.4 3.2 3.1
```

In this example, the number of engine starts per day for weekdays (1) for the gasoline passenger car vehicle class (1, LDGV) and the gasoline light-duty trucks less than 6,001 lbs. GVWR and less than 3,751 lbs. LVW (2, LDGT1) is set. The 25 age values range from 10.3 engine starts per day for vehicles of age 0 to 3.1 engine starts per day for vehicles of age 24. The default engine starts per day values will be used for all other vehicle classes and for LDGV for weekend days. The values are presented in three lines for each vehicle class/day type.

Tip: It is generally best to enter values with logical groupings and spacings that, in this case, for example, would easily distinguish one vehicle class from another. If Saturday and Sunday are different enough to be treated separately, two separate runs with their own weekend day values could be used.

2.8.8.4 Distribution of Vehicle Starts During the Day

Name: START DIST

Status: Optional.

Section: Run.

Description: This command allows users to allocate engine starts by hour of the day.

Default: Default values are explained in technical report, M6.FLT.003.

Explanation: The START DIST command allows users to change the default values for the hourly distribution of engine starts (trips) across the day. Users must supply 48 values to replace the MOBILE6 defaults. Each value represents the average fraction of all engine starts that occur in each hour of a 24 hour day, for both weekdays and weekends. All values must be less than or equal to 1 and greater than or equal to zero. The sum of all of the 24 values for a day must equal 1. If they do not, MOBILE6 will normalize the values to 1 without issuing a warning.

The values for this command must be entered in an external data file. The first entry in the external file must be the command name, START DIST, placed in the first column of the first row of the file. This entry is followed by the 48 values described above.

The order in which the 48 values appear is critical. The first 24 values must be the temporal distribution for a weekday. The second 24 values represent the weekend. The data for the 24-hour periods must be entered in the order presented in Table 4, Appendix B.

As long as the user enters the values in the required order and separates the values with a delimiter character such as a blank space, any format may be used. For example, the user may enter all 48 values on one line, divide them into two lines of 24, and so on.

Example: START DIST : SDIST.D

Where the external data file named, “SDIST.D”, contains the following records:

```
START DIST
0.020 0.055 0.060 0.047 0.052 0.067 0.081 0.073
0.080 0.090 0.084 0.077 0.060 0.014 0.014 0.014
0.014 0.014 0.014 0.014 0.014 0.014 0.014 0.014
0.010 0.019 0.031 0.065 0.069 0.080 0.102 0.073
0.089 0.074 0.080 0.071 0.061 0.016 0.016 0.016
0.016 0.016 0.016 0.016 0.016 0.016 0.016 0.016
```

In this example, the first 24 values (for a weekday) are contained in the first three lines, followed by the weekend values in the second three lines. This entry would direct MOBILE6 to allocate 2 percent of weekday starts to the time period between 6 a.m. and 6:59 a.m., and 1 percent of weekend starts to the same time period.

Tips: As with the other external data files, users may enter comment lines (i.e., lines beginning with an asterisk "*") between the Header line and the block of data. However, with this command, users should not enter comment line(s) within the numerical data.

2.8.8.5 Soak Distribution

Name: SOAK DISTRIBUTION

Status: Optional.

Section: Scenario.

Description: This command allows users to enter vehicle soak duration distributions that override MOBILE6 defaults. The soak time affects exhaust start and exhaust running emissions.

Default: Default information is provided in technical reports, M6.FLT.003, and M6.FLT.004.

Explanation: A vehicle is considered to be "soaking" if its engine is not running. Soak time is the length of time between when an engine is turned off and the next time it is started. MOBILE6 uses soak time data to determine, for each hour of the day, the percentage of vehicles that have been soaking for a given amount of time prior to an engine start. This, in turn, affects start emissions, which depend on the length of soak time. The same soak time distributions are applied to all vehicle classes and all vehicle ages.

The SOAK DISTRIBUTION command name requires the user to enter values for each of the 70 soak durations for each of the 24 hours of the day for week and

weekend days (3,360 values). The 70 soak duration values correspond to specific soak length intervals as defined in the table below. The 70 values for each hour must add up to 1. This information must be located in an external data file.

The external data file must first index the 24 hours and then the 70 soak times. That is, the first 24 values are the soak time distribution values for only the first soak time interval. The second set of 24 values are for the second soak time interval, and onward until all 70 sets of 24 soak time intervals have been included. The first of each set of 24 values is for the first hour (6 a.m. to 6:59 a.m.) through hour 24 (5 a.m. to 5:59 a.m.). The soak time intervals are:

Interval Number	Interval range (N=interval number)
1	(Greater than .01) to 1.0 minutes
2 to 30	(Greater than N-1) to N minutes
31 to 45	(Greater than 2N-32) to (2N-30) minutes
46 to 67	(Greater than 30N-1320) to (30N-1290) minutes
68	Greater than 720 minutes
69	(Greater than zero) to .01 minutes (Restarts)
70	Zero Minutes (Stalls, not used)

Once the weekday values have been entered, the weekend day values must be entered using the same format used for the weekday values.

The data values themselves are read from an external file in free column format. The fractions may occur in any column of the file, as long as each value is separated from other values by a space. For example, the 3,360 values could be entered on 140 lines (with 24 values on each line) or on 280 lines (with 12 values on each line).

Example: `SOAK DISTRIBUTION  : SOAKDST.D`

Where the external file, “SOAKDST.D”, has the command name as its first entry.

```
SOAK DISTRIBUTION
 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.57
 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0
 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0
 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0
 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0
 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0
 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.43 24*0.0 24*0.0
 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0,0 24*0.57
 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0
 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0
 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0
 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0
 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0
 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.0 24*0.43 24*0.0 24*0.0
```

In this example, the notation “24 * x” represents 24 values of x. The distribution of soak times is the same on the weekend as on weekdays, and it is the same for every hour of the day. In the example, 57 percent of the soak times are between 9 and 10 minutes long, and 43 percent are greater than 720 minutes (12 hours). Each of the 48 sets of 70 values add up to 1.

2.8.8.6 Hot Soak Activity

Name: HOT SOAK ACTIVITY

Status: Optional.

Section: Scenario.

Description: This command allows users to specify a hot soak duration distribution for each of 14 daily time periods.

Default: Please see technical reports, M6.FLT.003, and M6.FLT.004, for further information. Sample files containing default values will be distributed with MOBILE6.

HSACTDAY.D:	weekday rates
HSACTEND.D:	weekend rates

Explanation: Hot soak emissions occur when fuel vapors escape from a hot vehicle that has just been turned off. The emissions are highest immediately after the engine is shut down and decrease over time, reaching a baseline level in about an hour. Hot soak emissions are truncated if the engine is turned on again before the baseline has been reached (before an hour has elapsed). MOBILE6 assumes that hot soak durations range from 1 minute at minium to a maximum of 60 minutes.

The hot soak time distributions reflect the number of vehicles experiencing a hot soak of a given duration (1 to 60 minutes) at each hour of the day. MOBILE6 divides the day into 14 time periods: one for each hour between 6 a.m. and 7 p.m., plus one for the hours from 7 p.m. through 5 a.m. the next day. MOBILE6 computes hot soak emissions for each minute of each hour, and weights these emissions by the fraction of vehicles experiencing a hot soak at that time. If this command is used, 840 values must be entered representing the fraction of vehicles experiencing a hot soak of each duration (1 to 60 minutes) at each time period of the day (14).

This command requires an external data file. Format for the command is as follows:

The HOT SOAK ACTIVITY command name is followed by the name of the external file containing the user-supplied hot soak activity values. Each value is a fraction between 0 and 1, and the values must add up to one for each time period. The values must be arranged in columns of 60 fractions, with one column for each time period starting with 6 a.m. The rows represent the time periods from 1 to 60 minutes.

Example: `HOT SOAK ACTIVITY  : HSACT.D`

This example directs MOBILE6 to look for alternate hot soak activity data in an external file called “HSACT.D”. Within the file, the first line would be the command name. The second line would be 14 values representing the fraction of vehicles experiencing a 1-minute hot soak at each time period of the day. The second line would contain values for a 2-minute hot soak, and so on. Examples of properly formatted input can be found in the files:

HSACTDAY.D: Default MOBILE6 weekday rates.
HSACTEND.D: Default MOBILE6 weekend rates.

2.8.8.7 Diurnal Soak Activity

Name: DIURN SOAK ACTIVITY

Status: Optional.

Section: Scenario.

Description: This command allows users to specify a diurnal soak time distribution for each of 18 daily time periods.

Default: Please see technical report, M6.FLT.006.

Explanation: Diurnal emissions vary with the length of time a vehicle has been soaking (the length of time it has been parked). The diurnal ends with the start of a new trip. MOBILE6 assumes that diurnal soak times range from one hour at a minimum to a maximum of 72 hours.

Diurnal soak time distributions represent the distribution of the length of time that vehicles have been soaking during each of the 24 hours for which emissions are to be calculated. However, the seven hours from 11 PM through 6 AM are treated as having a common soak time distribution, reducing the number of required distributions that represent the day from 24 to 18. Since temperatures fall during the night, diurnal emissions will be calculated to be zero from 12 AM to 6 AM, regardless of the soak time distribution

For each hour of the day, MOBILE6 computes emissions separately for the 72 different soak distributions and weighs them by the fraction of vehicles experiencing a diurnal of that duration. If the user chooses this command, 1,296 values must be entered representing the fraction of vehicles experiencing a diurnal of each duration (72) at each time period of the day (18).

This command requires an external data file. Format for the command is as follows:

The DIURN SOAK ACTIVITY command name is followed by the name of an external data file containing the alternate diurnal activity values. The values must be arranged in columns, with one column for each time period starting with 6 a.m. Each column contains 72 rows. The values must fall between 0 and 1. Note that the sum of each hourly column does not need to add up to 1. The rows represent the 72 MOBILE6 diurnal soak durations.

Example: `DIURN SOAK ACTIVITY      : DSACT.D`

This example directs MOBILE6 to look for user-supplied diurnal distribution data in an external file called, “DSACT.D.” Within the file, the first line is the command name. The second line contains 18 values representing the fraction of vehicles experiencing the first diurnal soak duration at each time period of the day. The second line contains values for the second soak duration, and so on. Examples of properly formatted input can be found in the following file:

DSACT.D: MOBILE6 defaults

2.8.8.8 Weekday Trip Length Distribution

Name: WE DA TRI LEN DI

Status: Optional.

Section: Run or Scenario.

Description: This command allows users to specify the fraction of weekday VMT that occurs during trips of various durations at each hour of the day.

Default: Please see the example file below. These values are based on national data.

Explanation: The duration of a vehicle trip affects running loss evaporative emissions, which depend on the amount of time the vehicle has been running. This command is used to change the default values for the distributions of VMT by trip duration (in time) for weekdays. MOBILE6 uses these distributions to calculate running loss emissions. There is a separate distribution of VMT by trip duration for each hour of the day.

If the user chooses to use this command, percentages must be entered for six trip length ranges and 14 hourly groups, resulting in a total of 84 values. The trip length ranges are 10 minutes or less; 11 to 20 minutes; 21 to 30 minutes; 31 to 40 minutes; 41 to 50 minutes; 51 or more minutes. The percent of VMT in each of these six trip length ranges is required for each hour of the day from 6 a.m. to 7 p.m., plus an average distribution for the 11-hour block from 7 p.m. to 6 a.m.

This command requires fixed column format data entry. Data must be entered in a precise order and location in the external data file. The required format is as follows:

The first line consists of the command name.

The second line consists of the percent of VMT for the first hour (6 a.m. to 7 a.m.) for each of the six trip length ranges in order of increasing trip length. The six individual percentages vary from 0.00 through 100.0, inclusive, with their sum totaling 100.0.

The next twelve lines provide the corresponding information for hours #2 (7 a.m. to 8 a.m.) through #13 (6 p.m. to 7 p.m.).

The next (last) line provides the corresponding information for the 11-hour block of time from 7 p.m. to 6 a.m.

Each data line contains six blocks of numbers, in which the first character of each block is left blank and the remaining five characters are read as the value for that block. In Fortran code, this is represented as 6(1X,F5.2). Each value must contain a decimal, and each row must add up to 100.

Example: `WE DA TRI LEN DI : WEDATRIP.D`

Where data is supplied in an external file, "WEDATRIP.D", formatted as follows:

```
WE DA TRI LEN DI
 06.74 18.51 16.78 13.11 08.33 36.53
 06.74 18.51 16.78 13.11 08.33 36.53
 06.74 18.51 16.78 13.11 08.33 36.53
 06.74 18.51 16.78 13.11 08.33 36.53
 06.74 18.51 16.78 13.11 08.33 36.53
 06.74 18.51 16.78 13.11 08.33 36.53
 06.74 18.51 16.78 13.11 08.33 36.53
 06.74 18.51 16.78 13.11 08.33 36.53
 06.74 18.51 16.78 13.11 08.33 36.53
 06.74 18.51 16.78 13.11 08.33 36.53
 06.74 18.51 16.78 13.11 08.33 36.53
 06.74 18.51 16.78 13.11 08.33 36.53
 06.74 18.51 16.78 13.11 08.33 36.53
 06.74 18.51 16.78 13.11 08.33 36.53
```

This sample shows the default values used by MOBILE6 for the distributions of trip lengths for weekdays.

Tip: This command uses a highly specialized definition of "trip." For more information, please refer to the MOBILE6 document, "Trip Length Activity Factors for Running Loss and Exhaust Running Emissions" (document number M6.FLT.005). If the user plans to change the VMT by trip length, this specialized definition of trip length must be used to determine the VMT distributions.

2.8.8.9 Weekend Trip Length Distribution

Name: WE EN TRI LEN DI

Status: Optional.

Section: Run or Scenario.

Description: This command allows users to specify the fraction of weekend VMT that occurs during trips of various durations at each hour of the day.

Default: Please see the example file below. These values are based on national data.

Explanation: The duration of a vehicle trip affects running loss evaporative emissions, which depend on how long the vehicle has been running. This command is used to change the default values for the distributions of VMT by trip duration for weekends. MOBILE6 uses these distributions to calculate running loss emissions. There is a separate distribution of VMT by trip duration for each hour of the day.

If the user elects to use this command, percentages must be entered for six trip length ranges and 14 hourly groups, resulting in a total of 84 values. The trip length ranges are 10 minutes or less; 11-20 minutes; 21-30 minutes; 31-40 minutes; 41-50 minutes; and 51 or more minutes. The percent of VMT in each of these six ranges is required for each hour of the day from 6 a.m. to 7 p.m., plus an average distribution for the 11-hour block from 7 p.m. to 6 a.m.

This command requires fixed column format data entry. Data must be entered in a precise order and location in the external data file. The required format is as follows:

The first line consists of the command name.

The second line consists of the percent of VMT for the first hour (6 a.m. to 7 a.m.) for each of the six trip length groups in order of increasing trip length. The six individual percentages vary from 0.00 through 100.0, inclusive, with their sum totaling 100.0.

The next 12 lines provide the corresponding information for hours #2 (7 a.m. to 8 a.m.) through #13 (6 p.m. to 7 p.m.).

The next (last) line provides the corresponding information for the 11-hour block of time from 7 p.m. through 6 a.m.

Each data line contains six blocks of numbers, in which the first character of each block is left blank and the remaining five characters are read as the value for that block. In Fortran code, this is represented as 6(1X,F5.2). Each value must contain a decimal, and each row must add up to 100.

Example:
```
WE EN TRI LEN DI   : WEENTRIP.D
```

Where data is supplied in an external file, “WEENTRIP.D”, formatted as follows:

```
WE EN TRI LEN DI
 06.74 18.51 16.78 13.11 08.33 36.53
 06.74 18.51 16.78 13.11 08.33 36.53
 06.74 18.51 16.78 13.11 08.33 36.53
 06.74 18.51 16.78 13.11 08.33 36.53
 06.74 18.51 16.78 13.11 08.33 36.53
 06.74 18.51 16.78 13.11 08.33 36.53
 06.74 18.51 16.78 13.11 08.33 36.53
 06.74 18.51 16.78 13.11 08.33 36.53
 06.74 18.51 16.78 13.11 08.33 36.53
 06.74 18.51 16.78 13.11 08.33 36.53
 06.74 18.51 16.78 13.11 08.33 36.53
 06.74 18.51 16.78 13.11 08.33 36.53
 06.74 18.51 16.78 13.11 08.33 36.53
 06.74 18.51 16.78 13.11 08.33 36.53
```

This sample shows the default values used by MOBILE6 for the distributions of trip lengths for weekend days.

Tip: The MOBILE6 default case uses only weekday activity data. If the user wishes to use the weekend activity values, the "use weekend vehicle activity" (WE VEH US) command must be executed.

The WE EN TRI LEN DI command uses a highly specialized definition of "trip." For more information, please refer to the MOBILE6 document, "Trip Length Activity Factors for Running Loss and Exhaust Running Emissions" (document number M6.FLT.005). If the user plans to change the VMT by trip length, this specialized definition of trip length must be used to determine the VMT distributions.

2.8.8.10 Use Weekend Vehicle Activity

Name: WE VEH US

Status: Optional.

Section: Scenario.

Description: This command directs MOBILE6 to apply weekend activity information in calculating emissions that depend on vehicle usage rates.

Default: MOBILE6 applies weekday activity information to calculations.

Explanation: MOBILE6 activity values for vehicle usage affect engine start emissions (affected by starts per day distributions), hot soak evaporative emissions (affected by hot

soak duration distributions), and running loss evaporative emissions (affected by trip length distributions). This command directs MOBILE6 to use weekend-specific activity values.

The only requirement for this command is the command name. There is no data input required.

Example: `WE VEH US :`

2.8.9 State Programs

State program commands allow users to model the impact of state-specific emission control programs such as inspection and maintenance (I/M).

2.8.9.1 Effects of Fuel Program on Emissions

Name: FUEL PROGRAM

NOTE: This command is cross-listed below under commands covering fuels. Please see Section 2.8.10.1 for detailed information.

2.8.9.2 Effects of Stage II on Refueling Emissions

Name: STAGE II REFUELING

Status: Optional.

Section: Run.

Description: This command allows users to model the impact of a Stage II ("at-the-pump") vapor recovery system requirement on refueling emissions (also referred to as Stage II emissions) from gasoline-fueled vehicles.

Default: If the user does not use this command, then MOBILE6 does not calculate impact of a Stage II program.

Explanation: Stage II systems reduce HC emissions by reducing the amount of gasoline vapor that escapes to the atmosphere during refueling and fuel spillage. The amount of reduction depends on whether the vehicle has an onboard recovery system and the level of uncontrolled emissions. The uncontrolled emissions are calculated in MOBILE6 from inputs such as fuel RVP, fuel economy, and various fuel temperature parameters.

This command requires fixed column format data entry. The Fortran format is I2,1X,I1,2(1X,F3.0). The first line must contain the command name STAGE II REFUELING. The second line contains the following four items:

The first number supplies the last two digits of the calendar year in which the Stage II program began or will begin. The eligible calendar years are 1989 through 2050, inclusive. Therefore, this variable may be any two-digit integer except 51 through 88.

The second number is a one-digit integer for the number of phase-in years of the program. This value can range from 1 through 9. This value, in combination with the calendar year in which the Stage II program began, will determine the fraction of vehicle refueling affected by Stage II controls. The fraction is determined linearly, beginning at zero on the starting date and full effect on the final year of the phase in period.

The third number is a three-digit integer for the percent efficiency for the LDGVs and LDGTs in the program. This value can range from 0 through 100.

The fourth number is a three-digit integer for the percent efficiency for the HDGVs in the program. This value can range from 0 through 100.

Example:

```
STAGE II REFUELING :
89 4 80. 60.
```

This example would model a Stage II program that started in 1989, was phased in over four years, and was 80 percent efficient for LDGVs and LDGTs and 60 percent efficient for HDGVs.

Tips: MOBILE6 applies a 95 percent reduction in refueling emissions from uncontrolled levels from Onboard Refueling Vapor Recovery (ORVR) equipped vehicles. The effects of ORVR technology is phased in over several model years. For passenger cars, 40, 80, and 100 percent of 1998, 1999, and 2000 and newer model year cars respectively will have ORVR. For light duty trucks up to 6000 pounds gross vehicle weight, 40, 80, and 100 percent of 2001, 2002, and 2003 and newer model year trucks will have ORVR. For light duty trucks between 6001 and 8500 pounds gross vehicle weight, 40, 80, and 100 percent of 2004, 2005, and 2006 and newer model year trucks will have ORVR. Stage II programs will have no additional emission reduction effect on these vehicles.

2.8.9.3 Anti-Tampering Programs

Name: ANTI-TAMP PROG

Status: Optional.

Section: Run.

Description: This command allows users to model the impact of an anti-tampering program (ATP) and should be used only if the area being modeled has or expects to have such a program.

Default: MOBILE6 assumes there is no anti-tampering program present.

Explanation: Some parts of the United States have implemented ATPs to reduce the frequency and emissions impact of emission control system tampering, such as misfueling, removal, or disablement of catalytic converters. This command allows users to include the effects of such a program on calculated emission factors.

Selecting this command requires basic information about the anti-tampering program to be modeled. The required information includes the calendar year that the program began (start year), the earliest model year that is covered by the program, the latest model year covered by the program, on/off toggle values that determine if a particular vehicle class is included in the program, the frequency of inspection, the compliance rate for the anti-tampering program, and on/off toggle values that determine which vehicle components will be inspected.

This command requires fixed column format data entry. Any columns not mentioned must be left blank. The Fortran type format that must be observed is:

3(I2,1X),5I1,1X,8I1,1X,I1,1X,2I1,1X,F4.0,1X,8I1)

In the first line, the command name must start in column one. The second line contains the program parameters:

The first number is the last two digits of the calendar year in which the anti-tampering program began or will begin. The calendar year input can range from 1960 to 2050.

The second number is the earliest model year to be covered by the program. This input is the last two digits of the model year. The model year range can be from 1960 to 2050.

The third number is the last two digits of the final model year covered by the program. The model year range can be from 1960 to 2050.

Following these first three numbers, there are 14 individual vehicle ATP coverage toggle fields that contain either a value of 1 or 2. A value of 1 indicates that the particular vehicle type is NOT subject to an ATP inspection, and a 2 indicates that the particular vehicle type is subject to the inspection.

The first five ATP coverage toggle fields correspond to the light-duty gasoline vehicle classes. These five values for ATP vehicle coverage must be given in the following order:

LDGV, LDGT1, LDGT2, LDGT3, LDGT4.

The next eight vehicle ATP coverage toggle fields correspond to the eight heavy-duty gasoline vehicle classes. The order of these values is:

HDGV2B, HDGV3, HDGV4, HDGV5, HDGV6, HDGV7, HDGV8A, HDGV8B

The final vehicle ATP coverage toggle field corresponds to gasoline buses.

GAS BUS

The next entry must be the number ‘1’. Entering a value of “2" will cause the ATP benefits to be discontinued. EPA no longer supports this type of benefit discount.

The next data parameter is the ATP inspection frequency. A value must be either ‘1’ (annual frequency) or ‘2’ (biennial - every other year frequency).

The next data parameter is the program compliance rate. This value must be from 0 percent to 100 percent, inclusive.

The last eight data parameters are the toggles indicating which inspections the ATP will conduct. The value must be either 1 (no) or 2 (yes). The values correspond to component inspections in the following order.

Air pump system disablement.
Catalyst removal.
Fuel inlet restrictor disablement (requiring catalyst replacement).

Tailpipe lead deposit test (requiring catalyst replacement).
EGR disablement.

Evaporative system disablement.
PCV system disablement.
Missing gas cap.

Example:
```
ANTI-TAMP PROG    :
83 75 50 22222 22222222 2 11 096. 22222222
```

This example models an ATP that starts in 1983, covers 1975 through 2050 model years, inspects all 14 gasoline vehicle types, has an annual frequency, a compliance rate of 96.0 percent and does all of the anti-tampering inspection types.

Tips: The mere presence of an I/M program is expected to act as a deterrent to tampering. Therefore, if the "IM PROGRAM" command is present, MOBILE6 will alter the tampering rates even if there is no anti-tampering program.

All 1996 and newer model year vehicles are assumed to have negligible tampering effects. As a result, there is no tampering reduction benefit associated with the 1996 and newer vehicles.

2.8.9.4 Inspection/Maintenance (I/M) Programs

Many areas of the country have implemented inspection and maintenance (I/M) programs to further reduce mobile source air pollution. MOBILE6 has the capability of modeling the impact of up to seven different exhaust and evaporative emission I/M programs on calculated emission factors. By defining multiple I/M programs, the user can model different requirements on different types and ages of vehicles or different requirements in different calendar years.

MOBILE6 also allows users to enter a number of I/M program parameters to better model specific I/M program features. These parameters include:

Ability to model annual or biennial I/M programs.
Ability to model Idle, 2500/Idle, ASM, IM240, and onboard diagnostic (OBD) exhaust I/M programs.
Ability to model gas cap (GC), fill-pipe pressure test (FP), and OBD check evaporative I/M programs.
Ability to control model year coverage.
Ability to control vehicle class coverage (only gasoline-fueled vehicles can be modeled for I/M).
Ability to vary the failure rate of the exhaust I/M program for pre-1981 model year vehicles.
Ability to vary the compliance rate of the I/M program.
Ability to vary the waiver rate of the I/M program.
Ability to vary the cutpoints used in an IM240 program.
Ability to account for the effect of exempting old vehicles from program requirements.

Ability to account for the effect of exempting new vehicles from program requirements (referred to here as a “grace period”).
Ability to eliminate the effects of technician training on exhaust I/M performance.
Ability to assemble all of the I/M program parameters into a single external input file.

MOBILE6 provides 12 separate commands that allow users to specify I/M features. The commands are listed and described below. The list begins with the required I/M commands (these are required if the user wants to model any I/M program) and finishes with the less frequently used I/M commands.

List of I/M Commands

I/M PROGRAM	Required to model exhaust and evaporative I/M programs.
I/M MODEL YEARS	Required for exhaust and evaporative I/M programs.
I/M VEHICLES	Required for exhaust and evaporative I/M programs.
I/M STRINGENCY	Required for exhaust I/M programs. Do not use with evaporative I/M programs.
I/M COMPLIANCE	Required for exhaust I/M programs. Highly recommended for evaporative I/M programs.
I/M WAIVER RATES	Required for exhaust I/M programs. Highly recommended for evaporative I/M programs.
I/M CUTPOINTS	Required for IM240 programs. Do not use with other exhaust or evaporative I/M programs.
I/M EXEMPTION AGE	Optional for exhaust I/M programs. Highly recommended for evaporative I/M programs.
I/M GRACE PERIOD	Optional for exhaust I/M programs. Highly recommended for evaporative I/M programs.
NO I/M TTC CREDITS	Optional for exhaust I/M programs. Do not use with evaporative I/M programs.
I/M EFFECTIVENESS	Optional for exhaust I/M programs. Do not use with evaporative I/M programs.
I/M DESC FILE	Optional for both exhaust and evaporative I/M programs.

NOTE: For an exhaust I/M program, all program parameters are derived from that program's user-input parameters or from MOBILE6 default parameters. The program is not affected by user-input parameters for other I/M programs (exhaust or evaporative).

However, an evaporative I/M program that runs simultaneously and on the same model years as an exhaust program may be affected by the exhaust program. An evaporative program will use its own user-input parameters, but if those are not provided, the evaporative program will use the simultaneous exhaust program's user-input parameters; if those are not provided, the evaporative program will use MOBILE6 default parameters. To make sure that the parameters governing an evaporative I/M program do not change when other I/M program commands are modified, always specify the evaporative I/M parameters explicitly.

2.8.9.4.a

Name: I/M PROGRAM

Status: Optional (required if the user is modeling exhaust or evaporative I/M).

Section: Run.

Description: This command directs MOBILE6 to model an I/M program and defines some basic information about the program to be modeled.

Default: MOBILE6 assumes no I/M program is in place.

Explanation: If the user wishes to model an I/M program, this command must be executed. This is where the user defines basic information such as the type of I/M program in place, the calendar year that the I/M program began (start year), the final calendar year that the I/M program is to run, and the program inspection frequency.

The format required for this command is free column format.

The command name, I/M PROGRAM, must appear first.

The first data parameter is the I/M program number. This equals "1" to identify the first program the user is modeling, "2" to identify the second, and so on. The valid range of numbers for this input is from 1 to 7, and any series of values must be sequential (i.e., there must be a program 1 before there is a program 2).

The second and third data parameters in the I/M PROGRAM command are the I/M program start year and the I/M program end year. Both of these parameters can range from calendar year 1960 through calendar year 2051. All four digits are required, and the I/M program start year must precede or be the same as the I/M program end year. Note: The start year represents the year in which a particular group of vehicle types and model years were first tested within an evaporative or exhaust I/M program. If a program changes over time for a particular model year and vehicle type, the subsequent program changes should be modeled in separate model runs with separate I/M program descriptions that cover the relevant evaluation years, such that each program for a vehicle type/model year group is listed with the original start year. This assures that MOBILE6 will model the uninterrupted testing of these vehicles, rather than modeling each program change a s completely new program.

The fourth data parameter in the I/M PROGRAM command is the I/M frequency parameter. A value of 1 is entered if the user desires an annual program; a value of 2 is entered if the user desires a biennial program (vehicles are inspected every other year).

The fifth data parameter in the I/M PROGRAM command is the I/M program type. An Entry is required, but has no effect on the exhaust I/M program benefits unless the I/M EFFECTIVENESS command (2.8.9.4.k) is used. This entry is required for evaporative I/M programs as well, but has no effect on evaporative emissions, even with the use of the I/M EFFECTIVENESS command. The possible entries are:

TRC for a “Test and Repair (computerized)” program,
TRM for a “Test and Repair (manual)” program,
T/O for a “Test Only” program.

The I/M program type must be TRC or TRM if the I/M EFFECTIVENESS command is to be used.

The sixth and final data parameter in the I/M PROGRAM command is the I/M inspection test type. This is an alphanumeric input with the following choices for an exhaust I/M program.

IDLE
2500/IDLE
LOADED/IDLE
IM240
ASM 2525 PHASE-IN
ASM 2525 FINAL
ASM 5015 PHASE-IN
ASM 5015 FINAL
ASM 2525/5015 PHASE-IN
ASM 2525/5015 FINAL
OBD I/M

And the following choices are for an evaporative I/M program:

EVAP OBD
EVAP OBD & GC
FP & GC
GC

Example: `I/M PROGRAM : 1 1981 2050 2 T/O IM240`

This example means that I/M program number 1 begins in calendar year 1981 and ends in calendar year 2050. It is a biennial IM240 program. The T/O stands for "test only" and is a required input, but it has no effect on the results.

Tip: To model both the exhaust and evaporative benefits of an I/M program, the user must enter (at least) two separate I/M programs. For example, to model the exhaust and evaporative benefits of an OBD check program, the user must set up two simultaneous I/M programs. One for "EVAP OBD" (for evaporative benefits) and one for "OBD I/M" (for exhaust benefits).

2.8.9.4.b

Name: I/M MODEL YEARS

Status: Optional (required if the user is modeling exhaust or evaporative I/M).

Section: Run.

Description: This command allows the user to provide the first and last model years that will be covered by the I/M program to be modeled.

Default: There is no default for this command. This command is required if the user wishes to model an I/M program. If the I/M PROGRAM command is present and this command is not, MOBILE6 will issue an error message and the run will be aborted.

Explanation: The format requirement for this command is free column format.

The command name, I/M PROGRAM, must appear first.

The first data parameter is the I/M program number used for the corresponding I/M PROGRAM command. The valid range of numbers for this input is from 1 to 7, and any series of values must be sequential (i.e., there must be a program 1 before there is a program 2).

The second and third data parameters are the first model year that is covered by an I/M program and the last model year that is covered by an I/M program. Both of these parameters can range from model year 1941 through model year 2050. All four digits are required, and the first model year of coverage value must precede or be the same as the last model year of coverage.

Example:
```
I/M MODEL YEARS     : 1 1996 2050
```

This example means that I/M program number 1 tests model years 1996 through 2050.

Tips: The user cannot enter an OBD exhaust or evaporative I/M program that begins before the 1996 model year for any vehicle type. If this is done, the program will stop and generate an error message.

The user cannot enter an EVAP OBD I/M program for HD vehicles that begins before the 2007 model year. If this is done, the program will stop and generate an error message.

Fill-pipe pressure tests on OBD-equipped vehicles are not recommended. Credit for such tests is not calculated by MOBILE6.

2.8.9.4.c
Name: I/M VEHICLES

Status: Optional (required if the user is modeling exhaust or evaporative I/M).

Section: Run.

Description: This command identifies which vehicle types are subject to the specified I/M program.

Default: There is no default for this command. This command is required if the user wishes to model an I/M program. If the I/M PROGRAM command is present and this command is not, MOBILE6 will issue an error message and the run will be aborted.

Explanation: This command allows users to specify which of the 14 individual vehicle types potentially subject to I/M are covered by a given I/M program.

The format required for this command is fixed column format. Columns not discussed below must be left blank.

The first data parameter is the I/M program number used for the corresponding I/M PROGRAM command. The number is entered in column 22.

Following the I/M program number field, there are 14 individual vehicle I/M program coverage toggle fields that contain either a value of 1 or 2. A value of 1 indicates that the particular vehicle type is not subject to an I/M inspection, and a 2 indicates that the particular vehicle type is subject to the inspection.

The first five vehicle I/M program coverage fields correspond to the light-duty gasoline vehicle classes beginning in column 24.

LDGV, LDGT1, LDGT2, LDGT3, LDGT4.

The next eight vehicle I/M program coverage fields correspond to the eight heavy-duty gasoline vehicle classes beginning in column 30.

HDGV2B, HDGV3, HDGV4, HDGV5, HDGV6, HDGV7, HDGV8A, HDGV8B.

The final vehicle I/M program coverage field corresponds to the gasoline buses in column 39.

GAS BUS

Note that there is a blank space between the first five fields and the next eight fields and between the eight fields and the final gas bus field. An error will result if this exact format is not followed.

Example: `I/M VEHICLES : 1 22222 11111111 1`

This example instructs MOBILE6 to calculate I/M benefits for light-duty gasoline vehicles (cars and light-duty trucks) for I/M program number 1.

Tips: The user may choose any combination of vehicle types. However, the user must enter a value of 2 for at least one of the vehicle types to get meaningful I/M output.

The user cannot enter an EVAP OBD I/M program for HD vehicles that begins before the 2007 model year. If this is done, the program will stop and generate an error message.

2.8.9.4.d
Name: I/M STRINGENCY

Status: Optional (required if the user is modeling exhaust I/M; do not enter for evaporative I/M).

Section: Run.

Description: This command defines the expected exhaust inspection failure rate for pre-1981 model year vehicles covered by the I/M program.

Default: There is no default for this command. This command is required if the user wishes to model an exhaust I/M program. If the I/M PROGRAM command describes an exhaust program and this command is not present, MOBILE6 will issue an error message and the run will be aborted.

Explanation: The format required for this command is free column format.

The command name, I/M STRINGENCY, must appear first.

The first data parameter is the I/M program number used for the corresponding I/M PROGRAM command.

The second data parameter is the level of I/M stringency. The I/M stringency rate is the test failure rate expected in pre-1981 model year passenger cars or light trucks expressed as a percentage of tests administered. The value the user enters has no effect on model years greater than 1980.

The valid stringency range is from 10 percent stringency to 50 percent stringency. Entry of a value outside of this range will generate an error message. The value is entered into the program as a percentage including a decimal.

Example:
```
I/M STRINGENCY    : 1 50.0
```

This example instructs the computer for I/M program number 1 to set the stringency at 50.0 percent.

Tips: This command is required even in exhaust cases to which it does not directly apply, such as I/M programs in which pre-1981 model year vehicles are not tested, or even in calendar years such as 2050 in which pre-1981 vehicles do not exist.

The command is not needed for evaporative I/M programs. If it is provided with an evaporative I/M program number, the inputs will be ignored.

If the program stringency is greater than 50 percent, enter 50 percent. If the stringency is less than 10 percent, use 10 percent as the value.

2.8.9.4.e

Name: I/M COMPLIANCE

Status: Optional (required if the user is modeling exhaust I/M programs; highly recommended for evaporative I/M).

Section: Run.

Description: This command describes the expected compliance with a given I/M program. 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.

Default: There is no default for this command for exhaust I/M programs. It is required to model an exhaust I/M program. If the I/M PROGRAM command describes an exhaust program and this command is not present, MOBILE6 will issue an error message and the run will be aborted.

If the I/M PROGRAM command describes an evaporative program, but a compliance rate is not specified for the evaporative program and an exhaust program is not in effect for a specific vehicle class and model year, MOBILE6 will use a default value of 85 percent for the evaporative program. However, if a compliance rate is not provided for an evaporative program, but one is provided for a simultaneous exhaust program, MOBILE6 will use the exhaust program compliance rate to compute evaporative benefits on the vehicles and model years covered by both the exhaust and evaporative programs.

Explanation: The format requirement for this command is free column format.

The command name, I/M COMPLIANCE, must appear first.

The first data parameter is the I/M program number used for the corresponding I/M PROGRAM command.

The second data parameter is the level of I/M compliance the user wishes to use. The entered value indicates the percentage of the fleet subject to I/M that actually goes through the entire I/M process to receive a “pass” or waiver. The I/M credit is reduced in proportion to a reduction in the compliance rate. The valid compliance rate range is from 50 percent compliance to 100 percent. The value is entered into the program as a percentage that includes a decimal.

Example:
```
I/M COMPLIANCE     : 1 85.0
```

This example instructs the computer for I/M program number 1 to set the compliance at 85.0 percent.

Tip: Enter the I/M COMPLIANCE command for all I/M programs. If this command is not entered for an evaporative I/M program, the value may change when commands for other I/M programs are added or modified.

2.8.9.4.f

Name: I/M WAIVER RATES

Status: Optional (required for modeling exhaust I/M programs; highly recommended for evaporative I/M).

Section: Run.

Description: This command specifies the percentage of vehicles that fail an initial I/M test and do not pass a retest but receive a certificate of compliance.

Default: There is no default for this command for exhaust I/M programs. It is required if the user wishes to model an exhaust I/M program. If the I/M PROGRAM command describes an exhaust program and this command is not present, MOBILE6 will issue an error message and the run will be aborted.

If the I/M PROGRAM command describes an evaporative program, but waiver rates are not specified for the evaporative program and an exhaust program is not in effect for a specific vehicle class and model year, MOBILE6 will use default values of 5 percent for the evaporative program. However, if waiver rates are not provided for an evaporative program but are provided for a simultaneous exhaust program, MOBILE6 will use the exhaust program waiver rates to compute evaporative benefits on the vehicles and model years covered by both the exhaust and evaporative programs.

Explanation: The format required for this command is free column format.

The command name, I/M WAIVER RATES, must appear first.

The first data parameter is the I/M program number used for the corresponding I/M PROGRAM command.

The second data parameter is the waiver rate for the pre-1981 model year vehicles

The third data parameter in the I/M WAIVER RATES command is the waiver rate for 1981 and later model year vehicles.

The valid input range for waiver rate percentages are between 0 percent and 50 percent. The values are entered into the program as percentages that include a decimal. If either of the waiver rates exceed 50.0 percent, the program will issue an error message.

Example:
```
I/M WAIVER RATES   : 1 5.0 3.0
```

This example instructs MOBILE6 to set the waiver rate at 5.0 percent for pre-1981 model years and 3.0 percent for 1981 and later model years for I/M program number 1.

Tip: I/M waiver rates must be expressed as a percentage of the vehicles that fail the I/M program, not as a percentage of the entire fleet.

Enter the I/M WAIVER RATES command for all I/M programs. If this command is not entered for an evaporative I/M program, the value may change when commands for other I/M programs are added or modified.

2.8.9.4.g

Name: I/M CUTPOINTS

Status: Required for IM240 programs. Do not use with other exhaust or evaporative I/M programs.

Section: Run.

Description: This command specifies the emission level "cutpoints," which determine whether a vehicle passes or fails an I/M test. The I/M CUTPOINTS command is used only if the user is modeling an IM240 program.

Default: There is no default for this command. If the user wishes to model an I/M240 program, this command must be used to enter cutpoint values.

This command is not needed for evaporative I/M programs. If it is provided with an evaporative I/M program number, the inputs will be ignored. This command also should not be used with other (non IM240) exhaust I/M programs.

Explanation: The format required for this command is free column format.

The command name, I/M CUTPOINTS, must appear first.

The first data parameter is the I/M program number used for the corresponding I/M PROGRAM command.

The second data parameter is the name of an external file that contains the cutpoint information. The complete path information must be provided if the file is not in the same subdirectory as the MOBILE6 program.

The format required for data within the external file is free column format.

The label, I/M CUTPOINTS, needs to appear at the top of the file and begin in

column one. Following the I/M CUTPOINTS label are the IM240 cutpoints. These are entered in blocks of 75 cutpoints. The first block of cutpoints is for the passenger car and light-duty gas truck 1 vehicle classes (LDGV and LDGT1). The second block of cutpoints is for the light-duty gas truck 2 and 3 classes (LDGT2 and LDGT3). The third block of cutpoints is for the light-duty gas truck 4 class (LDGT4). The fourth and final block is for the heavy-duty gas vehicle class (HDGV).

Each of the four blocks mentioned above consist of three blocks of 25 values. These three sub-blocks are the HC, CO, and NO_x cutpoints, respectively. The values in a group of 25 are associated with age, starting with the youngest vehicle.

All IM240 cutpoint sets must have valid values for all HC and CO cutpoints. Valid cutpoints are between 0.80 / 15.0 / 2.0 grams per mile and 5.0/100.0/4.5 grams per mile (for HC, CO, and NOx respectively) If the user enters IM240 cutpoints that are more stringent (lower) than 0.80 / 15.0 / 2.0 grams per mile levels, MOBILE6 will set the cutpoints to the minimum levels and issue a warning. If the user enters IM240 cutpoints that are less stringent (higher) than 5.0 /100.0 grams per mile (HC and CO respectively), MOBILE6 will set the cutpoints to the maximum levels, but no warning will be issued. Entering a NOx cutpoint value greater than 4.5 grams per mile indicates that no NOx cutpoint is used in the program, and the NOx benefit calculated will be zero.

Example: `I/M CUTPOINTS : 1 C:\MOBILE\CUTPOINT.D`

This command directs MOBILE6 to look for the appropriate I/M cutpoints in the external file, “CUTPOINT.D”. An example of proper format for the external file can be found in the file, “CUTPOINT.D”.

Tips: Although cutpoints for heavy-duty vehicles are required for I/M 240 programs, they have no effect on MOBILE6 emission results.

2.8.9.4.h

Name: I/M EXEMPTION AGE

Status: Optional for exhaust I/M programs. Highly recommended for evaporative I/M programs.

Section: Run.

Description: This command allows users to specify the age at which vehicles become exempt from the I/M program they wish to model. This is similar in effect to setting the last model year covered by the I/M program using the I/M MODEL YEARS command. However, it allows vehicles over a given age to be exempted when

evaluating multiple calendar years without requiring separate runs using different values for the I/M MODEL YEARS command.

Default: 25 years old (in effect, under a default scenario, vehicles never become exempt from I/M because of age).

If an exhaust I/M program is in effect and the user enters an exemption age for the program, the exhaust program exemption age will apply to the same vehicles and model years in any simultaneous evaporative I/M program, unless a different exemption age is explicitly entered for the evaporative I/M program.

Explanation: The format requirement for this command is as follows:

The command name, I/M EXEMPTION AGE, must appear first.

The first data parameter is the I/M program number used for the corresponding I/M PROGRAM command.

The second data parameter is the I/M exemption age. This is the age at which vehicles are no longer subject to mandatory I/M requirements. The valid range for this input is 1 through 25. A value of 1 would exempt the entire fleet from the I/M requirements (vehicles aged 0 years are never subject to I/M), and a value of 25 would exempt vehicles aged 25 years and older. Exempted vehicles lose all potential I/M credit. The exemption age input value must be entered into MOBILE6 as an integer.

Example: `I/M EXEMPTION AGE : 1 21`

This example instructs MOBILE6 to set the I/M exemption age to 21 years old for I/M program number 1.

Tip: Including or exempting vehicles older than 25 years has no effect on I/M program benefits because MOBILE6 does not calculate emissions for vehicles older than 25 years.

Enter the I/M EXEMPTION AGE command for all evaporative I/M programs. If this command is not entered for an evaporative I/M program, the value used in the model may change when commands for other I/M programs are added or modified.

2.8.9.4.i

Name: I/M GRACE PERIOD

Status: Optional for exhaust I/M programs. Highly recommended for evaporative I/M programs.

Section: Run.

Description: This command allows users to specify the age at which vehicles first become subject to I/M testing (newer vehicles are exempt).

Default: 1 year old.

If an exhaust I/M program is in effect and the user enters a grace period for the exhaust program, the exhaust program grace period will apply to the same vehicles and model years in any simultaneous evaporative I/M program, unless a different exemption age is explicitly entered for the evaporative I/M program.

Explanation: The format required for this command is as follows:

The command name, I/M GRACE PERIOD, must appear first.

The first data parameter is the I/M program number used for the corresponding I/M PROGRAM command.

The second data parameter is the I/M grace period. This is the age at which vehicles are first subject to mandatory I/M requirements. This input allows users to model programs that exempt the newest vehicles from the requirements. The valid range for this input is 1 through 25. A value of 1 would exempt only those vehicles that are less than 1 year old (the default), and a value of 25 would exempt all but the oldest model year vehicle. Exempted vehicles lose all I/M credit. The exemption age input value must be entered into MOBILE6 as an integer.

Example:
```
I/M GRACE PERIOD   : 1  5
```

This example instructs MOBILE6 to set the I/M grace period to 5 years old for I/M program number 1.

Tip: Enter the I/M GRACE PERIOD command for all evaporative I/M programs. If this command is not entered for an evaporative I/M program, the value used in the model may change when commands for other I/M programs are added or modified.

2.8.9.4.j

Name: NO I/M TTC CREDITS

Status: Optional for exhaust I/M. Not used for evaporative I/M programs.

Section: Run.

Description: This command eliminates the I/M credit that MOBILE6 assigns to a technician training program.

Default: MOBILE6 assigns full I/M credit for technician training. This command is appropriate only if the I/M program does not conduct or plan to conduct a technician training program.

Explanation: This command requires only the command name and I/M program number to be entered.

The command is not needed for evaporative I/M programs. If it is provided with an evaporative I/M program number, the inputs will be ignored.

Example:
```
NO I/M TTC CREDITS : 1
```

This example instructs the computer to remove the I/M technician training credits from the I/M benefits for I/M program number 1.

2.8.9.4.k

Name: I/M EFFECTIVENESS

Status: Optional.

Section: Run.

Description: This command is a correction factor that reduces the exhaust I/M credit for test and repair programs by the specified input percentage.

Default: 100 percent or full credit to all I/M program types.

Explanation: This command allows the user to enter separate effectiveness values for each of the three pollutants. These values will apply to all exhaust I/M programs in that run. Within a run, it is not possible to model separate effectiveness levels for each I/M program element. The command does not affect evaporative I/M or ATP calculations.

The format required for this command is free column format. The command name, I/M EFFECTIVENESS, must appear first.

The next three inputs are the I/M effectiveness values for HC, CO and NO_x pollutants, respectively. The effectiveness values are entered as fractions. For example, if a value of 0.80 is entered for the first parameter, then the HC I/M benefits are reduced by 0.20 or 20 percent (1.0 - 0.80 = 0.20). All values are entered into the program as fractions from 0.0 to 1.0 and include a decimal. Values outside the range of 0.0 to 1.0 will produce error messages.

The I/M EFFECTIVENESS Command requires the I/M type parameter in the I/M PROGRAM Command (2.8.9.4.a) to be set to either “TRC” or “TRM”. If the user sets the program type is to “T/O”, then the I/M EFFECTIVENESS Command has no effect (default value of 100% is used).

Example: `I/M EFFECTIVENESS : 0.80 0.70 0.72`

2.8.9.4.l
Name: I/M DESC FILE

Status: Optional.

Section: Run.

Description: This command allows users to enter any set of I/M commands in an external file rather than in the MOBILE6 command input file.

Default: There is no MOBILE6 default for this command.

Explanation: This command instructs MOBILE6 to read I/M records from an external data file. When the model finds this command in the command input file, it opens the external file named in the command and continues to read I/M program description commands from that file. The external file can contain any of the I/M commands except another I/M DESC FILE command. It may also contain any number of blank and comment lines. Comment lines read from the external file will be treated exactly as though they had been read from the command input file. Comments beginning with a “greater than” symbol (>) will be appear in the output file. Blank lines and comments beginning with an asterisk (*) will be ignored.

The format required for this command is the command name followed by the name of the external file as the first data parameter. The file’s complete path name is required if the file is not in the same subdirectory as the MOBILE6 program.

Unlike most other external files, the one for this command does not repeat the command name on the first line.

Example: `I/M DESC FILE  : IMTEST.D`

This example instructs MOBILE6 to read I/M program descriptions from an external file called, "IMTEST.D". A sample data set can be found in the file, "IMTEST.D".

Tips: This option lets the user avoid retyping a long set of repetitive I/M commands each time the model is run. If the user decides to use this option, all of the I/M inputs should be included for a given run, rather than dividing them between an external file and the MOBILE6 command input file.

2.8.10 Fuel Commands

Fuel commands allow users to model the impact of various gasoline fuel parameters.

2.8.10.1 Fuel Program

Name: FUEL PROGRAM

Status: Optional.

Section: Run or Scenario.

Description: This command allows users to specify one of two Tier 2 sulfur phase-in schedules, to model the impact of a reformulated gasoline (RFG) program, or to specify sulfur content for gasoline after 1999.

Default: MOBILE6 assumes that there is no RFG program in place and applies the standard Tier 2 gasoline sulfur phase-in schedule for calendar years after 1999. This default condition is described below as "Conventional Gasoline East."

Explanation: This command allows four options. Users may specify one of two Tier 2 sulfur phase-in schedules, model the effect of an RFG program, or directly supply values for gasoline sulfur content after 1999.

Users select the desired option by entering an integer following the command name. This data entry is in free column format. Some options also require additional input data, as described below. The options and their associated numbers are:

1 Conventional Gasoline East
2 Reformulated Gasoline
3 Conventional Gasoline West
4 User-supplied gasoline sulfur levels

Each of these options and its input requirements are described in detail below.

Conventional Gasoline East—This is the MOBILE6 default. It supplies post-1999 gasoline sulfur levels by year under the phase-in schedule prescribed by the Tier 2 rule for most states.
See www.epa.gov/otaq/tr2home.htm#documents for more information on the Tier 2 rule.

The user may select Conventional Gasoline East by omitting the FUEL PROGRAM command (because this is the default option) or by placing the integer, "1", on the command line after the FUEL PROGRAM command.

Conventional Gasoline West—This option supplies post-1999 gasoline sulfur levels by year under the phase-in schedule prescribed by the Tier 2 rule for specific western states (i.e., Alaska, Colorado, Idaho, Montana, New Mexico, North Dakota, Utah, Wyoming) and bordering counties in other states.
See www.epa.gov/otaq/tr2home.htm#documents for more information on the Tier 2 rule, and see *66 FR 19306*, April 13, 2001, for a list of the relevant counties and Federal Indian reservations.

The user may select Conventional Gasoline West by placing the integer, "3", on the command line after the FUEL PROGRAM command.

Reformulated Gasoline (RFG)—This option should be used to model the effects of an RFG program. The option sets 1995-and-later gasoline sulfur content, oxygen content, and fuel volatility values for the MOBILE6 calculations, generally overriding default fuel parameters and parameters set with the FUEL RVP, SULFUR CONTENT, and OXYGENATED FUELS commands. Although the exact composition of RFG fuel may vary by refiner, the RFG fuel values modeled in MOBILE6 are consistent with the RFG requirements, and represent the typical values expected in an RFG area.

Like conventional gasoline, RFG must meet fuel volatility requirements that vary by geographic region (see "Volatility Regulations for Gasoline and Alcohol Blends Sold in Calendar Years 1992 and Beyond," 55 FR 23658, June 11, 1990). Because the RFG option often sets fuel volatility

and overrides the FUEL RVP label, the RFG option requires the user to indicate which region (north or south) is being modeled. The user may select Reformulated Gasoline by placing the integer, “2”, on the command line after the FUEL PROGRAM command, followed by the appropriate letter, “S” (for south), or “N” (for north). The value designating the fuel volatility region must be separated from the program value, “2”, by at least one blank space.

The exact fuel parameters modeled for RFG depend on the geographic region, the calendar year, and the season. The values used in MOBILE6 are listed in the following two tables. Explanatory notes follow the tables.

Reformulated Gasoline Parameters—Summer (1)						
Year (2)	RVP (pounds per square inch, or psi)		Oxygenated Fuels		Sulfur Content (ppm)	
	North	South	Ether Oxygen Content (% by weight)	Ether Market Share (%)	Average	Max
1995-1999	8.0	7.1	2.1	100	300	N/A
2000	6.7	6.7	2.1	100	150	1000
2001	6.7	6.7	2.1	100	149	1000
2002	6.7	6.7	2.1	100	129	1000
2003	6.8	6.8	2.1	100	120	1000
2004	6.8	6.8	2.1	100	120	303
2005	6.8	6.8	2.1	100	90	303
2006	6.8	6.8	2.1	100	30	87
2007	6.8	6.8	2.1	100	30	87
2008	6.8	6.8	2.1	100	30	80

Reformulated Gasoline Parameters—Winter (1)							
Year (2)	RVP (psi)	Oxygenated Fuels (3)				Sulfur Content (ppm) (4)	
	North or South	Ether Oxygen Content (% by weight)	Ether Market Share (%)	Ethanol Oxygen Content (% by weight)	Ethanol Market Share	Average	Max
1995-1999	as set by user	1.5	70	3.5	30	300 (5)	N/A
2000		1.5	70	3.5	30	300	1000
2001		1.5	70	3.5	30	299	1000
2002		1.5	70	3.5	30	279	1000
2003		1.5	70	3.5	30	259	1000
2004		1.5	70	3.5	30	121	303
2005		1.5	70	3.5	30	92	303
2006		1.5	70	3.5	30	33	87
2007		1.5	70	3.5	30	33	87
2008		1.5	70	3.5	30	30	80

Notes for Reformulated Gasoline Parameter tables:

(1) The Clean Air Act defines the RFG “Summer” as May 1 through September 15. “Winter” is the rest of the year. MOBILE6 will generally determine which fuel season to model using the value input for EVALUATION MONTH (1 = January and indicates winter; 7 = July and indicates summer). However, the user can override the fuel season indicated by the EVALUATION MONTH by using the SEASON command described later in this chapter.

(2) For most of the fuel parameters, the year listed here indicates the calendar year for which the fuel parameter is typical. However, the “Maximum Sulfur”value represents the maximum sulfur level ever experienced by a vehicle, regardless of the fuel level in the calendar year of the MOBILE6 run. Thus, the “year” in these tables is used to assign the maximum sulfur values to the appropriate vehicle model year. The

maximum sulfur effect is not calculated for 1999-and-earlier vehicles, so no maximum sulfur level is needed for these years.

(3) During the winter fuel season, the user may override the default RFG parameters for oxygenated fuels if the user-supplied oxygenated fuel parameters have a combined oxygenate for ethanol and ether blends greater than 2.1 percent by weight and the combined oxygenate market share is 100 percent.

(4) The winter RFG sulfur values listed here and used in MOBILE6 when the RFG option is selected are appropriate for most of the United States, but they are not correct for states with "western" Tier 2 fuel (see "Conventional Gasoline West" above). The "Tips" section on page 107 explains how to model winter RFG for these western states.

(5) In the winter RFG season, user input for SULFUR CONTENT will override the default average fuel sulfur for calendar years 1999-and-earlier. This is not true for summer RFG.

User-supplied Gasoline Sulfur Levels—This option allows the user to directly specify the average and maximum sulfur levels for calendar years 2000 and later if these are known to differ from RFG or the conventional fuels programmed into the model. For calendar years prior to 2000, the SULFUR CONTENT command must be used.

The user may select user-supplied sulfur levels for 2000 and later by placing the integer, "4", on the command line after the FUEL PROGRAM command. On the following lines, the user must enter 32 values, indicating average and maximum fuel sulfur contents (parts per million, or ppm) in the lines following the command. The first 16 values are the average fuel sulfur content for gasoline in calendar years 2000 through 2015. The next 16 values are the maximum sulfur levels to which the model years 2000 through 2015 are exposed. These values should represent the maximum sulfur in any batch of fuel sold in the modeled area. The 2015 value is used for all 2015 and newer model years. Values from 30 ppm to 1,000 ppm are valid inputs for both the average and the maximum sulfur levels, but MOBILE6 calculates identical sulfur effects for all values more than 600 ppm. All values are in ppm and must be entered with a decimal point. Each value must be separated by at least one space.

Examples:

```
FUEL PROGRAM          :  1
```

The preceding example calls for the Conventional Gasoline East fuel program.

```
FUEL PROGRAM       :  3
```

The preceding example calls for the Conventional Gasoline West fuel program.

```
FUEL PROGRAM       :  2  S
```

The preceding example calls for a RFG fuel program for a southern region.

```
FUEL PROGRAM       :  2  N
```

The preceding example calls for a RFG fuel program for a northern region.

```
FUEL PROGRAM       :  4
 300.0  299.0  279.0  259.0  121.0   92.0   33.0   33.0
  30.0   30.0   30.0   30.0   30.0   30.0   30.0   30.0
1000.0 1000.0 1000.0 1000.0  303.0  303.0   87.0   87.0
  80.0   80.0   80.0   80.0   80.0   80.0   80.0   80.0
```

This final example demonstrates user-supplied gasoline sulfur levels. The values provided here are the same sulfur levels used for the MOBILE6 default (Conventional Gasoline East).

Tips: The FUEL PROGRAM command affects sulfur content prior to calendar year 2000 only when RFG is selected. In general, use the SULFUR CONTENT command to define the sulfur content of gasoline in calendar years before 2000.

MOBILE6 treats FUEL PROGRAM command option 4 as a conventional gasoline program with alternate sulfur levels. If an RFG program is desired with alternate sulfur levels, the FUEL PROGRAM command option 4 lets users enter the sulfur levels and alter the other non-sulfur fuel parameters through the FUEL RVP and OXYGENATED FUELS commands to approximate the non-sulfur effects of RFG.

It is not appropriate to use the FUEL PROGRAM command option 2 to choose a Phase 2 (calendar year 2000 or later) RFG program for western Tier 2 sulfur content phase in states (listed above). Users wishing to model western RFG will need to specify all of the fuel parameters (sulfur content, oxygen content and RVP) separately for each calendar year they wish to evaluate. In winter season scenarios, users should use the FUEL PROGRAM command to choose "Conventional Gasoline West" to obtain the appropriate winter sulfur levels. Then, using the OXYGENATED FUELS command, users must enter either the winter RFG oxygenated fuel parameters described above or a local oxygenated fuels program that satisfies the RFG rule. The FUEL RVP command is used to specify fuel volatility. Modeling western RFG in summer will require the user to specify the sulfur levels using the FUEL PROGRAM command option 4, because

the summer average sulfur will be the same as those shown above for RFG, however, the maximum sulfur values will be those shown for the western phase in states. As with winter, the user must specify the appropriate oxygen content and fuel RVP levels shown above for RFG using the OXYGENATED FUELS and FUEL RVP commands.

2.8.10.2 Sulfur Content of Gasoline

Name: SULFUR CONTENT

Status: Optional.

Section: Scenario.

Description: This command allows the user to enter the sulfur content of gasoline fuel for calendar years through 1999. This input is valid only through the 1999 calendar year. For calendar years after 1999, MOBILE6 will ignore this input.

Default: 300 ppm

Explanation: MOBILE6 will accept sulfur contents for 30.0 ppm through 600.0 ppm. If a sulfur level outside that range is entered, MOBILE6 will round to the (appropriate) end point (30 ppm or 600 ppm) and generate a warning message.

This command only requires one value in the data field of the command, namely the sulfur content of the fuel in ppm.

Example:
```
SULFUR CONTENT      :   50.0
```

Tips: To enter values for years after 1999, the FUEL PROGRAM command must be used.

Using this command will override the default fuel sulfur content (300 ppm) used for Reformulated Gasoline in calendar years 1995 through 1999 (Phase 1) in both Regions (North and South) and in both winter and summer seasons.

2.8.10.3 Oxygenated Fuels Programs

Name: OXYGENATED FUELS

Status: Optional.

Section: Run or Scenario.

Description: This command permits users to model the effects of oxygenated gasoline on exhaust emissions for all gasoline-fueled vehicle types.

Default: If the OXYGENATED FUELS command is not used and the FUELS PROGRAM command is not used to select a RFG program, MOBILE6 assumes that the fuel used by gasoline-fueled vehicles does not contain an oxygenate and does not calculate an oxygenated fuels benefit.

Explanation: The effect of oxygenated fuels on emissions depends on several fuel parameters that are specified by this command. These include whether the oxygenate is an alcohol or ether blend; the amount of oxygen in the fuel; and the market share of oxygenated fuels. In certain cases, the presence of oxygenate in fuel can affect fuel RVP, generating an additional emission effect (see the "Tips" section on page 110).

The command requires five numbers be provided by the user in the data field portion of the command record. Each of the five values must be separated from the others by at least one blank space:

The first number specifies the ether blend market share (expressed as a decimal fraction). The range is 0.000 to 1.000.

The second number specifies the alcohol blend market share (expressed as a decimal fraction). The range is 0.000 to 1.000.

The third number specifies the average oxygen content of ether blend fuels (percent weight, expressed as a decimal fraction). The range is 0.000 to 0.027.

The fourth number specifies the average oxygen content of alcohol blend fuels (percent weight, expressed as a decimal fraction). The range is 0.000 to 0.035.

The fifth number specifies whether a Reid vapor pressure (RVP) waiver has been granted to allow "splash" blending of alcohol-based oxygenates. If a waiver has <u>not</u> been granted (value = 1), then alcohol-based oxygenated fuels must meet the same RVP requirements as non-oxygenated fuels sold in the area. If a waiver <u>has</u> been granted (value = 2), then alcohol-based oxygenated fuels are allowed to exceed the RVP requirements by up to 1 pound per square inch (psi), and the user-input RVP is increased to account for the market share of the higher RVP fuel.

Note: If the market share of the oxygenated fuels is not 100%, then the average RVP of fuel will be increased by a commingling effect from the mixing of oxygenated and non-oxygenated fuels, even if there is no RVP waiver for oxygenated fuels.

Example: `OXYGENATED FUELS : .035 .129 .027 .031 2`

This example states that 3.5 percent of the fuel sold in the area is an ether blend with an average oxygen content of 2.7 percent weight; that 12.9 percent of the fuel sold in the area is an alcohol blend with an average oxygen content of 3.1 percent by weight; and that an RVP waiver is in effect allowing the volatility of the alcohol-based oxygenated fuels to be up to 1.0 psi RVP greater than the limit applicable to straight gasoline.

Tips: If the user specifies a RFG program using the FUEL PROGRAM command, then the oxygenated fuel parameters of that program take precedence over the OXYGENATED FUELS command. See Section 2.8.10.1, which describes the FUEL PROGRAM command, for more information on the RFG program parameters and their effects.

The OXYGENATED FUELS command may change the expected effects of the mandatory user input for the SCENARIO RECORD command. For more details, see the discussion of the RVP waiver for "splash-blended" fuels in the "Explanation" section on page 109.

2.8.10.4 Fuel Reid Vapor Pressure (RVP)

Name: FUEL RVP

Status: Required.

Section: Run or Scenario.

Description: This command allows users to specify fuel RVP for the area to be modeled

Default: There is no MOBILE6 default for fuel RVP. Users must enter a value for all scenarios (in the Run section) or for each scenario (in the Scenario section) of each MOBILE6 command input file.

Explanation: RVP is one measure of the volatility of gasoline. Exhaust and especially non-exhaust emissions vary with fuel volatility. The FUEL RVP command specifies the value of RVP (in psi) representing the prevailing average fuel volatility for the geographic area of interest.

The RVP value entered must reflect the average in-use RVP of gasoline in the region of the country being modeled. The RVP value can be between 6.5 psi and 15.2 psi, inclusive. If the user enters a value outside this range, MOBILE6 will round to the appropriate endpoint (6.5 psi or 15.2 psi) and will generate a warning message.

However, there are federal limits on fuel RVP in ozone-producing months (May through September), which began in 1989. For the calendar years 1989 to1991, the RVP limit is 10.5 psi, 9.5 psi, or 9.0 psi depending on the region of the country or summer month (see Federal Register 54 FR 11868, March 22, 1989). For calendar years 1992 and beyond, the summer RVP limit is either 9.0 psi or 7.8 psi depending on the region or month (see Federal Register 54 FR 23658, June 11, 1990).

The only required data are the command name FUEL RVP and the fuel RVP (in psi), which can be placed anywhere in the data field of the command record.

Example:
```
FUEL RVP              : 9.0
```

This example would model a region of the country where the prevailing fuel RVP was 9.0 psi.

Tips: At temperatures below 45°F, fuel evaporation becomes negligible and RVP is assumed to have no effect on emissions. However, it is still a required input.

The RVP effects are the same for all RVP values greater than 11.7 psi.

The OXYGENATED FUELS and the FUEL PROGRAM commands may affect the RVP used in the model calculations. See the sections on these commands for more details.

2.8.10.5 Effective Season for RFGs Calculation

Name: SEASON

Status: Optional.

Section: Run or Scenario.

Description: This command identifies the effective season (winter or summer) for the RFG calculation regardless of the month being modeled.

Default: MOBILE6 assumes the season is winter when January is selected as the evaluation month and that the season is summer when July is selected as the evaluation month. The MOBILE6 default evaluation month is January, so winter RFG will be modeled unless the user selects July using the EVALUATION MONTH command or selects summer by using this command.

Explanation: The effect of RFG on emissions differs in summer and winter. The SEASON command allows the user to override the effect of the EVALUATION MONTH command on RFG calculations, either specifying that summer RFG rules be applied when the evaluation month is January or that winter RFG rules be applied when the evaluation month is July. This command affects only RFG-related emission results.

The SEASON command can assume only two values: a “1” (denoting summer) or a “2” (denoting winter). This information must appear in the data portion of the record following the command name.

Example:
```
SEASON                : 1
```

This example directs MOBILE6 to use summer RFG values.

Tips: The SEASON command affects results only relating to RFG. The SEASON command will have no effect on results unless the input includes a FUEL PROGRAM command, indicating that an RFG program is in place.

2.8.11 Alternative Emission Regulations and Control Measures

2.8.11.1 Disablement of the 1990 Clean Air Act Requirements

Name: NO CLEAN AIR ACT

Status: Optional.

Section: Run.

Description: This command allows users to model vehicle emissions as if the Federal Clean Air Act Amendments of 1990 had not been implemented. This command may be used in conjunction with the modeling of state Rate of Progress (ROP) plans.

Default: MOBILE6 assumes that the Clean Air Act (CAA)Amendments of 1990 did occur.

Explanation: MOBILE6 has been updated to include a number of vehicle and fuel requirements mandated by the 1990 Clean Air Act Amendments. These include Tier1, low emissions vehicle (LEV), and Tier2 tailpipe exhaust emission standards, and new evaporative emission test procedure requirements. Nevertheless, for some modeling purposes, emission factors for future calendar years in the absence of the requirements imposed by the 1990 CAA amendments may be needed (e.g., to support ROP plans).

By using this command, the user can disable the following effects in MOBILE6:

- The effect of all Federal exhaust tailpipe standards after Tier0 standards or the 1993 model year will be shut off. All model years subsequent to the 1993 model year will be assigned the 1993 model year emission factor. The 1993 model year was selected because it is the last year that was unaffected by the CAA amendments.

- The evaporative emission benefits from the Enhanced Evaporative Test procedure will be eliminated. This affects running loss, diurnal, hot soak, resting loss, and refueling emission factors.

- The emission benefits from the Supplemental Federal Test Procedure for both off-cycle and air-conditioning emission effects will be eliminated if the command is issued.

- The effects of OBD will be eliminated, and an OBD I/M program will not be allowed. Evaporative OBD I/M programs are also not allowed when this command is used. Only Exhaust and Evaporative I/M programs that existed in calendar year 1990 can be modeled, and they can be modeled for model years 1996 and later.

- The fuel sulfur level is set to 300 parts per million (ppm) for all model years greater than 1993.

- The detergent gas emission effect is eliminated.

- The 1995 model year tampering rates are extended past the 1995 model year / calendar year. For these years, the rates that prevailed in the 1995 model year are used.

- Cold temperature CO effects are affected. These will be set to 1993 model year rates.

<u>The following effects are NOT affected by the NO CLEAN AIR ACT command.</u>

- Heavy-duty vehicle off-cycle effects (defeat device), and heavy-duty vehicle conversion factors are unaffected by this command.

- The MOBILE6 correction factors for average speed are unaffected by this command.

- Facility cycle or roadway effects are unaffected by this command.

- Fleet effects such as fleet turnover, changes in VMT between classes, mileage accumulation effects, and registration distributions are unaffected by this command.

Example: `NO CLEAN AIR ACT :`

Tips: If this command is entered in conjunction with an I/M PROGRAM command, the OBD I/M test type is not allowed for any model years. Only exhaust-based emission tests are allowed, such as the IDLE, 2500/IDLE , or non-OBD Evaporative test programs, such as the gas cap check. An error message will result if the user enters an OBD-based I/M program, or if the user enters an I/M240 or ASM type program.

When this command is used, the model year coverage for exhaust-based I/M emission test programs may extend to 1996 and newer model years.

2.8.11.2 Heavy-Duty Diesel Vehicle NOx Off-Cycle Emission Effects

2.8.11.2.a

Name: NO DEFEAT DEVICE

Status: Optional.

Section: Run.

Description: This command allows users to turn off the effects of the heavy-duty diesel vehicle NOx off-cycle emission effects (defeat device emissions). It affects only NOx emissions from vehicle classes 17 through 23, and has an appreciable emission effect only on vehicle classes 22 and 23. It also only affects the NOx emission results from calendar years 1989 through 2028 by affecting model years 1988 through 2003.

Default: MOBILE6 uses national estimates to report the effects of off-cycle NOx emissions from heavy-duty diesel vehicles. The default setting for this command is to include these effects. IT IS RECOMMENDED THAT MOST USERS DO NOT USE THE 'NO DEFEAT DEVICE' COMMAND.

Explanation: EPA's best estimate for the effects of heavy-duty vehicle NOx off-cycle emissions has been programmed into MOBILE6 as the default input. Most users will not need to model the anything other than the default emission effects which include an off-cycle emission contribution. However, this command has been added to MOBILE6 to allow users the ability to easily shut off the reporting of the NOx off-cycle emissions should they need the capability.

Example:
```
NO DEFEAT DEVICE    :
```

This example directs MOBILE6 to NOT report the NOx off-cycle emission effects.

Tips: Care should be taken when using this command since it disables EPA's best estimates for the effect of NOx off-cycle emissions. It also has interactive effects with the other heavy-duty diesel vehicle NOx off-cycle commands. For example, the NO DEFEAT DEVICE should not be used in conjunction with the other NOx

off-cycle commands such as “REBUILD EFFECTS”, “NO REBUILD”, and “NO NOx PULL AHEAD”. These command are invalid when used in conjunction with the “NO DEFEAT DEVICE” command. This is because if there were NOx off-cycle emissions produced by heavy-duty diesel vehicles, then there would no need for the mitigation strategies such as Pull Ahead and Rebuild.

2.8.11.2.b

Name: NO NOX PULL AHEAD

Status: Optional.

Section: Run.

Description: This command allows the user to turn off the effects of the Pull Ahead mitigation program used to reduce heavy-duty diesel vehicle NOx off-cycle emissions. It affects only NOx emissions from vehicle classes 17 through 23, and has an appreciable emission effect only on vehicle classes 22 and 23. It also only affects the NOx emission results from model years 2002 and 2003.

Default: MOBILE6 uses national estimates to report the effects of off-cycle NOx emissions pull ahead from heavy-duty diesel vehicles. The default setting for this command is to include these effects. IT IS RECOMMENDED THAT MOST USERS DO NOT USE THE ‘NO NOX PULL AHEAD’ COMMAND.

Explanation: EPA’s best estimate for the effects of heavy-duty vehicle NOx off-cycle emissions and the effects of the EPA Pull Ahead mitigation program have been programmed into MOBILE6 as the default input. The Pull Ahead program modeled by MOBILE6 is the best estimate at the time of the release of MOBILE6 of what the actual program will achieve. It was assumed to have only partial compliance by the engine manufacturers in both model year 2002 and 2003, and achieve an average NOx emission standard of 6.0 g/bhp-hr for those vehicles which comply. It does not give the user any capability to change the compliance rates, the implementation schedule or the emission level of 6.0 g/bhp-hr.

Example:

```
NO NOX PULL AHEAD     :
```

This example directs MOBILE6 to NOT report the NOx off-cycle emission Pull Ahead effects.

Tips: Care should be taken when using this command since it disables EPA’s best estimates for the effect of the NOx off-cycle emissions mitigation strategy called

Pull Ahead. The command also has interactive effects with the "NO DEFEAT DEVICE" command, and should not be used in conjunction with this command.

2.8.11.2.c

Name: NO REBUILD

Status: Optional.

Section: Run.

Description: This command allows the user to turn off the effects of the Rebuild mitigation program used to reduce heavy-duty diesel vehicle NOx off-cycle emissions. It affects only NOx emissions from vehicle classes 17 through 23, and has an appreciable emission effect only on vehicle classes 22 and 23. It also only affects the NOx emission results from model years 1993 through 2003.

Default: MOBILE6 uses national estimates to report the effects of off-cycle NOx emissions Rebuild program for heavy-duty diesel vehicles. The default setting for this command is to include these effects at an effectiveness rate of 90%. IT IS RECOMMENDED THAT MOST USERS DO NOT USE THE 'NO REBUILD' COMMAND.

Explanation: EPA's best estimate for the effects of heavy-duty vehicle NOx off-cycle emissions and the effects of the EPA Rebuild mitigation program have been programmed into MOBILE6 as the default input. The Rebuild program modeled by MOBILE6 is the best estimate at the time of the release of MOBILE6 of what the actual program will achieve. It was assumed to have an effectiveness rate of 90 percent, cover 1994 through 2003 model years, begin after five years of service for class 8a and 8b trucks and 12 years for medium duty diesel trucks, and rebuild engines to a standard of 6.00 g/bhp-hr. The command does not give the user the ability to change any of these parameters. The effective parameter (90%) can be changed with the REBUILD EFFECTS command.

Example:
```
NO REBUILD    :
```

This example directs MOBILE6 to NOT report the NOx off-cycle emission Rebuild program effects.

Tips: Care should be taken when using this command since it disables EPA's best estimates for the effect of the NOx off-cycle emissions mitigation strategy called Rebuild. The command also has interactive effects with the "NO DEFEAT

DEVICE" command, and should not be used in conjunction with this command. This command also cannot be used in conjunction with the command REBUILD EFFECTS

2.8.11.2.d

Name: REBUILD EFFECTS

Status: Optional.

Section: Run.

Description: This command allows the user to change the Rebuild program effectiveness rate used to reduce heavy-duty diesel vehicle NOx off-cycle emissions. It affects only NOx emissions from vehicle classes 17 through 23, and has an appreciable emission effect only on vehicle classes 22 and 23. It also only affects the NOx emission results from model years 1993 through 2003.

Default: MOBILE6 uses national estimates to report the effects of off-cycle NOx emissions Rebuild program for heavy-duty diesel vehicles. The range of legal values for this input parameter are 0.01 to 0.90. The default setting for this command is to include these effects at an effectiveness rate of 90%. IT IS RECOMMENDED THAT MOST USERS DO NOT USE THE 'REBUILD EFFECTS' COMMAND.

Explanation: EPA's best estimate for the effects of heavy-duty vehicle NOx off-cycle emissions and the effects of the EPA Rebuild mitigation program have been programmed into MOBILE6 as the default input. This default effectiveness level is 90 percent.

Example:
```
REBUILD EFFECTS    : 0.50
```

This example directs MOBILE6 to use a rebuild effectiveness of 50%.

Tips: This command allows the user to vary the Rebuild Effectiveness to perhaps better fit a local situation. However, it is unlikely that most users will have good local data on this parameters, and are thus, encouraged to not use it.

2.8.11.3 Tier 2 Emission Standards and Fuel Requirements

The following commands override default settings for the Tier 2 emission standards and fuel requirements.

2.8.11.3.a

Name: NO TIER2

Status: Optional.

Section: Run.

Description: This command allows the user to disable the Tier 2 emission standards and fuel sulfur requirements.

Default: MOBILE6 accounts for the Tier 2 emission standards and fuel requirements if the user does not use the NO TIER2 command.

Explanation: Use of the NO TIER2 command causes MOBILE6 to calculate emission factors without the effects of the Tier 2 standards. MOBILE6 will continue modeling the NLEV vehicle and truck program through 2050 with the default fuel sulfur levels for calendar year 2000 (300 ppm for conventional gasoline, 150 ppm for reformulated gasoline).

Example: NO TIER2 :

2.8.11.3.b

Name: T2 EXH PHASE-IN

Status: Optional.

Section: Run.

Description: This command allows the user to replace the default phase-in fractions (by certification bin) for the Tier 2 exhaust emission standards, allowing different phase-in schedules to be modeled. This command is also necessary to model the exhaust emission effects of California's LEV II requirement.

Default: MOBILE6 uses the default Tier2 certification standard phase-in schedule.

Explanation: The input file used in conjunction with the T2 EXH PHASE-IN command must begin with T2 EXH PHASE-IN on the first line. Beginning with the second line, the input file contains a comma-delimited data matrix of 12 columns by 180 rows. The columns reflect model years 2004 through 2015, inclusive. The rows reflect phase-in percentages by a) 12 certification bins, b) 3 pollutants (HC/CO/NOx), and c) 5 light-duty vehicle classes (LDV/LDT1/LDT2/LDT3/LDT4). For example, the first 12 rows of the matrix contain bins 1-12 for LDV HC; the second 12 rows contain bins 1-12 for LDV CO; the third 12 rows contain bins 1-12 for LDV NOx; the fourth 12 rows contain bins 1-12 for LDT1 HC, etc.

In terms of model operation, each fraction must be between zero and one, (inclusive). The sum of the phase-in fractions must be between 0.999 and 1.001 (inclusive) for a given vehicle class, model year, and pollutant, or the input data will be rejected and the previously stored values will be used. An error message will be generated when the user-supplied input for the alternate Tier2 phase-in fractions has been rejected. Beyond model execution, the user must ensure that alternate phase-in assumptions for the Tier 2 requirement satisfy the fleet-average and minimum phase-in provisions of the Tier 2 rule; MOBILE6 does not check for the latter condition. As discussed in the MOBILE6 technical report M6.EXH.004, the Tier 2 requirement contains 10 actual certification bins; 8 "final", and 2 "interim". Bins 1-8 are the final bins (lowest standard to highest), and Bins 9-10 are the interim standards. Under the default scenario of MOBILE6, Bins 11-12 are used only to account for provisions of the HC interim standards for LDT3s and LDT4s which necessitate multiple standards being assigned to one bin. The user can "activate" these bins through the T2 CERT command (discussed in section 2.8.11.3.d).

Under the default condition, the certification standard for Bin 1 is 0. However, zero-emitting vehicles (ZEVs) should not be assigned to this bin, because overall emissions as calculated by MOBILE6 will not be zero. Instead, the user would need to specify the percentage of ZEVs under the 94+ LDG IMP command discussed in section 2.8.11.4, and use the T2 EXH PHASE-IN command to apportion the non-ZEVs in Bins 2-10. In this scenario the non-ZEV phase-in fractions would have to be normalized in the input file containing the phase-in schedule so that they sum to one across vehicle class, model year, and pollutant.

Example: T2 EXH PHASE-IN : T2EXH.D

2.8.11.3.c

Name: T2 EVAP PHASE-IN

Status: Optional.

Section: Run.

Description: This command allows the user to replace the default phase-in fractions (by certification bin) for the Tier 2 evaporative emission standards, allowing different phase-in schedules to be modeled. This command is also necessary to model the evaporative emission effects of California's LEV II requirement.

Default: MOBILE6 uses the default Tier2 certification standard phase-in schedule.

Explanation: The T2 EVAP PHASE-IN command specifies an external input file containing values that will override the default Tier 2 phase-in fractions. The input file used in conjunction with the T2 EVAP PHASE-IN command must begin with T2 EVAP PHASE-IN on the first line. Beginning with the second line, the input file contains a comma-delimited data matrix of 12 columns by 5 rows. The columns reflect model years 2004 through 2015, inclusive. The rows reflect phase-in percentages by the 5 light-duty vehicle classes (LDV/LDT1/LDT2/LDT3/LDT4).

The input file called by T2 EVAP PHASE-IN will read in phase-in fractions for each light-duty vehicle type for model years 2004 through 2015, inclusive. Each of the phase-in fractions must be between zero and one, inclusive. The sum of the phase-in fractions must be between 0.999 and 1.001 (inclusive) for a given vehicle, model year, and pollutant, or the input data will be rejected and the previously stored values will be used. An error message will be sent to the descriptive output when the user supplied input for the alternate Tier2 phase-in fractions has been rejected.

If modeling the effect of zero-emitting vehicles (ZEVs), the user needs to specify the percentage of ZEVs under the 94+ LDG IMP command discussed in section 2.8.11.4, and use the T2 EVAP PHASE-IN command to assign the phase-in schedule for non-ZEVs. In this scenario the non-ZEV phase-in fractions have to be normalized in the input file containing the phase-in schedule so that they sum to one across vehicle class and model year.

Example: T2 EVAP PHASE-IN : T2EVAP.D

2.8.11.3.d

Name: T2 CERT

Status: Optional.

Section: Run.

Description: This command allows the user to specify alternative Tier 2 50,000 mile certification standards and must be used to model the effects of California's LEV II requirement. Since the standards under the Tier 2 rule are final and therefore static, the intended use of the this command is to model the effects of California's LEV II program.

Default: MOBILE6 uses the default Tier2 certification standards.

Explanation: The T2 CERT command is used to specify an external input file containing values that will override the default Tier 2 certification standards. The input file called by T2 CERT will read in 50,000 mile certification standards for each of the 10 certification "bins" (interim and final) for each light-duty vehicle type (Classes 1 through 5) and pollutant (HC, CO and NOx). The Tier 2 requirement contains 10 actual certification bins; 8 "final", and 2 "interim". Bins 1-8 are the final bins (lowest standard to highest), and Bins 9-10 are the interim standards. Under the default scenario of MOBILE6, bins 11-12 are used only to account for provisions of the HC interim standards for LDT3s and LDT4s which necessitate multiple standards being assigned to one bin. The user can "activate" these bins through the T2 CERT command, a necessary step for modeling the California LEV II program.

The alternate certification standards supplied under T2 CERT are checked to ensure that they are greater than or equal to zero. Negative values or missing values result in all user supplied input values being rejected. An error message will be sent to the descriptive output when user supplied input has been rejected.

T2 CERT requires an external file which supplies alternate 50,000 mile exhaust certification standards for Bins 1-12.

The input file used in conjunction with the T2 CERT command must begin with T2 CERT on the first line. Beginning with the second line, the input file contains 3 separate comma-delimited data matrices of 5 columns by 12 rows. The columns reflect 5 light-duty vehicle classes (LDV/LDT1/LDT2/LDT3/LDT4). The rows reflect Bins 1-12. Each matrix represents a pollutant (HC, CO, NOx), and is

separated by a space. The entries in each matrix "cell" are the 50,000 miles certification standard for the appropriate bin, vehicle class and pollutant.

Example: T2 CERT: T2CERT.D

2.8.11.4 Alterative Schedule for 1994 and Later Model Year Light Duty Gasoline Vehicle Standards

Name: 94+ LDG IMP

Status: Optional.

Section: Run.

Description: This command allows the user to input optional 1994 and later fleet penetration fractions for light-duty gasoline vehicles under the Tier 1, NLEV (or California LEV 1), and Tier 2 emission standard programs.

Default: MOBILE6 uses the default certification standard phase-in schedule for the Tier 1, NLEV and Tier 2 programs.

Explanation: This command allows for optional user input of light-duty gas 1994+ model year emission standard implementation values. These values are fleet penetration fractions of the eleven vehicle certification standard categories under the Tier 1, NLEV (or California LEV I), and Tier 2 vehicle emission programs. For a given model year and light-duty gas vehicle type the eleven fractions must add up to 1.000. The standards types are:

1. Tier0
2. Intermediate Tier1
3. Tier1
4. Tier2
5. Intermediate TLEV
6. TLEV
7. Intermediate LEV I
8. LEV I
9. Intermediate ULEV I
10. ULEV I
11. ZEV (zero emitting vehicle)

It should be noted that the category “Tier 2" under this command only denotes the fraction of light-duty vehicles and trucks participating in the Tier 2 program. The full “bin” implementation of the Tier 2 vehicle program (or LEV II program) would be modeled using the Tier 2 input commands discussed in Section 2.8.11.3. However, this command must be used to model the effect of zero-emitting vehicles under the LEV I or LEV II programs.

MOBILE6 does not have separate emission estimates for the intermediate useful life standards. The “intermediate” standard level categories use the emission estimates for the final category; e.g., Intermediate Tier1 type uses the Tier1 emission level.

The input file used in conjunction with the 94+ LDG IMP command must begin with 94+ LDG IMP on the first line. After this, the required data are divided into 5 blocks, one each for LDGV, LDGT1, LDGT2, LDGT3, and LDGT4. In each data block there is one data line for each calendar year from 1994 to 2025. Each line contains the phase-in values for that year for the 11 different vehicle standards categories, according to the list above. Those values for a given model year and vehicle type must sum to 1. The data for a given row (model year and vehicle type) must use the following FORTRAN fixed format:

F5.3,10(1X,F5.3)

Example: 94+ LDG IMP : P94IMP.D

2.8.11.5 2007 Heavy Duty Vehicle Emissions Reductions

The following command overrides the default settings for the 2007 Heavy Duty Vehicle emission standards.

Name: NO 2007 HDDV RULE

Status: Optional.

Section: Run.

Description: This command allows the user to disable the 2007 heavy duty vehicle emission standards.

Default: MOBILE6 will account for the 2007 heavy duty vehicle emission standards if the user does not use the NO 2007 HDDV RULE command.

Explanation: Use of the NO 2007 HDDV RULE command causes MOBILE6 to calculate emission factors without the effects of the 2007 heavy duty vehicle emission standards. These standards and the associated lower sulfur diesel fuels will begin effecting emissions in 2008 and will be fully implemented in all vehicles manufactured in 2009 and subsequent years. The interplay of this command with the NO TIER2 command is illustrated in the Tables below.

Example: `NO 2007 HDDV RULE :`

Effects of Applying the NO HD2007 RULE and NO TIER2 Commands On Heavy Duty Gasoline Vehicle Emissions

GASOLINE FUELED HEAVY TRUCKS		
NO TIER2	**NO HD2007**	
Not Applied	Not Applied	EXHAUST: This is the default case with emissions reduced starting in 2005 according to the 2005 heavy duty rule and any Tier2 effects. Another reduction in 2008 which accounts for phase in of the heavy duty 2007 rules. The last reduction is in 2009. EVAPORATIVE: This default case includes the effects of Tier2 and the heavy duty vehicle (HDV) rules.
Applied	Not Applied	EXHAUST: In this case only the 2007 heavy duty step-wise emissions reductions occur in 2008 and in 2009. There are no emissions reductions in the earlier years, 2005 through 2007. This essentially removes any Tier2 and 2005 heavy duty rule emissions reductions. EVAPORATIVE: This shuts off the effects of HDV and Tier2 rules.
Not Applied	Applied	EXHAUST: Except for the HDG2B's, a single step-wise reduction occurs in 2005 which is equivalent to the default reduction in 2005 for each particular vehicle type. This reduction is due to the 2005 rule. No further reductions occur in subsequent years. The HDGV2B's are reduced according to the 2005 rule and Tier2 effects. The Tier2 effects are applied to a subset of HDGV2B's, i.e., medium duty passenger vehicles. EVAPORATIVE: This shuts off the effects the HDV and Tier2 rules.
Applied	Applied	EXHAUST: No emissions reductions occur. This combination of commands effectively shuts off the Tier2 and both heavy duty vehicle rules. The emissions rates for all years subsequent to 2004 remain at the 2004 levels. EVAPORATIVE: This shuts off the effects of the HDV and Tier2 rules.

Effects of Applying The NO HD2007 RULE and NO TIER2 Commands On Heavy Duty Diesel Vehicle Emissions

DIESEL FUELED HEAVY TRUCKS		
NO TIER2	**NO HD2007**	
Not Applied	Not Applied	This is the default case with two step-wise emission reductions. The first starting in 2004. The second reduction is in 2007. This second reduction is due to the 2007 heavy duty diesel rule.
Applied	Not Applied	This is the same as the default case.
Not Applied	Applied	This command removes the 2007 heavy duty diesel rule. A single reduction occurs which goes into effect in 2004. These reduced emission rates begin in 2004 and remain in effect for all years proceeding 2004. These emission rates are identical to those that take place in 2004 for the default case.
Applied	Applied	This is the same as the above case whereby emissions are reduced in 2004 and remain at that level for all subsequent model years.

CHAPTER 3

MOBILE6 OUTPUTS

3.0 INTRODUCTION

This chapter describes the output that can be produced by the MOBILE6 highway vehicle emission factor model. There are four basic kinds of output:

1. The Database Output Report.
2. The Descriptive Output Report.
3. Warning and Error Messages.
4. User Screen Dialog.

The database output report contains detailed emission results in a form suitable for use with database management or spreadsheet software.

The descriptive output report contains summary-level emission results in a format suitable for printing. This report also contains any warning or error messages pertaining to user-supplied input values.

During execution of the MOBILE6 program, a few simple prompting and status messages are displayed on the computer screen. Certain error messages related to the interaction between the computer software operating system and the MOBILE6 program might also appear on the screen.

3.1 DATABASE OUTPUT REPORT

The user can (by using the DATABASE OUTPUT command) create a tab-separated variable, ASCII text file, which can then be imported into various database or spreadsheet programs. Database output is not produced unless this command is specified in the Header section of the command input file. By default, the database output file is given the base name of the command input file with a ".TB1" file name extension. The user can give the file any desired DOS file name by using the EMISSIONS TABLE command.

3.1.1 Database Output Formatting Options

The database output has three forms. The first is the default form in an hourly format, which reports all emission factors for each hour of the 24-hour day. This output is often quite voluminous and is suitable only for use with database management software. The second form is

a daily format, which summarizes the hourly information into emission factors pertaining to the entire 24-hour day. This significantly reduces the amount of output produced and often produces output that can be analyzed with spreadsheet software. The third form is aggregated format, which aggregates the daily results into values similar to those reported in the descriptive output option. By default (assuming the DATABASE OUTPUT command has been specified), MOBILE6 produces the hourly format. The DAILY OUTPUT or the AGGREGATED OUTPUT command can be specified in the Header section of the command input file to produce the daily or aggregated database format instead. The user cannot specify both the DAILY OUTPUT and the AGGREGATED OUTPUT commands in the same MOBILE6 input file.

By default, the database output table, whether in hourly, daily, or aggregated format, is a purely "flat" file, in which every record has the same format and contains only result information. The WITH FIELDNAMES command can be used to add an initial record to the database output file containing short names for each column of information it contains.

The hourly database output file contains 22 fields; the daily format contains 18 of these. The aggregated format contains only 13 fields. The fields can be divided into three groups: key fields, echoed fields, and calculated fields. In the following section, command input refers to non-batch input.

3.1.1.1 Key Fields

These nine key fields serve, in combination, to uniquely identify a particular record in the output.

1.35 File Number (FILE). The number of the command input file, beginning with 1. Batch input files may contain more than one command input file.

1.36 Run Number (RUN). The run number within the input file, beginning with 1. Command input files may contain multiple runs.

1.37 Scenario Number (SCEN). The scenario number within the run, beginning with 1.

Runs may contain multiple scenarios.

1.38 Hour of the Day (HOUR). 1 through 24. Hour "1" begins at 6:00 a.m. and extends until 7:00 a.m.. This field is not present in the daily or aggregated format.

1.39 Vehicle Type (VTYPE). Values 1 through 28 as shown Table 3, Appendix B.

1.40 Vehicle Age in Years (AGE). 0 through 24. This age is relative to the calendar year for which the scenario is being run. Age value 24 represents vehicles of age 24 or more. This field is not present in the aggregated format.

1.41 Pollutants (POL). Values of 1 through 3.

1. HC
2. CO
3. NO_x

1.42 Emission Types (ETYPE). Values of 1 through 8.

1. Exhaust emissions nominally from running operations, including start emissions from heavy-duty vehicles. (All exhaust emissions not included in type 2 below.)
2. Exhaust emissions from the engine start operations of light-duty vehicles and motorcycles.

NOTE: Emission types 1 and 2 are used somewhat differently in the database output than in the descriptive output, in which the exhaust emissions of heavy-duty vehicles are reported only as "composite" exhaust results, not as either start or running.

3. Evaporative emissions from hot soak conditions.
4. Evaporative emissions from diurnal conditions.
5. Evaporative emissions from resting loss conditions.
6. Evaporative emissions from running loss conditions.
7. Evaporative emissions from crankcase emissions.
8. Evaporative emissions from refueling conditions.

This field is not present in the aggregated format.

1.43 Roadway or "Facility" Types (FTYPE) (1 through 5).

1. Freeway.
2. Arterial.
3. Local.
4. Ramp.
5. None or "not applicable" (e.g., for emissions independent of facility type, such as engine start emissions and most evaporative emission types.)

This field is not present in the aggregated format.

3.1.1.2 Echoed Fields Carried To Output From Input

Eleven fields of the database output are "echoed" from MOBILE6 inputs. It is important for users to understand that these information items are not substantively calculated or modeled by MOBILE6—they are essentially independent rather than dependent variables. They are provided in the database output to facilitate conversion of the emission factor results into alternative units, such as grams per engine start, grams per gallon, and so on. These fields also are provided to facilitate the calculation of average emissions for nonstandard combinations of vehicle types.

The "echoed" fields include the following:

- STARTS: The average number of engine starts per vehicle in the time period (hour or day) represented by the record.

- ENDS: The average number of trip ends per vehicle in the time period (hour or day) represented by the record. The number of trip ENDS is generally less than the number of STARTS because very short periods of engine operation are not considered a "trip" by MOBILE6 in calculating hot soak emissions.

- MILES: Miles traveled per vehicle of this type and age in the time period (hour or day) represented by the record.

- MPG: Miles per gallon per vehicle of this type. Note: For motorcycles and diesel-fueled vehicles, a value of "0.0" is output, indicating that MOBILE6 does not have this information.

- HRVMT: Percentage of daily vehicle miles traveled, for all vehicles combined, in the hour to which this record pertains. This field is not present in the daily or aggregated database output.

- FACVMT: Percentage of vehicle miles traveled in the time period (day or hour) represented by this record on the indicated facility (roadway type). This field is not present in the aggregated format.

- REG_DIST: Percentage of vehicles of this type (from VTYPE field) that are of this age (from the AGE field). This field is not present in the aggregated format.

- VCOUNT: Number of vehicles of each VTYPE used by MOBILE6 to calculate these results. Note: The absolute number of vehicles is not significant in

MOBILE6, which expresses all emission results on a per-vehicle basis. Ratios or percentages of VCOUNT numbers can be useful, however, when combining vehicle classes. This field is not present in the aggregated format.

- AMBTEMP: Ambient temperature during this hour expressed in degrees Fahrenheit. This field is not present in the daily output format or the aggregated format.

- DIURTEMP: Temperature used for diurnal evaporative emission calculations during this hour, expressed in degrees Fahrenheit. Normally, this equals AMBTEMP, but it may differ if the user has supplied alternate hourly temperature information. This field is not present in the daily or aggregated output format.

- MYR: Model Year. This is calculated as Calendar Year - Age. This field is not present in the aggregated output.

- The aggregated output includes an echoed field—the fraction of vehicle miles traveled (VMT)—which is not included in either the hourly or daily format.

- The aggregated output includes another echoed field—calendar year (CAL_YEAR)—which is not included in either the hourly or daily format.

3.1.1.3 Calculated Fields

These two fields are calculated by the MOBILE6 model.

- G_MI: Emissions of the given emission type and pollutant on the given facility (roadway) type during the given time period (hour or day) in grams per mile per average vehicle of the given type (e.g., LDGV) and age.

- G_HR or G_DAY: Emissions of the given emission type and pollutant on the given facility (roadway) type in grams per hour or day per average vehicle of the given type and age.

NOTE: These calculated values are emission rates. They are not simple mass values that can easily be summed up. Calculations that involve combinations of these values require that proper weighting factors are used.

In the aggregated format option, the content of the calculated fields can be controlled by the DATABASE EMISSIONS and NO REFUELING commands. By default, the aggregated

results are the sum of all emissions for all vehicle ages and roadway types. Using the DATABASE EMISSIONS or NO REFUELING command, the emission types included in the aggregated results can be restricted.

3.1.2 Database Output Structure

The database output file is a highly "flattened" table structure. As a result, many of its non-key field values do not depend upon all of its key fields. In database design terms, the table is not "normalized" because it violates the rule for "second normal form." Users should understand these field dependencies (or the lack of them) when working with the database output tables. All of the non-key fields depend upon FILE, RUN, and SCEN. Beyond this, their dependencies are as follows:

- CAL_YEAR depends upon no other field.
- STARTS and ENDS depend only upon HOUR (if present), VTYPE, and AGE (though the default input does not vary by age).
- MILES depends only upon HOUR (if present), VTYPE and AGE.
- MPG depends only upon VTYPE and AGE.
- HRVMT depends only upon HOUR.
- FACVMT depends only upon HOUR (if present), VTYPE, and FTYPE.
- REG_DIST depends only upon VTYPE and AGE.
- VCOUNT depends only upon VTYPE.
- AMBTEMP and DIURTEMP depend only upon HOUR.
- G_MI, G_HR and G_DAY depend upon all the key fields.
- VMT depends upon VTYPE.
- MYR depends upon AGE.

3.1.3 Restricting the Set of Database Output Records Produced

If users request hourly database output and do nothing to restrict which records are produced, MOBILE6 produces a truly huge output file (about 35 megabytes per scenario). Therefore, users are advised to limit their requested data by using commands that restrict the set of output records produced.

The POLLUTANTS command limits which of the three pollutants records are produced and affects the descriptive output.

The DATABASE AGES command specifies which of the 25 vehicle ages are reported in the hourly or daily database output formats.

The DATABASE EMISSIONS command specifies which of the eight emission types records are produced.

The DATABASE FACILITIES command specifies which of the five values of facility type records are produced.

The DATABASE HOURS command specifies which of the 24 hours are reported in the hourly format of the database output.

The DATABASE VEHICLES command specifies which of the 28 vehicle types records are produced.

The DATABASE YEARS command specifies which of the 25 model years, based on the calendar year chosen, are reported in the hourly or daily database output formats.

The DAILY OUTPUT command may be used to produce output in which the hourly data is aggregated to the daily level (see Section 2.8.5.1.j). This reduces the volume of the database output by a factor of about 30. Any combination of the above commands can be used.

The AGGREGATED OUTPUT command option allows the user to further aggregate the daily results by age, roadway, and emission type. This reduces the number of data lines per scenario to a maximum of 84 lines (not including the optional field names). This can be further reduced by restricting the vehicle classes and the pollutants to be written using the DATABASE VEHICLES and POLLUTANTS commands.

3.2 DESCRIPTIVE OUTPUT

The default output for MOBILE6 is a basic descriptive output report that includes (following any error or warning messages and some introductory scenario identifying information) only the composite emission rates calculated for the eight basic vehicle classes. Several of these classes are combinations of individual vehicle classes and are explained later in this section.

By default, the descriptive output file is given the base name of the command input file with a ".TXT" file name extension. The user can give the file any desired DOS file name with the REPORT FILE command.

A sample MOBILE6 descriptive output file is shown below in Figure 1:

Figure 1

```
*****************************************************************************
* MOBILE6 Draft (28-Aug-2000)                                               *
* Input file: TESTAIR4.IN (file 1, run 1).                                  *
*****************************************************************************
  M603 Comment:
              User has disabled the calculation of REFUELING emissions.

* # # # # # # # # # # # # # # # # # # # # # # # #
*
* File 1, Run 1, Scenario 1.
* # # # # # # # # # # # # # # # # # # # # # # # #
  M 48 Warning:
              there are no sales for vehicle class HDGV8b

                    Calendar Year:  2000
                            Month:  Jan.
                         Altitude:  Low
               Minimum Temperature:   60. (F)
               Maximum Temperature:   84. (F)
                  Nominal Fuel RVP:  11.5 psi
                     Weathered RVP:  11.2 psi
               Fuel Sulfur Content:  300. ppm

                       I/M Program:  No
                       ATP Program:  No
                  Reformulated Gas:  No

               Following assumptions made for air conditioning adjustments:
                   Absolute Humidity:   75. grains/lb
                   Sun rise at  600; Sun set at 2100
                   Peak sun occurring between 1000 and 1600.
                   Fraction of cloud cover equal to  0.00

      Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT      HDGV      LDDV      LDDT      HDDV        MC   All Veh
              GVWR:                <6000     >6000     (All)
                     ------    ------    ------    ------    ------    ------    ------    ------    ------    ------
  VMT Distribution:     0.494     0.283     0.097               0.036     0.001     0.002     0.081     0.006     1.000
 ---------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
    Composite THC :      2.45      2.57      3.92      2.92      3.30      0.76      0.92      0.82      2.93     2.524
    Composite CO  :     29.38     35.34     49.07     38.84     36.05      1.77      1.65      4.25     14.73    30.997
    Composite NOX :      1.33      1.46      1.85      1.56      5.10      1.81      1.81     18.47      1.25     2.948
 ---------------------------------------------------------------------------------------------------------------------
```

The main portion of the report is essentially a table with rows that represent different kinds (or combinations of kinds) of emissions and columns that are vehicle types (or combinations of vehicle types). This information is at a much more summary level than in the database output. In particular, the descriptive output values are always aggregates, derived from the sum of hour, facility (roadway) type, and age. However, if detailed information is needed by hour, facility (roadway) type, or age, then the database output must be used. A detailed description of the meaning of these terms is found in Section 3.1.

3.2.1 Descriptive Output Formatting Options

Users can suppress calculated descriptive outputs by including an optional command, NO DESC OUTPUT, in the Header portion of the command input file. The user must specify in this case that database output be produced. Otherwise, the model will run without reporting any results.

Users can produce an expanded list of exhaust emission rates (engine start and running) by including an optional run-level command, EXPAND EXHAUST, in the command input file. These values are in addition to the basic descriptive output of composite emission rates. The start and running exhaust emissions are split for only the LDVs and LDTs. A total exhaust line is also printed that is the simple sum of the start and running exhaust emissions. The total exhaust differs from the composite for any HC output for gasoline vehicles. This is because the composite values include evaporative emissions, while the total exhaust values do not.

Users can produce expanded rows detailing the evaporative emissions by type by including the optional run-level command, EXPAND EVAP, in the command input file. These values are in addition to the basic descriptive output of composite emission rates.

Users can produce an extra descriptive page of light-duty truck emission rates by weight (LDGT1, LDGT2, LDGT3, LDGT4, LDDT12, and LDDT34) by including an optional run-level command, EXPAND LDT EFS, in the command input file. The user will get the basic descriptive output (composite) emission rates for these vehicle classes. This additional page will also be affected by the user options for expanded exhaust or evaporative emissions, as well as by user options controlling pollutants and speciation.

Users can produce an extra descriptive page of heavy-duty gasoline fueled truck emission rates by weight by including an optional run-level command, EXPAND HDGV EFS, in the command input file. Users will get the basic descriptive output (composite) emission rates for these vehicle classes. This additional page will also be affected by user options for expanded exhaust or evaporative emissions, as well as by user options controlling pollutants and speciation.

Users can produce an extra descriptive page of heavy-duty diesel-fueled truck emission rates by weight by including an optional run-level command, EXPAND HDDV EFS, in the command input file. Users will get the basic descriptive output (composite) emission rates for these vehicle classes. This additional page will also be affected by user options for expanded exhaust or evaporative emissions, as well as by user options controlling pollutants and speciation.

Users can produce an extra descriptive page of diesel- and gasoline-fueled bus emission rates (both school bus and transit bus) by including an optional run-level command, EXPAND

BUS EFS, in the command input file. Users will get the basic descriptive output (composite) emission rates for these vehicle classes. This additional page will also be affected by user options for expanded exhaust or evaporative emissions, as well as by user options controlling pollutants and speciation.

Users can select which pollutants will appear in all of the descriptive output options by including an optional command, POLLUTANTS, in the Header portion of the command input file. This option will allow any combination of pollutants (e.g., HC and NO_x) and will suppress the output of pollutants not selected. The default is to include all pollutants (HC, CO and NO_x). It should be noted that not selecting HC when using the POLLUTANTS command will result in MOBILE6 not reporting any HC emissions, even if the user has specified the reporting of expanded evaporative emission rates.

Users may select which variety of HC emissions (THC, NMHC, VOC, TOG, and NMOG) will be calculated and reported in the descriptive output by including one of five optional run-level commands (EXPRESS HC AS ...) in the command input file. The default value for HC speciation will be VOC. The descriptive output labeling reflects the selection of species by the user.

3.2.2 Explanation Of Additional Items in the Descriptive Output

The descriptive output report includes a preliminary information section containing:

- Calendar year.
- Evaluation month.
- Altitude.
- Minimum and maximum temperatures.
- Nominal fuel RVP (user-supplied).
- Weathered RVP.
- Fuel sulfur content.

The minimum and maximum temperatures reported in this section are selected from the hourly temperatures—if the user supplies hourly temperatures. Otherwise, they are the values specified by the user with the MIN/MAX TEMP command.

The vehicle classes and combinations of classes that appear in the default descriptive output are listed below:

-- LDGV.

-- LDGT 1 and 2 together (LDGT 1-2).

-- LDGT 3 and 4 together (LDGT 3-4).

-- LDGT 1,2, 3, and 4 together (LDGT).

-- LDDV.

-- LDDT 1,2, 3, and 4 together (LDDT).

-- All HDGV and HDGB together (HDG).

-- All HDDV and HDDB together (HDD).

-- All 28 subtypes together: (All Vehicles).

All 28 sub-type classes (LDGV, LDGT1, LDGT2, LDGT3, LDGT4, HDGV2b, HDGV3, HDGV4, HDGV5, HDGV6, HDGV7, HDGV8a, HDGV8b, LDDV1-2,LDDT1-2, HDDV2b, HDDV3, HDDV4, HDDV5, HDDV6, HDDV7, HDDV8a, HDDV8b, MC, HDGB, HDDB-T, HDDB-S, LDDT3-4.) can appear, separately, in the descriptive output with the use of the EXPAND LDT EFS, EXPAND HDGV EFS, EXPAND HDDV EFS, and EXPAND BUS EFS commands.

Any comments that users place after the RUN DATA Command, beginning with the "greater than" symbol, are echoed immediately after the Run section and before any error or warning messages or any other type of program output. There are other options for users to annotate the output using comments in the command input file as explained in Chapter 2.

The Header is enclosed in a frame of asterisks (see Section 3.2, Figure 1). The eye-catching effect of the new Header can be very useful when paging through long output files.

An output line that is printed before each scenario that includes the file number, run number, and scenario number. Again, this feature can be very useful when going through large output files.

To obtain the "by-model-year" results, users must specify the database output (see Sections 2.8.5.1 and 3.1).

3.3 WARNING AND ERROR MESSAGES

Diagnostic messages are used to caution users concerning user-supplied information. They are written to an error message file or the descriptive output (.txt) file and are produced even if the NO DESC OUTPUT command has been specified.

There are three types of diagnostic messages: errors, warnings, and comments. Errors are reported to a file named m6error.txt. An error will in all cases terminate processing of the current scenario; in most cases, it will terminate processing of the entire run. In such cases, however, the program will print out all error messages for the run, not just the first one. Warnings and comments are included to help users interpret the results.

Error messages indicate either that invalid input data were entered into MOBILE6, or that MOBILE6 attempted to perform invalid operations. If the error message is due to an input value that is out of bounds, the range of acceptable values is also printed.

Warning messages indicate that MOBILE6 input data caused an operation not necessarily intended by the user, although the situation is not serious enough to necessarily be considered an error. Nonetheless, users should examine the warning messages to ascertain the conditions that were modeled because these may be different from what was expected.

Comments are a type of diagnostic warning message that are printed for the user's information. Neither warning nor a comment will stop a MOBILE6 run.

3.4 USER SCREEN OUTPUT

As the MOBILE6 program executes, a very simple textual display is produced on the computer screen. The program announces itself, including giving version date information, then prompts for a batch or command input file name. Once the user enters this information, the program displays some basic status information as it processes each scenario and run.

Of particular interest is that, following each run, a value labeled, "INERR", is shown. This value represents the total number of errors found processing the input data for that run. Normally, this value is zero. If a number other than zero is reported, detailed error messages will appear in the error message file and the descriptive output file.

CHAPTER 4

MOBILE6 INSTALLATION AND COMPUTER REQUIREMENTS

4.0 INTRODUCTION

This chapter contains technical information on how to install MOBILE6 that may be useful in implementing MOBILE6 on various computer systems. Although this chapter tries to make this information clear to novice computer users and veteran MOBILE model users, it cannot and does not attempt to train users on all aspects of every computer system. The user should be familiar with the system on which the MOBILE model is operated.

4.1 GENERAL INFORMATION

MOBILE6, the latest update to the highway vehicle emission factor model, is an official release of the U. S. Environmental Protection Agency's (EPA's) Office of Transportation and Air Quality (OTAQ), for use in State Implementation Plans and other official EPA business. MOBILE6 is provided without restrictions: the software application, source code, and all related files may be copied and distributed freely and may be used as a basis for other work. However, any unauthorized modifications to the program may nullify its usefulness for official EPA business.

4.2 PROGRAM AVAILABILITY

MOBILE6, along with the related external data files and the User's Guide document, is available directly from EPA via the OTAQ Web site:

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

All versions of the distributed MOBILE6 executable application will only run on DOS-based PCs. All Fortran source code and external data files are in ASCII text format. The User's Guide document is available in WordPerfect 8.0 for Windows and in Adobe Acrobat (PDF multi-platform) format. There is no fee for these files. As stated in the above section, MOBILE6 is provided without restrictions.

Removable media (e.g.., disks or CD-ROMs) containing this information may also be requested from EPA Regional offices or any of the other usual sources for EPA models. The model may also be requested directly from OTAQ:

MOBILE6 Model
U.S. EPA, OTAQ, ASD
2000 Traverwood
Ann Arbor, MI 48105-2498
(734) 214-4892
mobile@epa.gov

EPA has not prepared versions of MOBILE6 that can run on platforms other than DOS-based PCs. However, it should be possible to create executable applications for any platform, as long as a Fortran90 compiler application is available to the user for that platform. However, EPA cannot help users choose a compiler or run compiler software.

4.3 SYSTEM REQUIREMENTS

The executable DOS application version of MOBILE6 was compiled using the Lahey Fortran90 Version 4.0e compiler. The source code for this version of MOBILE6 is identical to the source code made available for other computer platforms. This is the platform that was used to develop the initial code for MOBILE6 and is the only executable application initially intended to be distributed.

MOBILE6 will require the minimum microcomputer hardware configuration for DOS machines:

IBM-compatible 80386 (or better, such as 80486 or Pentium).
At least 8 megabytes of RAM memory.
Math coprocessor chip (such as Intel 80387).

Microcomputers using the 80286 microprocessor will not be able to run the MOBILE6 model. Microcomputers using 80386- or 80486-based microcomputers without a math coprocessor also will not be able to run MOBILE6. MOBILE6 will probably not run in a DOS window of machines using the OS/2 operating system because earlier versions of MOBILE had this problem.

Because the scope of the MOBILE6 model has increased, the time required to run individual scenarios has increased compared with earlier versions. It is recommended that users consider the time it takes to execute runs of the model when selecting the appropriate machine for running MOBILE6. Using a 400-MHz Pentium machine, typical scenarios take about six seconds each. The time necessary to run the model using older, slower machines, may be intolerable. EPA recommends that only Pentium (or better) machines run MOBILE6.

Some individual computers may have a problem running MOBILE6 if the DOS PATH specification (in the AUTOEXEC.BAT file) is too long. A memory protection fault will likely result if the DOS PATH is longer than 260 characters. Reducing the DOS PATH specification will solve this problem.

Because some of these system requirements may be a result of the particular Fortran compiler that was used, users with Fortran compilers may attempt to compile the source code themselves to have greater control over the characteristics of the final executable application. Users should refer to their compiler software documentation for further guidance.

4.4 INSTALLATION

MOBILE6 does not include an installation application. The necessary directories must be created by the user, and the user must copy the appropriate files to the created directories. However, improper installation will not harm the files used by the model, although it may be necessary to relocate files to operate the model.

4.4.1 Basic Installation

The instructions presented in this section assume that 1) the user has obtained a complete set of MOBILE6-related files, 2) the files have been decompressed if necessary, and 3) the files have been placed in a set of directories as explained in this section.

To obtain a complete set of MOBILE6-related files, the user should consult the EPA OTAQ Web site at the URL listed in Section 4.2. The user may download the files from the Web site or obtain them from a third party, but the user should always consult the Web site for all the necessary files and for any updates in source code or documentation.

When downloaded, some of the files may be stored in a compressed, or "ZIP" format archive file. The compressed files must first be extracted from the archive file and decompressed before they can be used. Applications for this purpose are publically available, but obtaining and using those applications will not be discussed here.

The MOBILE6 program and related materials are distributed in the following DOS directory structure:

MOBILE6 (main folder)
- RUN (sub-folder)
  - EXAMPLES (in RUN sub-folder)
- UGUIDE (sub-folder)
- SOURCE (sub-folder)

The simplest installation procedure is to copy this entire structure to the user's hard drive. The instructions presented in this section assume that the user has created this directory structure and installed all MOBILE6 files to the appropriate directory.

4.4.1.1 The RUN Subdirectory—The Executable Program

The MOBILE6 executable application file will run from any directory on any available drive, as long as the appropriate external data files requested by user input are available to the application. However, for practical purposes, the user will probably want to locate commonly used files in the same directory as the executable application file to reduce the length of the combined file name and directory path name when specifying external data files in the input. The limitations are:

- The file, "LF90.EER", must reside in the same directory as the executable application file. This is an error description file used by the Lahey compiler, and MOBILE6 will automatically look for this file in the local directory if a Fortran error occurs. MOBILE6 will run without this file being available, but some error messages will be cryptic, making diagnostics difficult.

- All data and input files must have the read-only attribute set to "off." MOBILE6 will not read a file that has been set to read-only status. This attribute can be changed by the user through the file properties.

The only critical file necessary to run MOBILE6 is the executable application file itself ("MOBILE6.EXE") and the default example command input file, "MOBILE6.IN". The command input file does not need to reside in the same directory as the MOBILE6 application to be used. The files, "ASMDATA.D", and "TECH12.D", are also required to model the effect of I/M programs.

It is recommended that users install more than just the MOBILE6 application. In particular, it is recommended that users have the complete set of example inputs available for reference and for use as templates to create more complex command input files. Also, users will want a complete set of alternate external input files to use as templates for creating data inputs using local information. A set of alternate external data input files are provided with MOBILE6. These alternate example files are useful as templates for construction of external data files that contain local data. The example external input files are set up assuming that they are available in the same directory as the MOBILE6 application. As a result, these example external data files should all be placed in the directory containing the MOBILE6 executable application file. These files will not interfere with any other input files and will take effect only if invoked within a command input file. It is recommended that the user not change these files. If they are used as templates, a copy should be made with a different file name, and changes should be made to the copy. However, because they are invoked by the command input files, they must not be set at read-only status, or MOBILE6 will not read them.

4.4.1.2 The Examples Subdirectory

An additional subdirectory (i.e., EXAMPLES) should be created to contain example command input files. All of the example command input files provided should be placed in this

directory for reference. It is recommended that these files be read-only and not be changed. If they are used as templates, a copy should be made with a different file name, and changes should be made only to the copy. A complete list of the example command input files has been made available with the initial release of MOBILE6 and are available at the MOBILE6 Web page (http://www.epa.gov/otaq/m6.htm).

4.4.1.3 The UGUIDE Subdirectory

The MOBILE6 User's Guide is available electronically. Although it may be convenient to have a printed copy of the User's Guide, it is recommended that the user keep a copy of the electronic version of the User's Guide with the copy of MOBILE6. An additional subdirectory (e.g., UGUIDE) containing the MOBILE6 User's Guide files is recommended. There are two files:

UGMOB60.WPD,
UGMOB60.PDF.

4.4.1.4 The SOURCE Subdirectory

EPA will make the Fortran source code available for the final MOBILE6 application. This source code is provided so the user can recompile the application for different platforms and optimize the application for specific operating systems. However, unauthorized modifications to the program source code might nullify its usefulness for official EPA business. EPA cannot assist users in their choice of a compiler or with running compiler software. In most instances, users will not need to keep a copy of the MOBILE6 source code. It is not needed to run the application or understand how to run the model. It is not recommended that the user store the source code. However, if the user wishes to keep a local copy of the source code, it is recommended that a separate subdirectory (SOURCE) be created to keep the source code files.

4.4.2 Advanced Options

Users may want to share command input files and external data files to avoid duplication and confusion. This is possible by locating these files on a network (shared) drive. Because MOBILE6 allows file names to include drive and directory path information, users can share these files as long as they are properly identified in the command input file and specified in the keyboard entry of the file name. Some systems, however, specify shared drive locations differently for different users on the network. All users should share the same location designation and have simple access.

The MOBILE6 executable application file itself can be located on a shared drive. However, running MOBILE6 through a network will further slow the execution time. Because the MOBILE6 application file itself is not large and can be copied without restriction, it may make more sense to provide each user with their own copy on their local hard drive. The application itself does not change and does not need to be shared.

MOBILE6 cannot read directory names that are more than eight characters or contain characters that cannot be read by DOS. Some operating systems allow longer names and non-standard characters. Do not take advantage of these features.

4.5 RUNNING MOBILE6

MOBILE6 cannot run in a full interactive mode. The user must provide a text file (i.e., a command input file) containing control information (i.e., commands, data) that MOBILE6 uses to determine what sort of output to produce. If such a file does not exist, MOBILE6 will not run. The user should read Chapter 2 to learn more about how to create an appropriate command input file. MOBILE6 is also distributed with many example command and external input data files. Users may want to use these example files to test or practice using MOBILE6. The command and external input files must exist on a drive available to the user and must not be compressed or set to read-only status.

4.5.1 Basic Run

To execute the application in DOS mode, the user must invoke the application name at the DOS prompt by typing the name MOBILE6 and pressing the “enter” or “return” key. The program will return with a prompt:

“Enter the name of the Mobile6 input file:”

The file name the user enters will determine the source of input information used by MOBILE6. The user must enter the location of the input information and press the “enter” or “return” key. The program will prompt the user in the same way on all computer platforms. If the user enters an invalid or nonexistent file name, MOBILE6 will prompt the user for a valid file name. If the user leaves the entry blank and presses the “enter” or “return” key, MOBILE6 will quit. Valid file names are discussed in Section 4.5.5.

When using a version of Microsoft Windows, double clicking on the MOBILE6 application icon will start a DOS window that will include the DOS prompt described above. The user will then enter the input information the same way as if running MOBILE6 from DOS.

MOBILE6 has been written to attempt to make use of the ability of DOS-based machines to access information that does not reside in the local directory. As a result, any time the MOBILE model asks for a file name, the user may also supply a DOS path with the file name. This will allow input and output file information to reside in directories other than the one in which MOBILE6 resides.

For example, the user has a command input file, “TEST.IN”, on their hard drive at the location:

c:\mobile6\run\test.in

When MOBILE6 is invoked, the prompt will ask for the location of the command input file. The user should enter the full drive, path, and file name. It will not matter where the MOBILE6 application is located or where the command input file is located, as long as the full drive, path, and file name is entered when prompted.

Windows users can place "shortcuts" to the MOBILE6 application in convenient locations (e.g., the desktop) to make it easier to invoke the MOBILE6 application. The name of the directory that contains the "MOBILE6.EXE" file can be added to the PATH statement in the "AUTOEXEC.BAT" file, which will allow MOBILE6 to be invoked from any directory when in DOS mode.

If the command input file is in a subdirectory of the directory that contains the actual MOBILE6 application (not a shortcut to the MOBILE6 application), then the full path name does not need to be used. This can reduce the amount of required typing by the user to enter the file name. For example, if the MOBILE6 application is in the directory, "c:\mobile6" (as in the example on page 130), then the file name can be entered (at the prompt) as:

run/test.in

MOBILE6 will search for a subdirectory of that name and locate the file there. The drive designation and the primary directory location are not needed. A slash (/) character may be substituted for the normal backslash (\) character for this purpose.

MOBILE6 will automatically label the output file names and choose file name extensions for the output files by default. For more information, see Section 4.5.3. This means that if the user does not specify the output file names and locations, all output will automatically be located in the same directory as the command input file. The output file names will also be the same as the command input file name, but with the different file name extensions. This feature allows users to run MOBILE6 without designating output file names. However, users can designate output file names and locations, which is discussed in Section 4.5.5.

Another feature allows even less typing. MOBILE6 expects that all command input files have a file name extension of ".IN". For example, the above command input file prompt can further be shortened to:

run/test

In this case, all output will be written to the "c:\mobile6\run" directory, and all output files will have TEST file names with different file name extensions (depending on the type of output).

4.5.2 Input

Any word processing software or text editor can create or modify the example MOBILE6 command and external input files to match user requirements. Editing an example command or external input file with careful reading of the relevant sections of Chapter 2 is the easiest way to ensure that the proper commands, locations, and formats are maintained. However, when using word processing software, the user should always save input files only as DOS text documents (ASCII text). MOBILE6 expects all input files to be in text. Converting and saving MOBILE6 input files as word processing documents will add hidden characters, which will not be properly processed by MOBILE6. Command and external input files that have been inadvertently converted to a word processing document can be recovered by saving the file again as a DOS text file. Simple text editors (such as Notepad) will not normally add unwanted characters to a file. Do not add hidden characters (such as tabs) to MOBILE6 input files because MOBILE6 cannot read them properly.

The user can determine if an input file has hidden characters by using the TYPE command available in DOS to list the input file to the screen. Any characters shown that were not intended to be in the file will likely cause problems when the file is read by MOBILE6. An example of the TYPE command, with an option to pause after each screen of characters would be:

TYPE <file name> | MORE

Most word processors and editors also have features that allow the user to see hidden characters. These features can also be used to identify and remove hidden characters.

When altering or creating MOBILE6 command or external input files, the user should know the rules for annotating the input and output text (described in Sections 2.6.3 and 2.7). MOBILE6 allows liberal inclusion of descriptive text in command and external input files and allows text to be added to the output via the command input file. EPA encourages users to take advantage of this feature.

4.5.3 Output

All results from MOBILE6 are written to ASCII text files. There are two basic output types: descriptive, and database. Descriptive output is appropriate to be printed and includes sufficient labeling and notation so it can be interpreted without extensive knowledge of MOBILE6. The database output is intended to be processed using applications such as database software or spreadsheets. Interpretation of the database output will require advanced understanding of MOBILE6. Both output options are described in more detail in Chapter 3.

By default, MOBILE6 uses two file name extensions, “.TXT” and “.TB1”. The descriptive output will be found in the file name with the “.TXT” extension. The database output will be found in the file name with the “.TB1” extension. For example, if the command input file

is named, “CASE1B3.IN”, then MOBILE6 will by default create output files, “CASE1B3.TXT” and “CASE1B3.TB1”, in the same directory. The user has the option to specify the file name of either output file. This feature is discussed in Section 4.5.5. EPA recommends that, like the example, the base of the output file names be the same as the base of the command input file name to avoid confusion when matching MOBILE6 results with the corresponding command input file that was used to create it. By default, output files are written to the same directory location as the command input file. This location can be altered by providing the output file name and indicating a different path for output file names.

The descriptive output file can be printed once it has been opened by an application such as a word processor. For best results, EPA recommends using non-proportional fonts (such as Courier font) because the output file design contains no formatting characters (such as tabs). Because the output is 120 characters wide, EPA recommends printing the pages in “landscape” format (11” by 8-1/2”), reducing the font size to 10 points, and setting both the left and right margins to 0.5 inches. In this case, the full width of the descriptive output should fit on a standard page. Because the length of the output is determined by a great variety of parameters, it is likely that the text of the output will run over several pages. EPA recommends that the user add automatic page numbering to the output document via options available in the application used for printing. A run and scenario number will be indicated in the text within the output itself.

The database output file is not intended to be printed. Unless the user specifies the WITH FIELDNAMES command in the Header section of the command input file (see Section 2.8.5.1.b), the database output will be an ASCII text file containing thousands of numbers and no text. EPA recommends that applications designed to process numbers be used to access this information, such as database, spreadsheet, or statistical applications. A detailed description of the content of the database output is found in Chapter 3.

4.5.4 Batch Input

Batch input is used to refer to the ability to run several command input files together with a single invocation of MOBILE6. Each command input file can contain several runs with multiple scenarios, and each scenario produces a separate result. In this way, many results can be obtained by either multiple runs in a command input file or by running multiple command input files using the batch option. Setting up a batch input file is described in Section 2.8.2.2.

Running a batch input file is done exactly the same as any input file. The first line of any MOBILE6 input file must contain the command that describes the type of in the file. A batch input file announces itself to the MOBILE6 program using the MOBILE6 BATCH FILE command. MOBILE6 will then process the input and output file names that it contains. For example, if the user created a batch input file with the name, “TESTBAT.IN”, at the file name prompt, the user could type:

run/testbat

This assumes that the “TESTBAT.IN” file is located in a subdirectory named RUN and that the MOBILE6 application is located in the directory that has the subdirectory RUN. None of the files (input or output) that are listed in the “TESTBAT.IN” file need to be in either directory as long as the path is included with each file name.

4.5.5 Input and Output File Names

Mobile6 input and output file names cannot contain more than eight characters, followed by a decimal and an optional three-character extension. The names must contain only valid DOS file name characters. If a batch or command input file name is not provided, MOBILE6 will assume that the input file name is MOBILE6.IN. The content of input files is discussed in Chapter 2.

MOBILE6 displays the names of both the command input file and the descriptive output file on the monitor screen before it processes the command input file. When processing a batch input file, the names of each of the command input files and the descriptive output files are displayed on the monitor screen before MOBILE6 begins to process each command input file. Database output file names are not displayed on the monitor screen.

The user may specify a name for any MOBILE6 output file or elect to have MOBILE6 assign a default name. By default, all output file names will use the same initial eight characters used in the input file name supplied by the user to name output files, but MOBILE6 will add extensions that indicate the type of output contained in each file.

- The extension, “.TXT”, is used for descriptive output files.
- The extension, “.TB1”, is used for database output files.

The content of output files is discussed in Chapter 3. Although the user can change the output file name, to avoid confusion, it is recommended that the names of all output files be the same (except for the three-character extensions) as the names of the command input files that were used to generate the results. This will make it easier to associate the resulting data with the appropriate command input file. This is the default case. However, there may be cases in which the user wishes the name and/or location of the output files to be different than that of the command input file that created them.

There are three ways to specify the output file names:

- Using the REPORT FILE and EMISSIONS TABLE commands.
- Adding the output file name after the input file name in batch input files.
- Adding the output file name after the input file name when running MOBILE6.

By default, if an output file name is not specified, the output file will be written to the same directory as the location of the command input file (as indicated in the path portion of the file name). If the user specifies an output file name but does not include a path—but the input file

names have a path—the output files will not be written to the same directory as the command input file. Instead, the output files will be written to the same directory as the MOBILE6 program. If the user wishes to have the output written to another directory, the path to the directory must be specified in the output file name. MOBILE6 will treat slashes (/) and backslashes (\) interchangeably in the path names.

The optional REPORT FILE command (see Section 2.8.4.1) can be used to name the descriptive output file, and the optional EMISSIONS TABLE command (See Section 2.8.5.2) can be use to name the database output file from within the command input file. The effect of both of these commands will be overridden if either of the other two options for naming output files is used.

Output file names can also be specified from within a batch input file. This is done by entering the desired output file name(s) following any corresponding command input file name. The user must leave at least one blank space between the input and output file names.

The output file name specified in a batch input file will take precedence over both the file name specified using the REPORT FILE command and the file name specified using the EMISSIONS TABLE command within the MOBILE6 input file named. Both the descriptive and database output file names will always use the default extensions for output files, regardless of the extension of the file name provided by the user after the file name prompt. As a result, only the eight-character name may be specified for the MOBILE6 output files in this manner. For example:

```
MOBILE6 BATCH INPUT
c:\town\input
c:\village\data.inp  c:\results\output.dat
run12
test/m6in  m6out
```

The results from the first command input file (“INPUT.IN”, located in the “c:\town” directory) will be written to the “INPUT.TXT” file (and “INPUT.TB1”), located in the “c:\town” directory. The results from the second command input file (file “DATA.INP”, located in the “c:\village” directory) will be written to the file, “OUTPUT.TXT” (and “OUTPUT.TB1”), located in the “c:\results” directory. Although the “.DAT” extension is used on the output file name, the extension is ignored by MOBILE6, and the default extensions (“.TXT” and “.TB1”) are used instead. The third command input file, “RUN12.IN”, must be located in the same directory as the MOBILE6 application because the user did not specify a path. The results will be written to the same directory and will have the default names, “RUN12.TXT”, and “RUN12.TB1”. The last example indicates that the command input file, “M6IN.IN”, must be located in the “\test” subdirectory of the directory in which the MOBILE6 program is located. The results will be written to the same directory as the MOBILE6 application and will have the default names, “M6OUT.TXT”, and “M6OUT.TB1”.

Alternatively, if a batch input file is not being used, the user can simply enter the desired output file name (with or without DOS path) following the user-supplied input file name when entering the command input file name in response to the initial "Enter the name of the MOBILE6 input file:" prompt. The user must leave at least one blank space between the input and output file names and may specify only an output file name if the command input file name has already been specified (i.e., not blank).

Both the descriptive and database output file names will use the default extensions for output files, regardless of the extension of the output file name provided by the user after the file name prompt. For example:

Enter the name of the MOBILE6 input file:
c:\city\data

Enter the name of the MOBILE6 input file:
c:\city\input.in c:\results\output

Enter the name of the MOBILE6 input file:
test/m6in m6out

The first example indicates that the input file ("DATA.IN") is located in the "c:\city" directory. The descriptive output file will be written to the "c:\city" directory and will be named, "DATA.TXT", and "DATA.TB1", if database output is specified. The second example indicates that the command input file ("INPUT.IN") is located in the "c:\city" directory. The descriptive output file will be written to the "c:\results" directory and will be named, "OUTPUT.TXT", and "OUTPUT.TB1", if database output is specified. The last example indicates that the command input file ("M6IN.IN") must be located in the "\test" subdirectory off the directory in which the MOBILE6 application is located. The results will be written to the same directory as the MOBILE6 application and will have the default names, "M6OUT.TXT", and "M6OUT.TB1".

4.5.6 Open Actions

The user may optionally specify open actions for output files. These actions dictate whether MOBILE6 creates a new output file or inserts modeling results into an existing output file. The legal open action options are APPEND and REPLACE. Both options create a new file if the specified output file name does not already exist. If the output file does already exist:

- The APPEND action adds new output to the end of the output file. Thus, results from previous MOBILE6 runs using the same output file name are retained.

- The REPLACE action deletes existing text in the output file so that only new modeling results are retained. REPLACE is the default open action.

To avoid confusion, it is recommended that the APPEND action be used only in special circumstances. This will ensure that the output files contain the results only from the most recent running of the associated command input file. These options may be entered in mixed case. If no open action is specified, the action will default to REPLACE.

To specify the open action, the user must enter both the command input file name and the output file name. The open action is entered on the same line, following the output file name. The open action must be separated from the output file name by at least one blank space and may be specified in mixed case.

4.6 MOBILE6 SOURCE CODE

The MOBILE6 model as released was written in standard Fortran90 computer language, using the ANSI X3.198-1992 standard published by the American National Standards Institute.

The source code is distributed in ASCII text files. Most subroutines and functions have been separated into separate text files, although some files may contain more than one function or subroutine. All subroutine and function files have the file name extension A*.FOR@. Files that have the extension "*.I" are "include" files, which contain information used in common blocks. MOBILE6 was compiled using an option (MAKE), which allowed the various subroutines to be compiled separately and "linked" at the end to make the executable application. The various function and subroutine files may be combined, if the user wishes, to reduce the number of files that must be compiled without affecting the results from the program.

The same source code (including all comment records) should be used for any installation of the model on any computer platform, with the exception of necessary changes in the input/output (I/O) device allocations for different platforms. There are 11 device assignments. The variable name used to represent the device assignment in the program code is listed below:

Description	Variable Name	Default Device Number
Control file input	(IOUGEN)	1
I/M parameters input	(IOUXIM)	3
I/M credit input	(IOUIMD)	4
Keyboard input	(IOUIN)	5
External data file input	(IOUALT)	7
Batch control file input	(IOBAT)	19
Program descriptive output	(IOUREP)	2
Error message output to file	(IOUERR)	2
Monitor screen output	(IOUOUT)	6
Program database output	(DBUNIT)	**51**
Unneeded output	(IOUNULL)	- 1

The device assignment variables are initialized in Block Data Subprogram 16. The device assignment variables are also reset in the "driver" program when the application is invoked.

The default setting for these devices are optimized for the DOS platform. If a user wishes to change the default settings, the settings should be changed at both locations. In earlier MOBILE versions, the system of using variable names for device assignments was not fully implemented. Every attempt has been made in MOBILE6 to use only the variable names above, with all initialization in the two locations listed. In general, it is prudent for users not to attempt to change the device settings unless it is absolutely necessary.

4.7 USING MOBILE6 ON OTHER COMPUTER PLATFORMS

If properly compiled and built, MOBILE6 will run the same way on all computer platforms and have all of the same options and capabilities. As a result, the same User's Guide may be used for all versions. There are some minor considerations that are platform-specific and are discussed in the remainder of this section.

In this section, “computer platform” means a specific combination of computer hardware version, operating system version, and Fortran compiler version.

An executable application of MOBILE6 is provided for only one platform, requiring typical Intel APC@ hardware and DOS operating system compatibility (section 4.3). Because the source code for all computer platforms is identical, a source code file available on one platform (such as DOS-based microcomputers) may be used on another platform (such as a mainframe computer or Unix system) as long as any appropriate changes for that platform are made to the device allocations. This will require the user to have access to a Fortran90 compiler capable of handling the MOBILE6 source code in order to re-create the executable application from the (altered) source code.

EPA cannot assist users in their choice of a compiler or with running compiler software. EPA will not be able to assist users with problems resulting from conflicts with the platform operating system.

The following are some considerations that might help for users who intend to create MOBILE6 executable applications for their own platforms.

4.7.1 Platform-Specific Differences

Users can generally expect to see MOBILE6 perform differently in two areas when used on different computer platforms. First, small differences in the model results will exist, and the second is a difference in the file names and paths that will be accepted.

There sometimes will be a negligible difference in the model results (the emission factors calculated by MOBILE6) when comparing results from different computer platforms. This can be the case even when the model is run on the same hardware using different compiler versions. This discrepancy is likely due to the number of significant digits that the computer system carries when doing calculations. The differences are usually small (less than one half of one percent), but they sometimes will show up in larger numbers in the last digit of MOBILE6 output. As a result, for the sake of consistency, comparison or mixing of results from MOBILE6 runs executed on different computer platforms is not recommended.

Although the MOBILE6 code accepts file names and pathway information up to 80 characters in length, some Fortran compilers are more restrictive, and some operating systems may allow file names and paths much longer than 80 characters. It is also important to note that some operating systems (e.g., Unix) use file names that are case-sensitive, while others interpret upper-case and lower-case letters as the same.

4.7.2 DOS Platform Differences

On systems with Intel hardware and the DOS operating system, the Fortran compilers available to EPA for development of the release version of MOBILE6 are not the only ones available. However, there are limits to the amount of exploration into compiler differences that can be done by EPA. It may be possible to recompile MOBILE6 source code using a different compiler to avoid limitations in the distributed version of MOBILE6. However, EPA cannot assist users in their choice of a compiler or with running compiler software.

4.7.3 Apple Macintosh Microcomputers

Macintosh operating systems use different default device assignments than DOS-based machines. This will likely require changes to the default device assignments in MOBILE6. In particular, the assignment of the keyboard input may be different. Below is the correct assignment for the keyboard input variable:

Keyboard input (IOUIN) Device 9

The location of files in the Macintosh operating system works differently than in DOS. As a result, it is recommended that all input and external data files be placed in the same folder as the MOBILE6 application. This way, only the file name (and not the path) is needed for the command input file prompt.

To execute the application, double click on the MOBILE6 icon or choose FILE OPEN from the system menu. A window will appear with the MOBILE6 standard prompts. The program will prompt the user in the same way on all computer platforms.

4.7.4 Mainframe, Unix, and Other Computers

As explained at the beginning of this section, the same source code (including all comment records) should be used for any installation of the model on any platform, with the exception of necessary changes in the input/output (I/O) device allocations for different platforms. It will be necessary for the MOBILE6 source code and other files to be uploaded to the target computer system from the Web site or other source.

The default device assignments for MOBILE6 will likely cause problems on some Unix computers. Although the Office of Transportation and Air Quality (OTAQ) has not run MOBILE6 on other computer platforms, the following comments have been received from users with Sun systems using the Unix operating system with earlier versions of MOBILE. The modifications discussed in this section are known to be useful only for Sun systems; other systems may require different device assignments.

Standard device assignments for the Sun machines are "5" for input, "6" for output, and "0" for error messages. This suggests that the following device assignments be made in the main program:

Keyboard input	(IOUIN)	Device 5
Control file input	(IOUGEN)	Device 11
Error message output to file	(IOUERR)	Device 0
Program descriptive output	(IOUREP)	Device 0

It is important to remember that other device assignments are used for data file input and program output. The complete list of device numbers in Section 4.6 should be examined for conflicts.

It is also important to remember that Unix operating systems are case-sensitive, so external data file names entered as part of the input must match the case of the actual file names. MOBILE6 converts all user supplied file names to all upper case for processing. This means that all external file names (and the paths leading to them, if used) on Unix based platforms must be in all upper case to be used by MOBILE6.

The changes mentioned above have not been tested by OTAQ. Other computer systems may require different device assignments than those given above for Sun systems. However, any changes in the device assignments will not affect the validity of the results of the model.

CHAPTER 5

CONVERTING MOBILE5 INPUTS TO MOBILE6

5.0 INTRODUCTION

This chapter discusses how to use an existing MOBILE5 input file to create a corresponding MOBILE6 input command file. Users should familiarize themselves thoroughly with how MOBILE6 input commands are used before they attempt to use this chapter.

As explained in Chapter 2, MOBILE6 uses input commands to replace the control flags used in MOBILE5. The chapter discusses how to convert each MOBILE5 input file entry into the equivalent MOBILE6 command entry.

5.1 BASIC CONVERSION

The table in Appendix C lists every MOBILE5 input parameter and identifies the corresponding command that serves the same function in MOBLE6. Most MOBILE5 features can be used directly, without additional calculations, once the corresponding MOBILE6 command has been identified. For example, the PRTFLG in MOBILE5 has been replaced by the POLLUTANTS command in MOBILE6. Several other MOBILE5 input parameters, such as the PROMPT or the LOCFLG flag, are no longer needed because they were used in MOBILE5 to control the format of the input file. Several other MOBILE5 features, identified in the table in Appendix C and discussed below, have been eliminated from MOBILE6.

On the other hand, there are several MOBILE5 features that required user-supplied values, which often require more extensive effort with MOBILE6. For example, the user-supplied vehicle miles traveled (VMT) by vehicle class (using VMFLAG) in MOBILE5 now requires fractions for 16 combined vehicle classes in MOBILE6 (using the VMT FRACTIONS command) instead of the eight necessary for MOBILE5 input. The conversion of these features is discussed in Section 5.3.

In general, because MOBILE6 has expanded capabilities, directly converting MOBILE5 input to MOBILE6 input will underutilize MOBILE6. Further guidance is expected to be provided to utilize more of the features of MOBILE6 once users become familiar with it. Users should be cautious in experimenting with these new capabilities for official emission estimates until EPA provides official guidance. Once proper guidance is available, it may supercede these rough conversion methods. Until then, users should continue to use existing guidance to determine which features to use and how to select or calculate the required input values.

Once users have become familiar with MOBILE6 input structure, users should refer to the table in Appendix C to identify which MOBILE5 inputs require conversion. For features that translate easily, the user will be directed to the appropriate MOBILE6 command described in

detail in Chapter 2. For features that are more difficult to translate, Appendix C will direct the user back to this section to supply additional information.

5.2 FEATURES NO LONGER AVAILABLE

Features that are no longer available in MOBILE6 cannot be modeled and should be dropped when converting MOBILE5 inputs to MOBILE6:

Idle Emission Rates (IDLFLG)

This feature allowed the user to get additional values in the descriptive output for the emission rate of vehicles idling in grams per hour. This feature was not included in MOBILE6, although gram per hour results are available in the database output.

Input and Output Devices (IOUNEW)

This feature allowed the user to specify the Fortran device designation value used for output. In particular, this feature allowed the user to write error messages to a separate output file. This feature did not always work properly in MOBILE5 and was not considered useful for the release of MOBILE6.

Alternate Tampering Rates (TAMFLG)

With the introduction of the phase 2 of the onboard diagnostic (OBD) electronics in 1996, the explicit modeling of the effects of tampering on vehicle emissions will phase out because OBD vehicles are assumed to have negligible tampering rates. Providing for user-supplied tampering rates for pre-1996 model year vehicles was not considered necessary for the release of MOBILE6.

User Entry of Basic Exhaust Emission Rates (NEWFLG)

Because it had no legitimate use in normal calculations, this feature was not included in the plan for official MOBILE6 release.

Override User-Specified I/M for Tier 1 Vehicles (IMFLAG)

Because this feature was considered a diagnostic capability with no legitimate use in normal calculations, it was not included in the plan for MOBILE6 release.

Functional Purge Check Inspection Programs (ATPFLG)

Because no acceptable inspection procedure was developed, this feature has been dropped from MOBILE6.

Remote Sensing Device Inspection Programs

This flag (located on the I/M Control Flag Record) was used in MOBILE5b to ensure that the alternate I/M credits used had been adjusted to reflect the effects of a remote sensing device inspection program. MOBILE6 no longer allows the entry of alternate I/M credits. Therefore, the ability to model remote sensing device inspection programs was not considered necessary for the release of MOBILE6. It may be considered in future releases.

Effectiveness for Anti-Tampering Programs

This feature was not considered necessary for MOBILE6.

Effectiveness for Functional Pressure and Purge Check Programs

This feature was not considered necessary for MOBILE6.

Extra Load and Trailer Towing Fractions (ALHFLG)

EPA guidance has long suggested that these features not be used, so they have been removed from MOBILE6.

5.3 CONVERTING USER-SUPPLIED DATA

Certain user-supplied data available from a MOBILE5 input file will not be directly usable in MOBILE6 without guidance. These are:

- Data provided daily.
- Data provided by vehicle class.
- User-supplied operating modes.
- Average speed.
- Specific roadway (facility) type modeling.

In these cases, data available from a MOBILE5 input file will need to be converted in order to be used in MOBILE6. If default MOBILE5 values were used, MOBILE6 input and conversions are not required.

5.3.1 Hour of the Day

MOBILE6 allows the user to enter many activity parameters individually for each hour of the day. MOBILE5 allowed for only a single activity entry. Until further guidance is available, the same (single) MOBILE5 entry should be used for each of the 24 hours in MOBILE6.

One example is trip length distributions. MOBILE5 allowed the user to enter a single trip length distribution, but MOBILE6 allows the user to enter 14 trip length distributions for separate hourly groupings. For MOBILE6 input, the same MOBILE5 trip length distribution would be entered for each of the 14 hourly groups using either the WE DA TRI LEN or WE EN TRI LEN commands.

5.3.2 Vehicle Class

MOBILE5 accounted for only eight vehicle classes, but MOBILE6 has greatly expanded the number of individual vehicle classes to 28. In some contexts, MOBILE6 input is provided in terms of 16 combined vehicle classes. In some cases, aggregated user-supplied MOBILE5 data will be used for each of the vehicle classes in MOBILE6. In other cases, such as distributions, the MOBILE5 values must be split by vehicle class for use in MOBILE6.

VMT Distribution by Vehicle Class

Because of the unequal growth that occurs in various vehicle classes, the VMT distribution by vehicle class becomes a function of calendar year. MOBILE5 allowed the user to enter eight VMT values, corresponding to the eight vehicle classes represented in the MOBILE5 output. MOBILE6 allows the user to enter 16 VMT values by combined vehicle class.

Whereas MOBILE5 allowed the user to enter separate VMT for diesel- and gasoline-fueled vehicle classes, MOBILE6 requires that VMT by vehicle class be supplied in terms of the 16 combined gasoline and diesel-fuel categories. In MOBILE6, the VMT by vehicle class is split internally—accounting for the diesel sales fractions and annual mileage accumulation rates—in order to ensure that all of the fleet description and activity values are consistent with one another. The first step in converting MOBILE5 to MOBILE6 VMT fractions is to combine the VMT fractions for gasoline and diesel categories into five composite gasoline/diesel groupings:

- LDV Group = LDGV + LDDV
- LDT Group 1 = LDGT1 + LDDT
- LDT Group 2 = LDGT2
- HDV Group = HDGV + HDDV
- MC Group = MC

The sum of the VMT fractions from the five groups should still equal 1. These fractions are then adjusted using factors calculated from the default distributions of VMT from MOBILE6 for the appropriate calendar year. These adjustment factors are provided in Appendix D. When the adjustments are completed properly, the sum of the 16 MOBILE6 VMT fractions will be 1.

16 Combined MOBILE6 Vehicle Classes	VMT Fraction Calculation
LDV	LDV Group
LDT1	LDT Group 1 * A
LDT2	LDT Group 1 * B
LDT3	LDT Group 2 * C
LDT4	LDT Group 2 * D
HDV2b	HDV Group * E
HDV3	HDV Group * F
HDV4	HDV Group * G
HDV5	HDV Group * H
HDV6	HDV Group * I
HDV7	HDV Group * J
HDV8a	HDV Group * K
HDV8b	HDV Group * L
HDBS	HDV Group * M
HDBT	HDV Group * N
MC	MC Group

The values A through N are taken for the appropriate calendar year from the table in Appendix D. They are calculated from the default MOBILE6 VMT fractions for that calendar year. The terms A and B, C and D, and E through N should each add up to 1. The resulting 16 VMT fractions are supplied to MOBILE6 using the VMT FRACTIONS command.

Registration Distribution

As with VMT fractions, MOBILE6 allows the entry of registration distributions for 16 vehicle classes, which combine the gasoline and diesel categories using the REG DIST command. MOBILE5 allowed the user to enter eight sets of registration distribution values, corresponding to the eight vehicle classes represented in the MOBILE5 output. In MOBILE5, the registration distributions for LDGV and LDDV and the registration distributions for LDGT1 and LDDT had to be identical.

MOBILE5 allowed the user to enter registration distributions separately for diesel- and gasoline-fueled heavy-duty vehicle classes. MOBILE6 requires that all entries of registration distributions by vehicle class be in terms of the combined gasoline- and diesel-fuel categories. In MOBILE6, the registration distributions are split internally—accounting for the diesel sales fractions and annual mileage accumulation rates—in order to ensure that all of the fleet description and activity values are consistent with one another.

The first step in converting MOBILE5 registration distributions to MOBILE6 registration distribution fractions is to combine the registration distributions for gasoline and diesel heavy-duty categories, creating five groups:

- LDV Group = LDGV or LDDV (they should be the same in MOBILE5)
- LDT Group 1 = LDGT1 or LDDT (they should be the same in MOBILE5)
- LDT Group 2 = LDGT2
- HDV Group = weighted HDGV + HDDV (see below)
- MC Group = MC

The HDGV and HDDV registration distributions need to be combined using the fraction of all heavy-duty vehicles in each category. The values (O and P) shown in the table in Appendix D are the gasoline and diesel heavy-duty vehicle fractions for each calendar year. The sum of the O and P value must be 1 for each calendar year. These weighting factors are derived using the MOBILE6 default distributions and vehicle counts.

Each HDGV registration fraction is multiplied by the value O, and each HDDV registration fraction is multiplied by the value P. The registration fractions for each age (HDGV and HDDV) are then added together to give the combined registration fraction for that age for the HDV group. The sum of all fractions in the HDV group must be 1.

Once all the group registration distributions have been determined, the grouped registration distributions are repeated for the appropriate MOBILE6 vehicle classes, with the exception of the MOBILE6 heavy-duty transit bus vehicle category. Because transit buses are assumed to be all diesel-fueled, the MOBILE5 HDDV registration distribution can be used directly.

Sixteen Combined MOBILE6 Vehicle Classes	Registration Distribution Used
LDV	LDV Group
LDT1	LDT Group 1
LDT2	LDT Group 1
LDT3	LDT Group 2
LDT4	LDT Group 2
HDV2b	HDV Group
HDV3	HDV Group
HDV4	HDV Group
HDV5	HDV Group
HDV6	HDV Group
HDV7	HDV Group
HDV8a	HDV Group
HDV8b	HDV Group
HDBS	HDV Group
HDBT	MOBILE5 HDDV
MC	MC Group

The resulting 16 registration distributions are supplied to MOBILE6 using the REG DIST command.

Diesel Sales Fractions

MOBILE6 uses diesel sales fractions by model year and vehicle type to distribute the overall vehicle counts by combined vehicle class into those that are gasoline-fueled and those that are diesel-fueled. These values are entered into MOBILE6 using the DIESEL FRACTIONS command. MOBILE5 also used diesel sales fractions, but only for light-duty passenger vehicles and light-duty trucks.

MOBILE5 diesel sales fractions don't need to be converted. However, the values must be placed in the correct order for MOBILE6 as described for the DIESEL FRACTIONS command.

The MOBILE5 order is 25 pairs of values, with each pair containing one passenger car (LDV) value followed by one light-truck (LDT1) value. Unfortunately, the MOBILE6 command requires that the diesel sales fractions for all 14 combined vehicle classes be provided. The MOBILE5 value for the LDV vehicle class can be used directly, and the MOBILE5 value for the LDT1 class can be used for the LDT1 and LDT2 classes in MOBILE6.

The simplest approach is to fill in the remaining 11 vehicle classes with the default values from MOBILE6. However, the default diesel sales fractions in the MOBILE6 code are stored by model year, and the values read from the input file must be arranged by age, based on the scenario calendar year.

The table in Appendix E shows the default MOBILE6 diesel sales fractions by model year. In copying these values to a command input file, the user must begin with the scenario calendar year and select values for 25 vehicle ages. If the calendar year is not 1996, the diesel sales fractions will be repeated for some older or newer model years. The values in Appendix E are identical to the values in example file, "DIESFRAC.DEF", which is provided as part of the distribution of the MOBILE6 program.

Mileage Accumulation Rates

Annual mileage accumulation rates were entered for each of the eight vehicle classes in MOBILE5. MOBILE6 allows the entry of annual mileage accumulation rates for any of the 28 individual vehicle classes using the MILE ACCUM RATE command. No conversion of the MOBILE5 annual mileage accumulation rates is necessary. It is necessary to apply only the appropriate MOBILE5 annual mileage accumulation rate to the corresponding vehicle classes in MOBILE6.

MOBILE6 Individual Vehicle Class	Appropriate MOBILE5 Annual Mileage Accumulation Rate
LDGV	LDGV
LDGT1, LDGT2	LDGT1
LDGT3, LDGT4	LDGT2
HDGV2b, HDGV3, HDGV4, HDGV5, HDGV6, HDGV7, HDGV8a, HDGV8b, HDGB	HDGV
LDDV	LDDV
LDDT12, LDDT34	LDDT
HDDV2b, HDDV3, HDDV4, HDDV5, HDDV6, HDDV7, HDDV8a, HDDV8b, HDDBS, HDDBT	HDDV
MC	MC

Table 3 of Appendix B has a more detailed description of the 28 vehicle classes used in MOBILE6.

The MILE ACCUM RATE command requires input data only for the vehicle classes being changed.

5.3.3 Operating Modes

Each MOBILE5 scenario had three operating modes. MOBILE6 does not use operating mode and instead controls the effect of engine starts using the SOAK DISTRIBUTION and STARTS PER DAY commands. The three MOBILE5 operating modes were:

- PCCN : Percent of miles traveled in cold start mode for non-catalyst vehicles.
- PCHC : Percent of miles traveled in hot start mode for all vehicles.
- PCCC : Percent of miles traveled in cold start mode for catalyst vehicles.

The definition of MOBILE5 operating modes is the same as the bags of the Federal Test Procedure (FTP). The cold start mode is bag1 (PCCN and PCCC operating modes), and the hot start mode is bag 3 (PCHC operating mode). The VMT remaining is assumed to be in a stabilized mode, which is bag 2. The default operating mode fractions for MOBILE5 are the operating modes of the FTP:

- Cold Start : 20.6 percent (both catalyst and non-catalyst).
- Hot Start : 27.3 percent.

This means that 43 percent of all starts are cold (20.6/(20.6+27.3)) and 57 percent are hot starts. In the FTP, a cold start is an engine start after at least 12 hours of soak, and a hot start is an engine start done after 10 minutes of soak (after bag 1 and bag 2 are completed).

If the MOBILE5 input uses these (default) operating modes, then no user input is required for MOBILE6 input, and the default MOBILE6 values related to operating mode will be used. However, if the user did not specify the default (FTP) case, then corresponding MOBILE6 input values must be calculated.

Soak Distribution

The first step is to determine an engine start soak distribution that contains only FTP hot starts and FTP cold starts. Using the MOBILE6 SOAK DISTRIBUTION command, this can be represented by entering soak distribution fractions of zero for all times except 10 minutes (hot start) and 720 minutes (cold start) for every other hour of the day. The only two non-zero values entered in the distribution will be:

- 10-Minute Soak Fraction = PCHC/(PCHC + PCCC).
- 720-Minute Soak Fraction = PCCC/(PCHC + PCCC).

The percent of miles traveled in cold start mode for non-catalyst vehicles (PCCN) is not used because most vehicles will be equipped with catalysts. MOBILE6 does not allow for different soak distributions for catalyst and non-catalyst vehicles. The effect of soak time on the emissions of non-catalyst vehicles is handled internally by MOBILE6.

Engine Starts Per Day

In addition to the change in the engine start soak distribution, the user must also change the number of engine starts per day assumed by MOBILE6. In MOBILE5 the number of starts per mile of vehicle travel does not change with age and is set by the operating mode fractions. In MOBILE6, the number of engine starts per day does not vary and is not affected by changes in the miles traveled each day. This means that the number of starts per mile of vehicle travel varies depending on the daily VMT in MOBILE6. This difference makes precise conversion of MOBILE5 assumptions into MOBILE6 difficult.

There is a separate entry in MOBILE6 for each of the 28 vehicle classes. Only light-duty vehicles, light-duty trucks, and motorcycles use the estimate of starts per day in MOBILE6. Heavy-duty vehicle classes do not estimate engine start emissions separately and will not use the estimate of starts per day entered by the user.

The average LDGV in MOBILE5 travels 10,528 miles each year, or 28.8 miles per day (10,528/365). The sum of the PCCC and PCHC indicates that the fraction of those miles are driven each day in “bag 1 or bag 3 mode”. Both bag 1 and bag 3 (represented by the PCCC and PCHC values) have 3.59 miles of travel. The number of engine starts is the number of miles driven each day in “bag 1 or bag 3 mode”, and it is then divided by the 3.59 miles per start. The value of engine starts per day is entered into MOBILE6 using the STARTS PER DAY command.

The average annual mileage accumulation rate for a vehicle class in a calendar year will vary depending on the age distribution, annual mileage accumulation rates by vehicle age and the fraction of diesel vehicles in each model year. MOBILE6 will calculate the daily miles per day for your specific set of values when you specify database output using the aggregated output option. The following table gives the default annual mileage for all MOBILE6 vehicle categories in the calendar year 2000:

National Average Miles Per Day by Vehicle Class for Calendar Year 2000

Vehicle Index	Vehicle Type	Average Annual Mileage Accumulation	Average Miles Per Day
1	**LDGV**	10,528	28.8
2	**LDGT1**	12,529	34.3
3	**LDGT2**	12,529	34.3
4	**LDGT3**	12,185	33.4
5	**LDGT4**	12,185	33.4
6	**HDGV2B**	12,618	34.6
7	**HDGV3**	11,021	30.2
8	**HDGV4**	6,891	18.9
9	**HDGV5**	9,412	25.8
10	**HDGV6**	9,187	25.2
11	**HDGV7**	7,801	21.4
12	**HDGV8A**	7,251	19.9
13	**HDGV8B**	0	0.0
14	**LDDV**	6,906	18.9
15	**LDDT12**	3,628	9.9
16	**HDDV2B**	15,747	43.1
17	**HDDV3**	16,881	46.2
18	**HDDV4**	21,813	59.8
19	**HDDV5**	22,850	62.6
20	**HDDV6**	22,494	61.6
21	**HDDV7**	21,335	58.5
22	**HDDT8A**	37,483	102.7
23	**HDDT8B**	58,276	159.7
24	**MC**	3554	9.7
25	**HDGB**	9939	27.2
26	**HDDBT**	34838	95.4
27	**HDDBS**	9939	27.2
28	**LDDT34**	15,612	42.8

For example, for passenger cars using the default FTP values for PCCC and PCHC, the calculation would be:

Starts Per Day = (Miles Per Day)*(PCCC+PCHC)/(3.59 miles per start)

or

Starts Per Day = (10,528/365)*(0.206+0.273)/3.59 = 3.85 engine starts per day

5.3.4 Average Speed

MOBILE5 allowed the entry of a single average speed or the entry of a separate average speed for each of the eight vehicle types. In MOBILE6, the average speed is a distribution of average speeds at a given hour on a given roadway type for all vehicle types together. As a result, it is not possible to model a separate average speed for each vehicle type in a single MOBILE6 run. Multiple MOBILE6 runs can be done to model each vehicle class separately to allow for different average speeds. The distribution of average speeds is entered into MOBILE6 using the SPEED VMT command.

When using MOBILE5, an average speed of 19.6 mph was often used to represent a national average urban driving speed as a default. If the default MOBILE5 speed of 19.6 mph was used as a national average, there is no required MOBILE6 input for speed and no conversions are required.

The AVERAGE SPEED command has been added to MOBILE6 to assist in the use of MOBILE6 to model a single average speed. The same effect can be obtained using a careful combination of the SPEED VMT and VMT BY FACILITY commands as discussed below. However, the steps necessary to model a single average speed using MOBILE6 are often complex and prone to error. In most cases when modeling a single average speed, users should use the AVERAGE SPEED command.

In order to model a single, area-wide average speed, the average speed must be disassociated by roadway type. This is discussed below. If the MOBILE5 input is intended to represent a single roadway type, the user should read the following section describing how to select a single roadway type using the VMT BY FACILITY command. If the single roadway type is a freeway, then the user must also adjust the freeway speed to account for freeway ramps separately from freeway VMT not on freeway ramps. In all cases, the average speed might not fit precisely into one of the 14 average speed bins and will need to be represented as an interpolation between two average speed bins. This is discussed below. Once the distribution of average speeds has been determined, the same distribution should be entered for every hour of the day using the SPEED VMT command.

The values in the tables in Appendix F have been calculated using the methods described below by assuming the MOBILE6 default values for the distribution of VMT by roadway type. Since MOBILE5 did not have inputs related to VMT by roadway type, these tables may be all that is required for conversion of MOBILE5 average speed to MOBILE6 distributions. Users are encouraged to use these tables. The average speeds are in mile-per-hour increments. If users have decimal values for MOBILE5 average speed, users may interpolate the values shown in the tables. Since the MOBILE6 default distribution of VMT by roadway type was used, translating MOBILE5 average speeds becomes unrealistic at higher speeds. If users intend to model area-wide average speeds over 40 mph, users should consider obtaining local distribution of VMT by roadway type and entering the distribution into MOBILE6 using the VMT BY FACILITY command.

If local values for VMT by roadway type are to be used, the tables in Appendix F should not be used, and the user must make the appropriate calculations described below using the local VMT by roadway type distribution.

Average Speed for All Roadways

In a simple case, using MOBILE5, the user entered a single average speed. Roadway type was not an input for MOBILE5, and it was assumed that the single average speed was an aggregation of all speeds on all roadway types. MOBILE6 has different speed adjustments for each of four roadway types.

When a user input of a single average speed is meant to apply to all roadway types (i.e., area-wide average speed), the single average speed value must be distributed among the roadway types. The default distribution of vehicle miles traveled on each of the four MOBILE6 roadway types is:

- 34.2 percent of total daily VMT occurs on freeways.
- 49.8 percent of total daily VMT occurs on arterial/collectors.
- 13.0 percent of total daily VMT occurs on local roadways.
- 3.0 percent of total daily VMT occurs on freeway ramps.

This same distribution is used for each hour of the day. The default daily average speed for these roadway types is:

- 36.5 mph for freeways.
- 31.2 mph for arterial/collectors.
- 12.9 mph for local roadways.
- 34.6 mph for freeway ramps.

The average speed for local roadways and freeway ramps are constant for all hours of the day and cannot be changed by user inputs. A harmonic mean of the average speeds, weighted by the VMT fractions, gives the default daily average speed assumed by MOBILE6:

Avg. Speed = 1/((1/36.5)*0.342 + (1/31.2)*0.498 + (1/12.9)*0.13 + (1/34.6)*0.03) = 27.6 mph

Since the user knows the daily average speed desired (“target” speed), and the daily average speeds for local roadways and freeway ramps cannot be changed by user inputs, the above equation can be represented with a single unknown value, X, which is the change in speed of the freeway and arterial/collector roadway categories. This formulation assumes that the increase in speed occurs only for freeway and arterial/collector roadway categories and that the increase is the same proportional change on both roadway types. This also assumes that the mix of roadway types is not changed.

Avg. Speed = 1/((1/(36.5*X))*0.342 + (1/(31.2*X))*0.498 + (1/12.9)*0.13 + (1/34.6)*0.03)

When we solve for the value, X, in terms of the average speed, we get:

X = 0.02533/((1 / Avg. Speed) - 0.01095)

The value, X, would be used to determine the average speed necessary for input into MOBILE6 for freeways and for arterial/collector roadways to be consistent with the overall average speed provided by the user. For example, if the overall average speed is 32 mph, then:

X = 0.02533/ ((1 / 32) - 0.01095) = 1.2475

Then, the input for average speed for MOBILE6 would be:

Average Freeway Speed = 36.5 * 1.2475 = 45.5 mph

Average Arterial/Collector Speed = 31.2 * 1.2475 = 38.9 mph

This average freeway speed has already accounted for freeway ramps and will not need the adjustment described later in this section. However, these values cannot be directly entered into the model and must be converted to a VMT distribution by average speed as described below in calculating the average speed for a single roadway. These VMT distribution values will be entered into the MOBILE6 model using the SPEED VMT command. The same speed distribution for arterial/collectors and freeways will be used for each hour of the day.

Average Speed for a Single Roadway (Not Freeways)

Once you know the average speed for a roadway, you can convert the single speed value to a distribution of VMT by average speed. This distribution is entered into the MOBILE6 model using the SPEED VMT command.

There are 14 speed bins to describe the distribution of VMT by average speed separately for freeways and arterial/collector roadways (described above). It is likely that the speed value does not fall precisely at the mean value in any of the 14 speed bins. Single average speed inputs must be interpolated using a harmonic mean to give a distribution of average speeds.

For example, we have an average speed on arterial/collectors of 43.5 mph. We do not have the actual distribution of average speed VMT for this average speed. The means of the 14 available speed bins do not include this value, so a combination of two speed bins are needed. The general harmonic mean formula would be:

Speed = 1/(X/(Lower Speed Bin Speed) + (1-X)/(Higher Speed Bin Speed))

or

X = (1/Speed-1/Higher Speed Bin Speed)/(1/Lower Speed Bin Speed-1/Higher Speed Bin Speed)

Where:

X	VMT fraction for the lower speed bin (0 < X < 1)
Speed	The average speed used in MOBILE5
Lower Speed Bin	The nearest speed bin lower than the Target Speed
Higher Speed Bin	The nearest speed bin higher than the Target Speed

For this example, the mean of the lower speed bin would be 40 mph, and the mean of the higher speed bin would be 45 mph. The value of X is then 0.276. This would be the value for the 40 mph speed bin in the speed VMT distribution for arterial/collector roadways. The 45 mph speed bin would have the remainder (0.724, or (1-X)). All other speed bins will be zero for arterial/collector roadway distributions. This VMT distribution will be entered into the MOBILE6 model using the SPEED VMT command. The same distributions will be repeated for all hours of the day.

If the roadway type is a freeway, and freeway ramps have not already been accounted for in the calculation of average speeds, then users should follow the directions below for freeways. Once a freeway average speed that accounts for freeway ramps has been determined, then the VMT distribution can be calculated using the above method.

Average Speed for Freeways

When modeling freeways exclusively, if current estimates of average speed do not include freeway ramp travel, then the current speed estimate should be directly used for the SPEED VMT command input. The speed may need to be distributed among the speed bins (as described above). When freeway average speeds include ramp activity, since MOBILE6 models freeways and freeway ramps separately, the freeway average speed estimate must be adjusted to exclude the effects of ramp activity. This adjustment is described below.

MOBILE6 models freeways and freeway ramps separately, allowing the impact of freeway ramps to be accounted for explicitly in freeway segments. The average speed of freeway ramps cannot be changed by the user. If the user has changed the distribution of VMT by facility, which affects the fraction of freeway VMT that occurs on freeway ramps, this will affect the overall average speed assumed for freeways. The equations below assume the default fraction of all freeway VMT that occurs on freeway ramps (8 percent). The coefficients must be recalculated if a different VMT fraction is to be used.

The average speed on freeways is the harmonic mean of the average speed on freeway ramps and the average speed on the remaining freeway segments. Using the default fractions and speeds described above:

Speed = 1/((Non-Ramp VMT/Non-Ramp Speed) + (Ramp VMT/Ramp Speed))

Speed = 1/((34.2/(34.2+3.0))/36.5 + (3.0/(34.2+3.0))/34.6) = 36.4 mph

Where:

- 34.2 is the default Non-Ramp VMT fraction for freeways.
- 3.0 is the default Ramp VMT fraction for freeways.
- 36.5 is the default Non-Ramp average speed for freeways.
- 34.6 is the default Ramp average speed for freeways.

The VMT fractions must be normalized to include only freeway (non-ramp) and freeway ramp VMT (as shown in the equation above). The sum of non-ramp VMT and ramp VMT will be 1. 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 fraction (and thus, non-ramp VMT) is known.

Non-Ramp Speed = (1-Ramp VMT)/(1/Speed - Ramp VMT/Ramp Speed)

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

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

For example, if my average speed on freeways (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

Once this average speed of 40.6 mph is known, a VMT distribution by average speed can be calculated using the method above. The VMT distribution by average speed for freeways would be entered into MOBILE6 using the SPEED VMT command. The same distributions will be repeated for all hours of the day.

5.3.5 Roadway Type

MOBILE5 did not differentiate by vehicle roadway (facility) type. Since there was no user-supplied input for MOBILE5, there is no input value in a MOBILE5 input corresponding to roadway type in MOBILE6. However, because MOBILE6 assumes some activity on each roadway type, if the user wants the MOBILE5 input that is to be converted to MOBILE6 to represent a single roadway type, then the user must specify which roadway type is to be modeled. This is done using the VMT BY FACILITY command in MOBILE6. Setting the fraction of VMT to 1.0 for the roadway type of interest (and setting the VMT for the other roadway types to zero), the user can specify which roadway type is desired.

There are four roadway types simulated by MOBILE6:

- Freeways
- Arterial/Collectors
- Local
- Freeway Ramps

MOBILE6 separates all freeway VMT into freeway (non-ramp) VMT and freeway ramp VMT. When modeling freeways, if the user does not know the split between ramp and non-ramp freeway VMT, the default MOBILE6 value should be used. MOBILE6 assumes that 8 percent of all freeway VMT occurs on ramps.

There is no average speed input for either the local roadways or freeway ramps.

Appendix A

Alphabetical List of MOBILE6 Commands

Command Name	User's Guide Section	Command Input File Section	Command Parameter Type	Required Command?	Command Function
ABSOLUTE HUMIDITY	External Conditions 2.8.6.6	Run or Scenario	Value		Absolute humidity in grains per pound.
AGGREGATED OUTPUT	Database Output 2.8.5.1.k	Header	On/Off		Database output by daily time periods aggregated to the level of the descriptive output.
ALTITUDE	External Conditions 2.8.6.5	Scenario	Option		High or low altitude of area evaluated.
ANTI-TAMP PROG	State Programs 2.8.9.3	Run	Program description		Anti-Tampering Programs.
AVERAGE SPEED	Activity 2.8.8.2.d	Scenario	Value		Allows the user to enter a single average speed value, rather than an average speed distribution.
CALENDAR YEAR	External Conditions 2.8.6.1	Scenario	Value	Yes	Calendar year of scenario evaluated.
CLOUD COVER	External Conditions 2.8.6.7.a	Run or Scenario	Value		Allows user to input fraction of cloud cover for a given day.
DAILY OUTPUT	Database Output 2.8.5.1.j	Header	On/Off		Database output by time periods.
DATABASE AGES	Database Output 2.8.5.1.g	Header	Vehicle age choice		Limits which of the 25 vehicle ages have emissions reported in database output format.
DATABASE EMISSIONS	Database Output 2.8.5.1.d	Header	Etype choice		Limits which of the eight types of emissions are reported in database output format.
DATABASE FACILITIES	Database Output 2.8.5.1.e	Header	Facility choice		Limits which of five roadway types have emissions reported in database output format.
DATABASE HOURS	Database Output 2.8.5.1.h	Header	Hours of day choice		Limits which of the 24 hours of the day have emissions reported in database output format.
DATABASE OPTIONS	Database Output 2.8.5.1.c	Header	File name		Specifies a name for the external file holding a set of database output selection records.
DATABASE OUTPUT	Database Output 2.8.5.1.a	Header	On/Off		Specifies MOBILE6 to report output in database format.

Command Name	User's Guide Section	Command Input File Section	Command Parameter Type	Required Command?	Command Function
DATABASE VEHICLES	Database Output 2.8.5.1.f	Header	Vehicle choice		Limits which of the 28 vehicle types have emissions reported in database output format.
DATABASE YEARS	Database Output 2.8.5.1.i	Header	Model year choice		Limits which of the 25 model years, based on the calendar year chosen, have emissions reported in database output format.
DIESEL FRACTIONS	Fleets 2.8.7.2	Run or Scenario	Values		Allows user-supplied alternate diesel sales fractions.
DIURN SOAK ACTIVITY	Activity 2.8.8.7	Scenario	External file		Specifies alternative distribution of diurnal soak times.
EMISSIONS TABLE	Database Output 2.8.5.2	Header	File name		Specifies a file name for the database output file.
END OF RUN	Separators 2.8.2.5	End of Run			Required to separate multiple runs in command input files.
EVALUATION MONTH	External Conditions 2.8.6.2	Scenario	Value		Specifies January 1 or July 1 for calendar year of interest.
EXPAND BUS EFS	Descriptive Output 2.8.4.3	Run	On/Off		Directs M6 to report gas, urban and school bus categories separately.
EXPAND EVAPORATIVE	Descriptive Output 2.8.4.5	Run	On/Off		Display all 6 evaporative emission types in descriptive output.
EXPAND EXHAUST	Descriptive Output 2.8.4.4	Run	On/Off		Causes start, running and total exhaust EFs to be displayed in descriptive output.
EXPAND HDDV EFS	Descriptive Output 2.8.4.3	Run	On/Off		Directs MOBILE6 to display EFs by eight HDDV classes.
EXPAND HDGV EFS	Descriptive Output 2.8.4.3	Run	On/Off		Directs MOBILE6 to display EFs by eight HDGV classes.
EXPAND LDT EFS	Descriptive Output 2.8.4.3	Run	On/Off		Directs MOBILE6 to display EFs by six LDT classes.
EXPRESS HC AS NMHC	All Output 2.8.3.2	Run	On/Off		Directs MOBILE6 to output exhaust HC as non-methane hydrocarbons.
EXPRESS HC AS NMOG	All Output 2.8.3.2	Run	On/Off		Directs MOBILE6 to output exhaust HC as non-methane organic gases.
EXPRESS HC AS THC	All Output 2.8.3.2	Run	On/Off		Directs MOBILE6 to output exhaust HC as total hydrocarbons.

Command Name	User's Guide Section	Command Input File Section	Command Parameter Type	Required Command?	Command Function
EXPRESS HC AS TOG	All Output 2.8.3.2	Run	On/Off		Directs MOBILE6 to output exhaust HC as total organic gases.
EXPRESS HC AS VOC	All Output 2.8.3.2	Run	On/Off		Directs MOBILE6 to output exhaust HC as volatile organic compounds.
FUEL PROGRAM	State Programs 2.8.10.1	Run or Scenario	Program description		Designates fuel sulfur level of gasoline and whether RFG use should be assumed.
FUEL RVP	Fuels 2.8.10.4	Run or Scenario	Values	Yes	Required input of average fuel Reid vapor pressure.
HOT SOAK ACTIVITY	Activity 2.8.8.6	Scenario	External file		Specifies alternative distribution of lengths of hot soaks.
HOURLY TEMPERATURES	External Conditions 2.8.6.4	Run or Scenario	Values	Yes*	Allows entry of 24 hourly temperatures. *Required unless MIN/MAX TEMP is used.
I/M COMPLIANCE	State Programs 2.8.9.4.e	Run	Value		Required input indicating percentage of total vehicle fleet certified or waived by I/M program.
I/M CUTPOINTS	State Programs 2.8.9.4.g	Run	External file		Required command for cutpoints if IM 240 used. Do not use with other exhaust or evaporative I/M programs.
I/M DESC FILE	State Programs 2.8.9.4.l	Run	File name		Optional external input file containing I/M program description records.
I/M EFFECTIVENESS	State Programs 2.8.9.4.k	Run	Value		Reduce I/M effectiveness to account for Test and Repair losses.
I/M EXEMPTION AGE	State Programs 2.8.9.4.h	Run	Value		Optional command indicating age that vehicle automatically becomes exempt from I/M program.
I/M GRACE PERIOD	State Programs 2.8.9.4.i	Run	Value		Optional command indicating when vehicle first becomes subject to I/M program.
I/M MODEL YEARS	State Programs 2.8.9.4.b	Run	Values		Required command indicating vehicle model years subject to I/M program.
I/M PROGRAM	State Programs 2.8.9.4.a	Run	Values		Required command indicating program start and end dates, frequency and test type.
I/M STRINGENCY	State Programs 2.8.9.4.d	Run	Values		Required command indicating initial test failure rate (%) for pre-1981 LDGVs and pre-1984 LDGTs.
I/M VEHICLES	State Programs 2.8.9.4.c	Run	Vehicle choice		Required command indicating vehicle types subject to I/M.

Command Name	User's Guide Section	Command Input File Section	Command Parameter Type	Required Command?	Command Function
I/M WAIVER RATES	State Programs 2.8.9.4.f	Run	Values		Required command indicating percentage of vehicles failing initial I/M test and do not have to pass a retest.
MILE ACCUM RATE	Fleets 2.8.7.3	Run	External file		Allows user to supply annual accumulation rates by age for each of the 28 vehicle types.
MIN/MAX TEMP	External Conditions 2.8.6.3	Run or Scenario	Values	Yes*	Specifies minimum and maximum daily temperature. * This command is required unless HOURLY TEMPERATURES is used.
MOBILE6 BATCH FILE	Separators 2.8.2.2	Header	On/Off		Identifies MOBILE6 input file as batch file as opposed to a regular command input file.
MOBILE6 INPUT FILE	Separators 2.8.2.1	Header		Yes	Identifies MOBILE6 input file as a regular command input file as opposed to a batch input file.
NGV EF	Fleets 2.8.7.6	Run	External file		Allows the user to enter alternate NGV emission factors for each of the 28 vehicle types, for each of the three pollutants, and (where applicable) for running and start emissions. Must be used in conjunction with NGV FRACTION command.
NGV FRACTION	Fleets 2.8.7.5	Run	External file		Indicates percentage of natural gas vehicles in each of the 28 vehicles classes.
94+ LDG IMP	Alternative Regulations and Control Programs 2.8.11.4	Run	File name		Allows the user to input optional 1994 and later fleet penetration fractions for light-duty gasoline vehicles under the Tier 1, NLEV (or California LEV 1), and Tier 2 standards.
NO 2007 HDDV RULE	Alternative Regulations and Control Programs 2.8.11.5	Run	On/Off		Allows the user to disable the 2007 heavy duty vehicle emission standards.
NO CLEAN AIR ACT	State Programs 2.8.11.1	Run	On/Off		Allows users to model vehicle emissions as if the Federal Clean Air Act Amendments of 1990 had not been implemented.
NO DEFEAT DEVICE	Alternative Regulations and Control Programs 2.8.11.2.a	Run	On/Off		Allows users to turn off the effects of the heavy-duty diesel vehicle NOx off-cycle emission effects (defeat device emissions).
NO DESC OUTPUT	Descriptive Output 2.8.4.2	Header	On/Off		Optional command that prevents production of descriptive output.
NO I/M TTC CREDITS	State Programs 2.8.9.4.j	Run	On/Off		Optional command to eliminate credit for a technician training program.
NO NOX PULL AHEAD	2.8.11.2.b	Run	On/Off		Allows the user to turn off the effects of the Pull Ahead

Command Name	User's Guide Section	Command Input File Section	Command Parameter Type	Required Command?	Command Function
	Alternative Regulations and Control Programs				mitigation program used to reduce heavy-duty diesel vehicle off-cycle emissions.
NO REBUILD	2.8.11.2.c Alternative Regulations and Control Programs	Run	On/Off		Allows the user to turn off the effects of the Rebuild mitigation program used to reduce heavy-duty diesel off-cycle emissions.
NO REFUELING	All Output 2.8.3.3	Run	On/Off		Allows user to "zero out" refueling (Stage 2) emissions, which then must be accounted for in stationary source part of SIP.
NO TIER2	Alternative Regulations and Control Programs 2.8.11.3.a	Run	On/Off		Allows the user to disable the Tier 2 emission standards and fuel sulfur requirements.
OXYGENATED FUELS	Fuels 2.8.10.3	Run or Scenario	Values		Allows modeling of the effects of use of oxygenated fuels on exhaust emissions.
PEAK SUN	External Conditions 2.8.6.7.b	Run or Scenario	Value		Allows input of 2 daily times demarcating period of peak sun.
POLLUTANTS	All Output 2.8.3.1	Header	Pollutant choice		Controls which pollutants will be calculated and output to the database report and descriptive output.
REBUILD EFFECTS	Alternative Regulations and Control Programs 2.8.11.2.d	Run	Value		Allows the user to change the Rebuild program effectiveness rate used to reduce heavy-duty diesel vehicle NOx off-cycle emissions.
REG DIST	Fleets 2.8.7.1	Run	External file		Allows user to supply vehicle registration distributions by age for all 16 composite vehicles types.
REPORT FILE	Descriptive Output 2.8.4.1	Header	File name		Specifies name for descriptive output file.
RUN DATA	Separators 2.8.2.3	End of Header		Yes	Marks end of Header section and beginning of Run section of regular MOBILE6 command input file.
SCENARIO RECORD	Separators 2.8.2.4	Start of Scenario		Yes	Allows user to label individual scenario results. Marks start of new scenario.
SEASON	Fuels 2.8.10.5	Run or Scenario	Value		Allows users to specify winter or summer RVP independent of evaluation month.
SOAK DISTRIBUTION	Activity 2.8.8.5	Scenario	External file		Allows user to enter soak duration distributions for each hour of the day that will override MOBILE6 defaults.
SPEED VMT	Activity 2.8.8.2.c	Run or Scenario	External file		Allows user to enter VMT distribution across 14 preselected average speed ranges for each of the 24 hours of the day for

Command Name	User's Guide Section	Command Input File Section	Command Parameter Type	Required Command?	Command Function
					each scenario.
STAGE II REFUELING	State Programs 2.8.9.2	Run	Program description		Allows modeling of impact of stage II "at-the-pump" vapor recovery system for refueling emissions.
STAR DIST	Activity 2.8.8.4	Run	External file		Allows user to change the default for the hourly temporal distribution of engine starts (trips) across the day.
STARTS PER DAY	Activity 2.8.8.3	Run	External file		Allows user to change default average number of engine starts per day per vehicle.
SULFUR CONTENT	Fuels 2.8.10.2	Scenario	Value		Allows user to enter alternate sulfur content of gasoline (ppm) that overrides MOBILE6 default of 300 ppm.
SUNRISE/SUNSET	External Conditions 2.8.6.7.c	Run or Scenario	Values		Specifies times for sunrise and sunset for A/C calculations.
T2 CERT	Alternative Regulations and Control Programs 2.8.11.3.d	Run	File name		Allows the user to specify alternative Tier 2 50,000 mile certification standards. Must be used to model the effects of California's LEV II requirement.
T2 EVAP PHASE-IN	Alternative Regulations and Control Programs 2.8.11.3.b	Run	File name		Allows the user to replace the default phase-in fractions (by certification bin) for the Tier 2 evaporative emissions standards, permitting different phase-in schedules to be modeled. Also necessary to model the evaporative effects of California's LEVII requirement.
T2 EXH PHASE-IN	Alternative Regulations and Control Programs 2.8.11.3.c	Run	File name		Allows the user to replace the default phase-in fractions (by certification bin) for the Tier 2 exhaust emission standards, allowing different phase-in schedules to be modeled. Also necessary to model the exhaust effects of the California LEV II requirement.
VMT BY FACILITY	Activity 2.8.8.2.a	Run or Scenario	External file		Allows user to supply alternate VMT distributions by facility type that override MOBILE6 defaults for each scenario.
VMT BY HOUR	Activity 2.8.8.2.b	Run or Scenario	External file		Allows user to supply alternate hourly distributions of VMT that override MOBILE6 defaults for each scenario.
VMT FRACTIONS	Activity 2.8.8.1	Run or Scenario	Values		Allows user to apply alternate vehicle miles traveled fractions by each of 16 combined vehicle types.
WE DA TRI LEN DI	Activity 2.8.8.8	Run or Scenario	External file		Allows user to supply alternate weekday hourly running loss trip length distribution.
WE EN TRI LEN DI	Activity	Run or	External file		Allows user to supply alternate weekend hourly running loss trip

Command Name	User's Guide Section	Command Input File Section	Command Parameter Type	Required Command?	Command Function
	2.8.8.9	Scenario			length distribution.
WE VEH US	Activity 2.8.8.10	Scenario	On/Off		Directs MOBILE6 to use the weekend activity fractions in its calculations.
WITH FIELDNAMES	Database Output 2.8.5.1.b	Header	On/Off		Specifies that a header record of field names is to be generated for the database output.

Appendix B

MOBILE6 Input Data Format Reference Tables

Table 1: Composite Vehicle Classes for Vehicle Registration Data and Vehicle Miles Traveled Fractions (REG DIST and VMT FRACTIONS Commands)

Number	Abbreviation	Description
1	LDV	Light-Duty Vehicles (Passenger Cars)
2	LDT1	Light-Duty Trucks 1 (0-6,000 lbs. GVWR, 0-3,750 lbs. LVW)
3	LDT2	Light-Duty Trucks 2 (0-6,000 lbs. GVWR, 3,751-5,750 lbs. LVW)
4	LDT3	Light-Duty Trucks 3 (6,001-8,500 lbs. GVWR, 0-5,750 lbs. ALVW*)
5	LDT4	Light-Duty Trucks 4 (6,001-8,500 lbs. GVWR, 5,751 lbs. and greater ALVW)
6	HDV2B	Class 2b Heavy-Duty Vehicles (8,501-10,000 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)

* ALVW = Alternative Loaded Vehicle Weight: The adjusted loaded vehicle weight is the numerical average of the vehicle curb weight and the gross vehicle weight rating (GVWR)

Table 2: Composite Vehicle Types for Diesel Sales Fractions (DIESEL FRACTIONS Command)

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 (0-6,000 lbs. GVWR, 3751-5750 lbs. LVW)
4	LDT3	Light-Duty Trucks 3 (6,001-8,500 lbs. GVWR, 0-5750 lbs. ALVW)
5	LDT4	Light-Duty Trucks 4 (6,001-8,500 lbs. GVWR, 5751 lbs. and greater 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

Appendix B

MOBILE6 Input Data Format Reference Tables

Table 3:Complete MOBILE6 Vehicle Classifications
(STARTS PER DAY Command)

Number	Abbreviation	Description
1	LDGV	Light-Duty Gasoline Vehicles (Passenger Cars)
2	LDGT1	Light-Duty Gasoline Trucks 1 (0-6,000 lbs. GVWR, 0-3750 lbs. LVW)
3	LDGT2	Light-Duty Gasoline Trucks 2 (0-6,000 lbs. GVWR, 3751-5750 lbs. LVW)
4	LDGT3	Light-Duty Gasoline Trucks 3 (6,001-8,500 lbs. GVWR, 0-5750 lbs. ALVW)
5	LDGT4	Light-Duty Gasoline Trucks 4 (6,001-8,500 lbs. GVWR, 5751 lbs. and greater ALVW)
6	HDGV2B	Class 2b Heavy-Duty Gasoline Vehicles (8501-10,000 lbs. GVWR)
7	HDGV3	Class 3 Heavy-Duty Gasoline Vehicles (10,001-14,000 lbs. GVWR)
8	HDGV4	Class 4 Heavy-Duty Gasoline Vehicles (14,001-16,000 lbs. GVWR)
9	HDGV5	Class 5 Heavy-Duty Gasoline Vehicles (16,001-19,500 lbs. GVWR)
10	HDGV6	Class 6 Heavy-Duty Gasoline Vehicles (19,501-26,000 lbs. GVWR)
11	HDGV7	Class 7 Heavy-Duty Gasoline Vehicles (26,001-33,000 lbs. GVWR)
12	HDGV8A	Class 8a Heavy-Duty Gasoline Vehicles (33,001-60,000 lbs. GVWR)
13	HDGV8B	Class 8b Heavy-Duty Gasoline Vehicles (>60,000 lbs. GVWR)
14	LDDV	Light-Duty Diesel Vehicles (Passenger Cars)
15	LDDT12	Light-Duty Diesel Trucks 1 and 2 (0-6,000 lbs. GVWR)
16	HDDV2B	Class 2b Heavy-Duty Diesel Vehicles (8501-10,000 lbs. GVWR)
17	HDDV3	Class 3 Heavy-Duty Diesel Vehicles (10,001-14,000 lbs. GVWR)
18	HDDV4	Class 4 Heavy-Duty Diesel Vehicles (14,001-16,000 lbs. GVWR)
19	HDDV5	Class 5 Heavy-Duty Diesel Vehicles (16,001-19,500 lbs. GVWR)
20	HDDV6	Class 6 Heavy-Duty Diesel Vehicles (19,501-26,000 lbs. GVWR)
21	HDDV7	Class 7 Heavy-Duty Diesel Vehicles (26,001-33,000 lbs. GVWR)
22	HDDV8A	Class 8a Heavy-Duty Diesel Vehicles (33,001-60,000 lbs. GVWR)
23	HDDV8B	Class 8b Heavy-Duty Diesel Vehicles (>60,000 lbs. GVWR)
24	MC	Motorcycles (Gasoline)
25	HDGB	Gasoline Buses (School, Transit and Urban)
26	HDDBT	Diesel Transit and Urban Buses
27	HDDBS	Diesel School Buses
28	LDDT34	Light-Duty Diesel Trucks 3 and 4 (6,001-8,500 lbs. GVWR)

Appendix B

MOBILE6 Input Data Format Reference Tables

Table 4:Daily Hour Mapping for Distribution of Vehicle Starts During the Day
(START DIST and HOURLY TEMPERATURE Commands)

Number	Abbreviation	Description
1	6 a.m.	6 a.m. through 6:59 a.m.
2	7a.m.	7 a.m. through 7:59 a.m.
3	8 a.m	8 a.m. through 8:59 a.m.
4	9 a.m.	9 a.m. through 9:59 a.m.
5	10 a.m	10 a.m. through 10:59 a.m.
6	11 a.m.	11 a.m. through 11:59 a.m.
7	12 Noon	12 Noon through 12:59 p.m.
8	1 p.m.	1 p.m. through 1:59 p.m.
9	2 p.m.	2 p.m. through 2:59 p.m.
10	3 p.m.	3 p.m. through 3:59 p.m.
11	4 p.m.	4 p.m. through 4:59 p.m.
12	5 p.m.	5 p.m. through 5:59 p.m.
13	6 p.m.	6 p.m. through 6:59 p.m.
14	7 p.m.	7 p.m. through 7:59 p.m.
15	8 p.m.	8 p.m. through 8:59 p.m.
16	9 p.m.	9 p.m. through 9:59 p.m.
17	10 p.m	10 p.m. through 10:59 p.m.
18	11 p.m.	11 p.m. through 11:59 p.m.
19	12 Midnight	12 Midnight through 12:59 a.m.
20	1 a.m.	1 a.m. through 1:59 a.m.
21	2 a.m.	2 a.m. through 2:59 a.m.
22	3 a.m.	3 a.m. through 3:59 a.m.
23	4 a.m.	4 a.m. through 4:59 a.m.
24	5 a.m.	5 a.m. through 5:59 a.m.

Appendix B

MOBILE6 Input Data Format Reference Tables

Table 5:Average Speed Ranges for Speed Bins (SPEED VMT command)

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

Appendix C

Corresponding MOBILE6 Inputs for MOBILE5 Inputs
Part 1

Location	MOBILE5 Input	Related MOBILE6 Commands
Control Section	PROMPT=1,2,3,4	No longer needed with MOBILE6.
Control Section	PROMPT=5	MOBILE6 Default. No required user input.
Control Section	IOUNEW	This feature is not available in MOBILE6.
Control Section	Title (PROJID)	See section describing how to enter comments.
Control Section	TAMFLG=1	MOBILE6 Default. No required user input.
Control Section	TAMFLG=2	This feature is not available in MOBILE6.
Control Section	SPDFLG=1	MOBILE6 Default. No required user input.
Control Section	SPDFLG=2	See SPEED VMT command. Additional guidance is provided in Chapter 5.
Control Section	SPDFLG=3 or 4	See WE DA TRI LEN DI or WE EN TRI LEN DI commands. Additional guidance is provided in Chapter 5.
Control Section	VMFLAG=1	MOBILE6 Default. No required user input.
Control Section	VMFLAG=2 or 3	See VMT FRACTIONS command. Additional guidance is provided in Chapter 5.
Control Section	MYMRFG=2	See MILE ACCUM RATE command. Additional guidance is provided in Chapter 5.
Control Section	MYMRFG=3	See REG DIST command. Additional guidance is provided in Chapter 5.
Control Section	MYMRFG=4	See REG DIST and MILE ACCUM RATE commands. Additional guidance is provided in Chapter 5.
Control Section	MYMRFG=I	MOBILE6 Default. No required user input.
Control Section	NEWFLG=1	MOBILE6 Default. No required user input.
Control Section	NEWFLG=2 or 3 or 4 or 6	This feature is not available in MOBILE6.
Control Section	NEWFLG=5	See NO CLEAN AIR ACT command.
Control Section	IMFLAG=1	MOBILE6 Default. No required user input.
Control Section	IMFLAG=4 or 5	This feature is not available in MOBILE6.
Control Section	IMFLAG=2	See I/M PROGRAM command.
Control Section	IMFLAG=3	See I/M PROGRAM command.
Control Section	IMFLAG=6	See I/M TTC EFF command.

Appendix C

Corresponding MOBILE6 Inputs for MOBILE5 Inputs

Part 2

Location	MOBILE5 Input	Related MOBILE6 Commands
Control Section	ALHFLG=1	MOBILE6 Default. No required user input.
Control Section	ALHFLG=2 or 3	See ABSOLUTE HUMIDITY; CLOUD COVER; PEAK SUN and SUNRISE SUNSET commands for air-conditioning effects. MOBILE6 no longer allows additional loading.
Control Section	ATPFLG=1	MOBILE6 Default. No required user input.
Control Section	ATPFLG=2	See ANTI-TAMP PROG command.
Control Section	ATPFLG=3	See I/M PROGRAM command.
Control Section	ATPFLG=4	This feature is not available in MOBILE6.
Control Section	ATPFLG=5	See ANTI-TAMP PROG and I/M PROGRAM commands.
Control Section	ATPFLG=6	See ANTI-TAMP PROG command. The purge program feature is no longer available in MOBILE6.
Control Section	ATPFLG=7	See I/M PROGRAM command. The purge program feature is no longer available in MOBILE6.
Control Section	ATPFLG=8	See ANTI-TAMP PROG and I/M PROGRAM commands. The purge program feature is no longer available in MOBILE6.
Control Section	RLFLAG=1 or 3	MOBILE6 Default. No required user input.
Control Section	RLFLAG=2 or 4	See STAGE II REFUELING command.
Control Section	RLFLAG=5	See NO REFUELING command.
Control Section	LOCFLG=1,2	No longer needed with MOBILE6.
Control Section	TEMFLG=1 or 2	See MIN/MAX TEMPERATURE and HOURLY TEMPERATURES commands.
Control Section	OUTFMT=1, 2, 5 or 6	See DESCRIPTIVE OUTPUT and DATABASE OUTPUT commands.
Control Section	OUTFMT=3 or 4	See DESCRIPTIVE OUTPUT command.
Control Section	IDLFLG=1 or 2	This feature is not available in MOBILE6.
Control Section	PRTFLG=1	See POLLUTANTS command.
Control Section	PRTFLG=2	See POLLUTANTS command.
Control Section	PRTFLG=3	See POLLUTANTS command.
Control Section	PRTFLG=4	See POLLUTANTS command.

Appendix C

Corresponding MOBILE6 Inputs for MOBILE5 Inputs

Part 3

Location	MOBILE5 Input	Related MOBILE6 Commands
Control Section	NMHFLG=1	See EXPRESS HC AS THC command.
Control Section	NMHFLG=2	See EXPRESS HC AS NMHC command.
Control Section	NMHFLG=3	See EXPRESS HC AS VOC command.
Control Section	NMHFLG=4	See EXPRESS HC AS TOG command.
Control Section	NMHFLG=5	See EXPRESS HC AS NMOG command.
Control Section	HCFLAG=1	MOBILE6 Default. No required user input.
Control Section	HCFLAG=3	See DATABASE OUTPUT command.
Control Section	HCFLAG=2	See EXPAND EVAPORATIVE command.
Tampering Rates	Tampering Rates	This feature is not available in MOBILE6.
VMT Mix Record	VMT Mix Record	See VMT FRACTIONS command. Additional guidance is provided in Chapter 5.
Mileage Accumulation Rates	Mileage Accumulation Rates	See MILE ACCUM RATE command. Additional guidance is provided in Chapter 5.
Registration Distributions	Registration Distributions	See REG DIST command. Additional guidance is provided in Chapter 5.
Basic Emission Rates	Basic Emission Rates	This feature is not available in MOBILE6.
New Evap Test Procedure Record	New Evap Test Procedure Record	MOBILE6 Default. No required user input.
I/M Control Flag Record	Number of I/M program descriptive records	No longer needed with MOBILE6.
I/M Control Flag Record	Override user specified I/M for Tier 1 vehicles	This feature is not available in MOBILE6.
I/M Control Flag Record	Technician Training and Certification = 1	See I/M TTC EFF command.
I/M Control Flag Record	Technician Training and Certification = 2	MOBILE6 Default. No required user input.
I/M Control Flag Record	Remote Sensing Device Inspections = 1	MOBILE6 Default. No required user input.
I/M Control Flag Record	Remote Sensing Device Inspections = 2	This feature is not available in MOBILE6.
I/M Program Descriptive Record	Start Year	See I/M PROGRAM command.
I/M Program Descriptive Record	Stringency Level	See I/M STRINGENCY command.
I/M Program Descriptive Record	First Model Year	See I/M MODEL YEARS command.
I/M Program Descriptive Record	Last Model Year	See I/M MODEL YEARS command.
I/M Program Descriptive Record	Waiver Rates	See I/M WAIVER RATES command.
I/M Program Descriptive Record	Compliance Rate	See I/M COMPLIANCE command.

Appendix C

Corresponding MOBILE6 Inputs for MOBILE5 Inputs

Part 4

Location	MOBILE5 Input	Related MOBILE6 Commands
I/M Program Descriptive Record	Program Type	See I/M PROGRAM command.
I/M Program Descriptive Record	Alternate Effectiveness Rates Flag = 1	MOBILE6 Default. No required user input.
I/M Program Descriptive Record	Alternate Effectiveness Rates Flag = 2	See I/M EFFECTIVENESS command.
I/M Program Descriptive Record	Inspection Frequency	See I/M PROGRAM command.
I/M Program Descriptive Record	Vehicle Types	See I/M VEHICLES command.
I/M Program Descriptive Record	Test Type	See I/M PROGRAM command.
I/M Program Descriptive Record	Non-default Cutpoints = 2	See I/M CUTPOINTS command.
I/M Program Descriptive Record	Alternate I/M Credits = 1	MOBILE6 Default. No required user input.
I/M Program Descriptive Record	Alternate I/M Credits = 2	This feature is not available in MOBILE6.
I/M Program Descriptive Record	User-Supplied Cutpoint for HC	See I/M CUTPOINTS command.
I/M Program Descriptive Record	User-Supplied Cutpoint for CO	See I/M CUTPOINTS command.
I/M Program Descriptive Record	User-Supplied Cutpoint for NO_x	See I/M CUTPOINTS command.
Program Effectiveness Record	Effectiveness Rate for HC emissions	See I/M EFFECTIVENESS command.
Program Effectiveness Record	Effectiveness Rate for CO emissions	See I/M EFFECTIVENESS command.
Program Effectiveness Record	Effectiveness Rate for NO_x emissions	See I/M EFFECTIVENESS command.
Program Effectiveness Record	Effectiveness Rate for anti-tampering program (ATP)	This feature is not available in MOBILE6.
Program Effectiveness Record	Effectiveness Rate for pressure/purge checks	This feature is not available in MOBILE6.
Alternate I/M Program Credit Files	Alternate I/M Program Credit Files	This feature is not available in MOBILE6.
ATP Descriptive Record	ATP Descriptive Record	See ANTI-TAMP PROG command.
Functional Pressure Test Record	Functional Pressure Test Record	See I/M PROGRAM command.
Functional Purge Test Record	Functional Purge Test Record	This feature is not available in MOBILE6.
Stage II Descriptive Record	Stage II Descriptive Record	See STAGE II REFUELING command.
Local Area Parameter Record	Scenario Name	See section describing how to enter comments.
Local Area Parameter Record	Fuel Volatility Class	Normally, no required user input. If Reformulated Gasoline Flag = 2, see FUEL PROGRAM command.
Local Area Parameter Record	Minimum Daily Temperature	See MIN/MAX TEMP
Local Area Parameter Record	Maximum Daily Temperature	See MIN/MAX TEMP

Appendix C

Corresponding MOBILE6 Inputs for MOBILE5 Inputs

Part 5

Location	MOBILE5 Input	Related MOBILE6 Commands
Local Area Parameter Record	RVP Period 1	See FUEL RVP command.
Local Area Parameter Record	RVP Period 2	See FUEL RVP command.
Local Area Parameter Record	RVP Period 2 Start Year	See FUEL RVP command.
Local Area Parameter Record	Oxygenated Fuels Flag (OXYFLG) = 1	MOBILE6 Default. No required user input.
Local Area Parameter Record	Oxygenated Fuels Flag (OXYFLG) = 2	See OXYGENATED FUELS command.
Local Area Parameter Record	Diesel Sales Flag (DSFLAG) = 1	MOBILE6 Default. No required user input.
Local Area Parameter Record	Diesel Sales Flag (DSFLAG) = 2	See DIESEL FRACTIONS command.
Local Area Parameter Record	Reformulated Gasoline Flag (RFGFLG) = 1	MOBILE6 Default. No required user input.
Local Area Parameter Record	Reformulated Gasoline Flag (RFGFLG) = 2	See FUEL PROGRAM command.
Oxygenated Fuels Descriptive Record	Oxygenated Fuels Descriptive Record	See OXYGENATED FUELS command.
Gasoline Detergent Additive Parameter Record	Gasoline Detergent Additive Parameter Record	MOBILE6 Default. No required user input.
Trip Length Distribution Record	Trip Length Distribution Record	See WE DA TRI LEN DI or WE EN TRI LEN DI commands. Additional guidance is provided in Chapter 5.
By Model Year Inclusion Record	By Model Year Inclusion Record	See DATABASE VEHICLES command.
Scenario Record	REGION=1	MOBILE6 Default. No required user input.
Scenario Record	REGION=2	See ALTITUDE command.
Scenario Record	CALENDAR YEAR	See CALENDAR YEAR.
Scenario Record	Average Speed	See SPEED VMT command. Additional guidance is provided in Chapter 5.
Scenario Record	Ambient Temperature	See HOURLY TEMPERATURE and MIN/MAX TEMP commands. Additional guidance is provided in Chapter 5.
Scenario Record	Operating Modes (PCCN, PCHC, PCCC)	See EXPAND EXHAUST, SOAK DISTRIBUTION, and STARTS PER DAY commands. Additional guidance is provided in Chapter 5.
Scenario Record	MONTH	See SEASON and/or EVALUATION MONTH.
LEV Program Parameter Record	LEV Program Parameter Record	MOBILE6 Default. No required user input.
Diesel Sales Fractions	Diesel Sales Fractions	See DIESEL FRACTIONS command. Additional guidance is provided in Chapter 5.

Appendix C

Corresponding MOBILE6 Inputs for MOBILE5 Inputs

Part 6

Location	MOBILE5 Input	Related MOBILE6 Commands
Additional Correction Factor Record	Air Conditioning User Fraction	See ABSOLUTE HUMIDITY; CLOUD COVER; PEAK SUN, and SUNRISE SUNSET commands for air conditioning effects.
Additional Correction Factor Record	Extra Load Fractions	This feature is not available in MOBILE6.
Additional Correction Factor Record	Trailer Towing Fractions	This feature is not available in MOBILE6.
Additional Correction Factor Record	Absolute Humidity Level	See ABSOLUTE HUMIDITY command.
Additional Correction Factor Record	Dry and Wet Bulb Temperatures	See ABSOLUTE HUMIDITY command.

Appendix D

Vehicle Class Adjustment Factors

Part 1

Calendar Year	A LDT1	B LDT2	C LDT3	D LDT4	E HDV2b	F HDV3	G HDV4	H HDV5	I HDV6	J HDV7	K HDV8a	L HDV8b	M HDBS	N HDBT	O HDGV	P HDDV
1952--1972	0.2310	0.7690	0.6850	0.3150	0.3387	0.0300	0.0190	0.0169	0.0538	0.0595	0.0985	0.3577	0.0178	0.0081	0.8203	0.1797
1973	0.2310	0.7690	0.6850	0.3150	0.3387	0.0300	0.0190	0.0169	0.0538	0.0595	0.0986	0.3577	0.0178	0.0081	0.8203	0.1797
1974	0.2310	0.7690	0.6850	0.3150	0.3387	0.0300	0.0190	0.0169	0.0538	0.0595	0.0987	0.3577	0.0178	0.0081	0.8203	0.1797
1975	0.2310	0.7690	0.6850	0.3150	0.3386	0.0301	0.0190	0.0169	0.0538	0.0595	0.0988	0.3576	0.0177	0.0081	0.8201	0.1799
1976	0.2310	0.7690	0.6850	0.3150	0.3384	0.0300	0.0190	0.0169	0.0538	0.0597	0.0990	0.3574	0.0177	0.0081	0.8197	0.1803
1977	0.2310	0.7690	0.6850	0.3150	0.3380	0.0300	0.0189	0.0168	0.0540	0.0603	0.0991	0.3570	0.0177	0.0081	0.8186	0.1814
1978	0.2310	0.7690	0.6850	0.3150	0.3374	0.0299	0.0189	0.0168	0.0544	0.0615	0.0990	0.3563	0.0177	0.0081	0.8166	0.1834
1979	0.2310	0.7690	0.6850	0.3150	0.3365	0.0298	0.0188	0.0167	0.0550	0.0632	0.0989	0.3554	0.0176	0.0081	0.8137	0.1863
1980	0.2310	0.7690	0.6850	0.3150	0.3352	0.0297	0.0188	0.0167	0.0560	0.0654	0.0987	0.3540	0.0176	0.0080	0.8094	0.1906
1981	0.2310	0.7690	0.6850	0.3150	0.3335	0.0296	0.0187	0.0166	0.0576	0.0682	0.0983	0.3521	0.0175	0.0080	0.8026	0.1974
1982	0.2310	0.7690	0.6850	0.3150	0.3335	0.0299	0.0185	0.0165	0.0590	0.0705	0.0976	0.3493	0.0173	0.0079	0.7874	0.2126
1983	0.2310	0.7690	0.6850	0.3150	0.3348	0.0308	0.0185	0.0163	0.0597	0.0720	0.0967	0.3461	0.0171	0.0078	0.7663	0.2337
1984	0.2310	0.7690	0.6850	0.3150	0.3357	0.0314	0.0184	0.0162	0.0605	0.0733	0.0962	0.3434	0.0170	0.0078	0.7458	0.2542
1985	0.2310	0.7690	0.6850	0.3150	0.3359	0.0320	0.0185	0.0161	0.0613	0.0746	0.0955	0.3413	0.0169	0.0078	0.7261	0.2739
1986	0.2310	0.7690	0.6850	0.3150	0.3357	0.0327	0.0186	0.0160	0.0622	0.0758	0.0950	0.3395	0.0168	0.0077	0.7074	0.2926
1987	0.2310	0.7690	0.6850	0.3150	0.3347	0.0334	0.0188	0.0161	0.0630	0.0769	0.0946	0.3382	0.0168	0.0077	0.6912	0.3088
1988	0.2310	0.7690	0.6850	0.3150	0.3334	0.0338	0.0192	0.0161	0.0636	0.0777	0.0945	0.3373	0.0167	0.0077	0.6783	0.3217
1989	0.2310	0.7690	0.6850	0.3150	0.3323	0.0341	0.0197	0.0162	0.0640	0.0783	0.0943	0.3365	0.0167	0.0077	0.6654	0.3346
1990	0.2310	0.7690	0.6850	0.3150	0.3315	0.0344	0.0204	0.0164	0.0646	0.0791	0.0940	0.3354	0.0166	0.0076	0.6504	0.3496
1991	0.2310	0.7690	0.6850	0.3150	0.3309	0.0345	0.0209	0.0166	0.0655	0.0798	0.0936	0.3340	0.0166	0.0077	0.6333	0.3667
1992	0.2310	0.7690	0.6850	0.3150	0.3307	0.0344	0.0214	0.0168	0.0661	0.0804	0.0932	0.3328	0.0165	0.0076	0.6167	0.3833
1993	0.2310	0.7690	0.6850	0.3150	0.3306	0.0343	0.0219	0.0170	0.0667	0.0809	0.0929	0.3317	0.0164	0.0076	0.6003	0.3997
1994	0.2310	0.7690	0.6850	0.3150	0.3302	0.0341	0.0223	0.0172	0.0671	0.0813	0.0929	0.3311	0.0164	0.0075	0.5863	0.4137
1995	0.2310	0.7690	0.6850	0.3150	0.3294	0.0339	0.0228	0.0175	0.0675	0.0816	0.0927	0.3305	0.0164	0.0076	0.5747	0.4253
1996	0.2310	0.7690	0.6850	0.3150	0.3284	0.0336	0.0232	0.0177	0.0682	0.0822	0.0926	0.3301	0.0164	0.0076	0.5646	0.4354

Appendix D

Vehicle Class Adjustment Factors

Part 2

Calendar Year	A LDT1	B LDT2	C LDT3	D LDT4	E HDV2b	F HDV3	G HDV4	H HDV5	I HDV6	J HDV7	K HDV8a	L HDV8b	M HDBS	N HDBT	O HDGV	P HDDV
1997	0.2310	0.7690	0.6850	0.3150	0.3272	0.0332	0.0236	0.0180	0.0689	0.0827	0.0926	0.3300	0.0163	0.0075	0.5566	0.4434
1998	0.2310	0.7690	0.6850	0.3150	0.3262	0.0329	0.0240	0.0182	0.0695	0.0831	0.0926	0.3297	0.0163	0.0076	0.5490	0.4510
1999	0.2310	0.7690	0.6850	0.3150	0.3253	0.0327	0.0243	0.0184	0.0700	0.0835	0.0924	0.3296	0.0163	0.0075	0.5418	0.4582
2000	0.2310	0.7690	0.6850	0.3150	0.3246	0.0325	0.0246	0.0185	0.0704	0.0838	0.0924	0.3294	0.0163	0.0076	0.5350	0.4650
2001	0.2310	0.7690	0.6850	0.3150	0.3240	0.0323	0.0248	0.0187	0.0707	0.0840	0.0924	0.3292	0.0163	0.0075	0.5283	0.4717
2002	0.2310	0.7690	0.6850	0.3150	0.3235	0.0321	0.0250	0.0189	0.0709	0.0842	0.0924	0.3291	0.0163	0.0075	0.5218	0.4782
2003	0.2310	0.7690	0.6850	0.3150	0.3232	0.0321	0.0252	0.0190	0.0711	0.0844	0.0923	0.3289	0.0163	0.0076	0.5165	0.4835
2004	0.2310	0.7690	0.6850	0.3150	0.3228	0.0320	0.0254	0.0191	0.0714	0.0846	0.0922	0.3288	0.0163	0.0075	0.5100	0.4900
2005	0.2310	0.7690	0.6850	0.3150	0.3225	0.0319	0.0256	0.0192	0.0715	0.0846	0.0922	0.3287	0.0163	0.0075	0.5041	0.4959
2006	0.2310	0.7690	0.6850	0.3150	0.3221	0.0317	0.0257	0.0193	0.0716	0.0847	0.0923	0.3287	0.0163	0.0075	0.4959	0.5041
2007	0.2310	0.7690	0.6850	0.3150	0.3220	0.0317	0.0259	0.0194	0.0717	0.0847	0.0922	0.3286	0.0163	0.0075	0.4944	0.5056
2008	0.2310	0.7690	0.6850	0.3150	0.3218	0.0317	0.0260	0.0194	0.0718	0.0848	0.0921	0.3286	0.0163	0.0075	0.4918	0.5082
2009	0.2310	0.7690	0.6850	0.3150	0.3218	0.0316	0.0261	0.0195	0.0718	0.0848	0.0922	0.3284	0.0163	0.0075	0.4907	0.5093
2010	0.2310	0.7690	0.6850	0.3150	0.3217	0.0316	0.0262	0.0196	0.0718	0.0848	0.0921	0.3284	0.0163	0.0075	0.4891	0.5109
2011	0.2310	0.7690	0.6850	0.3150	0.3217	0.0316	0.0263	0.0196	0.0719	0.0848	0.0921	0.3281	0.0162	0.0076	0.4897	0.5103
2012	0.2310	0.7690	0.6850	0.3150	0.3216	0.0316	0.0265	0.0197	0.0718	0.0848	0.0921	0.3281	0.0162	0.0075	0.4892	0.5108
2013	0.2310	0.7690	0.6850	0.3150	0.3215	0.0316	0.0265	0.0197	0.0719	0.0848	0.0921	0.3281	0.0162	0.0075	0.4868	0.5132
2014	0.2310	0.7690	0.6850	0.3150	0.3215	0.0316	0.0266	0.0198	0.0719	0.0848	0.0921	0.3280	0.0163	0.0075	0.4843	0.5157
2015	0.2310	0.7690	0.6850	0.3150	0.3214	0.0316	0.0266	0.0198	0.0719	0.0848	0.0921	0.3280	0.0163	0.0075	0.4831	0.5169
2016	0.2310	0.7690	0.6850	0.3150	0.3215	0.0316	0.0266	0.0198	0.0719	0.0848	0.0921	0.3279	0.0162	0.0075	0.4839	0.5161
2017	0.2310	0.7690	0.6850	0.3150	0.3214	0.0316	0.0266	0.0199	0.0719	0.0848	0.0921	0.3280	0.0162	0.0075	0.4828	0.5172
2018	0.2310	0.7690	0.6850	0.3150	0.3215	0.0316	0.0266	0.0199	0.0719	0.0848	0.0920	0.3278	0.0162	0.0075	0.4856	0.5144
2019	0.2310	0.7690	0.6850	0.3150	0.3215	0.0317	0.0266	0.0199	0.0719	0.0848	0.0920	0.3278	0.0162	0.0075	0.4844	0.5156
2020--2050	0.2310	0.7690	0.6850	0.3150	0.3216	0.0317	0.0266	0.0199	0.0719	0.0848	0.0920	0.3278	0.0162	0.0075	0.4855	0.5145

Appendix E

MOBILE6 Default Diesel Sales Fractions

Model Year	LDV	LDT1 or LDT2	LDT3 or LDT4	HDV2B	HDV3	HDV4	HDV5	HDV6	HDV7	HDV8A	HDV8B	HDBS
1996 and later	0.0009	0.0000	0.0126	0.1998	0.6774	0.8606	0.4647	0.6300	0.8563	0.9992	1.0000	0.9585
1995	0.0006	0.0000	0.0115	0.2578	0.7715	0.8473	0.4384	0.6078	0.8443	0.9989	1.0000	0.8857
1994	0.0001	0.0000	0.0111	0.2515	0.7910	0.8048	0.3670	0.5246	0.7943	0.9987	1.0000	0.8525
1993	0.0003	0.0000	0.0145	0.3263	0.8105	0.8331	0.4125	0.5767	0.8266	0.9989	1.0000	0.8795
1992	0.0006	0.0000	0.0115	0.2784	0.8068	0.7901	0.3462	0.5289	0.7972	0.9977	1.0000	0.9900
1991	0.0013	0.0000	0.0129	0.2963	0.8280	0.7316	0.2771	0.5788	0.8279	0.9984	1.0000	0.9105
1990	0.0004	0.0000	0.0096	0.2384	0.8477	0.7275	0.2730	0.5617	0.8177	0.9982	1.0000	0.8760
1989	0.0004	0.0000	0.0083	0.2058	0.7940	0.7158	0.2616	0.4537	0.7440	0.9979	1.0000	0.7710
1988	0.0001	0.0000	0.0072	0.1756	0.7488	0.5647	0.1543	0.4216	0.7184	0.9969	1.0000	0.7502
1987	0.0027	0.0007	0.0082	0.1958	0.7789	0.3178	0.0615	0.4734	0.7588	0.9978	1.0000	0.7345
1986	0.0032	0.0033	0.0124	0.2726	0.7842	0.2207	0.0383	0.4705	0.7567	0.9980	1.0000	0.6733
1985	0.0097	0.0048	0.0135	0.2743	0.6145	0.1968	0.0333	0.4525	0.7431	0.9979	1.0000	0.5155
1984	0.0162	0.0120	0.0169	0.3004	0.5139	0.1570	0.0255	0.4310	0.7261	0.9976	1.0000	0.3845
1983	0.0241	0.0223	0.0209	0.2918	0.5032	0.0738	0.0111	0.3569	0.6602	0.9969	1.0000	0.3238
1982	0.0510	0.0656	0.0256	0.2859	0.4277	0.0341	0.0049	0.3690	0.6717	0.9978	1.0000	0.3260
1981	0.0706	0.0616	0.0013	0.0138	0.0079	0.0414	0.0060	0.4413	0.7344	0.9982	1.0000	0.2639
1980	0.0390	0.0439	0.0006	0.0000	0.0000	0.0003	0.0000	0.3094	0.6107	0.9974	1.0000	0.0594
1979	0.0269	0.0316	0.0011	0.0000	0.0000	0.0000	0.0000	0.1679	0.4140	0.9965	1.0000	0.0460
1978	0.0114	0.0259	0.0001	0.0000	0.0001	0.0000	0.0000	0.1390	0.3610	0.9964	1.0000	0.0291
1977	0.0093	0.0000	0.0000	0.0000	0.0003	0.0000	0.0000	0.0808	0.2353	0.9949	1.0000	0.0240
1976	0.0137	0.0187	0.0000	0.0000	0.0010	0.0259	0.0037	0.0476	0.1489	0.9920	1.0000	0.0086
1975	0.0155	0.1038	0.0000	0.0000	0.0028	0.0078	0.0011	0.0365	0.1170	0.9936	1.0000	0.0087
1974	0.0067	0.1170	0.0001	0.0000	0.0248	0.0004	0.0001	0.0288	0.0940	0.9819	1.0000	0.0000
1973	0.0067	0.1170	0.0001	0.0000	0.0000	0.0090	0.0013	0.0274	0.0897	0.9812	1.0000	0.0000
1972 and earlier	0.0067	0.1170	0.0001	0.0000	0.0000	0.0112	0.0016	0.0297	0.0966	0.9720	1.0000	0.0000

Appendix F
Creating MOBILE6 Average Speed Distributions From Average Speed
(all speeds in miles per hour)

Area Wide Average Speed
Table 1 (Part 1)

MOBILE5 Area Wide Average Speed	MOBILE6 Freeway Average Speed	MOBILE6 Arterial/Col. Average Speed	MOBILE6 Freeway Lower Speed Bin Speed	MOBILE6 Freeway Lower Speed Bin Fraction	MOBILE6 Freeway Upper Speed Bin Speed	MOBILE6 Freeway Upper Speed Bin Fraction	MOBILE6 Arterial/Col. Lower Speed Bin Speed	MOBILE6 Arterial/Col. Lower Speed Bin Fraction	MOBILE6 Arterial/Col. Upper Speed Bin Speed	MOBILE6 Arterial/Col. Upper Speed Bin Fraction
3	2.9	2.5	2.5	0.743	5	0.257	2.5	1.000	5	0.000
4	3.9	3.3	2.5	0.293	5	0.707	2.5	0.512	5	0.488
5	4.9	4.2	2.5	0.022	5	0.978	2.5	0.196	5	0.804
6	5.9	5.1	5	0.684	10	0.316	5	0.970	10	0.030
7	7.0	6.0	5	0.427	10	0.573	5	0.669	10	0.331
8	8.1	6.9	5	0.234	10	0.766	5	0.443	10	0.557
9	9.2	7.9	5	0.083	10	0.917	5	0.267	10	0.733
10	10.4	8.9	10	0.890	15	0.110	5	0.127	10	0.873
11	11.6	9.9	10	0.595	15	0.405	5	0.012	10	0.988
12	12.8	10.9	10	0.349	15	0.651	10	0.748	15	0.252
13	14.0	12.0	10	0.141	15	0.859	10	0.504	15	0.496
14	15.3	13.1	15	0.925	20	0.075	10	0.296	15	0.704
15	16.6	14.2	15	0.616	20	0.384	10	0.115	15	0.885
16	17.9	15.3	15	0.346	20	0.654	15	0.914	20	0.086
17	19.3	16.5	15	0.107	20	0.893	15	0.635	20	0.365
18	20.7	17.7	20	0.825	25	0.175	15	0.387	20	0.613
19	22.2	19.0	20	0.509	25	0.491	15	0.165	20	0.835
20	23.7	20.2	20	0.224	25	0.776	20	0.942	25	0.058
21	25.2	21.6	25	0.950	30	0.050	20	0.640	25	0.360
22	26.8	22.9	25	0.599	30	0.401	20	0.366	25	0.634
23	28.4	24.3	25	0.278	30	0.722	20	0.116	25	0.884
24	30.1	25.7	30	0.978	35	0.022	25	0.831	30	0.169

Appendix F
Creating MOBILE6 Average Speed Distributions from Average Speed
(all speeds in miles per hour)

Area Wide Average Speed
Table 1 (Part 2)

MOBILE5 Area Wide Average Speed	MOBILE6 Freeway Average Speed	MOBILE6 Arterial/Col Average Speed	MOBILE6 Freeway Lower Speed Bin Speed	MOBILE6 Freeway Lower Speed Bin Fraction	MOBILE6 Freeway Upper Speed Bin Speed	MOBILE6 Freeway Upper Speed Bin Fraction	MOBILE6 Arterial/Col. Lower Speed Bin Speed	MOBILE6 Arterial/Col. Lower Speed Bin Fraction	MOBILE6 Arterial/Col. Upper Speed Bin Speed	MOBILE6 Arterial/Col. Upper Speed Bin Fraction
25	31.8	27.2	30	0.599	35	0.401	25	0.514	30	0.486
26	33.6	28.7	30	0.250	35	0.750	25	0.222	30	0.778
27	35.4	30.3	35	0.902	40	0.098	30	0.933	35	0.067
28	37.3	31.9	35	0.501	40	0.499	30	0.582	35	0.418
29	39.3	33.6	35	0.128	40	0.872	30	0.254	35	0.746
30	41.3	35.3	40	0.717	45	0.283	35	0.932	40	0.068
31	43.4	37.1	40	0.299	45	0.701	35	0.551	40	0.449
32	45.5	38.9	45	0.883	50	0.117	35	0.194	40	0.806
33	47.8	40.8	45	0.422	50	0.578	40	0.818	45	0.182
34	50.1	42.8	50	0.985	55	0.015	40	0.412	45	0.588
35	52.5	44.8	50	0.485	55	0.515	40	0.029	45	0.971
36	54.9	47.0	50	0.013	55	0.987	45	0.584	50	0.416
37	57.5	49.1	55	0.480	60	0.520	45	0.157	50	0.843
38	60.2	51.4	60	0.967	65	0.033	50	0.697	55	0.303
39	62.9	53.8	60	0.398	65	0.602	50	0.227	55	0.773
40	65.8	56.2	60	0.000	65	1.000	55	0.737	60	0.263
41	68.8	58.8	60	0.000	65	1.000	55	0.228	60	0.772
42	71.9	61.4	60	0.000	65	1.000	60	0.697	65	0.303
43	75.1	64.2	60	0.000	65	1.000	60	0.150	65	0.850
44	78.5	67.1	60	0.000	65	1.000	60	0.000	65	1.000
Greater Than 44	N/A	N/A	60	0.000	65	1.000	60	0.000	65	1.000

Appendix F

Creating MOBILE6 Average Speed Distributions From Average Speed
(all speeds in miles per hour)

Freeway Average Speed
Table 2 (Part 1)

MOBILE5 Freeway Average Speed	MOBILE6 Freeway Average Speed	MOBILE6 Freeway Lower Speed Bin Speed	MOBILE6 Freeway Lower Speed Bin Fraction	MOBILE6 Freeway Upper Speed Bin Speed	MOBILE6 Freeway Upper Speed Bin Fraction
2.5	2.3	2.5	1.000	5	0.000
3	2.8	2.5	0.799	5	0.201
4	3.7	2.5	0.346	5	0.654
5	4.7	2.5	0.074	5	0.926
6	5.6	5	0.786	10	0.214
7	6.5	5	0.528	10	0.472
8	7.5	5	0.334	10	0.666
9	8.5	5	0.183	10	0.817
10	9.4	5	0.062	10	0.938
11	10.4	10	0.889	15	0.111
12	11.4	10	0.642	15	0.358
13	12.3	10	0.433	15	0.567
14	13.3	10	0.254	15	0.746
15	14.3	10	0.099	15	0.901
16	15.3	15	0.925	20	0.075
17	16.3	15	0.686	20	0.314
18	17.3	15	0.472	20	0.528
19	18.3	15	0.282	20	0.718
20	19.3	15	0.110	20	0.890
21	20.3	20	0.925	25	0.075
22	21.3	20	0.689	25	0.311
23	22.3	20	0.475	25	0.525
24	23.4	20	0.278	25	0.722
25	24.4	20	0.097	25	0.903
26	25.4	25	0.894	30	0.106
27	26.5	25	0.662	30	0.338
28	27.5	25	0.446	30	0.554
29	28.6	25	0.245	30	0.755
30	29.7	25	0.058	30	0.942
31	30.7	30	0.835	35	0.165
32	31.8	30	0.605	35	0.395
33	32.9	30	0.389	35	0.611

Appendix F

Creating MOBILE6 Average Speed Distributions From Average Speed
(all speeds in miles per hour)

Freeway Average Speed
Table 2 (Part 2)

MOBILE5 Freeway Average Speed	MOBILE6 Freeway Average Speed	MOBILE6 Freeway Lower Speed Bin Speed	MOBILE6 Freeway Lower Speed Bin Fraction	MOBILE6 Freeway Upper Speed Bin Speed	MOBILE6 Freeway Upper Speed Bin Fraction
34	33.9	30	0.186	35	0.814
35	35.0	30	0.000	35	1.000
36	36.1	35	0.750	40	0.250
37	37.2	35	0.522	40	0.478
38	38.3	35	0.305	40	0.695
39	39.4	35	0.100	40	0.900
40	40.6	40	0.878	45	0.122
41	41.7	40	0.639	45	0.361
42	42.8	40	0.412	45	0.588
43	43.9	40	0.195	45	0.805
44	45.1	45	0.986	50	0.014
45	46.2	45	0.739	50	0.261
46	47.4	45	0.502	50	0.498
47	48.5	45	0.276	50	0.724
48	49.7	45	0.059	50	0.941
49	50.8	50	0.818	55	0.182
50	52.0	50	0.574	55	0.426
51	53.2	50	0.340	55	0.660
52	54.4	50	0.114	55	0.886
53	55.6	55	0.877	60	0.123
54	56.8	55	0.626	60	0.374
55	58.0	55	0.385	60	0.615
56	59.2	55	0.152	60	0.848
57	60.4	60	0.914	65	0.086
58	61.6	60	0.657	65	0.343
59	62.9	60	0.410	65	0.590
60	64.1	60	0.170	65	0.830
61	65.3	60	0.000	65	1.000
Greater Than 61	N/A	60	0.000	65	1.000

Appendix F

Creating MOBILE6 Average Speed Distributions From Average Speed (all speeds in miles per hour)

Arterial/Collector Average Speed Table 3 (Part 1)

MOBILE5 Arterial/Col. Average Speed	MOBILE6 Arterial/Col. Lower Speed Bin Speed	MOBILE6 Arterial/Col. Lower Speed Bin Fraction	MOBILE6 Arterial/Col. Upper Speed Bin Speed	MOBILE6 Arterial/Col. Upper Speed Bin Fraction
2.5	2.5	1.000	5	0.000
3	2.5	0.667	5	0.333
4	2.5	0.250	5	0.750
5	2.5	0.000	5	1.000
6	5	0.667	10	0.333
7	5	0.429	10	0.571
8	5	0.250	10	0.750
9	5	0.111	10	0.889
10	5	0.000	10	1.000
11	10	0.727	15	0.273
12	10	0.500	15	0.500
13	10	0.308	15	0.692
14	10	0.143	15	0.857
15	10	0.000	15	1.000
16	15	0.750	20	0.250
17	15	0.529	20	0.471
18	15	0.333	20	0.667
19	15	0.158	20	0.842
20	15	0.000	20	1.000
21	20	0.762	25	0.238
22	20	0.545	25	0.455
23	20	0.348	25	0.652
24	20	0.167	25	0.833
25	20	0.000	25	1.000
26	25	0.769	30	0.231
27	25	0.556	30	0.444
28	25	0.357	30	0.643
29	25	0.172	30	0.828
30	25	0.000	30	1.000
31	30	0.774	35	0.226
32	30	0.563	35	0.438
33	30	0.364	35	0.636

Appendix F

Creating MOBILE6 Average Speed Distributions From Average Speed
(all speeds in miles per hour)

Arterial/Collector Average Speed
Table 3 (Part 2)

MOBILE5 Arterial/Col. Average Speed	MOBILE6 Arterial/Col. Lower Speed Bin Speed	MOBILE6 Arterial/Col. Lower Speed Bin Fraction	MOBILE6 Arterial/Col. Upper Speed Bin Speed	MOBILE6 Arterial/Col. Upper Speed Bin Fraction
34	30	0.176	35	0.824
35	30	0.000	35	1.000
36	35	0.778	40	0.222
37	35	0.568	40	0.432
38	35	0.368	40	0.632
39	35	0.179	40	0.821
40	35	0.000	40	1.000
41	40	0.780	45	0.220
42	40	0.571	45	0.429
43	40	0.372	45	0.628
44	40	0.182	45	0.818
45	40	0.000	45	1.000
46	45	0.783	50	0.217
47	45	0.574	50	0.426
48	45	0.375	50	0.625
49	45	0.184	50	0.816
50	45	0.000	50	1.000
51	50	0.784	55	0.216
52	50	0.577	55	0.423
53	50	0.377	55	0.623
54	50	0.185	55	0.815
55	50	0.000	55	1.000
56	55	0.786	60	0.214
57	55	0.579	60	0.421
58	55	0.379	60	0.621
59	55	0.186	60	0.814
60	55	0.000	60	1.000
61	60	0.787	65	0.213
62	60	0.581	65	0.419
63	60	0.381	65	0.619
64	60	0.188	65	0.813
65	60	0.000	65	1.000
Greater Than 65	60	0.000	65	1.000