Development and Production of On-Road, Mobile Source, Photo-Chemical Model Ready, 2007 Future Case Emissions Inventory for the Beaumont-Port Arthur Eight-Hour Ozone Nonattainment Counties

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SUBJECT: Development and Production of On-Road, Mobile Source, Photo-chemical Model Ready, 2007 Future Case Emissions Inventory for Beaumont-Port Arthur Eight-Hour Ozone Non-Attainment Counties
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INTRODUCTION AND TASK SUMMARY

This Technical Note documents the methods that the Texas Transportation Institute (TTI) used to develop the Beaumont-Port Arthur ozone nonattainment area (BPA) 2007 future base-case ozone episode on-road mobile source modeling emissions inventories (EI), a task in support of eight-hour ozone standard State Implementation Planning. The 2010 and 2013 future base-case episode EI analyses documentation associated with this task are provided in separate Technical Notes.

The three BPA counties are: Hardin, Jefferson, and Orange. The forecast periods for the emissions estimates are 17 episode days comprising the following three "mini episodes" within the period August 10, 2000 through September 6, 2000: 1) August 10 through August 13 (four days), 2) August 18 through August 21 (four days), and 3) August 29 through September 6 (nine days). Although the days-of-week are different for these dates in 2007, for modeling purposes the base-year episode date-to-day-of-week correlation was maintained. Emissions of volatile organic compounds (VOC), carbon monoxide (CO), and oxides of nitrogen (NOx) were estimated for each day on an hourly basis. The hourly estimates were computed by network link with geographical coordinates provided for spatial allocation of emissions estimates. Emissions are categorized by 28 vehicle types and the pertinent pollutant-specific emissions types (sub-components).

Documented within are the methods used for developing EI elements including link-based vehicle miles traveled (VMT) and speed estimates (developed by post-processing the BPA travel demand model [TDM]), development of episode period day-of-week-adjusted Highway Performance Monitoring System (HPMS) consistent VMT totals, VMT mix, MOBILE6 (October 2002) emissions factors, and the emissions estimates.

Acknowledgments
Chris Kite, with the Texas Commission on Environmental Quality (TCEQ), and Teresa Qu, P.E., and Martin Boardman, both with TTI, contributed to the development of the MOBILE6 emissions factors inputs. Qu produced the MOBILE6 model set-ups and performed the emissions factors and emissions analyses. The Texas Department of Transportation (TxDOT) provided the BPA travel model data sets (network traffic assignment, intrazonal trips, and zonal radii). Dennis Perkinson, Ph.D., of TTI, developed episode day-of-week VMT adjustment factors, hourly VMT allocation factors and VMT mix. L. D. White, of TTI, post-processed the BPA travel model data sets to develop estimates of link VMT and operational link speeds. Each member of the assigned TTI staff contributed to the quality assurance of the emissions inventory elements. Dr. Perkinson was the principal investigator for this project. This work was performed by TTI under contract to TCEQ. Anusuya Iyer was the TCEQ project technical manager.

Deliverables
Interim deliverables are an informal Technical Note (a narrative in memorandum format that explains the task, the approaches used, and the findings) provided to the Project Manager in WordPerfect 6/7/8 format, and supported by electronic document files. All pertinent data are being submitted in specified electronic format. (There is no FORTRAN source code or executable files developed under this task.) CD-ROM is used to record the final data and supporting documentation. TTI is providing five copies of the final report. One of the copies is an unbound original suitable for copying. Electronic copies of all materials related to the task report to document results and conclusions (e.g., data, work files, text files, etc.), or developed as work products under this contract are provided as requested by the TCEQ staff.

The detailed 2007 emissions inventory data sets were previously provided to TCEQ on CD-ROM. Appendix A lists the CD-ROM volume names and the data set file names and descriptions contained on each CD-ROM. The data sets provided include:

- network link nodes with corresponding link-emissions estimates for each pollutant sub-component and vehicle type, by county for each hour of each specified day;
- network node (link endpoint) coordinates for spatially allocating the link-emissions estimates;
- emissions summary files by county and episode day with facility type and vehicle type level hourly and 24-hour VMT, VMT mix, average speed, and pollutant composite emissions estimates; and

- MOBILE6 model emissions factor inputs, adjustment factors, and the resulting county level, hourly, day-specific emissions factor tables.

SUMMARY OF VMT AND EMISSIONS

Table 1 presents a summary of 24-hour BPA network total VMT, average operational speeds (VMT divided by TDM vehicle hours traveled [VHT] estimates), and emissions for each of the 17 ozone episode analysis days.

Table 1
BPA All Counties 2007 Ozone Episode Day
On-Road Mobile Source VMT*, Average Speed (mph)*, and Emissions (tons per day)

Day	VMT	Speed	VOC	CO	NOx
Thursday, August 10	11,885,906	38.8	10.0	130.4	25.3
Friday, August 11	14,106,027	38.2	11.9	156.6	23.9
Saturday, August 12	11,780,788	39.2	9.1	127.3	16.4
Sunday, August 13	9,825,913	39.4	7.5	107.4	12.1
Friday, August 18	14,106,027	38.2	12.2	158.2	24.3
Saturday, August 19	11,780,788	39.2	9.0	126.2	16.2
Sunday, August 20	9,825,913	39.4	7.6	109.6	11.6
Monday, August 21	11,885,906	38.8	9.9	131.3	25.1
Tuesday, August 29	11,885,906	38.8	10.1	131.7	25.3
Wednesday, August 30	11,885,906	38.8	10.6	132.9	25.7
Thursday, August 31	11,885,906	38.8	10.9	134.5	25.9
Friday, September 01	14,106,027	38.2	12.4	161.0	24.3
Saturday, September 02	11,780,788	39.2	9.3	127.8	16.3
Sunday, September 03	9,825,913	39.4	7.9	111.5	11.7
Monday, September 04**	9,825,913	39.4	8.2	111.6	12.0
Tuesday, September 05	11,885,906	38.8	10.7	133.5	25.9
Wednesday, September 06	11,885,906	38.8	10.0	129.3	25.7

* 2007 link-VMT and speeds estimates were processed on the nearest analysis year (2005) TxDOT travel model available. Average speed is VMT/VHT,
** September 4, Labor Day, emissions estimates were developed using Sunday activity factors based on comparative analysis of Automatic Traffic Recorder (ATR) data and in consultation with TCEQ.

OVERVIEW OF METHODOLOGY

To develop the BPA ozone episode emissions estimates, a directional link-based, hourly methodology was applied. Emissions estimates were calculated by roadway network link for each hour of each analysis day.

The MOBILE6 model (EPA, October 2002) was used to develop hourly emissions factors by MOBILE6 road type (or drive cycle) and 28 vehicle types. The speed sensitive freeway and arterial emissions factors, and the fixed-speed ramp emissions factors were used. The freeway emissions factors were applied to the TDM network interstate, freeway, and parkway facility type links; the ramp emissions factors were used with ramp facility type links; and arterial emissions factors were applied to all other links. The activity basis were the Beaumont/Port Arthur 2005 TDM data sets provided by TxDOT (non-directional, user equilibrium traffic assigned networks, trip matrices, and zonal radii [assumed intrazonal trip lengths]) with adjustments for growth in VMT to 2007 and adjusted to episode day-type-specific activity and for consistency with HPMS VMT. ATR data were used to produce the episode day-type VMT adjustment factors as well as hourly travel fractions applied to allocate the episode day type VMT by hour-of-day. Directional split factors were used to allocate the hourly VMT by peak and off-peak direction. Hourly, directional, average operational speeds (congested speed estimates based on estimated volume-to-capacity (v/c) ratio-based delay applied to estimated link freeflow speeds) were modeled by link. Vehicle classification data were used to estimate time-of-day VMT mixes for apportioning fleetwide link VMT for three road type groups to the 28 U.S. Environmental Protection Agency (EPA) vehicle types. Based on comparative analysis of ATR data and in consultation with TCEQ, the Sunday activity factors and Sunday VMT mix estimates were chosen to represent activity for the September 4 (Monday Labor Day) episode day. Link-level emissions by vehicle type were calculated by hour. To allow for geographical allocation of emissions, the link endpoints (designated by network node numbers for which X-Y coordinates were provided) were recorded with the hourly link emissions.

TTI previously developed a series of computer programs to develop detailed on-road mobile source emissions inventories. These computer programs were used to produce and apply the major emissions inventory elements (adjusted operational time-of-day link VMT by vehicle type, operational link-speeds, VMT mix, and MOBILE6 emissions factors) to calculate the emissions estimates. Appendix B describes these programs and their application.

ESTIMATION OF VMT

The product of the VMT estimation process is 2007 evaluation year estimates of HPMS-consistent link VMT (with geographical coordinates), by episode period day type (average Monday through Thursday, Friday, Saturday and Sunday), and hour. The BPA 2005 TDM network link data and added intrazonal links, and post-processing factors developed from several other data sources, were used to estimate the link-VMT component of the emissions calculations.

The TRANSVMTDSPD program was used to produce this VMT (and speeds for each link, discussed in a following section). Appendix B contains a description of the program.

Data Sources

A 2007 TDM for BPA did not exist for this analysis. Therefore, the latest non-directional, user equilibrium traffic assigned network for 2005 (model run May 15, 2003), trip matrix, and zonal radii (supplied by TxDOT) were used to estimate the 2007 VMT and speeds. Since the intrazonal trips are not included in the TDM, the trip matrix and zonal radii were used to estimate the intrazonal VMT. To adjust the TDM average non-summer weekday traffic (ANSWT) VMT and allocate it as needed for the subject episode days in 2007, several other sources of data were needed.

HPMS VMT estimates are based on traffic count data collected according to a statistical sampling procedure specified by the Federal Highway Administration (FHWA) designed to estimate VMT. A wide range of traffic data is collected under the HPMS program. For the purpose of this study, county total HPMS Annual Average Daily Traffic (AADT) VMT were used to ensure the travel model VMT were consistent with the HPMS VMT estimates. (EPA and FHWA have endorsed HPMS as the appropriate source of VMT and require that VMT used to construct on-road mobile source emissions inventories be consistent with that reported through HPMS.)

ATR vehicle counts are collected by TxDOT at selected locations on a continuous basis throughout Texas. These counts are available by season, month, and weekday, as well as on an annual average daily basis (i.e., AADT). Since they are continuous, they are especially well suited for making seasonal, day-of-week and time-of-day comparisons (e.g., seasonal adjustment and hourly allocation factors), even though there may be relatively few ATR data collection locations in any given area. Multiple years (1999 through 2002) of data from the ATR stations in the BPA were grouped for this analysis. These ATR count data were used to produce the episode day-type-specific adjustment factors and the time-of-day (hourly) allocation factors.

VMT Adjustments

The 2005 TDM VMT were adjusted for consistency with HPMS (using an HPMS factor), from ANSWT form to episode period day-type-specific travel (using episode day-type factors), and for growth to 2007 (using growth factors). Hourly travel factors were also used to generate the hourly link files. These factors were multiplied by the individual link volumes and link lengths from the TDM to produce the link VMT. Table 2 shows the unadjusted TDM VMT and the episode period day-type VMT.

Table 2
BPA Travel Model and Episode Day Type VMT

County	Travel Model*	Weekday	Friday	Saturday	Sunday
Jefferson	7,237,007.56	7,388,357.64	8,768,402.86	7,323,016.35	6,107,852.12
Orange	2,863,168.67	2,975,802.60	3,531,638.44	2,949,484.60	2,460,055.53
Hardin	1,999,053.97	1,521,745.29	1,805,985.75	1,508,287.22	1,258,005.61

* The 2005 travel model was used for this analysis to estimate the 2007 episode period day-type VMT.

HPMS and Seasonal Adjustment Factors

The county-specific HPMS factors were developed using the county-level VMT from the 1997 travel model validation (model run March 19, 2003), the 1997 county-level HPMS VMT reported by TxDOT, and 1997 BPA regional ATR data (to produce the ANSWT adjustment factor of the first equation below). The formula for the HPMS factor calculation, as applied for each BPA county is:

HPMS VMT (AADT) × ANSWT Adjustment Factor = HPMS VMT (ANSWT)

HPMS VMT (ANSWT) / Model VMT (ANSWT) = HPMS Factor

The ANSWT adjustment (a factor of 1.02135) to the HPMS AADT VMT (i.e., conversion from AADT to ANSWT) was used to produce seasonal, day-of-week consistency between the TDM VMT and HPMS VMT components of the HPMS factor. The actual values for the county HPMS factors are:

Hardin: 1,351,818 × 1.02135 = 1,380,679.3 (HPMS ANSWT VMT)
1,380,679.3 / 1,849,830.0 = 0.74638173 (HPMS Factor);

Jefferson: 6,964,338 × 1.02135 = 7,113,026.6 (HPMS ANSWT VMT)
7,113,026.6 / 6,943,411.3 = 1.02442824 (HPMS Factor); and

Orange: 2,507,925 × 1.02135 = 2,561,469.2 (HPMS ANSWT VMT)
2,561,469.2 / 2,480,660.7 = 1.03257539 (HPMS Factor).

Episode Day-Type Factors

The episode day-type factors were calculated using a procedure similar to the HPMS factor. The aggregated BPA episode period, multi-year (1999 through 2002) ATR data were used. The three-county area episode day-type adjustment factors were produced by dividing the average day-type count by the ANSWT count. Table 3 shows the episode day-type factors.

Table 3
BPA Region Episode Period Day Type Adjustment Factors

Day Type	Adjustment Factor
Weekday*	0.98942
Friday	1.17423
Saturday	0.98067
Sunday	0.81794

* Average Monday through Thursday.

Growth Factors

Since a 2007 TDM does not exist, growth factors were applied to the 2005 TDM to estimate the 2007 VMT. These growth factors were calculated using the county-level 2005 TDM and intrazonal VMT and the 2015 TDM (model run July 11, 2003) and intrazonal VMT (i.e, total of three factors). The growth factors were then applied to each link in 2005 TDM to produce the 2007 VMT estimates. The county-level growth factors used to estimate the 2007 VMT from the 2005 TDM are shown below in Table 4.

Table 4
BPA Growth Factors - 2007 from 2005 TDM

County	Growth Factor
Jefferson	1.00723
Orange	1.01731
Hardin	1.03080

Hourly Travel Factors

To create the desired hourly VMT, the composite 24-hour VMT from the TDM was distributed to each hour of the day using hourly travel factors. These factors were developed using the aggregated multi-year BPA episode period ATR data. Using the episode day type-specific volumes, these factors are the ratio of each hourly volume total to the 24-hour total volume. Each set of factors (i.e., 24, or one for each hour of the day) was then applied to the corresponding day-type-specific 24-hour VMT to create the VMT for each hour of the day. Table 5 shows the hourly weekday factors.

Table 5
Hourly VMT Factors

Hour*	Weekday	Friday	Saturday	Sunday
1	0.011233	0.010476	0.020523	0.024416
2	0.008650	0.008138	0.015457	0.018787
3	0.007860	0.007315	0.013049	0.015695
4	0.007453	0.006918	0.009986	0.010912
5	0.012230	0.010598	0.011831	0.011372
6	0.026290	0.021144	0.016901	0.013529
7	0.046580	0.038037	0.023770	0.016406
8	0.062649	0.054142	0.031632	0.020724
9	0.052268	0.046666	0.040850	0.027398
10	0.048115	0.044495	0.049413	0.039526
11	0.051088	0.048844	0.057809	0.049222
12	0.055436	0.054107	0.062466	0.055927
13	0.058833	0.057578	0.064577	0.067574
14	0.060151	0.058955	0.064398	0.072487
15	0.061966	0.061666	0.062909	0.072217
16	0.069793	0.069320	0.064207	0.074289
17	0.075497	0.075394	0.064102	0.074234
18	0.078980	0.073233	0.063727	0.074809
19	0.058024	0.063555	0.061156	0.068245
20	0.043323	0.053274	0.054058	0.056332
21	0.036449	0.044091	0.046525	0.047646
22	0.029701	0.039299	0.042119	0.038605
23	0.021446	0.029669	0.032529	0.028579
24	0.015985	0.023086	0.026006	0.021069

* Hour number 1 represents midnight to 1 a.m., etc.

Time-of-Day Directional Split Factors

Since the travel model is nondirectional, directional split factors were used to estimate the portion of travel in each direction. These directional volume estimates were used not only to estimate the VMT in each direction but also to estimate the directional speeds (discussed in the next section). Application of the directional split factors resulted in two link records for each network link: one record containing the estimated VMT and speed in the peak (or dominant) direction, and the second record containing the estimated VMT and speed in the opposite direction.

The directional split factors (shown in Appendix C) were developed for application by time-of-day period (see Table 6) at the functional class and area type level.

Table 6
BPA Time-of-Day Travel Periods

Period	Hours
AM Peak	7 a.m. - 8 a.m.
Mid-Day	8 a.m. - 5 p.m.
PM Peak	5 p.m. - 6 p.m.
Overnight	6 p.m. - 7 a.m.

These time-of-day directional splits for each functional class and area type combination were taken from the Technical Note entitled, "1996 Jefferson, Orange, and Hardin Counties Periodic Emission Inventory" (TTI, November 26, 1997). These data were provided by TxDOT's Transportation Planning and Programming Division after collaboration with TxDOT's Beaumont District and the Beaumont/Port Arthur Metropolitan Planning Organization.

ESTIMATION OF LINK SPEEDS

To estimate a links directional, time-of-day congested speed, a speed model involving the estimated freeflow speed for that link and the estimated directional delay for that link was applied. This model was applied to each link and direction (after all VMT adjustments were made), based on the link's county-specific area type and facility type combination, for each time period and each direction. The directional congested speed was computed as follows:

$$Congested\ speed = \frac{60}{\frac{60}{Freeflow\ speed} + Delay}$$

Freeflow speed factors were used to convert travel demand model speeds (which are by definition level of service [LOS] C) to LOS A speeds (freeflow). Appendix D shows the freeflow speed factors used for BPA by county-specific area type/facility type combination.

The second component of the speed model used to calculate the congested speed is the estimated directional delay. The directional delay (in minutes per mile) due to congestion was computed using the following volume/delay equation:

$$Delay = Min\ [A\, e^{B(\frac{V}{C})}, M]$$

Where:

Delay = congestion delay (in minutes/mile);
A & B = volume/delay equation coefficients;
M = maximum minutes of delay per mile; and
V/C = time-of-day directional v/c ratio.

The delay model parameters (A, B, and M) were developed for the Dallas/Fort Worth area and verified by application in other Texas urban areas. Table 7 shows these parameters. The BPA network high capacity facility types are Interstate Highway, Freeway, and Parkway; the remaining facility types (except for centroid connector and intrazonal, which do not use capacity data) are low-capacity facilities.

Table 7
Volume/Delay Equation Parameters

Facility Category	A	B	M
High Capacity Facilities (> 3,400 vehicles per hour [vph], e.g., Interstates and Freeways)	0.015	3.5	5.0
Low Capacity Facilities (≤ 3,400 vph, e.g., Arterials, Collectors and Locals)	0.050	3.0	10.0

The time-of-day directional v/c ratios were estimated using the directional volume (from the VMT estimation) and the time-of-day directional capacity. However, the 24-hour user equilibrium assignments were performed using nondirectional 24-hour capacities. To estimate the time-of-day directional capacity, the directional split for capacity was assumed at 50-50 and time-of-day (i.e., hourly) capacity factors were applied to the nondirectional capacity for each link. The hourly capacity factors vary by the time-of-day travel periods in Table 6 (i.e, four sets of hourly capacity factors were used). Appendix D summarizes the capacity factors by county-specific area type/facility type combination. Capacity factors are computed as follows:

$$Capacity\ Factor = \frac{(Hourly\ Capacity\ per\ Lane)(Length\ of\ the\ Time\ Period)}{24\text{-}hour\ Capacity\ per\ Lane}$$

Capacity data were not used, however, for the centroid connector links and intrazonal links (intrazonal links are developed specifically for air emissions analyses). The centroid connector traffic assignment input speeds were used as the centroid connector operational speeds estimates. Operational speeds for the intrazonal trips category were estimated by zone as the average of the zone's centroid connector speeds.

The hourly and 24-hour VMT weighted speed summaries by county and road type (network facility type) were provided electronically on CD-ROM (see Appendix A for electronic data descriptions).

ESTIMATION OF VMT MIX

VMT mixes were estimated using TxDOT 1997 - 2002 vehicle classification data, TxDOT registrations data (latest available, i.e., 2003), and MOBILE6 default diesel fractions where necessary. There were four time-of-day period VMT mix estimates developed by three functional classification groups for each of the four day types (Weekday, Friday, Saturday and Sunday). The three-county area (Hardin, Jefferson and Orange) data were aggregated.

TxDOT classification counts classify vehicles into the standard FHWA vehicle classifications (based on vehicle length/number of axles) using best practice vehicle classification count methods:

C	Passenger vehicles;
P	Two-axle, four-tire single-unit trucks;
B	Buses;
SU2	Six-tire, two-axle single-unit vehicles;
SU3	Three-axle single-unit vehicles;
SU4	Four or more axle single-unit vehicles;
SE4	Three or four axle single-trailer vehicles;
SE5	Five-axle single-trailer vehicles;
SE6	Six or more axle single-trailer vehicles;
SD5	Five or less axle multi-trailer vehicles;
SD6	Six-axle multi-trailer vehicles; and
SD7	Seven or more axle multi-trailer vehicles.

EPA and MOBILE use a different vehicle classification scheme than the FHWA categories. The 28 EPA vehicle categories are defined as a function of gross vehicle weight rating (GVWR) and fuel type (see Table 8). The FHWA axle/vehicle length based classification categories must be converted into 28 MOBILE GVWR/fuel-type-based categories.

The FHWA vehicle classification counts were first aggregated into three intermediate groups.

Passenger Vehicles (PV)	C + P,
Heavy-Duty Vehicles (HDV)	SU2 + SU3 + SU4 + SE4, and
HDDV8b (HDX)	SE5 + SE6 + SD5 + SD6 + SD7.

This was followed by a second intermediate allocation that separated light-duty vehicles (LDV) into passenger cars and light-duty trucks (LDT) based on TxDOT registration data:

LDV	0.638 × PV (by county, 2002 Jefferson registration data shown); and
LDT	0.362 × PV (by county, 2002Jefferson registration data shown).

A third intermediate allocation further separated LDTs into LDT1 and HLDT (note that LDT1 is itself intermediate and was further divided into LDGT1 and LDDT):

LDT1	0.835 × LDT (by county, 2002 Jefferson registration data shown); and
HLDT	0.165 × LDT (by county, 2002 Jefferson registration data shown).

Next, the remaining FHWA categories were disaggregated into EPA vehicle groups, as shown. Note that TxDOT vehicle classification count procedures do not distinguish between gasoline and diesel LDTs. Consequently, MOBILE defaults for the year of interest were used. As before, actual TxDOT vehicle registration data were used to separate gasoline from diesel heavy-duty trucks. Note also that motorcycles are not counted separately and were included as a default (subtracted from LDGV):

LDGV	0.9986619 × LDV (MOBILE6 default for 2005 shown);
LDDV	0.0013381 × LDV (MOBILE6 default for 2005 shown);
LLDT	0.9945429 × LDT1 (MOBILE6 default for 2005 shown);
LDDT	0.0054571 × LDT1 (MOBILE6 default for 2005 shown);
HDGV	0.312 × HDV (by county, 2002 Jefferson registration data shown);
HDDV	0.688 × HDV (by county, 2002 Jefferson registration data shown); and
MC	0.001 of total (subtracted from LDGV).

This converted the FHWA axle count-based categories into GVWR categories. This part of the conversion procedure is summarized schematically in Table 9. Starting with the TxDOT vehicle classification data, these data themselves provide sufficient information to complete the first step in the conversion process, the allocation of vehicles into PVs, HDVs, HDDV8bs, and buses (B). Steps 2 and 3 further allocated these categories using TxDOT registration data. Finally, Step 4 allocated light-duty vehicles by fuel type using EPA MOBILE diesel fractions and motorcycles were separated from light-duty gas vehicles using a nominal constant.

The MOBILE6 28-category typology is a subset of this typology. A combination of EPA MOBILE6 defaults and area vehicle registration data were used to expand these intermediate categories.

For the 28-category EPA scheme, heavy-duty vehicles (HDV) — HDGV and HDDV — were separated into eight and seven categories respectively. HDDV8b vehicle were counted directly. The 15 HDV categories were separated from total HDV, which were separated by fuel type using TxDOT registration data by county. Each HDV category (HDGV and HDDV) was then divided into sub-categories based on TxDOT area vehicle registration data. Buses were treated separately.

The 28-category EPA scheme also further divided the two LDT categories based in part on assumed loading. The previous LDGT1 and LDGT2 categories (previously defined as GVWR $\leq$ 6,000 and GVWR > 6,000 to 8,500, respectively) were separated into subcategories in terms of adjusted loaded vehicle weight (ALVW). ALVW is the average of vehicle curb weight and GVWR. Thus, two new intermediate categories were introduced. These are light light-duty trucks (LLDT) and heavy light-duty trucks (HLDT), which are defined as:

- LLDT - any light-duty truck rated through 6,000 pounds GVWR, and
- HLDT - any light-duty truck rated greater than 6,000 pounds GVWR.

These two new intermediate categories were then used to define the four LDT categories using EPA MOBILE6 defaults for the year of interest. The four LDT categories are:

- LDGT1 - light light-duty trucks through 3,750 pounds loaded vehicle weight (LVW);
- LDGT2 - light light-duty trucks greater than 3,750 pounds LVW;
- LDGT3 - heavy light-duty trucks to 5,750 pounds ALVW; and
- LDGT4 - heavy light-duty trucks greater than 5,750 pounds ALVW.

Similarly, the LDDT category was sub-divided into two categories based on GVWR (less than or equal to 6,000 GVWR and 6,000 to 8,500 GVWR). This was accomplished using EPA MOBILE6 default values for the year of interest.

Finally the three bus categories were separated from the TxDOT classification counts bus category using EPA MOBILE6 default values. (Under MOBILE6 the HDV category does not include buses.)

Vehicle classification data is not forecast. For future VMT mix estimates, MOBILE6 default values consistent with the future year were used (i.e., 2007). No other adjustments were made to alter the count data and conversion procedure to accommodate future years. Table 10 shows the VMT mix estimation procedure summary followed by explanatory notes. The VMT mix estimates were developed for three functional classification groups (see Table 30 in Emissions Calculations section) and the four time-of-day periods (Table 6).

This procedure was performed as described for weekdays. TxDOT vehicle classification data are only collected for weekdays (Monday through Thursday), consequently other data were used to estimate VMT mix for Fridays, Saturdays, and Sundays. The procedure used to estimate Friday, Saturday, and Sunday VMT mix relies on vehicle classification data collected over

several years in urban areas. The ratio of weekday VMT mix to Friday, Saturday, and Sunday VMT mix was applied to the weekday VMT mix to produce region specific Friday, Saturday and Sunday VMT mix. (No seasonal changes were assumed.) The VMT mixes are shown in Tables 11 through 14.

Table 8
EPA Vehicle Types - 28 Categories

Category	Description	GVWR
LDGV	Light-duty gasoline vehicle	≤ 6,000
LDGT1	Light-duty gasoline truck	≤ 6,000
LDGT2	Light-duty gasoline truck	≤ 6,000
LDGT3	Light-duty gasoline truck	6,001 - 8,500
LDGT4	Light-duty gasoline truck	6,001 - 8,500
HDGV2b	Heavy-duty gasoline vehicle	8,501 - 10,000
HDGV3	Heavy-duty gasoline vehicle	10,001 - 14,000
HDGV4	Heavy-duty gasoline vehicle	14,001 - 16,000
HDGV5	Heavy-duty gasoline vehicle	16,001 - 19,500
HDGV6	Heavy-duty gasoline vehicle	19,501 - 26,000
HDGV7	Heavy-duty gasoline vehicle	26,001 - 33,000
HDGV8a	Heavy-duty gasoline vehicle	33,001 - 60,000
HDGV8b	Heavy-duty gasoline vehicle	> 60,000
HDGB	Heavy-duty gasoline bus	all
LDDV	Light-duty diesel vehicle	≤ 6,000
LDDT12	Light-duty diesel truck	≤ 6,000
LDDT34	Light-duty diesel truck	6,001 - 8,500
HDDV2b	Heavy-duty diesel vehicle	8,501 - 10,000
HDDV3	Heavy-duty diesel vehicle	10,001 - 14,000
HDDV4	Heavy-duty diesel vehicle	14,001 - 16,000
HDDV5	Heavy-duty diesel vehicle	16,001 - 19,500
HDDV6	Heavy-duty diesel vehicle	19,501 - 26,000
HDDV7	Heavy-duty diesel vehicle	26,001 - 33,000
HDDV8a	Heavy-duty diesel vehicle	33,001 - 60,000
HDDV8b	Heavy-duty diesel vehicle	> 60,000
HDDBS	Heavy-duty diesel school bus	all
HDDBT	Heavy-duty diesel transit bus	all
MC	Motorcycle	all

Table 9
Initial Vehicle Classification Conversion Procedure

<table>
<tr><th>Start</th><th>Step 1</th><th>Step 2</th><th>Step 3</th><th>Step 4</th></tr>
<tr><td rowspan="8">Total Vehicles</td><td rowspan="5">PV</td><td rowspan="3">LDV</td><td rowspan="2">LDGV</td><td>MC</td></tr>
<tr><td>LDGV</td></tr>
<tr><td colspan="2">LDDV</td></tr>
<tr><td rowspan="3">LDT</td><td rowspan="2">LDT1</td><td>LLDT</td></tr>
<tr><td>LDDT</td></tr>
<tr><td colspan="2">HLDT</td></tr>
<tr><td rowspan="2">HDV</td><td colspan="3">HDGV</td></tr>
<tr><td colspan="3">HDDV</td></tr>
<tr><td colspan="4">HDDV8b</td></tr>
<tr><td colspan="4">B</td></tr>
</table>

Table 10
VMT Mix Estimation Procedure Summary

EPA-8	EPA-28	Conversion
LDGV	LDGV	.9987 × LDV
LDGT1	LDGT1	.2310 × LLDT
	LDGT2	.7690 × LLDT
LDGT2	LDGT3	.6850 × HLDT
	LDGT4	.3150 × HLDT
HDGV	HDGV2b	.393 × HDGV
	HDGV3	.189 × HDGV
	HDGV4	.079 × HDGV
	HDGV5	.048 × HDGV
	HDGV6	.185 × HDGV
	HDGV7	.046 × HDGV
	HDGV8a	.056 × HDGV
	HDGV8b	.004 × HDGV
	HDGB	.1155 × B
LDDV	LDDV	.0013 × LDV
LDDT	LDDT12	.1035 × LDDT
	LDDT34	.8965 × LDDT
HDDV	HDDV2b	.330 × HDDV
	HDDV3	.124 × HDDV
	HDDV4	.065 × HDDV
	HDDV5	.045 × HDDV
	HDDV6	.157 × HDDV
	HDDV7	.076 × HDDV
	HDDV8a	.203 × HDDV
	HDDV8b	HDX
	HDDBT	.3235 × B
	HDDBS	.5610 × B
MC	MC	MC

Notes to VMT Mix Estimation Procedure Summary

Intermediate category factors and sources:

LDV	.638 × PV (by county, 2002 Jefferson registration data shown)
LDT	.362 × PV (by county, 2002 Jefferson registration data shown)
LDT1	.835 × LDT (by county, 2002 Jefferson registration data shown)
HLDT	.165 × LDT (by county, 2002 Jefferson registration data shown)
LLDT	.9945 × LDT1 (EPA MOBILE6 default)
LDDT	.0055 × LDT1 (EPA MOBILE6 default)
HDV	SU2+SU3+SU4+SE3+SE4
HDX	SE5+SE6+SD5+SD6+SD7
HDGV	.312 × HDV (by county, 2002 Jefferson registration data shown)
HDDV	.688 × HDV (by county, 2002 Jefferson registration data shown)

Category conversion factors and sources:

LDGV	.9987 × LDV (EPA MOBILE6 default, 2005 shown)
LDGT1	.2310 × LLDT (EPA MOBILE6 default, 2005 shown)
LDGT2	.7690 × LLDT (EPA MOBILE6 default, 2005 shown)
LDGT3	.6850 × HLDT (EPA MOBILE6 default, 2005 shown)
LDGT4	.3150 × HLDT (EPA MOBILE6 default, 2005 shown)
HDGV2a	.393 × HDGV (JOHRTS area registration data)
HDGV3	.189 × HDGV (JOHRTS area registration data)
HDGV4	.079 × HDGV (JOHRTS area registration data)
HDGV5	.048 × HDGV (JOHRTS area registration data)
HDGV6	.185 × HDGV (JOHRTS area registration data)
HDGV7	.046 × HDGV (JOHRTS area registration data)
HDGV8a	.056 × HDGV (JOHRTS area registration data)
HDGV8b	.004 × HDGV (JOHRTS area registration data)
HDGB	.1155 × B (EPA MOBILE6 default, 2005 shown)
LDDV	.0013 × LDV (EPA MOBILE6 default, 2005 shown)
LDDT12	.1035 × LDDT (EPA MOBILE6 default, 2005 shown)
LDDT34	.8965 × LDDT (EPA MOBILE6 default, 2005 shown)
HDDV2b	.330 × HDDV (JOHRTS area registration data)
HDDV3	.124 × HDDV (JOHRTS area registration data)
HDDV4	.065 × HDDV (JOHRTS area registration data)
HDDV5	.045 × HDDV (JOHRTS area registration data)
HDDV6	.157 × HDDV (JOHRTS area registration data)
HDDV7	.076 × HDDV (JOHRTS area registration data)
HDDV8a	.203 × HDDV (JOHRTS area registration data)
HDDV8b	HDX (TxDOT classification counts)
HDDBT	.3235 × B (EPA MOBILE6 default, 2005 shown)
HDDBS	.5610 × B (EPA MOBILE6 default, 2005 shown)
MC	MC (default subtracted from LDGV, no conversion)

Table 11
2007 BPA Weekday VMT Mix by Time Period and Roadway Facility Type Group

Obs	TP	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2b	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	AM_Peak	Art	0.5323930	0.0717415	0.2388224	0.0420865	0.0193545	0.0058725	0.0028242	0.0011805	0.0007173
2	AM_Peak	Col	0.4876979	0.0845543	0.2814753	0.0523557	0.0240771	0.0051229	0.0024637	0.0010298	0.0006257
3	AM_Peak	Fway	0.4968840	0.0646768	0.2153045	0.0368794	0.0169599	0.0065088	0.0031302	0.0013084	0.0007950
4	Mid_Day	Art	0.5100979	0.0695282	0.2314543	0.0409592	0.0188361	0.0087587	0.0042122	0.0017607	0.0010698
5	Mid_Day	Col	0.4798619	0.0831985	0.2769620	0.0515162	0.0236910	0.0070352	0.0033833	0.0014142	0.0008593
6	Mid_Day	Fway	0.4688712	0.0610089	0.2030943	0.0347907	0.0159994	0.0079794	0.0038374	0.0016040	0.0009746
7	Ovr_Nite	Art	0.5353382	0.0730366	0.2431338	0.0428525	0.0197068	0.0051017	0.0024535	0.0010255	0.0006231
8	Ovr_Nite	Col	0.4985650	0.0864345	0.2877344	0.0535200	0.0246124	0.0045619	0.0021939	0.0009170	0.0005572
9	Ovr_Nite	Fway	0.4290715	0.0562288	0.1871818	0.0320269	0.0147283	0.0057249	0.0027532	0.0011508	0.0006992
10	PM_Peak	Art	0.5476796	0.0739891	0.2463045	0.0435375	0.0200218	0.0054761	0.0026335	0.0011008	0.0006688
11	PM_Peak	Col	0.4956434	0.0859290	0.2860517	0.0532070	0.0244685	0.0053313	0.0025639	0.0010717	0.0006512
12	PM_Peak	Fway	0.4989787	0.0651835	0.2169913	0.0371453	0.0170822	0.0053566	0.0025761	0.0010768	0.0006542

Obs	P_HDGV_6	P_HDGV_7	P_HDGV8a	P_HDGV8b	P_LDDV	P_LDDT12	P_HDDV2b	P_HDDV_3	P_HDDV_4	P_HDDV_5
1	0.0027644	0.0006874	0.0008368	0.0000598	0.0005346	0.0000547	0.0106012	0.0039835	0.0020881	0.0014456
2	0.0024115	0.0005996	0.0007300	0.0000521	0.0004898	0.0000645	0.0084251	0.0031658	0.0016595	0.0011489
3	0.0030639	0.0007618	0.0009275	0.0000662	0.0004990	0.0000493	0.0123370	0.0046357	0.0024300	0.0016823
4	0.0041231	0.0010252	0.0012481	0.0000891	0.0005123	0.0000530	0.0157924	0.0059341	0.0031106	0.0021535
5	0.0033117	0.0008235	0.0010025	0.0000716	0.0004820	0.0000634	0.0115701	0.0043476	0.0022790	0.0015777
6	0.0037562	0.0009340	0.0011370	0.0000812	0.0004710	0.0000465	0.0151219	0.0056822	0.0029785	0.0020621
7	0.0024015	0.0005971	0.0007270	0.0000519	0.0005376	0.0000557	0.0092064	0.0034594	0.0018134	0.0012554
8	0.0021474	0.0005340	0.0006500	0.0000464	0.0005007	0.0000659	0.0075025	0.0028191	0.0014778	0.0010231
9	0.0026949	0.0006701	0.0008158	0.0000583	0.0004311	0.0000429	0.0108621	0.0040815	0.0021395	0.0014812
10	0.0025778	0.0006410	0.0007803	0.0000557	0.0005499	0.0000564	0.0098310	0.0036941	0.0019364	0.0013406
11	0.0025097	0.0006240	0.0007597	0.0000543	0.0004978	0.0000655	0.0087680	0.0032946	0.0017270	0.0011956
12	0.0025215	0.0006270	0.0007633	0.0000545	0.0005011	0.0000497	0.0101548	0.0038157	0.0020002	0.0013847

Obs	P_HDDV_6	P_HDDV_7	P_HDDV8a	P_HDDV8b	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34
1	0.0050436	0.0024415	0.0065213	0.0365343	0.0010000	0.0008235	0.0028639	0.0051542	0.0015695
2	0.0040083	0.0019403	0.0051827	0.0119012	0.0010000	0.0014873	0.0051724	0.0093089	0.0018498
3	0.0058694	0.0028413	0.0075892	0.1074049	0.0010000	0.0004639	0.0016132	0.0029034	0.0014149
4	0.0075133	0.0036370	0.0097147	0.0521091	0.0010000	0.0003527	0.0012265	0.0022073	0.0015210
5	0.0055046	0.0026646	0.0071174	0.0235179	0.0010000	0.0004587	0.0015952	0.0028709	0.0018201
6	0.0071943	0.0034826	0.0093022	0.1434945	0.0010000	0.0003503	0.0012183	0.0021926	0.0013347
7	0.0043800	0.0021203	0.0056633	0.0391327	0.0010000	0.0002542	0.0008840	0.0015909	0.0015978
8	0.0035694	0.0017278	0.0046152	0.0099053	0.0010000	0.0001330	0.0004627	0.0008327	0.0018909
9	0.0051677	0.0025016	0.0066818	0.2251238	0.0010000	0.0005078	0.0017661	0.0031785	0.0012301
10	0.0046772	0.0022641	0.0060476	0.0196884	0.0010000	0.0001704	0.0005925	0.0010663	0.0016186
11	0.0041714	0.0020193	0.0053936	0.0105174	0.0010000	0.0000563	0.0001958	0.0003524	0.0018798
12	0.0048312	0.0023387	0.0062467	0.1144890	0.0010000	0.0002562	0.0008911	0.0016037	0.0014260

Table 12
2007 BPA Friday VMT Mix by Time Period and Roadway Facility Type Group

Obs	TP	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2b	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	AM_Peak	Art	0.5858703	0.0673200	0.2241036	0.0398103	0.0183077	0.0034182	0.0016438	0.0006871	0.0004175
2	AM_Peak	Col	0.5368763	0.0793701	0.2642174	0.0495409	0.0227826	0.0029828	0.0014345	0.0005996	0.0003643
3	AM_Peak	Fway	0.5607761	0.0622390	0.2071893	0.0357747	0.0164519	0.0038851	0.0018684	0.0007810	0.0004745
4	Mid_Day	Art	0.5687024	0.0660973	0.2200333	0.0392511	0.0180506	0.0051648	0.0024838	0.0010382	0.0006308
5	Mid_Day	Col	0.5311796	0.0785294	0.2614190	0.0490162	0.0225413	0.0041189	0.0019809	0.0008280	0.0005031
6	Mid_Day	Fway	0.5385670	0.0597501	0.1989039	0.0343469	0.0157952	0.0048474	0.0023312	0.0009744	0.0005921
7	Ovr_Nite	Art	0.5872134	0.0683150	0.2274158	0.0404045	0.0185810	0.0029599	0.0014235	0.0005950	0.0003615
8	Ovr_Nite	Col	0.5448114	0.0805410	0.2681153	0.0502717	0.0231187	0.0026367	0.0012680	0.0005300	0.0003220
9	Ovr_Nite	Fway	0.5047396	0.0563929	0.1877280	0.0323786	0.0148901	0.0035614	0.0017127	0.0007159	0.0004350
10	PM_Peak	Art	0.5969307	0.0687668	0.2289198	0.0407899	0.0187582	0.0031570	0.0015183	0.0006346	0.0003856
11	PM_Peak	Col	0.5427508	0.0802369	0.2671031	0.0500819	0.0230314	0.0030879	0.0014850	0.0006207	0.0003771
12	PM_Peak	Fway	0.5620664	0.0626073	0.2084153	0.0359641	0.0165390	0.0031913	0.0015347	0.0006415	0.0003898

Obs	P_HDGV_6	P_HDGV_7	P_HDGV8a	P_HDGV8b	P_LDDV	P_LDDT12	P_HDDV2b	P_HDDV_3	P_HDDV_4	P_HDDV_5
1	0.0016091	0.0004001	0.0004871	0.0000348	0.0005865	0.0000514	0.0072306	0.0027170	0.0014242	0.0009860
2	0.0014041	0.0003491	0.0004250	0.0000304	0.0005375	0.0000606	0.0057483	0.0021600	0.0011323	0.0007839
3	0.0018289	0.0004547	0.0005536	0.0000395	0.0005614	0.0000475	0.0086292	0.0032425	0.0016997	0.0011767
4	0.0024313	0.0006045	0.0007360	0.0000526	0.0005693	0.0000505	0.0109123	0.0041004	0.0021494	0.0014880
5	0.0019389	0.0004821	0.0005869	0.0000419	0.0005318	0.0000600	0.0079378	0.0029827	0.0015635	0.0010824
6	0.0022819	0.0005674	0.0006907	0.0000493	0.0005392	0.0000456	0.0107646	0.0040449	0.0021203	0.0014679
7	0.0013933	0.0003465	0.0004218	0.0000301	0.0005878	0.0000522	0.0062591	0.0023519	0.0012329	0.0008535
8	0.0012412	0.0003086	0.0003757	0.0000268	0.0005455	0.0000615	0.0050814	0.0019094	0.0010009	0.0006929
9	0.0016765	0.0004169	0.0005075	0.0000362	0.0005054	0.0000431	0.0079182	0.0029753	0.0015596	0.0010798
10	0.0014861	0.0003695	0.0004499	0.0000321	0.0005975	0.0000525	0.0066414	0.0024955	0.0013081	0.0009056
11	0.0014536	0.0003614	0.0004400	0.0000314	0.0005434	0.0000613	0.0059509	0.0022361	0.0011721	0.0008115
12	0.0015023	0.0003735	0.0004547	0.0000325	0.0005627	0.0000478	0.0070893	0.0026639	0.0013964	0.0009667

Obs	P_HDDV_6	P_HDDV_7	P_HDDV8a	P_HDDV8b	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34
1	0.0034400	0.0016652	0.0044479	0.0249185	0.0010000	0.0004793	0.0019533	0.0035154	0.0014751
2	0.0027348	0.0013239	0.0035361	0.0081200	0.0010000	0.0008660	0.0035291	0.0063514	0.0017391
3	0.0041054	0.0019873	0.0053083	0.0751252	0.0010000	0.0002769	0.0011284	0.0020308	0.0013637
4	0.0051916	0.0025131	0.0067127	0.0360068	0.0010000	0.0002080	0.0008475	0.0015252	0.0014483
5	0.0037765	0.0018281	0.0048830	0.0161348	0.0010000	0.0002686	0.0010944	0.0019696	0.0017207
6	0.0051213	0.0024791	0.0066219	0.1021476	0.0010000	0.0002128	0.0008673	0.0015608	0.0013092
7	0.0029778	0.0014415	0.0038503	0.0266049	0.0010000	0.0001475	0.0006010	0.0010816	0.0014969
8	0.0024175	0.0011703	0.0031258	0.0067088	0.0010000	0.0000769	0.0003134	0.0005640	0.0017647
9	0.0037671	0.0018236	0.0048709	0.1641097	0.0010000	0.0003159	0.0012875	0.0023171	0.0012356
10	0.0031597	0.0015295	0.0040854	0.0133005	0.0010000	0.0000982	0.0004002	0.0007203	0.0015068
11	0.0028312	0.0013705	0.0036607	0.0071382	0.0010000	0.0000326	0.0001329	0.0002392	0.0017581
12	0.0033728	0.0016327	0.0043610	0.0799279	0.0010000	0.0001527	0.0006221	0.0011196	0.0013718

Table 13
2007 BPA Saturday VMT Mix by Time Period and Roadway Facility Type Group

Obs	TP	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2b	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	AM_Peak	Art	0.6136153	0.0669532	0.2228823	0.0371797	0.0170980	0.0021766	0.0010468	0.0004375	0.0002658
2	AM_Peak	Col	0.5607044	0.0787132	0.2620307	0.0461358	0.0212167	0.0018940	0.0009109	0.0003807	0.0002313
3	AM_Peak	Fway	0.5993266	0.0631615	0.2102602	0.0340918	0.0156779	0.0025244	0.0012140	0.0005074	0.0003083
4	Mid_Day	Art	0.6011769	0.0663476	0.2208665	0.0369980	0.0170144	0.0033194	0.0015964	0.0006673	0.0004054
5	Mid_Day	Col	0.5569125	0.0781818	0.2602618	0.0458244	0.0210735	0.0026255	0.0012627	0.0005278	0.0003207
6	Mid_Day	Fway	0.5837209	0.0614904	0.2046972	0.0331925	0.0152644	0.0031940	0.0015361	0.0006421	0.0003901
7	Ovr_Nite	Art	0.6135722	0.0677828	0.2256441	0.0376458	0.0173123	0.0018804	0.0009043	0.0003780	0.0002297
8	Ovr_Nite	Col	0.5659375	0.0794465	0.2644719	0.0465657	0.0214143	0.0016653	0.0008009	0.0003347	0.0002034
9	Ovr_Nite	Fway	0.5586351	0.0592608	0.1972752	0.0319511	0.0146935	0.0023962	0.0011524	0.0004817	0.0002927
10	PM_Peak	Art	0.6207079	0.0679016	0.2260395	0.0378214	0.0173931	0.0019959	0.0009599	0.0004012	0.0002438
11	PM_Peak	Col	0.5645840	0.0792569	0.2638405	0.0464545	0.0213632	0.0019529	0.0009392	0.0003926	0.0002385
12	PM_Peak	Fway	0.5999783	0.0634585	0.2112488	0.0342309	0.0157419	0.0020711	0.0009960	0.0004163	0.0002530

Obs	P_HDGV_6	P_HDGV_7	P_HDGV8a	P_HDGV8b	P_LDDV	P_LDDT12	P_HDDV2b	P_HDDV_3	P_HDDV_4	P_HDDV_5
1	0.0010246	0.0002548	0.0003102	0.0000222	0.0006149	0.0000510	0.0046039	0.0017299	0.0009068	0.0006278
2	0.0008916	0.0002217	0.0002699	0.0000193	0.0005620	0.0000599	0.0036497	0.0013714	0.0007189	0.0004977
3	0.0011883	0.0002955	0.0003597	0.0000257	0.0006006	0.0000481	0.0056064	0.0021066	0.0011043	0.0007645
4	0.0015626	0.0003885	0.0004730	0.0000338	0.0006025	0.0000505	0.0070126	0.0026350	0.0013813	0.0009563
5	0.0012359	0.0003073	0.0003741	0.0000267	0.0005582	0.0000595	0.0050593	0.0019011	0.0009965	0.0006899
6	0.0015036	0.0003739	0.0004551	0.0000325	0.0005850	0.0000468	0.0070923	0.0026650	0.0013970	0.0009671
7	0.0008852	0.0002201	0.0002679	0.0000191	0.0006149	0.0000516	0.0039759	0.0014940	0.0007831	0.0005422
8	0.0007839	0.0001949	0.0002373	0.0000169	0.0005672	0.0000605	0.0032089	0.0012058	0.0006321	0.0004376
9	0.0011280	0.0002805	0.0003414	0.0000244	0.0005599	0.0000451	0.0053271	0.0020017	0.0010493	0.0007264
10	0.0009395	0.0002336	0.0002844	0.0000203	0.0006220	0.0000517	0.0041983	0.0015776	0.0008269	0.0005725
11	0.0009193	0.0002286	0.0002783	0.0000199	0.0005659	0.0000604	0.0037633	0.0014141	0.0007412	0.0005132
12	0.0009749	0.0002424	0.0002951	0.0000211	0.0006013	0.0000483	0.0046003	0.0017286	0.0009061	0.0006273

Obs	P_HDDV_6	P_HDDV_7	P_HDDV8a	P_HDDV8b	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34
1	0.0021903	0.0010603	0.0028321	0.0158660	0.0010000	0.0003052	0.0012437	0.0022383	0.0014629
2	0.0017364	0.0008405	0.0022451	0.0051555	0.0010000	0.0005499	0.0022406	0.0040325	0.0017198
3	0.0026673	0.0012912	0.0034488	0.0488084	0.0010000	0.0001799	0.0007331	0.0013194	0.0013800
4	0.0033363	0.0016150	0.0043138	0.0231390	0.0010000	0.0001337	0.0005446	0.0009802	0.0014496
5	0.0024070	0.0011652	0.0031123	0.0102838	0.0010000	0.0001712	0.0006975	0.0012554	0.0017082
6	0.0033742	0.0016334	0.0043628	0.0673002	0.0010000	0.0001402	0.0005714	0.0010283	0.0013435
7	0.0018916	0.0009157	0.0024458	0.0168999	0.0010000	0.0000937	0.0003817	0.0006870	0.0014810
8	0.0015267	0.0007390	0.0019740	0.0042366	0.0010000	0.0000486	0.0001979	0.0003561	0.0017358
9	0.0025344	0.0012268	0.0032769	0.1104071	0.0010000	0.0002126	0.0008662	0.0015589	0.0012948
10	0.0019974	0.0009669	0.0025826	0.0084079	0.0010000	0.0000621	0.0002530	0.0004553	0.0014836
11	0.0017904	0.0008667	0.0023150	0.0045141	0.0010000	0.0000206	0.0000840	0.0001512	0.0017317
12	0.0021886	0.0010595	0.0028299	0.0518659	0.0010000	0.0000991	0.0004037	0.0007265	0.0013865

Table 14
2007 BPA Sunday VMT Mix by Time Period and Roadway Facility Type Group

Obs	TP	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2b	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	AM_Peak	Art	0.5696366	0.0785232	0.2613980	0.0418469	0.0192443	0.0014462	0.0006955	0.0002907	0.0001766
2	AM_Peak	Col	0.5112605	0.0906778	0.3018601	0.0510062	0.0234564	0.0012361	0.0005945	0.0002485	0.0001510
3	AM_Peak	Fway	0.5644222	0.0751464	0.2501571	0.0389257	0.0179009	0.0017015	0.0008183	0.0003420	0.0002078
4	Mid_Day	Art	0.5607557	0.0781842	0.2602697	0.0418411	0.0192416	0.0022161	0.0010657	0.0004455	0.0002707
5	Mid_Day	Col	0.5089981	0.0902774	0.3005269	0.0507809	0.0233528	0.0017176	0.0008260	0.0003453	0.0002098
6	Mid_Day	Fway	0.5544713	0.0737889	0.2456379	0.0382256	0.0175790	0.0021715	0.0010443	0.0004365	0.0002652
7	Ovr_Nite	Art	0.5683796	0.0793266	0.2640727	0.0422812	0.0194440	0.0012467	0.0005996	0.0002506	0.0001523
8	Ovr_Nite	Col	0.5143654	0.0912274	0.3036897	0.0513154	0.0235986	0.0010833	0.0005210	0.0002178	0.0001323
9	Ovr_Nite	Fway	0.5374696	0.0720269	0.2397724	0.0372686	0.0171389	0.0016500	0.0007935	0.0003317	0.0002015
10	PM_Peak	Art	0.5736909	0.0792863	0.2639385	0.0423826	0.0194907	0.0013203	0.0006350	0.0002654	0.0001613
11	PM_Peak	Col	0.5135643	0.0910856	0.3032176	0.0512356	0.0235619	0.0012715	0.0006115	0.0002556	0.0001553
12	PM_Peak	Fway	0.5645067	0.0754291	0.2510982	0.0390480	0.0179572	0.0013947	0.0006707	0.0002804	0.0001703

Obs	P_HDGV_6	P_HDGV_7	P_HDGV8a	P_HDGV8b	P_LDDV	P_LDDT12	P_HDDV2b	P_HDDV_3	P_HDDV_4	P_HDDV_5
1	0.0006808	0.0001693	0.0002061	0.0000147	0.0005720	0.0000596	0.0030592	0.0011495	0.0006026	0.0004172
2	0.0005819	0.0001447	0.0001761	0.0000126	0.0005135	0.0000688	0.0023821	0.0008951	0.0004692	0.0003248
3	0.0008010	0.0001992	0.0002425	0.0000173	0.0005668	0.0000570	0.0037792	0.0014201	0.0007444	0.0005153
4	0.0010432	0.0002594	0.0003158	0.0000226	0.0005631	0.0000593	0.0046820	0.0017593	0.0009222	0.0006385
5	0.0008085	0.0002010	0.0002447	0.0000175	0.0005112	0.0000685	0.0033100	0.0012438	0.0006520	0.0004514
6	0.0010222	0.0002542	0.0003094	0.0000221	0.0005568	0.0000560	0.0048220	0.0018119	0.0009498	0.0006576
7	0.0005869	0.0001459	0.0001777	0.0000127	0.0005707	0.0000602	0.0026363	0.0009906	0.0005193	0.0003595
8	0.0005100	0.0001268	0.0001544	0.0000110	0.0005166	0.0000692	0.0020877	0.0007845	0.0004112	0.0002847
9	0.0007767	0.0001931	0.0002351	0.0000168	0.0005397	0.0000547	0.0036684	0.0013784	0.0007226	0.0005002
10	0.0006215	0.0001545	0.0001881	0.0000134	0.0005761	0.0000602	0.0027775	0.0010437	0.0005471	0.0003788
11	0.0005986	0.0001488	0.0001812	0.0000129	0.0005158	0.0000691	0.0024504	0.0009208	0.0004827	0.0003341
12	0.0006565	0.0001632	0.0001987	0.0000142	0.0005668	0.0000572	0.0030981	0.0011641	0.0006102	0.0004225

Obs	P_HDDV_6	P_HDDV_7	P_HDDV8a	P_HDDV8b	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34
1	0.0014554	0.0007045	0.0018819	0.0105428	0.0010000	0.0002028	0.0008264	0.0014874	0.0017097
2	0.0011333	0.0005486	0.0014654	0.0033650	0.0010000	0.0003589	0.0014625	0.0026320	0.0019743
3	0.0017980	0.0008704	0.0023248	0.0329012	0.0010000	0.0001213	0.0004942	0.0008894	0.0016362
4	0.0022275	0.0010783	0.0028801	0.0154490	0.0010000	0.0000892	0.0003636	0.0006544	0.0017023
5	0.0015748	0.0007623	0.0020362	0.0067280	0.0010000	0.0001120	0.0004564	0.0008213	0.0019656
6	0.0022941	0.0011105	0.0029663	0.0457573	0.0010000	0.0000953	0.0003885	0.0006992	0.0016066
7	0.0012542	0.0006071	0.0016217	0.0112059	0.0010000	0.0000621	0.0002531	0.0004556	0.0017272
8	0.0009932	0.0004808	0.0012843	0.0027563	0.0010000	0.0000316	0.0001287	0.0002317	0.0019863
9	0.0017453	0.0008448	0.0022566	0.0760299	0.0010000	0.0001464	0.0005965	0.0010735	0.0015682
10	0.0013214	0.0006397	0.0017086	0.0055625	0.0010000	0.0000411	0.0001674	0.0003012	0.0017263
11	0.0011658	0.0005643	0.0015074	0.0029393	0.0010000	0.0000134	0.0000547	0.0000985	0.0019832
12	0.0014740	0.0007135	0.0019058	0.0349295	0.0010000	0.0000667	0.0002719	0.0004893	0.0016423

ESTIMATION OF EMISSIONS FACTORS

The MOBILE6 model (October 2002) was applied to calculate the episode-day emissions factors (in grams per mile [g/mi]) of VOC, CO, and NOx. Emissions factors were estimated by speed, emissions type (i.e., emissions factor sub-component), hour, MOBILE6 roadway type (or drive cycle), and average vehicle class fleet (28) for each BPA ozone nonattainment area county. The modeled emissions factors are organized in tables (indexed by pollutant, speed, emissions type, hour, roadway type, and vehicle type) for each county and episode day. The diesel vehicle NOx emissions factors in these tables were adjusted (post-processed) to reflect the impact of the Texas Low Emissions Diesel (LED) Program. These emissions factor tables were then input to the emissions calculations.

The MOBILE6 model is equipped with national default modeling values for a wide range of conditions that affect emissions factors. The only actual data parameters requiring user-input values to run the model are fuel Reid Vapor Pressure (RVP), temperature, and calendar year. Many of the MOBILE6 default modeling parameters may be overridden through the use of MOBILE6 commands and their associated inputs and options. Wherever possible, MOBILE6 defaults were replaced by local input values. Such local inputs were developed and applied to yield emissions factors characteristic of the 2000 episode-day climatic conditions, and evaluation specific vehicle fleet estimates, activity, and emissions control programs.

The following sections discuss the MOBILE6 input/output files, summarize the control programs modeled, detail the aggregation-level of the applied MOBILE6 emissions factors, and describe all of the MOBILE6 commands that may affect emissions factor calculations. Also, applied commands are identified, development of the locality-specific inputs are explained, and the emissions factor post-processing procedure is described.

MOBILE6 Input and Output Files

The MOBILE6 commands and particular model input data are entered in the MOBILE6 command file. Other input parameters (and in some cases, commands) are applied to MOBILE6 from external data files.

The POLFAC62 program, a utility for running MOBILE6 and processing its by-model-year database output to produce the emissions factor tables input for the emissions calculations (described in Appendix B), was applied to run MOBILE6 with the user-input command and external data files to produce the VOC, CO, and NOx emissions factors. (RATEADJV62 was applied to POLFAC62 emissions factor tables where post-processing of emissions factors was required, discussed later.) The final product of the emissions factor modeling is 51 emissions factor files (i.e., one table of hourly emissions factors for each county for each episode day). (A corresponding set of average 24-hour emissions factors was also produced for quality assurance purposes.)

All of the MOBILE6 input files and output files (MOBILE6 emissions factor tables developed with POLFAC62 and RATEADJV62) were provided on CD-ROM. Appendix A lists the CD-ROM volume names and MOBILE6 input and output file names.

Control Programs Modeled
All federal motor vehicle control programs were modeled (this is the MOBILE6 default). Also modeled were the federal programs to offset heavy-duty diesel (HDDV) defeat device effects — the low emissions rebuild program, and the HDDV 2004 standard pull-ahead program (this is the MOBILE6 default). The Texas LED Program was modeled as well.

Post-processing of MOBILE6 emissions factors was required to model the impacts of the LED Program. The MOBILE6 constraint, as related to the diesel-fueled vehicle emissions factor modeling requirement, and the post-processing procedure applied to overcome this limit are discussed in more detail later.

Aggregation Level of MOBILE6 Emissions Factors
The by-model-year (or age-specific) emissions factors from the MOBILE6 detailed database output were condensed into average fleet emissions factors by vehicle class. POLFAC62 performed this function for each vehicle type by weighting (multiplying) each of its age-specific emissions factors by their corresponding travel fractions (developed from the MOBILE6 database output age-specific registration distribution and miles-traveled fraction values) and summing the resulting products. Each emissions factor table provides the MOBILE6 emissions factors by:

- 28 vehicle types,
- 4 road types,
- 14 speeds (except for two MOBILE6 road types, each with one average speed),
- 15 pollutant (VOC, CO, and NOx)-specific emissions types, and
- 24 hourly time periods.

Tables 15 through 17 describe the MOBILE6 vehicle type, emissions type (pertaining to VOC, CO, and NOx pollutants only), and roadway type classifications. Tables 18 and 19 show the speeds and the sequence for hourly time periods, respectively.

Table 15 shows the 28 MOBILE6 vehicle types as defined by fuel-type (gasoline or diesel) and GVWR category in sequence by MOBILE6 vehicle type number.

Table 15
Complete 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 1 and 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)

* The ALVW is the numerical average of the vehicle curb weight and the GVWR.

Source: MOBILE6 User's Guide (EPA, January 2002).

Table 16 shows the eight MOBILE6 emissions type classifications (excludes the pollutants, e.g., particulates and toxics, which are not pertinent to this application). Expanding these emissions types by individual pollutant yields 12 pollutant-specific emissions types. In addition to these 12 pollutant-specific emissions types, POLFAC62 emissions factor tables contain the three composite emissions factors (i.e., one for each pollutant). Thus, for VOC, CO, and NOx applications, POLFAC62 calculates MOBILE6 emissions factors for up to 15 pollutant-specific emissions types. For this application, MOBILE6 emissions factors were calculated for all of the 15 pollutant-specific emissions types except for refueling emissions, which are classified as an area source emissions category.

Table 16
MOBILE6 Emission Type Classifications

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

Source: MOBILE6 User's Guide (EPA, January 2002).

MOBILE6 calculates emissions factors reflective of driving cycles observed on four roadway types, as well as emissions factors for those emissions types that are not directly applicable to the driving cycles (e.g., start and the evaporative components excluding running losses). Table 17 shows the driving cycle (or roadway type) descriptions. The fifth roadway type, according to MOBILE6 is "None." None, or roadway type number 5, is the index for the emissions types that do not apply to the driving cycles, and thus are not sensitive to, or do not vary by, roadway type or speed.

POLFAC62, however, categorizes all of the pollutant-specific emissions types by MOBILE6 roadway types one through four — Freeway, Arterial, Local, and Ramp. That is, in POLFAC62 tables, the MOBILE6 g/mi emissions factors corresponding to the "None" roadway type are

tabulated as emissions factors under each of the four actual roadway types. This allocation of the MOBILE6 "None" road type emissions factors to the Freeway, Arterial, Local, and Ramp MOBILE6 road types is performed in POLFAC62 so that all emissions, regardless of "type," may be spatially allocated to the functional class (or roadway type)-coded network links.

Table 17
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)

Source: MOBILE6 User's Guide (EPA, January 2002).

Table 18 shows the 14 speeds for which the MOBILE6 freeway and arterial emissions factors are calculated and tabulated. Later in the emissions estimation process, emissions factors for average operational speeds that are not represented in the 14 speeds as tabulated, are calculated by interpolation (except for those speeds higher than the MOBILE6 maximum speed, and those lower than the MOBILE6 minimum speed, in which case the emissions factors corresponding to these bounding speeds are used, respectively). The MOBILE6 Local and Ramp road type emissions factors are not speed sensitive and are each characterized by one average speed.

Table 18
Speeds for POLFAC62 Tabulated MOBILE6 Freeway and Arterial Emissions Factors*

Number	Speed
1	2.5 mph
2	5 mph
3	10 mph
4	15 mph
5	20 mph
6	25 mph
7	30 mph
8	35 mph
9	40 mph
10	45 mph
11	50 mph
12	55 mph
13	60 mph
14	65 mph

* The MOBILE6 Local and Ramp drive cycle emissions factor's fixed speeds are 12.9 and 34.6 mph, respectively.

MOBILE6 uses several hourly input parameters (e.g., hourly temperatures, hourly VMT fractions, etc.) to model hourly emissions factors. MOBILE6 requires that hourly input parameters be sequenced starting from the 6 a.m. hour. In some cases, however, particular overnight hours are grouped together as a single time period. Table 19 shows the MOBILE6 sequence for hourly inputs.

Table 19
General Sequence for Calendar Day Hourly* Inputs to MOBILE6

Input Sequence Number	Abbreviation	Description
1	6 a.m.	6 a.m. through 6:59 a.m.
2	7 a.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 p.m. 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 a.m. 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.

* For some MOBILE6 hourly input parameters, overnight hours are grouped. Hourly inputs are representative of the same day or day type, but are reordered for input to MOBILE6 to start at 6 a.m.

Application of MOBILE6 Commands and Associated Input Parameters

Tables 20 through 26 list and describe all of the MOBILE6 commands that may affect calculating emissions factors (excluding some commands such as those that affect only the output format or content). Respectively, these seven tables are: MOBILE6 Pollutants and Emission Rates, MOBILE6 External Conditions, MOBILE6 Vehicle Fleet Characteristics,

MOBILE6 Activity, MOBILE6 State Programs, MOBILE6 Fuels, and MOBILE6 Alternative Emissions Regulations and Control Measures. These tables identify the combinations of MOBILE6 commands and parameters used.

Parameters associated with each MOBILE6 command are in general labeled as either EPA default, locality-specific or NOT APPLIED. The tabulated commands where the associated input parameters are labeled only as "EPA default" are generally not input by the analyst. MOBILE6 technical report references (electronic file names available on the EPA MOBILE Internet site [http://www.epa.gov/otaq/models/mobile6/m6tech.htm] are provided for particular parameters.

The procedures used to develop the locality-specific inputs to MOBILE6 and to post-process the emissions factors for LED effects are detailed following the seven MOBILE6 input category tables.

Table 20
MOBILE6 Pollutants and Emission Rates

Command	Function/Description	Input Parameter Source/Value
POLLUTANTS	Defines the basic set of pollutants to report.	NOT APPLIED. (The MOBILE6 default is assumed: HC, CO, NOx.)
PARTICULATES	Enables computation of particulate matter (PM) an related emissions factors.	NOT APPLIED.
PARTICULATE EF	Specifies location of files that contain the particulate emissions factors when PARTICULATES command is used.	NOT APPLIED.
PARTICLE SIZE	Allows user to specify the maximum particulate size cutoff used by MOBILE6.	NOT APPLIED.
EXPRESS HC AS VOC	One of five possible commands that allow the user to specify the particular HC species (non-methane hydrocarbons, non-methane organic gases, total hydrocarbons, total organic gases, and VOC) to report in the exhaust emissions output.	APPLIED for VOC. Only the command is required.
NO REFUELING	Directs MOBILE6 not to calculate refueling emissions factors.	APPLIED. Only the command is required.
AIR TOXICS	Enables the computation of air toxic emissions factors (six explicit pollutants) and specifies which to calculate.	NOT APPLIED.
ADDITIONAL HAPS	Allows entry of emissions factors or air toxic ratios for calculation of additional user-defined air toxic pollutant emissions factors.	NOT APPLIED.
MPG ESTIMATES	Allows entry of alternate fuel economy performance data by vehicle class and model year.	NOT APPLIED. (MOBILE6 default values were assumed.)

Table 21
MOBILE6 External Conditions

Command	Function/Description	Input Parameter Source/Value
CALENDAR YEAR	Identifies calendar year for which emissions factors are to be calculated. (Required to run model).	2007
EVALUATION MONTH	Provides option of calculating January 1 or July 1 emissions factors for calendar year of evaluation.	7 (for July)
MIN/MAX TEMPERATURE	Sets minimum and maximum daily temperatures. (Required to run model if the HOURLY TEMPERATURES command is not used.)	NOT APPLIED. (See HOURLY TEMPERATURES.)
HOURLY TEMPERATURES	Allows temperatures input for each hour of day. (Required to run model if MIN/ MAX TEMPERATURE command is not used.)	County, episode day-specific, developed by TCEQ (May 2003), based on Central Daylight Time. See Appendix E.
ALTITUDE	Specifies high- or low-altitude for modeling area.	NOT APPLIED. (EPA default, low altitude, was assumed).
ABSOLUTE HUMIDITY	Used to specify daily average humidity (directly affects NOx emissions). MOBILE6 also converts absolute humidity to heat index which affects HC and CO emissions for the portion of the fleet that MOBILE6 determines is using air conditioning.	NOT APPLIED. (See RELATIVE HUMIDITY.)
Environmental Effects on Air Conditioning:	Commands used by MOBILE6 to model the extent of vehicle air-conditioning usage.	
CLOUD COVER	Specifies average percent cloud cover for given day.	NOT APPLIED. (EPA default assumed.)
PEAK SUN	Specifies Mid-Day hours with peak sun intensity.	NOT APPLIED. (EPA default assumed.)
SUNRISE/SUNSET	Allows user to specify time of sunrise and sunset.	Region-specific values: 7 a.m., 8 p.m. (TCEQ. May, 2003).
RELATIVE HUMIDITY	Specifies use of 24 hourly relative humidity values entered by user. MOBILE6 will perform hour-specific calculations with hourly values rather than use single daily default absolute humidity value.	County, episode day-specific, developed by TCEQ (May 2003), based on Central Daylight Time. See Appendix E.
BAROMETRIC PRES	Specifies use of user input daily average barometric pressure for use with hourly relative humidity to calculate hourly absolute humidity values.	County and episode day-specific, developed by TCEQ (May 2003). See Appendix E.

Table 22
MOBILE6 Vehicle Fleet Characteristics

Command	Function/Description	Input Parameter Source/Value
REG DIST	Allows the user to supply registration distributions by age for any of the 16 composite (combined gasoline and diesel) vehicle types.	Locality-Specific/EPA default. TTI developed the age distributions using the latest available local data and EPA defaults where needed. Mid-year 2003 TxDOT county-level registrations data were applied for LDV, LDT and MC; regional data were applied for HDV; MOBILE6 defaults were used for buses. See Appendix F.
DIESEL FRACTIONS	Permits user to supply locality-specific diesel fractions for 14 of the 16 composite vehicle categories by age.	Locality-Specific/EPA default. TTI developed the evaluation year-specific local diesel fractions with the latest available data. Mid-year 2003 TxDOT statewide gasoline/diesel registrations data were used for HDV; LDV, LDT, Bus fractions are MOBILE6 defaults. The latest diesel fractions (2003) were assumed as the values for each model year up to the future year of evaluation (e.g., 2004, 2005.... 2007). Earlier model year fractions beyond the 25 model year input data set limit were removed from the input data. See Appendix F.
MILE ACCUM RATE	Allows the user to supply the annual mileage accumulation rates by vehicle type and age.	NOT APPLIED. (EPA defaults assumed — see technical report M6FLT.007)
NGV FRACTION	Lets user specify percent of natural gas vehicles (NGV) in the fleet by type and age certified to operate on either compressed or liquefied natural gas.	NOT APPLIED. (The EPA default, zero percent, was assumed.)
NGV EF	Permits the user to enter alternate NGV emissions factors for each of the 28 vehicle types, for running and start emissions.	NOT APPLIED. (The EPA default, none, was assumed.)

Table 23
MOBILE6 Activity

Command	Function/Description	Input Parameter Source/Value
VMT FRACTIONS	Used in MOBILE6 to weight the emissions of various vehicle types into average rates for groupings of vehicle classes.	NOT APPLIED. (EPA default assumed, used for aggregate results which do not apply to this analysis.)
VMT BY FACILITY	VMT fractions by MOBILE6 road type combine the four road type emissions factors into the "all road types" emissions factors.	NOT APPLIED. (EPA default assumed, used for aggregate results with no impact on this analysis.)
VMT BY HOUR	Allows VMT fractions allocation by hour-of-day; applied to convert grams per hour to g/mi, as well as to weight hourly g/mi rates to obtain daily emissions factors.	Region-Specific. There are four hourly VMT fractions distributions, one for each day type. These are the same fractions as developed and used by TTI to 24-hour link VMT by hour of day. See Table 5.
SPEED VMT	Allows user to allocate VMT by average speed (14 pre-selected: 2.5 and 5 through 65 at 5 mph increments) for arterials and freeways for each hour of the day.	Generic input for all counties. Inputs were set up to calculate emissions factors by 14 MOBILE6 speed bin speed scenarios for MOBILE6 freeway and arterial road types.
AVERAGE SPEED	Allows a single average speed for combined freeways and arterials for the entire day.	NOT APPLIED.
STARTS PER DAY	Lets user specify the average number of engine starts per vehicle per day by vehicle types for weekend days and weekdays.	NOT APPLIED. (MOBILE6 weekday defaults assumed — see technical report M6FLT.003.)
START DIST	Allows user to allocate engine starts by hour of the day for weekend days and weekdays.	NOT APPLIED. (MOBILE6 weekday defaults assumed — see technical report M6FLT.003.)
SOAK DISTRIBUTION	Allows use of alternate vehicle soak duration distributions for weekend days and weekdays.	NOT APPLIED. (MOBILE6 weekday defaults assumed — see technical reports M6FLT.003 and 004.)
HOT SOAK ACTIVITY	Allows users to specify a hot soak duration distribution for each of 14 daily time periods for weekend days and for weekdays.	NOT APPLIED. (MOBILE6 weekday defaults assumed — see technical reports M6FLT.003 and 004.)
DIURN SOAK ACTIVITY	Allows user to set diurnal soak time distributions for each of 18 daily time periods.	NOT APPLIED. (MOBILE6 defaults assumed. — see technical report M6FLT.006.)
WE DA TRI LEN DI	Specifies alternate fractions of VMT that occur during trips of various durations at each hour of the average weekday.	NOT APPLIED. (MOBILE6 defaults assumed. — see technical report M6FLT.005.)
WE EN TRI LEN DI	Specifies hourly alternate VMT fractions for trips of various lengths for weekend days.	NOT APPLIED. (MOBILE6 weekday defaults assumed — there are no weekend day defaults.)
WE VEH US	Directs MOBILE6 to use weekend activity data for calculating emissions factors.	Applied command for weekend day analyses.

Table 24
MOBILE6 State Programs

Command	Function/Description	Input Parameter Source/Value
STAGE II REFUELING	Allows modeling of at-the-pump refueling emissions.	NOT APPLIED. Accounted for as an area source category.
ANTI-TAMP PROG	Allows user to model impacts of an Anti-Tampering Program (ATP).	NOT APPLIED. (Although Texas administers a statewide ATP, ATP credit is only taken in those counties which also administer and enforce an I/M program.)
I/M Commands: 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	 Required for exhaust/evaporative I/M programs. Required for exhaust/evaporative I/M programs. Required for exhaust/evaporative I/M programs. Required for exhaust. Do not use for evaporative. Required for exhaust. Optional for evaporative. Required for exhaust. Optional for evaporative. Optional for exhaust (but required for IM240). Do not use with evaporative. Optional for both exhaust and evaporative. Optional for both exhaust and evaporative. Optional for exhaust. Do not use with evaporative. Optional for exhaust. Do not use with evaporative. Optional for both.	NOT APPLIED.

Table 25
MOBILE6 Fuels

Command	Function/Description	Input Parameter Source/Value
FUEL PROGRAM	Allows specification of one of four options: 1) Conventional Gasoline East Tier 2 sulfur phase-in schedule (includes Texas); 2) Reformulated Gasoline (RFG); 3) Conventional Gasoline West Tier 2 sulfur geographical phase-in area schedule; or 4) Sulfur content for gasoline after 1999.	Option 1: Applied for all counties.
SULFUR CONTENT	(or GASOLINE SULFUR) Allows use of alternate sulfur content for conventional gasoline through calendar year 1999.	NOT APPLIED. (See FUEL PROGRAM Option above.)
DIESEL SULFUR	Allows use of average diesel fuel sulfur level for all calendar years. Required if PARTICULATES command is used. No affect on HC, CO, NOx or air toxics (except if calculated as ratio to PM).	NOT APPLIED.
OXYGENATED FUELS	Allows modeling of oxygenated gasoline effects on exhaust for all gasoline-fueled vehicle types. Not for use with AIR TOXICS command.	NOT APPLIED.
FUEL RVP	Allows user to specify fuel RVP for area being modeled (required to run model).	Region-specific. Used federal limit, 7.8 psi
SEASON	Identifies effective season for RFG calculation regardless of month modeled.	NOT APPLIED.
GAS AROMATIC%	Only when AIR TOXICS command is used.	NOT APPLIED.
GAS OLEFIN%	Only when AIR TOXICS command is used.	NOT APPLIED.
GAS BENZENE%	Only when AIR TOXICS command is used.	NOT APPLIED.
E200	Only when AIR TOXICS command is used.	NOT APPLIED.
E300	Only when AIR TOXICS command is used.	NOT APPLIED.
OXYGENATE	Only when AIR TOXICS command is used.	NOT APPLIED.
RVP OXY WAIVER	Only when AIR TOXICS command is used.	NOT APPLIED.

Table 26
MOBILE6 Alternative Emissions Regulations and Control Measures

Command	Function/Description	Input Parameter Source/Value
NO CLEAN AIR ACT	Models vehicle emissions as if the Federal Clean Air Act Amendments of 1990 had not been implemented.	NOT APPLIED.
HDDV NOx Off-Cycle Emissions Effects: NO DEFEAT DEVICE NO NOX PULL AHEAD NO REBUILD REBUILD EFFECTS	 Turns off the effects of the HDD vehicle NOx off-cycle emissions effects (defeat device emissions). Turns off HDD NOx emissions reduction effects of Pull- Ahead program. Turns off HDD NOx emissions reduction effects of Rebuild program. Allows user to change Rebuild program effectiveness rate.	 NOT APPLIED (MOBILE6 default, 0.90, is assumed for REBUILD EFFECTS.)
Tier 2 Emission Standards and Fuel Requirements: NO TIER2 T2 EXH PHASE-IN T2 EVAP PHASE-IN T2 CERT	Allow the overriding of the default Tier 2 emissions standards and fuel requirements settings. Disables Tier 2 requirements. Allows alternate Tier 2 exhaust standard phase-in schedules. Allows alternate Tier 2 evaporative standard phase-in schedules. Allows user to specify alternate Tier 2 50,000-mile certification standards.	NOT APPLIED.
94+ LDG IMPLEMENTATON	Allows use of alternate 1994 and later fleet penetration fractions for LDGVs under the Tier 1, National Low-Emissions Vehicle (NLEV) (or California Low-Emissions Vehicle (LEV) 1), and Tier 2 emissions standard programs.	NOT APPLIED.
NO 2007 HDDV RULE	Disables 2007 HDV emissions standards.	NOT APPLIED.

External Conditions — Locality-Specific Inputs to MOBILE6
MOBILE6 local inputs for hourly temperatures, hourly relative humidity, and sunrise and sunset times were developed and applied by calendar day based on local (central daylight) time. TCEQ developed these input values (provided May 2003), using 2000 episode day data.

Temperatures (HOURLY TEMPERATURES Command)
TCEQ developed ambient hourly temperatures (degrees Fahrenheit) for input to MOBILE6 by county for each of the analysis days within the August 10, 2000 through September 6, 2000 period. The temperatures are hourly averages from monitoring stations within the BPA counties. TCEQ used monitoring data from the EPA Aerometric Information Retrieval System, the National Weather Service, and the Conrad Blucher Institute weather stations. Each county with more than one monitoring station uses the hourly average temperatures from the monitoring

stations within its border. Counties without monitoring stations, or with stations that did not record particular data parameter values, use average hourly data values from monitoring stations from adjacent counties.

The MOBILE6 User's Guide states that the 24 hourly temperature inputs are entered from 6 a.m. continuing through 5 a.m. of the "next day." The emissions estimation method applied by TTI, however, applied the hourly input data by "calendar day." This calendar day method simplifies the emissions estimation process, especially when modeling consecutive calendar days exhibiting different hourly travel activity. Thus, the hourly average temperatures for each calendar day provided by TCEQ were sequenced starting with 6 a.m. through 11:59 p.m. followed by 12 a.m. through 5:59 a.m. of the same calendar day. The temperatures input were for Central Daylight Time (CDT) (local time).

Modeling three counties for 17 days resulted in 51 hourly temperature data sets. The temperatures were input in the MOBILE6 command file. Appendix E contains a summary of the temperatures used.

Humidity (RELATIVE HUMIDITY Command)
The RELATIVE HUMIDITY command is used to specify hourly percent relative humidity values for each of the eight counties.

TCEQ developed hourly relative humidity input values essentially following the hourly temperature input development procedure and using data available from the stations described in the hourly temperature discussion above. Many of these stations do not record humidity; humidity data from adjacent counties were used for the counties with no humidity data available. The humidity parameter was input in the MOBILE6 command file. Appendix E shows the humidity values used.

Sunrise and Sunset Times (SUNRISE/SUNSET Command)
The SUNRISE/SUNSET Command allows the user to specify the time of sunrise and sunset. This feature affects only the air-conditioning correction. TCEQ provided the sunrise and sunset times which were the same for all counties and days. The times are 7 a.m. and 8 p.m. CDT.

Barometric Pressure (BAROMETRIC PRES Command)
The BAROMETRIC PRES command is used to specify the 24-hour average barometric pressure value (in units of inches of Mercury) by county and episode analysis day.

The daily barometric pressure inputs were developed by TCEQ by averaging the hourly barometric pressure data for each day (based on local time) from the weather stations with available barometric pressure data. As is the case for temperature and humidity inputs for counties without available data, values from adjacent counties were applied. The barometric pressure is input in the MOBILE6 command file. Appendix E shows the barometric pressure input values.

Vehicle Fleet Characteristics

Vehicle age distributions and diesel fractions inputs were developed from TxDOT mid-year 2003 county vehicle registration data for the vehicle classes with available TxDOT registrations data. MOBILE6 defaults were otherwise used. Due to sparse registration data for some HDV vehicle classes resulting from the increased disaggregation level of the classifications in MOBILE6, HDV registrations data were aggregated at the three-county region level for developing age distributions, and were aggregated at the statewide level for developing diesel fractions.

Vehicle Registration Distributions (REG DIST Command)

The user-supplied vehicle registration distributions input to MOBILE6 are the vehicle age fractions for any of the 16 composite (combined gasoline and diesel) vehicle types shown in Table 27. MOBILE6 default distributions are internally applied for vehicle classes for which the modeler does not provide alternate values. The input values for each vehicle class are 25 age fractions representing the fraction of vehicles by age for that particular vehicle class as of July of the evaluation year. These fractions start with the evaluation year as the 1st age fraction and go back in annual increments to the 25th fraction, which represents the fraction of vehicles of age 25 years and older. The fractions are calculated as model year-specific registrations in a class divided by all vehicles registered in that class. Table 27 shows the data sources of age fractions used in this study.

Table 27
Composite Vehicle Classes and Data Sources for MOBILE6 Age Distributions Input

Number*	Abbreviation	Description	Source of Distributions
1	LDV	Light-Duty Vehicles	TxDOT July 2003 County Registrations
2	LDT1	Light-Duty Trucks 1	TxDOT July 2003 County Registrations
3	LDT2	Light-Duty Trucks 2	TxDOT July 2003 County Registrations
4	LDT3	Light-Duty Trucks 3	TxDOT July 2003 County Registrations
5	LDT4	Light-Duty Trucks 4	TxDOT July 2003 County Registrations
6	HDV2B	Class 2b Heavy-Duty Vehicles	TxDOT July 2003 Regional Registrations
7	HDV3	Class 3 Heavy-Duty Vehicles	TxDOT July 2003 Regional Registrations
8	HDV4	Class 4 Heavy-Duty Vehicles	TxDOT July 2003 Regional Registrations
9	HDV5	Class 5 Heavy-Duty Vehicles	TxDOT July 2003 Regional Registrations
10	HDV6	Class 6 Heavy-Duty Vehicles	TxDOT July 2003 Regional Registrations
11	HDV7	Class 7 Heavy-Duty Vehicles	TxDOT July 2003 Regional Registrations
12	HDV8A	Class 8a Heavy-Duty Vehicles	TxDOT July 2003 Regional Registrations
13	HDV8B	Class 8b Heavy-Duty Vehicles	TxDOT July 2003 Regional Registrations
14	HDBS	School Buses	MOBILE6 Default
15	HDBT	Transit and Urban Buses	MOBILE6 Default
16	MC	Motorcycles	TxDOT July 2003 County Registrations

* MOBILE6 input sequence.

TTI developed MOBILE6 age distributions fractions input from TxDOT data for all vehicle types except for the two bus categories for which the MOBILE6 defaults were used. To develop these distributions, TTI used two county-level data sets provided by TxDOT. The TxDOT registrations data provided are:

- July 2003 registrations for:
  gasoline and diesel: LDV, LDT12, LDT34, MC, HDGT, HDDT; and
- July 2003 registrations for:
  gasoline: HDV2B, HDV3, HDV4, HDV5, HDV6, HDV7, HDV8A, HDV8B;
  diesel: HDV2B, HDV3, HDV4, HDV5, HDV6, HDV7, HDV8A, HDV8B.

The LDT12 and LDT34 classes of the combined gasoline and diesel registrations data set correspond to the MOBILE6 classes LDT1 and LDT2, and LDT3 and LDT4, respectively. The aggregate HDGTs and HDDTs were not used.

The TxDOT county level registrations data for each of the HDV weight classes (numbers 6 through 13 in Table 27) were first summed to the three-county regional level and also across fuel types within each model year. There were then three steps to develop the TxDOT registrations-

based MOBILE6 age distributions input for the 14 non-bus vehicle classes. The first step in the process developed the July 2003 registrations by the 25 age groups (as required by MOBILE6) for 12 of the 16 composite (by fuel) vehicle classes (the eight HDV classes at the regional level, and the LDV, LDT12, LDT34, MC classes at the county level). The second step converted the registrations for each of the 25 model years from numbers of vehicles registered, to fractions registered by age for each of these 12 classes. The registrations were then expanded from 12 to 14 vehicle classes.

The eight regional HDV class registrations (fuel type composites) were combined with the four light-duty vehicle class county level registrations to yield one data set for the 12 vehicle classes, of composite by fuel vehicle registrations by age (i.e. the eight HDV classes and LDV, LDT12, LDT34, and MC). For each vehicle class, model year registrations corresponding to 25 years old and older vehicles were summed to form the "25 years old and older" age group.

The conversion of the registrations from numbers of vehicles to fractions of vehicles by age was made for each vehicle class by dividing its registrations for each age by its total registrations. In some cases the age distributions fractions do not sum to one due to insignificant rounding error. In such cases, MOBILE6 normalizes the input age distribution fractions.

The resulting July 2003 estimated age distribution fractions for the 12 composite classes were then expanded to 14 classes. This was accomplished by using the LDT12 age fractions for both the MOBILE6 LDT1 and LDT2 classes, and the by using the LDT34 age fractions for both the MOBILE6 LDT3 and LDT4 classes. The MOBILE6 vehicle registration distributions were input from external data files. The external data files were provided to TCEQ on CD-ROM. Appendix A lists the data files submitted. Appendix F shows the age distributions input.

Diesel Fractions (DIESEL FRACTIONS Command)

The DIESEL FRACTIONS command allows the user to specify diesel fractions for 14 of the 16 composite (gasoline and diesel) vehicle categories by vehicle age. MOBILE6 assumes that urban/transit buses are 100 percent diesel, and that motorcycles are all gasoline fueled, so these two categories do not require diesel fractions. The diesel fraction represents the portion of diesels in a composite (gasoline and diesel) vehicle class for any vehicle age. When the analyst enters diesel fractions, all 14 sets of fractions are required. Each set of fractions contains the diesel fractions for 25 vehicle ages from the evaluation year back through the 25th fraction, which represents vehicle ages of 25 years and older.

The MOBILE6 default fractions vary by age for model years 1972 through 1996. MOBILE6 assumes that the diesel fractions for 1971 and earlier model years are the same as the 1972 model year fractions, and that the diesel fractions for the 1997 and later model years (through the calendar year of evaluation) are the same as its latest model year (1996) fraction.

TTI developed the 2007 diesel fractions input data set using a combination of estimated TxDOT statewide diesel fractions (based on the 2003 mid-year HDV registrations data sets) and

MOBILE6 default diesel fractions. Table 28 shows the MOBILE6 diesel fractions input sequence and categories with corresponding data sources.

The statewide diesel fractions estimates through the latest available model year registrations (2003 model year) were calculated using individual diesel and gasoline vehicle statewide registrations data for the eight HDV (HDV2b through HDV8b) weight classes. To produce the individual HDV diesel fractions by model year, the model year-specific individual HDV vehicle class registrations were divided by the sum of the gasoline and diesel registrations for that vehicle class and model year. This procedure was performed for each HDV vehicle class and model year.

To produce the diesel fractions input data sets specific to the 2007 evaluation year, the latest available fractions (2003 for statewide data and 1996 for MOBILE6 default data) were assumed for each later year through the year of evaluation. Earlier model year diesel fractions exceeding the 25 model year input data set requirement were removed from the 2007 evaluation year input data set. The estimated evaluation year-specific HDV diesel fractions were combined with the corresponding evaluation year-specific MOBILE6 default diesel fractions for the remaining vehicle classes (LDV, LDT1, LDT2, LDT3, LDT4, and HDBS) to produce the complete input data set for 2007. Diesel fractions are entered in the MOBILE6 command file. Appendix F list the diesel fractions inputs.

Table 28
Source of Diesel Fractions for Composite Vehicle Types

Number*	Abbreviation	Description	Source of Fractions
1	LDV	Light-Duty Vehicles	EPA MOBILE6 Evaluation Year Default
2	LDT1	Light-Duty Trucks 1	EPA MOBILE6 Evaluation Year Default
3	LDT2	Light-Duty Trucks 2	EPA MOBILE6 Evaluation Year Default
4	LDT3	Light-Duty Trucks 3	EPA MOBILE6 Evaluation Year Default
5	LDT4	Light-Duty Trucks 4	EPA MOBILE6 Evaluation Year Default
6	HDV2B	Class 2b Heavy-Duty Vehicles	TxDOT July, 2003 Statewide registrations
7	HDV3	Class 3 Heavy-Duty Vehicles	TxDOT July, 2003 Statewide registrations
8	HDV4	Class 4 Heavy-Duty Vehicles	TxDOT July, 2003 Statewide registrations
9	HDV5	Class 5 Heavy-Duty Vehicles	TxDOT July, 2003 Statewide registrations
10	HDV6	Class 6 Heavy-Duty Vehicles	TxDOT July, 2003 Statewide registrations
11	HDV7	Class 7 Heavy-Duty Vehicles	TxDOT July, 2003 Statewide registrations
12	HDV8A	Class 8a Heavy-Duty Vehicles	TxDOT July, 2003 Statewide registrations
13	HDV8B	Class 8b Heavy-Duty Vehicles	TxDOT July, 2003 Statewide registrations
14	HDBS	School Buses	EPA MOBILE6 Evaluation Year Default

* MOBILE6 input sequence

Activity
The locality-specific activity parameters used to develop the hourly emissions factors were fleet hourly VMT fractions (through the VMT BY HOUR command).

Additional non-default, but generic activity inputs used in the modeling were hourly fractions of VMT by the 14 speeds for arterials and freeways (SPEED VMT command). Also, weekend day hourly vehicle usage rates (MOBILE6 defaults) for particular activity input parameters (through the WE VEH US command) were applied for the Saturday and Sunday episode days.

VMT Fractions (Also Known as VMT Mix)
These sets of fractions (VMT fractions attributable to individual vehicle classes) are an input to MOBILE6, however, the method for this study calls for the application of the VMT mix (or mixes) later in the emissions calculation process. VMT mix development was discussed previously in this documentation.

Total VMT by Hour (VMT BY HOUR Command)
Hourly fleet total VMT distributions were input to MOBILE6 by using the VMT BY HOUR command. These fractions were used by MOBILE6 to convert the units of the non travel-related hourly emissions factors (e.g., hot soak, diurnal, start, etc.) to units of g/mi. (The VMT-by-hour

fractions were also used to produce daily emissions factors as composites of the hourly emissions factors.)

Development of the hourly VMT fractions for the BPA three-county nonattainment area were previously discussed in the "Hourly Travel Factors" section (see Table 5). These hourly travel fractions, used to distribute 24-hour link VMT by hour-of-day, were also input to MOBILE6, except that the MOBILE6 input sequence starts with the 6 a.m. fraction. The hourly VMT fractions are input to MOBILE6 as an external data file. The data files were provided on CD-ROM as described in Appendix A.

VMT Distribution by Average Speed on Freeways and Arterials (SPEED VMT Command)
The VMT distributions by average speed inputs are called by the SPEED VMT command, but are accommodated internally by the POLFAC62 program (that is, no user speed input commands or data parameter values are required when producing MOBILE6 emissions factors tables with POLFAC62). POLFAC62 used the SPEED VMT inputs to produce the individual Freeway and Arterial emissions factors indexed by the 14 MOBILE6 speed bin speeds (see Table 18).

There are 14 scenarios, each with 100 percent of Freeway and Arterial VMT set to one of the 14 MOBILE speed bin speeds. Each scenario produced a set of Arterial and Freeway emissions factors corresponding to one of the 14 speeds.

Weekend Day Vehicle Usage (WE VEH US Command)
MOBILE6 supplies default weekend day hourly vehicle usage rates for start distributions, soak distributions, hot soak activity, and trip length distributions. For Saturday and Sunday day types the WE VEH US command was applied to model the EPA default weekend usage rates for these parameters, however, MOBILE6 used only the default weekday trip length distributions for both weekday and weekend day types.

State Programs
There were no MOBILE6 State Programs descriptive inputs (i.e., inspection and maintenance, anti-tampering, and stage II refueling programs) modeled.

Fuels – Locality-Specific Inputs to MOBILE6
User input for fuel effects for modeling BPA 2007 includes only the FUELS PROGRAM and FUEL RVP commands and associated input parameters.

Fuel Program (FUEL PROGRAM Command)
The MOBILE6 FUEL PROGRAM command provides the user four options for modeling fuels effects. The first option, Conventional Gasoline East, which is also the MOBILE6 default, was modeled for all three counties. This option supplies post-1999 gasoline sulfur levels by year under the Tier 2 rule phase-in schedule for most states (including Texas). The FUEL PROGRAM option is entered in the MOBILE6 command file.

Gasoline RVP (FUEL RVP Command)
The BPA regulated RVP limit of 7.8 psi was used as the RVP input for 2007. This parameter is also a command file input.

MOBILE6 Alternative Emissions Regulations and Control Measures Commands
No user input was applied in this section of the model; thus, all inputs pertaining to this part of the model were MOBILE6 defaults. This includes the REBUILD EFFECTS parameter value (i.e., sets the effectiveness rate for modeling the low-NOx emissions rebuilds program for heavy-duty diesels) for which MOBILE6 uses a default effectiveness rate of 0.90, or 90 percent.

According to all of the above-described MOBILE6 input parameters and options, MOBILE6 input files were set up and run with the POLFAC62 program for each county and analysis day. The resulting POLFAC62 tabulated hourly emissions factors output were then post-processed as described below.

Emissions Factor Post-Processing
MOBILE6 does not allow user-specified alternate diesel fuel input parameters that affect the modeled VOC, CO, and NOx emissions factors. This MOBILE6 model limitation resulted in the emissions factors post-processing requirement for modeling Texas LED fuel. No other post-processing of emissions factors was required.

To model the impacts of the Texas LED Fuel Program, MOBILE6 diesel vehicle NOx emissions factors were post-processed (using the RATEADJV62 utility which applies factors to POLFAC62 emissions factor tables, described in Appendix B). TCEQ provided TTI with the estimated BPA area NOx reductions estimates for 2007 and the corresponding adjustment factors by diesel vehicle type as shown in Table 29. TTI multiplied these diesel vehicle type-specific NOx adjustment factors by the corresponding vehicle-type NOx emissions factors for each county and analysis day.

Table 29
2007 Texas LED Program Estimated NOx Reduction Factors*
Beaumont-Port Arthur Nonattainment Area

Diesel Vehicle Type	NOx Reduction	NOx Adjustment Factor
LDDV	6.11%	0.9389
LDDT12	6.20%	0.9380
LDDT34	5.43%	0.9457
HDDV2b	5.05%	0.9495
HDDV3	5.28%	0.9472
HDDV4	5.47%	0.9453
HDDV5	5.37%	0.9463
HDDV6	5.50%	0.9450
HDDV7	5.67%	0.9433
HDDV8a	5.99%	0.9401
HDDV8b	5.57%	0.9443
HDDBT	5.82%	0.9418
HDDBS	5.82%	0.9418

* Provided by TCEQ (February 2004). Based on latest local age distributions and diesel fraction estimates and application of EPA's estimates for Texas LED NOx reductions by model year: 4.8 percent for 2002 and newer diesel vehicles, and 6.2 percent for 2001 and older diesel ("Texas Low Emissions Diesel Fuel Benefits," EPA Memorandum, September 27, 2001).

TCEQ developed the average vehicle class adjustment factors in Table 29 by applying 4.8 percent and 6.2 percent reductions to a set of locality-specific emissions estimates on a by-model-year (4.8 percent for 2002 and newer, and 6.2 percent for 2001 and older, per EPA Memorandum, Texas Low Emission Diesel [LED] Fuel Benefits, September 27, 2001) and drive cycle-specific basis. TCEQ produced the tabulated average vehicle class results using BPA area on-road mobile source inventory-specific model year travel fractions and the latest age distributions and diesel fractions estimates (developed from mid-year 2003 TxDOT registrations data).

Upon completion of this emissions factor post-processing step, the emissions factors were input to the IMPSUM62 program to calculate estimated emissions. The modeled emissions factors were provided to TCEQ on CD-ROM. See Appendix A for file names and descriptions.

EMISSIONS CALCULATIONS

Hourly emissions were calculated at the network link level using the IMPSUM62 program (Appendix B). Generally, for each hour the episode day link-VMT estimates were multiplied by the episode-day emissions factors (g/mi) to produce hourly emissions estimates for each of the 28 vehicle types and each pollutant sub-component on each network link (the MOBILE6 Freeway, Arterial or Ramp emissions factors were used depending on the link facility type code). For each day, 75 files were output from the emissions calculations. These files include: 72 hourly link emissions files (24 hours multiplied by three counties), a summary file of county-level and area total hourly and 24-hour emissions estimates cross classified by vehicle type and road type, a tab-delimited version of the emissions summary file, and the file that logged the execution of the emissions calculation programs. These files were provided on CD-ROM (see Appendix A).

Hourly Link Emissions

Ozone season weekday emissions were first calculated by hour for each network and intrazonal link (indexed to county and road type) using the following basic inputs:

- MOBILE6 emissions factors indexed by pollutant, speed, emission type, hour, road type, and vehicle type, as developed with POLFAC62 (and RATEADJV6);

- records associating the MOBILE6 drive-cycle-specific emissions factors with the appropriate functional classification codes (or facility type codes) used in the network links;

- link data from the assignment results as developed (for each hour) using the TRANSVMTDSPD program including: county number, functional classification (or facility type) number, VMT on link, operational link-speed estimate, link node (end point) numbers, and link distance; and

- VMT mix (to allocate link VMT by each of the 28 vehicle types) by time period and roadway type.

For each county, day, and hour, the emissions estimates were computed by vehicle type for each link. The analysis day emissions factors, discussed previously, were tabulated by pollutant, emissions type, hour, road type (drive cycle), vehicle type, and 14 speeds (2.5 mph and 5 mph to 65 mph at 5 mph intervals) for each county. The county coded hourly fleet total link-VMT estimates were first stratified by vehicle type. The time period and functional classification group-specific VMT mixes were correlated to the appropriate links (by functional classification code and hour-of-day) and were multiplied by the fleet total link VMT to produce the hourly link VMT estimates by the 28 vehicle types. The emissions factors for each pollutant subcomponent were then matched with appropriate link-level VMT based on road type drive cycle, vehicle class, and speed. Emissions factors for link speeds that were not represented in the set of 14 MOBILE6 speed bin speeds were calculated by interpolation (see example calculation, Appendix B). For link speeds greater than or less than the MOBILE6 bounding speeds of 65 mph and 2.5 mph, the emissions factors corresponding to those bounding speeds were applied,

respectively. The link VMT were then multiplied by the emissions factors to produce the link-level emissions estimates. The link-emissions estimates were recorded in g/mi with the link node numbers, link facility type code, pollutant, and pollutant sub-component labels (see link-emissions file specifications in Appendix A).

Table 30 shows the BPA TDM network facility type groupings used to allocate the MOBILE6 drive-cycle-specific emissions factors and VMT mix to the links based on facility type code. The four-period, time-of-day VMT mixes were applied by the peak and off-peak periods as shown in Table 6.

Table 30
BPA Network Facility Type Groups for VMT Mix and MOBILE6 Emissions Factors

MOBILE6 Drive Cycle	Facility Type (Code and Name)	VMT mix Group
Freeway	1. Interstate Highway - 10	Freeway
	2. Freeway - main lanes only	
	3. Parkway	
Ramp	29. Ramp	Arterial
Arterial	9. Divided Principal Arterial	
	10. Divided Principal Arterial with Left Turn Bay	
	12. Divided Principal Arterial with Parking	
	13. One-Way Principal Arterial	
	14. Undivided Principal Arterial	
	15. Undivided Principal Arterial with Left Turn Bay	
	16. Undivided Principal Arterial with Continuous Left Turn	
	17. Divided Minor Arterial	
	18. Divided Minor Arterial with Left Turn Bay	
	20. Divided Minor Arterial with Parking	
	21. One-Way Minor Arterial	
	22. Undivided Minor Arterial	
	23. Undivided Minor Arterial with Left Turn Bay	
	19. Undivided Minor Arterial with Continuous Left Turn	
	32. Undivided Minor Arterial with Parking	
	28. Frontage Road one-way	
	33. Frontage Road two-way	
	24. Divided Collector	Collector
	26. Divided Collector with Left Turn Bay	
	25. Undivided Collector	
	31. Undivided Collector with Continuous Left Turn	
	27. Gravel/Dirt Collector	
	30. Centroid Connector	
	40. Intrazonal	

Hourly and 24-hour Emissions Summaries

For each analysis day, by individual county and for all counties, the link-emissions estimates were summed for each hour, and the hourly emissions were summed for each day. The resulting composite VOC, CO, and NOx emissions estimates were summarized by road type (BPA network facility type), vehicle type, road-type, and vehicle-type cross-classification. VMT mix, VMT, VHT, and VMT-weighted speeds are included with the emissions summaries. These files (*.LST and the tab delimited version, *.TAB) were provided on CD-ROM (see Appendix A).

APPENDIX A
ELECTRONIC SUBMITTAL DATA SET NAMES AND DESCRIPTIONS

BPA 2007 ELECTRONIC DATA SUBMITTAL FILE NAMES/DESCRIPTIONS

This appendix describes the BPA 2007 modeling emissions inventory electronic data submittal (TTI, February 26, 2004). The 17 days within the following three BPA 2000 "mini-episodes" were modeled: 1) August 10 through 13; 2) August 18 through 21; and 3) August 29 through September 6. The BPA 2007 modeling emissions inventories data are contained on 10 CD-ROMs:

- 9 CD-ROMs containing link emissions and inventory summary report files, and
- 1 CD-ROM containing: 1) BPA 2005 travel model network node coordinates (no 2007 network was available); 2) MOBILE6 input and output files; and 3) this data description.

The link emissions file format and data definitions are tabulated at the end of this appendix.

EMISSIONS

There are two episode day-specific ZIP files on each CD-ROM (except for the odd day CD-ROM). The episode day dates for each CD-ROM are included in the CD-ROM title. The following emissions output files (75) are in each ZIP file:

- county-level hourly link-emissions files (72 ASCII files: * .T***hr*** , ***hr*** = 01, 02,.... 24);
- county-level hourly emissions inventory data summaries to include VMT mix, VMT, VHT, average speed, and emissions cross-classified by vehicle type and road type; hourly "all counties" emissions inventory data summaries; county-level and "all counties" 24-hour emissions inventory data summaries (1 ASCII file, .LST extension);
- a tab-delimited version of second bullet above (1 ASCII file, .TAB extension); and
- a log of the emissions estimation program runs (1 ASCII file with .LOG extension).

ZIP file names and data set file names follow the convention:

ddmmm07bpa.ZIP (day-specific emissions output zip file),
ddmmm2007bpa_ems.tab (day-specific three-county network TAB file),
ddmmm2007bpa_ems.lst (day-specific three-county network LST file),
ddmmm2007bpa_ems.log (day-specific three-county network LOG file),
ddmmm2007***CCCC***_ems.T***hr*** (day-specific hourly link-emissions files by county).

Where:

CCCC is the first four letters of the three BPA county names;
ddmmm is the episode day date/month (e.g., 10AUG, 06SEP); and
hr is 01... 24 representing the hours 12 a.m. through 11 p.m, respectively.

COORDINATES
The CD-ROM with the coordinates is "bpa2007_rates". This CD-ROM contains a file named "BPA05_Coord.txt" that contains longitude and latitude in millionths of degrees for the BPA 2005 travel model network nodes (link endpoints and zone centroids for use with the 2007 link emissions estimates, as no 2007 network was available). The order of the data is: network node number, longitude, and latitude.

EMISSIONS FACTORS
The CD-ROM "bpa2007_rates" includes the emissions factor run input/output files and post-processing factors used.

- MOBILE6 command input files (51):
  ddmmm2007_***CCCC***.in (input files for producing emissions factors prior to LED adjustment to diesel vehicle NOx emissions factors).

- MOBILE6 external data input files (7):
  *03.rgd (three county level registration distributions files);
  *.vhr (four region level, day type-specific hourly VMT fraction files).

- MOBILE6 final hourly emissions factor output files (51):
  ddmmm2007***CCCC***.rat (final rate files post-processed for LED).

- LED post-processing NOx adjustment factor file (1):
  LED_bpa2007_nox.fc (file for modeling LED effects for all counties).

- MOBILE6 interim hourly emissions factor output files (51):
  ddmmm2007_***CCCC***_preLED.rat (interim rates output, prior to LED adjustment).

- MOBILE6 daily emissions factor output files* (102):
  identical file set/file names as for hourly rate files except with .rtd extension.

- Program run LOG and LST files** (34):
  ddmmm2007_bpa_RT.LOG (17 files);
  ddmmm2007_bpa_RT.LST (17 files).

Where:

CCCC is the first four letters of the BPA county names;
ddmmm is the episode day date/month (e.g., 10AUG, 06SEP);

*<u>MOBILE6 Daily Emissions Factors Files:</u>
The set of 24-hour average emissions factor files (*.rtd) have no impact on the analysis. The "daily all roads" emissions factors (i.e., composites based on MOBILE6 default VMT by facility values) in the *.rtd files are invalid. The individual MOBILE6 road type (Freeway, Arterial, Local, Ramp) emissions factors are valid.

**Emissions Factor Log (*.LOG) and MOBILE6 Descriptive Output (*.LST) files:
The log files recorded the emissions factor (POLFAC62) runs (one file with .log extension). The MOBILE6 descriptive output (LST) is a record of MOBILE6 descriptive output for each POLFAC62 run/scenario, which lists user-inputs to the MOBILE6 scenarios; MOBILE6 descriptive output emissions factors, however, are "daily all road types" values composed using MOBILE6 default VMT BY FACILITY values, and thus are not valid.

TDM Network Link Emissions Data File Format

Abbreviation	Columns	Format Type	Description
A Node	1 - 6	I6	A-Node of link
B Node	7 - 12	I6	B-Node of link
FC	13 - 15	I3	Facility Type Code of Link (see subsequent table)
EMISS	17 - 26	A3	“VOC,” or “CO,” or “NOx”
ETYPE	28 - 40	A11	Emissions Sub-Component Type (see second subsequent table)
LDGV	41 - 50	F10.?*	LDGV link emissions in grams
LDGT1	51 - 60	F10.?	LDGT1 link emissions in grams
LDGT2	61 - 70	F10.?	LDGT2 link emissions in grams
LDGT3	71 - 80	F10.?	LDGT3 link emissions in grams
LDGT4	81 - 90	F10.?	LDGT4 link emissions in grams
HDGV2B	91 - 100	F10.?	HDGV2B link emissions in grams
HDGV3	101 - 110	F10.?	HDGV3 link emissions in grams
HDGV4	111 - 120	F10.?	HDGV4 link emissions in grams
HDGV5	121 - 130	F10.?	HDGV5 link emissions in grams
HDGV6	131 - 140	F10.?	HDGV6 link emissions in grams
HDGV7	141 - 150	F10.?	HDGV7 link emissions in grams
HDGV8A	151 - 160	F10.?	HDGV8A link emissions in grams
HDGV8B	161 - 170	F10.?	HDGV8B link emissions in grams
LDDV	171 - 180	F10.?	LDDV link emissions in grams
LDDT12	181 - 190	F10.?	LDDT12 link emissions in grams
HDDV2B	191 - 200	F10.?	HDDV2B link emissions in grams
HDDV3	201 - 210	F10.?	HDDV3 link emissions in grams
HDDV4	211 - 220	F10.?	HDDV4 link emissions in grams
HDDV5	221 - 230	F10.?	HDDV5 link emissions in grams
HDDV6	231 - 240	F10.?	HDDV6 link emissions in grams
HDDV7	241 - 250	F10.?	HDDV7 link emissions in grams
HDDV8A	251 - 260	F10.?	HDDV8A link emissions in grams
HDDV8B	261 - 270	F10.?	HDDV8B link emissions in grams
MC	271 - 280	F10.?	MC link emissions in grams
HDGB	281 - 290	F10.?	HDGB link emissions in grams
HDDBT	291 - 300	F10.?	HDDBT link emissions in grams
HDDBS	301 - 310	F10.?	HDDBS link emissions in grams
LDDT34	311 - 320	F10.?	LDDT34 link emissions in grams

***** The F10? format is either F10.0, F10.1, F10.2, F10.3, or F10.4. The format selected for a field is based on the value of the field.

Facility Type Codes for BPA Link Emissions

Facility Group	Facility Type (Code and Name)
IH and Freeway	1. Interstate Highway - 10
	2. Freeway - main lanes only
	3. Parkway*
Principle Arterial Divided	9. Divided Principal Arterial
	10. Divided Principal Arterial with Left Turn Bay
	12. Divided Principal Arterial with Parking**
	13. One Way Principal Arterial
Principle Arterial Undivided	14. Undivided Principal Arterial
	15. Undivided Principal Arterial with Left Turn Bay
	16. Undivided Principal Arterial with Continuous Left Turn
Minor Arterial Divided	17. Divided Minor Arterial
	18. Divided Minor Arterial with Left Turn Bay
	20. Divided Minor Arterial with Parking**
	21. One Way Minor Arterial
Minor Arterial Undivided	22. Undivided Minor Arterial
	23. Undivided Minor Arterial with Left Turn Bay
	19. Undivided Minor Arterial with Continuous Left Turn
	32. Undivided Minor Arterial with Parking**
Frontage Road	28. Frontage Road 1-way
	33. Frontage Road 2-way
Ramp	29. Ramp
Collector	24. Divided Collector
	26. Divided Collector with Left Turn Bay
	25. Undivided Collector
	31. Undivided Collector with Continuous Left Turn
	27. Gravel/Dirt Collector
Local	30. Centroid Connector
	0. Intrazonal

* Parkway is a Freeway without any supporting frontage roads.

** Denotes allowable parking which obstructs a normal traffic flow lane.

Emissions Sub-Component Type

Sub-Component Abbreviation	Description
COMPOSITE	Total emissions
EXH_RUNNING	Exhaust running emissions
START	Start emissions
Hot_Soak	Hot soak VOC emissions
Diurnal	Diurnal VOC emissions
Rest_Loss	Resting loss VOC emissions
Run_Loss	Running loss VOC emissions
Crankcase	Crankcase VOC emissions
Refueling	Refueling loss VOC emissions

APPENDIX B
EMISSIONS ESTIMATION PROGRAMS

TTI EMISSIONS ESTIMATION PROGRAMS

The following is a summary of the series of programs developed by TTI for developing link-based, time-of-day, on-road mobile source emissions estimates for air quality analyses.

These programs produce emissions factors with the latest version of EPA's MOBILE emissions factor model, and apply them to travel model-based activity estimates to calculate emissions at user-specified temporal and spatial scales. The location of emissions by grid, or travel network link coordinates, may also be specified.

The emissions estimation programs are: TRANSVMTDSPD, POLFAC62, RATEADJ62, RATEADJV62, IMPSUM62, and SUMALL62. TRANSVMTDSPD prepares activity input, POLFAC62 prepares emissions factor input, the RATEADJ programs make special adjustments to emissions factors when required, IMPSUM62 calculates emissions by time period, and SUMALL62 summarizes emissions at various levels by 24-hour period.

TRANSVMTDSPD

The TRANSVMTDSPD program post-process TDMs to produce time-of-day specific, on-road vehicle, link VMT and speed estimates. The TRANSVMTDSPD program processes a TDM traffic assignment by scaling the link volumes by the appropriate HPMS, seasonal or other VMT factors. Time-of-day factors are then applied to distribute the link VMT to each hour in the day. The Dallas speed model is used to estimate the operational time-of-day links speeds for each direction. Since intrazonal links are not included in the TDM, special intrazonal links are created and the VMT and speeds for these special links are estimated using the intrazonal trips from the trip matrix and the zonal radii. The link VMT and speeds produced by TRANSVMTDSPD are subsequently input to the IMPSUM62 program for the application of MOBILE6 emission factors.

POLFAC62

The POLFAC62 program is used to apply the EPA's MOBILE6 program (October 2002 version with additional pollutant capabilities) to calculate the on-road mobile emissions factors. The MOBILE6 emissions factors may be produced for each of the pollutant-specific emissions types (e.g., depending on the pollutant and vehicle type, the total composite, exhaust running, exhaust start, plus the six sub-component evaporative rates), 28 vehicle types, four MOBILE6 functional classifications (or drive cycles, i.e., Freeway, Arterial/Collector, Local, and Ramp), 14 speeds (i.e., 2.5 mph, and 5 mph through 65 mph at 5 mph increments for Freeway and Arterial functional classifications — MOBILE6 local and ramp functional classification rates are single speed only, 12.9 mph, and 34.6 mph, respectively), and each of the 24 hours of the day. The POLFAC62 emissions factors are average vehicle class rates calculated from the MOBILE6 database output by weighting the by-model-year emissions rates within each vehicle class by its corresponding travel fraction. These emissions factors are tabulated individually by geographical area (county or county group) and analysis day for the evaluation year. These emissions factors are output to an ASCII file for subsequent input to the IMPSUM62 program. The IMPSUM62 program is then used to apply the hourly emissions factors to hourly VMT estimates by link. (POLFAC62 also optionally produces a set of daily emissions factors.) POLFAC62 also

calculates the additional pollutant emissions factors provided by the MOBILE6 October 2002 version.

RATEADJ62
RATEADJ62 is a special utility program that produces a new set of emissions factors by linearly combining the emissions factors from multiple applications of POLFAC62. There is one set of linear factors. Each factor is applied to all emissions rates in a single data set.

A practical application of the RATEADJ program is the combining of two sets of emissions factors, where each set has different control program credits, into one set including the combined credits. For example, this program may be used to combine different ATP credits from two separate POLFAC62 runs into one set of emissions factors that includes the credits for both ATPs.

RATEADJV62
RATEADJV62 is a special utility program that produces a new set of emissions factors by linearly combining the emissions factors from multiple applications of POLFAC62 or RATEADJ62. There is a separate set of factors (that may be different for each pollutant-specific emissions type and vehicle type combination) for each of the input emissions factor data sets.

A practical application of RATEADJV62 is the application of emissions factor credits by individual vehicle class and/or individual pollutant. For example, for analyses requiring the effects of the Texas LED Fuel Program in MOBILE6 emissions factors, RATEADJV62 is used to apply reduction factors to only the NOx emissions factors for diesel-fueled vehicle classes only.

IMPSUM62
The IMPSUM62 program applies the emissions factors obtained from POLFAC62 (or from one of the RATEADJ programs, when used) and VMT mixes (fractions of fleet VMT attributable to each vehicle classification in the study) to the time-of-day fleet VMT and speed estimates to calculate emissions by the specified time periods. The five primary inputs to IMPSUM62 are:

- MOBILE6 emissions factors developed with POLFAC62 (or a RATEADJ6, if used);
- link-based hourly VMT and speeds developed using a TRANSVMT program. For each link, the following information is input to IMPSUM: county number, roadway type number, VMT on link, operational link-speed estimate, and link distance;
- VMT mix by time period, county and roadway type;
- X-Y coordinates (optional for gridded emissions); and

- data records associating the MOBILE6 drive cycle (Freeway, Arterial, Local, Ramp) emissions factors (or percentages thereof) to specific travel model functional classifications. These MOBILE6 drive cycle emissions factor percentages (valid from zero to 100) must sum to 100 percent for each travel model functional classification.

Using these input data, the VMT for each link is stratified by MOBILE6 drive cycle and the 28 vehicle types. The MOBILE6 emissions factors are matched to link VMT by drive cycle, speed, and vehicle type and are interpolated (for the speed that falls between the 14 MOBILE6 speeds, see the MOBILE6 interpolation methodology below) and multiplied by the link VMT to estimate the mobile source emissions for that link. Emissions factors for 65 mph are used for links with speeds greater than 65 mph and emissions factors for 2.5 mph are used for links with speeds lower than 2.5 mph. The emissions for the county and emissions type are reported by both roadway type and vehicle type for each of the subject time periods. A data set is produced for subsequent input to the SUMALL62 program. Also, link emissions may be written by county at the pollutant-specific emissions type sub-component level and 28 vehicle types level.

A tab-delimited output is optionally produced. This output includes all 28 vehicle types (or eight vehicle types in the compressed format) across a single output line. Each field in the output is separated by a tab character.

Example Emissions Factor Interpolation
To calculate emissions factors for average operational speeds that fall between two of the 14 MOBILE6 speed bin speeds, MOBILE6 interpolates each emissions factor using a factor developed from the inverse link speed and the inverse high and low bounding speed bin speeds (Section 5.3.4, MOBILE6 User's Guide, January 2002).

Using the MOBILE6 emissions factors tabulated by the 14 speeds, the IMPSUM62 program uses the MOBILE6 method to interpolate emissions factors as shown in the following example. This example interpolates an emissions factor corresponding to an average speed of 41.2 mph.

The interpolated emissions factor (EF_{Interp}) is expressed as:

$$EF_{Interp}=EF_{LowSpeed} - FAC_{Interp} \times (EF_{LowSpeed} - EF_{HighSpeed})$$

Where:

$EF_{LowSpeed}$ = emission factor (EF) corresponding to tabulated speed below the average link speed,

$EF_{HighSpeed}$ = EF corresponding to tabulated speed above the average link speed, and

$$FAC_{Interp}= \left(\frac{1}{Speed_{link}} - \frac{1}{Speed_{low}} \right) \Big/ \left(\frac{1}{Speed_{high}} - \frac{1}{Speed_{low}} \right)$$

Given that:

$EF_{LowSpeed}$ = 0.7413 g/mi;
$EF_{HighSpeed}$ = 0.7274 g/mi;
$Speed_{lnk}$ = 41.2 mph;
$Speed_{low}$ = 40 mph; and
$Speed_{high}$ = 45 mph.

$$FAC_{Interp} = \left(\frac{1}{41.2mph} - \frac{1}{40mph}\right) \Big/ \left(\frac{1}{45mph} - \frac{1}{40mph}\right) = \frac{-0.00073}{-0.00278} = 0.26214,$$

$$EF_{Interp} = 0.7413 \text{ g/mi} - (0.26214) \times (0.7413 \text{ g/mi} - 0.7274 \text{ g/mi})$$

$$= 0.7377 \text{ g/mi}$$

SUMALL62

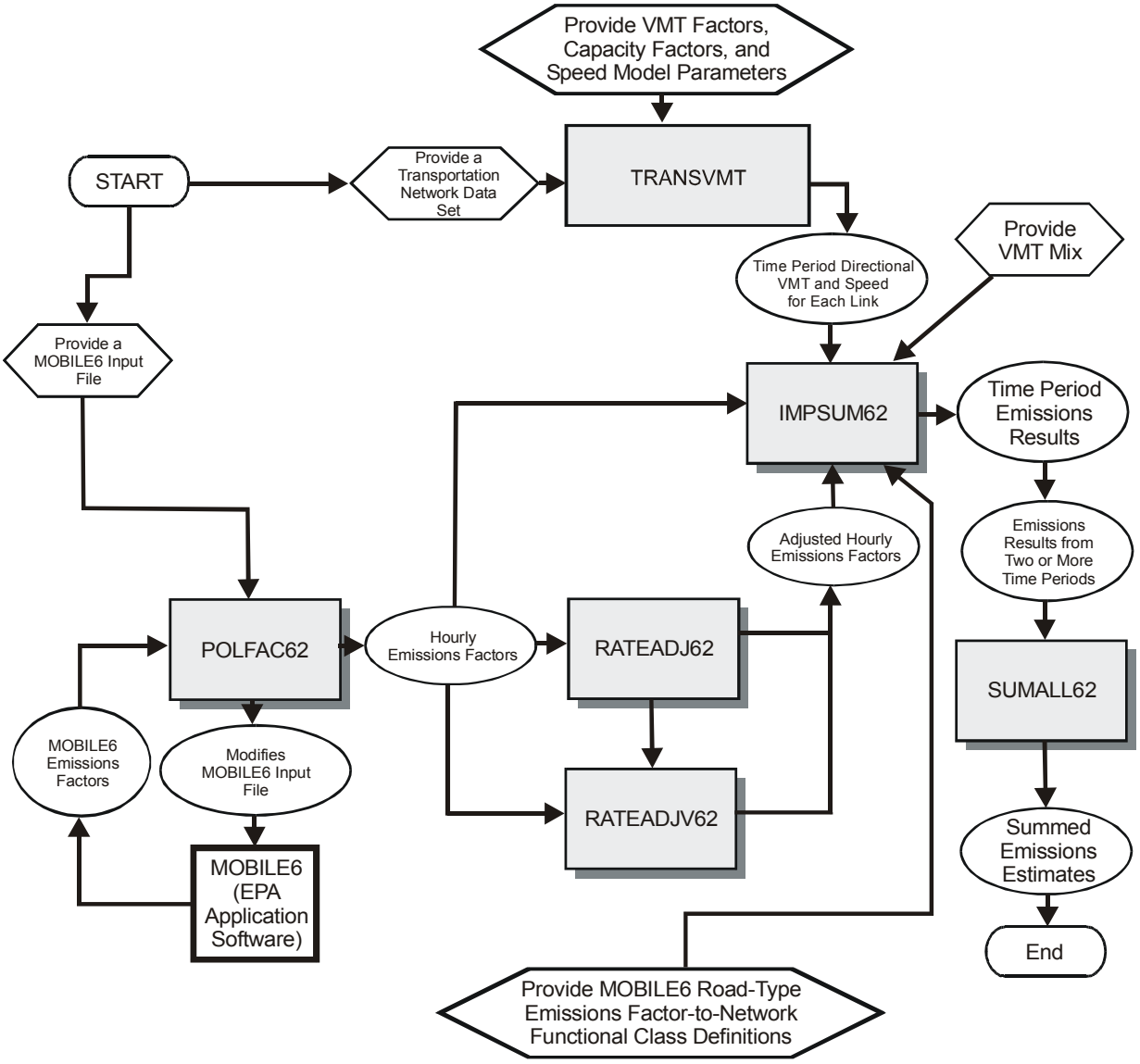
The SUMALL62 program is used to sum the emissions estimates for the time-of-day periods (e.g., 24 periods in the case of hourly analyses) to develop 24-hour emissions estimates. The emissions by pollutant type are reported by roadway type and 28 vehicle types (or optionally condensed to eight vehicle types).

A tab-delimited output is optionally produced. This output includes all 28 vehicle types (or eight vehicle types in the compressed format) across a single output line. Each field in the output is separated by a tab character.

The overall emissions estimate process flow is shown in the diagram below.

General Process Flow

Travel Demand Model Network Link-Based Hourly MOBILE6 Emissions Estimates with Texas Mobile Source Emissions Software



APPENDIX C
DIRECTIONAL SPLIT ESTIMATES

AM Peak Period Directional Split Estimates

Area Types**	Functional Classifications*								
	0	1	3	4	5	6	7	8	9
	Centroid Connector	IH and Freeway	Principle Arterial Divided	Principle Arterial Undivided	Minor Arterial Divided	Minor Arterial Undivided	Collector	Frontage Road	Ramp
1 CBD	54.0	50.0	65.0	65.0	58.0	58.0	64.5	50.0	50.0
2 CBD Fringe	87.0	50.0	60.0	60.0	59.0	59.0	63.0	50.0	50.0
3 Urban	85.0	60.0	62.0	62.0	58.0	58.0	53.0	60.0	60.0
4 Suburban	72.0	61.0	65.0	65.0	64.0	64.0	64.5	61.0	61.0
5 Suburban Fringe	80.0	65.0	68.0	68.0	66.0	66.0	62.5	67.0	67.0
6 Rural	78.0	70.0	71.0	71.0	68.0	68.0	75.0	70.0	70.0

* The BPA TDM network traffic assignments are based on facility type. The functional classification-to-facility type correlation is shown at the end of this appendix.

** The area types are aggregated into regional area types for the directional splits. The county-level area types-to- regional area type correlation is shown at the end of this appendix.

Mid-Day and Overnight (Off-Peak) Directional Split Estimates

Area Types**	Functional Classifications*								
	0	1	3	4	5	6	7	8	9
	Centroid Connector	IH and Freeway	Principle Arterial Divided	Principle Arterial Undivided	Minor Arterial Divided	Minor Arterial Undivided	Collector	Frontage Road	Ramp
1 CBD	54.0	51.0	55.0	55.0	55.0	55.0	54.5	51.0	51.0
2 CBD Fringe	54.0	51.0	54.0	54.0	55.0	55.0	53.0	51.0	51.0
3 Urban	55.0	53.0	50.0	50.0	52.0	52.0	52.0	53.0	53.0
4 Suburban	55.0	51.0	57.0	57.0	56.0	56.0	57.0	51.0	51.0
5 Suburban Fringe	53.0	51.0	56.0	56.0	57.0	57.0	54.0	51.0	51.0
6 Rural	52.0	53.0	55.0	55.0	58.0	58.0	54.0	53.0	53.0

* The BPA TDM network traffic assignments are based on facility type. The functional classification-to-facility type correlation is shown at the end of this appendix.

** The area types are aggregated into regional area types for the directional splits. The county-level area types-to- regional area type correlation is shown at the end of this appendix.

PM Peak Period Directional Split Estimates

Area Types**	Functional Classifications*								
	0	1	3	4	5	6	7	8	9
	Centroid Connector	IH and Freeway	Principle Arterial Divided	Principle Arterial Undivided	Minor Arterial Divided	Minor Arterial Undivided	Collector	Frontage Road	Ramp
1 CBD	55.0	54.0	62.0	62.0	52.0	52.0	57.5	54.0	54.0
2 CBD Fringe	72.0	54.0	59.0	59.0	53.0	53.0	64.5	54.0	54.0
3 Urban	72.0	56.0	57.0	57.0	64.0	64.0	68.0	56.0	56.0
4 Suburban	72.0	67.0	60.0	60.0	65.0	65.0	62.5	67.0	67.0
5 Suburban Fringe	71.0	66.0	63.0	63.0	64.0	64.0	67.0	66.0	66.0
6 Rural	71.0	65.0	66.0	66.0	63.0	63.0	70.0	65.0	65.0

* The BPA TDM network traffic assignments are based on facility type. The functional classification-to-facility type correlation is shown at the end of this appendix.

** The area types are aggregated into regional area types for the directional splits. The county-level area types-to- regional area type correlation is shown at the end of this appendix.

BPA Network Facility Types Correlated to Functional Classifications

Functional Classification	Facility Type
IH and Freeway	1. Interstate Highway - 10
	2. Freeway - main lanes only
	3. Parkway
Principle Arterial Divided	9. Divided Principal Arterial
	10. Divided Principal Arterial with Left Turn Bay
	12. Divided Principal Arterial with Parking*
	13. One-Way Principal Arterial
Principle Arterial Undivided	14. Undivided Principal Arterial
	15. Undivided Principal Arterial with Left Turn Bay
	16. Undivided Principal Arterial with Continuous Left Turn
Minor Arterial Divided	17. Divided Minor Arterial
	18. Divided Minor Arterial with Left Turn Bay
	20. Divided Minor Arterial with Parking*
	21. One-Way Minor Arterial
Minor Arterial Undivided	22. Undivided Minor Arterial
	23. Undivided Minor Arterial with Left Turn Bay
	19. Undivided Minor Arterial with Continuous Left Turn
	32. Undivided Minor Arterial with Parking*
Frontage Road	28. Frontage Road One-Way
	33. Frontage Road Two-Way
Ramp	29. Ramp
Collector	24. Divided Collector
	26. Divided Collector with Left Turn Bay
	25. Undivided Collector
	31. Undivided Collector with Continuous Left Turn
	27. Gravel/Dirt Collector
Centroid Connector	0. Centroid Connector
Intrazonal	40. Intrazonal

* Allowable parking that obstructs a normal traffic flow lane.

BPA Network Area Types

Regional Area Type	County-Specific Area Type
CBD	CBD Jefferson
CBD Fringe	CBD Fringe Jefferson
	CBD Fringe Orange
Urban	Urban Jefferson
	Urban Orange
	Urban Hardin
Suburban	Suburban Jefferson
	Suburban Orange
	Suburban Hardin
Suburban Fringe	Suburban Fringe Jefferson
	Suburban Fringe Orange
	Suburban Fringe Hardin
Rural	Rural Jefferson
	Rural Orange
	Rural Hardin

APPENDIX D
CAPACITY FACTORS AND SPEED FACTORS

BPA 2005 TDM Capacity Factors

Facility Type*	Regional Area Type**					
	CBD	CBD Fringe	Urban	Suburban	Suburban Fringe	Rural
1	0.1034	0.1063	0.0942	0.1185	0.1330	0.1905
2	0.1034	0.1063	0.0942	0.1185	0.1330	0.1905
3	0.1034	0.1063	0.0942	0.1185	0.1330	0.1905
9	0.0724	0.0811	0.0903	0.1043	0.1351	0.1416
10	0.0724	0.0811	0.0903	0.1043	0.1351	0.1416
13	0.0724	0.0811	0.0903	0.1043	0.1119	0.1231
14	0.0685	0.0775	0.0870	0.1007	0.1077	0.1151
15	0.0685	0.0775	0.0870	0.1007	0.1077	0.1151
16	0.0685	0.0775	0.0870	0.1007	0.1077	0.1151
17	0.0809	0.0902	0.0969	0.1261	0.1543	0.1667
18	0.0809	0.0902	0.0969	0.1261	0.1543	0.1667
19	0.0769	0.0873	0.0943	0.1059	0.1140	0.1227
20	0.0809	0.0902	0.0969	0.1261	0.1543	0.1667
21	0.0809	0.0902	0.0969	0.1261	0.1543	0.1667
22	0.0769	0.0873	0.0943	0.1059	0.1140	0.1227
23	0.0769	0.0873	0.0943	0.1059	0.1140	0.1227
24	0.0750	0.0848	0.0962	0.1146	0.1280	0.1438
25	0.0727	0.0833	0.0978	0.1190	0.1350	0.1544
26	0.0750	0.0848	0.0962	0.1146	0.1280	0.1438
27	0.0727	0.0833	0.0978	0.1190	0.1350	0.1544
28	0.0482	0.0541	0.0579	0.0667	0.0721	0.0769
29	0.0726	0.0811	0.0865	0.1007	0.1306	0.1327
30	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000
31	0.0727	0.0833	0.0978	0.1190	0.1350	0.1544
32	0.0769	0.0873	0.0943	0.1059	0.1140	0.1227
33	0.0719	0.0815	0.0871	0.0984	0.1287	0.1324

* See facility type name/number key at end of this appendix.

** The area types are aggregated into regional area types for the capacity factors. The county-level area types-to-regional area type correlation is shown at the end of this appendix.

BPA 2005 TDM Freeflow (Volume=1) Speed Factors

Facility Type*	Area Type													
	CBD Jefferson	CBD Fringe Jefferson	Urban Jefferson	Suburban Jefferson	Suburban Fringe Jefferson	Rural Jefferson	CBD Fringe Orange	Urban Orange	Suburban Orange	Suburban Fringe Orange	Rural Orange	Suburban Hardin	Suburban Fringe Hardin	Rural Hardin
1	1.3333	1.2609	1.5128	1.3636	1.4773	1.2679	1.6111	2.0345	1.4634	1.5854	1.5435	1.3333	1.3333	1.6905
2	1.3333	1.2609	1.5128	1.2766	1.4773	1.2241	--	1.3333	1.3333	1.3333	1.3333	1.4286	1.3333	1.6905
3	1.3333	1.3333	1.5128	1.3636	1.3333	1.2679	--	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
9	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	--	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
10	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	--	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
12	--	--	--	--	--	--	--	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
13	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	--	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
14	--	1.3333	1.3333	1.3333	1.3333	1.3333	--	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
15	--	1.3333	1.3333	--	--	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
16	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
17	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	--	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
18	1.3333	--	1.3333	1.3333	1.3333	1.3333	--	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
19	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	--	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
20	--	--	1.3333	1.3333	1.3333	1.3333	--	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
21	1.3333	1.3333	1.3333	1.3333	--	1.3333	--	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
22	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	--	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
23	1.3333	1.3333	1.3333	--	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333

BPA 2005 TDM Freeflow (Volume=1) Speed Factors (continued)

Facility Type*	Area Type													
	CBD Jefferson	CBD Fringe Jefferson	Urban Jefferson	Suburban Jefferson	Suburban Fringe Jefferson	Rural Jefferson	CBD Fringe Orange	Urban Orange	Suburban Orange	Suburban Fringe Orange	Rural Orange	Suburban Hardin	Suburban Fringe Hardin	Rural Hardin
24	1.3333	--	1.3333	1.3333	--	1.3333	--	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
25	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	--	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
26	1.3333	1.3333	1.3333	--	--	1.3333	--	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
27	1.3333	--	--	--	--	1.3333	--	1.3333	1.3333	1.3333	1.3333	1.3333	---	1.3333
28	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
29	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
31	1.3333	1.3333	1.3333	1.3333	--	1.3333	--	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
32	--	--	--	--	--	1.3333	--	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
33	--	1.3333	1.3333	1.3333	1.3333	1.3333	--	--	--	1.3333	1.3333	1.3333		1.3333

* See facility type name/number key at end of appendix.

BPA 2005 Facility Type Number Key

Facility Type Number	Facility Description
1	Interstate Highway - 10
2	Freeway - main lanes only
3	Parkway
9	Divided Principal Arterial
10	Divided Principal Arterial with Left Turn Bay
12	Divided Principal Arterial with Parking
13	One-Way Principal Arterial
14	Undivided Principal Arterial
15	Undivided Principal Arterial with Left Turn Bay
16	Undivided Principal Arterial with Continuous Left Turn
17	Divided Minor Arterial
18	Divided Minor Arterial with Left Turn Bay
19	Undivided Minor Arterial with Continuous Left Turn
20	Divided Minor Arterial with Parking
21	One-Way Minor Arterial
22	Undivided Minor Arterial
23	Undivided Minor Arterial with Left Turn Bay
24	Divided Collector
25	Undivided Collector
26	Divided Collector with Left Turn Bay
27	Gravel/Dirt Collector
28	Frontage Road One-Way
29	Ramp
31	Undivided Collector with Continuous Left Turn
32	Undivided Minor Arterial with Parking
33	Frontage Road Two-Way

BPA 2005 Network Area Types

Regional Area Type	County-Specific Area Type
CBD	CBD Jefferson
CBD Fringe	CBD Fringe Jefferson
	CBD Fringe Orange
Urban	Urban Jefferson
	Urban Orange
	Urban Hardin
Suburban	Suburban Jefferson
	Suburban Orange
	Suburban Hardin
Suburban Fringe	Suburban Fringe Jefferson
	Suburban Fringe Orange
	Suburban Fringe Hardin
Rural	Rural Jefferson
	Rural Orange
	Rural Hardin

APPENDIX E
BPA AUGUST 2000 EPISODE DAY CLIMATIC INPUTS TO MOBILE6

BPA COUNTY AUGUST 2000 EPISODE DAY CLIMATIC INPUTS TO MOBILE6

Hourly temperatures (degrees F)**,**
Hour of sunrise and sunset,
Hourly relative humidity (percent), and
Barometric pressure (inches of Mercury).

Central Daylight (Local) Time (hourly data sequence: 6 a.m. to 12 a.m., 12 a.m. to 6 a.m.).

Thursday, August 10

Hardin County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 75.3 75.9 77.6 81.5 84.5 87.0 89.7 91.3 92.2 94.0 94.9 94.4 91.2 88.3 85.3 83.2 81.8 80.6 79.7 78.2 77.5 76.8 76.8 76.3
RELATIVE HUMIDITY: 96.0 85.0 77.0 63.0 56.0 49.0 42.0 41.0 40.0 44.0 54.0 57.0 65.0 74.0 74.0 75.0 75.0 88.0 97.0 96.0 97.0 100.0 97.0 97.0
BAROMETRIC PRES: 29.94

Jefferson County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 75.3 76.3 79.4 82.5 85.3 88.0 90.2 91.9 92.9 93.6 93.7 92.1 89.8 86.9 84.1 82.0 80.8 79.5 79.1 78.0 77.3 76.6 75.9 75.1
RELATIVE HUMIDITY: 96.0 85.0 77.0 63.0 56.0 49.0 42.0 41.0 40.0 44.0 54.0 57.0 65.0 74.0 74.0 75.0 75.0 88.0 97.0 96.0 97.0 100.0 97.0 97.0
BAROMETRIC PRES: 29.94

Orange County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 74.6 75.2 78.0 81.2 83.9 86.4 88.8 91.1 92.4 93.7 94.0 93.0 91.2 88.9 86.0 84.2 82.7 81.0 80.1 79.4 78.1 77.6 76.7 75.3
RELATIVE HUMIDITY: 96.0 85.0 77.0 63.0 56.0 49.0 42.0 41.0 40.0 44.0 54.0 57.0 65.0 74.0 74.0 75.0 75.0 88.0 97.0 96.0 97.0 100.0 97.0 97.0
BAROMETRIC PRES: 29.94

Friday, August 11

Hardin County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 77.8 78.4 80.1 81.9 84.5 86.3 88.8 91.4 94.4 96.3 88.3 79.3 76.3 76.6 75.4 75.7 76.3 77.3 79.6 79.3 80.0 79.7 78.8 77.8
RELATIVE HUMIDITY: 90.0 79.0 81.7 72.5 62.2 55.0 50.5 43.8 43.0 51.0 72.0 82.0 85.0 94.0 90.0 90.0 94.0 94.0 88.0 85.0 94.0 94.0 90.0 94.0
BAROMETRIC PRES: 29.88

Jefferson County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 77.4 78.4 80.2 82.3 84.8 86.5 89.0 92.0 94.1 94.1 90.8 84.3 79.9 78.4 77.4 76.1 76.0 75.9 78.9 78.8 78.6 78.3 77.9 77.4
RELATIVE HUMIDITY: 90.0 79.0 81.7 72.5 62.2 55.0 50.5 43.8 43.0 51.0 72.0 82.0 85.0 94.0 90.0 90.0 94.0 94.0 88.0 85.0 94.0 94.0 90.0 94.0
BAROMETRIC PRES: 29.88

Orange County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 77.0 78.1 79.8 82.1 83.7 85.7 88.2 90.8 93.0 94.4 93.4 87.9 82.9 78.6 77.1 76.4 75.9 75.4 80.2 79.4 79.4 78.2 77.3 77.2
RELATIVE HUMIDITY: 90.0 79.0 81.7 72.5 62.2 55.0 50.5 43.8 43.0 51.0 72.0 82.0 85.0 94.0 90.0 90.0 94.0 94.0 88.0 85.0 94.0 94.0 90.0 94.0
BAROMETRIC PRES: 29.88

Saturday, August 12

Hardin County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 73.7 74.5 76.7 79.0 82.0 84.7 87.6 90.1 92.4 93.8 94.7 96.5 95.9 94.8 88.4 86.1 84.3 83.4 76.5 74.3 74.0 74.0 74.1 74.4
RELATIVE HUMIDITY: 84.0 74.0 65.0 63.0 54.0 56.0 49.0 46.0 39.0 42.0 40.0 48.0 70.0 79.0 85.0 90.0 85.0 96.0 94.0 91.0 91.0 90.0 96.0 96.0
BAROMETRIC PRES: 29.82

Jefferson County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 73.2 74.4 77.4 81.0 84.1 86.8 89.1 91.3 93.1 94.5 95.1 95.1 93.5 90.3 85.3 82.8 82.3 80.6 75.7 75.0 74.3 73.9 73.4 73.2
RELATIVE HUMIDITY: 84.0 74.0 65.0 63.0 54.0 56.0 49.0 46.0 39.0 42.0 40.0 48.0 70.0 79.0 85.0 90.0 85.0 96.0 94.0 91.0 91.0 90.0 96.0 96.0
BAROMETRIC PRES: 29.82

Orange County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 71.3 72.6 75.6 79.1 82.5 85.5 88.7 90.7 92.3 93.6 94.6 95.6 95.2 92.7 89.9 85.9 83.4 81.1 74.9 74.5 74.2 73.3 72.8 72.3
RELATIVE HUMIDITY: 84.0 74.0 65.0 63.0 54.0 56.0 49.0 46.0 39.0 42.0 40.0 48.0 70.0 79.0 85.0 90.0 85.0 96.0 94.0 91.0 91.0 90.0 96.0 96.0
BAROMETRIC PRES: 29.82

Sunday, August 13

Hardin County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 75.2 74.6 75.8 79.2 82.5 85.5 88.8 91.2 92.1 92.7 93.5 93.4 92.7 91.6 89.2 87.1 86.0 84.7 82.2 80.8 78.9 77.3 76.5 75.6
RELATIVE HUMIDITY: 74.0 58.0 51.0 46.0 41.0 34.0 36.0 36.0 36.0 36.0 37.0 41.0 53.0 61.0 77.0 82.0 82.0 85.0 94.0 97.0 94.0 97.0 96.0 96.0
BAROMETRIC PRES: 29.80

Jefferson County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 75.7 75.9 78.4 81.5 84.6 87.7 90.0 91.3 91.9 92.7 93.0 92.6 91.2 88.6 85.7 83.9 82.7 81.9 80.3 78.9 78.1 77.3 76.7 76.1
RELATIVE HUMIDITY: 74.0 58.0 51.0 46.0 41.0 34.0 36.0 36.0 36.0 36.0 37.0 41.0 53.0 61.0 77.0 82.0 82.0 85.0 94.0 97.0 94.0 97.0 96.0 96.0
BAROMETRIC PRES: 29.80

Orange County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 72.5 72.3 75.3 78.8 81.9 85.2 88.2 89.7 91.2 91.7 92.4 92.4 92.0 89.5 86.5 84.0 82.9 82.1 79.3 77.8 76.9 76.9 75.5 74.2
RELATIVE HUMIDITY: 74.0 58.0 51.0 46.0 41.0 34.0 36.0 36.0 36.0 36.0 37.0 41.0 53.0 61.0 77.0 82.0 82.0 85.0 94.0 97.0 94.0 97.0 96.0 96.0
BAROMETRIC PRES: 29.80

Monday, Friday 18

Hardin County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 75.6 75.4 77.4 81.7 84.5 87.5 90.4 92.0 93.9 95.0 95.2 93.9 91.6 88.3 84.7 81.7 80.1 79.3 78.9 78.0 77.3 77.1 76.5 76.0
RELATIVE HUMIDITY: 96.0 85.0 75.0 63.0 54.0 47.0 48.0 43.0 36.0 40.0 41.0 54.0 69.0 79.0 88.0 88.0 90.0 88.0 94.0 97.0 97.0 96.0 100.0 96.0
BAROMETRIC PRES: 29.94

Jefferson County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 74.0 75.0 78.4 82.2 85.8 88.6 91.1 92.9 93.8 94.3 93.9 92.1 89.5 85.9 82.2 79.9 78.7 78.1 78.1 77.3 76.7 76.1 74.6 74.2
RELATIVE HUMIDITY: 96.0 85.0 75.0 63.0 54.0 47.0 48.0 43.0 36.0 40.0 41.0 54.0 69.0 79.0 88.0 88.0 90.0 88.0 94.0 97.0 97.0 96.0 100.0 96.0
BAROMETRIC PRES: 29.94

Orange County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 73.4 73.5 76.4 80.0 83.8 86.8 89.4 91.3 92.9 94.0 93.8 92.8 90.6 87.8 84.7 82.2 80.0 78.3 78.9 78.5 77.2 76.0 75.4 74.2
RELATIVE HUMIDITY: 96.0 85.0 75.0 63.0 54.0 47.0 48.0 43.0 36.0 40.0 41.0 54.0 69.0 79.0 88.0 88.0 90.0 88.0 94.0 97.0 97.0 96.0 100.0 96.0
BAROMETRIC PRES: 29.94

Saturday, August 19

Hardin County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 74.9 75.0 78.5 81.9 84.6 87.8 90.1 92.4 94.1 95.1 94.7 92.7 90.0 86.9 84.2 81.8 80.0 78.9 78.9 78.0 77.2 76.2 75.7 75.9
RELATIVE HUMIDITY: 91.0 79.0 70.0 59.0 50.0 44.0 37.0 41.0 49.0 52.0 57.0 63.0 74.0 79.0 85.0 88.0 88.0 94.0 91.0 97.0 97.0 94.0 94.0 94.0
BAROMETRIC PRES: 29.95

Jefferson County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 74.3 75.3 78.8 82.6 85.9 89.0 91.1 92.6 93.2 93.4 92.6 90.8 88.3 85.3 82.1 80.2 79.1 78.2 77.0 76.5 76.0 75.3 74.9 74.4
RELATIVE HUMIDITY: 91.0 79.0 70.0 59.0 50.0 44.0 37.0 41.0 49.0 52.0 57.0 63.0 74.0 79.0 85.0 88.0 88.0 94.0 91.0 97.0 97.0 94.0 94.0 94.0
BAROMETRIC PRES: 29.95

Orange County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 73.1 73.4 76.9 80.8 84.3 87.3 89.7 91.6 93.1 93.5 92.7 91.8 89.8 87.1 83.9 81.8 80.6 80.1 77.8 77.8 76.7 75.7 74.7 74.2
RELATIVE HUMIDITY: 91.0 79.0 70.0 59.0 50.0 44.0 37.0 41.0 49.0 52.0 57.0 63.0 74.0 79.0 85.0 88.0 88.0 94.0 91.0 97.0 97.0 94.0 94.0 94.0
BAROMETRIC PRES: 29.95

Sunday, August 20

Hardin County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 76.4 76.3 78.6 82.3 85.0 87.4 89.9 91.6 93.5 94.8 96.0 95.5 92.8 88.3 84.9 83.3 82.0 81.3 78.3 77.6 77.0 76.8 76.9 76.4
RELATIVE HUMIDITY: 94.0 82.0 72.0 66.0 58.0 50.0 49.0 44.0 44.0 53.0 58.0 70.0 80.0 82.0 87.0 93.0 93.0 93.0 94.0 97.0 94.0 94.0 94.0 94.0
BAROMETRIC PRES: 29.93

Jefferson County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 75.2 76.2 79.2 82.7 85.8 88.3 90.4 92.3 93.4 94.2 93.9 92.5 89.9 86.7 83.9 82.1 81.1 80.2 77.5 76.9 76.6 76.3 76.0 75.5
RELATIVE HUMIDITY: 94.0 82.0 72.0 66.0 58.0 50.0 49.0 44.0 44.0 53.0 58.0 70.0 80.0 82.0 87.0 93.0 93.0 93.0 94.0 97.0 94.0 94.0 94.0 94.0
BAROMETRIC PRES: 29.93

Orange County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 75.1 75.7 77.9 81.0 84.3 87.0 89.3 91.2 92.9 94.3 94.6 93.7 92.1 89.0 86.3 83.9 82.2 81.7 79.5 78.5 77.9 77.5 76.9 75.8
RELATIVE HUMIDITY: 94.0 82.0 72.0 66.0 58.0 50.0 49.0 44.0 44.0 53.0 58.0 70.0 80.0 82.0 87.0 93.0 93.0 93.0 94.0 97.0 94.0 94.0 94.0 94.0
BAROMETRIC PRES: 29.93

Monday, August 21

Hardin County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 79.0 79.1 79.4 82.3 84.6 87.3 89.8 92.5 92.9 92.4 92.7 92.0 90.4 88.1 85.9 85.8 85.2 83.9 80.6 79.9 79.5 78.8 78.4 78.6
RELATIVE HUMIDITY: 93.0 82.0 75.0 62.0 59.0 56.0 52.0 61.0 60.0 44.0 59.0 54.0 67.0 72.0 79.0 85.0 87.0 90.0 94.0 97.0 97.0 94.0 94.0 96.0
BAROMETRIC PRES: 29.95

Jefferson County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 77.3 78.6 81.1 84.0 86.2 88.4 90.7 91.1 90.8 91.4 91.0 90.0 88.6 86.5 84.6 83.4 82.5 81.0 79.3 78.5 78.5 78.2 77.9 77.4
RELATIVE HUMIDITY: 93.0 82.0 75.0 62.0 59.0 56.0 52.0 61.0 60.0 44.0 59.0 54.0 67.0 72.0 79.0 85.0 87.0 90.0 94.0 97.0 97.0 94.0 94.0 96.0
BAROMETRIC PRES: 29.95

Orange County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 77.4 77.7 80.1 82.7 85.5 87.7 89.6 91.0 90.8 91.3 91.2 91.0 89.9 87.8 85.7 84.4 82.3 81.1 80.9 80.1 79.6 78.8 78.7 78.2
RELATIVE HUMIDITY: 93.0 82.0 75.0 62.0 59.0 56.0 52.0 61.0 60.0 44.0 59.0 54.0 67.0 72.0 79.0 85.0 87.0 90.0 94.0 97.0 97.0 94.0 94.0 96.0
BAROMETRIC PRES: 29.95

Tuesday, August 29

Hardin County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 77.0 76.5 77.6 82.6 85.8 88.8 91.2 93.5 95.3 96.0 97.3 96.6 92.6 88.9 85.8 83.7 82.4 81.3 79.0 78.4 77.7 77.3 76.9 77.0
RELATIVE HUMIDITY: 94.0 82.0 72.0 61.0 56.0 48.0 43.0 37.0 36.0 48.0 58.0 65.0 77.0 85.0 85.0 87.0 90.0 90.0 97.0 100.0 97.0 97.0 97.0 100.0
BAROMETRIC PRES: 29.87

Jefferson County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 75.5 76.7 79.8 83.3 86.4 88.9 91.1 93.1 94.4 94.9 94.6 93.2 90.1 86.6 83.8 81.9 81.0 79.8 78.3 77.6 76.9 76.4 75.8 75.2
RELATIVE HUMIDITY: 94.0 82.0 72.0 61.0 56.0 48.0 43.0 37.0 36.0 48.0 58.0 65.0 77.0 85.0 85.0 87.0 90.0 90.0 97.0 100.0 97.0 97.0 97.0 100.0
BAROMETRIC PRES: 29.87

Orange County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 75.3 75.2 78.4 81.8 84.7 87.4 89.8 91.9 94.2 95.7 95.6 94.9 92.7 89.6 86.0 83.9 82.7 81.1 79.4 78.4 77.5 77.1 75.6 75.1
RELATIVE HUMIDITY: 94.0 82.0 72.0 61.0 56.0 48.0 43.0 37.0 36.0 48.0 58.0 65.0 77.0 85.0 85.0 87.0 90.0 90.0 97.0 100.0 97.0 97.0 97.0 100.0
BAROMETRIC PRES: 29.87

Wednesday, August 30

Hardin County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 77.5 77.6 79.5 82.7 86.3 89.8 92.9 95.7 98.1 100.0 101.4 101.8 101.5 96.5 90.9 87.4 85.6 84.2 80.0 79.9 78.5 78.8 78.2 77.5
RELATIVE HUMIDITY: 94.0 85.0 65.0 54.0 43.0 36.0 33.0 30.0 26.0 25.0 31.0 49.0 61.0 77.0 85.0 91.0 94.0 97.0 90.0 94.0 97.0 94.0 96.0 94.0
BAROMETRIC PRES: 29.80

Jefferson County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 76.1 76.8 79.5 83.1 87.1 90.6 94.1 96.7 98.9 100.1 100.4 99.7 96.8 91.4 87.8 85.4 83.8 82.6 79.1 78.5 78.0 77.6 76.6 76.2
RELATIVE HUMIDITY: 94.0 85.0 65.0 54.0 43.0 36.0 33.0 30.0 26.0 25.0 31.0 49.0 61.0 77.0 85.0 91.0 94.0 97.0 90.0 94.0 97.0 94.0 96.0 94.0
BAROMETRIC PRES: 29.80

Orange County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 76.4 76.6 78.3 81.6 85.7 89.6 93.5 96.4 99.1 100.8 100.8 100.7 98.9 94.9 91.4 88.6 86.3 84.4 80.1 79.1 78.6 77.7 77.4 76.9
RELATIVE HUMIDITY: 94.0 85.0 65.0 54.0 43.0 36.0 33.0 30.0 26.0 25.0 31.0 49.0 61.0 77.0 85.0 91.0 94.0 97.0 90.0 94.0 97.0 94.0 96.0 94.0
BAROMETRIC PRES: 29.80

Thursday, August 31

Hardin County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 80.4 80.0 81.9 87.4 91.7 95.7 98.4 101.2 103.4 105.0 103.7 100.4 100.9 97.7 94.8 92.0 89.9 88.1 83.0 82.7 82.1 81.5 81.2 80.0
RELATIVE HUMIDITY: 90.0 65.0 39.0 33.0 30.0 29.0 27.0 26.0 25.0 29.0 33.0 43.0 52.0 61.0 70.0 72.0 85.0 88.0 94.0 94.0 90.0 97.0 94.0 88.0
BAROMETRIC PRES: 29.74

Jefferson County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 77.7 78.4 81.9 87.0 92.1 96.2 99.3 101.8 103.5 104.1 102.5 99.6 97.4 93.3 89.6 88.1 86.8 85.9 82.0 81.5 80.6 79.4 78.7 78.0
RELATIVE HUMIDITY: 90.0 65.0 39.0 33.0 30.0 29.0 27.0 26.0 25.0 29.0 33.0 43.0 52.0 61.0 70.0 72.0 85.0 88.0 94.0 94.0 90.0 97.0 94.0 88.0
BAROMETRIC PRES: 29.74

Orange County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 77.6 77.6 80.1 84.8 89.7 95.0 99.2 102.2 103.5 104.3 104.8 101.1 100.0 95.2 91.6 90.1 87.6 86.2 83.3 82.0 81.0 80.1 79.4 78.4
RELATIVE HUMIDITY: 90.0 65.0 39.0 33.0 30.0 29.0 27.0 26.0 25.0 29.0 33.0 43.0 52.0 61.0 70.0 72.0 85.0 88.0 94.0 94.0 90.0 97.0 94.0 88.0
BAROMETRIC PRES: 29.74

Friday, September 1

Hardin County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 80.8 80.6 83.2 86.2 89.5 93.0 95.1 97.7 99.9 101.0 96.3 88.5 89.6 88.6 86.5 85.8 86.7 84.7 87.2 85.1 83.8 82.7 82.5 80.9
RELATIVE HUMIDITY: 79.0 70.0 53.0 47.0 46.0 46.0 41.0 41.0 39.0 56.0 50.0 55.0 61.0 55.0 79.0 74.0 87.0 97.0 88.0 87.0 77.0 79.0 79.0 79.0
BAROMETRIC PRES: 29.78

Jefferson County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 79.9 80.0 82.3 85.4 89.2 92.8 95.1 96.8 98.5 98.2 94.3 89.0 87.2 86.9 85.0 84.5 83.3 82.0 85.2 84.0 83.1 82.3 81.5 80.7
RELATIVE HUMIDITY: 79.0 70.0 53.0 47.0 46.0 46.0 41.0 41.0 39.0 56.0 50.0 55.0 61.0 55.0 79.0 74.0 87.0 97.0 88.0 87.0 77.0 79.0 79.0 79.0
BAROMETRIC PRES: 29.78

Orange County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 80.6 80.0 81.7 83.5 87.4 90.9 94.0 96.8 98.1 98.3 95.3 91.3 88.5 86.5 85.2 85.0 81.9 80.9 85.7 85.5 84.4 83.2 83.3 82.0
RELATIVE HUMIDITY: 79.0 70.0 53.0 47.0 46.0 46.0 41.0 41.0 39.0 56.0 50.0 55.0 61.0 55.0 79.0 74.0 87.0 97.0 88.0 87.0 77.0 79.0 79.0 79.0
BAROMETRIC PRES: 29.78

Saturday, September 2

Hardin County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 78.5 78.9 81.8 85.0 88.4 90.9 94.3 97.1 99.4 100.7 101.8 101.9 95.3 81.5 79.2 78.6 78.4 79.0 82.9 81.8 81.0 80.5 80.0 79.1
RELATIVE HUMIDITY: 93.0 85.0 63.0 52.0 47.0 46.0 39.0 35.0 32.0 32.0 55.0 52.0 71.0 77.0 82.0 85.0 88.0 85.0 97.0 97.0 97.0 97.0 94.0 96.0
BAROMETRIC PRES: 29.77

Jefferson County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 77.9 78.8 82.4 86.1 89.4 92.2 95.0 97.4 99.0 100.2 99.3 95.6 89.1 82.2 80.6 80.0 80.3 80.7 81.9 81.7 81.1 80.3 79.1 78.5
RELATIVE HUMIDITY: 93.0 85.0 63.0 52.0 47.0 46.0 39.0 35.0 32.0 32.0 55.0 52.0 71.0 77.0 82.0 85.0 88.0 85.0 97.0 97.0 97.0 97.0 94.0 96.0
BAROMETRIC PRES: 29.77

Orange County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 77.8 77.8 80.7 84.3 88.0 91.1 94.1 96.7 98.7 100.4 100.7 96.8 86.1 79.7 80.6 79.4 79.3 79.7 81.7 81.8 81.1 80.8 80.3 78.9
RELATIVE HUMIDITY: 93.0 85.0 63.0 52.0 47.0 46.0 39.0 35.0 32.0 32.0 55.0 52.0 71.0 77.0 82.0 85.0 88.0 85.0 97.0 97.0 97.0 97.0 94.0 96.0
BAROMETRIC PRES: 29.77

Sunday, September 3

Hardin County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 79.9 79.1 80.6 83.9 88.1 91.7 95.5 98.3 99.9 101.9 102.4 88.9 86.1 86.8 87.4 85.9 84.2 82.1 79.5 81.2 81.4 80.7 79.3 79.9
RELATIVE HUMIDITY: 87.0 77.0 63.0 56.0 48.0 45.0 41.0 37.0 36.0 35.0 61.0 65.0 83.0 91.0 97.0 91.0 87.0 90.0 85.0 90.0 94.0 90.0 94.0 94.0
BAROMETRIC PRES: 29.73

Jefferson County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 77.9 78.6 80.9 84.6 88.4 91.8 95.1 97.8 99.6 100.9 99.5 92.9 89.3 87.7 86.2 84.7 83.2 81.6 80.9 80.5 79.9 79.3 78.9 78.4
RELATIVE HUMIDITY: 87.0 77.0 63.0 56.0 48.0 45.0 41.0 37.0 36.0 35.0 61.0 65.0 83.0 91.0 97.0 91.0 87.0 90.0 85.0 90.0 94.0 90.0 94.0 94.0
BAROMETRIC PRES: 29.73

Orange County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 76.5 76.7 79.7 84.0 88.2 91.9 95.2 97.9 100.2 101.4 101.0 93.5 89.1 87.9 85.7 84.4 82.9 82.0 80.6 81.0 80.0 79.0 78.5 77.0
RELATIVE HUMIDITY: 87.0 77.0 63.0 56.0 48.0 45.0 41.0 37.0 36.0 35.0 61.0 65.0 83.0 91.0 97.0 91.0 87.0 90.0 85.0 90.0 94.0 90.0 94.0 94.0
BAROMETRIC PRES: 29.73

Monday, September 4

Hardin County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 76.8 77.9 81.2 85.0 88.9 92.9 96.5 99.7 102.3 104.3 104.3 103.5 100.5 94.5 91.2 88.9 87.1 85.7 81.6 80.9 80.2 79.0 78.4 78.2
RELATIVE HUMIDITY: 90.0 72.0 61.0 54.0 37.0 34.0 30.0 29.0 28.0 30.0 34.0 49.0 63.0 77.0 79.0 87.0 85.0 90.0 90.0 96.0 87.0 90.0 94.0 97.0
BAROMETRIC PRES: 29.73

Jefferson County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 76.5 77.1 81.1 85.6 90.1 94.5 98.2 100.6 102.0 102.7 102.5 101.3 96.7 91.2 88.3 85.6 84.4 83.1 81.2 80.0 79.1 78.6 77.9 76.8
RELATIVE HUMIDITY: 90.0 72.0 61.0 54.0 37.0 34.0 30.0 29.0 28.0 30.0 34.0 49.0 63.0 77.0 79.0 87.0 85.0 90.0 90.0 96.0 87.0 90.0 94.0 97.0
BAROMETRIC PRES: 29.73

Orange County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 74.3 74.3 79.4 84.7 89.9 95.5 98.9 101.7 102.9 103.6 103.6 102.6 98.0 92.4 88.2 85.1 82.7 81.7 79.8 77.9 77.1 76.8 76.3 75.7
RELATIVE HUMIDITY: 90.0 72.0 61.0 54.0 37.0 34.0 30.0 29.0 28.0 30.0 34.0 49.0 63.0 77.0 79.0 87.0 85.0 90.0 90.0 96.0 87.0 90.0 94.0 97.0
BAROMETRIC PRES: 29.73

Tuesday, September 5

Hardin County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 80.9 80.9 83.0 86.0 89.4 92.6 96.0 98.6 100.5 101.2 101.6 101.0 99.4 96.5 94.3 92.3 90.2 88.1 85.2 84.9 84.5 82.3 81.6 80.8
RELATIVE HUMIDITY: 82.0 63.0 54.0 49.0 42.0 39.0 31.0 33.0 38.0 31.0 30.0 30.0 37.0 42.0 45.0 45.0 43.0 46.0 90.0 93.0 96.0 97.0 94.0 82.0
BAROMETRIC PRES: 29.75

Jefferson County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 79.8 80.9 84.5 88.7 92.0 95.0 97.2 98.9 100.6 101.0 101.4 100.6 98.5 95.1 91.6 89.7 87.5 84.9 82.5 81.7 80.9 80.1 79.8 79.6
RELATIVE HUMIDITY: 82.0 63.0 54.0 49.0 42.0 39.0 31.0 33.0 38.0 31.0 30.0 30.0 37.0 42.0 45.0 45.0 43.0 46.0 90.0 93.0 96.0 97.0 94.0 82.0
BAROMETRIC PRES: 29.75

Orange County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 78.3 78.9 84.4 88.3 91.7 95.4 98.3 100.7 102.1 100.1 101.5 100.8 98.3 94.6 90.8 88.8 86.8 84.6 81.0 79.4 77.9 77.4 77.1 77.0
RELATIVE HUMIDITY: 82.0 63.0 54.0 49.0 42.0 39.0 31.0 33.0 38.0 31.0 30.0 30.0 37.0 42.0 45.0 45.0 43.0 46.0 90.0 93.0 96.0 97.0 94.0 82.0
BAROMETRIC PRES: 29.75

Wednesday, September 6

Hardin County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 72.1 71.6 72.8 76.4 80.5 83.2 85.7 87.8 90.7 93.5 94.1 94.2 93.2 92.0 90.0 88.5 87.1 84.2 84.5 82.2 77.8 75.6 73.7 72.7
RELATIVE HUMIDITY: 79.0 74.0 65.0 59.0 55.0 52.0 47.0 43.0 41.0 40.0 47.0 44.0 52.0 51.0 55.0 59.0 65.0 71.0 52.0 62.0 66.0 74.0 76.0 81.0
BAROMETRIC PRES: 29.76

Jefferson County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 72.5 72.4 74.4 77.5 80.9 83.9 86.6 89.1 91.2 92.7 92.6 91.8 90.0 88.5 86.7 85.1 83.3 82.0 82.5 80.2 77.8 75.8 74.3 73.2
RELATIVE HUMIDITY: 79.0 74.0 65.0 59.0 55.0 52.0 47.0 43.0 41.0 40.0 47.0 44.0 52.0 51.0 55.0 59.0 65.0 71.0 52.0 62.0 66.0 74.0 76.0 81.0
BAROMETRIC PRES: 29.76

Orange County
SUNRISE/SUNSET: 7 8
HOURLY TEMPERATURES: 71.6 71.6 73.9 77.3 80.7 83.9 86.9 89.6 92.0 93.2 93.6 92.3 90.6 88.5 86.7 85.1 83.3 81.4 82.3 79.5 77.0 75.1 73.7 72.5
RELATIVE HUMIDITY: 79.0 74.0 65.0 59.0 55.0 52.0 47.0 43.0 41.0 40.0 47.0 44.0 52.0 51.0 55.0 59.0 65.0 71.0 52.0 62.0 66.0 74.0 76.0 81.0
BAROMETRIC PRES: 29.76

APPENDIX F
MOBILE6 REGISTRATION DISTRIBUTIONS AND DIESEL FRACTIONS INPUT

Hardin County MOBILE6 Registration Distributions* Input

```
* Calculated from Mid-Year (July) 2003 Registration data
* LDV
       1 0.04821 0.07971 0.08586 0.09185 0.08322 0.07415 0.07102 0.05981 0.06442 0.05354 0.04881
0.04211 0.03573 0.03254 0.02655 0.02237 0.01473 0.01242 0.01105 0.00863 0.00528 0.00324 0.00319
0.00231 0.01924
* LDT1
       2 0.05407 0.09570 0.09526 0.07372 0.06965 0.06623 0.06557 0.05502 0.05800 0.05800 0.04221
0.03806 0.03682 0.02700 0.03115 0.02372 0.01616 0.01586 0.01339 0.01303 0.00859 0.00910 0.00597
0.00291 0.02482
* LDT2
       3 0.05407 0.09570 0.09526 0.07372 0.06965 0.06623 0.06557 0.05502 0.05800 0.05800 0.04221
0.03806 0.03682 0.02700 0.03115 0.02372 0.01616 0.01586 0.01339 0.01303 0.00859 0.00910 0.00597
0.00291 0.02482
* LDT3
       4 0.11528 0.14152 0.14540 0.10201 0.11917 0.05084 0.06962 0.04760 0.04177 0.02623 0.02332
0.01878 0.01522 0.01457 0.01360 0.00518 0.00486 0.00939 0.00583 0.00907 0.00356 0.00518 0.00162
0.00259 0.00777
* LDT4
       5 0.11528 0.14152 0.14540 0.10201 0.11917 0.05084 0.06962 0.04760 0.04177 0.02623 0.02332
0.01878 0.01522 0.01457 0.01360 0.00518 0.00486 0.00939 0.00583 0.00907 0.00356 0.00518 0.00162
0.00259 0.00777
* HDV2
       6 0.13854 0.14627 0.14909 0.09353 0.11955 0.05556 0.05907 0.02672 0.03024 0.01828 0.02110
0.01477 0.01617 0.01547 0.00774 0.01406 0.00914 0.01195 0.00633 0.00563 0.00281 0.00633 0.00352
0.00914 0.01899
* HDV3
       7 0.06475 0.09712 0.09892 0.09532 0.10072 0.03777 0.07734 0.04676 0.08273 0.03957 0.03417
0.03237 0.03058 0.01439 0.01978 0.02158 0.00719 0.00540 0.00899 0.00180 0.00360 0.01259 0.00899
0.00180 0.05576
* HDV4
       8 0.05200 0.06000 0.07200 0.08800 0.12800 0.07200 0.10800 0.08800 0.06800 0.03200 0.03200
0.03200 0.03200 0.03600 0.00800 0.00400 0.02000 0.00800 0.00400 0.00400 0.00000 0.00000 0.00000
0.00800 0.04400
* HDV5
       9 0.05747 0.09770 0.11494 0.11494 0.09195 0.04023 0.07471 0.02299 0.04598 0.02299 0.03448
0.01724 0.02299 0.01149 0.02874 0.02874 0.00575 0.01149 0.01149 0.01149 0.02299 0.01149 0.02299
0.00575 0.06897
* HDV6
      10 0.03509 0.07018 0.05263 0.08246 0.10175 0.04737 0.05614 0.04561 0.03333 0.03860 0.05614
0.03860 0.06491 0.02807 0.02105 0.01404 0.02456 0.01053 0.03333 0.02105 0.00702 0.01754 0.02281
0.01404 0.06316
* HDV7
      11 0.00957 0.02871 0.02871 0.08134 0.03828 0.09091 0.02871 0.04785 0.06699 0.02871 0.06220
0.07177 0.10526 0.04785 0.01914 0.02392 0.03828 0.01435 0.03349 0.01914 0.00000 0.02871 0.01914
0.01435 0.05263
* HDV8a
      12 0.01161 0.01354 0.01547 0.02321 0.05609 0.02128 0.01161 0.03675 0.06190 0.07544 0.09478
0.05029 0.05803 0.07157 0.06963 0.03868 0.04642 0.02515 0.04255 0.03288 0.01354 0.01354 0.01934
0.01934 0.07737
* HDV8b
      13 0.05323 0.01901 0.10266 0.12357 0.13498 0.11787 0.05894 0.09696 0.20342 0.07034 0.00190
0.00000 0.00570 0.00380 0.00190 0.00000 0.00000 0.00380 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00190
*   HDBS is MOBILE6 default
*   HDBT is MOBILE6 default
* MC
      16 0.09296 0.12437 0.13819 0.14698 0.06533 0.05025 0.05528 0.04146 0.03392 0.02387 0.01759
0.01131 0.01256 0.01005 0.01005 0.00879 0.00628 0.02010 0.01131 0.01005 0.01633 0.02010 0.01382
0.01256 0.04648
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***** Based on TxDOT mid-year 2003 eight-county regional data for HDVs and county registration data otherwise (except MOBILE6 defaults are used for Buses).

Jefferson County MOBILE6 Registration Distributions* Input

```
* Calculated from Mid-Year (July) 2003 Registration data
* LDV
       1 0.04895 0.07870 0.08035 0.08888 0.07525 0.06851 0.06422 0.06164 0.06602 0.05462 0.05065
0.04424 0.04017 0.03548 0.03043 0.02224 0.01754 0.01432 0.01367 0.01034 0.00612 0.00422 0.00310
0.00240 0.01793
* LDT1
       2 0.06123 0.09661 0.08374 0.07063 0.06983 0.06439 0.06363 0.05632 0.05756 0.05929 0.04496
0.03661 0.03680 0.02930 0.02934 0.02236 0.01631 0.01713 0.01560 0.01359 0.00873 0.00982 0.00847
0.00365 0.02413
* LDT2
       3 0.06123 0.09661 0.08374 0.07063 0.06983 0.06439 0.06363 0.05632 0.05756 0.05929 0.04496
0.03661 0.03680 0.02930 0.02934 0.02236 0.01631 0.01713 0.01560 0.01359 0.00873 0.00982 0.00847
0.00365 0.02413
* LDT3
       4 0.14193 0.15884 0.13333 0.09913 0.12145 0.04792 0.06618 0.04705 0.04000 0.02367 0.02290
0.01797 0.01159 0.00937 0.01101 0.00831 0.00319 0.00657 0.00512 0.00599 0.00377 0.00251 0.00242
0.00126 0.00850
* LDT4
       5 0.14193 0.15884 0.13333 0.09913 0.12145 0.04792 0.06618 0.04705 0.04000 0.02367 0.02290
0.01797 0.01159 0.00937 0.01101 0.00831 0.00319 0.00657 0.00512 0.00599 0.00377 0.00251 0.00242
0.00126 0.00850
* HDV2
       6 0.13854 0.14627 0.14909 0.09353 0.11955 0.05556 0.05907 0.02672 0.03024 0.01828 0.02110
0.01477 0.01617 0.01547 0.00774 0.01406 0.00914 0.01195 0.00633 0.00563 0.00281 0.00633 0.00352
0.00914 0.01899
* HDV3
       7 0.06475 0.09712 0.09892 0.09532 0.10072 0.03777 0.07734 0.04676 0.08273 0.03957 0.03417
0.03237 0.03058 0.01439 0.01978 0.02158 0.00719 0.00540 0.00899 0.00180 0.00360 0.01259 0.00899
0.00180 0.05576
* HDV4
       8 0.05200 0.06000 0.07200 0.08800 0.12800 0.07200 0.10800 0.08800 0.06800 0.03200 0.03200
0.03200 0.03200 0.03600 0.00800 0.00400 0.02000 0.00800 0.00400 0.00400 0.00000 0.00000 0.00000
0.00800 0.04400
* HDV5
       9 0.05747 0.09770 0.11494 0.11494 0.09195 0.04023 0.07471 0.02299 0.04598 0.02299 0.03448
0.01724 0.02299 0.01149 0.02874 0.02874 0.00575 0.01149 0.01149 0.01149 0.02299 0.01149 0.02299
0.00575 0.06897
* HDV6
      10 0.03509 0.07018 0.05263 0.08246 0.10175 0.04737 0.05614 0.04561 0.03333 0.03860 0.05614
0.03860 0.06491 0.02807 0.02105 0.01404 0.02456 0.01053 0.03333 0.02105 0.00702 0.01754 0.02281
0.01404 0.06316
* HDV7
      11 0.00957 0.02871 0.02871 0.08134 0.03828 0.09091 0.02871 0.04785 0.06699 0.02871 0.06220
0.07177 0.10526 0.04785 0.01914 0.02392 0.03828 0.01435 0.03349 0.01914 0.00000 0.02871 0.01914
0.01435 0.05263
* HDV8a
      12 0.01161 0.01354 0.01547 0.02321 0.05609 0.02128 0.01161 0.03675 0.06190 0.07544 0.09478
0.05029 0.05803 0.07157 0.06963 0.03868 0.04642 0.02515 0.04255 0.03288 0.01354 0.01354 0.01934
0.01934 0.07737
* HDV8b
      13 0.05323 0.01901 0.10266 0.12357 0.13498 0.11787 0.05894 0.09696 0.20342 0.07034 0.00190
0.00000 0.00570 0.00380 0.00190 0.00000 0.00000 0.00380 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00190
*   HDBS is MOBILE6 default
*   HDBT is MOBILE6 default
* MC
      16 0.09655 0.14000 0.14172 0.12241 0.07759 0.06448 0.05207 0.04345 0.03138 0.02759 0.01655
0.01138 0.00931 0.00724 0.01241 0.01207 0.01138 0.01483 0.01138 0.00759 0.01138 0.01138 0.01069
0.01207 0.04310
```

* Based on TxDOT mid-year 2003 eight-county regional data for HDVs and county registration data otherwise (except MOBILE6 defaults are used for Buses).

Orange County MOBILE6 Registration Distributions* Input

```
* Calculated from Mid-Year (July) 2003 Registration data
* LDV
       1 0.04024 0.07916 0.07885 0.08936 0.07814 0.07288 0.06895 0.06289 0.06698 0.05690 0.04952
0.04528 0.03676 0.03280 0.02819 0.02330 0.01648 0.01463 0.01223 0.01073 0.00587 0.00427 0.00347
0.00286 0.01924
* LDT1
       2 0.04761 0.08148 0.07865 0.07171 0.06826 0.06653 0.06557 0.05767 0.06069 0.06313 0.04507
0.03966 0.03952 0.03272 0.03281 0.02520 0.01624 0.01772 0.01538 0.01538 0.01073 0.01030 0.00819
0.00359 0.02620
* LDT2
       3 0.04761 0.08148 0.07865 0.07171 0.06826 0.06653 0.06557 0.05767 0.06069 0.06313 0.04507
0.03966 0.03952 0.03272 0.03281 0.02520 0.01624 0.01772 0.01538 0.01538 0.01073 0.01030 0.00819
0.00359 0.02620
* LDT3
       4 0.09986 0.12207 0.12613 0.09436 0.11634 0.04730 0.08122 0.06331 0.05375 0.03440 0.03058
0.02341 0.01481 0.01601 0.01672 0.00812 0.00573 0.00836 0.00860 0.00669 0.00382 0.00406 0.00263
0.00215 0.00956
* LDT4
       5 0.09986 0.12207 0.12613 0.09436 0.11634 0.04730 0.08122 0.06331 0.05375 0.03440 0.03058
0.02341 0.01481 0.01601 0.01672 0.00812 0.00573 0.00836 0.00860 0.00669 0.00382 0.00406 0.00263
0.00215 0.00956
* HDV2
       6 0.13854 0.14627 0.14909 0.09353 0.11955 0.05556 0.05907 0.02672 0.03024 0.01828 0.02110
0.01477 0.01617 0.01547 0.00774 0.01406 0.00914 0.01195 0.00633 0.00563 0.00281 0.00633 0.00352
0.00914 0.01899
* HDV3
       7 0.06475 0.09712 0.09892 0.09532 0.10072 0.03777 0.07734 0.04676 0.08273 0.03957 0.03417
0.03237 0.03058 0.01439 0.01978 0.02158 0.00719 0.00540 0.00899 0.00180 0.00360 0.01259 0.00899
0.00180 0.05576
* HDV4
       8 0.05200 0.06000 0.07200 0.08800 0.12800 0.07200 0.10800 0.08800 0.06800 0.03200 0.03200
0.03200 0.03200 0.03600 0.00800 0.00400 0.02000 0.00800 0.00400 0.00400 0.00000 0.00000 0.00000
0.00800 0.04400
* HDV5
       9 0.05747 0.09770 0.11494 0.11494 0.09195 0.04023 0.07471 0.02299 0.04598 0.02299 0.03448
0.01724 0.02299 0.01149 0.02874 0.02874 0.00575 0.01149 0.01149 0.01149 0.02299 0.01149 0.02299
0.00575 0.06897
* HDV6
      10 0.03509 0.07018 0.05263 0.08246 0.10175 0.04737 0.05614 0.04561 0.03333 0.03860 0.05614
0.03860 0.06491 0.02807 0.02105 0.01404 0.02456 0.01053 0.03333 0.02105 0.00702 0.01754 0.02281
0.01404 0.06316
* HDV7
      11 0.00957 0.02871 0.02871 0.08134 0.03828 0.09091 0.02871 0.04785 0.06699 0.02871 0.06220
0.07177 0.10526 0.04785 0.01914 0.02392 0.03828 0.01435 0.03349 0.01914 0.00000 0.02871 0.01914
0.01435 0.05263
* HDV8a
      12 0.01161 0.01354 0.01547 0.02321 0.05609 0.02128 0.01161 0.03675 0.06190 0.07544 0.09478
0.05029 0.05803 0.07157 0.06963 0.03868 0.04642 0.02515 0.04255 0.03288 0.01354 0.01354 0.01934
0.01934 0.07737
* HDV8b
      13 0.05323 0.01901 0.10266 0.12357 0.13498 0.11787 0.05894 0.09696 0.20342 0.07034 0.00190
0.00000 0.00570 0.00380 0.00190 0.00000 0.00000 0.00380 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00190
*   HDBS is MOBILE6 default
*   HDBT is MOBILE6 default
* MC
      16 0.09306 0.15918 0.13959 0.11020 0.08816 0.04653 0.03837 0.05224 0.03347 0.02776 0.01878
0.01714 0.00735 0.00571 0.00898 0.00408 0.01061 0.01959 0.01878 0.00735 0.01306 0.01633 0.00408
0.01224 0.04735
```

***** Based on TxDOT mid-year 2003 eight-county regional data for HDVs and county registration data otherwise (except MOBILE6 defaults are used for Buses).

2007 Statewide Diesel Sales Fraction Estimates

```
* HDV fractions are estimated from TxDOT registration data (Mid-year July 2003)
* LDV, LDT and Bus fractions are EPA defaults
* One record per vehicle type.  The orders of vehicle types are: LDV, LDT1, LDT2,
LDT3, LDT4, HDV2B, HDV3, HDV4, HDV5, HDV6, HDV7, HDV8a, HDV8b, HDBS
DIESEL FRACTIONS:
0.00090 0.00090 0.00090 0.00090 0.00090 0.00090 0.00090 0.00090 0.00090 0.00090
0.00090 0.00090 0.00060 0.00010 0.00030 0.00060 0.00130 0.00040 0.00040 0.00010
0.00270 0.00320 0.00970 0.01620 0.02410
0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00070 0.00330 0.00480 0.01200 0.02230
0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00070 0.00330 0.00480 0.01200 0.02230
0.01260 0.01260 0.01260 0.01260 0.01260 0.01260 0.01260 0.01260 0.01260 0.01260
0.01260 0.01260 0.01150 0.01110 0.01450 0.01150 0.01290 0.00960 0.00830 0.00720
0.00820 0.01240 0.01350 0.01690 0.02090
0.01260 0.01260 0.01260 0.01260 0.01260 0.01260 0.01260 0.01260 0.01260 0.01260
0.01260 0.01260 0.01150 0.01110 0.01450 0.01150 0.01290 0.00960 0.00830 0.00720
0.00820 0.01240 0.01350 0.01690 0.02090
0.81181 0.81181 0.81181 0.81181 0.81181 0.79824 0.73298 0.59915 0.65281 0.55185
0.46989 0.44335 0.19724 0.39897 0.36691 0.34004 0.35368 0.27925 0.23851 0.18792
0.15347 0.20435 0.18015 0.19924 0.16859
0.68739 0.68739 0.68739 0.68739 0.68739 0.65945 0.63468 0.64627 0.63023 0.49458
0.57199 0.53520 0.33333 0.53948 0.57430 0.60513 0.51334 0.52345 0.48064 0.39058
0.25146 0.31034 0.19926 0.22896 0.19337
0.74693 0.74693 0.74693 0.74693 0.74693 0.70141 0.71133 0.71802 0.64135 0.67914
0.72936 0.66503 0.44792 0.68771 0.69409 0.64675 0.67560 0.57219 0.60125 0.34597
0.26380 0.14662 0.10460 0.22430 0.13889
0.86760 0.86760 0.86760 0.86760 0.86760 0.89930 0.86584 0.89257 0.87421 0.71327
0.69458 0.79024 0.46167 0.66557 0.74609 0.65315 0.73387 0.60000 0.58497 0.39405
0.33585 0.22256 0.28179 0.23048 0.28814
0.90728 0.90728 0.90728 0.90728 0.90728 0.92425 0.87157 0.85796 0.84998 0.79650
0.74226 0.79933 0.57106 0.76778 0.77010 0.58023 0.67444 0.73775 0.71495 0.57487
0.64472 0.54446 0.47463 0.44476 0.41207
0.98673 0.98673 0.98673 0.98673 0.98673 0.90875 0.88590 0.90763 0.89463 0.84466
0.76407 0.81215 0.51817 0.82933 0.83696 0.86728 0.85905 0.84129 0.84547 0.81250
0.83893 0.79186 0.76037 0.73670 0.70313
0.96237 0.96237 0.96237 0.96237 0.96237 0.95062 0.93822 0.93447 0.95209 0.94684
0.88634 0.91329 0.70270 0.96310 0.94696 0.94607 0.93297 0.94038 0.95321 0.95402
0.94283 0.89961 0.90783 0.92819 0.90253
0.98054 0.98054 0.98054 0.98054 0.98054 0.98148 0.99014 0.98620 0.97967 0.97740
0.94737 0.99534 0.78199 0.95385 0.98521 0.96809 0.98519 0.95614 0.97931 0.93151
0.90909 0.92188 0.98734 0.97917 0.96000
0.95850 0.95850 0.95850 0.95850 0.95850 0.95850 0.95850 0.95850 0.95850 0.95850
0.95850 0.95850 0.88570 0.85250 0.87950 0.99000 0.91050 0.87600 0.77100 0.75020
0.73450 0.67330 0.51550 0.38450 0.32380
```

* Based on TxDOT Stateswide mid-year 2003 county registration data except EPA fractions are used for LDV, LDT and Bus.