

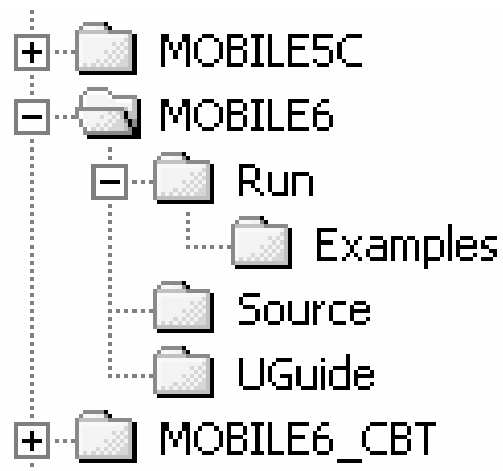
V. MOBILE6 BASIC HANDS-ON TRAINING

Day 2 Agenda

- Brief overview of MOBILE6 installation and input file structure
- Extensive discussion of MOBILE6 commands with examples worked out by participants
- The commands will be categorized as follows:
 - Required commands
 - Output options
 - Vehicle activity and fleet characteristics
 - External/ambient conditions
 - Fuels options
 - State programs (e.g., I/M)
 - Miscellaneous commands
- Conversion of MOBILE5 inputs to MOBILE6 inputs

Basic Installation

- The draft MOBILE6 model has been released in a ZIP file with the following directory structure:



- Copy the ZIP file (M6ZIP.ZIP) onto the hard drive and unzip; the above directory structure will be established

Contents of Sub-Directories

- C:\MOBILE6
 - README.TXT, which contains brief instructions on how to run the model
- C:\MOBILE6\RUN
 - MOBILE6 executable and necessary external files (e.g., I/M credits); a sample MOBILE6 input file; sample data files (*.D and *.DEF)
 - *.DEF files reflect MOBILE6 defaults; *.D files are not necessarily defaults
- C:\MOBILE6\RUN\EXAMPLES
 - Example input/output files
- C:\MOBILE6\SOURCE
 - Source code (currently empty)
- C:\MOBILE6\UGUIDE
 - User's guide and FAQ document

MOBILE6 INPUT FILE DEVELOPMENT

MOBILE6 Input File Basics

- MOBILE6 is not interactive; an input file must be prepared
- Input files **MUST**:
 - **Be in DOS text (ASCII) format**
 - **NOT contain TAB characters**
 - **NOT have a root name longer than 8 characters**
- Thus, to create input files:
 - Use a text editor (e.g., Notepad); or
 - Use a word processor and use the “Save As” command to save as a DOS text file (beware of auto-tabbing!)
- Recommendation:

Use a non-proportional font (e.g., Courier) when creating input files. Although MOBILE6 is more forgiving than MOBILE5, inputs still need to be placed in the correct columns.

“Bare Bones” MOBILE6 Input File

123456789012345678901234567890123456789012...

```
MOBILE6 INPUT FILE :  
RUN DATA          :  
SCENARIO RECORD   : The Title Goes Here  
CALENDAR YEAR     : 2000  
MIN/MAX TEMP      : 72.0  92.0  
FUEL RVP          : 8.7  
END OF RUN        :
```

Items to Note:

- Columns 1 to 19 contain “Command Names”
- By convention, column 20 contains a colon when data are input but is not required; column 21 is left blank
- Columns 22-150 contain specific inputs that are either free-format or fixed-format, depending on the entry
 - In free-format, the data values are entered into any column, but must be separated by a blank space
 - In fixed-format, the inputs follow Fortran formatting rules
- The seven lines reflected in the input file above are the **only required inputs** for a MOBILE6 run

MOBILE6 Input File Structure Comment Lines

- Blank lines and comment lines are disregarded by the program, and should be used liberally in your input file development
- Comment lines are distinguished by:
 - “*” in the first column for non-printed comments
 - “>” in the first column for comments printed on the output file

MOBILE6 Input File Structure

- MOBILE6 input files are broken up into three sections:
 - HEADER
 - RUN
 - SCENARIO
- Certain commands can only be placed in one of these three sections
- An END OF RUN command appears at the end to mark the end of the run and to separate multiple runs
- Our input file above becomes:

```
***** Header Section *****
MOBILE6 INPUT FILE :

RUN DATA          :
***** Run Section *****

***** Scenario Section *****
SCENARIO RECORD   : The Title Goes Here
CALENDAR YEAR     : 2000
MIN/MAX TEMP     : 72.0  92.0
FUEL RVP          : 8.7

***** End of This Run *****
END OF RUN       :
```

MOBILE6 Input File Structure

Separator Commands

- The commands

MOBILE6 INPUT FILE (for regular input files)

MOBILE6 BATCH FILE (for batch input files)

RUN DATA

SCENARIO RECORD

END OF RUN

Are known as “Separator Commands” because they mark the beginning or end of an input file, and/or establish the start or end of a HEADER, RUN, or SCENARIO section

- Each MOBILE6 input file **MUST** begin with either of the following:

MOBILE6 INPUT FILE (for regular input files)

MOBILE6 BATCH FILE (for batch input files)

MOBILE6 Input File Structure

Multiple Runs

For multiple runs, the following input file structure is adopted:

Header Section

Run Section #1

Scenario Section #1-1
Scenario Section #1-2
Scenario Section #1-n

Run Section #2

Scenario Section #2-1
Scenario Section #2-2
Scenario Section #2-n

Run Section #m

Scenario Section #m-1
Scenario Section #m-2
Scenario Section #m-n

Sample Input File for Multiple Run Sections

```
*****      Header Section      *****
MOBILE6 INPUT FILE :

RUN DATA      :
*****      Run Section #1      *****
MIN/MAX TEMP   : 72.0  92.0
FUEL RVP       : 8.7

*****      Scenario Section #1  *****
SCENARIO RECORD : Run#1 - Scenario #1
CALENDAR YEAR   : 2000

SCENARIO RECORD : Run#1 - Scenario #2
CALENDAR YEAR   : 2010

*****      End of Run #1      *****
END OF RUN      :

*****      Run Section #2      *****
MIN/MAX TEMP   : 72.0  92.0
FUEL RVP       : 6.7

***  *****      Scenario Section #2  *****
SCENARIO RECORD : Run#2 - Scenario #1
CALENDAR YEAR   : 2000

SCENARIO RECORD : Run#2 - Scenario #2
CALENDAR YEAR   : 2010
*****      End of Run #2      *****
END OF RUN      :
```

MOBILE6 INPUTS AND COMMANDS

Summary of MOBILE6 Required and Optional User Inputs

Required Inputs	
Parameter	Comments
Min/Max or Hourly Temperatures	Used to estimate TCF temp, evap temps, diurnal emissions.
RVP	Gasoline volatility.
Calendar Year	Range: 1955 to 2050.

Optional Inputs/Features	
Parameter	Comments
<u>Output Options:</u> Reporting HC Results Specify Pollutant(s) to Print Expanded Exhaust/Evap Results Expanded LDT/HDT/Bus Results Database Output	HC can be reported as THC, NMHC, VOC, TOG, NMOG HC, CO, and/or NOx can be printed. Allows more detail to be output. Allows more detail to be output. Allows for MY-specific and other detailed output.
<u>Activity Parameters:</u> VMT Mix by Veh Type Alternate VMT Distribution by Hour Alternate VMT Distribution by Facility Type VMT by Speed Distribution Average Speed Starts per Day Start Distribution Soak Time Distribution Hot Soak Activity Diurnal Soak Activity Trip Length Dist - Weekend and Weekday Weekend vs Weekday Activity	User may input locally derived VMT mix. Takes the place of average speed. Takes the place of average speed. Takes the place of average speed. User can input average speed. Alternate number of starts by hour of day. Alternate distribution of starts by hour of day. Alternate distribution of soak time by hour of day. Alternate distribution of hot soak length. Alternate distribution of diurnal soak times. Used in estimating running loss emissions. User can specify activity type, depending on need.
<u>Fleet Characteristics:</u> Registration Distribution Mileage Accumulation Alternate Diesel Sales Fraction NGV Fractions	User may input locally derived registration distribution. User may input locally derived mileage accumulation rates. User may input locally derived LDV Diesel registration info. User may specify a fraction of natural gas vehicles.
<u>External Conditions:</u> Month of Evaluation Altitude Humidity Cloud Cover Peak Sun Sunrise/Sunset	Jan or Jul - choice based on winter or summer evaluation. Low/high altitude - low is default. Used for A/C calculations and impacts exhaust NOx. Used primarily for A/C calculations. Used primarily for A/C calculations. Used primarily for A/C calculations.
<u>Fuels Options:</u> Reformulated Gasoline Gasoline Sulfur Level Oxygenated Fuels	Effects of reformulated gasoline can be included. Local data on gasoline sulfur level can be entered. Ether/alcohol market share and oxygen content required.
<u>State Programs:</u> I/M Program Anti-Tampering Program Functional Pressure/Cap Check Refueling Emissions	Idle, Idle/2500, ASM, and IM240 tests included in MOBILE5. Effects of an anti-tampering program can be included. Effects of a functional evap system check can be included. Uncontrolled, with Stage II, with on-board, or zeroed.
<u>Miscellaneous Options:</u> Disable CAAA Requirements Tier 1/Tier 2/LEV Implementation HDDV Defeat Device Parameters 2007 HDDV Rule Disablement	Cold CO, Tier 1 and 2, and evap benefits can be disabled. Implementation and emission rates can be modified. Inputs to the defeat device emissions calcs can be modified. Disables the impacts of this regulation.

MOBILE6 Command Structure

- All of the preceding inputs and features are “enabled” with a command
- Depending on the specific command, it is placed in the HEADER section, the RUN section, or the SCENARIO section of the input file
- Command names are entered in columns 1-19, column 20 is a colon, column 21 is blank, and command data are entered in columns 22 - 150...

```
          1          2          3          4
1234567890123456789012345678901234567890123...
SCENARIO RECORD      : The Title Goes Here
CALENDAR YEAR        : 2000
MIN/MAX TEMP         : 72.0  92.0
FUEL RVP              : 8.7
```

- Some commands do not need data, while others have data entered below the command, and still others reference an external data file
- Refer to the User’s Guide for a complete description of each command

MOBILE6 Command Structure

- Commands requiring no data (i.e., On/Off)

```
      1           2           3           4  
1234567890123456789012345678901234567890123...  
EXPAND EVAPORATIVE :  
EXPRESS HC AS TOG  :
```

- Commands requiring input on same line

```
      1           2           3           4  
1234567890123456789012345678901234567890123...  
POLLUTANTS          : HC NOX  
SULFUR CONTENT      : 230.0
```

- Command requiring input below the command

```
      1           2           3           4  
1234567890123456789012345678901234567890123...  
STAGE II REFUELING :  
89 3 92. 84.
```

- Commands requiring an external data file

```
      1           2           3           4  
1234567890123456789012345678901234567890123...  
VMT BY HOUR         : HVMT.DEF  
REG DIST            : C:\M6\DATA\REGDATA.D
```


MOBILE6 Command Structure

Location of Commands

- Recall the three input file sections:
 - HEADER
 - RUN
 - SCENARIO
- Some commands can only be placed in specific sections
- Other commands may be placed in either the RUN or SCENARIO sections
- Commands can occur more than once in a section, but **only the last occurrence** is used in the calculations
- For commands that conflict, the last entry is used

Data Entry Format

- Free Format
 - New for MOBILE6, allows data to be entered into any column in the data space, with values separated by spaces or single commas
 - Allows data to be entered onto more than one data line
- Fixed Format
 - Typical input format for MOBILE5, used for some inputs in MOBILE6
 - Specifies precisely in which columns data must be placed
 - Specifies the form of the data (real, integer)
 - Follows Fortran convention

Fortran Fixed Format Summary

<u>Descriptor</u>	<u>Definition and Interpretation</u>
'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.

MOBILE6 REQUIRED COMMANDS

Summary of MOBILE6 Required Commands

MOBILE6 Command	Header/ Run/ Scenario?	Comment
MOBILE6 INPUT FILE	H	First Line of Input File
RUN DATA	H	Ends Header/Begins Run
SCENARIO RECORD	S	Begins Scenario Section
CALENDAR YEAR : 2000	S	Calendar Year of Analysis
FUEL RVP : 8.7	R/S	Gasoline RVP (in psi)
MIN/MAX TEMP : 72.0 92.0	R/S	Min/Max Daily Temperature
HOURLY TEMPERATURES: 72.0 73.0 74.5 ...	R/S	Hourly Temp (24 Entries)
END OF RUN :	R	Marks the End of the Run Section

Example 1

Generate VOC, CO, and NO_x fleet-average emission rates for 1990 to 2020 in 5-year increments. Plot results.

Temperature: 72°F to 92°F

RVP: 8.7 psi

MOBILE6 OUTPUTS AND OUTPUT COMMANDS

Pollutants

- MOBILE6.0 calculates emission rates for:
 - hydrocarbons (HC)
 - carbon monoxide (CO)
 - oxides of nitrogen (NO_x)
- Hydrocarbon emission rates can be reported as:
 - total hydrocarbons (THC)
 - non-methane hydrocarbons (NMHC)
 - volatile organic compounds (VOC)
 - total organic gases (TOG)
 - non-methane organic gases (NMOG)

Number	Abbr.	FID HC	Methane	Ethane	Aldehydes
1	THC	yes	yes	yes	no
2	NMHC	yes	no	yes	no
3	VOC	yes	no	no	yes
4	TOG	yes	yes	yes	yes
5	NMOG	yes	no	yes	yes

MOBILE6 Vehicle Classifications

<i>Number</i>	<i>Abbreviation</i>	<i>Description</i>
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, 3,751-5750 lbs. LVW)
4	LDGT3	Light-Duty Gasoline Trucks 3 (6,001-8500 lbs. GVWR, 0-3750 lbs. LVW)
5	LDGT4	Light-Duty Gasoline Trucks 4 (6,001-8500 lbs. GVWR, 3,751-5750 lbs. LVW)
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 1and 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)

New Vehicle Types for MOBILE6

- MOBILE6 vehicle types more closely match classifications used for emission standards than MOBILE5:

MOBILE5	MOBILE6
LDV	LDV
LDT1	LDT1 LDT2
LDT2	LDT3 LDT4
HDV	HDV2B HDV3 HDV4 HDV5 HDV6 HDV7 HDV8A HDV8B HDBS HDBT
MC	MC

MOBILE6 Emission Type Classifications

<i>Number</i>	<i>Abbreviation</i>	<i>Description</i>	<i>Pollutants</i>	<i>Vehicle Classes</i>
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

MOBILE6 Roadway Classifications

<i>Number</i>	<i>Abbreviation</i>	<i>Description</i>
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)

Summary of MOBILE6 Output Commands

MOBILE6 Command	Header/ Run/ Scenario?	Comment
POLLUTANTS : HC NOX	H	Specify Pollutants to Print
EXPRESS HC AS NMHC :	R	Report HC as NMHC
EXPRESS HC AS NMOG :	R	Report HC as NMOG
EXPRESS HC AS THC :	R	Report HC as THC
EXPRESS HC AS TOG :	R	Report HC as TOG
EXPRESS HC AS VOC :	R	Report HC as VOC
NO REFUELING :	R	Zero Out Refueling Losses
REPORT FILE : FILENAME .OUT	H	User-Specified Output File Name
NO DESC OUTPUT :	H	Do Not Print Descriptive Output
EXPAND BUS EFS :	R	More Detailed Bus Output
EXPAND EVAPORATIVE :	R	More Detailed Evap Output
EXPAND EXHAUST :	R	More Detailed Exhaust Output
EXPAND HDDV EFS :	R	More Detailed HDDV Output
EXPAND HDGV EFS :	R	More Detailed HDGV Output
EXPAND LDT EFS :	R	More Detailed LDT Output
DATABASE OUTPUT :	H	MY-Specific and Other Details

Example 2

Generate LDGV VOC and NO_x emission rates for 1990 to 2020 in 5-year increments. For NO_x, plot running versus starting emission rates. For VOC, plot exhaust versus evaporative emission rates. Specify an output file name.

Temperature: 72°F to 92°F

RVP: 8.7 psi

Output File Options in MOBILE6 (Database Output)

- Database output format allows the user to specify very detailed output (most similar output in MOBILE5 was the by-model-year output)
- However, unless variables in the output file are limited, each run will comprise approximately 40 megabytes per scenario
- Details of specific database output formats are summarized on the following pages
- Note that the “DATABASE OPTIONS” command allows the DATABASE commands to be placed in an external file called by MOBILE6

MOBILE6 Database Output Format

- All DATABASE commands go in the Header section
- The following commands are used in conjunction with the DATABASE OUTPUT command

<u>Command</u>	<u>Comment</u>	<u>Add'l Input?</u>
DATABASE OUTPUT	Specifies database output	No
<u>Commands Specifying Control</u>		
WITH FIELDNAMES	Adds header row to output	No
DATABASE OPTIONS	External file with commands	Yes
EMISSIONS TABLE	Non-default file name for output	Yes
<u>Commands Limiting Output</u>		
POLLUTANTS	Specifies pollutants	Yes
DATABASE EMISSIONS	Specifies emission types	Yes
DATABASE FACILITIES	Specifies roadway types	Yes
DATABASE VEHICLES	Specifies vehicle classes	Yes
DATABASE YEARS	Specifies model years	Yes
DATABASE AGES	Specifies vehicle ages	Yes
DATABASE HOURS	Specifies hours of the day	Yes
DAILY OUTPUT	Average daily emissions	No
AGGREGATED OUTPUT	Aggregates ages, MY, etc.	No

- Format of command inputs follow

MOBILE6 Input File Structure -- DATABASE Output Options

Commands Specifying Control

1 2 3 4 5 6 7 8 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

WITH FIELDNAMES :
No data entry required

1 2 3 4 5 6 7 8 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

DATABASE OPTIONS :

F	I	L	E	N	A	M	E	.	E	X	T
---	---	---	---	---	---	---	---	---	---	---	---

Name of File (Can include directory path)

1 2 3 4 5 6 7 8 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

EMISSIONS TABLE :

F	I	L	E	N	A	M	E	.	E	X	T
---	---	---	---	---	---	---	---	---	---	---	---

Name of File (Can include directory path)

Commands Limiting Output

1 2 3 4 5 6 7 8 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

POLLUTANTS :

H	C		C	O		N	O	X
---	---	--	---	---	--	---	---	---

Options:
HC
CO
NOX
First Pollutant
Second Pollutant
Third Pollutant

1 2 3 4 5 6 7 8 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

DATABASE EMISSIONS :

2	2	2	2		1	1	1	1
---	---	---	---	--	---	---	---	---

(2=ON; 1=OFF)
Exh Running
Exh Starting
Hot Soak
Diurnal
Evap Resting
Evap Running Loss
Crankcase
Refueling

1 2 3 4 5 6 7 8 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

DATABASE FACILITIES:

L	O	C	A	L		R	A	M	P		E	T	C	...
---	---	---	---	---	--	---	---	---	---	--	---	---	---	-----

Options:
ARTERIAL
FREEWAY
LOCAL
RAMP
NONE (i.e., for exh start and evap processes)
First Facility Type
Second Facility Type, etc.

MOBILE6 Input File Structure -- DATABASE Output Options

Commands Limiting Output (Continued)

1 2 3 4 5 6 7 8 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

DATABASE YEARS :

1	9	9	0	,	2	0	0	0
---	---	---	---	---	---	---	---	---

(Valid Entries = 1928 to 2050)

First MY Last MY

1 2 3 4 5 6 7 8 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

DATABASE AGES :

0	9	,	2	0
---	---	---	---	---

(Valid Entries = 0 to 24)

First Age Last Age

1 2 3 4 5 6 7 8 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

DATABASE HOURS :

0	9	,	2	0
---	---	---	---	---

(Valid Entries = 0 to 24)

First Hour Last Hour

1 2 3 4 5 6 7 8 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

DAILY OUTPUT :

No data entry required

1 2 3 4 5 6 7 8 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

AGGREGATED OUTPUT :

No data entry required

Example 3

Using DATABASE commands, find:

- a. Exhaust and evap VOC emission rates of 5-year-old LDGVs from 1970 through 2010 model years.
- b. NO_x emission rates of 10-year old Class 8B HDDVs from 1980 through 2010 model years.

Plot the results.

Temperature: 72°F to 92°F

RVP: 8.7 psi

**MOBILE6
VEHICLE ACTIVITY AND
FLEET CHARACTERISTICS
COMMANDS**

Activity and Fleet Characteristics

- These commands allow the use of locally derived data often developed for MOBILE5 modeling
- As a result, conversion of several MOBILE5 inputs to MOBILE6 inputs is covered prior to the examples

Summary of MOBILE6 Activity Commands

MOBILE6 Command	Header/ Run/ Scenario?	Comment
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	R/S	VMT Mix by Veh Type (Included in Fleet Commands)
VMT BY HOUR : HVMT.DEF ^a	R/S	VMT Distribution by Hour
VMT BY FACILITY : FVMT.DEF	R/S	VMT Distribution by Facility Type
SPEED VMT : SVMT.DEF	R/S	VMT by Speed Distribution
AVERAGE SPEED : 38.0 Freeway	S	User-Input Average Speed
STARTS PER DAY : FTP_SPD.D	R	Starts per Day
START DIST : SDIST.D	R	Start Distribution
SOAK DISTRIBUTION : SOAKDST.D	S	Soak Time Distribution
HOT SOAK ACTIVITY : HSACT.D	S	Hot Soak Activity
DIURN SOAK ACTIVITY: DSACT.D	S	Diurnal Soak Activity
WE DA TRI LEN DI : WEDATRIP.D	R/S	Trip Length Dist - Weekday
WE EN TRI LEN DI : WEENTRIP.D	R/S	Trip Length Dist - Weekend
WE VEH US :	S	Weekend Activity

^a File names refer to the default or template files provided with the model.

Summary of MOBILE6 Fleet Characteristics Commands

MOBILE6 Command	Header/ Run/ Scenario?	Comment
REG DIST : REGDATA.D ^a	R	User-Input Registration Data
DIESEL FRACTIONS : DIESFRAC.DEF	R/S	User-Input Diesel Fractions
MILE ACCUM RATE : MARDATA.DEF	R	Mileage Accumulation Rates
VMT FRACTIONS :	R/S	VMT Mix by Veh Type (Included in Activity Commands)
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		
NGV FRACTION : NGVFR.D	R	Natural Gas Vehicle Analyses

^a File names refer to the default or template files provided with the model.

Converting MOBILE5 to MOBILE6 Registration Distribution by Vehicle Class

- Both M5 and M6 use 25 years for each vehicle class (MC typically limited to 12 years)
- M5 uses eight vehicle classes and M6 uses 16 vehicle classes with gas and Diesel combined
- To convert M5 to M6, proper mapping of registration distributions among vehicle classes is necessary, and the M5 HDGV and HDDV classes need to be weighted together
- See User's Guide for procedure, or refer to M6_Utility.xls
- Revised distributions are entered with an external file called from the input file (first entry for each vehicle class is age=1; last entry is age=25) :

REG DIST : FILENAME.D

- Where the format of the FILENAME.D file is:

```
REG DIST
* LDV
1  0.0330  0.0790  0.0740  0.0770  0.0690  0.0640  0.0720  0.0830
   0.0870  0.0870  0.0780  0.0600  0.0450  0.0260  0.0150  0.0110
   0.0080  0.0080  0.0050  0.0030  0.0020  0.0010  0.0010  0.0010
   0.0110
* LDT1
2  0.0460  0.1030  0.1000  0.0800  0.0620  0.0540  0.0580  0.0730
   0.0930  0.0830  0.0700  0.0510  0.0360  0.0190  0.0110  0.0080
   0.0060  0.0120  0.0090  0.0060  0.0030  0.0020  0.0020  0.0020
   0.0110
```

etc.

Converting MOBILE5 to MOBILE6 VMT Distribution by Vehicle Class

- MOBILE5 uses eight vehicle classes:

LDGV LDGT1 LDGT2 HDGV LDDV LDDT HDDV MC

- MOBILE6 uses 16 vehicle classes (gas and Diesel combined):

LDV LDT1 LDT2 LDT3 LDT4 HDV2b HDV3 HDV4
HDV5 HDV6 HDV7 HDV8a HDV8b HDBS HDVC MC

- To perform the conversion from M5 to M6:
 - Combine M5 gas and Diesel
 - Use fractions in Appendix B of User's Guide to go from M5 to M6
- See calculations in M6_Utility.xls
- Input revised fractions as follows (Run or Scenario):

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

Example 4

Perform CY2000 and CY2010 runs with:

- a. MOBILE5-based registration fractions,
- b. MOBILE5-based VMT mix, and
- c. a. and b.

Prepare a bar-chart of the fleet-average VOC results. Compare these results to Example 1.

Temperature: 72°F to 92°F

RVP: 8.7 psi

Example 5

Perform CY2000 runs for freeway operation based on the following:

- a. Average speeds of 10, 20, 40, 60, and 65 mph using the AVERAGE SPEED command. Plot results.
- b. Modify the VMT by average speed matrix to reflect 20% of travel in each of the above speed bins. Also modify VMT by facility type to specify 100% of travel on freeways.

Compare a composite emission factor from a. to the results from b.

Temperature: 72°F to 92°F

RVP: 8.7 psi

MOBILE6 EXTERNAL/AMBIENT CONDITIONS COMMANDS

Summary of MOBILE6 External/Ambient Condition Commands

MOBILE6 Command	Header/ Run/ Scenario?	Comment
EVALUATION MONTH : 7	S	7 for July; 1 for Jan (Default=1)
ALTITUDE : 1	S	1 for Low; 2 for High (Default=1)
MIN/MAX TEMP : 72.0 92.0	R/S	Min/Max Daily Temperature
HOURLY TEMPERATURES: 72.0 73.0 74.5 76.5	R/S	Hourly Temp (24 Entries)
ABSOLUTE HUMIDITY : 94.8	R/S	Humidity in grains water/lb dry air
CLOUD COVER : 0.07	R/S	Fraction Cloud Cover (0 to 1.0)
PEAK SUN : 10 4	R/S	Time for Peak Sun (9 to 5)
SUNRISE/SUNSET : 6 9	R/S	Sunrise (AM)/Sunset (PM)

Mapping for Distribution of Hourly Inputs

(e.g., 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.

Example 6

Perform 1995, 2000, 2005, and 2010 runs for a July evaluation date using:

- a. Min/max temperatures; and
- b. 24-hour temperature profile. (See profile below.)

Compare VOC results.

Temperature: 72°F to 92°F

RVP: 8.7 psi

Evaluation Month: July

		MOBILE6 Enhanced		User-Input Min/Max Temp		
		Period	Evap Temp	Min	Max	
min	Hour			Temp (F):	72.0 92.0	
	6	1	72.0	Resulting Temp Profile		
	7	2	72.5	72.0		
	8	3	75.5	72.4		
	9	4	80.3	74.9		
	10	5	85.2	78.9		
	11	6	89.4	83.0		
	12	7	93.1	86.5		
	13	8	95.1	89.6		
	14	9	95.8	91.3		
	max	15	10	96.0	91.8	
		16	11	95.5	92.0	
		17	12	94.1	91.6	
		18	13	91.7	90.4	
19		14	88.6	88.4		
20		15	85.5	85.8		
21		16	82.8	83.3		
22		17	80.9	81.0		
23		18	79.0	79.4		
24		19	77.2	77.8		
1		20	75.8	76.3		
2	21	74.7	75.2			
3	22	73.9	74.3			
4	23	73.3	73.6			
5	24	72.6	73.1			
			72.5			

Example 7

Generate CO emission factors for a high-altitude area in CY1990, CY2000, and CY2010 using a January evaluation date. (Results to be used later...)

Temperature: 18°F to 26°F
RVP: 14.5 psi

Humidity

- Although humidity could be specified by the user in MOBILE5, most areas did not use that option
- If used, humidity impacted NO_x emissions (i.e., higher humidity than standard FTP conditions resulted in decreased NO_x)
- For MOBILE6, humidity also impacts the heat index calculation, which is used to estimate air conditioning usage
- The units for humidity in MOBILE6 are grains of water per lb. of dry air
- To convert relative humidity to the above units, see the utility M6HUMIDITY.EXE

MOBILE6 FUELS COMMANDS

Summary of MOBILE6 Fuels Commands

MOBILE6 Command	Header/ Run/ Scenario?	Comment
FUEL PROGRAM : 2 N	R/S	Used to Specify RFG
FUEL PROGRAM : 4	R/S	Used to Specify Alt Sulfur Levels For CY2000 and Later Years
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 1000 1000 1000 303.0 303.0 87.0 87.0		
80.0 80.0 80.0 80.0 80.0 80.0 80.0 80.0		
SULFUR CONTENT : 230.0	S	Gasoline Sulfur (30-600 ppm) for pre-CY2000
OXYGENATED FUELS : .200 .800 .027 .035 1	R/S	Specification of Oxy Fuels
SEASON : 1	R/S	Season for RFG (1=Sum;2=Win)

Detailed Input File Structure for Fuels Programs and Specifications

- Fuel programs and specifications are placed in the RUN or SCENARIO sections of the input file
- The following commands apply to fuel programs:

FUEL PROGRAM	:	(Run or Scenario)
SULFUR CONTENT	:	(Scenario)
OXYGENATED FUELS	:	(Run or Scenario)
FUEL RVP	:	(Run or Scenario)
SEASON	:	(Run or Scenario)
STAGE II REFUELING	:	(Run)
NO REFUELING	:	(Run)

- Details of specific user inputs are summarized on the following pages

MOBILE6 Input File Structure -- Fuels Options

1 2 3 4 5 6 7 8 20 21
NO REFUELING : No data entry required.

1 2 3 4 5 6 7 8 20 21
STAGE II REFUELING : Note that input data are entered on the next line.

1 2 3 4 5 6 7 8 9 10 11 12

8	9	3	9	2	.	8	4	.
---	---	---	---	---	---	---	---	---

 (i2,1x,i1,1x,f3.0,1x,f3.0)

Percent Efficiency for HDGVs (0 to 100)

Percent Efficiency for LDGVs and LDGTs (0 to 100)

Number of Phase-in Years

Stage II Start Year (89 - 50, reflecting 1989 - 2050)

1 2 3 4 5 6 7 8 20 21 22 23 24 25
FUEL RVP :

8	.	7
---	---	---

(6.5 - 15.2)

1 2 3 4 5 6 7 8 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42
OXYGENATED FUELS :

.	2	0	0	.	8	0	0	.	0	2	7	.	0	3	5	1
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Ether Blends Market Share
Alcohol Blends Market Share
Oxy Content of Ether Blends
Oxy Content of Alcohol Blends
RVP Waiver Flag

MOBILE6 Input File Structure -- Fuels Options (Continued)

1 2 3 4 5 6 7 8 20 21 22 23 24 25 26
SULFUR CONTENT :

2	3	0	.	0
---	---	---	---	---

 (30 - 600 ppm)

Only to be used for pre-2000 calendar years. To input gasoline sulfur content for 2000+ CY, use the FUEL PROGRAM = 4 command below.

1 2 3 4 5 6 7 8 20 21 22 23 24
FUEL PROGRAM :

1

FUEL PROGRAM :

3

FUEL PROGRAM :

2		N
---	--	---

FUEL PROGRAM OPTIONS (1 to 4)

- 1 = Conventional gasoline - East
- 3 = Conventional gasoline - West
- 2 = RFG

If RFG is specified, need to identify Northern (N) or Southern (S) region.

1 2 3 4 5 6 7 8 20 21 22
FUEL PROGRAM :

4

4 = User-supplied sulfur levels for 2000+ calendar years.
 Note that input data are entered on the next 4 lines.

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

- Line 1 = Average sulfur (ppm) for 2000 - 2007
- Line 2 = Average sulfur (ppm) for 2008 - 2015
- Line 3 = Maximum sulfur (ppm) for 2000 - 2007
- Line 4 = Maximum sulfur (ppm) for 2008 - 2015

Example 8

Generate CO emission factors for a high-altitude area in CY1990, CY2000, and CY2010 using a January evaluation date. Assume that oxygenated gasoline is used (20% ethanol; 80% MTBE) and that the fuel has an oxygen content of 2.7% by weight. Compare these results to Example 7.

Temperature: 18°F to 26°F

RVP: 14.5 psi (No waiver)

Example 9

Generate VOC emission factors for 1995, 2000, 2005, and 2010 assuming an RFG program and Stage II refueling controls are in place. (July basis.) Compare results to Example 6.

Temperature: 72°F to 92°F

RVP: 8.7 psi

Evaluation Month: July

MOBILE6 STATE PROGRAM COMMANDS

Summary of MOBILE6 State Programs Commands

MOBILE6 Command	Header/ Run/ Scenario?	Comment
I/M PROGRAM : 1 1983 2020 2 T/O IDLE	R	I/M Program
ANTI-TAMP PROG :	R	Anti-Tampering Program
83 68 20 22222 11111111 1 11 096. 22112222 STAGE II REFUELLING 89 3 92. 84.	R	Stage II Refueling Vapor Recovery

Detailed Input File Structure for I/M and ATP Programs

- I/M and ATP program specifications are placed in the RUN section of the MOBILE6 input file or in an external file read by the input file
- Up to seven I/M programs can be specified for each run
- The following commands can apply to each I/M program:

```
I/M PROGRAM           :  
I/M MODEL YEARS      :  
I/M VEHICLES         :  
I/M STRINGENCY       :  
I/M COMPLIANCE       :  
I/M WAIVER RATES     :  
I/M CUTPOINTS        :  
I/M EXEMPTION AGE    :  
I/M GRACE PERIOD     :  
NO I/M TTC CREDITS   :  
I/M EFFECTIVENESS    :  
I/M DESC FILE        :
```

- The following command specifies an ATP program:

```
ANTI-TAMP PROG       :
```

- Details of specific user inputs are summarized on the following pages

MOBILE6 Input File Structure -- I/M Program Parameters

1 2 3 4 5 6 7 8 20 21 22 23 24 25 26 27
I/M STRINGENCY :

1		2	0	.	0
---	--	---	---	---	---

Stringency
I/M Program Number

1 2 3 4 5 6 7 8 20 21 22 23 24 25 26 27
I/M COMPLIANCE :

1		9	6	.	0
---	--	---	---	---	---

Compliance Rate
I/M Program Number

1 2 3 4 5 6 7 8 20 21 22 23 24 25 26 27 28 29 30 31 32
I/M WAIVER RATES :

1			3	.	0			3	.	0
---	--	--	---	---	---	--	--	---	---	---

Waiver Rate for 1981+ MY
Waiver Rate for Pre-81 MY
I/M Program Number

1 2 3 4 5 6 7 8 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
I/M CUTPOINTS :

1		F	I	L	E	N	A	M	E	.	E	X	T
---	--	---	---	---	---	---	---	---	---	---	---	---	---

Name of Cutpoint File (Can include directory)
I/M Program Number
 (Required for IM240 Testing)

1 2 3 4 5 6 7 8 20 21 22 23 24 25
I/M EXEMPTION AGE :

1		2	1
---	--	---	---

Age at Which Vehicles
Become Exempt (1 -25)
I/M Program Number

1 2 3 4 5 6 7 8 20 21 22 23 24 25
I/M GRACE PERIOD :

1			5
---	--	--	---

Age at Which Vehicles
Become Subject to Testing
I/M Program Number

1 2 3 4 5 6 7 8 20 21 22
NO I/M TTC CREDITS :

1

I/M Program Number

1 2 3 4 5 6 7 8 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37
I/M EFFECTIVENESS :

1		0	.	7	0			0	.	8	0			0	.	5	0
---	--	---	---	---	---	--	--	---	---	---	---	--	--	---	---	---	---

HC Effectiveness
CO Effectiveness
NOx Effectiveness
I/M Program Number

Example 10

Generate VOC emission factors for 1995, 2000, 2005, and 2010 (July basis) assuming the following:

- a. A basic I/M program is in place; and
- b. An enhanced I/M program is in place.

Use the program parameters outlined in the Day 1 briefing. Compare results to Example 6.

- c. Add Stage II refueling and RFG to b.

Compare results to Example 9.

Temperature: 72°F to 92°F

RVP: 8.7 psi

Evaluation Month: July

**MOBILE6
MISCELLANEOUS/RULE
IMPLEMENTATION COMMANDS**

Summary of MOBILE6 Rule Implementation Commands

MOBILE6 Command	Header/ Run/ Scenario?	Comment
NGV FRACTION : NGVFR.D ^a	R	Natural Gas Vehicle Fractions
NGV EF : NGVEF2.D	R	NGV Emission Factors
NO CLEAN AIR ACT :	R	Turn Off Effects of 1990 CAAA
94+ LDG IMP : P94IMP.D	R	Alt Tier 1/LEV Implementation
NO TIER 2 :	R	Turn Off Effects of Tier 2 Rule
T2 CERT : T2CERT.D	R	Alt Tier 2 Stds (for CA LEV II Rule)
T2 EXH PHASE-IN : T2EXH.D	R	Alt Phase-in Fractions for Exhaust
T2 EVAP PHASE-IN : T2EVAP.D	R	Alt Phase-in Fractions for Evap
NO DEFEAT DEVICE :	R	Turn Off Effects of HDDV Off-Cycle
NO NOX PULL AHEAD :	R	Turn Off HDDV NOx Pull Ahead
NO REBUILD :	R	Turn Off HDDV Rebuild Program
REBUILD EFFECTS : 0.50	R	Alt Effectiveness of Rebuild
NO 2007 HDDV RULE :	R	Turn Off 2007 HDDV Rule

^a File names refer to the default or template files provided with the model.

Example 11

Using DATABASE commands, find:

NO_x emission rates of 10-year old class 8B
HDDVs from 1980 through 2010 model years
without the impacts of off-cycle NO_x.

Compare results to Example 3.

Temperature: 72°F to 92°F

RVP: 8.7 psi

Evaluation Month: July

Converting MOBILE5 Inputs to MOBILE6 Inputs

- Most of the MOBILE5 inputs and features can be used directly in MOBILE6 once the corresponding command has been identified
- Appendix C of the User's Guide contains a summary table listing all MOBILE5 inputs and the corresponding MOBILE6 commands
- Because MOBILE6 has expanded features relative to MOBILE5, direct conversion of MOBILE5 input files will under-utilize MOBILE6; however, guidance from EPA will be needed for official inventory work
- In addition, a number of user-supplied inputs need conversion from MOBILE5 format to MOBILE6 format:
 - Data provided daily
 - Data provided by vehicle class
 - User-supplied operating modes
 - Average speed
 - Specific roadway/facility type modeling
- Registration fractions and VMT mix have already been discussed; see additional discussion below

Converting MOBILE5 to MOBILE6 Mileage Accumulation Rates by Vehicle Class

- No conversion necessary, just need to map the M5 values to the correct vehicle classes in M6
- These values are input through an external file that is called with the command (in the Run section):

```
MILE ACCUM RATE      : FILENAME.D
```

- The user can specify revised mileage accumulation rates for one or all 28 vehicle classes considered by M6
- The format of the external file is as follows (first entry for each vehicle class is age=1; last entry is age=25):

```
MILE ACCUM RATE
* LDGV
1 0.14910 0.14174 0.13475 0.12810 0.12178 0.11577 0.11006 0.10463 0.09947 0.09456
  0.08989 0.08546 0.08124 0.07723 0.07342 0.06980 0.06636 0.06308 0.05997 0.05701
  0.05420 0.05152 0.04898 0.04656 0.04427
* LDGT1
2 0.19496 0.18384 0.17308 0.16267 0.15260 0.14289 0.13352 0.12451 0.11584 0.10752
  0.09955 0.09194 0.08467 0.07775 0.07118 0.06496 0.05909 0.05356 0.04839 0.04357
  0.03909 0.03497 0.03120 0.02777 0.02470
```

etc.

Converting MOBILE5 to MOBILE6 Operating Mode Fractions

- MOBILE5 runs are usually based on FTP fractions
 - In MOBILE6, operating mode fractions are no longer used; starting emissions are separated from running emissions
 - If using FTP operating mode fractions in M5, no conversion to M6 is necessary
 - If that is not the case, things get complicated:
 - The soak distribution needs to be modified to reflect 10-minute and 720-minute soak times
- $$10\text{-min} = \text{HS}/(\text{HS}+\text{CS}) \quad (\text{FTP} = 0.57)$$
- $$720\text{-min} = \text{CS}/(\text{HS}+\text{CS}) \quad (\text{FTP} = 0.43)$$
- Default engine starts per day need to be modified

Converting MOBILE5 to MOBILE6 Network Average Speed

- MOBILE5 includes user-defined speed as a required input
- In MOBILE6 average speed is determined from the distribution of VMT across all speed bins, road types, etc.
- MOBILE6 default area-wide speed is 27.6 mph
- If the user wishes to change this value, Section 5.3.4 of the User's Guide goes through the procedure, also see M6_Utility.xls for changes to area-wide speed
- Alternatively, the AVERAGE SPEED command can be used in conjunction with specifying "Areawide" as the roadway type. **This is the recommended approach.**