Texas Transportation Institute

Northeast Texas Region On-Road Mobile Source Modeling Emissions Inventories: 1995, 1999, 2002, 2005, 2007, and 2012

TEXAS TRANSPORTATION INSTITUTE
THE TEXAS A&M UNIVERSITY SYSTEM
COLLEGE STATION, TEXAS

Sponsored by the
Texas Commission
On Environmental Quality
August 2003

TECHNICAL NOTE

Transportation Air Quality Technical Support Interagency Contract with Texas Commission on Environmental Quality

TO: Mary McGarry-Barber, Project Manager
Texas Commission on Environmental Quality
DATE: 22 August 2003

FROM: Dennis G. Perkinson, Ph.D.,
Martin E. Boardman and
L.D. White
Texas Transportation Institute

SUBJECT: Northeast Texas Region On-Road Mobile Source Modeling Emissions Inventories: 1995, 1999, 2002, 2005, 2007, and 2012 (Umbrella Contract 03-60200-04: Task 03) - **Final**

INTRODUCTION

This technical note documents the methods the Texas Transportation Institute (TTI) used to develop 1995, 1999, 2002, 2005, 2007, and 2012 August day-of-week hourly on-road mobile source emissions inventories (EIs) for the five counties bound by the Northeast Texas Early Action Compact (EAC). These EIs are for the four ozone episode days, August 19 through 22, 1999 (a Thursday, Friday, Saturday, and Sunday). The results are produced in the form of photochemical model preprocessor-ready input as well as in tabular summaries. This task is in support of the Northeast Texas EAC air quality analyses.

The five Northeast Texas EAC region counties are Gregg, Smith, Harrison, Rusk, and Upshur. The emissions basis for each county may be distinguished as either link or virtual link. Emissions are estimated on a transportation network link basis for counties with travel demand models (TDM) available (Gregg and Smith). Emissions are estimated on a "virtual" link basis, or Highway Performance Monitoring System (HPMS) functional class/area type level, for counties without complete TDMs available (Harrison, Rusk and Upshur).

The August 1999 episode day climate inputs were used for all evaluation years. Emissions estimates were developed based on August activity characteristic of the four day types: Weekday (average Monday through Thursday), Friday, Saturday, and Sunday.

Emissions of volatile organic compounds (VOC), carbon monoxide (CO), and oxides of nitrogen (NOx), are estimated for each county and day type on an hourly basis. Emissions are categorized by 28 vehicle types and 14 pollutant-specific emissions types. Geographical coordinates are provided for the TDM network links.

Documented in this technical note are the methods relating to calculating inventory elements including vehicle miles traveled (VMT), speeds, VMT mix, MOBILE6 emissions factors, and emissions estimates.

ACKNOWLEDGMENTS
Chris Kite, with the Texas Commission on Environmental Quality (TCEQ), and Martin Boardman and L.D. White, of TTI, contributed to the development of the MOBILE6 emissions factors input data parameter values. Boardman produced the MOBILE6 model set-ups used, and performed the emissions factors analyses. Dennis Perkinson, Ph.D., of TTI, developed VMT growth factors, seasonal day-of-week VMT adjustment factors, hourly VMT allocation factors, and VMT mix. White processed TDM-based VMT and modeled congested link speeds. Boardman processed HPMS-based VMT and modeled congested virtual link speeds and performed the emissions estimations. Each member of the assigned TTI staff contributed to the quality assurance of the EI elements. Dr. Perkinson was the principle investigator for this project. This work was performed by TTI under contract to TCEQ. Mary McGarry-Barber 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 full results of the emissions analyses include: 1) individual county hourly link-emissions files in the detailed disaggregate photochemical model preprocessor input format, and 2) summary EI data files with hourly and 24-hour county, vehicle type, and road type summaries of VMT, VHT, average speeds, and emissions estimates. These data files for each evaluation year and day type were previously provided to TCEQ on CD-ROM. The data files are described in Appendix A.

SUMMARY OF VMT AND EMISSIONS

Tables 1 through 4 summarize the Northeast Texas region episode day emissions estimates by day type — Weekday, Friday, Saturday, and Sunday — respectively. Each table summarizes the daily total VMT, average speed (24-hour VMT divided by vehicle hours traveled [VHT]), and VOC, CO, and NOx emissions (tons) for each of the six analysis years by county and Northeast Texas region totals.

Table 1
Northeast Texas Region August Weekday* On-road Mobile Source
VMT, Average Speed, and Emissions of VOC, CO, NOx (Tons)

Year	County	VMT	Speed	VOC	CO	NOx
1995	Gregg	3,178,306	40.8	8.56	102.61	27.00
	Smith	2,277,255	47.2	5.98	78.86	18.92
	Harrison	1,253,805	40.8	3.68	44.66	4.44
	Rusk	4,953,729	42.2	13.74	169.58	27.95
	Upshur	824,444	43.3	2.37	29.62	2.97
	Total	12,487,539	42.6	34.33	425.32	81.28
1999	Gregg	3,427,333	41.7	6.28	78.43	25.57
	Smith	2,626,879	46.9	4.74	63.98	19.66
	Harrison	1,357,321	41.1	2.69	33.67	4.13
	Rusk	5,439,383	42.2	10.28	130.33	28.01
	Upshur	913,018	42.6	1.79	22.82	2.80
	Total	13,763,934	42.8	25.79	329.22	80.17
2002	Gregg	3,573,526	41.6	5.22	66.03	20.88
	Smith	2,862,197	46.9	4.12	56.58	17.09
	Harrison	1,404,949	41.1	2.23	28.45	3.54
	Rusk	5,585,448	42.2	8.43	108.92	23.37
	Upshur	978,435	42.5	1.54	19.95	2.49
	Total	14,404,555	42.8	21.54	279.93	67.36
2005	Gregg	3,725,952	41.4	3.99	49.52	14.13
	Smith	3,023,177	46.8	3.17	43.11	12.19
	Harrison	1,444,031	41.1	1.66	20.98	2.72
	Rusk	5,735,432	42.1	6.32	81.10	16.72
	Upshur	1,030,604	42.5	1.17	15.08	1.96
	Total	14,959,196	42.7	16.31	209.80	47.71
2007	Gregg	4,058,450	41.6	3.75	44.04	11.69
	Smith	3,130,771	46.8	2.84	36.26	9.60
	Harrison	1,470,691	41.1	1.46	17.40	2.20
	Rusk	5,905,868	42.0	5.63	68.10	13.32
	Upshur	1,066,141	42.5	1.05	12.70	1.61
	Total	15,631,921	42.7	14.73	178.49	38.42
2012	Gregg	4,139,687	42.2	2.58	33.28	5.80
	Smith	3,400,320	46.7	2.10	29.11	5.02
	Harrison	1,538,517	41.1	1.03	13.65	1.29
	Rusk	6,319,996	41.9	4.08	54.41	7.32
	Upshur	1,154,998	42.4	0.77	10.31	0.98
	Total	16,553,518	42.8	10.56	140.75	20.40

* Average Monday through Thursday activity, August 19, 1999 meteorology.

Table 2
Northeast Texas Region August Friday* On-road Mobile Source
VMT, Average Speed, and Emissions of VOC, CO, NOx (Tons)

Year	County	VMT	Speed	VOC	CO	NOx
1995	Gregg	4,010,115	39.9	10.23	122.96	26.72
	Smith	2,873,246	47.1	7.08	93.91	18.80
	Harrison	1,581,943	40.7	4.27	51.95	4.68
	Rusk	6,250,192	41.3	16.42	200.88	28.87
	Upshur	1,040,213	43.2	2.75	34.49	3.12
	Total	15,755,710	41.9	40.74	504.20	82.19
1999	Gregg	4,324,315	40.9	7.69	96.50	25.09
	Smith	3,314,371	46.7	5.77	78.61	19.36
	Harrison	1,712,551	41.0	3.21	40.39	4.27
	Rusk	6,862,949	41.2	12.58	157.65	28.47
	Upshur	1,151,967	42.4	2.14	27.39	2.89
	Total	17,366,154	42.2	31.39	400.54	80.08
2002	Gregg	4,508,768	40.7	6.42	82.38	20.63
	Smith	3,611,276	46.6	5.03	70.45	16.95
	Harrison	1,772,644	41.0	2.67	34.51	3.68
	Rusk	7,047,237	41.0	10.35	133.07	23.96
	Upshur	1,234,506	42.4	1.84	24.22	2.59
	Total	18,174,432	42.1	26.31	344.64	67.80
2005	Gregg	4,701,085	40.5	4.93	63.70	14.12
	Smith	3,814,386	46.6	3.89	55.35	12.21
	Harrison	1,821,955	41.0	2.00	26.28	2.86
	Rusk	7,236,472	40.9	7.81	101.83	17.40
	Upshur	1,300,328	42.3	1.42	18.90	2.05
	Total	18,874,226	41.9	20.05	266.06	48.65
2007	Gregg	5,120,603	40.5	4.64	56.77	11.71
	Smith	3,950,138	46.5	3.48	46.68	9.66
	Harrison	1,855,594	41.0	1.76	21.87	2.32
	Rusk	7,451,515	40.7	6.95	85.94	13.93
	Upshur	1,345,166	42.3	1.27	15.96	1.69
	Total	19,723,016	41.8	18.09	227.22	39.31
2012	Gregg	5,223,100	41.3	3.19	43.81	5.98
	Smith	4,290,232	46.4	2.57	38.19	5.19
	Harrison	1,941,169	40.9	1.24	17.41	1.40
	Rusk	7,974,028	40.6	5.04	70.07	7.94
	Upshur	1,457,278	42.2	0.93	13.15	1.06
	Total	20,885,808	42.0	12.97	182.65	21.57

* Average Monday through Thursday activity, August 19, 1999 meteorology.

Table 3
Northeast Texas Region August Saturday* On-road Mobile Source
VMT, Average Speed, and Emissions of VOC, CO, NOx (Tons)

Year	County	VMT	Speed	VOC	CO	NOx
1995	Gregg	3,897,203	40.1	8.93	110.58	19.74
	Smith	2,792,343	47.1	6.11	84.12	13.89
	Harrison	1,537,401	40.7	3.64	45.32	3.83
	Rusk	6,074,204	41.5	14.20	181.06	21.74
	Upshur	1,010,923	43.2	2.34	30.15	2.54
	Total	15,312,075	42.1	35.23	451.23	61.74
1999	Gregg	4,202,555	41.1	6.74	88.30	18.42
	Smith	3,221,048	46.8	5.02	71.83	14.19
	Harrison	1,664,331	41.0	2.76	35.93	3.46
	Rusk	6,669,708	41.5	10.95	145.47	21.24
	Upshur	1,119,531	42.5	1.84	24.39	2.34
	Total	16,877,174	42.3	27.32	365.92	59.65
2002	Gregg	4,381,781	40.9	5.62	75.62	15.36
	Smith	3,509,593	46.7	4.37	64.56	12.57
	Harrison	1,722,731	41.0	2.28	30.73	3.03
	Rusk	6,848,756	41.3	8.99	123.06	18.08
	Upshur	1,199,746	42.4	1.57	21.60	2.13
	Total	17,662,607	42.2	22.83	315.56	51.16
2005	Gregg	4,568,683	40.7	4.32	59.39	10.81
	Smith	3,706,984	46.6	3.39	51.51	9.27
	Harrison	1,770,653	41.0	1.72	23.79	2.41
	Rusk	7,032,661	41.1	6.78	95.17	13.45
	Upshur	1,263,715	42.4	1.22	17.13	1.73
	Total	18,342,696	42.1	17.43	246.99	37.68
2007	Gregg	4,976,388	40.7	4.04	52.77	9.03
	Smith	3,838,914	46.6	3.01	43.33	7.38
	Harrison	1,803,345	41.0	1.50	19.74	1.96
	Rusk	7,241,646	41.0	6.00	79.80	10.82
	Upshur	1,307,290	42.3	1.08	14.43	1.43
	Total	19,167,583	42.0	15.63	210.06	30.62
2012	Gregg	5,075,994	41.5	2.76	41.31	4.80
	Smith	4,169,432	46.5	2.21	35.89	4.12
	Harrison	1,886,512	41.0	1.06	15.87	1.22
	Rusk	7,749,444	40.9	4.32	65.47	6.36
	Upshur	1,416,245	42.3	0.79	12.00	0.92
	Total	20,297,627	42.2	11.14	170.54	17.42

* Average Monday through Thursday activity, August 19, 1999 meteorology.

Table 4
Northeast Texas Region August Sunday* On-road Mobile Source VMT, Average Speed, and Emissions of VOC, CO, NOx (Tons)

Year	County	VMT	Speed	VOC	CO	NOx
1995	**Gregg**	3,574,239	40.1	8.55	108.00	14.49
	Smith	2,560,938	47.1	5.82	81.78	10.21
	Harrison	1,409,995	40.7	3.44	43.53	3.13
	Rusk	5,570,828	41.5	13.55	174.71	16.62
	Upshur	927,147	43.2	2.21	28.97	2.08
	Total	14,043,146	42.1	33.58	436.99	46.53
1999	**Gregg**	3,854,286	41.1	6.44	86.23	13.39
	Smith	2,954,115	46.8	4.78	69.95	10.31
	Harrison	1,526,405	41.1	2.60	34.52	2.82
	Rusk	6,116,981	41.4	10.42	140.66	16.02
	Upshur	1,026,754	42.5	1.74	23.44	1.90
	Total	15,478,542	42.3	25.99	354.79	44.44
2002	**Gregg**	4,018,682	40.9	5.35	73.73	11.32
	Smith	3,218,748	46.7	4.15	62.77	9.24
	Harrison	1,579,966	41.0	2.15	29.43	2.50
	Rusk	6,281,232	41.3	8.53	118.77	13.80
	Upshur	1,100,321	42.4	1.48	20.69	1.75
	Total	16,198,949	42.2	21.66	305.38	38.61
2005	**Gregg**	4,190,098	40.7	4.09	57.32	8.21
	Smith	3,399,782	46.6	3.20	49.58	6.99
	Harrison	1,623,917	41.0	1.61	22.56	2.02
	Rusk	6,449,897	41.1	6.41	91.02	10.52
	Upshur	1,158,989	42.4	1.14	16.25	1.45
	Total	16,822,683	42.1	16.46	236.73	29.18
2007	**Gregg**	4,564,014	40.7	3.83	50.85	6.92
	Smith	3,520,778	46.6	2.84	41.63	5.61
	Harrison	1,653,899	41.0	1.41	18.69	1.65
	Rusk	6,641,567	41.0	5.67	76.20	8.53
	Upshur	1,198,953	42.4	1.01	13.67	1.20
	Total	17,579,211	42.0	14.77	201.04	23.92
2012	**Gregg**	4,655,372	41.5	2.62	39.79	3.83
	Smith	3,823,906	46.5	2.09	34.44	3.26
	Harrison	1,730,174	41.0	0.99	14.98	1.05
	Rusk	7,107,284	40.9	4.09	62.40	5.20
	Upshur	1,298,879	42.3	0.74	11.33	0.79
	Total	18,615,615	42.2	10.53	162.95	14.14

* Average Monday through Thursday activity, August 19, 1999 meteorology.

OVERVIEW OF METHODOLOGY

To develop the emissions estimates by county, one of two methodologies were used depending on whether or not TDMs were available.

The main difference in the methodologies is in the level of disaggregation and the spatial allocation of the modeled VMT (and speeds). For the TDM-based counties, the method uses network links where emissions are estimated directionally at the link level for thousands of links with geographical coordinates. For counties without TDMs, emissions are estimated directionally at the HPMS functional classification and area type level for up to 21 functional class and area type combinations with no physical coordinates. The HPMS-method for estimating on-road mobile source emissions is detailed in the TTI document, "Rural County Methodology Review, Refinement, and Update," August, 2003.

Aside from the differences in the methodologies associated with the aggregation level of vehicle activity, the overall emissions estimation methods are basically analogous. The HPMS-based emissions inventories may be thought of as link-based for a virtual network consisting of larger and fewer links. For the purpose of further discussion in this report, the term "link" means both TDM network link and the HPMS "virtual" link (or HPMS functional class, area type combination). For this analysis, emissions are estimated directionally, at the link level, by hour-of-day, for each county, for each of the four episode days.

Emissions factors are modeled with the MOBILE6 model (October, 2002 release). The emissions factors are modeled by hour, MOBILE6 road type (or drive cycle), 28 vehicle types, and speed. Texas Low Emissions Diesel (LED) NOx benefits were modeled in the diesel vehicle class emissions factors via post-processing. The speed sensitive freeway and arterial drive cycle emissions factors were applied — freeway emissions factors to freeway functional classifications, and arterial emissions factors to non-freeway functional classifications.

The activity basis for the TDM counties are the Texas Department of Transportation (TxDOT) TDM network equilibrium traffic assignments and trip information for 1990, 2005, 2007, and 2015 networks for Smith County and 1994, 2005, 2007, and 2015 networks for Gregg County. Intermediate evaluation future year (i.e., 2002 and 2012) VMT are estimated using growth rates developed from the bounding year traffic assignment (and intrazonal) VMT totals. For the HPMS-based counties, the activity basis are 1995 and 1999 historical HPMS VMT and 2002, 2005, 2007, and 2012 VMT forecasts. The HPMS-county VMT forecasts are based on TxDOT HPMS-county VMT data for 1990 through 2000 and population statistics and projections.

TxDOT Automatic Traffic Recorder- (ATR) based August day-of-week VMT factors were developed and applied to the county base VMT estimates for each evaluation year to produce the four day type-specific, seasonally adjusted VMT estimates for each year. ATR-based hourly travel fractions were developed for each of the four August day types and used to allocate the

VMT for each county by hour-of-day. Directional split factors were applied to allocate the hourly VMT by peak and off-peak direction. Based on the estimated hourly directional traffic volumes (and capacities and freeflow speeds), fleet-level, hourly, directional, average operational (congested) speeds were estimated. The link congested speed is estimated as the link freeflow speed reduced by the "delay" estimate, which is a function of the link's volume-to-capacity (v/c) ratio.

Vehicle classification count data were used with vehicle registration data and MOBILE6 default gasoline/diesel fractions to estimate 24-hour regional VMT mixes for apportioning fleetwide functional classification-specific VMT for three functional classification groups to the 28 U.S. Environmental Protection Agency (EPA) vehicle types. VMT mixes were estimated for each of the four day types.

Link emissions by vehicle type were calculated by hour for each county and evaluation year. For each evaluation year, there were four sets of hourly emissions files (24 files per day type) produced for each of the five counties. These hourly emissions files are formatted for photochemical grid model preprocessor input. The hourly emissions estimates include emissions type sub-components and total composites in grams of VOC, CO, and NOx. Tabular emissions summary files were also produced.

TTI previously developed a series of computer programs to produce detailed on-road mobile source EIs. These computer programs were used to produce and/or apply the EI elements (adjusted operational hourly link VMT and speeds, VMT mix, and MOBILE6 emissions factors) to calculate the emissions estimates for this analysis. Appendix B describes these applications.

ESTIMATION OF VMT

For each evaluation year and county, the main products of the VMT estimation process are estimates of seasonally adjusted, day type-specific, HPMS-consistent VMT by hour and direction for each link (i.e. of the individual TDM networks for Tyler [Smith County] and Longview [Gregg County] and the HPMS "virtual network" for Harrison, Rusk and Upshur counties).

Growth estimates were developed and applied to estimate VMT for evaluation years where historical VMT estimates, or modeled VMT estimates were not available. Seasonal (August), day type (Weekday, Friday, Saturday, Sunday) adjustment factors and hourly travel factors were also developed and used to characterize the seasonal and day type travel on an hourly basis. The directional split factors were applied for estimating directional VMT (or traffic volumes) for modeling directional congested link speeds (discussed later).

Data Sources

There are four traffic data sources used for developing the required adjustment factors and VMT estimates. These are the TDM data sets, ATR counts, HPMS VMT estimates, and vehicle classification counts (used to estimate VMT mix). The TDMs are developed by TxDOT, and the other three data sets are collected by TxDOT on a formal and on-going basis as part of the larger HPMS data collection program. U.S. Census and Texas State Data Center (TSDC) county population statistics and projections were used in the HPMS VMT forecasts.

The latest 1994, 2005, 2007, and 2015 TDM networks and trip matrices for Longview and the 1990, 2005, 2007, and 2015 TDM networks and trip matrices for Tyler (eight total TDMs) were used for this analysis. The Longview networks and trip matrices were TRANPLAN format. The Tyler networks and trip matrices were TRANSCAD format. Because the estimated intrazonal trips are not assigned to the network, the intrazonal trips and zonal radii were needed to estimate the intrazonal VMT. The zonal radii (assumed intrazonal trip length) was calculated for each of the Tyler networks. For the Longview networks, the previously supplied zonal radii was used. The TDM VMT are modeled as annual non-summer weekday traffic (ANSWT, or average Monday through Thursday traffic excluding the months of June through August). The Tyler TDM network links are categorized by up to nine functional classifications, five area types, and one county (Smith). The Longview TDM network links are categorized by up to 11 functional classifications, four area types, and four counties (Gregg, Harrison, Rusk, and Upshur). However, only Gregg county is located entirely within the TDM area (i.e, Harrison, Rusk, and Upshur counties do not play a role in the TDM VMT and speed estimation process).

HPMS VMT annual average daily traffic (AADT, or average Monday through Sunday, January through December traffic) 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 (as well as lane miles and centerline miles). A wide range of traffic data is collected under the HPMS program. HPMS VMT, centerline miles, and lane miles are applied in this analysis. The HPMS VMT is categorized by seven functional classifications and three area types. The historical HPMS data used were taken from TsDOT's Roadway Inventory Functional Classification Record reports for 1990 through 2000.

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 AADT basis. Since they are continuous, they are especially well-suited for making seasonal, day-of-week, and time-of-day comparisons (i.e., adjustment factors), even though there may be relatively few ATR data collection locations in any given area. The ATR counts may also may be aggregated within time periods (e.g., hours of day) and in the form of allocation factors, to distribute 24-hour VMT estimates, for example, to each hour of the day.

Vehicle classification counts are collected at representative locations throughout Texas on a regular but periodic basis. Roadway functional classification is included as part of the data collected. Vehicle classification counts were used to estimate the relative proportion of VMT to be assigned to each type of vehicle (VMT mix is described later in this report).

HPMS VMT estimates are available for all counties. ATR and vehicle classification (VMT mix) data are available for most but not all counties. Consequently, these last two data sources were aggregated for the Northeast Texas region to provide adequate data for this analysis.

County-Level VMT Totals
This section discusses the seasonal adjustment factors, the HPMS adjustment for TDM future year VMT, development of the VMT totals for the TDM-based county, and development of the VMT totals for the HPMS-based counties.

Seasonal Day-of-Week Factors
Emissions estimates are required for the August Weekday, Friday, Saturday, and Sunday day types. Since the evaluation year base-VMT estimates are either in AADT form (HPMS-based) or ANSWT form (TDM-based), August day-type adjustment factors are needed to convert VMT from both of these forms of VMT. To develop the two August day type conversion factor sets for this analysis, three years (1999 through 2001) of Northeast Texas region ATR data are aggregated.

The two sets of Northeast Texas region-level August day type factors include four ratios each, which are the August average Weekday, Friday, Saturday, and Sunday volumes to AADT volume, and the August average Weekday, Friday, Saturday, and Sunday volumes to ANSWT volume.

These Northeast Texas region-level factors are used for all evaluation years to convert either AADT VMT or ANSWT VMT to the selected seasonal day type form. The August Weekday, Friday, Saturday, and Sunday adjustment factors are shown in Table 5.

Table 5
Northeast Texas Region-Level August Day-Type VMT Factors*

Day-Type	For Conversion from ANSWT	For Conversion from AADT
Weekday**	0.99028	0.95310
Friday	1.24945	1.20254
Saturday	1.21426	1.16868
Sunday	1.11364	1.07183

* Factors are based on TLM EAC county ATR data from 1999 through 2001.
** Average Monday through Thursday.

HPMS Adjustment for TDM Future Year VMT
For air quality analyses, TDM network traffic assignment VMT are adjusted to consistency with HPMS VMT. For TDM model analysis years where historical official HPMS VMT estimates are available, county HPMS VMT control totals are disaggregated to the network links proportionally to the model VMT (including the intrazonal estimate) on each link. A different adjustment must be made for the future years.

The HPMS adjustment for the future year network (including intrazonal) VMT is performed using the TDM validation year (i.e. 1990 for the Tyler networks and 1994 for the Longview networks) HPMS factor. This factor is the ratio of the validation year HPMS ANSWT VMT (adjusted to ANSWT form with ATR-based "AADT to ANSWT factor") to the validation year TDM ANSWT VMT (including the intrazonal estimate). The calculation of this factor is shown below and the actual values used in this calculation are shown in Table 6.

$$\text{HPMS VMT (AADT)} \times \text{ANSWT Adjustment Factor} = \text{HPMS VMT (ANSWT)}$$

$$\text{HPMS VMT (ANSWT)} / \text{Model VMT (ANSWT)} = \text{HPMS Factor}$$

Table 6
HPMS Factor Values for Tyler and Longview TDMs

County	AADT HPMS VMT	ANSWT Adjustment Factor	ANSWT HPMS VMT	Model VMT	HPMS Factor
Tyler	4,764,830.0	1.01141	4,819,196.7	4,449,863.9	1.08299867
Longview	3,289,399.0	0.92772	3,051,641.2	3,435,177.4	0.88835041

Estimation of TDM-Based County VMT Totals
To calculate the HPMS consistent TDM-based county VMT totals for each evaluation year and day type, three main steps were applied. First, the seasonal day-type specific 1995, 1999, 2005, and 2007 evaluation year VMT were estimated. Since a 1995 TDM was not available, the 1994 (Longview) and 1990 (Tyler) networks were used to estimate the 1995 VMT. In a similar manner the 2005 networks for both Tyler and Longview were used to estimate the 1999 and 2002 VMT. Next, growth rates were estimated for use in factoring the 2015 network link VMT estimates to the 2012 intermediate year VMT values. Finally, the adjustment factor sets were applied to the appropriate networks to produce the August day-type link VMT for each county for the remaining evaluation years (hourly and directional factors are discussed later).

Since TDMs do not assign intrazonal VMT to the network links, intrazonal VMT is estimated and assigned a link (i.e. A-node = B-node = zone centroid). Each of the 24-hour TDM network data sets were processed to produce link estimates for total ANSWT VMT to include both the network and intrazonal VMT (which is assumed to be a part of the "local" road type VMT estimate). The intrazonal VMT is estimated as the product of the number of intrazonal trips, the average intrazonal travel time, and the average of the zone's coded centroid connector link speeds.

For the 1995 and1999 evaluation years, the official historical HPMS AADT VMT estimates are available. To estimate the 1995 link VMT, county-level seasonal day type-adjusted HPMS VMT control totals were used. These control totals were disaggregated to the 1990 TDM network (Tyler) and the 1994 TDM network (Longview) assignment links proportionally to the unadjusted model (and added intrazonal) VMT on each link. These 1995 seasonal day-type control totals are calculated by multiplying the 1995 county HPMS AADT VMT total by the seasonal day-type factor (for AADT, see Table 5 above). This calculation was performed for each of the four day types and each county (Gregg and Smith) to produce a total of eight control totals. the 1999 link VMT was estimated in a similar matter using the 1999 county HPMS AADT VMT and the 2005 networks (one for Tyler), one for Longview).

For the 2005 and 2007 evaluation year, the link VMT estimates were calculated by multiplying the unadjusted TDM link (and intrazonal) VMT by two factors: the TDM validation year county-level HPMS factor (described above), and the Northeast Texas region-level seasonal day type factor (for ANSWT, Table 5 above).

To estimate the link VMT for the intermediate years (2002 and 2012) growth rates for Longview and Tyler were developed (i.e, four different growth rates). The growth rates were computed using the HPMS consistent link and intrazonal TDM VMT estimates from the 1999 and 2005 VMT estimates (2002 analysis year) and from the 2007 and 2015 VMT estimates (2012 analysis year). These growth rateswere then transformed to a factor used to convert the 2005 link VMT estimates to the 2002 link VMT estimates and the 2015 link VMT estimates to the 2012 link VMT estimates. This conversion factor is calculated as the annual growth rate to the power of the target year minus the base year (i.e., 2002 conversion factor = $[1.01829773]^{1999-2005}$). The growth rates and conversion factors for both Tyler and Longview are shown in Table 7.

Table 7
Estimated Annual Growth Rates and Conversion Factors

Years	Growth Rate		Conversion Factor	
	Tyler	Longview	Tyler	Longview
1999 - 2005	1.00887189	1.01402072	0.97384970	0.995909034
2007 - 2015	1.01364677	1.00397162	0.96015219	0.98817917

* Applied to the 2005 TDM for the 2002 analysis year and the 2015 TDM for the 2012 analysis year.

The 2002 link-VMT estimates were calculated by multiplying the 2005 network and intrazonal unadjusted link VMT by the validation year HPMS factor, the 2005 to 2002 conversion factor, and the August day type factor. This procedure was performed for each of the four August day type factors to produce the August Weekday, Friday, Saturday, and Sunday link-VMT estimates for each county. the 2012 link-VMT estimates were calculated in a similar manner using the 2015 network and intrazonal VMT, HPMS factor, 2015 to 2012 conversion factor and the August day type factor.

The fully adjusted county-level evaluation year August Weekday, Friday, Saturday, and Sunday VMT totals are summarized in Tables 1 through 4, respectively.

Estimation of HPMS-Based County VMT Totals

The base link VMT for the HPMS-based counties is AADT. The 1995 and 1999 evaluation years base-VMT estimates are the respective evaluation year historical HPMS VMT totals for each county. For the evaluation years with no historical HPMS AADT VMT estimates available, HPMS AADT forecasts were made.

TxDOT HPMS AADT VMT data for each county for 1990 through 2000, in combination with official (i.e., U.S. Census and TSDC) county population statistics and projections, were used to develop VMT forecasts. More specifically, there are conceptually two types of VMT — local and through. Local VMT is generated by the residents of the county. Through VMT is generated by persons and vehicles passing through the county. The relative importance varies by the proximity of the county to large urban areas (that generate substantial VMT of their own).

Theoretically, local VMT is more closely related to population, while through VMT is more closely related to historical VMT. Though these distinctions are not absolute (i.e., local VMT is not independent of historical patterns and through VMT is not independent of county population), they imply very different strategies for forecasting. Local VMT is likely to be a function of population, while through VMT is likely to be a function of historical VMT (i.e., growth). If used alone, however, each tends to err in a different direction. Population-based forecasts (i.e., VMT per capita) tend to under estimate future VMT, especially in small counties adjacent to large urban areas. Conversely, historical-based (i.e., growth trend) forecasts tend to over estimate future VMT, especially in areas where there has been recent atypical rapid growth.

Viewed differently, however, these two forecast strategies define the boundaries of the forecast, that is, defining a range that will produce credible results. Consequently, the strategy adopted for the HPMS-based counties (Harrison, Rusk and Upshur) was to use the midpoint of the two forecasts. In other words, both methods were used. First, a forecast was developed for each county with a per capita-based method using a VMT to population ratio (based on 1990 through 2000 population and VMT) applied to future official TSDC population projections. Next, a traditional regression analysis was performed on the historic HPMS VMT data from 1990 to 2000 to develop coefficients that were then used to forecast future VMT for each county.

Then, the two forecasts were combined and the midpoint calculated. The midpoint of the two methods was used as the forecast VMT value for each county for each forecast year.

Table 8 shows the county level AADT VMT estimates, 1999 official historical and future year forecasts.

Table 8
County-Level HPMS Historical and Forecast AADT VMT Estimates

Year	Harrision	Rusk	Upshur
1995	2,389,314	1,315,503	865,013
1999	2,756,142	1,424,111	957,945
2002	3,003,040	1,474,083	1,026,582
2005	3,171,941	1,515,088	1,081,318
2007	3,284,829	1,543,061	1,118,604
2012	3,567,642	1,614,224	1,211,833

These AADT estimates were adjusted to each of the four August day type control total values (VMT shown in Tables 1 through 4) using the seasonal day type factors for conversion of VMT from the AADT form (Table 5). To allocate county control total VMT to the HPMS virtual links, historical official HPMS functional class and area type AADT VMT proportions were used. The latest available historical HPMS AADT VMT proportions (2001) were used for the forecast evaluation years.

Hourly Travel and Directional Factors

Emissions estimates are required by hour during August for each of the four day types. Since the VMT forecasts are 24-hour estimates, hourly travel factors are required to apportion the VMT to each hour of the day.

TxDOT continuous ATR data (for 1999 through 2001) from the Northeast Texas EAC counties were aggregated to develop regional level hourly travel factors for application at the county level. Hourly travel factors were developed for each of the four day types. Using the August day type-specific volumes, these factors are the ratio of hourly volumes to 24-hour volume. Table 9 shows the hourly travel factors for the Northeast Texas EAC counties.

The Northeast Texas region hourly factors were applied to the 24-hour link VMT estimates for each county to produce the hourly link VMT estimates for each of the four day types. The same set of hourly factors were applied for all evaluation years.

Table 9
Hourly Travel Factors* for the Northeast Texas Counties

Hour	Weekday**	Friday	Saturday	Sunday
6:00 a.m.	0.03429	0.02781	0.02201	0.01618
7:00 a.m.	0.05025	0.04115	0.03042	0.02084
8:00 a.m.	0.04905	0.04145	0.03993	0.02898
9:00 a.m.	0.05116	0.04474	0.04812	0.04066
10:00 a.m.	0.05368	0.04838	0.05707	0.05128
11:00 a.m.	0.05691	0.05251	0.06188	0.06064
12:00 p.m.	0.05854	0.05555	0.06248	0.06697
1:00 p.m.	0.06009	0.05756	0.06286	0.07096
2:00 p.m.	0.06332	0.06141	0.06355	0.07149
3:00 p.m.	0.06725	0.06676	0.06465	0.07293
4:00 p.m.	0.06871	0.06788	0.06351	0.07149
5:00 p.m.	0.07047	0.06939	0.06214	0.06992
6:00 p.m.	0.05754	0.06505	0.05801	0.06420
7:00 p.m.	0.04570	0.05653	0.05263	0.05588
8:00 p.m.	0.03865	0.04951	0.04561	0.04477
9:00 p.m.	0.03359	0.04434	0.04105	0.03736
10:00 p.m.	0.02784	0.03882	0.03465	0.02971
11:00 p.m.	0.02195	0.03115	0.02849	0.02238
12:00 a.m.	0.01724	0.01524	0.02422	0.02578
1:00 a.m.	0.01440	0.01320	0.01926	0.02092
2:00 a.m.	0.01295	0.01156	0.01593	0.01840
3:00 a.m.	0.01232	0.01101	0.01294	0.01363
4:00 a.m.	0.01374	0.01201	0.01314	0.01227
5:00 a.m.	0.02037	0.01701	0.01547	0.01239

* Based on 1999 through 2001 Northeast Texas 5-county region aggregate ATR count data.
** Average Monday through Thursday.

The VMT were apportioned by direction to allow for differences in congestion levels based on the direction of traffic flow. Directional volumes are required for modeling directional operational speeds, discussed in the next section. The directional split ratio applied for the HPMS-based counties is 60/40 based on aggregate observed values for areas where data are available. The directional splits used for the TDM-based counties vary by network functional classification and area type and by peak and off-peak travel periods. The directional splits and their corresponding travel periods for the TDM-based analysis are listed in Appendix C.

Tables 10 and 11, respectively, show the TDM network functional classes and area types for both the Tyler and Longview TDMs. Table 12 shows the HPMS functional classes and area types.

Table 10
TDM Network Functional Classifications

Functional Class Code	Tyler TDM Functional Class Name	Longview TDM Functional Class Name
0	Centroid Connector	Centroid Connector*
1	Radial Freeway	Interstate
2	Divided Circular Principal Arterial	Divided Major Highway
3	Divided Principal Arterial	Undivided Major Highway
4	Undivided Principal Arterial	Divided Principal Arterial
5	Divided Minor Arterial	Undivided Principal Arterial
6	Undivided Minor Arterial	Divided Minor Arterial
7	Collector	Undivided Minor Arterial
8	N/A	Divided Collector
9	N/A	Undivided Collector
40	Intrazonal	N/A

* Includes intrazonal VMT.

Table 11
TDM Network Area Types

Area Type Code	Tyler TDM Area Type Name	Longview TDM Area Type Name
1	CBD	CBD
2	Urban	Urban
3	Urban South	Suburban
4	Suburban	Rural
5	Rural	N/A

Table 12
HPMS Functional Classes and Area Types

HPMS Area Type*	HPMS Roadway Functional Classification						
Rural Small Urban Urban	Interstate	Freeway	Other Principal Arterial	Minor Arterial	Major Collector	Minor Collector	Local

* For this analysis, the Urban area type is for population of 50,000 +.

Hourly and 24-hour VMT summaries (by day type, road type, and vehicle type) are included with the EI data previously provided on CD-ROM. Appendix A lists the electronic data files with descriptions.

ESTIMATION OF SPEEDS

Speed is a critical parameter for estimating emissions. Similarly, capacity and freeflow speed (and traffic volume, as discussed in the previous section) are critical parameters for determining speed. Capacity is the maximum flow past a given point on a roadway. It varies by the type of roadway (i.e., by functional classification). Freeflow speed is the maximum speed that traffic will move along a given roadway if there are no impediments (e.g., congestion, bad weather).

To estimate a link's (or "virtual" link, for the HPMS-based analyses) directional, time-of-day congested speed, a speed model involving both the estimated freeflow speed and estimated directional delay as a function of volume and capacity for the link and time-period is applied. The model is applied to each link (except for TDM centroid connectors and the special intrazonal links) for each time period and direction. Development of the link capacities and freeflow speeds input to the speed model is first discussed, followed by the model delay and congested speed equations.

Capacities and Freeflow Speeds for HPMS-Based Analysis

The capacities and freeflow speeds used for the HPMS-based county analyses all come from the Highway Capacity Manual (HCM). For HPMS functional classifications 1 and 2 (interstate and freeway), both capacities and freeflow speeds are taken directly from the HCM (3-3). The capacity (2,200 passenger cars per hour per lane [pcphpl]) and freeflow speed (70 mph) for four-lane freeways was used for all interstates, regardless of area type. Similarly, a freeflow speed of 65 mph and capacity of 2,100 pcphpl was used for all freeways (HCM figure 3-2a).

HPMS functional classifications 3, 4, 5, 6, and 7 (principal arterial, minor arterial, major collector, minor collector, and local) have traffic control devices (i.e., signals or stop signs) that determine their capacities. The capacities of these signalized roadways were calculated based on signalized intersection capacity defined as shown (HCM 1994: 9-5, equation 9-3):

$$Ci = Si \times (gi/C).$$

Where:

Ci	=	capacity of lane group i, vehicles per hour (vph);
Si	=	saturation flow rate of lane group i, vehicles per hour of effective green time (vphg); and
gi/c	=	effective green ratio for lane group i.

The saturation flow rate (Si) is the flow in vph that could be accommodated by the lane group assuming that the green phase was always available to the lane group (i.e., green ratio = 1.0). Computation of the adjusted saturation flow rate begins with the ideal saturation flow rate of 1,900, which is adjusted to reflect variance from ideal conditions. The saturation flow rate was adjusted for area type using the following assumptions (HCM 1994: 9-14, equation 9-12):

$$S = N \times fw \times fhv \times fg \times fp \times fbb \times fa \times frt \times flt.$$

Where:

S	=	saturation flow rate factor (rounded to two decimal places);
N	=	number of lanes in the lane group;

fw = lane width adjustment factor (12-foot lane for all area types assumed);
fhv = heavy vehicle adjustment factor (5 percent heavy vehicles for all area types to adjust for passenger car equivalents, not to be confused with VMT mix);
fg = approach grade factor (level terrain assumed for all area types);
fp = parking lane adjustment (none for rural areas, one maneuver per hour for urban areas);
fbb = bus blocking factor (none for rural areas, 10 per hour for urban areas, mid-point for small urban areas);
fa = area type adjustment (0.9 for urban area, 1.0 for all other areas);
frt = right turn adjustment factor (shared lane for right turns for all area types, high pedestrian crossing for urban areas, moderate for small urban areas, and low for rural); and
flt = left turn adjustment factor (exclusive left turn lanes and protected phasing for rural areas, shared left turn lanes and protected plus permitted phasing for urban areas, mid-point for small urban areas).

Table 13 shows the saturation flow rate adjustment factors used for the three different area types.

Table 13
Saturation Flow Rate Adjust Factors by Area Type

Area Type	fw	fhv	fg	fp	fbb	fa	frt	flt
Rural	1	0.95	1	1	1	1	0.98	0.95
Small Urban	1	0.95	1	0.98	0.98	1	0.94	0.90
Urban	1	0.95	1	0.95	0.96	0.90	0.90	0.85

Table 14 shows the effective green ratios used for different functional classes. The same ratios were used for all area types. (Interstates and freeways are unsignalized and do not require green ratios.)

Table 14
Effective Green Ratios (gi/C) by HPMS Roadway Functional Classification

Principal Arterial	Minor Arterial	Major Collector	Minor Collector	Local
0.60	0.55	0.50	0.40	0.30

Table 15 shows the adjusted saturation flow rate (expressed in pcphpl) for all signalized streets (i.e., not interstate or freeway) for the three area types.

Table 15
Adjusted Saturation Flow Rate (pcphpl) by Area Type

HPMS Area Type	Ideal Flow	Adjustment Factor	Adjusted Saturation Flow
Rural	1,900	0.88	1,672
Small Urban		0.77	1,463
Urban		0.59	1,121

The freeflow speed for rural and urban arterials (FC-3 and FC-4) were taken directly from HCM (HMC 1994: 7-10 and 11-6, respectively). The freeflow speed for other functional classes decreases from arterial freeflow speed by 5 mph increments. No freeflow speed is below 30 mph. Table 16 shows the hourly lane capacities for all functional classes and area types.

Table 16
Hourly Lane Capacities (vehicles per hour per lane [vphpl])

HPMS Area Type	HPMS Roadway Functional Classification						
	Interstate	Freeway	Other Principal Arterial	Minor Arterial	Major Collector	Minor Collector	Local
Rural	2,200	2,100	1,003	920	836	669	502
Small Urban	2,200	2,100	878	805	732	585	439
Urban	2,200	2,100	673	617	561	448	336

Similarly, freeflow speeds are provided for each of the three area types and seven roadway functional classifications (or 21-HPMS virtual links). Table 17 shows the freeflow speeds.

Table 17
Freeflow Speeds (mph)

HPMS Area Type	HPMS Roadway Functional Classification						
	Interstate	Freeway	Other Principal Arterial	Minor Arterial	Major Collector	Minor Collector	Local
Rural	70	65	55	50	40	35	30
Small Urban	70	65	45	40	35	30	30
Urban	70	65	40	35	30	30	30

V/C ratios were generated for each combination of time period, roadway functional classification, area type, and direction using these capacities and VMT. The following describes the calculation for this procedure:

- Volume: VMT was multiplied by each 24 hourly time period factor yielding VMT for each time period. VMT per time period was divided by centerline miles, yielding volume for each time period. This procedure was performed for each combination of time period, roadway functional classification, area type, and direction.

- Capacity: Lane miles were divided by centerline miles to produce lanes. Lanes were multiplied by the lane capacities (i.e., adjusted saturation flows) generated by the process described above, producing hourly lane capacities. Hourly lane capacities were multiplied by the number of hours in the time period to produce time period capacities. This procedure was performed for each combination of time period, roadway functional classification, and area type. (Capacity is the same for each direction.)

- V/C ratios: The speed model was applied to the resulting volumes and capacities for each functional classification and area type combination. This yields volumes adjusted for the impact of congestion-related delay for each combination of time period, functional classification, area type, and direction.

Capacities and Freeflow Speeds for the TDM-based Analysis

The Tyler and Longview TDM network 24-hour equilibrium assignments were performed using nondirectional 24-hour capacities. Time-of-day (i.e., hourly) capacity factors were applied to nondirectional capacity (or service volume) for the 24-hour assignment time period. In computing the directional v/c ratio for estimating the directional speeds, the directional split for capacity is assumed at 50-50. The network was processed to compute the average capacity per lane by functional classification and area type. Appendix D summarizes the capacity factors, which are computed as follows:

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

Freeflow speed factors are used to convert TDM level-of-service (LOS) C speeds to LOS A (i.e., freeflow) speeds. The freeflow speed factors for the Tyler and Longview TDMs by area type and functional classification are shown in Appendix D.

With the freeflow speeds and hourly, directional volumes and capacities on each link, the congested speeds may be computed.

Estimation of Congested Speeds

The congested speed model first calculates delay on the link which it then applies to the link freeflow speed to compute the link operational congested speed estimate. The volume/delay equation is:

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

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. There is a set of parameters for high-capacity facilities and a set for low-capacity facilities (see Table 18). The high-capacity facility types are radial freeway for the Tyler network and interstate for Longview. The remaining facility types (except for centroid connector and intrazonal, which do not use capacity data) are low-capacity facilities. The HPMS high-capacity facilities are interstate and freeway classifications.

Table 18
Volume/Delay Equation Parameters

Facility Category	A	B	M*
High Capacity Facilities (> 3,400 vph one way, 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

* For HPMS, M values are 3.0 for high capacity and 5.0 for low capacity facilities.

Given the estimated directional delay (in minutes/mile) and the estimated freeflow speed, the directional congested speed is computed as follows:

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

This model is applied to each link, based on functional class and area type, for each time period and each direction.

TDM Centroid Connector and Intrazonal Speeds
For the centroid connector links and intrazonal links (intrazonal links are developed specifically for air emissions analyses), capacity data are not used. 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 are included in the set of data files previously provided on CD-ROM (see Appendix A for electronic data descriptions). Tables 1 through 4 summarize the TLM EAC county 24-hour average speeds calculated as total VMT divided by total VHT.

VMT MIX
VMT mix for 1995, 1999, 2002, 2005, 2007, and 2012 were estimated using TxDOT 1997 - 1999 vehicle classification data for 1995 and 1999 and TxDOT 1997 - 2001 vehicle classification data for subsequent years. As was the case with the seasonal adjustment factor for the VMT estimation procedure, the five-county Northeast Texas region 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 19). The FHWA axle/vehicle length based classification categories must be converted into 28 MOBILE GVWR/fuel type-based categories.

Table 19
EPA Vehicle Types - 28 Categories

Category	Description	GVWR
LDGV	Light-duty gasoline vehicle	$\leq$ 6,000
LDGT1	Light-duty gasoline truck	$\leq$ 6,000
LDGT2	Light-duty gasoline truck	$\leq$ 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	$\leq$ 6,000
LDDT12	Light-duty diesel truck	$\leq$ 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

The FHWA category counts (based on number of axles or vehicle length) are first converted into categories (based on GVWR). Vehicle classification counts are 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 is followed by a second intermediate allocation that separates light-duty vehicles (LDV) into passenger cars and light-duty trucks (LDT) based on TxDOT registration data:

LDV	0.657 × PV (by county, 1999 Gregg registration data shown); and
LDT	0.343 × PV (by county, 1999 Gregg registration data shown).

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

LDT1	0.823 × LDT (by county, 2002 Gregg registration data shown); and
HLDT	0.177 × LDT (by county, 2002 Gregg registration data shown).

Next, the remaining FHWA categories are 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 are used. As before, actual TxDOT vehicle registration data are used to separate gasoline from diesel heavy-duty trucks. Note also that motorcycles are not counted separately and are included as a default (subtracted from LDGV):

LDGV	0.9972136 × LDV (MOBILE6 default for 1999 shown);
LDDV	0.0027864 × LDV (MOBILE6 default for 1999 shown);
LLDT	0.9936534 × LDT1 (MOBILE6 default for 1999 shown);
LDDT	0.0063466 × LDT1 (MOBILE6 default for 1999 shown);
HDGV	0.339 × HDV (by county, 1999 Gregg registration data shown);
HDDV	0.661 × HDV (by county, 1999 Gregg registration data shown); and
MC	0.001 of total (subtracted from LDGV).

This converts the FHWA axle count-based categories into GVWR categories. This part of the conversion procedure is summarized schematically in Table 20. 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 allocate these categories using TxDOT registration data. Finally, Step 4 allocates light-duty vehicles by fuel type using EPA MOBILE diesel fractions and motorcycles are separated from light-duty gasoline vehicles using a nominal constant.

Table 20
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="10">Total Vehicles</td><td rowspan="6">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>

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

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

The 28-category EPA scheme also further divides the two LDT categories based in part on assumed loading. The previous LDGT1 and LDGT2 categories (previously defined as GVWR ≤ 6,000 and GVWR > 6,000 to 8,500, respectively) are 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 are 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 are 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 is sub-divided into two categories based on GVWR (less than or equal to 6,000 GVWR and 6,000 to 8,500 GVWR). This is accomplished using EPA MOBILE6 default values for the year of interest.

Finally the three bus categories are 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 VMT mix estimates (for both historical and future analysis years), MOBILE6 default values consistent with each analysis year are used. No other adjustments are made to alter the count data and conversion procedure to accommodate future years or historical years. Table 21 shows the VMT mix estimation procedure summary followed by explanatory notes. VMT mix estimates were developed for three functional classification groups (identified later in the "Emissions Estimation" section of this report).

This procedure is performed as described for weekdays. TxDOT vehicle classification data are only collected for weekdays (Monday through Thursday), consequently other data is 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 is applied to the weekday VMT mix to produce region specific Friday, Saturday and Sunday VMT mix. (No seasonal changes are assumed.) Appendix E contains the estimated VMT mixes.

Table 21
VMT Mix Estimation Procedure Summary

EPA-8	EPA-28	Conversion
LDGV	LDGV	.9972 × LDV
LDGT1	LDGT1	.2310 × LLDT
	LDGT2	.7690 × LLDT
LDGT2	LDGT3	.6850 × HDLT
	LDGT4	.3150 × HDLT
HDGV	HDGV2b	.415 × HDGV
	HDGV3	.196 × HDGV
	HDGV4	.098 × HDGV
	HDGV5	.057 × HDGV
	HDGV6	.141 × HDGV
	HDGV7	.049 × HDGV
	HDGV8a	.039 × HDGV
	HDGV8b	.005 × HDGV
	HDGB	.2045 × B
LDDV	LDDV	.0028 × LDV
LDDT	LDDT12	.1623 × LDDT
	LDDT34	.8377 × LDDT
HDDV	HDDV2b	.386 × HDDV
	HDDV3	.143 × HDDV
	HDDV4	.069 × HDDV
	HDDV5	.053 × HDDV
	HDDV6	.160 × HDDV
	HDDV7	.085 × HDDV
	HDDV8a	.104 × HDDV
	HDDV8b	HDX
	HDDBT	.3253 × B
	HDDBS	.4702 × B
MC	MC	MC

Notes to VMT Mix Estimation Procedure Summary

Intermediate category factors and sources:

LDV	.657 × PV (by county, 1999 Gregg registration data shown)
LDT	.343 × PV (by county, 2002 Gregg registration data shown)
LDT1	.823 × LDT (by county, 2002 Gregg registration data shown)
HLDT	.177 × LDT (by county, 1999 Gregg registration data shown)
LLDT	.9937 × LDT1 (EPA MOBILE6 default)
LDDT	.0063 × LDT1 (EPA MOBILE6 default)
HDV	SU2+SU3+SU4+SE3+SE4
HDX	SE5+SE6+SD5+SD6+SD7
HDGV	.339 × HDV (by county, 1999 Gregg registration data shown)
HDDV	.661 × HDV (by county, 1999 Gregg registration data shown)

Category conversion factors and sources:

LDGV	.9972 × LDV (EPA MOBILE6 default, 1999 shown)
LDGT1	.2310 × LLDT (EPA MOBILE6 default, 1999 shown)
LDGT2	.7690 × LLDT (EPA MOBILE6 default, 1999 shown)
LDGT3	.6850 × HLDT (EPA MOBILE6 default, 1999 shown)
LDGT4	.3150 × HLDT (EPA MOBILE6 default, 1999 shown)
HDGV2a	.415 × HDGV (Northeast Texas region registration data)
HDGV3	.196 × HDGV (Northeast Texas region registration data)
HDGV4	.098 × HDGV (Northeast Texas region registration data)
HDGV5	.057 × HDGV (Northeast Texas region registration data)
HDGV6	.141 × HDGV (Northeast Texas region registration data)
HDGV7	.049 × HDGV (Northeast Texas region registration data)
HDGV8a	.039 × HDGV (Northeast Texas region registration data)
HDGV8b	.005 × HDGV (Northeast Texas region registration data)
HDGB	.2243 × B (EPA MOBILE6 default, 1999 shown)
LDDV	.0028 × LDV (EPA MOBILE6 default, 1999 shown)
LDDT12	.2723 × LDDT (EPA MOBILE6 default, 1999 shown)
LDDT34	.7277 × LDDT (EPA MOBILE6 default, 1999 shown)
HDDV2b	.386 × HDDV (Northeast Texas region registration data)
HDDV3	.143 × HDDV (Northeast Texas region registration data)
HDDV4	.069 × HDDV (Northeast Texas region registration data)
HDDV5	.053 × HDDV (Northeast Texas region registration data)
HDDV6	.160 × HDDV (Northeast Texas region registration data)
HDDV7	.085 × HDDV (Northeast Texas region registration data)
HDDV8a	.104 × HDDV (Northeast Texas region registration data)
HDDV8b	HDX (TxDOT classification counts)
HDDBT	.3240 × B (EPA MOBILE6 default, 1999 shown)
HDDBS	.4517 × B (EPA MOBILE6 default, 1999 shown)
MC	MC (default subtracted from LDGV, no conversion)

ESTIMATING EMISSIONS FACTORS

The MOBILE6 model (October 2002) was applied to calculate day-of-week-specific 1995, 1999, 2002, 2005, 2007, and 2012 emissions factors (in grams per mile [g/mi]) of VOC, CO, and NOx. As distinguished by the available climatic input data (temperature and humidity), emissions factors are developed for Smithy County and for the remaining four-county group (Gregg, Harrison, Rusk and Upshur). Emissions factors are estimated by speed, emissions type (i.e., emissions factor sub-component), hour, MOBILE6 road type (or drive cycle), and vehicle type. The average emissions factors for each of the 28 vehicle types are developed by combining the MOBILE6 database output by-model-year emissions factors weighted by their corresponding travel fractions. The emissions factors are organized in the form of “look-up” tables.

The MOBILE6 model is equipped with national (or EPA) default modeling values for a wide range of conditions that affect emissions factors. In fact, the only actual data parameters requiring user-input values to run the model are fuel Reid Vapor Pressure (RVP), temperature, and calendar year. Many MOBILE6 default modeling parameters may be overridden through the use of MOBILE6 commands and their associated inputs and options. For this analysis, particular MOBILE6 defaults were replaced by local input values that were developed to yield emissions factors characteristic of the August 1999 ozone episode climatic conditions, evaluation-specific vehicle fleets, activity, and emissions control programs.

The following emissions factors documentation discusses the MOBILE6 input/output files, summarizes the control programs modeled, details the aggregation level of the applied MOBILE6 emissions factors, and briefly describes all of the MOBILE6 commands that may affect emissions factor calculations. It also identifies the commands that were applied, explains the development of the locality-specific inputs, and describes the emissions factor post-processing procedure.

MOBILE6 Input and Output Files

The MOBILE6 commands and some 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 (see program descriptions in Appendix B) was applied to run MOBILE6 with the user-input command and external data files to produce VOC, CO, and NOx emissions factor tables. (The RATEADJV6 program was applied to POLFAC62 output where post-processing of emissions factors was required, discussed later.) The final product of the emissions factor modeling is eight hourly emissions factor files (one per episode day each for Smith County and for the other four grouped-counties) for each of the six evaluation years.

All of the MOBILE6 input files and output files (MOBILE6 emissions factor tables developed with POLFAC62, and RATEADJV62) are included in the set of data files previously provided on CD-ROM. Appendix A describes the electronic data submittal.

Control Programs Modeled (And Emissions Factor Post Processing Summary)
All federal motor vehicle control programs, particular to evaluation year, were modeled (this is the MOBILE6 default). Also modeled were the federal programs to offset HDDV defeat device effects — the low emissions rebuild program, and the HDDV 2004 standard pull-ahead program (this is the MOBILE6 default). The Texas Regional Low Reid Vapor Pressure Gasoline Program and Texas LED Program were modeled as well. Emissions reduction estimates for the vehicle Anti-tampering Program (ATP), although administered statewide, are credited only to those counties with enforced Inspection and Maintenance (I/M) Programs, which excludes the Northeast Texas region counties.

Post-processing of MOBILE6 emissions factors was performed for modeling LED (required for 2005, 2007, and 2012) for the region. The procedures used to overcome the limits of MOBILE6 as related to the diesel fuel modeling requirements for this analysis are discussed in detail later in this section.

Aggregation Level of MOBILE6 Emissions Factors
The by-model-year emissions factors from the MOBILE6 database output format are condensed into average fleet emissions factors by vehicle class. This is performed by multiplying each by-model-year emissions factor by its corresponding travel fraction 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-specific emissions types, and
- 24 hourly time periods.

Tables 22 through 24 describe the MOBILE6 vehicle type, emissions type (pertaining to VOC, CO, and NOx pollutants only), and roadway type classifications. Tables 25 and 26 show the speeds and sequence for hourly time periods, respectively.

Table 22 shows the 28 MOBILE6 vehicle types as defined by fuel-type (gasoline or diesel) and GVWR category, in sequence by EPA vehicle type number.

Table 22
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 23 shows the eight MOBILE6 emissions type classifications (excluding the non-pertinent pollutants). 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, POLFAC62 calculates MOBILE6 emissions factors for up to 15 pollutant-specific emissions types. For this analysis, 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 23
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. Table 24 provides descriptions of the driving cycle (or roadway type). 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.

The POLFAC62 emissions factor table, 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 to facilitate the geographical allocation of the link-emissions estimates by the roadway link coordinates.

Table 24
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 25 shows the 14 speeds used for calculating and tabulating the MOBILE6 Freeway and Arterial emissions factors. 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 25
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 26 shows the MOBILE6 sequence for hourly inputs.

Table 26
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 27 through 33 lists and describes all of the MOBILE6 commands that may affect calculating emissions factors (and some commands that affect only 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 generally labeled as either EPA default, locality-specific, or NOT APPLIED. The commands where the associated input parameters are labeled only as "EPA default" are generally not input for this analysis.

The procedures used to develop the locality-specific inputs to MOBILE6 are detailed after the following seven MOBILE6 input category tables.

Table 27
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.	"VOC" command is applied. Only the command is required.
NO REFUELING	Directs MOBILE6 not to calculate refueling emissions factors.	This command is 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 are assumed.)

Table 28
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).	1995, 1999, 2002, 2005, 2007, 2012.
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.)	One set for all counties by 1999 episode day, developed by TCEQ. The hourly input sequence is 6 a.m. to 12 a.m. followed by 12 a.m. to 6 a.m. for the same day. Smith County temperatures applied for Smith County emissions factors, Gregg County temperatures used for Gregg, Harrison, Rusk, and Upshur.
ALTITUDE	Specifies high- or low-altitude for modeling area.	NOT APPLIED. (EPA default, low altitude, is 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: CLOUD COVER PEAK SUN SUNRISE/SUNSET	Commands used by MOBILE6 to model the extent of vehicle air-conditioning usage. Specifies average percent cloud cover for given day. Specifies Mid-Day hours with peak sun intensity. Allows user to specify time of sunrise and sunset.	 NOT APPLIED. (EPA default assumed.) NOT APPLIED. (EPA default assumed.) Region-specific, 7 a.m. 8 p.m., TCEQ.
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.	One set for all counties by 1999 by episode day, developed by TCEQ. The hourly input sequence is 6 a.m. to 12 a.m. followed by 12 a.m. to 6 a.m. for the same day. Humidity data available from neighboring counties are used.
BAROMETRIC PRES	Specifies use of user input daily average barometric pressure for use with hourly relative humidity to calculate hourly absolute humidity values.	Used MOBILE6 default, 29.92 inches Mercury.

Table 29
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. Developed by TTI. Beginning in 2002, TxDOT mid-year registrations specify gasoline and diesel fueled vehicles for the eight HDV classes. Mid-year 2002 TxDOT registrations data (5-county group aggregate) are applied except for buses where the MOBILE6 default is used. The age distributions are assumed to be the same for all evaluation years.
DIESEL FRACTIONS	Permits user to supply locality-specific diesel fractions for 14 of the 16 composite vehicle categories by age.	Locality-Specific/EPA default. Developed by TTI. Mid-year 2002 TxDOT statewide registrations are used to develop the HDV diesel fractions (EPA defaults are applied for the remaining classes). For future year evaluations, the latest diesel fractions (2002) are used for each calendar year up to the future year of evaluation (e.g., 2003, 2004, 2005, 2006, 2007). For historical year evaluations, diesel fractions are produced by dropping the later year fractions from the 2002 diesel fractions data set, then applying the earliest model year fractions to each prior year back to the 25 years old and older category.
MILE ACCUM RATE	Allows the user to supply the annual mileage accumulation rates by vehicle type and age.	NOT APPLIED. (EPA defaults are 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 percentage of NGV vehicles in the fleet, zero, is 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, is assumed.)

Table 30
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 with no impact on this analysis. VMT mix is applied to link VMT outside MOBILE6 later in the process to calculate emissions by the 28 vehicle types.)
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 for aggregate results with no impact on this analysis.)
VMT BY HOUR	Allows VMT fractions allocation by hour-of-day; applied in conversion of grams per hour (g/hr) to g/mi, as well as in weighting of hourly g/mi rates to obtain daily emissions factors.	Region-specific. The hourly travel fractions (same as those used to distribute 24-hour link-VMT by hour of day) are based on 1999 through 2001, August five-county group ATR counts. One set each is applied for Weekday, Friday, Saturday, and Sunday. The same fractions are used for all years.
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. Same for all counties. Inputs are 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. (Used EPA weekday and weekend day-specific defaults — 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. (Used EPA weekday and weekend day-specific defaults — see technical report M6FLT.003.)
SOAK DISTRIBUTION	Allows use of alternate vehicle soak duration distributions for weekend days and weekdays.	NOT APPLIED. (Used EPA weekday and weekend day-specific defaults — 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. (Used EPA weekday and weekend day-specific defaults — see technical reports M6FLT.003 and 004.)
DIURN SOAK ACTIVITY	Allows diurnal soak time distributions input for each of 18 daily time periods.	NOT APPLIED. (The EPA defaults are 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. (The EPA defaults are assumed — see technical report M6FLT.005.)
WE EN TRI LEN DI	Allows alternate input of VMT fractions for trips of various lengths for weekend days.	NOT APPLIED.
WE VEH US	Directs MOBILE6 to use weekend activity data for calculating emissions factors.	Applied command for the weekend day analyses.

Table 31
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 ATP.	NOT APPLIED. (Although Texas administers a statewide ATP, ATP credit is only taken in those counties which also administer an enforced 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 32
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 and evaluation years, except 2002. Option 4: Applied for 2002 to allow use of summer 2002 baseline sample survey-based sulfur content value (166 parts per million [ppm]).
SULFUR CONTENT	(or GASOLINE SULFUR) Allows use of alternate sulfur content for conventional gasoline through calendar year 1999.	Appllied for 1999: used 304.3 ppm, based on TRW summer 1999 district gasoline sample survey data (Eastern Research Group [ERG], October 2002). (1995 assumes EPA default, 300 ppm.)
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, 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).	1995: 8.7 psi (regulated limit minus 0.3 default refiner safety margin) 1996: 1999: 7.6 psi (survey based) 2002 +: 7.6 psi (regulated limit minus 0.2 safety margin)
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 33
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	Turns off the effects of the HDD vehicle NOx off-cycle emissions effects (defeat device emissions).	NOT APPLIED.
NO NOX PULL AHEAD	Turns off HDD NOx emissions reduction effects of Pull- Ahead program.	NOT APPLIED.
NO REBUILD	Turns off HDD NOx emissions reduction effects of Rebuild program.	NOT APPLIED.
REBUILD EFFECTS	Allows user change Rebuild program effectiveness rate.	1995, 1999, and 2002: 0.01 (TCEQ 2001 estimate is assumed), 2005 +: 0.90 (EPA default is assumed).
Tier 2 Emission Standards and Fuel Requirements:	Allow the overriding of the default Tier 2 emissions standards and fuel requirements settings.	NOT APPLIED.
NO TIER2	Disables Tier 2 requirements.	
T2 EXH PHASE-IN	Allows alternate Tier 2 exhaust standard phase-in schedules.	
T2 EVAP PHASE-IN	Allows alternate Tier 2 evaporative standard phase-in schedules.	
T2 CERT	Allows user to specify alternate Tier 2 50,000-mile certification standards.	
94+ LDG IMPLEMENTATON	Allows use of alternate 1994 and later fleet penetration fractions for LDGVs under the Tier 1, NLEV (or California LEV 1), and Tier 2 emissions standard programs.	NOT APPLIED.
NO 2007 HDDV RULE	Disables 2007 HDV emissions standards.	NOT APPLIED.

External Conditions

MOBILE6 local inputs for hourly temperatures, daily average humidity, and sunrise and sunset times were developed by TCEQ from August 1999 ozone episode data and applied based on "local time."

Temperatures (HOURLY TEMPERATURES Command)
TCEQ developed one set of ambient hourly temperatures (degrees Fahrenheit) for input to MOBILE6 from weather monitors within Smith County (Tyler Pounds Field) and within Gregg County (Longview Airport). The data sources are the EPA Aerometric Information Retrieval System (http://www.epa.gov/airs), and the National Weather Service (http://www.nws.noaa.gov). Hourly temperatures from Gregg County were applied as input for the adjacent Northeast Texas region counties, Harrison, Rusk and Upshur.

The ozone episode modeling period for the Northeast Texas region is August 13, 1999 through August 22, 1999. Since the emissions estimation method calls for emissions estimates for four day types as opposed to for individual episode days, temperature data were selected from the modeling period to correspond with the day-type being modeled. The average weekday episode day was chosen as August 19 (a Thursday). The Friday, Saturday, and Sunday episode days were chosen as August 20, August 21 and August 22, respectively.

The temperatures were sequenced as required for input to MOBILE6 starting with the 6 a.m. hour. The temperatures are a MOBILE6 command file input. The same hourly temperatures were used for all analysis years. Appendix F presents a summary of the temperature inputs.

Relative Humidity (RELATIVE HUMIDITY Command)
The RELATIVE HUMIDITY command was applied to specify local hourly percent relative humidity values for the region.

The hourly relative humidity inputs were developed following the same procedure as described above for the hourly temperature input development, except that hourly humidity data were not available from within the five-county study area. TCEQ developed hourly humidity data values from neighboring county weather stations for use as input for the Northeast Texas region. For Smith County, hourly humidity values were averaged within each hour from Tarrant County, Texas, to the west and Caddo Parish, Louisiana, to the east. For Gregg County and the HPMS-based counties (Harrison, Rusk and Upshur), the hourly humidity values from Caddo Parish were used. The humidity parameter is input in the MOBILE6 command file. Appendix F summarizes the humidity values used (the same set are used for all evaluation years).

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 are the same for the region for all evaluations. The times were developed using data from the city of Longview. The data source is the U.S. Naval Observatory Astronomical Applications Department Internet site (http://aa.usno.navy.mil/). The times are 7 a.m. and 8 p.m. local time.

Vehicle Fleet Characteristics
Vehicle registration (age) distributions and diesel fractions inputs to MOBILE6 were developed from TxDOT mid-year 2002 county vehicle registration data for those vehicle types where TxDOT registrations data were available. EPA defaults were used where necessary. Due to sparse registration data for some vehicle classes resulting from the increased disaggregation level of the vehicle classifications in MOBILE6 (28 vehicle types versus the previous eight vehicle class scheme), the registrations data are grouped for the five-county area for developing the age distributions input, and grouped for the state for developing the diesel fractions inputs.

The application of local registration distributions and diesel fractions for these EI forecasts follows guidance in Technical Guidance on the Use of MOBILE6 for Emission Inventory Preparation (EPA, January 2002). Namely, this analysis uses the latest available registration data for estimating vehicle class age distributions, and uses the most recent diesel fractions available as the projected fractions for future years.

Vehicle Registration Distributions (REG DIST Command)
Table 34 shows the user-supplied vehicle registration distributions input to MOBILE6 by vehicle age for any of the 16 composite (combined gas and diesel) vehicle types. EPA default distributions are internally applied by MOBILE6 for vehicle classes where the user 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 age fractions start with the evaluation year as the 1st age fraction and work back in annual increments to end with the 25th fraction, which represents the fraction of vehicles of age 25 years and older. The fractions are calculated as the model year-specific registrations in a class divided by the total vehicles registered in that class.

Table 34
Composite Vehicle Classes for Vehicle Registration Data
(REG DIST Command)

Number	Abbreviation	Description
1	LDV	Light-Duty Vehicles (Passenger Cars)
2	LDT1	Light-Duty Trucks 1 (0-6,000 lbs. GVWR, 0-3,750 lbs. LVW)
3	LDT2	Light-Duty Trucks 2 (0-6,000 lbs. GVWR, 3,751-5,750 lbs. LVW)
4	LDT3	Light-Duty Trucks 3 (6,001-8,500 lbs. GVWR, 0-5,750 lbs. ALVW)
5	LDT4	Light-Duty Trucks 4 (6,001-8,500 lbs. GVWR, 5,751 lbs. and greater ALVW)
6	HDV2B	Class 2b Heavy-Duty Vehicles (8,501-10,000 lbs. GVWR)
7	HDV3	Class 3 Heavy-Duty Vehicles (10,001-14,000 lbs. GVWR)
8	HDV4	Class 4 Heavy-Duty Vehicles (14,001-16,000 lbs. GVWR)
9	HDV5	Class 5 Heavy-Duty Vehicles (16,001-19,500 lbs. GVWR)
10	HDV6	Class 6 Heavy-Duty Vehicles (19,501-26,000 lbs. GVWR)
11	HDV7	Class 7 Heavy-Duty Vehicles (26,001-33,000 lbs. GVWR)
12	HDV8A	Class 8a Heavy-Duty Vehicles (33,001-60,000 lbs. GVWR)
13	HDV8B	Class 8b Heavy-Duty Vehicles (>60,000 lbs. GVWR)
14	HDBS	School Buses
15	HDBT	Transit and Urban Buses
16	MC	Motorcycles (All)

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

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

- July 2002 registrations for:
  LDV, LDT12, LDT34, MC, HDGT, HDDT; and

- July 2002 registrations for:
  Gas: HDV2B, HDV3, HDV4, HDV5, HDV6, HDV7, HDV8A, HDV8B; and
  Diesel: HDV2B, HDV3, HDV4, HDV5, HDV6, HDV7, HDV8A, HDV8B.

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

First the county registrations data for the five counties were combined. There are three steps to developing the MOBILE6 registration distributions input for the 14 non-bus vehicle classes. The first step in the process develops the July 2002 registrations by the 25 age groups for 12 of the 16 composite (by fuel) vehicle classes (eight HDV, LDV, LDT12, LDT34, MC). The second step converts the registrations from numbers of vehicles registered, to fractions registered by age for each of these 12 classes. The registrations are then expanded from 12 to 14 vehicle classes.

The 16 HDV class registrations were combined into the MOBILE6 eight composite (gasoline and diesel) classes by summing the individual fuel type registrations by age within each weight category. The 1978 and older registrations were summed to yield the "age 25 and older" registrations for each of the 12 composite vehicle classes (i.e., the eight HDV classes plus LDV, LDT12, LDT34, and MC).

The conversion of the registrations from numbers of vehicles to fractions of vehicles by age was made for each vehicle class by dividing the registrations for each age by the total registrations. MOBILE6 requires that the age distribution fractions for each vehicle class sum to one. In this step the age distribution fractions for each class were summed. For sums not equal to one (due to rounding error), the largest registration fraction was adjusted to make the fractions sum to one.

The resulting July 2002 estimated Northeast Texas region registration distribution fractions for the 12 composite classes were then expanded to 14 classes by using the LDT12 age fractions, for the LDT1 and LDT2 classes and by using the LDT34 age fractions for the LDT3 and LDT4 classes. The MOBILE6 vehicle registration distributions are input from external data files. The external data files are on CD-ROM. Appendix A lists the data files. Appendix G shows the registration 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 user 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. For 1971 and earlier model years, the default diesel fractions are assumed the same as the 1972 model year fractions. For the 1997 and later model years, the default diesel fractions are assumed the same as the 1996 model year fractions.

TTI developed evaluation-year specific, state-level diesel fractions inputs for the analysis. One individual state-level set of diesel fractions was developed for each evaluation year. TTI used a combination of estimated TxDOT diesel fractions and EPA default diesel fractions for modeling the emissions factors. Table 35 shows the MOBILE6 diesel fractions input categories with corresponding data sources. The diesel fraction estimates were calculated based on TxDOT individual diesel and gasoline vehicle registrations for the eight HDV (HDV2b through HDV8b) weight classes. To produce the HDV diesel fractions by model year, the diesel registrations were divided by the sum of the gasoline and diesel registrations, by HDV composite vehicle class, and model year.

The HDV diesel fractions were forecast from 2002 to the future analysis years by applying the latest diesel fraction (2002) to each of the future years up to the analysis years. To estimate the 1995 and 1999 analysis years diesel fractions, the diesel fractions for later than each analysis year were dropped from each data set; the fractions for oldest model year in the data set, 1978, were applied to each of the earlier model years to complete the data set through 25 model years. The 1995, 1999, 2002, 2005, 2007, and 2012 estimated HDV diesel fractions were then combined with the corresponding evaluation year specific July EPA default diesel fractions for the remaining vehicle classes to produce the complete input data set for each evaluation year. Diesel fractions are entered in the MOBILE6 command file. Appendix G shows the diesel fractions input for each evaluation year.

Table 35
Source of Diesel Fractions for Composite Vehicle Types
(DIESEL FRACTIONS Command)

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, 2002 Statewide Registrations
7	HDV3	Class 3 Heavy-Duty Vehicles	TxDOT July, 2002 Statewide Registrations
8	HDV4	Class 4 Heavy-Duty Vehicles	TxDOT July, 2002 Statewide Registrations
9	HDV5	Class 5 Heavy-Duty Vehicles	TxDOT July, 2002 Statewide Registrations
10	HDV6	Class 6 Heavy-Duty Vehicles	TxDOT July, 2002 Statewide Registrations
11	HDV7	Class 7 Heavy-Duty Vehicles	TxDOT July, 2002 Statewide Registrations
12	HDV8A	Class 8a Heavy-Duty Vehicles	TxDOT July, 2002 Statewide Registrations
13	HDV8B	Class 8b Heavy-Duty Vehicles	TxDOT July, 2002 Statewide Registrations
14	HDBS	School Buses	EPA MOBILE6 Evaluation Year Default

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

Additional non-default activity inputs to the model were hourly fractions of VMT by the 14 speeds for Arterials and Freeways (SPEED VMT command). 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 are input to MOBILE6 by using the VMT BY HOUR command. These fractions are 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 are also used to produce the daily emissions factors as composites of the hourly emissions factors.)

Development of the hourly travel fractions for the TxDOT Northeast Texas region were previously discussed in the "Hourly Travel and Directional Factors" section. These same hourly fractions, used to distribute HPMS VMT by hour of day, are applied as input to MOBILE6.

These fractions are input to MOBILE6 as an external data file. There is one set of four day type-specific hourly VMT fractions files used for all evaluation years. Table 9 shows the hourly travel factors. The MOBILE6 external data files are included 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 uses the SPEED VMT inputs to produce the individual Freeway and Arterial emissions factors indexed by the 14 MOBILE6 speed bin speeds.

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 produces 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 (MOBILE6 uses only the default weekday trip length distributions for both weekday and weekend day types).

State Programs
There are no MOBILE6 State Programs descriptive inputs (i.e., I/M, ATP, and stage II refueling programs) modeled.

Fuels – Locality-Specific Inputs to MOBILE6
User input for fuel effects modeling for the SA/MSA evaluations are the FUELS PROGRAM, FUEL RVP and GASOLINE SULFUR commands and associated input parameters and options. These inputs are entered in the MOBILE6 command file. The MSA is modeled with conventional gasoline.

The fuel property input parameters applied (see Table 36) are gasoline sulfur content in ppm and gasoline RVP in psi. TTI used gasoline sample survey-based average RVP estimates for 1999 and gasoline sample survey-based average sulfur content estimates for 1999 and 2002. MOBILE6 default sulfur content values were assumed for 1995 (for which survey-based estimates were not readily available) and 2005 + analysis years (i.e., Tier 2 rule phase in schedule). Default RVP values (analysis year summer volatility limit minus a refiner compliance safety margin) were applied for 1995 and 2002 + analysis years.

Table 36
Average Gasoline RVP and Sulfur Content Input Values* to MOBILE6

Analysis Year	Sulfur (ppm)	RVP (psi)
1995	300	8.7
1999	447	7.6
2002	166	7.6
2005	92	7.6
2007	33	7.6
2012	30	7.6

* Sulfur values are MOBILE6 defaults except for 1999 and 2002 which are estimates based on gasoline sample surveys. RVP values are (except for 1999 gasoline sample survey based estimate) analysis year summer volatility limit minus refiner compliance safety margin (9.0 minus 0.30 for 1995; 7.8 minus 0.20 for 2002 and later).

The 1999 survey based sulfur and RVP input parameter values used (Table 36) were developed by Eastern Research Group, Inc. (ERG) for the purpose of updating existing EPA National Toxic Inventory (NTI) estimates (see County-Specific Fuel Parameters for 1990, 1996, and 1999 Toxic Emissions Modeling [Preparation for MOBILE6.2 Model Runs], ERG, October 2002). These 1999 input value estimates (7.6 psi and 447 ppm) are based on Alliance Automobile Manufacturers North American (AAM) Gasoline and Diesel Fuel Survey report data from summer 1999 gasoline sample surveys conducted in the city of San Antonio. This 7.6 psi estimated actual RVP value was also use for the later analysis years, assuming a compliance safety margin of 0.2 psi (value of actual 1999 RVP estimate below the regulated RVP limit, which is 7.8 psi starting in 2000). This assumed compliance safety margin (0.20 psi) for the future year analyses is a conservative estimate in comparison to the difference between the 1999 summer volatility limit and actual 1999 survey-based RVP estimate (9.0 psi regulated limit minus 7.6 psi estimated actual equals 1.4 psi under the limit).

The 1999 survey-based 7.6 psi value was first used as 2007 and 2012 analysis year EI input prior to development of the 2002 and 2005 EIs. After TTI had used 7.6 psi for 2007 and 2012 analyses, TCEQ estimated and provided 7.5 psi as the summer 2002 average RVP based on newly available summer 2002 City of San Antonio sample survey data. TTI used the 7.6 psi value for 2002 and 2005 as well as for 2007 and 2012, however, to maintain consistency in RVP input for the future year analyses.

The data TCEQ used to estimate the summer 2002 average RVP input values are from the reports "Motor Gasolines, Summer 2002" by Northrop Grumman Mission Systems (or NGM, formerly TRW). Gasoline sample analysis results were reported in the NGM survey for six Texas cities, including San Antonio.

TCEQ estimated weighting factors by fuel grade for calculating average gasoline fuel property inputs from the grade-specific survey sample averages. TCEQ developed these weighting factors using Texas 2001 gasoline sales volume by grade data. The gasoline sales volume values used are the Texas average monthly "to end users through retail outlets"values from Table 43 of the Department of Energy, Energy Information Administration "Petroleum Marketing Annual 2001" (see http://www.eia.doe.gov/oil_gas/petroleum/data_publications/petroleum_marketing_annual/pma_historical.html). (Mid-grade volumes, about 15 percent of total, were excluded from the sales volume weight calculation because no mid-grade gasoline sample data were available.) The weighting is 86 percent premium and 14 percent regular.

TCEQ provided the gasoline sample data and spreadsheets with summer average RVP calculations to TTI. Using these gasoline survey data and fuel grade weights, TTI estimated summer 2002 average gasoline sulfur content of 166 ppm used as input for 2002, as shown in Table 36.

Fuel Program (FUEL PROGRAM Command)

The MOBILE6 FUEL PROGRAM command provides the user four options for modeling fuels effects. The conventional gasoline east option (option 1) is used for all analysis years except for 2002; this option supplies post-1999 gasoline sulfur levels by year under the Tier 2 rule phase-in schedule for most states (including Texas). For 2002, conventional gasoline with alternate sulfur levels (option 4) was applied; the 2002 gasoline survey-based average sulfur content estimate was input with this option. Option four required inputs are average gasoline sulfur content (ppm) values for 2000 through 2015 and a corresponding set of maximum sulfur levels to which those model year vehicles are exposed. The MOBILE6 defaults were used for all of these inputs except for the summer 2002 average sulfur content value shown in Table 36. The FUEL PROGRAM option and input parameter values are entered in the MOBILE6 command file. MOBILE6 command files were submitted on CD-ROM (see the electronic data submittal description in Appendix A).

Gasoline RVP (FUEL RVP Command)
Gasoline RVP is a required user-input to MOBILE6 with the FUEL RVP command. For developing modeling emissions inventories, estimated actual RVPs from gasoline sample survey data from the modeling area and episode day are used when available. The input values applied in this analysis are shown in Table 36.

Gasoline Sulfur Content (GASOLINE SULFUR Command)
For 1999 and earlier evaluation years, MOBILE6 allows alternate input for gasoline sulfur content through use of the GASOLINE SULFUR command. The MOBILE6 default is 300 ppm sulfur for 1999 and earlier years.

This command was used only for the summer 1999 analysis to allow input of the estimated actual gasoline sulfur content (447 ppm) for San Antonio, summer 1999 (see discussion above).

MOBILE6 Alternative Emissions Regulations and Control Measures
The only user-input value applied within this section of MOBILE6 commands, is related to the HDDV NOx off-cycle emissions effects.

In the late 1980s and most of the 1990s, HDDV engines were built with “defeat devices” allowing in-use engine emissions to be higher than emissions as specified under Federal Test Procedure conditions. MOBILE6 includes estimates of these excess HDDV emissions as well as the emissions offsetting effects of two programs — early pull-ahead of 2004 HDDV emissions standards, and low emissions rebuilds of existing engines.

TCEQ estimated a 1.0 percent effectiveness rate for the low-NOx emissioons rebuild program for heavy duty diesels. The basis of TCEQ’s estimate was latest available information from the EPA showing that the number of low-NOx rebuild kits supplied (as of January, 2002) in the affected population was 0.97 percent. The 1.0 percent effectiveness rate is assumed for 1999 and 2002, however, no information was available to justify a non-default rebuild effects input value for 2005, 2007, and 2012. the rebuild program was not in effect in 1995 and has no affect on MOBILE6 emissions factors for the 1995 calendar year.

Thus, for each evaluation year, the effectiveness rates were set as follows:

- 1995, Not applicable: no input;
- 1999, 2002 Rebuild Program effectiveness rate: 1.0 percent; and
- 2007 + Rebuild Program effectiveness rate: 90.0 percent.

The 90 percent effectiveness value used for the 2007 and 2012 evaluations is the EPA's estimate, which is applied as the MOBILE6 default. This value and its associated command, REBUILD EFFECTS, are inputs to the MOBILE6 command file.

Emissions Factor Post-Processing Requirements and Procedures
There is one limitation of the MOBILE6 model that results in an emissions factors post-processing requirement for this analysis — MOBILE6 user-specified alternate diesel fuel parameters are not available for computing the VOC, CO, and NOx emissions factors (aside from diesel sulfur content input which only applies to the particulate matter-related emissions factors).

To model the impacts of Texas LED, MOBILE6 diesel vehicle emissions factors were post-processed (with the RATADJV6 program, described in Appendix B). The NOx adjustment factor of 0.943 was multiplied by all of the diesel-fueled vehicle MOBILE6 2005, 2007, and 2012 NOx emissions factors. This adjustment corresponds to a reduction in NOx emissions factors of 5.7 percent. Development of this value is documented in the ERG report, Revised SIP Modeling Procedures for the HGA Nonattainment Area, included as Appendix G of Houston/Galveston Attainment Demonstration and Post-1999 Rate-of-Progress SIP, TNRCC, October 2001.

On completion of the post-processing for LED, the emissions factors are ready for input to the emissions estimation program. The emissions factors output files are included on the CD-ROM. See Appendix A for file names and descriptions.

EMISSIONS CALCULATIONS
Hourly emissions were calculated by county for each of the four episode days using the IMPSUM62 program (see description in Appendix B). With the day-of-week-specific VMT and emissions factors (g/mi) for each hour, emissions were calculated for each of the 28 vehicle types and each of 14 pollutant-specific emissions types by direction on each link (i.e. TDM network links and HPMS virtual links).

For each evaluation year and day, 108 files were output from the emissions calculations: 96 hourly link-emissions files (24 hours multiplied by five counties), five summary files of county-level hourly and 24-hour emissions estimates cross classified by vehicle type and road type (one for each county), a tab-delimited version of each of the five emissions summary files, and an emissions calculation program execution log file corresponding to each of the five emissions summary files. These files are included on the CD-ROM (see Appendix A).

Hourly Link Emissions

For each county and analysis day type, the emissions were calculated by hour for each link using the following basic inputs:

- MOBILE6 hourly Freeway and Arterial emissions factors indexed by speed for 28 vehicle types, developed with POLFAC62 (and RATEADJV6 program for post-processed rates);
- records associating the MOBILE6 Freeway emissions factors to the freeway links, and the MOBILE6 Arterial emissions factors to the non-freeway links;
- link-specific operational VMT and speed estimates as developed (for each hour) for TDM network and added intrazonal links (or HPMS virtual links) using the PREPIN program to include: A-node (HPMS area type code), B-node (HPMS functional class code), county number, functional classification code (HPMS area type and functional class cross combination code), link length (HPMS center lane miles), congested speed, and VMT; and
- VMT mix (to allocate link VMT by each of the 28 vehicle types) by time period and roadway type.

For each hour, the emissions estimates were computed by vehicle type for each link. The emissions factors, discussed previously, were tabulated in look-up tables by hour, road type (drive cycle), vehicle type, and 14 speeds (2.5 mph and 5 mph to 65 mph at 5 mph intervals) for Smith County and for the other four Northeast Texas region counties. Regional, 24-hour VMT mix correlated to day type and functional classification group, were multiplied by the fleet total link VMT to produce hourly link VMT estimates by the 28 vehicle types. Emissions factors were then matched with link-level VMT based on county, speed, road type, hour, and vehicle class. Emissions factors for link speeds that are 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 2.5 mph and 65 mph, the emissions factors corresponding to those bounding speeds were used, respectively. The link VMT were then multiplied by the emissions factors to produce the link-level emissions estimates in grams.

Tables 37 and 38 show the correlation of the functional classes to the MOBILE6 drive cycles and to the VMT mix functional classification groups, as used in the emissions calculations for the TDM network counties and the HPMS-based counties, respectively.

Table 37
TDM Network Functional Class Groupings for
Allocation of VMT Mix and MOBILE6 Drive Cycle Emissions Factors

Gregg Network		
MOBILE6 Drive Cycle	**Functional Class Name**	**VMT Mix Functional Group**
Freeway	Interstate	Freeway
	Divided Major Highway	
	Undivided Major Highway	
Arterial	Divided Principle Arterial	Arterial
	Undivided Principle Arterial	
	Divided Minor Arterial	
	Undivided Minor Arterial	
	Divided Collector	
	Undivided Collector	
	Centroid Connector	Collector/Local
	Intrazonal	

Smith Network		
MOBILE6 Drive Cycle	**Functional Class Name**	**VMT Mix Functional Group**
Freeway	Freeway	Freeway
Arterial	Divided Circular Principle Arterial	Arterial
	Divided Principle Arterial	
	Undivided Principle Arterial	
	Divided Minor Arterial	
	Undivided Minor Arterial	
	Collector	Collector/Local
	Centroid Connector	
	Intrazonal	

Table 38
HPMS Functional Class Groupings for
Allocation of VMT Mix and MOBILE6 Drive Cycle Emissions Factors

<table>
<tr><th>MOBILE6 Drive Cycle</th><th>HPMS Functional Class</th><th>VMT mix Functional Group</th></tr>
<tr><td rowspan="2">Freeway</td><td>Interstate</td><td rowspan="2">Freeway</td></tr>
<tr><td>Freeway</td></tr>
<tr><td rowspan="5">Arterial</td><td>Other Principal Arterial</td><td rowspan="2">Arterial</td></tr>
<tr><td>Minor Arterial</td></tr>
<tr><td>Major Collector</td><td rowspan="3">Collector</td></tr>
<tr><td>Minor Collector</td></tr>
<tr><td>Local</td></tr>
</table>

For each evaluation year and episode day, county-level, hourly link-emissions files were produced. The link-emissions file data elements for each TDM network (and intrazonal) link are: A-node, B-node, functional class code, pollutant-specific emissions type label, and emissions estimates (grams) for each of the 28 vehicle types. The HPMS-based county link-emissions output data elements are the same except for the first three, which are: HPMS functional classification number, HPMS area type number, and HPMS area type and functional class cross combination code (See Appendix A).

Day-of-Week Hourly and 24-hour Emissions Summaries

For each analysis day, by individual county, 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 are summarized in pounds by road type, vehicle type, and road type and vehicle type cross classification. VMT, VHT, VMT-weighted speeds, and other inventory data are included with the emissions summaries. These files (*.LST and a tab delimited version, *.TAB) are included with the set of data files previously provided on CD-ROM (see Appendix A).

APPENDIX A
ELECTRONIC SUBMITTAL DATA SET NAMES AND DESCRIPTIONS

NORTHEAST TEXAS REGION 1995, 1999, 2002, 2005, 2007 AND 2012 EMISSIONS INVENTORIES ELECTRONIC SUBMITTAL DATA SET NAMES AND DESCRIPTIONS

The EIs for the Northeast Texas region include two TDM network-based counties (Smith and Gregg), and three HPMS-based counties (Harrison, Rusk and Upshur). The EIs are for four August 1999 episode days (a Weekday [average Monday through Thursday], Friday, Saturday, and Sunday) for each county and evaluation year. This appendix describes the EI data set files that were provided on CD-ROM.

Although the HPMS-based EIs are not network link based, the hourly emissions files are produced in the network link emissions file format, and are referred to as link-emissions files. Network link coordinates are provide for the TDM-based counties; no coordinates are provided for the HPMS-based county data.

CD-ROMs

The EI data are contained on seven CD-ROMs:

- three (named TLM***YY***_EM, ***YY*** = 95, 99, 02, 05, 07, 12) that contain the emissions files; and
- one (named TLM_EF_XY) that contains the MOBILE6 input/output files, the network link coordinates and the data file descriptions.

Link-Emissions File Formats and Data Definitions

Tables 38 through 44 show the link emissions file format and data definitions. Emissions are not gridded; coordinates are included for the travel demand model network links.

TDM Network Node Coordinates Files:

The TDM network node coordinate files are zipped (in coord.zip) on the CD-ROM named "TLM_EF_XY." The node ID, Longitude, and Latitude are provided in millionths of degrees for the following networks:

- 2005 network (1999 and 2002 analysis years): Gregg05coord.TXT, Smith05coord.TXT;
- 2007 network: Gregg07coord.TXT, Smith07coord.TXT; and
- 2015 network (2012 analysis year): Gregg15coord.TXT, Smith15coord.TXT.

Emissions Data Files:

Each CD-ROM contains a zip file with the following data for a particular evaluation year:

- county level hourly link-emissions files (24 hours for each of the five counties for each of the four days = 480 ASCII files, with .T01, .T02.... T24 extensions);

- IMPSUM62 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; SUMALL62 county-level 24-hour emissions inventory data summaries (one ASCII file per TDM network and one ASCII file per HPMS-based county for each of the four day types = 20 files, with .LST extension);

- tab-delimited version of second bullet above (20 ASCII files with .TAB extension); and

- log of emissions estimation program runs (20 ASCII files with .LOG extension).

Data set file names are:

NcountynameAUG***yydd***_emis.T***hr***;
tlmAUG***yydd_Hcountyname***_emis.T***hr***;
tlmAUG***yydd_Ncountyname***Ntwk.LST,
tlmAUG***yydd_Hcountyname***.LST,
tlmAUG***yydd_Ncountyname***Ntwk.LOG,
tlmAUG***yydd_Hcountyname***.LOG,
tlmAUG***yydd_Ncountyname***Ntwk.TAB,
tlmAUG***yydd_Hcountyname***.TAB,.

Where:

Ncountyname is the TDM network county name (Gregg, Smith);
yy is the last two digits of the evaluation year (95, 99, 02, 05, 07, 12);
dd is the day-type: WK, FR, SA, or SU;
hr is 01... 24 representing the hours 12 a.m. through 11 p.m. (local time);
Hcountyname is HPMS-based county name (Harrison, Rusk, Upshur).

Emissions Factor Data Files:
There are 209 emissions factors input/output files for the analysis. The files include MOBILE6 command and external data files, interim and final hourly emissions factors, interim and final daily emissions factors, modeling run logs and MOBILE6 descriptive output listings. Emissions factors were developed for two areas (Smith County and the other four counties combined) based on climate data aggregation.

Input files are:

ddAUG***yyDT_area***.in	(48 command input files);
TLM02.rgd	(one five-county region registration distribution file);
TLM_***dd***.vhr	(four regional hourly VMT files, one per day type).

Final hourly emissions factor table output files are:

ddAUG99***DT_area***.rat	(24 files, one per area per day type for 1995, 1999, and 2002); and
ddAUG***fyDT_area***_led.rat	(24 files, one per area per day type each for 2005, 2007, and 2012 adjusted for LED).

Interim hourly emissions factor table output files are:

ddAUG***fyDT_area***.rat (24 hourly files, one per area per day type each for 2005, 2007; and
2012 before LED adjustment procedure).

Daily emissions factor output files are the same as hourly except ".rtd" extension.

LOG and LST output files:

tlmEAC_AUG***yy***_RT.LOG (six emissions factor run log files, one per year); and
tlmEAC_AUG***yy***_RT.LST (six MOBILE6 descriptive output** files).

Where:

area is Smith County and GHRU (for Gregg, Harrison, Rusk, and Upshur);
yy is the last two digits for each of the three evaluation years;
dd is the day date for each of the four episode days;
fy is the last two digits of the two evaluation years: 2007, 2012; and
DT is day-type represented by: WK, FR, SA, and SU.

* Note that the "Daily ALL" emissions factors (network average daily emissions factors) in the .rtd files are meaningless for this analysis (because they are composited based on the MOBILE6 default VMT BY FACILITY). From the daily emissions factor files, only the road type-specific (i.e., individual drive cycle) daily emissions factors (FRWY, ART, LOC, and RAMP) are valid.
**The descriptive MOBILE6 output is useful as a check of inputs (some of which are listed in the descriptive output) but not for the emissions factors themselves which composites based on MOBILE6 default VMT BY FACILITY values.

Table 39
Link Emissions Data Fields for HPMS-based Counties

Abbreviation	Columns	Format Type	Description
HPMS Area Type	1 - 6	I6	HPMS Area Type Code (1-3) (see Table 40).
HPMS Functional Class	7 - 12	I6	HPMS Functional Class Code (1-7) (see Table 41).
FC	13 - 15	I3	Functional Classification of Link (see Table 42).
EMISS	17 - 26	A3	“VOC,” or “CO,” or “NOx”
ETYPE	28 - 40	A11	Emissions sub-component type (see Table 45).
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.

Table 40
HPMS Area Type Codes

HPMS Area Type Code	Description
1	Rural
2	Small Urban
3	Urban

Table 41
HPMS Functional Classification Codes

HPMS Functional Class Code	Description
1	Interstate
2	Freeway
3	Other Principal Arterial
4	Minor Arterial
5	Major Collector
6	Minor Collector
7	Local

Table 42
Link Functional Classification* Codes for HPMS-based Counties

Functional Class*	Description
0	Rural Interstate
2	Rural Other Principal Arterial
3	Rural Minor Arterial
4	Rural Major Collector
5	Rural Minor Collector
6	Rural Local
7	Small Urban Interstate
8	Small Urban Freeway
9	Small Urban Other Principal Arterial
10	Small Urban Minor Arterial
11	Small Urban Major Collector
12	Small Urban Minor Collector
13	Small Urban Local
14	Urban Interstate
15	Urban Freeway
16	Urban Other Principal Arterial
17	Urban Minor Arterial
18	Urban Major Collector
20	Urban Local

* "Virtual link"codes for each of the up to 21 HPMS Functional Class and Area Type combinations.

Table 43
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	Functional Classification Code of Link (see Table 43)
EMISS	17 - 26	A3	“VOC,” or “CO,” or “NOx”
ETYPE	28 - 40	A11	Emissions Sub-Component Type (see Table 44)
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.

Table 44
Tyler (Smith County) and Longview (Gregg County) TDM Functional Classifications

Network	Functional Class Code	Functional Class Name
Longview	0	Centroid Connector (Local Roads)
	1	Interstate
	2	Divided Major Highway
	3	Undivided Major Highway
	4	Divided Principal Arterial
	5	Undivided Principal Arterial
	6	Divided Minor Arterial
	7	Undivided Minor Arterial
	8	Divided Collector
	9	Undivided Collector
	40*	Intrazonal (Local Roads)
Tyler	0	Centroid Connector (Local Roads)
	1	Radial Freeway
	2	Divided Circular Principal Arterial
	3	Divided Principal Arterial
	4	Undivided Principal Arterial
	5	Divided Minor Arterial
	6	Undivided Minor Arterial
	7	Collector
	40	Intrazonal (Local Roads)

* For Gregg County FC code 40 is not used – Intrazonal VMT is grouped with centroid connectors under FC code 0.

Table 45
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

* VOC, CO, and NOx.

APPENDIX B
EMISSIONS ESTIMATION PROGRAMS

TTI EMISSIONS ESTIMATION PROGRAMS

The following is a summary of programs developed by TTI that may be used to produce TDM network link-based and HPMS "virtual link"-based, hourly, on-road mobile source emissions estimates for air quality analyses.

For the TDM-based analyses, the emissions estimates are made at the TDM network link level (for thousands of links) where geographical coordinates are associated.

For the HPMS-based analyses, emissions estimates are made at the functional classification/area type level which constitutes a 21-cell array defined by seven functional classifications and three area types, or road-type "cells." These road-type cells may be viewed as a roadway network (analogous to the TDM network, but with larger and fewer links) consisting of up to 21 links (or, with directionality included, 42 links).

Hereafter, for the purpose of this discussion, the term "link" may be used to mean either a TDM network link or an HPMS "virtual link."

The main emissions estimation programs are: PREPIN (2BW for Tyler TDM network analyses and 254HPMS for HPMS analyses), POLFAC62, RATEADJ62, RATEADJV62, IMPSUM62, and SUMALL62. PREPIN 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 and other EI data at various levels by 24-hour period.

PREPIN

The PREPIN program post-processes travel model output to produce time-of-day-specific, on-road vehicle fleet, link VMT and speed estimates for emissions inventory applications. The PREPIN program was developed for use in urban areas that do not have all of the time-of-day assignments and operational speeds available as may be required for air quality analyses of particular temporal scales (e.g., hourly).

For example, PREPIN reads a travel demand model traffic assignment data set from a directional four period time-of-day assignment (another common assignment read by PREPIN is the nondirectional or directional 24-hour assignment). PREPIN initially scales the assignment volumes on each link to the appropriate VMT (seasonal, day-of-week specific, for instance). Time-of-day (hourly, for example) factors (and directional split factors, in the case of a nondirectional assignment) are applied to the adjusted assignment results on each link to estimate the directional time-of-day travel on the link. Speed models, originally developed for the Dallas/Fort Worth Region or optionally the Houston/Galveston Region, are used to estimate the operational time-of-day speeds by direction on the links. Special intrazonal links are defined (as intrazonal links are not a feature of travel demand models), and the VMT and speeds for intrazonal trips are estimated. These VMT and speeds by link are subsequently input to the IMPSUM6 program for the application of MOBILE6 emissions factors.

PREPIN254HPMS

The PREPIN254HPMS program processes the statewide HPMS county AADT VMT, centerline miles, and lane miles by functional classification and area type to produce hourly, on-road vehicle fleet, seasonal and day-of-week-specific, actual or forecast VMT and directional speed estimates for EI applications. These estimated VMT and speeds are produced for 21 HPMS functional classification/area type combinations, or "links." The program was developed for use in areas that do not have TDM networks, and for EI applications where network link-based detail is not required. However, the HPMS link speeds are developed analogous to those produced from network travel model-based input data, except with a much smaller set of "links." The main inputs are:

- TxDOT statewide HPMS data set at the county level which includes AADT VMT, centerline miles, and lane miles by HPMS area type and functional class;
- county-level VMT control totals;
- list of Texas county names;
- hourly VMT distributions; and
- Dallas/Fort Worth speed modeling inputs to include volume/delay equation parameters adapted for HPMS, and freeflow speeds and lane capacities by HPMS functional classification and area type.

The program initially allocates the county control total VMT (VMT adjusted for season, etc.) to the link, proportional HPMS AADT VMT on each link. Hourly factors and directional split factors are applied to the adjusted VMT on each link to estimate the hourly directional VMT (and volumes) by HPMS link. Speed models, originally developed for the Dallas/Fort Worth Region, are used to estimate the hourly operational speeds by direction for each link. The operational speeds are based on v/c derived directional delay (minutes/mile) applied to the estimated freeflow speeds for each link. These HPMS link-VMT and speed estimates are subsequently input to the IMPSUM62 program for the application of MOBILE6 emissions 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 PREPIN 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

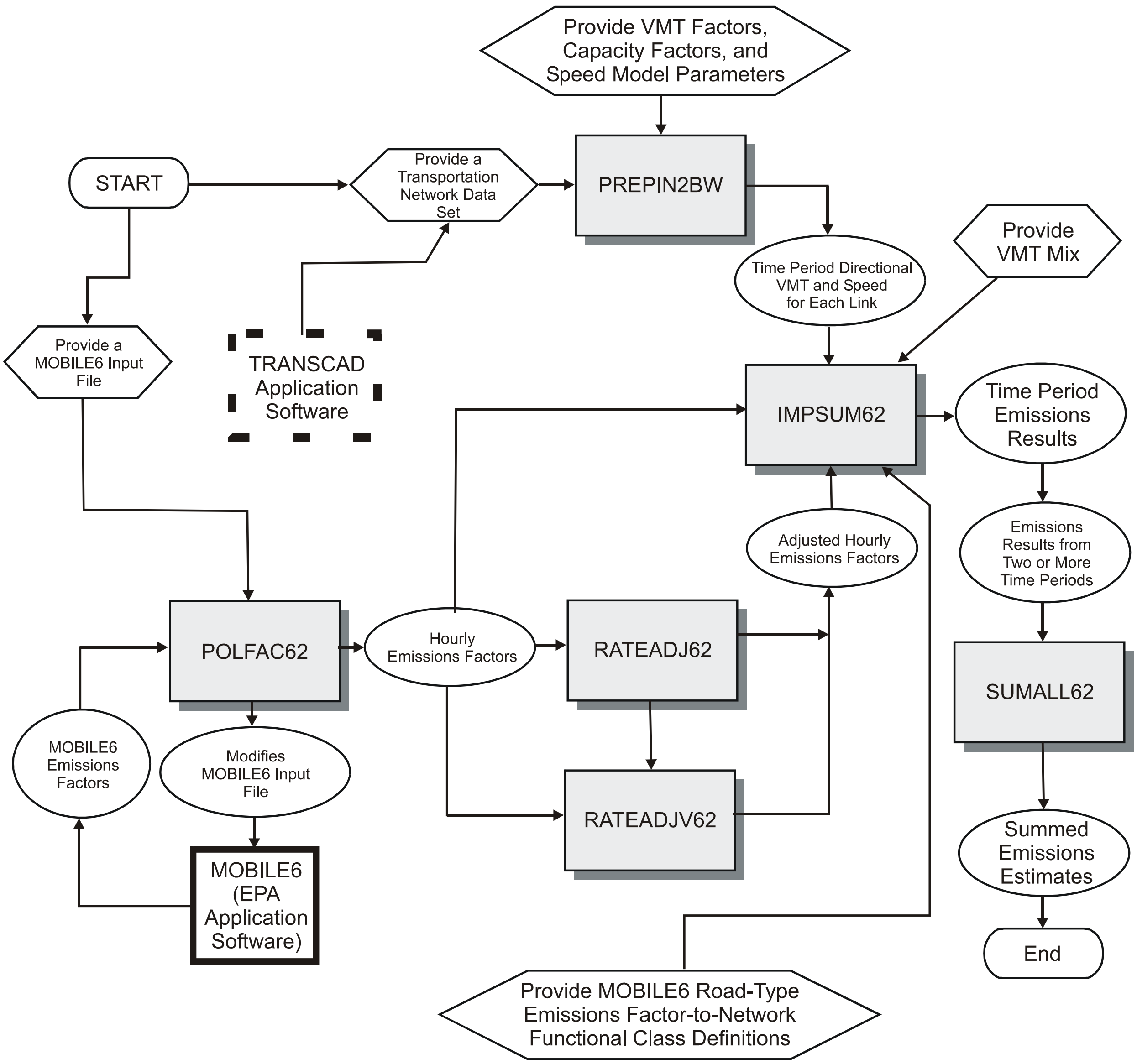
The SUMALL62 program is used to sum the emissions estimates for the time-of-day periods (e.g., 24 periods in the case of hourly analyses) to develop 24-hour emissions estimates. The emissions by pollutant type are reported by roadway type and 28 vehicle types (or optionally condensed to eight vehicle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

Longview Directional Split Factors — AM Peak

Functional Classification	CBD	Urban	Suburban	Rural
Centroid Connector	54	85	72	78
Interstate	50	60	61	70
Divided Major Highway	65	62	65	71
Undivided Major Highway	65	62	65	71
Divided Principal Arterial	65	62	65	71
Undivided Principal Arterial	65	62	65	71
Divided Minor Arterial	58	58	64	68
Undivided Minor Arterial	58	58	64	68
Divided Collector	64.5	53	64.5	75
Undivided Collector	64.5	53	64.5	75

Longview Network Directional Split Factors — Mid-Day and Overnight

Functional Classification	CBD	Urban	Suburban	Rural
Centroid Connector	54	55	55	52
Interstate	51	53	51	53
Divided Major Highway	55	50	57	55
Undivided Major Highway	55	50	57	55
Divided Principal Arterial	55	50	57	55
Undivided Principal Arterial	55	50	57	55
Divided Minor Arterial	55	52	56	58
Undivided Minor Arterial	55	52	56	58
Divided Collector	54.5	52	57	54
Undivided Collector	54.5	52	57	54

Longview Directional Split Factors — PM Peak

Functional Classification	CBD	Urban	Suburban	Rural
Centroid Connector	55	72	72	71
Interstate	54	56	67	65
Divided Major Highway	62	57	60	66
Undivided Major Highway	62	57	60	66
Divided Principal Arterial	62	57	60	66
Undivided Principal Arterial	62	57	60	66
Divided Minor Arterial	52	54	65	63
Undivided Minor Arterial	52	54	65	63
Divided Collector	57.5	68	62.5	70
Undivided Collector	57.5	68	62.5	70

Tyler Network Directional Splits — AM Peak

Functional Classification	CBD	Urban	Urban South	Suburban	Rural
Centroid Connector	54	85	85	72	78
Radial Freeway	50	60	60	61	70
Divided Circular Principal Arterial	65	62	62	65	71
Divided Principal Arterial	65	62	62	65	71
Undivided Principal Arterial	65	62	62	65	71
Divided Minor Arterial	58	58	58	64	68
Undivided Minor Arterial	58	58	58	64	68
Collector	64.5	53	53	64.5	75

Tyler Network Directional Splits — Off Peak

Functional Classification	CBD	Urban	Urban South	Suburban	Rural
Centroid Connector	54	55	55	55	52
Radial Freeway	51	53	53	51	53
Divided Circular Principal Arterial	55	50	50	57	55
Divided Principal Arterial	55	50	50	57	55
Undivided Principal Arterial	55	50	50	57	55
Divided Minor Arterial	55	52	52	56	58
Undivided Minor Arterial	55	52	52	56	58
Collector	54.5	52	52	57	54

Tyler Network Directional Splits — PM Peak

Functional Classification	CBD	Urban	Urban South	Suburban	Rural
Centroid Connector	54	56	56	67	65
Radial Freeway	62	57	57	60	66
Divided Circular Principal Arterial	62	57	57	60	66
Divided Principal Arterial	62	57	57	60	66
Undivided Principal Arterial	52	54	54	65	63
Divided Minor Arterial	52	54	54	65	63
Undivided Minor Arterial	57.5	68	68	62.5	70
Collector	55	72	72	72	71

Longview 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.

Tyler 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.

* Midday and Overnight travel periods both correspond to the Off Peak directional split factors.

APPENDIX D
CAPACITY FACTORS AND SPEED FACTORS

Longview Network Hourly Capacity Factors

Functional Classification	CBD	Urban	Suburban	Rural
Centroid Connector	0.100000	0.100000	0.100000	0.100000
Interstate	0.097693	0.092707	0.106122	0.157171
Divided Major Highway	0.096257	0.108754	0.121495	0.180995
Undivided Major Highway	0.082234	0.092769	0.103846	0.155172
Divided Principal Arterial	0.090164	0.114537	0.137441	0.188235
Undivided Principal Arterial	0.070671	0.091954	0.110204	0.147959
Divided Minor Arterial	0.101382	0.063776	0.082353	0.220588
Undivided Minor Arterial	0.078431	0.100877	0.125000	0.168750
Divided Collector	0.100000	0.124138	0.155039	0.210000
Undivided Collector	0.100000	0.124138	0.155039	0.210000

Tyler Network Hourly Capacity Factors

Functional Classification	CBD	Urban	Urban South	Suburban	Rural
Centroid Connector	0.100000	0.100000	0.100000	0.100000	0.100000
Radial Freeway	0.136106	0.128205	0.128205	0.152642	0.173536
Divided Circular Principal Arterial	0.110660	0.115333	0.115333	0.119882	0.122956
Divided Principal Arterial	0.094421	0.102362	0.079511	0.096026	0.110727
Undivided Principal Arterial	0.095694	0.114286	0.114286	0.084112	0.145000
Divided Minor Arterial	0.106280	0.136612	0.136612	0.169697	0.209790
Undivided Minor Arterial	0.090909	0.133721	0.133721	0.176903	0.262953
Collector	0.148148	0.250000	0.200000	0.238095	0.700000

Longview Network Speed Factors

Functional Classification	CBD	Urban	Suburban	Rural
Centroid Connector	1.000000	1.000000	1.000000	1.000000
Interstate	1.526316	1.372093	1.224490	1.267857
Divided Major Highway	1.200000	1.200000	1.205128	1.132075
Undivided Major Highway	1.206897	1.205882	1.210526	1.180000
Divided Principal Arterial	1.200000	1.214286	1.205882	1.100000
Undivided Principal Arterial	1.214286	1.192308	1.218750	1.145833
Divided Minor Arterial	1.230769	1.192308	1.193548	1.086957
Undivided Minor Arterial	1.230769	1.200000	1.193548	1.086957
Divided Collector	1.230769	1.227273	1.222222	1.216216
Undivided Collector	1.230769	1.227273	1.222222	1.216216

Tyler Network Speed Factors

Functional Classification	CBD	Urban	Urban South	Suburban	Rural
Centroid Connector	1.000000	1.000000	1.000000	1.000000	1.000000
Radial Freeway	1.45000	1.37209	1.22917	1.13208	1.14516
Divided Circular Principal Arterial	1.20690	1.21212	1.20588	1.19512	1.17647
Divided Principal Arterial	1.20000	1.20690	1.19444	1.20513	1.30952
Undivided Principal Arterial	1.20833	1.20690	1.19355	1.18919	1.30952
Divided Minor Arterial	1.20833	1.20000	1.20588	1.19444	1.13636
Undivided Minor Arterial	1.21739	1.19231	1.20000	1.20000	1.42857
Collector	1.20833	1.19231	1.18519	1.20690	1.32353

APPENDIX E
VMT MIX

Northeast Texas Region 1995 VMT Mix — Weekday

OBS	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2B	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	Art	0.5862110	0.0556416	0.1852313	0.0355588	0.0163517	0.0094653	0.0044703	0.0022352	0.0013001
2	Col	0.6047131	0.0553006	0.1840962	0.0351045	0.0161428	0.0097007	0.0045815	0.0022908	0.0013324
3	Fway	0.4283322	0.0443327	0.1475840	0.0273831	0.0125921	0.0115996	0.0054784	0.0027392	0.0015932

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	0.0032159	0.0011176	0.0008895	0.0001140	0.0039857	0.0013259	0.0102456	0.0037957	0.0018315	0.0014068
2	0.0032959	0.0011454	0.0009116	0.0001169	0.0041113	0.0013178	0.0108815	0.0040312	0.0019451	0.0014941
3	0.0039411	0.0013696	0.0010901	0.0001398	0.0029141	0.0010564	0.0116414	0.0043127	0.0020810	0.0015984

OBS	P_HDDV_6	P_HDDV_7	P_HDDV8A	P_HDDV8B	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34
1	0.0042469	0.0022562	0.0027605	0.0630927	0.0010000	0.0003827	0.0003962	0.0004366	0.0010347
2	0.0045105	0.0023962	0.0029318	0.0443906	0.0010000	0.0003870	0.0004006	0.0004415	0.0010284
3	0.0048254	0.0025635	0.0031365	0.2724795	0.0010000	0.0010678	0.0011055	0.0012183	0.0008244

Northeast Texas Region 1995 VMT Mix — Friday

OBS	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2B	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	Art	0.6431458	0.0520558	0.1732940	0.0335347	0.0154209	0.0054928	0.0025942	0.0012971	0.0007544
2	Col	0.6587222	0.0513693	0.1710086	0.0328711	0.0151158	0.0055895	0.0026398	0.0013199	0.0007677
3	Fway	0.5123771	0.0452113	0.1505086	0.0281503	0.0129449	0.0073377	0.0034655	0.0017328	0.0010078

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	0.0018662	0.0006485	0.0005162	0.0000662	0.0043593	0.0012424	0.0069672	0.0025811	0.0012454	0.0009566
2	0.0018991	0.0006600	0.0005253	0.0000673	0.0044647	0.0012260	0.0073470	0.0027218	0.0013133	0.0010088
3	0.0024930	0.0008664	0.0006896	0.0000884	0.0034743	0.0010791	0.0086293	0.0031969	0.0015425	0.0011848

OBS	P_HDDV_6	P_HDDV_7	P_HDDV8A	P_HDDV8B	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34
1	0.0028879	0.0015342	0.0018772	0.0429038	0.0010000	0.0002221	0.0002694	0.0002969	0.0009696
2	0.0030454	0.0016179	0.0019795	0.0299717	0.0010000	0.0002230	0.0002705	0.0002981	0.0009568
3	0.0035769	0.0019002	0.0023250	0.2019776	0.0010000	0.0006755	0.0008194	0.0009031	0.0008421

Northeast Texas Region 1995 VMT Mix — Saturday

OBS	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2B	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	Art	0.6743108	0.0518267	0.1725315	0.0313519	0.0144171	0.0035014	0.0016537	0.0008268	0.0004809
2	Col	0.6871436	0.0508846	0.1693953	0.0305761	0.0140604	0.0035450	0.0016743	0.0008371	0.0004869
3	Fway	0.5759675	0.0482533	0.1606355	0.0282128	0.0129736	0.0050142	0.0023681	0.0011841	0.0006887

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	0.0011896	0.0004134	0.0003290	0.0000422	0.0045754	0.0012334	0.0044408	0.0016452	0.0007938	0.0006097
2	0.0012044	0.0004186	0.0003331	0.0000427	0.0046623	0.0012110	0.0046592	0.0017261	0.0008329	0.0006397
3	0.0017036	0.0005920	0.0004712	0.0000604	0.0039091	0.0011484	0.0058962	0.0021844	0.0010540	0.0008096

OBS	P_HDDV_6	P_HDDV_7	P_HDDV8A	P_HDDV8B	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34
1	0.0018407	0.0009779	0.0011965	0.0273464	0.0010000	0.0001416	0.0001717	0.0001893	0.0009626
2	0.0019313	0.0010260	0.0012553	0.0190070	0.0010000	0.0001414	0.0001715	0.0001890	0.0009451
3	0.0024440	0.0012984	0.0015886	0.1380075	0.0010000	0.0004616	0.0005599	0.0006171	0.0008962

Northeast Texas Region 1995 VMT Mix — Sunday

OBS	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2B	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	Art	0.6386470	0.0620099	0.2064313	0.0360000	0.0165545	0.0023734	0.0011209	0.0005605	0.0003260
2	Col	0.6502739	0.0608334	0.2025146	0.0350807	0.0161318	0.0024010	0.0011340	0.0005670	0.0003298
3	Fway	0.5664467	0.0599475	0.1995656	0.0336374	0.0154681	0.0035292	0.0016668	0.0008334	0.0004847

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	0.0008064	0.0002802	0.0002230	0.0000286	0.0043419	0.0014707	0.0030104	0.0011153	0.0005381	0.0004133
2	0.0008158	0.0002835	0.0002256	0.0000289	0.0044209	0.0014428	0.0031559	0.0011692	0.0005641	0.0004333
3	0.0011991	0.0004167	0.0003317	0.0000425	0.0038518	0.0014217	0.0041503	0.0015375	0.0007419	0.0005699

OBS	P_HDDV_6	P_HDDV_7	P_HDDV8A	P_HDDV8B	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34
1	0.0012478	0.0006629	0.0008111	0.0185382	0.0010000	0.0000960	0.0001164	0.0001283	0.0011477
2	0.0013082	0.0006950	0.0008503	0.0128745	0.0010000	0.0000958	0.0001162	0.0001281	0.0011259
3	0.0017203	0.0009139	0.0011182	0.0971422	0.0010000	0.0003249	0.0003941	0.0004344	0.0011095

Northeast Texas Region 1999 VMT Mix — Weekday

OBS	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2B	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	Art	0.5813395	0.0572002	0.1904165	0.0364252	0.0167506	0.0082426	0.0038929	0.0019464	0.0011321
2	Col	0.6010647	0.0566420	0.1885582	0.0358263	0.0164752	0.0083828	0.0039591	0.0019796	0.0011514
3	Fway	0.4121095	0.0479055	0.1594749	0.0294892	0.0135610	0.0107073	0.0050570	0.0025285	0.0014706

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	0.0028005	0.0009732	0.0007746	0.0000993	0.0016272	0.0004307	0.0113829	0.0042170	0.0020348	0.0015629
2	0.0028481	0.0009898	0.0007878	0.0001010	0.0016823	0.0004265	0.0121073	0.0044854	0.0021643	0.0016624
3	0.0036379	0.0012642	0.0010062	0.0001290	0.0011543	0.0003607	0.0124713	0.0046202	0.0022293	0.0017124

OBS	P_HDDV_6	P_HDDV_7	P_HDDV8A	P_HDDV8B	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34
1	0.0047183	0.0025066	0.0030669	0.0630927	0.0010000	0.0002727	0.0003939	0.0005490	0.0011509
2	0.0050186	0.0026661	0.0032621	0.0443906	0.0010000	0.0002757	0.0003983	0.0005551	0.0011396
3	0.0051695	0.0027463	0.0033601	0.2724795	0.0010000	0.0007608	0.0010990	0.0015318	0.0009639

Northeast Texas Region 1999 VMT Mix — Friday

OBS	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2B	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	Art	0.6383431	0.0535593	0.1782959	0.0343809	0.0158105	0.0047873	0.0022610	0.0011305	0.0006575
2	Col	0.6551645	0.0526487	0.1752645	0.0335682	0.0154368	0.0048332	0.0022826	0.0011413	0.0006638
3	Fway	0.4943987	0.0489953	0.1631027	0.0304025	0.0139810	0.0067927	0.0032081	0.0016041	0.0009330

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	0.0016265	0.0005652	0.0004499	0.0000577	0.0017812	0.0004039	0.0077471	0.0028700	0.0013848	0.0010637
2	0.0016421	0.0005707	0.0004542	0.0000582	0.0018280	0.0003971	0.0081798	0.0030304	0.0014622	0.0011231
3	0.0023079	0.0008020	0.0006384	0.0000818	0.0013802	0.0003695	0.0092710	0.0034346	0.0016573	0.0012730

OBS	P_HDDV_6	P_HDDV_7	P_HDDV8A	P_HDDV8B	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34
1	0.0032112	0.0017060	0.0020873	0.0429401	0.0010000	0.0001584	0.0002681	0.0003736	0.0010793
2	0.0033906	0.0018013	0.0022039	0.0299907	0.0010000	0.0001590	0.0002691	0.0003750	0.0010610
3	0.0038429	0.0020416	0.0024979	0.2025582	0.0010000	0.0004827	0.0008170	0.0011387	0.0009873

Northeast Texas Region 1999 VMT Mix — Saturday

OBS	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2B	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	Art	0.6696765	0.0533555	0.1776176	0.0321622	0.0147902	0.0030535	0.0014421	0.0007211	0.0004194
2	Col	0.6837875	0.0521790	0.1737011	0.0312407	0.0143665	0.0030669	0.0014485	0.0007242	0.0004212
3	Fway	0.5567232	0.0523822	0.1743775	0.0305227	0.0140363	0.0046498	0.0021960	0.0010980	0.0006386

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	0.0010375	0.0003605	0.0002870	0.0000368	0.0018706	0.0004012	0.0049408	0.0018304	0.0008832	0.0006784
2	0.0010420	0.0003621	0.0002882	0.0000370	0.0019099	0.0003924	0.0051901	0.0019227	0.0009278	0.0007126
3	0.0015798	0.0005490	0.0004370	0.0000560	0.0015555	0.0003939	0.0063457	0.0023509	0.0011343	0.0008713

OBS	P_HDDV_6	P_HDDV_7	P_HDDV8A	P_HDDV8B	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34
1	0.0020480	0.0010880	0.0013312	0.0273859	0.0010000	0.0001010	0.0001710	0.0002383	0.0010722
2	0.0021513	0.0011429	0.0013984	0.0190289	0.0010000	0.0001009	0.0001707	0.0002380	0.0010485
3	0.0026303	0.0013974	0.0017097	0.1386432	0.0010000	0.0003304	0.0005592	0.0007794	0.0010526

Northeast Texas Region 1999 VMT Mix — Sunday

OBS	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2B	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	Art	0.6332211	0.0637349	0.2121700	0.0368701	0.0169552	0.0020665	0.0009760	0.0004880	0.0002838
2	Col	0.6462291	0.0622972	0.2073840	0.0357952	0.0164609	0.0020744	0.0009797	0.0004899	0.0002849
3	Fway	0.5448415	0.0647593	0.2155802	0.0362136	0.0166533	0.0032567	0.0015381	0.0007691	0.0004473

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	0.0007021	0.0002440	0.0001942	0.0000249	0.0017722	0.0004776	0.0033440	0.0012388	0.0005978	0.0004591
2	0.0007048	0.0002449	0.0001949	0.0000250	0.0018086	0.0004669	0.0035108	0.0013006	0.0006276	0.0004821
3	0.0011065	0.0003845	0.0003061	0.0000392	0.0015253	0.0004853	0.0044448	0.0016467	0.0007945	0.0006103

OBS	P_HDDV_6	P_HDDV_7	P_HDDV8A	P_HDDV8B	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34
1	0.0013861	0.0007364	0.0009010	0.0185347	0.0010000	0.0000684	0.0001157	0.0001613	0.0012763
2	0.0014553	0.0007731	0.0009459	0.0128721	0.0010000	0.0000682	0.0001155	0.0001610	0.0012475
3	0.0018424	0.0009788	0.0011976	0.0971131	0.0010000	0.0002314	0.0003917	0.0005459	0.0012968

Northeast Texas Region 2002 VMT Mix — Weekday

OBS	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2B	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	Art	0.5744466	0.0580686	0.1933164	0.0369408	0.0169881	0.0077079	0.0036404	0.0018202	0.0010587
2	Col	0.6033035	0.0580859	0.1933739	0.0367119	0.0168828	0.0080971	0.0038242	0.0019121	0.0011121
3	Fway	0.4038545	0.0485529	0.1616377	0.0298616	0.0137325	0.0078546	0.0037097	0.0018548	0.0010788

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	0.0026188	0.0009101	0.0007244	0.0000929	0.0009465	0.0001683	0.0128137	0.0047470	0.0022905	0.0017594
2	0.0027511	0.0009560	0.0007609	0.0000976	0.0009940	0.0001683	0.0129860	0.0048109	0.0023213	0.0017831
3	0.0026687	0.0009274	0.0007381	0.0000946	0.0006659	0.0001407	0.0153829	0.0056988	0.0027498	0.0021122

OBS	P_HDDV_6	P_HDDV_7	P_HDDV8A	P_HDDV8B	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34
1	0.0053114	0.0028217	0.0034524	0.0636291	0.0010000	0.0002562	0.0004924	0.0007687	0.0012090
2	0.0053828	0.0028596	0.0034988	0.0332494	0.0010000	0.0003153	0.0006060	0.0009461	0.0012093
3	0.0063763	0.0033874	0.0041446	0.2771645	0.0010000	0.0006079	0.0011683	0.0018238	0.0010109

Northeast Texas Region 2002 VMT Mix — Friday

OBS	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2B	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	Art	0.6319899	0.0544768	0.1813591	0.0349346	0.0160655	0.0044854	0.0021184	0.0010592	0.0006161
2	Col	0.6559045	0.0538513	0.1792768	0.0343093	0.0157779	0.0046564	0.0021991	0.0010996	0.0006395
3	Fway	0.4856306	0.0497731	0.1656999	0.0308582	0.0141909	0.0049946	0.0023589	0.0011794	0.0006860

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	0.0015240	0.0005296	0.0004215	0.0000540	0.0010381	0.0001581	0.0087376	0.0032370	0.0015619	0.0011997
2	0.0015820	0.0005498	0.0004376	0.0000561	0.0010773	0.0001563	0.0087508	0.0032419	0.0015643	0.0012015
3	0.0016969	0.0005897	0.0004694	0.0000602	0.0007980	0.0001445	0.0114621	0.0042463	0.0020489	0.0015738

OBS	P_HDDV_6	P_HDDV_7	P_HDDV8A	P_HDDV8B	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34
1	0.0036218	0.0019241	0.0023542	0.0433885	0.0010000	0.0001491	0.0003358	0.0005242	0.0011360
2	0.0036273	0.0019270	0.0023577	0.0224056	0.0010000	0.0001813	0.0004084	0.0006375	0.0011229
3	0.0047511	0.0025240	0.0030882	0.2065212	0.0010000	0.0003865	0.0008705	0.0013589	0.0010379

Northeast Texas Region 2002 VMT Mix — Saturday

OBS	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2B	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	Art	0.6638888	0.0543412	0.1809077	0.0327233	0.0150486	0.0028647	0.0013530	0.0006765	0.0003935
2	Col	0.6831153	0.0532585	0.1773032	0.0318631	0.0146530	0.0029485	0.0013925	0.0006963	0.0004050
3	Fway	0.5483262	0.0533570	0.1776309	0.0310635	0.0142853	0.0034281	0.0016191	0.0008095	0.0004708

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	0.0009733	0.0003382	0.0002692	0.0000345	0.0010916	0.0001573	0.0055799	0.0020672	0.0009975	0.0007662
2	0.0010018	0.0003481	0.0002771	0.0000355	0.0011232	0.0001541	0.0055407	0.0020526	0.0009904	0.0007608
3	0.0011647	0.0004048	0.0003222	0.0000413	0.0009019	0.0001544	0.0078665	0.0029143	0.0014062	0.0010801

OBS	P_HDDV_6	P_HDDV_7	P_HDDV8A	P_HDDV8B	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34
1	0.0023129	0.0012287	0.0015034	0.0277084	0.0010000	0.0000952	0.0002144	0.0003347	0.0011299
2	0.0022966	0.0012201	0.0014928	0.0141863	0.0010000	0.0001148	0.0002586	0.0004036	0.0011074
3	0.0032607	0.0017323	0.0021195	0.1417360	0.0010000	0.0002653	0.0005974	0.0009326	0.0011095

Northeast Texas Region 1999 VMT Mix — Sunday

OBS	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2B	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	Art	0.6272855	0.0648646	0.2159412	0.0374858	0.0172387	0.0019373	0.0009149	0.0004575	0.0002661
2	Col	0.6440690	0.0634361	0.2111854	0.0364223	0.0167496	0.0019897	0.0009397	0.0004698	0.0002733
3	Fway	0.5366056	0.0659622	0.2195950	0.0368541	0.0169482	0.0024010	0.0011340	0.0005670	0.0003298

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	0.0006582	0.0002287	0.0001821	0.0000233	0.0010335	0.0001871	0.0037737	0.0013980	0.0006746	0.0005182
2	0.0006760	0.0002349	0.0001870	0.0000240	0.0010611	0.0001829	0.0037391	0.0013852	0.0006684	0.0005134
3	0.0008158	0.0002835	0.0002256	0.0000289	0.0008843	0.0001902	0.0055099	0.0020412	0.0009849	0.0007565

OBS	P_HDDV_6	P_HDDV_7	P_HDDV8A	P_HDDV8B	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34
1	0.0015642	0.0008310	0.0010168	0.0187392	0.0010000	0.0000644	0.0001450	0.0002264	0.0013441
2	0.0015499	0.0008234	0.0010074	0.0095736	0.0010000	0.0000775	0.0001745	0.0002724	0.0013145
3	0.0022839	0.0012133	0.0014845	0.0992761	0.0010000	0.0001858	0.0004185	0.0006532	0.0013668

Northeast Texas Region 2005 VMT Mix — Weekday

OBS	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2B	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	Art	0.5746218	0.0580698	0.1933130	0.0369407	0.0169883	0.0077079	0.0036404	0.0018202	0.0010587
2	Col	0.6034875	0.0580870	0.1933706	0.0367118	0.0168830	0.0080971	0.0038242	0.0019121	0.0011121
3	Fway	0.4039778	0.0485539	0.1616350	0.0298614	0.0137327	0.0078546	0.0037097	0.0018548	0.0010788

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	0.0026188	0.0009101	0.0007244	0.0000929	0.0007713	0.0001427	0.0128137	0.0047470	0.0022905	0.0017594
2	0.0027511	0.0009560	0.0007609	0.0000976	0.0008099	0.0001428	0.0129860	0.0048109	0.0023213	0.0017831
3	0.0026687	0.0009274	0.0007381	0.0000946	0.0005426	0.0001193	0.0153829	0.0056988	0.0027498	0.0021122

OBS	P_HDDV_6	P_HDDV_7	P_HDDV8A	P_HDDV8B	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34
1	0.0053114	0.0028217	0.0034524	0.0636291	0.0010000	0.0001753	0.0004909	0.0008511	0.0012366
2	0.0053828	0.0028596	0.0034988	0.0332494	0.0010000	0.0002157	0.0006042	0.0010475	0.0012370
3	0.0063763	0.0033874	0.0041446	0.2771645	0.0010000	0.0004159	0.0011648	0.0020193	0.0010340

Northeast Texas Region 2005 VMT Mix — Friday

OBS	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2B	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	Art	0.6321771	0.0544775	0.1813544	0.0349341	0.0160655	0.0044853	0.0021184	0.0010592	0.0006161
2	Col	0.6560977	0.0538519	0.1792719	0.0343088	0.0157779	0.0046563	0.0021991	0.0010996	0.0006395
3	Fway	0.4857684	0.0497731	0.1656935	0.0308574	0.0141907	0.0049945	0.0023588	0.0011794	0.0006860

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	0.0015239	0.0005296	0.0004215	0.0000540	0.0008459	0.0001341	0.0087375	0.0032370	0.0015619	0.0011997
2	0.0015820	0.0005498	0.0004376	0.0000561	0.0008778	0.0001326	0.0087507	0.0032419	0.0015643	0.0012015
3	0.0016969	0.0005897	0.0004694	0.0000602	0.0006503	0.0001225	0.0114619	0.0042462	0.0020489	0.0015738

OBS	P_HDDV_6	P_HDDV_7	P_HDDV8A	P_HDDV8B	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34
1	0.0036218	0.0019241	0.0023542	0.0433881	0.0010000	0.0001020	0.0003348	0.0005804	0.0011620
2	0.0036272	0.0019270	0.0023577	0.0224054	0.0010000	0.0001241	0.0004071	0.0007059	0.0011486
3	0.0047510	0.0025240	0.0030882	0.2065167	0.0010000	0.0002645	0.0008679	0.0015046	0.0010616

Northeast Texas Region 2005 VMT Mix — Saturday

OBS	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2B	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	Art	0.6640876	0.0543421	0.1809036	0.0327230	0.0150487	0.0028647	0.0013530	0.0006765	0.0003935
2	Col	0.6833191	0.0532593	0.1772990	0.0318628	0.0146530	0.0029485	0.0013925	0.0006963	0.0004050
3	Fway	0.5484854	0.0533573	0.1776253	0.0310629	0.0142852	0.0034281	0.0016190	0.0008095	0.0004708

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	0.0009733	0.0003382	0.0002692	0.0000345	0.0008895	0.0001334	0.0055799	0.0020672	0.0009974	0.0007662
2	0.0010018	0.0003481	0.0002771	0.0000355	0.0009152	0.0001307	0.0055406	0.0020526	0.0009904	0.0007608
3	0.0011647	0.0004048	0.0003222	0.0000413	0.0007349	0.0001310	0.0078664	0.0029142	0.0014062	0.0010801

OBS	P_HDDV_6	P_HDDV_7	P_HDDV8A	P_HDDV8B	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34
1	0.0023129	0.0012287	0.0015034	0.0277082	0.0010000	0.0000651	0.0002138	0.0003706	0.0011558
2	0.0022966	0.0012201	0.0014928	0.0141862	0.0010000	0.0000786	0.0002578	0.0004469	0.0011327
3	0.0032607	0.0017322	0.0021194	0.1417339	0.0010000	0.0001815	0.0005956	0.0010326	0.0011348

Northeast Texas Region 2005 VMT Mix — Sunday

OBS	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2B	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	Art	0.6274746	0.0648657	0.2159368	0.0374855	0.0172388	0.0019372	0.0009149	0.0004575	0.0002661
2	Col	0.6442627	0.0634371	0.2111809	0.0364219	0.0167497	0.0019896	0.0009397	0.0004698	0.0002733
3	Fway	0.5367639	0.0659629	0.2195891	0.0368536	0.0169482	0.0024010	0.0011339	0.0005670	0.0003298

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	0.0006582	0.0002287	0.0001821	0.0000233	0.0008421	0.0001587	0.0037737	0.0013980	0.0006746	0.0005182
2	0.0006760	0.0002349	0.0001870	0.0000240	0.0008646	0.0001552	0.0037391	0.0013852	0.0006684	0.0005134
3	0.0008157	0.0002835	0.0002256	0.0000289	0.0007206	0.0001614	0.0055099	0.0020412	0.0009849	0.0007565

OBS	P_HDDV_6	P_HDDV_7	P_HDDV8A	P_HDDV8B	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34
1	0.0015642	0.0008310	0.0010167	0.0187391	0.0010000	0.0000441	0.0001446	0.0002507	0.0013748
2	0.0015499	0.0008234	0.0010074	0.0095736	0.0010000	0.0000530	0.0001740	0.0003016	0.0013445
3	0.0022839	0.0012133	0.0014845	0.0992751	0.0010000	0.0001271	0.0004172	0.0007233	0.0013981

Northeast Texas Region 2007 VMT Mix — Weekday

OBS	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2B	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	Art	0.5748160	0.0580853	0.1933619	0.0369408	0.0169881	0.0077079	0.0036404	0.0018202	0.0010587
2	Col	0.6036914	0.0581026	0.1934194	0.0367119	0.0168829	0.0080971	0.0038242	0.0019121	0.0011121
3	Fway	0.4041144	0.0485669	0.1616758	0.0298615	0.0137326	0.0078546	0.0037097	0.0018548	0.0010788

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	0.0026188	0.0009101	0.0007244	0.0000929	0.0005771	0.0000443	0.0128137	0.0047470	0.0022905	0.0017594
2	0.0027511	0.0009560	0.0007609	0.0000976	0.0006061	0.0000443	0.0129860	0.0048109	0.0023213	0.0017831
3	0.0026687	0.0009274	0.0007381	0.0000946	0.0004060	0.0000370	0.0153829	0.0056988	0.0027498	0.0021122

OBS	P_HDDV_6	P_HDDV_7	P_HDDV8A	P_HDDV8B	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34
1	0.0053114	0.0028217	0.0034524	0.0636291	0.0010000	0.0001413	0.0004915	0.0008845	0.0012707
2	0.0053828	0.0028596	0.0034988	0.0332494	0.0010000	0.0001739	0.0006049	0.0010886	0.0012711
3	0.0063763	0.0033874	0.0041446	0.2771645	0.0010000	0.0003353	0.0011661	0.0020986	0.0010625

Northeast Texas Region 2007 VMT Mix — Friday

OBS	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2B	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	Art	0.6323882	0.0544919	0.1813995	0.0349341	0.0160653	0.0044853	0.0021184	0.0010592	0.0006161
2	Col	0.6563162	0.0538661	0.1793163	0.0343088	0.0157777	0.0046563	0.0021991	0.0010996	0.0006395
3	Fway	0.4859281	0.0497859	0.1657339	0.0308572	0.0141904	0.0049944	0.0023588	0.0011794	0.0006860

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	0.0015239	0.0005296	0.0004215	0.0000540	0.0006330	0.0000416	0.0087375	0.0032369	0.0015619	0.0011997
2	0.0015820	0.0005498	0.0004376	0.0000561	0.0006569	0.0000411	0.0087507	0.0032418	0.0015642	0.0012015
3	0.0016969	0.0005897	0.0004694	0.0000602	0.0004866	0.0000380	0.0114618	0.0042462	0.0020489	0.0015738

OBS	P_HDDV_6	P_HDDV_7	P_HDDV8A	P_HDDV8B	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34
1	0.0036218	0.0019241	0.0023541	0.0433879	0.0010000	0.0000822	0.0003351	0.0006031	0.0011940
2	0.0036272	0.0019270	0.0023577	0.0224053	0.0010000	0.0001000	0.0004076	0.0007336	0.0011803
3	0.0047510	0.0025240	0.0030881	0.2065148	0.0010000	0.0002132	0.0008688	0.0015637	0.0010909

Northeast Texas Region 2007 VMT Mix — Saturday

OBS	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2B	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	Art	0.6643101	0.0543565	0.1809488	0.0327230	0.0150485	0.0028647	0.0013530	0.0006765	0.0003935
2	Col	0.6835477	0.0532733	0.1773432	0.0318628	0.0146529	0.0029485	0.0013925	0.0006963	0.0004050
3	Fway	0.5486671	0.0533712	0.1776690	0.0310628	0.0142850	0.0034280	0.0016190	0.0008095	0.0004708

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	0.0009733	0.0003382	0.0002692	0.0000345	0.0006656	0.0000414	0.0055799	0.0020672	0.0009974	0.0007662
2	0.0010018	0.0003481	0.0002771	0.0000355	0.0006849	0.0000406	0.0055406	0.0020526	0.0009904	0.0007608
3	0.0011647	0.0004048	0.0003222	0.0000413	0.0005499	0.0000406	0.0078663	0.0029142	0.0014062	0.0010801

OBS	P_HDDV_6	P_HDDV_7	P_HDDV8A	P_HDDV8B	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34
1	0.0023129	0.0012287	0.0015034	0.0277082	0.0010000	0.0000525	0.0002140	0.0003852	0.0011876
2	0.0022966	0.0012201	0.0014928	0.0141862	0.0010000	0.0000633	0.0002581	0.0004645	0.0011640
3	0.0032606	0.0017322	0.0021194	0.1417330	0.0010000	0.0001463	0.0005963	0.0010732	0.0011661

Northeast Texas Region 2007 VMT Mix — Sunday

OBS	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2B	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	Art	0.6276854	0.0648830	0.2159909	0.0374856	0.0172387	0.0019372	0.0009149	0.0004575	0.0002661
2	Col	0.6444790	0.0634540	0.2112338	0.0364220	0.0167495	0.0019896	0.0009397	0.0004698	0.0002733
3	Fway	0.5369428	0.0659802	0.2196435	0.0368535	0.0169480	0.0024009	0.0011339	0.0005670	0.0003298

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	0.0006582	0.0002287	0.0001821	0.0000233	0.0006302	0.0000492	0.0037737	0.0013980	0.0006746	0.0005181
2	0.0006760	0.0002349	0.0001870	0.0000240	0.0006470	0.0000482	0.0037391	0.0013852	0.0006684	0.0005134
3	0.0008157	0.0002835	0.0002256	0.0000289	0.0005392	0.0000501	0.0055098	0.0020412	0.0009849	0.0007565

OBS	P_HDDV_6	P_HDDV_7	P_HDDV8A	P_HDDV8B	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34
1	0.0015642	0.0008310	0.0010167	0.0187391	0.0010000	0.0000355	0.0001447	0.0002605	0.0014127
2	0.0015499	0.0008234	0.0010074	0.0095736	0.0010000	0.0000427	0.0001742	0.0003134	0.0013816
3	0.0022839	0.0012133	0.0014845	0.0992747	0.0010000	0.0001025	0.0004177	0.0007517	0.0014366

Northeast Texas Region 2012 VMT Mix — Weekday

OBS	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2B	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	Art	0.5748835	0.0558959	0.1956113	0.0369416	0.0169874	0.0077079	0.0036404	0.0018202	0.0010587
2	Col	0.6037623	0.0559125	0.1956696	0.0367127	0.0168821	0.0080971	0.0038242	0.0019121	0.0011121
3	Fway	0.4041619	0.0467362	0.1635566	0.0298622	0.0137319	0.0078546	0.0037097	0.0018548	0.0010788

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	0.0026188	0.0009101	0.0007244	0.0000929	0.0005096	0.0000000	0.0128137	0.0047470	0.0022905	0.0017594
2	0.0027511	0.0009560	0.0007609	0.0000976	0.0005351	0.0000000	0.0129860	0.0048109	0.0023213	0.0017831
3	0.0026687	0.0009274	0.0007381	0.0000946	0.0003585	0.0000000	0.0153829	0.0056988	0.0027498	0.0021122

OBS	P_HDDV_6	P_HDDV_7	P_HDDV8A	P_HDDV8B	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34
1	0.0053114	0.0028217	0.0034524	0.0636291	0.0010000	0.0000703	0.0004919	0.0009552	0.0012550
2	0.0053828	0.0028596	0.0034988	0.0332494	0.0010000	0.0000865	0.0006054	0.0011756	0.0012553
3	0.0063763	0.0033874	0.0041446	0.2771645	0.0010000	0.0001667	0.0011670	0.0022662	0.0010493

Northeast Texas Region 2012 VMT Mix — Friday

OBS	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2B	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	Art	0.6324579	0.0524375	0.1835085	0.0349346	0.0160645	0.0044853	0.0021184	0.0010592	0.0006161
2	Col	0.6563876	0.0518352	0.1814008	0.0343092	0.0157769	0.0046562	0.0021991	0.0010995	0.0006395
3	Fway	0.4859762	0.0479084	0.1676588	0.0308573	0.0141895	0.0049943	0.0023588	0.0011794	0.0006860

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	0.0015239	0.0005296	0.0004215	0.0000540	0.0005589	0.0000000	0.0087374	0.0032369	0.0015619	0.0011997
2	0.0015820	0.0005498	0.0004376	0.0000561	0.0005800	0.0000000	0.0087506	0.0032418	0.0015642	0.0012015
3	0.0016969	0.0005897	0.0004693	0.0000602	0.0004296	0.0000000	0.0114616	0.0042461	0.0020488	0.0015737

OBS	P_HDDV_6	P_HDDV_7	P_HDDV8A	P_HDDV8B	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34
1	0.0036217	0.0019240	0.0023541	0.0433876	0.0010000	0.0000409	0.0003354	0.0006513	0.0011792
2	0.0036272	0.0019269	0.0023577	0.0224051	0.0010000	0.0000497	0.0004079	0.0007922	0.0011656
3	0.0047509	0.0025239	0.0030881	0.2065110	0.0010000	0.0001060	0.0008695	0.0016885	0.0010773

Northeast Texas Region 2012 VMT Mix — Saturday

OBS	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2B	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	Art	0.6643850	0.0523073	0.1830530	0.0327236	0.0150477	0.0028647	0.0013529	0.0006765	0.0003935
2	Col	0.6836241	0.0512650	0.1794053	0.0318633	0.0146521	0.0029485	0.0013925	0.0006963	0.0004050
3	Fway	0.5487246	0.0513588	0.1797336	0.0310631	0.0142842	0.0034280	0.0016190	0.0008095	0.0004708

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	0.0009733	0.0003382	0.0002692	0.0000345	0.0005877	0.0000000	0.0055799	0.0020672	0.0009974	0.0007661
2	0.0010018	0.0003481	0.0002771	0.0000355	0.0006047	0.0000000	0.0055406	0.0020526	0.0009904	0.0007608
3	0.0011647	0.0004048	0.0003221	0.0000413	0.0004856	0.0000000	0.0078662	0.0029142	0.0014061	0.0010801

OBS	P_HDDV_6	P_HDDV_7	P_HDDV8A	P_HDDV8B	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34
1	0.0023129	0.0012287	0.0015034	0.0277080	0.0010000	0.0000261	0.0002142	0.0004159	0.0011729
2	0.0022966	0.0012201	0.0014928	0.0141861	0.0010000	0.0000315	0.0002583	0.0005016	0.0011495
3	0.0032606	0.0017322	0.0021194	0.1417312	0.0010000	0.0000728	0.0005968	0.0011589	0.0011516

Northeast Texas Region 2012 VMT Mix — Sunday

OBS	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2B	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	Art	0.6277571	0.0624371	0.2185029	0.0374863	0.0172378	0.0019372	0.0009149	0.0004575	0.0002661
2	Col	0.6445521	0.0610619	0.2136903	0.0364226	0.0167487	0.0019896	0.0009397	0.0004698	0.0002733
3	Fway	0.5370010	0.0634926	0.2221967	0.0368540	0.0169471	0.0024009	0.0011339	0.0005670	0.0003298

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	0.0006582	0.0002287	0.0001821	0.0000233	0.0005564	0.0000000	0.0037737	0.0013980	0.0006746	0.0005181
2	0.0006760	0.0002349	0.0001870	0.0000240	0.0005713	0.0000000	0.0037391	0.0013852	0.0006684	0.0005134
3	0.0008157	0.0002835	0.0002256	0.0000289	0.0004761	0.0000000	0.0055098	0.0020412	0.0009849	0.0007565

OBS	P_HDDV_6	P_HDDV_7	P_HDDV8A	P_HDDV8B	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34
1	0.0015642	0.0008310	0.0010167	0.0187390	0.0010000	0.0000177	0.0001449	0.0002813	0.0013952
2	0.0015499	0.0008234	0.0010074	0.0095735	0.0010000	0.0000213	0.0001743	0.0003385	0.0013645
3	0.0022839	0.0012133	0.0014845	0.0992738	0.0010000	0.0000510	0.0004180	0.0008117	0.0014188

APPENDIX F
TEMPERATURE, HUMIDITY, SUNRISE/SUNSET TIME — MOBILE6 INPUTS

TEMPERATURE, PERCENT RELATIVE HUMIDITY, SUNRISE, AND SUNSET TIMES (TO NEAREST HOUR)

Hourly temperatures and hourly relative humidity inputs start with the 6 a.m. hour and are from the same calendar day (i.e., order is 6 a.m. to 12 a.m. followed by 12 a.m. to 6 a.m., CDT). Data are in MOBILE6 input format. Barometric pressure is MOBILE6 default.

* Gregg County (used for Harrision, Rusk, Upshur also), Thursday August 19, 1999
RELATIVE HUMIDITY: 76.0 72.0 53.0 42.0 37.0 35.0 32.0 25.0 23.0 24.0 22.0 23.0 24.0 36.0 36.0 48.0 48.0 51.0 62.0 62.0 62.0 67.0 74.0 69.0
SUNRISE/SUNSET: 7 8
BAROMETRIC PRES: 29.92
HOURLY TEMPERATURES: 76.6 76.5 81.7 87.7 91.2 95.0 98.1 99.5 101.0 101.6 101.7 101.8 100.8 95.7 91.0 90.2 87.5 85.1 82.1 84.1 83.3 81.4 79.4 78.0

* Gregg County (used for Harrision, Rusk, Upshur also), Friday August 20, 1999
RELATIVE HUMIDITY: 64.0 60.0 57.0 53.0 53.0 48.0 45.0 40.0 37.0 34.0 33.0 33.0 34.0 43.0 46.0 50.0 51.0 58.0 59.0 59.0 57.0 58.0 65.0 65.0
SUNRISE/SUNSET: 7 8
BAROMETRIC PRES: 29.92
HOURLY TEMPERATURES: 77.2 76.4 77.9 80.0 82.7 85.5 88.2 90.7 93.4 95.2 96.5 96.7 96.0 93.7 89.7 86.9 84.6 82.2 83.6 82.5 82.2 81.4 79.9 78.6

* Gregg County (used for Harrision, Rusk, Upshur also), Saturday August 21, 1999
RELATIVE HUMIDITY: 73.0 69.0 62.0 55.0 46.0 41.0 36.0 33.0 27.0 24.0 24.0 26.0 30.0 36.0 44.0 47.0 49.0 50.0 57.0 60.0 62.0 67.0 69.0 71.0
SUNRISE/SUNSET: 7 8
BAROMETRIC PRES: 29.92
HOURLY TEMPERATURES: 76.0 75.5 77.2 80.2 84.0 87.4 90.0 91.8 92.8 94.0 95.1 95.1 94.7 92.8 89.4 86.9 84.8 83.2 80.6 79.8 79.0 77.2 76.0 76.0

* Gregg County (used for Harrision, Rusk, Upshur also), Sunday August 22, 1999
RELATIVE HUMIDITY: 79.0 66.0 56.0 51.0 48.0 48.0 41.0 32.0 37.0 34.0 32.0 29.0 31.0 37.0 51.0 53.0 62.0 55.0 50.0 60.0 58.0 66.0 66.0 73.0
SUNRISE/SUNSET: 7 8
BAROMETRIC PRES: 29.92
HOURLY TEMPERATURES: 77.6 77.3 77.6 78.9 82.0 86.9 90.5 92.5 93.9 94.8 95.6 95.8 95.6 94.0 89.5 85.9 84.6 84.8 81.8 81.0 79.7 78.4 78.4 77.7

* Smith County, Thursday August 19, 1999
RELATIVE HUMIDITY: 68.5 61.5 50.5 41.0 36.5 36.0 30.5 26.5 24.0 24.0 23.0 29.0 31.5 42.5 45.0 53.5 46.5 42.0 56.5 56.5 56.5 61.0 64.5 61.0
SUNRISE/SUNSET: 7 8
BAROMETRIC PRES: 29.92
HOURLY TEMPERATURES: 74.7 75.7 81.3 85.6 89.9 93.4 96.0 98.0 99.9 100.8 100.9 101.1 98.5 94.0 89.1 87.2 84.8 83.7 81.0 79.0 79.8 79.2 77.7 74.1

* Smith County, Friday August 20, 1999
RELATIVE HUMIDITY: 54.5 52.5 49.5 45.0 44.5 41.0 37.5 33.5 28.5 27.0 25.5 26.0 27.0 32.0 35.5 40.0 43.5 49.0 47.0 49.5 49.0 51.0 56.0 57.5
SUNRISE/SUNSET: 7 8
BAROMETRIC PRES: 29.92
HOURLY TEMPERATURES: 74.9 74.5 76.7 79.8 82.6 85.1 88.1 91.5 94.3 95.6 96.4 96.5 95.8 92.5 88.0 83.9 81.8 80.2 82.6 81.0 80.7 79.0 76.9 75.3

* Smith County, Saturday August 21, 1999
RELATIVE HUMIDITY: 68.5 66.5 58.5 53.0 46.5 43.0 36.5 32.5 27.5 26.0 25.5 25.5 29.0 34.5 41.0 44.0 45.5 49.0 49.0 52.5 57.0 57.5 61.5 64.0
SUNRISE/SUNSET: 7 8
BAROMETRIC PRES: 29.92
HOURLY TEMPERATURES: 75.9 76.3 78.9 82.4 85.7 88.3 90.6 92.5 93.8 94.6 95.4 95.6 94.6 92.5 88.9 85.2 82.7 82.7 79.3 78.5 77.1 77.9 76.3 76.6

* Smith County, Sunday August 22, 1999
RELATIVE HUMIDITY: 77.5 70.0 60.5 57.0 49.0 46.0 41.0 36.0 36.5 35.0 33.0 32.0 34.0 37.5 48.0 49.0 56.0 53.0 47.5 53.0 56.5 64.0 66.5 71.0
SUNRISE/SUNSET: 7 8
BAROMETRIC PRES: 29.92
HOURLY TEMPERATURES: 74.6 74.6 80.3 83.3 86.5 88.6 90.9 92.4 93.8 95.3 96.1 96.1 95.2 91.7 88.2 84.4 83.9 83.9 82.3 80.9 79.0 76.5 74.9 75.1

APPENDIX G
MOBILE6 REGISTRATIONS DISTRIBUTIONS AND DIESEL FRACTIONS INPUTS

Registration Distributions

```
*  Tyler/Longview/Marshall MSA - Smith, Gregg, Harrison, Upshur, and Rusk Counties
*  Calculated from Mid-Year (July) 2002 Registration data
*  LDV
    1  0.05402 0.07597 0.08107 0.07819 0.06843 0.06872 0.06771 0.07465 0.06034 0.05551
       0.04791 0.04440 0.03913 0.03308 0.02753 0.02027 0.01826 0.01715 0.01347 0.00927
       0.00638 0.00505 0.00386 0.00542 0.02421
*  LDT1
    2  0.04990 0.07539 0.06959 0.05751 0.06481 0.06947 0.05636 0.06583 0.06283 0.04941
       0.04195 0.03794 0.03276 0.03277 0.02828 0.02142 0.02597 0.02301 0.02080 0.01428
       0.01483 0.01318 0.00734 0.01113 0.05324
*  LDT2
    3  0.04990 0.07539 0.06959 0.05751 0.06481 0.06947 0.05636 0.06583 0.06283 0.04941
       0.04195 0.03794 0.03276 0.03277 0.02828 0.02142 0.02597 0.02301 0.02080 0.01428
       0.01483 0.01318 0.00734 0.01113 0.05324
*  LDT3
    4  0.10126 0.15026 0.11127 0.11801 0.05174 0.07813 0.06127 0.05769 0.03920 0.03540
       0.02508 0.02297 0.01607 0.01633 0.01428 0.00875 0.01338 0.01459 0.01201 0.00717
       0.00853 0.00453 0.00458 0.00764 0.01986
*  LDT4
    5  0.10126 0.15026 0.11127 0.11801 0.05174 0.07813 0.06127 0.05769 0.03920 0.03540
       0.02508 0.02297 0.01607 0.01633 0.01428 0.00875 0.01338 0.01459 0.01201 0.00717
       0.00853 0.00453 0.00458 0.00764 0.01986
*  HDV2
    6  0.14243 0.20750 0.10629 0.09566 0.06845 0.06250 0.02849 0.04039 0.03061 0.02594
       0.01828 0.02211 0.01148 0.01318 0.01190 0.00893 0.01743 0.01786 0.00893 0.00723
       0.01190 0.00680 0.00680 0.00893 0.01998
*  HDV3
    7  0.03953 0.12287 0.12179 0.11966 0.04060 0.07906 0.03098 0.05662 0.04380 0.05556
       0.03526 0.03098 0.03098 0.03526 0.01709 0.00962 0.02030 0.00855 0.01282 0.00641
       0.02030 0.00427 0.00427 0.00641 0.04701
*  HDV4
    8  0.02915 0.08296 0.16145 0.14574 0.05605 0.07623 0.04933 0.07623 0.06502 0.04260
       0.03812 0.02466 0.02242 0.01794 0.00897 0.00224 0.00448 0.00897 0.00224 0.01121
       0.01121 0.00673 0.00448 0.01121 0.04036
*  HDV5
    9  0.07742 0.12903 0.14195 0.07742 0.02903 0.04516 0.00968 0.03548 0.04516 0.03871
       0.01290 0.02581 0.04194 0.01290 0.01290 0.01613 0.02581 0.02258 0.02903 0.02258
       0.01290 0.01613 0.01290 0.02258 0.08387
*  HDV6
   10  0.03734 0.04901 0.06184 0.07351 0.08519 0.05601 0.05951 0.06184 0.05718 0.06418
       0.03734 0.03967 0.03034 0.02567 0.02450 0.02800 0.02800 0.01634 0.01750 0.01867
       0.01284 0.01634 0.01867 0.01400 0.06651
*  HDV7
   11  0.06553 0.04126 0.04854 0.03883 0.07039 0.09467 0.05340 0.04369 0.05583 0.06068
       0.04126 0.08010 0.03155 0.04369 0.03155 0.03641 0.01456 0.03883 0.02670 0.01214
       0.00971 0.03641 0.01214 0.00485 0.00728
*  HDV8A
   12  0.01493 0.03838 0.01279 0.05117 0.04904 0.02985 0.06397 0.09169 0.05757 0.04904
       0.03625 0.05117 0.05117 0.03625 0.02985 0.03198 0.04478 0.06183 0.02772 0.00640
       0.01919 0.02772 0.02345 0.03198 0.06183
*  HDV8B
   13  0.11688 0.02597 0.12987 0.20779 0.05195 0.12987 0.03896 0.12987 0.02597 0.00000
       0.00000 0.00000 0.02597 0.01299 0.03896 0.01299 0.01299 0.01299 0.01299 0.00000
       0.00000 0.00000 0.00000 0.00000 0.01299
*   HDBS is MOBILE6 default
*   HDBT is MOBILE6 default
*  MC
   16  0.13446 0.12817 0.10644 0.09405 0.07069 0.05159 0.04631 0.03758 0.03169 0.02478
       0.01605 0.01239 0.01097 0.01158 0.01097 0.00995 0.02072 0.02641 0.01686 0.01991
       0.02458 0.01991 0.01463 0.00853 0.05078
```

Used for all analysis years.

1995 Statewide Diesel Sales Fractions* Estimates

```
DIESEL FRACTIONS:

 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 0.05100 0.07060 0.03900 0.02690 0.01140 0.00930 0.01370
 0.01550 0.00670 0.00670 0.00670 0.00670
 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 0.06560 0.06160 0.04390 0.03160 0.02590 0.00000 0.01870
 0.10380 0.11700 0.11700 0.11700 0.11700
 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 0.06560 0.06160 0.04390 0.03160 0.02590 0.00000 0.01870
 0.10380 0.11700 0.11700 0.11700 0.11700
 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 0.02560 0.00130 0.00060 0.00110 0.00010 0.00000 0.00000
 0.00000 0.00010 0.00010 0.00010 0.00010
 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 0.02560 0.00130 0.00060 0.00110 0.00010 0.00000 0.00000
 0.00000 0.00010 0.00010 0.00010 0.00010
 0.20063 0.39808 0.37552 0.32844 0.35352 0.27226 0.22309 0.17730 0.14483 0.20196
 0.17056 0.19074 0.17148 0.14044 0.00323 0.00000 0.00382 0.00303 0.00303 0.00303
 0.00303 0.00303 0.00303 0.00303 0.00303
 0.32661 0.55020 0.58601 0.62333 0.51890 0.51653 0.46856 0.35294 0.25512 0.29752
 0.17664 0.22368 0.21759 0.16066 0.03297 0.01508 0.00373 0.00406 0.00406 0.00406
 0.00406 0.00406 0.00406 0.00406 0.00406
 0.44671 0.70203 0.69632 0.65581 0.65789 0.57317 0.60350 0.35745 0.24855 0.13542
 0.12313 0.18852 0.13253 0.17797 0.14583 0.05000 0.03185 0.01034 0.01034 0.01034
 0.01034 0.01034 0.01034 0.01034 0.01034
 0.45659 0.67857 0.72535 0.65432 0.70483 0.60383 0.59509 0.41699 0.33654 0.25337
 0.30960 0.25418 0.28244 0.20767 0.23790 0.14394 0.12340 0.03350 0.03350 0.03350
 0.03350 0.03350 0.03350 0.03350 0.03350
 0.54923 0.77170 0.75818 0.57117 0.66954 0.72241 0.69427 0.56318 0.62198 0.54717
 0.46968 0.43758 0.40440 0.37461 0.43137 0.18953 0.14992 0.04644 0.04644 0.04644
 0.04644 0.04644 0.04644 0.04644 0.04644
 0.48829 0.82916 0.84387 0.84789 0.85788 0.83389 0.82784 0.81143 0.81176 0.78571
 0.74359 0.73051 0.70909 0.63052 0.70608 0.36715 0.27615 0.20888 0.20888 0.20888
 0.20888 0.20888 0.20888 0.20888 0.20888
 0.67588 0.96360 0.95187 0.94895 0.93046 0.94083 0.94469 0.95000 0.94092 0.91551
 0.91340 0.92834 0.91875 0.91908 0.88970 0.56726 0.56641 0.55152 0.55152 0.55152
 0.55152 0.55152 0.55152 0.55152 0.55152
 0.78746 0.96058 0.98670 0.96262 1.00000 0.95333 0.97500 0.95238 0.92424 0.92958
 0.98969 0.95455 0.97143 0.94286 0.96296 0.40000 0.44444 0.51064 0.51064 0.51064
 0.51064 0.51064 0.51064 0.51064 0.51064
 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 0.32600 0.26390 0.05940 0.04600 0.02910 0.02400 0.00860
 0.00870 0.00000 0.00000 0.00000 0.00000
```

HDV fractions are estimated from TxDOT registration data (mid-year July 2002).
LDV, LDT, and Bus fractions are EPA defaults.
*See vehicle type key at end of appendix.

1999 Statewide Diesel Sales Fractions* Estimates

```
DIESEL FRACTIONS:

 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 0.05100 0.07060 0.03900
 0.02690 0.01140 0.00930 0.01370 0.01550
 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 0.06560 0.06160 0.04390
 0.03160 0.02590 0.00000 0.01870 0.10380
 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 0.06560 0.06160 0.04390
 0.03160 0.02590 0.00000 0.01870 0.10380
 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 0.02560 0.00130 0.00060
 0.00110 0.00010 0.00000 0.00000 0.00000
 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 0.02560 0.00130 0.00060
 0.00110 0.00010 0.00000 0.00000 0.00000
 0.66232 0.57703 0.47784 0.45121 0.20063 0.39808 0.37552 0.32844 0.35352 0.27226
 0.22309 0.17730 0.14483 0.20196 0.17056 0.19074 0.17148 0.14044 0.00323 0.00000
 0.00382 0.00303 0.00303 0.00303 0.00303
 0.64013 0.51450 0.57439 0.54389 0.32661 0.55020 0.58601 0.62333 0.51890 0.51653
 0.46856 0.35294 0.25512 0.29752 0.17664 0.22368 0.21759 0.16066 0.03297 0.01508
 0.00373 0.00406 0.00406 0.00406 0.00406
 0.63857 0.67967 0.73075 0.66667 0.44671 0.70203 0.69632 0.65581 0.65789 0.57317
 0.60350 0.35745 0.24855 0.13542 0.12313 0.18852 0.13253 0.17797 0.14583 0.05000
 0.03185 0.01034 0.01034 0.01034 0.01034
 0.88016 0.75422 0.72991 0.80476 0.45659 0.67857 0.72535 0.65432 0.70483 0.60383
 0.59509 0.41699 0.33654 0.25337 0.30960 0.25418 0.28244 0.20767 0.23790 0.14394
 0.12340 0.03350 0.03350 0.03350 0.03350
 0.86169 0.81933 0.74312 0.78239 0.54923 0.77170 0.75818 0.57117 0.66954 0.72241
 0.69427 0.56318 0.62198 0.54717 0.46968 0.43758 0.40440 0.37461 0.43137 0.18953
 0.14992 0.04644 0.04644 0.04644 0.04644
 0.88593 0.84672 0.75646 0.81899 0.48829 0.82916 0.84387 0.84789 0.85788 0.83389
 0.82784 0.81143 0.81176 0.78571 0.74359 0.73051 0.70909 0.63052 0.70608 0.36715
 0.27615 0.20888 0.20888 0.20888 0.20888
 0.94685 0.94189 0.86917 0.90694 0.67588 0.96360 0.95187 0.94895 0.93046 0.94083
 0.94469 0.95000 0.94092 0.91551 0.91340 0.92834 0.91875 0.91908 0.88970 0.56726
 0.56641 0.55152 0.55152 0.55152 0.55152
 0.98288 0.98189 0.95390 0.99119 0.78746 0.96058 0.98670 0.96262 1.00000 0.95333
 0.97500 0.95238 0.92424 0.92958 0.98969 0.95455 0.97143 0.94286 0.96296 0.40000
 0.44444 0.51064 0.51064 0.51064 0.51064
 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 0.32600 0.26390 0.05940
 0.04600 0.02910 0.02400 0.00860 0.00870
```

HDV fractions are estimated from TxDOT registration data (mid-year July 2002).
LDV, LDT, and Bus fractions are EPA defaults.
*See vehicle type key at end of appendix.

2002 Statewide Diesel Sales Fractions* Estimates

```
DIESEL FRACTIONS:

 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
 0.05100 0.07060 0.03900 0.02690 0.01140
 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
 0.06560 0.06160 0.04390 0.03160 0.02590
 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
 0.06560 0.06160 0.04390 0.03160 0.02590
 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
 0.02560 0.00130 0.00060 0.00110 0.00010
 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
 0.02560 0.00130 0.00060 0.00110 0.00010
 0.81361 0.75050 0.61397 0.66232 0.57703 0.47784 0.45121 0.20063 0.39808 0.37552
 0.32844 0.35352 0.27226 0.22309 0.17730 0.14483 0.20196 0.17056 0.19074 0.17148
 0.14044 0.00323 0.00000 0.00382 0.00303
 0.68374 0.64723 0.65615 0.64013 0.51450 0.57439 0.54389 0.32661 0.55020 0.58601
 0.62333 0.51890 0.51653 0.46856 0.35294 0.25512 0.29752 0.17664 0.22368 0.21759
 0.16066 0.03297 0.01508 0.00373 0.00406
 0.75174 0.71334 0.72152 0.63857 0.67967 0.73075 0.66667 0.44671 0.70203 0.69632
 0.65581 0.65789 0.57317 0.60350 0.35745 0.24855 0.13542 0.12313 0.18852 0.13253
 0.17797 0.14583 0.05000 0.03185 0.01034
 0.92205 0.86775 0.89367 0.88016 0.75422 0.72991 0.80476 0.45659 0.67857 0.72535
 0.65432 0.70483 0.60383 0.59509 0.41699 0.33654 0.25337 0.30960 0.25418 0.28244
 0.20767 0.23790 0.14394 0.12340 0.03350
 0.92645 0.87176 0.86671 0.86169 0.81933 0.74312 0.78239 0.54923 0.77170 0.75818
 0.57117 0.66954 0.72241 0.69427 0.56318 0.62198 0.54717 0.46968 0.43758 0.40440
 0.37461 0.43137 0.18953 0.14992 0.04644
 0.93134 0.87037 0.90479 0.88593 0.84672 0.75646 0.81899 0.48829 0.82916 0.84387
 0.84789 0.85788 0.83389 0.82784 0.81143 0.81176 0.78571 0.74359 0.73051 0.70909
 0.63052 0.70608 0.36715 0.27615 0.20888
 0.95095 0.93265 0.93355 0.94685 0.94189 0.86917 0.90694 0.67588 0.96360 0.95187
 0.94895 0.93046 0.94083 0.94469 0.95000 0.94092 0.91551 0.91340 0.92834 0.91875
 0.91908 0.88970 0.56726 0.56641 0.55152
 0.98020 0.98603 0.99167 0.98288 0.98189 0.95390 0.99119 0.78746 0.96058 0.98670
 0.96262 1.00000 0.95333 0.97500 0.95238 0.92424 0.92958 0.98969 0.95455 0.97143
 0.94286 0.96296 0.40000 0.44444 0.51064
 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
 0.32600 0.26390 0.05940 0.04600 0.02910
```

HDV fractions are estimated from TxDOT registration data (mid-year July 2002).
LDV, LDT, and Bus fractions are EPA defaults.
*See vehicle type key at end of appendix.

2005 Statewide Diesel Sales Fractions* Estimates

```
DIESEL FRACTIONS:

 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 0.05100 0.07060
 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 0.06560 0.06160
 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 0.06560 0.06160
 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 0.02560 0.00130
 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 0.02560 0.00130
 0.81361 0.81361 0.81361 0.81361 0.75050 0.61397 0.66232 0.57703 0.47784 0.45121
 0.20063 0.39808 0.37552 0.32844 0.35352 0.27226 0.22309 0.17730 0.14483 0.20196
 0.17056 0.19074 0.17148 0.14044 0.00323
 0.68374 0.68374 0.68374 0.68374 0.64723 0.65615 0.64013 0.51450 0.57439 0.54389
 0.32661 0.55020 0.58601 0.62333 0.51890 0.51653 0.46856 0.35294 0.25512 0.29752
 0.17664 0.22368 0.21759 0.16066 0.03297
 0.75174 0.75174 0.75174 0.75174 0.71334 0.72152 0.63857 0.67967 0.73075 0.66667
 0.44671 0.70203 0.69632 0.65581 0.65789 0.57317 0.60350 0.35745 0.24855 0.13542
 0.12313 0.18852 0.13253 0.17797 0.14583
 0.92205 0.92205 0.92205 0.92205 0.86775 0.89367 0.88016 0.75422 0.72991 0.80476
 0.45659 0.67857 0.72535 0.65432 0.70483 0.60383 0.59509 0.41699 0.33654 0.25337
 0.30960 0.25418 0.28244 0.20767 0.23790
 0.92645 0.92645 0.92645 0.92645 0.87176 0.86671 0.86169 0.81933 0.74312 0.78239
 0.54923 0.77170 0.75818 0.57117 0.66954 0.72241 0.69427 0.56318 0.62198 0.54717
 0.46968 0.43758 0.40440 0.37461 0.43137
 0.93134 0.93134 0.93134 0.93134 0.87037 0.90479 0.88593 0.84672 0.75646 0.81899
 0.48829 0.82916 0.84387 0.84789 0.85788 0.83389 0.82784 0.81143 0.81176 0.78571
 0.74359 0.73051 0.70909 0.63052 0.70608
 0.95095 0.95095 0.95095 0.95095 0.93265 0.93355 0.94685 0.94189 0.86917 0.90694
 0.67588 0.96360 0.95187 0.94895 0.93046 0.94083 0.94469 0.95000 0.94092 0.91551
 0.91340 0.92834 0.91875 0.91908 0.88970
 0.98020 0.98020 0.98020 0.98020 0.98603 0.99167 0.98288 0.98189 0.95390 0.99119
 0.78746 0.96058 0.98670 0.96262 1.00000 0.95333 0.97500 0.95238 0.92424 0.92958
 0.98969 0.95455 0.97143 0.94286 0.96296
 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 0.32600 0.26390
```

HDV fractions are estimated from TxDOT registration data (mid-year July 2002).
LDV, LDT, and Bus fractions are EPA defaults.
*See vehicle type key at end of appendix.

2007 Statewide Diesel Sales Fractions* Estimates

```
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
 0.81361 0.81361 0.81361 0.81361 0.81361 0.81361 0.75050 0.61397 0.66232 0.57703
 0.47784 0.45121 0.20063 0.39808 0.37552 0.32844 0.35352 0.27226 0.22309 0.17730
 0.14483 0.20196 0.17056 0.19074 0.17148
 0.68374 0.68374 0.68374 0.68374 0.68374 0.68374 0.64723 0.65615 0.64013 0.51450
 0.57439 0.54389 0.32661 0.55020 0.58601 0.62333 0.51890 0.51653 0.46856 0.35294
 0.25512 0.29752 0.17664 0.22368 0.21759
 0.75174 0.75174 0.75174 0.75174 0.75174 0.75174 0.71334 0.72152 0.63857 0.67967
 0.73075 0.66667 0.44671 0.70203 0.69632 0.65581 0.65789 0.57317 0.60350 0.35745
 0.24855 0.13542 0.12313 0.18852 0.13253
 0.92205 0.92205 0.92205 0.92205 0.92205 0.92205 0.86775 0.89367 0.88016 0.75422
 0.72991 0.80476 0.45659 0.67857 0.72535 0.65432 0.70483 0.60383 0.59509 0.41699
 0.33654 0.25337 0.30960 0.25418 0.28244
 0.92645 0.92645 0.92645 0.92645 0.92645 0.92645 0.87176 0.86671 0.86169 0.81933
 0.74312 0.78239 0.54923 0.77170 0.75818 0.57117 0.66954 0.72241 0.69427 0.56318
 0.62198 0.54717 0.46968 0.43758 0.40440
 0.93134 0.93134 0.93134 0.93134 0.93134 0.93134 0.87037 0.90479 0.88593 0.84672
 0.75646 0.81899 0.48829 0.82916 0.84387 0.84789 0.85788 0.83389 0.82784 0.81143
 0.81176 0.78571 0.74359 0.73051 0.70909
 0.95095 0.95095 0.95095 0.95095 0.95095 0.95095 0.93265 0.93355 0.94685 0.94189
 0.86917 0.90694 0.67588 0.96360 0.95187 0.94895 0.93046 0.94083 0.94469 0.95000
 0.94092 0.91551 0.91340 0.92834 0.91875
 0.98020 0.98020 0.98020 0.98020 0.98020 0.98020 0.98603 0.99167 0.98288 0.98189
 0.95390 0.99119 0.78746 0.96058 0.98670 0.96262 1.00000 0.95333 0.97500 0.95238
 0.92424 0.92958 0.98969 0.95455 0.97143
 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
```

HDV fractions are estimated from TxDOT registration data (mid-year July 2002).
LDV, LDT, and Bus fractions are EPA defaults.
*See vehicle type key at end of appendix.

2012 Statewide Diesel Sales Fractions* Estimates

```
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 0.00090 0.00090 0.00090 0.00090 0.00090 0.00060 0.00010 0.00030
 0.00060 0.00130 0.00040 0.00040 0.00010
 0.00000 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
 0.00000 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 0.00000 0.00000 0.00000 0.00000 0.00000
 0.00000 0.00000 0.00000 0.00000 0.00000
 0.01260 0.01260 0.01260 0.01260 0.01260 0.01260 0.01260 0.01260 0.01260 0.01260
 0.01260 0.01260 0.01260 0.01260 0.01260 0.01260 0.01260 0.01150 0.01110 0.01450
 0.01150 0.01290 0.00960 0.00830 0.00720
 0.01260 0.01260 0.01260 0.01260 0.01260 0.01260 0.01260 0.01260 0.01260 0.01260
 0.01260 0.01260 0.01260 0.01260 0.01260 0.01260 0.01260 0.01150 0.01110 0.01450
 0.01150 0.01290 0.00960 0.00830 0.00720
 0.81361 0.81361 0.81361 0.81361 0.81361 0.81361 0.81361 0.81361 0.81361 0.81361
 0.81361 0.75050 0.61397 0.66232 0.57703 0.47784 0.45121 0.20063 0.39808 0.37552
 0.32844 0.35352 0.27226 0.22309 0.17730
 0.68374 0.68374 0.68374 0.68374 0.68374 0.68374 0.68374 0.68374 0.68374 0.68374
 0.68374 0.64723 0.65615 0.64013 0.51450 0.57439 0.54389 0.32661 0.55020 0.58601
 0.62333 0.51890 0.51653 0.46856 0.35294
 0.75174 0.75174 0.75174 0.75174 0.75174 0.75174 0.75174 0.75174 0.75174 0.75174
 0.75174 0.71334 0.72152 0.63857 0.67967 0.73075 0.66667 0.44671 0.70203 0.69632
 0.65581 0.65789 0.57317 0.60350 0.35745
 0.92205 0.92205 0.92205 0.92205 0.92205 0.92205 0.92205 0.92205 0.92205 0.92205
 0.92205 0.86775 0.89367 0.88016 0.75422 0.72991 0.80476 0.45659 0.67857 0.72535
 0.65432 0.70483 0.60383 0.59509 0.41699
 0.92645 0.92645 0.92645 0.92645 0.92645 0.92645 0.92645 0.92645 0.92645 0.92645
 0.92645 0.87176 0.86671 0.86169 0.81933 0.74312 0.78239 0.54923 0.77170 0.75818
 0.57117 0.66954 0.72241 0.69427 0.56318
 0.93134 0.93134 0.93134 0.93134 0.93134 0.93134 0.93134 0.93134 0.93134 0.93134
 0.93134 0.87037 0.90479 0.88593 0.84672 0.75646 0.81899 0.48829 0.82916 0.84387
 0.84789 0.85788 0.83389 0.82784 0.81143
 0.95095 0.95095 0.95095 0.95095 0.95095 0.95095 0.95095 0.95095 0.95095 0.95095
 0.95095 0.93265 0.93355 0.94685 0.94189 0.86917 0.90694 0.67588 0.96360 0.95187
 0.94895 0.93046 0.94083 0.94469 0.95000
 0.98020 0.98020 0.98020 0.98020 0.98020 0.98020 0.98020 0.98020 0.98020 0.98020
 0.98020 0.98603 0.99167 0.98288 0.98189 0.95390 0.99119 0.78746 0.96058 0.98670
 0.96262 1.00000 0.95333 0.97500 0.95238
 0.95850 0.95850 0.95850 0.95850 0.95850 0.95850 0.95850 0.95850 0.95850 0.95850
 0.95850 0.95850 0.95850 0.95850 0.95850 0.95850 0.95850 0.88570 0.85250 0.87950
 0.99000 0.91050 0.87600 0.77100 0.75020
```

HDV fractions are estimated from TxDOT registration data (mid-year July 2002).
LDV, LDT, and Bus fractions are EPA defaults.
*See vehicle type key at end of appendix.

Source of Diesel Fractions for Composite Vehicle Types (DIESEL FRACTIONS Command)

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, 2002 Statewide Registrations
7	HDV3	Class 3 Heavy-Duty Vehicles	TxDOT July, 2002 Statewide Registrations
8	HDV4	Class 4 Heavy-Duty Vehicles	TxDOT July, 2002 Statewide Registrations
9	HDV5	Class 5 Heavy-Duty Vehicles	TxDOT July, 2002 Statewide Registrations
10	HDV6	Class 6 Heavy-Duty Vehicles	TxDOT July, 2002 Statewide Registrations
11	HDV7	Class 7 Heavy-Duty Vehicles	TxDOT July, 2002 Statewide Registrations
12	HDV8A	Class 8a Heavy-Duty Vehicles	TxDOT July, 2002 Statewide Registrations
13	HDV8B	Class 8b Heavy-Duty Vehicles	TxDOT July, 2002 Statewide Registrations
14	HDBS	School Buses	EPA MOBILE6 Evaluation Year Default