APPENDIX D

REVISIONS TO APPENDIX 9, HOUSTON-GALVESTION-BRAZORIA 1997 EIGHT-HOUR OZONE NONATTAINMENT AREA REASONABLE FURTHER PROGRESS ON-ROAD MOBILE SOURCE EMISSIONS INVENTORIES, ADOPTED MARCH 10, 2010

Project Number 2012-002-SIP-NR

Proposal
October 17, 2012

HOUSTON-GALVESTON-BRAZORIA 1997 EIGHT-HOUR OZONE NONATTAINMENT AREA REASONABLE FURTHER PROGRESS ON-ROAD MOBILE SOURCE EMISSIONS INVENTORIES

This appendix documents the development of the on-road mobile emissions inventory for the updates to the Houston-Galveston-Brazoria (HGB) Reasonable Further Progress (RFP) State Implementation Plan for the 1997 Eight-Hour Ozone Standard.

The Texas Transportation Institute (TTI) developed the RFP emissions inventories at the request and under the direction of the Texas Commission on Environmental Quality (TCEQ). The on-road mobile source emissions inventories and control strategy reduction estimates reflect the most recent planning assumptions for the HGB transportation network. Complete documentation of the development and resulting emissions inventory is provided in the attached document, *HGB MOVES-Based RFP On-Road Inventories and Control Strategy Reductions, February 2012*. The final emissions estimates are summarized in the Executive Summary in Table 6: *HGB RFP Ozone Season Weekday On-Road Mobile Source Emissions Inventories*, Table 7: *HGB Ozone Season Weekday VOC Emissions – RFP Control Scenario Inventories (Tons)*, and Table 8: *HGB Ozone Season Weekday* NO_x *Emissions – RFP Control Scenario Inventories and Reductions (Tons)*. The supporting electronic documents for the emissions inventory development, including MOVES input and output files and the post processing spreadsheets, are available in electronic format upon request. Please contact the TCEQ, Air Quality Division, Mobile Source Programs Team for a copy of the electronic information.

The report also documents the development of control strategy reduction estimates for each of the RFP milestone years between 2008 and 2018, and the contingency analysis year 2019. Control strategy emission reduction estimates include the effects of the federal motor vehicle control program (FMVCP) emissions standards, the HGB vehicle inspection and maintenance (I/M) program, federal reformulated gasoline (RFG), and the Texas low-emission diesel (TxLED) program. The emissions summaries include estimates for all control scenarios. The control scenarios are the basis for quantifying the reductions for each control strategy. The final emissions estimates for each control scenario are summarized in the Executive Summary in Tables 7 and 8.

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

HGB MOVES-Based RFP On-Road Inventories and Control Strategy Reductions

Prepared by the Texas Transportation Institute

February 2012

HGB MOVES-BASED RFP ON-ROAD INVENTORIES AND CONTROL STRATEGY REDUCTIONS

TECHNICAL REPORT

FINAL

Prepared for the
Texas Commission on Environmental Quality
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Prepared by the
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EXECUTIVE SUMMARY

The Motor Vehicle Emission Simulator (MOVES) model for production of on-road emissions inventories (EIs) to be included with future State Implementation Plan (SIP) submissions was officially released by the U.S. Environmental Protection Agency (EPA) on March 2, 2010. The Texas Commission on Environmental Quality (TCEQ) will submit future SIPs to the EPA as required under the eight-hour ozone standard and these submissions must be developed using the MOVES model. The HGB Reasonable Further Progress (RFP) SIP will require an RFP analysis from the 2002 base year to the 2018 attainment year, to demonstrate the HGB nonattainment area's (i.e., the eight counties of Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller) progress toward attainment of the EPA's eight-hour ozone standard.

The HGB RFP SIP analysis will require RFP EIs for: the 2002 base year, the 2018 attainment year, the four milestone years (2008, 2011, 2014, 2017), and for the year after the attainment year (2019), for contingency measure analyses. Individual control measure reductions will be needed for each inventory year, excluding the base year. The inventories require the latest planning assumptions to assure the motor vehicle emissions budgets set by the SIP will be consistent with transportation conformity analysis assumptions.

The Texas Transportation Institute (TTI) developed and produced RFP on-road mobile source EIs for the seven HGB RFP analysis years of 2002, 2008, 2011, 2014, 2017, 2018, and 2019. The required on-road inventories include: a 2002 base year; 2002, 2008, 2011, 2014, 2017 and 2018 adjusted base years; future years without post-1990 controls for 2008, 2011, 2014, 2017, 2018, and 2019; and future years with control strategies (i.e., with post-1990 controls) for 2008, 2011, 2014, 2017, 2018, and 2019. TTI also estimated volatile organic compounds (VOC) and oxides of nitrogen (NO_x) emissions aggregate control measure reductions for the future control scenarios (difference between pre-1990 and post-1990 control scenarios), as well as for individual control measures. Since MOVES does not provide for separating the effects due to the individual components of the federal motor vehicle control program (FMVCP) such as Tier 1, Tier 2, and the 2007 heavy-duty diesel vehicle certification standard, TTI calculated the effect of FMVCP as one control reduction.

TTI used the hourly, travel demand model (TDM), MOVES-based "rates-per-activity" EI method (a TTI-developed alternative "external" EI calculation process) to produce hourly emissions estimates by MOVES source use type (SUT) and fuel type, pollutant and emissions process for each of the HGB nonattainment area counties for the ozone season weekday. The inventory process employs methods consistent with the EPA guidance on the use of MOVES for emissions inventory preparation in SIPs and transportation conformity.

Table 1 through Table 4 show summaries of the HGB ozone season weekday adjusted base year, pre-1990 control, and control strategy EIs of VOC and NO_x, and aggregate control measure reductions. A more detailed summary is provided in the following sections, along with the methods used and details of modeling input usage and development.

Table 1. HGB Region Ozone Season Weekday RFP Adjusted Base Year Emissions (Tons/Day).

Year	VMT	Speed	VOC	NO_x
2002	128,145,285	36.40	205.76	552.30
2008	128,145,285	36.40	205.89	578.29
2011	128,145,285	36.40	214.76	601.92
2014	128,145,285	36.40	210.66	600.98
2017	128,145,285	36.40	208.69	599.24
2018	128,145,285	36.40	208.33	598.95

Table 2. HGB Region Ozone Season Weekday RFP Pre-1990 Controls Emissions (Tons/Day).

Year	VMT	Speed	VOC	NO_x
2008	145,079,180	37.04	233.94	653.33
2011	157,480,120	36.64	266.44	744.52
2014	168,350,216	36.63	279.29	793.84
2017	179,999,154	36.07	298.20	850.60
2018	184,065,162	35.87	304.27	870.89
2019	188,226,423	35.65	311.70	891.79

Table 3. HGB Region Ozone Season Weekday RFP Control Strategy Emissions (Tons/Day).

Year	VMT	Speed	VOC	NO_x
2002	128,145,285	36.40	124.47	371.89
2008	145,079,180	37.04	92.91	238.13
2011	157,480,120	36.64	85.05	213.57
2014	168,350,216	36.63	65.04	156.03
2017	179,999,154	36.07	54.34	118.17
2018	184,065,162	35.87	51.84	109.98
2019	188,226,423	35.65	50.28	102.68

Table 4. HGB Ozone Season Weekday VOC and NO_x Emissions – RFP Control Scenario Inventories and Reductions (Tons).

Emissions Analysis		2008	2011	2014	2017	2018	2019
VOC	Pre-90 Control	233.94	266.44	279.29	298.20	304.27	311.70
	Control Strategy	92.91	85.05	65.04	54.34	51.84	50.28
	Reductions	141.03	181.38	214.25	243.86	252.44	261.42
NO_x	Pre-90 Control	653.33	744.52	793.84	850.60	870.89	891.79
	Control Strategy	238.13	213.57	156.03	118.17	109.98	102.68
	Reductions	415.20	530.95	637.81	732.43	760.91	789.11

PURPOSE

The purpose of this work was to develop RFP on-road mobile source EIs, control strategy reduction estimates, and contingency plan reduction estimates for the 2002, 2008, 2011, 2014, 2017, 2018 and 2019 analysis years, for the HGB ozone nonattainment area. The inventories will be used to support HGB RFP SIP analysis, planning, and development. The development of the inventories included consideration of the requirements for transportation conformity.

BACKGROUND

The TCEQ works with local planning districts, the Texas Department of Transportation (TxDOT), and TTI to provide on-road mobile source EIs of air quality pollutants. TxDOT typically funds transportation conformity determinations required under 40 Code of Federal Regulations (CFR) Part 93. TCEQ funds mobile source inventory work in support of the Federal Clean Air Act (CAA) requirements, such as attainment of the National Ambient Air Quality Standards (NAAQS, 42 U.S. Code Annotated 7409), and the study and control of hazardous air pollutants, including those from motor vehicles and/or motor vehicle fuels (as mandated under CAA sections 202 and 211).

TCEQ is planning an update to the HGB RFP SIP which will require RFP analysis from the base year of 2002 to an attainment year of 2018 to demonstrate continued progress toward attainment of the EPA's eight-hour ozone standard for the eight-county nonattainment area of HGB: Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller counties. To complete the HGB RFP SIP analysis, RFP inventories are required for 2002, 2008, 2011, 2014, 2017 and 2018. Individual control measure reduction estimates are required for 2008, 2011, 2014, 2017 and 2018. Contingency measure control reduction estimates are required for 2019.

Although RFP inventories and control reductions were previously developed to support a 2018 HGB RFP SIP, those inventories and control strategy estimates were developed using MOBILE6.2.03. At the time, MOBILE6.2.03 was the newest version of the EPA's on-road mobile emissions factor model. In March 2010, the EPA released a new mobile source emissions model, MOVES. To incorporate MOVES, the HGB RFP SIP inventories will need to be updated. The inventory updates will also include the latest planning assumptions to assure the motor vehicle emissions budgets set by the SIP will be consistent with transportation conformity analysis assumptions.

As part of the inventory development for the RFP analysis, on-road mobile inventories for the eight-hour RFP base, milestone, and attainment years needed to be developed. TTI developed and produced the required eight-hour RFP, on-road mobile source EIs for the HGB eight-hour RFP 2002, 2008, 2011, 2014, 2017 and 2018 analysis years. The required on-road inventories include: a base year inventory for 2002; adjusted base year inventories with a 2002 base year for 2002, 2008, 2011, 2014, 2017 and 2018; future year inventories without post-1990 controls for 2008, 2011, 2014, 2017 and 2018; and future year inventories with control strategies for 2008, 2011, 2014, 2017 and 2018.

The RFP demonstration includes quantifying control reductions that will meet the RFP requirements for each milestone year. Generally, it is best to have control strategy reductions estimated for each control strategy rather than bundled as a total reduction for a given source. As a part of the inventory work, TTI developed and provided emissions reduction estimates for each on-road mobile source control for the four eight-hour RFP milestone years and the attainment year, 2008, 2011, 2014, 2017 and 2018. TTI used standard methodology for quantifying individual control reductions for on-road mobile sources using MOVES2010a. Since MOVES does not provide for separating the effects due to the individual components of the FMVCP such as Tier 1, Tier 2, and the 2007 heavy-duty diesel vehicle certification standard, the effect of FMVCP was calculated as one control reduction.

The RFP demonstration also includes quantifying control reductions that will meet the RFP contingency measure requirements for the year following the attainment year. There are particular methods that have been established for quantifying individual control reductions for on-road mobile sources for RFP contingency analysis. The contingency reduction estimate procedure was based on methods agreed upon during consultation between TTI and TCEQ. TTI developed and furnished contingency measure emissions reduction estimates for each on-road mobile source control between the attainment year and the year following the attainment year, 2018 to 2019. This work was conducted by and completed consistent with the list of references.

Development of On-Road Mobile Source, Eight-Hour RFP Emissions Inventories for the HGB Eight-Hour Ozone Nonattainment Counties for the Eight-Hour Ozone Base Year, Four RFP Milestone Years, the Attainment Year, and the Contingency Year, 2002, 2008, 2011, 2014, 2017, 2018 and 2019

TTI developed link-based emissions inventory estimates for the eight HGB ozone nonattainment counties, for the seven RFP analysis years, 2002, 2008, 2011, 2014, 2017, 2018 and 2019. For the 2002 eight-hour RFP base year, there are two inventories: an RFP base year inventory, and an RFP adjusted base year inventory. For each of the four RFP milestone years, 2008, 2011, 2014 and 2017, and the attainment year, 2018, there are three inventories: an RFP adjusted base year based upon 2002, an RFP inventory with pre-1990 controls only, and an RFP inventory with pre and post-1990 control strategies. For the 2019 contingency year, there are two inventories: an RFP inventory with pre-1990 controls only, and an RFP inventory with pre and post-1990 control strategies.

For the HGB area RFP inventories to be consistent with inventory development for other SIP analyses, the most recent activity information, based upon current travel demand modeling, and the newest version of the EPA's on-road mobile source emission model, MOVES2010a, were used to complete the work. The RFP inventories were produced based on methods agreed upon in consultation with the TCEQ Project Representative. The methods were consistent with the EPA's RFP guidance. Individual control reduction calculations were consistent with the capabilities of MOVES.

TTI conformed to the following:

- The emissions factor model used in developing inventories for this task was the newest version of MOVES, MOVES2010a, released August 2010.
- The pollutants included in the inventory work are VOC, carbon monoxide (CO), NO_x, and carbon dioxide (CO_2).
- The day type for all the inventories was ozone-season, daily. Activity levels were adjusted for summer season and for average weekday, Monday through Friday.
- The temperatures were consistent with the eight-hour, ozone season temperatures as determined using the EPA guidance and provided by TCEQ.
- The humidity input was developed using the same methodology as the ozone season temperatures and was provided by TCEQ.
- The vehicle miles traveled (VMT) mixes were consistent with the EPA MOVES source use types. The most current VMT mix was used.
- TTI used 2002 and 2008 vehicle registration distributions for locality-specific age distributions for the RFP analysis years 2002 and 2008, and used the most recent year vehicle registration distributions developed from the TxDOT registration data as input for locality-specific MOVES age distributions for future RFP analysis years, 2011, 2014, 2017, 2018 and 2019.
- A link-based, time-of-day emissions analysis methodology was used for all of the referenced counties.
- Control program parameters, including Reid Vapor Pressure (RVP) and fuel settings were determined based upon the inventory type, adjusted base year, pre-1990 control, and control strategy. The control program parameters and fuel settings used by TTI for this analysis were developed in consultation with TCEQ.
- Year-specific TxLED adjustment factors developed using the established method were used. These were developed and provided by TCEQ.

Table 5 lists the RFP EI scenarios, along with the activity and emissions rate components comprising each inventory.

Table 5. HGB RFP Emissions Inventory Scenarios.

Number	RFP Inventory	Activity Input	Emissions Factor

		Year*	Input[1]
1	2002 Base Year	2002	2002 Base Year
2	2002 Adjusted Base Year		2002 Pre-1990 Control
3	2008 Adjusted Base Year		2008 Pre-1990 Control
4	2011 Adjusted Base Year		2011 Pre-1990 Control
5	2014 Adjusted Base Year		2014 Pre-1990 Control
6	2017 Adjusted Base Year		2017 Pre-1990 Control
7	2018 Adjusted Base Year		2018 Pre-1990 Control
8	2008 Pre-1990 Control	2008	2008 Pre-1990 Control
9	2011 Pre-1990 Control	2011	2011 Pre-1990 Control
10	2014 Pre-1990 Control	2014	2014 Pre-1990 Control
11	2017 Pre-1990 Control	2017	2017 Pre-1990 Control
12	2018 Pre-1990 Control	2018	2018 Pre-1990 Control
13	2019 Pre-1990 Control	2019	2019 Pre-1990 Control
14	2008 Control Strategy	2008	2008 Control Strategy
15	2011 Control Strategy	2011	2011 Control Strategy
16	2014 Control Strategy	2014	2014 Control Strategy
17	2017 Control Strategy	2017	2017 Control Strategy
18	2018 Control Strategy	2018	2018 Control Strategy
19	2019 Control Strategy	2019	2019 Control Strategy

[1] "Pre-1990 Control" emissions factors model future evaluation year fleets with pre-1990 controls. Therefore, no Inspection and Maintenance (I/M) programs was modeled, and the MOVES model switch to "turn off" post-1990 FMVCP emissions standards was used, along with summer 1992 fuel parameters (which includes the 1992 RVP limit promulgated prior to enactment of the 1990 Clean Air Act Amendments [CAAA]). "Control Strategy" emissions factors model the controls based on the current regulations (i.e., pre-1990 and all subsequent controls). Activity input includes VMT mix, link VMT/speeds, and off-network activity (source hours parked [SHP], starts, source hours idling [SHI]).

Quantification of Individual On-Road Mobile Eight-Hour RFP Control Reductions for the HGB Eight-Hour Ozone Nonattainment Counties for the RFP Milestone Years, 2008, 2011, 2014, 2017, and 2018

TTI developed emissions reduction estimates for each on-road mobile source control strategy for the four RFP milestone years, 2008, 2011, 2014 and 2017 and the attainment year, 2018. The entire MOVES2010a control strategy reduction was subdivided into individual control reductions using a methodology with MOVES2010a agreed to by the TCEQ. The methods were consistent with the EPA's RFP guidance. The methodology included turning on successive control strategies and rerunning the emissions model. For the HGB area RFP control reduction estimates to be consistent with other SIP analyses, the emissions reduction estimates were developed using the newest version of MOVES, MOVES2010a, released August 2010. The MOVES2010a inputs used for this work were consistent with the associated inventory work described previously.

The order in which the individual controls were added sequentially into the model runs for individual control measure reduction estimates was:

- Pre-1990 Control (Initial "uncontrolled" run);
- Reformulated Gasoline (RFG) (i.e., Pre-1990 Controls and RFG);
- FVMCP (i.e., Pre-1990 Controls, RFG, and post-1990 FMVCP);
- I/M Program (i.e., Pre-1990 Controls, RFG, post-1990 FMVCP, and I/M program); and
- TxLED (i.e., all of the above, and TxLED).

Development of On-Road Mobile Source, Eight-Hour RFP Contingency Reduction Estimates for the HGB Eight-Hour Ozone Nonattainment Counties for the Eight-Hour Ozone Contingency Year, 2018 to 2019

TTI developed emissions reduction estimates for each on-road mobile source control strategy for the HGB eight-hour RFP contingency measure analysis year, 2018 to 2019. The entire MOVES2010a control strategy reduction for 2019 was subdivided into individual control strategy reductions using a methodology with MOVES2010a agreed to by TCEQ. The methods were consistent with the EPA's RFP guidance. The methodology included turning on successive control strategies and re-running the emissions factor model. For the HGB area RFP contingency measure reduction estimates to be consistent with other SIP analyses, the emissions reduction estimates were developed using the newest version of MOVES, MOVES201a, released August 2010. The MOVES2010a inputs were consistent with the HGB RFP inventory work, and the RFP control reductions work for the other analysis years, described previously.

The order in which the individual controls were added sequentially into the model runs for the purpose of individual control measure reduction estimates for the contingency was the same as the individual control measure modeling protocol previously outlined for the milestone years.

To achieve maximum flexibility for subsequent analyses and use of the on-road mobile source inventories produced under this task, TTI provided the detailed, link-based inventories summarized for each county and analysis year in the most recent tab-delimited EI summary file format provided by TTI to TCEQ; and in a format compatible for uploading to TCEQ's Texas Air Emissions Repository (TexAER). TexAER has recently been updated to be compatible with the most recent version of the EPA's National Emission Inventory Format, the Consolidated Emissions Reporting Schema (CERS) written in Extensible Markup Language (XML). MOVES source use types are not consistent with the EPAs source classification code (SCC) system for reporting inventories in CERS. A mapping of the MOVES source use types to the EPAs SCCs will need to be established. TCEQ will work with the EPA to establish the methodology to incorporate MOVES-based inventories into the SCCs and the CERS XML format. The methodology is to be provided to TTI. The schedule for completion of the XML files is contingent upon when TTI receives the required mapping information from TCEQ. This deliverable can be completed within two months after receipt of the mapping information.

The following activities were completed:

- Prepared county-level hourly and 24-hour day tables that provide roadway and source use type summaries of VMT, vehicle hours traveled (VHT), average speed, source hours parked (SHP), vehicle starts, extended idle hours (SHI), and totals for the pollutants VOC, CO, NOx, and CO2 by associated emissions processes. These files are tab-delimited for ease of loading into spreadsheet software such as Microsoft® Excel.
- Prepared county-level 24-hour day spreadsheet tables that provide estimates of VOC and NOx emissions reductions due to post-1990 CAA on-road mobile source emissions control programs, in aggregate, and by individual post-1990 CAA control programs.
- Prepared TexAER ready formatted inventory files (to be provided within two months subsequent to TTI's receipt of the needed mapping convention from TCEQ for use in conversion of MOVES-based EIs to CERS XML format).
- Prepared documentation, complete and self contained, including electronic data files.

TTI will maintain a record of all electronic files developed or used in conjunction with the completion of this project. All pertinent data relating to project activities were submitted to TCEQ in the specified electronic format, in conjunction with supporting electronic document files, and copies of the this report. The electronic file submission is described in Appendix A – Electronic Data Submittal.

Acknowledgments

Dennis Perkinson, Ph.D., L.D. White, Gary Lobaugh, and Martin Boardman, all of TTI, contributed to the development of the MOVES link-based emissions estimates. Dr. Perkinson produced the VMT mixes used to divide fleet VMT activity into MOVES SUT by fuel type categories, county VMT control totals, and hourly VMT factors. Houston-Galveston Area Council (HGAC) staff provided the HGB regional travel model data sets. White processed roadway based activity (VMT and speeds) and off-network vehicle activity estimates (and

vehicle population estimates) needed for the emissions calculations. Lobaugh produced MOVES model and MOVES output post-processor set-ups, and Boardman produced MOVES-based emissions factors with adjustments for Texas Low-Emissions Diesel (TxLED) fuel. Boardman prepared MOVES model county input databases and performed the emissions runs. Chris Kite of TCEQ provided the TxLED fuel adjustment factors and Mary McGarry-Barber provided meteorological input data. Lobaugh was additionally responsible for editing, design, and production of this Technical Report. 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.

The discussion is organized in the following sections: Summary of Results, Overview of Methodology, Development of SUT/Fuel Type VMT Mix, Estimation of VMT, Estimation of Link Speeds, Estimation of Off-Network Activity, Estimation of Emissions Factors, Emissions Calculations, and Quality Assurance.

SUMMARY OF RESULTS

Table 6 summarizes the RFP inventories (VMT and speed, and VOC, CO, NO_x, and CO_2 emissions) for the HGB region. The emissions reductions estimates from the incremental inclusion of control measures in the modeling are summarized for VOC in Table 7, and for NO_x in Table 8.

Table 6. HGB RFP Ozone Season Weekday On-Road Mobile Source Emissions Inventories (Tons).

Inventory Type	Year	VMT	Speed[1]	VOC	CO	NO_x	CO_2
Adjusted Base Year	2002	128,145,285	36.40	205.76	2,571.38	552.30	70,360.17
	2008	128,145,285	36.40	205.89	2,544.53	578.29	69,761.69
	2011	128,145,285	36.40	214.76	2,680.25	601.92	69,573.04
	2014	128,145,285	36.40	210.66	2,658.41	600.98	69,500.22
	2017	128,145,285	36.40	208.69	2,639.31	599.24	69,476.11
	2018	128,145,285	36.40	208.33	2,638.01	598.95	69,471.74
Pre-1990 Controls	2008	145,079,180	37.04	233.94	2,878.39	653.33	78,547.29
	2011	157,480,120	36.64	266.44	3,301.92	744.52	85,648.60
	2014	168,350,216	36.63	279.29	3,493.90	793.84	91,383.35
	2017	179,999,154	36.07	298.20	3,728.70	850.60	98,223.10
	2018	184,065,162	35.87	304.27	3,801.47	870.89	100,688.94
	2019	188,226,423	35.65	311.70	3,893.88	891.79	103,190.26
Base Year and Control Strategy	2002	128,145,285	36.40	124.47	1,414.97	371.89	72,346.10
	2008	145,079,180	37.04	92.91	896.04	238.13	82,009.28
	2011	157,480,120	36.64	85.05	858.00	213.57	89,258.69
	2014	168,350,216	36.63	65.04	737.30	156.03	93,685.20
	2017	179,999,154	36.07	54.34	672.20	118.17	96,938.26
	2018	184,065,162	35.87	51.84	663.10	109.98	97,995.85
	2019	188,226,423	35.65	50.28	660.53	102.68	98,955.50

[1] Average speed in miles-per-hour.

Table 7. HGB Ozone Season Weekday VOC Emissions – RFP Control Scenario Inventories and Reductions (Tons).

Emissions Analysis		2008	2011	2014	2017	2018	2019
Inventory	Pre-90 Control	233.94	266.44	279.29	298.20	304.27	311.70
	Control Strategy	92.91	85.05	65.04	54.34	51.84	50.28
Reductions	Total	141.03	181.38	214.25	243.86	252.44	261.42
	RFG	22.30	22.79	17.27	14.12	13.48	13.23
	FMVCP	109.17	148.83	188.98	222.89	232.44	241.94
	I/M	9.56	9.77	7.99	6.86	6.51	6.25
	TxLED	0.00	0.00	0.00	0.00	0.00	0.00

Table 8. HGB Ozone Season Weekday NO_x Emissions – RFP Control Scenario Inventories and Reductions (Tons).

Emissions Analysis		2008	2011	2014	2017	2018	2019
Inventory	Pre-90 Control	653.33	744.52	793.84	850.60	870.89	891.79
	Control Strategy	238.13	213.57	156.03	118.17	109.98	102.68
Reductions	Total	415.20	530.95	637.81	732.43	760.91	789.11
	RFG	150.64	189.54	213.44	235.00	241.29	248.09
	FMVCP	241.17	319.72	409.05	486.84	510.15	532.43
	I/M	17.35	16.62	11.80	8.03	7.10	6.43
	TxLED	6.03	5.08	3.52	2.55	2.36	2.16

RFP inventory and individual control measure emissions reductions estimates with more detail (e.g., by county, SUT/fuel type) may be found in the electronic data submittal (see description in Appendix A).

OVERVIEW OF METHODOLOGY

A detailed, hourly, TDM link-based, MOVES “rates-per-activity”-based EI method was used to produce the hourly emissions estimates by MOVES SUT/fuel type (see Table 9), pollutant, and emission process (see Table 10) for each county and year, and for each RFP inventory type.

This method is an adaptation of the previous TDM link-based emissions inventory method used with MOBILE6. In addition to the VMT-based emissions calculations for roadway-based emissions processes, the model now uses off-network activity measures (i.e., starts, hours parked, extended idling hours) with MOVES model-based emissions rates in these off-network activity units (*Update of On-Road Inventory Development Methodologies for MOVES Model Compatibility*, TTI, July 2011). "Rates-per-activity" is emphasized because the standard MOVES off-network emission rate look-up table output for external emissions calculations provides rates in terms of pollutant mass per vehicle; however, the TTI method requires post-processing of the MOVES output into rate tables that include the off-network process emissions rates based in units of activity, rather than the MOVES "per vehicle" type of rates. This method was first implemented by TTI in the development of link-based emissions inventories as documented in *Development and Production of 2006 Base Case and 2008 Baseline On-road Mobile Source Emissions Inventories for the HGB Nonattainment Area* (TTI, July 2011).

Table 9. MOVES Source Use Type/Fuel Types.

Source Use Type ID	Source Use Type Description	Source Use Type Abbreviation[1]
11	Motorcycle	MC
21	Passenger Car	PC
31	Passenger Truck	PT
32	Light Commercial Truck	LCT
41	Intercity Bus	IBus
42	Transit Bus	TBus
43	School Bus	SBus
51	Refuse Truck	RT
52	Single Unit Short-Haul Truck	SUShT
53	Single Unit Long-Haul Truck	SULhT
54	Motor Home	MH
61	Combination Short-Haul Truck	CShT
62	Combination Long-Haul Truck	CLhT

[1] The SUT/fuel type labels are the SUT abbreviation and fuel type names separated by an underscore e.g., MC_Gas, RT_Diesel, and SBus_Gas are motorcycles, diesel-powered refuse trucks, and gasoline-powered school buses.

Table 10. MOVES Model Emissions Processes.

Process ID	Process Name
1	Running Exhaust
2	Start Exhaust
9	Brake Wear
10	Tire Wear
11	Evaporative Permeation
12	Evaporative Fuel Vapor Venting
13	Evaporative Fuel Leaks
15	Crankcase Running Exhaust
16	Crankcase Start Exhaust
17	Crankcase Extended Idle Exhaust
18[1]	Refueling Displacement Vapor Loss
19[1]	Refueling Spillage Loss
90	Extended Idle Exhaust
99[1]	Well-to-Pump

[1] Not subject to on-road mobile emissions analysis.

With TTI's MOVES link-based emissions estimation utility, in addition to VMT for roadway-based emissions processes, either vehicle populations (numbers of vehicles) or off-network activity measures are needed to estimate emissions for the off-network emissions processes. The method of choice requires rates-per-activity as opposed to rates-per-vehicle. The major difference is that this "rates-per-activity" method requires: 1) estimation of the associated off-network activity, rather than just numbers of vehicles, and 2) post-processing of the MOVES output into rate tables that include the off-network process emissions rates based in units of activity, rather than the MOVES "per vehicle" type of rates. Table 11 shows the emissions rate units with associated processes and activity factors used in this MOVES "rates-per-activity"-based analysis.

Table 11. Emissions Rates by Process and Activity Factor.

Emissions Process	Activity Factor[1]	Emissions Rate Units
Running Exhaust	VMT	Grams per mile (g/mi)
Brakewear	VMT	g/mi
Tirewear	VMT	g/mi
Evaporative Permeation	VMT; SHP	g/mi; g/shp
Evaporative Fuel Vapor Venting	VMT; SHP	g/mi; g/shp
Evaporative Fuel Leaks	VMT; SHP	g/mi; g/shp
Crankcase Running Exhaust	VMT	g/mi
Start Exhaust	Starts	g/start
Crankcase Start Exhaust	Starts	g/start
Crankcase Extended Idle Exhaust	SHI	g/shi
Extended Idle Exhaust	SHI	g/shi

[1] The amount of travel on roads (VMT), hours parked (SHP), vehicle starts, and SHI are the basic activity factors. SHI is for Combination Long-Haul Trucks only.

Major EI Process Components

The county EI estimation process requires development of the following major inventory components. All are inputs to the emissions calculations, except for vehicle populations, which are intermediate inputs needed for calculating estimates of SHP and vehicle starts.

- Area SUT/fuel type VMT mix;
- County, hourly link fleet VMT and average speeds;
- County SUT/fuel type vehicle populations;
- County, hourly SUT/fuel type SHP;
- County, hourly SUT/fuel type starts;
- County, hourly SUT/fuel type SHI; and
- County, hourly SUT/fuel type emissions rates: g/mile, g/SHP, g/start, and g/SHI.

VMT Mix

The VMT mix designates the SUT/fuel types included in the analysis, and specifies the fraction of on-road fleet VMT attributable to each SUT/fuel type by MOVES road type.

The SUT/fuel type mixes were estimated using TTI's SUT/fuel type mix method (*Methodologies for Conversion of Data Sets for MOVES Model Compatibility*, TTI, August 2009). The VMT mix method sets Texas vehicle registration category aggregations for MOVES SUT categories to be used in developing the VMT mix estimates, as well as for developing other fleet parameter inputs needed in the process (e.g., SUT age distributions). The current VMT mix method produced a set of 24-hour average SUT/fuel type VMT allocations by MOVES road type, estimated for each TxDOT district associated with the eight-county HGB region (i.e., Houston and Beaumont Districts), for use by analysis year. The data sources used were recent, multi-year TxDOT vehicle classification counts, year-end TxDOT/TxDMV registration data, along with MOVES default data where needed.

On-Road Fleet Link-VMT and Speeds

The TDM link-based method (as used in the prior, recent MOBILE6 analyses) was used to estimate fleet VMT and speed inputs to the roadway-based emissions calculations (product of "mass per mile" emissions factors and VMT).

TTI post-processed directional, four-period time-of-day, TDM network traffic assignments and trip matrix data provided by HGAC to produce the hourly, directional, link VMT (consistent with Highway Performance Monitoring System [HPMS] VMT estimates for each year) and associated average fleet speed estimates, reflective of the ozone season weekday (i.e., average Monday through Friday during the June through August period). The seasonal period, day type, and hourly distributions used were based on factors developed with TxDOT Automatic Traffic Recorder (ATR) data from the Houston area. The hourly average operational fleet speeds were estimated corresponding to the link VMT estimates using the Houston speed model, which uses the link's free-flow speed in combination with the link's congestion-related speed reduction estimate.

Vehicle Population and Off-Network Vehicle Activity Estimates

The non-roadway travel-related emissions estimates (e.g., from vehicle starts, parked vehicle evaporative permeation and tank vapor venting, and extended idling) were calculated as the product of the amount of associated activity and the pollutant mass per unit of activity (rate units as shown in Table 11). To estimate the SHP and vehicle starts, SUT/fuel type category population estimates were needed, whereas SHI was based on HGB county-specific actual estimates (*Heavy-Duty Vehicle Idle Activity and Emissions Characterization Study,* ERG, August 2004).

SUT/Fuel Type Populations: TTI based vehicle population estimates on registration data, SUT/fuel type VMT mix-based vehicle population factors, and for future years, VMT-based growth estimates. For historical years, the SUT/fuel type vehicle population estimates were based solely on mid-year TxDOT (or Texas Division of Motor Vehicles [TxDMV]) county registrations data and regional, all roads-weekday SUT/fuel type VMT mix-based population factors for the analysis year. For future years, SUT/fuel type populations were estimated as a function of base (e.g., latest available, mid-year) registrations, grown to a future value (growth as a function of base and future VMT), and all roads-weekday SUT/fuel type VMT mix-based population factors applicable to the analysis year.

SHP**:** The SHP was estimated as a function of total hours (hours a vehicle exists) minus its source hours of operation (SHO) on roads (SHO, which is the same as VHT). For historical years, the SUT/fuel type SHP estimates were based on VMT mix, link VMT and speeds, and the vehicle population estimates. The VMT mix was applied to the link VMT to produce SUT/fuel type-specific VMT estimates. Link VMT was divided by the associated speed to produce SHO estimates, which were subtracted from source hours resulting in SHP estimates. This was performed for each county by year and hour. For the future years, the SUT/fuel type SHP was estimated in the same manner as for historical years, except using the future year link VMT and speeds, VMT mix, and the vehicle population estimates.

Starts: Engine starts were based on the MOVES national default starts per vehicle, and the local, county SUT/fuel type vehicle population estimates. MOVES default weekday starts per vehicle are for the applicable day type and were used for this ozone season weekday analysis. The starts were calculated as the product of starts/vehicle from MOVES, and the county SUT/fuel type population estimates.

SHI: The SHI (for Combination Long-Haul Trucks) was estimated based on information from a TCEQ extended idling study, and additional scaling factors developed by TTI. The 2004 idle activity study produced 2004 summer weekday extended idling hours estimates by Texas county. TTI used the HGB county summer weekday 24-hour 2004 base year SHI estimates from this study in combination with 2004 base year and analysis year link VMT and SUT/fuel type VMT mixes (for producing the SHI scaling factors) to estimate county, hourly extended idling activity for each analysis year summer weekday scenario. SHI hourly factors (estimated as the inverse of the hourly VMT factors) were used to allocate the 24-hour SHI to each hour of the day.

MOVES Emissions Factors

TTI post-processed the MOVES (emissions and activity) output to calculate the emissions rates in the needed activity units (as summarized in Table 11).

Basic to the rates-per-activity emissions rates modeling method, the activity inputs used in MOVES are essentially MOVES defaults, which are later divided out (to unity) in the production of emissions rates, via post-processing of the MOVES activity and emissions output (i.e., emissions divided by activity). The actual local, year and scenario-specific activity estimates for each county are then used in the EI calculations outside of MOVES.

Look-up tables of MOVES emissions factors were developed (post-processed from "emission rate calculation type" MOVES model runs) by pollutant, process, speed (for roadway-based processes), hour, road type, and average SUT/fuel type. MOVES outputs were post-processed in two ways: 1) to calculate the emissions rates from emissions and activity output, and 2) to extract the rates for only those pollutants needed in the emissions calculations, and apply TxLED adjustments to each county's diesel vehicle NO_x emissions rates as well as combining effects of two I/M test-types where the test-type change occurred in the preceding 12 month I/M cycle (e.g., Harris County, 2002 Base Year).

County-level emissions factors were developed for each evaluation year, and for the two RFP control scenarios: 1) Pre-1990 Controls, and 2) Control Strategy (or "current controls"). Local emissions factor modeling input parameters were developed and used to produce emissions factors reflective of the local scenario conditions (e.g., weather and fleet characteristics, fuel properties, and I/M program). To estimate the individual control reductions, an additional set of MOVES runs was performed by sequentially adding in post-1990 CAA controls to the Pre-1990 Scenario; the order used was: RFG, FMVCP, I/M Program, and TxLED.

Emissions Calculations

In general, emissions were calculated for each county/year/RFP inventory type scenario using the major inputs as described previously, and summarized here: TxDOT district-level 24-hour SUT/fuel type VMT mix by MOVES road type; county, hourly link on-road fleet VMT and speed estimates; county hourly off-network activity estimates by SUT/fuel type of SHP, starts, and SHI; and the county-level look-up tables of activity-based hourly emissions rates by SUT/fuel type and emissions process.

For the VMT-based calculations, a MOVES road type to TDM network road type/area type designation was used to match the appropriate VMT mixes and link VMT. The VMT mixes by MOVES road type were multiplied by the link fleet VMT to distribute each link's VMT to the SUT/fuel types. Emissions rates for each link's average speed were interpolated (see procedure in Appendix B) from the set of look-up table rates and corresponding index speeds (i.e., the average bin speeds of 2.5, 5.0, 10.0, 15.0, … 75.0 mph), bounding the link's average speed. For link speeds below or above the minimum and maximum average bin speeds of 2.5 and 75 mph, the rates for those bounding speeds were used. The estimated SUT/fuel type/MOVES road type/link speed-specific emissions factors for each pollutant process were then multiplied by the associated VMT to produce the link-based emissions estimates. This process was executed for each hour.

For the off-network emissions calculations, which are county level, the emissions factors by SUT/fuel type were multiplied by the appropriate county total activity estimate, as determined by the pollutant process. This process was executed for each hour.

The emissions estimates are organized in a tab-delimited output file for the specified county by pollutant/process, roadway type, and SUT/fuel type combination for each hour, and for the 24-hour period. This tab-delimited file also includes hourly and 24-hour summaries of the off-network activity, VMT, vehicle hours traveled (VHT), and speed by roadway (more detailed output definitions and specifications are listed in Appendix A).

TTI developed and maintains a series of computer utilities to calculate and summarize detailed on-road mobile source EIs in various formats, such as those used in this analysis. Appendix B describes these applications.

DEVELOPMENT OF SUT/FUEL TYPE VMT MIX

The SUT/fuel type VMT mix is a major input to the MOVES link-based emissions estimation process. It is an estimate of the fraction of on-road fleet VMT attributable to each SUT by fuel type, and is used to subdivide the total VMT estimates on each link into VMT by SUT/fuel type. These hourly VMT estimates by SUT/fuel type are combined with the appropriate emissions factors in the link-emissions calculations.

TxDOT district-level, 24-hour average, weekday SUT/fuel type VMT mixes (for gasoline-powered and diesel-powered vehicles) were estimated by the four MOVES road-type categories following the methodology detailed in the report entitled, *Methodologies for Conversion of Data Sets for MOVES Model Compatibility*, TTI, August 2009. This methodology characterizes VMT by SUT/fuel type for a region (or district) as follows.

- TxDOT Classification Counts by County and TxDOT District — This is the standard TxDOT classification data assembled and used for determining the in-use road fleet mix (e.g., VMT mix under MOBILE).
- Redefine Roadway Functional Classifications from Federal Highway Administration (FHWA)/TxDOT to MOVES types — A straightforward transposition of FHWA/TxDOT roadway functional classifications in the classification count data into the five MOVES road types.
- Define MOVES vehicle categories. For example, PV21 – Passenger vehicles equivalent to FHWA C minus .001 for MCs.
- Define MOVES vehicle categories - Passenger and Light Commercial Trucks — Separates FHWA light-truck category (P) into passenger trucks and light commercial vehicles using approximate (rounded) MOVES default values. Note this disaggregation is similar to the MOBILE6 distinction between the two primary LDT categories (LDT12 and LDT34).
- Define MOVES vehicle categories – Single-Unit Trucks RTF51 — These are refuse trucks. These are currently assigned a nominal default value (.001) taken from the combined FHWA single-unit truck category total (SU2, SU3, and SU4). To be modified as improved or locally-specific data become available.
- Define MOVES vehicle categories – Single-Unit Trucks Short-Haul versus Long-Haul (SUSH52 and SULH53) per SUT_SSHX — Separates single-unit trucks into short-haul and long-haul based on local (TxDOT district) registrations versus observed vehicles from the classification counts. District allocations verified against statewide allocation.
- Define MOVES vehicle categories – Single-Unit Trucks MH54 — These are motor homes/recreational vehicles. These are currently assigned a nominal default value (.001) taken from the combined FHWA single-unit truck category total (SU2, SU3, and SU4). To be modified as improved or locally-specific data become available.
- Define MOVES vehicle categories - Buses (approximate MOBILE6 defaults) — To be modified as improved or locally-specific data become available.
- Define MOVES vehicle categories - Combination Trucks Short-Haul versus Long-Haul (CSH61 and CLH62) per SUT_HDX9 and SUT_CSHX — Separates combination trucks into short-haul and long-haul based on local (TxDOT district) registrations versus observed vehicles from the classification counts. District allocations verified against statewide allocation.

- Define MOVES vehicle categories - MCs — Nominal default value taken from passenger cars (FHWA C). To be modified as improved or locally-specific data become available.
- Fuel Type Allocation - PV and LDT fuel type allocation per TxDOT registration data and MOVES defaults (21, 31, and 32) per AgeReg9X and MF_Fuel — Other fuel types currently treated as *de minimus*. Additional fuel types can be incorporated as local or regional data become available, or from the MOVES national default database (though this latter option is not recommended). Note allocation of fuel type varies with analysis year.
- Fuel Type Allocation - Single Unit and Combination Trucks per TxDOT registration data per SUT_HDV9 — As with PV and LDT, other fuel types currently treated as *de minimus*.
- Aggregate and Calculate MOVES SUTs and apply day-of-week factors from urban area classification count data (Friday, Saturday, and Sunday).

TxDOT district-level weekday SUT/fuel type VMT mixes by MOVES road-type category (included as Appendix C) were produced based on recent multi-year vehicle classification counts and appropriate end-of-year TxDOT vehicle registrations data. Using the same data sets and a similar procedure, aggregate (i.e., all road-type categories) TxDOT district-level weekday SUT/fuel type VMT mixes (used in the vehicle population estimation) were also produced and included as Appendix D. To ensure general applicability and consistency across all study areas, all VMT mixes were developed in five-year increments beginning with the year 2000 and applied to the analysis years based on Table 12.

Table 12. VMT Mix Year/Analysis Year Correlations.

VMT Mix Year	Analysis Years
2000	1998 through 2002
2005	2003 through 2007
2010	2008 through 2012
2015	2013 through 2017
2020	2018 through 2022

ESTIMATION OF VMT

The detailed, hourly, link-based emissions process requires VMT estimates by hour and direction for each link in the TDMs. This analysis also required that VMT be adjusted for HPMS consistency and to reflect estimated levels characteristic of a typical summer ozone season (June through August) weekday (Monday through Friday). The TRANSVMT utility (see Appendix B for a description of the utility), the latest available HGB 2002, 2008, and 2018 TDMs, and post-processing factors developed from several other data sources, were used to produce this hourly

VMT by direction. The hourly and 24-hour VMT and VHT summaries by county and road type were provided electronically to TCEQ (see Appendix A for electronic data descriptions).

Data Sources

The latest available HGB 2002 (dated July 3, 2007), 2008 (dated April 25, 2011), and 2018 (dated October 18, 2011) TDMs were used to estimate the directional link VMT and speeds by hour. Since intrazonal VMT are not accounted for in the TDMs, the intrazonal VMT was estimated using the TDM's trip matrix and zonal radii.

Several other data sources were used to adjust the VMT for HPMS consistency and to estimate the seasonal sub-period day types. The first data source is HPMS VMT estimates, which are based on traffic count data collected according to a statistical sampling procedure specified by the FHWA designed to estimate VMT. The county total HPMS Annual Average Daily Traffic (AADT) VMT was used to ensure the travel model VMT was consistent with the HPMS VMT estimates. (EPA and FHWA have endorsed HPMS as the appropriate source of VMT and require that VMT used to construct on-road mobile source emissions estimates be consistent with that reported through HPMS.)

The second data source is ATR vehicle counts, which are collected by TxDOT at selected locations throughout Texas on a continuous basis. These vehicle counts are collected on a continuous basis and are available by season, month, and weekday, as well as on an annual average daily basis (i.e., AADT). The counts are very well suited for making seasonal, day-of-week, and time-of-day comparisons (e.g., seasonal adjustment and hourly allocation factors), even though there may be relatively few ATR data collection locations in any given area.

Multiple years (2000 through 2010) of data from the ATR stations were grouped for this analysis at different aggregation levels, depending upon the purpose. This data source was used to produce the day-type-specific adjustment factor, in which the data from the ATR stations within the Beaumont TxDOT District were combined for use with Chambers and Liberty counties and the ATR data was combined from those stations with in the Houston TxDOT District for use with Harris, Galveston, Fort Bend, Brazoria, Montgomery, and Waller counties. This data source was also used to product the time-of-day (hourly) allocation factors, in which the data from the ATR stations with in the eight-county region was combined.

VMT Adjustments

For each analysis year, the designated TDM VMT (see Table 13) was adjusted for HPMS consistency and for seasonality (i.e., ozone season summer weekday). For 2002 and 2008, which by definition are historical years (i.e., HPMS VMT data exists for those years), county-level VMT control totals were used. For the remaining analysis years (2011, 2014, 2017, 2018, and 2019), which are considered future years (i.e., HPMS VMT data does not exist), a regional HPMS factor and seasonal weekday factors were used. However, a TDM does not exist for 2011, 2014, 2017, and 2019. For 2011, 2014, and 2017, intermediate year factors were developed using the bounding TDMs (i.e., 2008 and 2018) and applied to the analysis year's respective TDM. Since 2019 does not have bounding TDMs, intermediate year factors were developed using the 2008 and 2018 TDMs for a one year increment and applied to the 2018 TDM. Hourly travel factors were also applied to distribute this adjusted VMT over each hour of the day.

Table 13. Analysis Year/TDM Year Designation.

Analysis Year	TDM Year
2002	2002
2008	2008
2011	2008
2014	2018
2017	2018
2018	2018
2019	2018

Historical Year Analyses – VMT Control Totals and VMT Adjustments

To estimate the HPMS-consistent ozone season summer weekday for each historical year, county-level VMT control totals were used to develop county-level VMT adjustment factors. The VMT control totals are comprised of two key components: the county-level HPMS AADT VMT for the respective analysis year and an ozone season summer day-of-week (i.e., weekday) adjustment factor.

The ozone season summer weekday adjustment factors were developed using aggregated ATR data for the years 2000 through 2010. Since the HGB area spans two TxDOT districts, two ozone season summer weekday adjustment factors were developed. One factor was developed for Liberty and Chambers counties (which are located in the Beaumont TxDOT District) and one factor was developed for Harris, Galveston, Fort Bend, Brazoria, Montgomery, and Waller counties (which are located in the Houston TxDOT District). These regional factors were calculated by dividing the average day-of-week count by the AADT traffic count. The same weekday adjustment factors were used for each historical year analysis. Table 14 shows the HGB weekday factors used in developing the VMT control totals.

Table 14. HGB Weekday Factors for Control Total Development.

TxDOT District	Weekday Adjustment Factor
Beaumont[1]	1.08998
Houston[2]	1.04160

[1] Only used for Liberty and Chambers counties.
[2] Only used for Harris, Galveston, Fort Bend, Brazoria, Montgomery, and Waller counties.

The VMT control totals were then developed by multiplying the analysis year HPMS AADT VMT for each county by the appropriate ozone season summer weekday adjustment factors to produce eight VMT control totals (one for each county) for each historical analysis year. To develop the county-level VMT adjustment factors, each county's respective control total was divided by the total VMT (TDM assignment VMT plus intrazonal VMT estimate) from the analysis year TDM to produce eight county-level VMT adjustment factors for each historical analysis year. For each link in the TDM, the volume was multiplied by the corresponding VMT adjustment factor (based on the county where the link is located). The adjusted link volumes were then multiplied by the associated link lengths to produce the link-level HPMS consistent, period day-type-specific VMT estimates for each analysis year. Table 15 and Table 16 show the weekday VMT control totals, the total TDM VMT, and the VMT adjustment factors for 2002 and 2008 respectively.

Table 15. HGB 2002 Weekday VMT Control Totals and VMT Adjustment Factors.

County	VMT Control Total	TDM VMT[1]	VMT Adjustment Factor
Harris	93,380,035	94,641,477.08	0.986671361
Brazoria	5,564,463	5,871,848.97	0.947650906
Fort Bend	7,738,690	7,968,385.94	0.971174095
Waller	1,865,629	1,753,131.92	1.064169204
Montgomery	9,293,357	9,167,873.35	1.013687323
Liberty	2,301,454	2,228,487.13	1.032742781
Chambers	2,268,351	2,410,984.11	0.940840294
Galveston	5,733,306	4,820,989.76	1.189238370

[1] 2002 TDM, including intrazonal VMT.

Table 16. HGB 2008 Weekday VMT Control Totals and VMT Adjustment Factors

County	VMT Control Total	TDM VMT[1]	VMT Adjustment Factor
Harris	106,762,742	108,268,747.25	0.986090120
Brazoria	6,106,303	6,713,738.53	0.909523505
Fort Bend	9,047,192	10,367,818.80	0.872622504
Waller	2,003,832	2,142,409.75	0.935316877
Montgomery	10,219,441	11,554,714.19	0.884439098
Liberty	2,391,466	2,679,389.43	0.892541401
Chambers	2,630,376	2,909,594.51	0.904035249
Galveston	5,917,828	5,854,126.47	1.010881474

[1] 2008 TDM, including intrazonal VMT.

Future Year Analyses – HPMS Adjustment Factor

For the future year analyses, an HPMS adjustment factor was used to adjust the total VMT (TDM assignment VMT plus intrazonal VMT estimate) for HPMS consistency for each TDM. This factor was developed using the total TDM VMT from the 2005 travel model validation (dated November 16, 2011), the 2005 HGB HPMS VMT reported by TxDOT, and aggregated 2006 ATR data (to produce the annual non-summer weekday traffic (ANSWT) adjustment factor of the following equation). The 2006 ATR data was used instead of the 2005 ATR data because of data irregularities due to the possible effects of a hurricane on the traffic counters. The formula for the HPMS factor calculation is:

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

Applying the ANSWT adjustment to the HPMS AADT VMT (i.e., conversion from AADT to ANSWT) produces seasonal, day-of-week consistency between the TDM VMT and HPMS VMT components of the HPMS factor. The actual values for the HPMS factor are:

132,093,142 × 1.059088 = 139,898,261.5 (HPMS ANSWT VMT)
139,898,261.5 / 138,790,409.7 = 1.007982193 (HPMS Factor)

Future Year Analyses – Seasonal Adjustment Factors

For the future year analyses, seasonal adjustment factors were used to adjust the TDM and estimated intrazonal VMT to ozone season summer weekday VMT. The seasonal adjustment factors were developed using aggregated ATR data for the years 2000 – 2010. Since the HGB area spans two TxDOT districts, two ozone season summer weekday adjustment factors were developed. One factor was developed for Liberty and Chambers counties (which are located in the Beaumont TxDOT District) and one factor was developed for Harris, Galveston, Fort Bend, Brazoria, Waller, and Montgomery counties (which are located in the Houston TxDOT District). These factors were calculated by dividing the average day-of-week (weekday) count by the ANSWT traffic count. Table 17 shows the seasonal adjustment factors by TxDOT district.

Table 17. HGB Weekday Seasonal Adjustment Factors for Future Year Analyses.

TxDOT District	Weekday Seasonal Adjustment Factor
Beaumont[1]	1.06428
Houston[2]	0.96769

[1] Only used for Liberty and Chambers counties.
[2] Only used for Harris, Galveston, Fort Bend, Brazoria, Montgomery, and Waller counties.

Future Year Analyses – Intermediate Year Adjustment Factors

For those analysis years where a TDM does not currently exist (i.e., 2011, 2014, 2017, and 2019), intermediate year adjustment factors were used to estimate the analysis year VMT from an existing TDM. These adjustment factors were developed using the bounding year TDMs (2008 and 2018) and applied to the TDM as specified in Table 12. However, the 2019 analysis year does not fall between the two available TDMs. For this analysis year, these adjustment factors were calculated for a one year increment (i.e., 2009 from the 2008 TDM) and applied to the 2018 TDM. The intermediate year adjustment factors were based on the annually compounded growth rates between the 2008 and 2018 TDM. The annual growth rates were then converted into the intermediate year adjustment factors using the following equation:

$$\text{Intermediate Year Adj. Factor} = \text{Growth Rate}^{\text{Target Year - Base Year}}$$

Where:

Target Year = the desired intermediate year;
Base Year = the year of the TDM used for estimating the VMT; and
Growth Rate = the annual growth rate from the range of TDM years encompassing the Target Year.

To maintain the consistency between counties and the four time periods in the TDM, these adjustment factors were developed for each time period and county. Appendix C shows the annually compounded growth rates and intermediate year adjustment factors for each analysis year without a TDM by county and time period.

Future Year Analyses – VMT Summary

For each future year (i.e., 2011, 2014, 2017, 2018, and 2019), the final HPMS-consistent, day-type specific VMT is comprised of two parts – the link-level VMT and the estimated intrazonal VMT. The volume for each link was multiplied by the HPMS factor, the seasonal adjustment factor, and the link's respective length to estimate the link-level VMT (hourly factors were applied to distribute the resulting VMT over each hour of the day, discussed in a later section). The HPMS and seasonal adjustment factors (as well as the hourly factors mentioned previously) were also applied to the estimated intrazonal VMT. For those future years where TDMs do not exist (i.e., 2011, 2014, 2017, and 2019), the appropriate intermediate year VMT factors were applied to the volume for each link prior to the VMT calculation and to the estimated intrazonal VMT. Table 18 and Table 19 show the TDM and ozone season weekday VMT summaries.

Table 18. HGB 2011, 2014, and 2017 VMT Summary.

County	2011[1]		2014[2]		2017[2]	
	TDM	Weekday	TDM	Weekday	TDM	Weekday
Harris	108,268,747	112,150,530	132,292,219	119,099,696	132,292,219	126,479,514
Brazoria	6,713,739	7,112,391	8,841,141	7,724,647	8,841,141	8,389,625
Fort Bend	10,367,819	11,163,056	14,411,651	12,322,273	14,411,651	13,601,903
Waller	2,142,410	2,252,971	2,752,993	2,428,988	2,752,993	2,618,792
Montgomery	11,554,714	12,311,835	15,512,473	13,449,280	15,512,473	14,691,870
Liberty	2,679,389	3,081,051	3,377,161	3,302,582	3,377,161	3,540,045
Chambers	2,909,595	3,333,782	3,623,749	3,560,694	3,623,749	3,803,063
Galveston	5,854,126	6,074,503	7,194,417	6,462,057	7,194,417	6,874,342

[1] Based on 2008 TDM with intermediate year VMT factors.
[2] Based on 2018 TDM with intermediate year VMT factors.

Table 19. HGB 2018 and 2019 VMT Summary.

County	2018		2019[1]	
	TDM	Weekday	TDM	Weekday
Harris	132,292,219	129,039,721	132,292,219	131,651,759
Brazoria	8,841,141	8,623,775	8,841,141	8,864,461
Fort Bend	14,411,651	14,057,330	14,411,651	14,528,011
Waller	2,752,993	2,685,309	2,752,993	2,753,519
Montgomery	15,512,473	15,131,088	15,512,473	15,583,443
Liberty	3,377,161	3,622,935	3,377,161	3,707,767
Chambers	3,623,749	3,887,468	3,623,749	3,973,748
Galveston	7,194,417	7,017,537	7,194,417	7,163,715

[1] Based on 2018 TDM with intermediate year VMT factors.

Hourly Travel Factors

Hourly travel factors were used to distribute the TDM and intrazonal VMT to each hour of the day. These hourly travel factors were developed using multi-year (2000 through 2010) aggregated ATR station data for the eight-county HGB region. To maintain VMT proportions within each of the four assignment time periods (including those proportions produced specifically for the weekend day types as described previously), the hourly fractions were normalized within each time period. Each factor (i.e., 24, or one for each hour of the day) was then multiplied by the link volume (in addition to the other VMT adjustment factors). These adjusted link volumes were then multiplied by their respective link lengths to estimate the link level, ozone season summer weekday VMT estimates for each analysis year. These factors were also multiplied by the estimated intrazonal VMT to produce the final hourly-adjusted VMT. Table 20 shows the weekday hourly travel factors.

Table 20. Weekday Hourly Travel Factors.

Assignment	Hour	Weekday
AM Peak	6:00 a.m.	0.319975
	7:00 a.m.	0.368425
	8:00 a.m.	0.311600
Mid-Day	9:00 a.m.	0.160270
	10:00 a.m.	0.155898
	11:00 a.m.	0.162983
	12:00 p.m.	0.168764
	1:00 p.m.	0.171777
	2:00 p.m.	0.180308
PM Peak	3:00 p.m.	0.238603
	4:00 p.m.	0.259721
	5:00 p.m.	0.275395
	6:00 p.m.	0.226281
Overnight	7:00 p.m.	0.204604
	8:00 p.m.	0.159440
	9:00 p.m.	0.143563
	10:00 p.m.	0.113907
	11:00 p.m.	0.077553
	12:00 a.m.	0.043044
	1:00 a.m.	0.028404
	2:00 a.m.	0.026089
	3:00 a.m.	0.024941
	4:00 a.m.	0.044559
	5:00 a.m.	0.133896

ESTIMATION OF LINK SPEEDS

The operational speeds for each link, excluding centroid connectors and the special intrazonal links, were calculated using the Houston speed model. The Houston speed model calculates these speeds using the travel model speed, speed factors (consisting of a free-flow speed factor and level of service [LOS] E speed factor) and a volume-to-capacity (V/C) ratio-based speed reduction factor (SRF) for each link.

The speed factors were used to convert the travel model speed to a free-flow speed and an LOS E speed (i.e., application of these factors results in two speeds). These factors were grouped into seven functional groups. Appendix D shows the speed factors and the network functional class and functional group relationship.

The link-specific V/C ratio is calculated as the time period (hourly) volume divided by the time period capacity. The V/C ratio is expressed as:

$$v/c \text{ ratio} = Vh / Ch$$

Where:

- Vh = the hourly link volume (travel model × HPMS factor × seasonal adjustment factor × hourly time period factor; Weekend profile factor is included for Saturday and Sunday); and
- Ch = the hourly link capacity (travel model capacity × hourly capacity factor). Appendix F shows the hourly capacity factors.

After the V/C ratio was calculated, the link-specific SRF was determined using the V/C ratio, the link-specific SRF area type, the link-specific SRF functional class, and the SRFs. The SRFs are for V/C ratios of 0 to 1 in 0.05 increments (i.e., 0, 0.05, 0.10, ... , 0.95, 1.0). Appendix D shows these speed reduction factors. The link-specific SRF was calculated using linear interpolation. For V/C ratios greater than 1.0, a SRF is not required.

The speed model (for V/C ratios from 0.00 to 1.00) is expressed as:

$$S_{V/C} = S_{0.0} - SRF_{V/C} \times (S_{0.0} - S_{1.0})$$

Where:

- $S_{V/C}$ = estimated directional speed for the forecast V/C ratio on the link in the given direction;
- $S_{0.0}$ = estimated free-flow speed for V/C ratio equal to 0.0;
- $S_{1.0}$ = estimated LOS E speed for V/C ratio equal to 1.0; and
- $SRF_{V/C}$ = speed reduction factor for the V/C ratio on the link. The V/C ratio can be 0.0 to 1.0.

For V/C ratios greater than 1.0 and less than 1.5, the following model extension was used. The speed model extension is:

$$S_{V/C} = S_{1.0} \times (1.15/(1.0 + (0.15 \times (v/c)^4)))$$

Where:

$S_{v/c}$ = estimated directional speed for the forecast V/C ratio on the link in the given direction;

$S_{1.0}$ = estimated LOS E speed for the V/C ratio equal to 1.0; and

v/c = the forecast V/C ratio on the link. The V/C ratio can be 1.0 to 1.5.

For V/C ratios greater than 1.5, the speed was calculated using the previous speed model extension, except the V/C ratio was set to 1.5.

These speed models were applied to all functional classes excluding the centroid connector and intrazonal functional classes. For these functional classes, capacity data were not used. The centroid connector travel model input speeds were used as the centroid connector operational speeds estimates. Operational speeds for the intrazonal functional class were estimated by zone as the average of the zone's centroid connector speeds.

The hourly and 24-hour speed (VMT/VHT) summaries by county and road type were provided electronically to TCEQ (see Appendix A for electronic data descriptions).

ESTIMATION OF OFF-NETWORK ACTIVITY

To estimate the off-network (or parked vehicle) emissions using the grams per activity emissions rates (i.e., grams per SHP, grams per start, and grams per SHI), county-level estimates of the SHP, starts, and SHI are required by hour and SUT/fuel type for each analysis year and day type. One of the main components of the SHP and starts off-network activity estimation is the county-level vehicle population for each analysis year. Summaries of the vehicle population and 24-hour SHP, starts, and SHI off-network activity are included as Appendix G. Hourly SHP, starts, and SHI activity estimates are included with the detailed EI data provided (see inventory data file descriptions in Appendix A).

The county-level vehicle population estimates were developed using the MOVESpopulationBuild utility. The county-level SHP and starts by hour and SUT/fuel type estimates were developed using the ShpExtIdleStartActBld utility. The county-level SHI by hour and SUT/fuel type estimates were developed using the ExtIdleHrsCalc utility. Appendix B contains a description of the utilities.

Estimation of Vehicle Population

The vehicle population estimates (by SUT and fuel type) are needed to estimate the SHP and starts off-network activity. The vehicle population estimates (included as Appendix G) were produced for each county and analysis year. The vehicle population estimates are a function of vehicle registration data (TxDOT registration data sets), population scaling factors (where applicable), and SUT/fuel type VMT mix.

For estimating vehicle populations, a historical analysis year is defined as any year where actual TxDOT registration data and HPMS VMT data (used in developing population scaling factors) exists. Therefore, the 2002 and 2008 analysis years were considered historical years and the vehicle population estimates were based on the TxDOT registration data for the analysis year. Since the 2011 HPMS VMT data was not available, the 2011 analysis year (along with the 2014, 2018, 2018, and 2019 analysis years) were considered future analysis years (i.e., TxDOT registration data does not exist). For the future analysis years, the vehicle population estimates were based on the most recent year (2010) TxDOT registration data set for which HPMS VMT data exists and analysis year population scaling factors.

The VMT mix used to estimate the vehicle population is the aggregate (i.e., all road-type categories) TxDOT district-level weekday SUT/fuel type VMT mixes. The development of these VMT mixes are described in more detail in the "Development of SUT/Fuel Type VMT Mix" section and included as Appendix D.

Historical Vehicle Population Estimates

The county-level vehicle population estimates for the historical analysis years (2002 and 2008) were calculated using the analysis year county-level, mid-year TxDOT vehicle registrations and the assigned aggregate SUT/fuel type VMT mix (see Table 12 and Appendix F). The vehicle estimation process assumes that all of the non-long-haul SUT category populations for a county are represented in the county vehicle registrations data. This process also estimates the long-haul category populations as an expansion of the county registrations. There are three main steps in the vehicle estimation process: registration data category aggregation, calculation of the SUT/fuel type population factors, and estimation of the county-level vehicle population by SUT/fuel type.

The first step in the vehicle estimation process is the registration data category aggregation. For each county, the analysis year vehicle registrations were aggregated into five categories. Table 21 shows these five categories.

Table 21. Registration Data Categories.

Registration Data Category	Vehicle Registration Aggregation
1	Motorcycles
2	Passenger Cars (PC)
3	Trucks <= 8.5 K GVWR (pounds)
4	Trucks > 8.5 and <= 19.5 K GVWR
5	Trucks > 19.5 K GVWR

The second step is calculating the SUT/fuel type population factors. Using the assigned aggregate SUT/fuel type VMT mix, SUT/fuel type population factors were calculated for each SUT/fuel type combination. For the non-long-haul SUT categories, the SUT/fuel population factors were calculated by dividing the SUT/fuel type VMT mix by the summed total of the SUT/fuel type VMT mix fractions in its associated vehicle registration data category. For example, the LCT_Diesel population factor using the VMT mix is LCT_Diesel/(PT_Gas + PT_Diesel + LCT_Gas + LCT_Diesel). For the long-haul SUTs, the SUT/fuel type population factors were calculated by taking the ratio of the long-haul and short-haul VMT mix values. For example, the SULhT_Gas population factor using SUT mix fractions is SULhT_Gas/SUShT_Gas. Table 22 shows the vehicle registration aggregations and their associated MOVES SUT/fuel types.

Table 22. TxDOT Vehicle Registration Aggregations and Associated SUT/Fuel Types for Estimating SUT/Fuel Type Populations.

Vehicle Registration[1] Aggregation	Associated MOVES SUT/Fuel Type[2]
Motorcycles	MC_Gas
Passenger Cars (PC)	PC_Gas; PC_Diesel
Trucks <= 8.5 K GVWR (pounds)	PT_Gas; PT_Diesel; LCT_Gas; LCT_Diesel
Trucks > 8.5 and <= 19.5 K GVWR	RT_Gas; RT_Diesel SUShT_Gas; SUShT_Diesel MH_Gas; MH_Diesel IBus_Diesel TBus_Gas; TBus_Diesel SBus_Gas; SBus_Diesel
Trucks > 19.5 K GVWR	CShT_Gas; CShT_Diesel
NA[1]	SULhT_Gas; SULhT_Diesel CLhT_Gas; CLhT_Diesel

[1] The four long-haul SUT/fuel type populations are estimated using a long-haul-to-short-haul weekday SUT VMT mix ratio applied to the short-haul SUT population estimate.

[2] The mid-year TxDOT county registrations data extracts were used (i.e., the three-file data set consisting of: 1 - light-duty cars, trucks, and motorcycles; 2 - heavy-duty diesel trucks; and 3 - heavy-duty gasoline trucks) for estimating the vehicle populations.

The third step is the estimation of the county-level vehicle population by SUT/fuel type. The non-long-haul SUT/fuel type vehicle populations were estimated by applying their SUT/fuel type population factors to the appropriate registration data category. For the CLht_Gas type, the vehicle population was set to 0. For the remaining three long-haul SUT/fuel types (SULhT_Gas, SULhT_Diesel, and CLhT_Diesel), the vehicle populations were calculated as the product of the corresponding short-haul category vehicle population and the associated long-haul population factor (e.g., SULhT_Gas vehicle population = SUShT_Gas vehicle population x [SULhT_Gas SUT mix fraction/ SUShT_Gas SUT mix fraction]).

Future Vehicle Population Estimates

The process for estimating the county-level vehicle population estimates for the future analysis years (2011, 2014, 2017, 2018, and 2019) is very similar to the historical vehicle population estimates except that instead of using the analysis year registration data sets, the most recent (2010) mid-year TxDOT registration data sets for which HPMS data exists were used. Using these registration data sets and the assigned VMT mix, the base SUT/fuel type population for 2010 was calculated. To estimate the future analysis year county-level vehicle populations, future year county-level vehicle population scaling factors were applied to the base SUT/fuel type population for 2010. These future year county-level vehicle population scaling factors were calculated as the ratio of the county-level weekday VMT for the analysis year to the county-level weekday VMT for the year of the most recent (2010) mid-year TxDOT registration data (i.e., vehicle population increases linearly with VMT).

Estimation of SHP

The first activity measure needed to estimate the off-network emissions using the grams per activity emissions rates are county-level weekday estimates of SHP by hour and SUT/fuel type for each analysis year. For each hour, the county-level SHP by SUT/fuel type was calculated by taking the difference between the total available hours minus the source hours operating (SHO) by SUT/fuel type. Since this calculation was performed at the hourly level, the total available hours by SUT/fuel type is the same as the vehicle population by SUT/fuel type. The SHO was calculated using the link VMT and speeds and the TxDOT district-level SUT/fuel type VMT mixes by MOVES road-type category (see the "Development of SUT/Fuel Type VMT Mix" section for more details). Appendix G includes the 24-hour summaries of the county-level weekday estimates of SHP by hour and SUT/fuel type for each analysis year (hourly summaries were provided electronically to TCEQ; see Appendix A for electronic data descriptions).

Total Available Hours by SUT/Fuel Type

The total available hours by SUT/fuel type is typically calculated as the vehicle population times the number of hours in the time period. Since this calculation was performed at the hourly level, the total available hours by SUT/fuel type for each analysis year was set equal to the vehicle population by SUT/fuel type for the analysis year.

SHO by SUT/Fuel Type

To calculate the VHT (or SHO) for for a given link, the VMT was allocated to each SUT/fuel type using the TxDOT district-level SUT/fuel type VMT mixes by MOVES road-type category, which was then divided by the link speed to calculate the link SHO by SUT/fuel type. These VMT mixes are the same VMT mixes used to estimate emissions in the emissions estimation process (see Table 12 and Appendix E). This SHO calculation was performed for each link in a given hour, aggregating the SHO to one value per SUT/fuel type per hour. The hourly SHO by SUT/fuel type was then set equal to the hourly VHT by SUT/fuel type.

Estimation of Starts

The second activity measure needed to estimate the off-network emissions using the grams per activity emissions rates are county-level weekday estimates of starts by hour and SUT/fuel type for each analysis year. The hourly default starts per vehicle by SUT/fuel type were multiplied by the analysis year county-level vehicle population by SUT/fuel type to estimate the county-level starts by hour and SUT/fuel type. Appendix G includes the 24-hour summaries of the county-level starts by hour and SUT/fuel type for each analysis year (hourly summaries were provided electronically to TCEQ; see Appendix A for electronic data descriptions).

For the hourly default starts per vehicle, the MOVES defaults were used. The MOVES activity output was used to estimate the hourly starts per vehicle for a MOVES weekday and MOVES weekend run by dividing the MOVES start output by the MOVES vehicle population output. These MOVES default starts per vehicle do not vary by year or geography (i.e., county), only by MOVES day type. Since the emissions inventories are for weekday, only the MOVES weekday default starts per vehicle were used.

Estimation of SHI

The third activity measure needed to estimate the off-network emissions using the grams per activity emissions rates are county-level weekday estimate of SHI by hour and SUT/fuel type for each analysis year. These SHI estimates were for source type 62, fuel type 2 (CLhT_Diesel) only. The SHI was based on information from a TCEQ extended idling study, which produced 2004 summer weekday SHI estimates for each Texas county. SHI scaling factors (by analysis) were applied to the base 2004 summer weekday SHI values from the study to estimate the 24-hour SHI by analysis year. SHI hourly factors were then applied to allocate the 24-hour SHI by analysis year to each hour of the day. To ensure valid hourly SHI values are used in the emissions estimation, the hourly SHI was compared to the CLhT_Diesel hourly SHP (i.e., hourly SHI values cannot exceed the hourly SHP values). Appendix G incudes the 24-hour summaries of the county-level estimates of SHI by hour and SUT/fuel type for each analysis year (hourly summaries were provided electronically to TCEQ; see Appendix A for electronic data descriptions).

SHI Scaling Factors

To estimate the county-level 24-hour SHI by analysis year, county-level SHI scaling factors were developed using county-level 2004 summer weekday link-level VMT and speeds, the TxDOT district-level base weekday SUT/fuel type VMT mix (by MOVES road type), the county-level analysis year weekday link-level VMT and speeds, and the TxDOT district-level analysis year SUT/fuel type VMT mix (by MOVES road type). The 2004 summer weekday link-level VMT and speeds were developed using a similar to process as the historical analysis years (2002 and 2008) analysis year weekday link-level VMT speeds using the HGB 2005 TDM (run date November 16, 2011) and a 2004 summer weekday VMT control totals. The SUT/fuel type VMT mixes were the same VMT mixes used to estimate emissions in the emissions estimation process (see Table 12 and Appendix E). For the base weekday SUT/fuel type VMT mix, the 2005 weekday SUT/fuel type VMT mix was used.

For each link in the 2004 summer weekday link-level VMT and speeds, the link VMT was allocated to CLhT_Diesel using the base weekday SUT/fuel type VMT mix. This VMT allocation was performed for each link and hour in the 2004 summer weekday link-level VMT and speeds, with the individual link VMT aggregated by hour to produce the CLhT_Diesel hourly and 24-hour 2004 summer weekday VMT. Using a similar allocation process, the analysis year CLhT_Diesel hourly and 24-hour VMT was calculated using the analysis year weekday link-level VMT and speeds and the analysis year SUT/fuel type VMT mix. The county-level 24-hour SHI scaling factors by analysis year were calculated by dividing the analysis year and day type CLhT_Diesel 24-hour VMT by the CLhT_Diesel 24-hour 2004 summer weekday VMT.

SHI Hourly Factors

To allocate the analysis year and weekday county-level 24-hour SHI to each hour of the day, SHI hourly factors were used. These SHI hourly factors were calculated as the inverse of the analysis year weekday CLhT_Diesel hourly VMT fractions. The analysis year weekday CLhT_Diesel hourly VMT fractions were calculated using the analysis year weekday CLhT_Diesel hourly VMT. The analysis year weekday CLhT_Diesel hourly VMT were converted to hourly fractions, therefore creating analysis year weekday CLhT_Diesel hourly VMT fractions. The inverse of these hourly VMT fractions were calculated and the inverse for each hour was divided by the sum of the inverse hourly VMT fractions across all hours to calculate the county-level analysis year weekday SHI hourly factors.

County-Level CLhT_Diesel SHI by Hour Estimation

The base analysis year weekday CLhT_Diesel SHI by hour was calculated by multiplying the 24-hour 2004 summer weekday SHI by the SHI scaling factor and by the SHI hourly factors. For each hour, the base analysis year weekday CLhT_Diesel SHI was then compared to the analysis year weekday CLhT_Diesel SHP to estimate the final analysis year weekday CLhT_Diesel SHI by hour. If the base analysis year weekday CLhT_Diesel SHI value was greater than the analysis year weekday CLhT_Diesel SHP value, then the final analysis year weekday CLhT_Diesel SHI for that hour was set to the analysis year weekday CLhT_Diesel SHP value. Otherwise, the final analysis year weekday CLhT_Diesel SHI for that hour was set to the base analysis year weekday CLhT_Diesel SHI value. All calculations (scaling factors, SHI hourly factors, and SHI by hour calculations) were performed by county and analysis year (i.e., eight SHI scaling factors were calculated per analysis year).

ESTIMATION OF EMISSIONS FACTORS

TTI developed emissions factors using MOVES2010a (software and database released in EPA's MOVES2010a Installation Suite, revised September 23, 2010, downloadable from http://www.epa.gov/otaq/models/moves/index.htm). The emissions factors were developed based on the current MOVES guidance as documented in *Technical Guidance on the Use of MOVES2010 for Emission Inventory Preparation in State Implementation Plans and Transportation Conformity*, EPA, April 2010. This MOVES EI *Technical Guidance* along with *Motor Vehicle Emission Simulator (MOVES) User Guide for MOVES1010a*, EPA, August 2010; and *Update Of On-Road Inventory Development Methodologies For Motor Vehicle Emissions Simulator (Moves) Model Compatibility Technical Report*, TTI, July 2011 (MOVES output post-processing utilities used are summarized in Appendix B of this Technical Report), are the main references where additional detail may be found, if desired.

The detailed link-based EI method of analysis requires emissions rates by speed in look-up table form; the MOVES Calculation Type of Emission Rate was therefore selected to direct MOVES to output emissions rates, emissions, and activity data by MOVES speed bin average speed (2.5, 5, 10….. 75 mph). The EI method required that all rates be in terms of mass/activity (as opposed to the off-network rates in terms of mass/vehicle as output by MOVES) for the external emissions calculations. TTI post processed the MOVES emissions and activity output to produce all emissions rates in mass/activity terms (see Table 23, which was included in a previous section, but is provided again here for convenience).

Table 23. Emissions Rates by Process and Activity Factor.

Emissions Process	Activity[1]	Emissions Rate Units
Running Exhaust	VMT	grams/mile (g/mi)
Brakewear	VMT	g/mi
Tirewear	VMT	g/mi
Evaporative Permeation	VMT; SHP	g/mi; g/shp
Evaporative Fuel Vapor Venting	VMT; SHP	g/mi; g/shp
Evaporative Fuel Leaks	VMT; SHP	g/mi; g/shp
Crankcase Running Exhaust	VMT	g/mi
Start Exhaust	starts	g/start
Crankcase Start Exhaust	starts	g/start
Crankcase Extended Idle Exhaust	SHI	g/shi
Extended Idle Exhaust	SHI	g/shi

[1] The amount of travel on roads (VMT), SHP, vehicle starts, and SHI are the basic activity factors. SHI is for Combination Long-Haul Trucks only.

The RFP inventory analysis required sets of emissions factors for the two main RFP control scenarios: Pre-1990 Controls, and Control Strategy. Since MOVES does not model TxLED fuel, emissions rates were post-processed to include TxLED effects in the Control Strategy emissions rates. Additional post-processing was performed specifically for the Harris County 2002 Control Strategy (or Base Year) scenario, to account for effects of the I/M test type switch (effective May 1, 2002) during the modeled I/M cycle.

The difference between Pre-1990 Controls and Control Strategy emissions are emissions reductions due to the Post-1990 CAA controls. To estimate emissions reductions from individual control measures, an additional set of MOVES runs was performed. A single county (Harris) was selected, and additional scenarios were set up by adding sequentially to the Pre-1990 Controls scenario: RFG, post-1990 FMVCP, I/M, and TxLED. The rates from these runs were used in a procedure discussed in a later section for estimating the individual control program emissions reductions.

In total, these are the five control scenarios (listed by label used in the modeling input/output files and databases):

- 1CS – Pre-1990 Controls (7.8 RVP conventional gasoline and no Post-1990 CAA FMVCP);
- 2CS – Pre-1990 FMVCP + RFG;
- 3CS – Pre-1990 FMVCP + RFG + Post-1990 FMVCP;

- 4CS – Pre-1990 FMVCP + RFG + Post-1990 FMVCP + I/M Program; and
- CSS – Control Strategy (Pre-1990 FMVCP + RFG + Post-1990 FMVCP + I/M Program +TxLED fuel).

Development of RFP emissions rates required for estimating emissions reductions from all Post-1990 CAA controls (the 1CS and CSS scenarios) will be discussed first, followed by discussion of the emissions rates modeling performed to estimate the emissions reductions for individual control programs.

The utilities used to calculate the emissions rates from the MOVES emissions and activity output and to adjust the emissions rates are MOVESratescalc and MOVESratesadj, respectively (see descriptions in Appendix B).

Development of Pre-1990 Controls and Control Strategy Scenario Emissions Factors

The main purpose of this section is two-fold: 1) explain the overall RFP ozone season weekday MOVES-based emissions rate look-up table development process, and 2) provide the specifics on modeling emissions rates for the two main RFP control scenarios, Pre-1990 Controls (1CS), and Control Strategy (CSS). All emissions rates for this RFP analysis were produced consistent with the methods and procedures presented in this section. The other control scenarios modeled (2CS, 3CS, and 4CS), are discussed in a later section.

The MOVES model is equipped with default modeling values for the range of conditions that affect emissions factors. MOVES defaults may be replaced by alternate input data sets that better reflect local scenario conditions. Where local data were available, MOVES defaults were replaced by local input values, via the MOVES Run Specifications file (RunSpec or MOVES Run Specifications [MRS]) and MOVES CDB (county input database). (The MOVES RunSpecs, CDBs, and MOVES default database provide the data for each local scenario model run.) Local inputs were developed and used to produce emissions factors characteristic of the June through August period peak ozone season average weather conditions, summer fuel properties, vehicle fleet characteristics, and emissions control programs (depending on local particular RFP control scenario). In the case of the activity input data to MOVES, the MOVES defaults were in general used, which is basic to the emissions rates method (default activity is divided out to unity in the rates calculation, and actual local activity estimates are applied later in the external emissions calculations).

MOVES Inputs, Outputs and Post-Processing

There is one RunSpec required per county, year and control scenario, and a corresponding number of CDBs (county input databases), and output databases (i.e., one output database per run). Therefore, for eight counties, seven years, and two control scenarios (plus the additional I/M scenario for Harris 2002 needed for the I/M test-type switch modeling procedure) there are 113 RunSpecs, 113 CDBs, 113 MOVES output databases, 113 MOVESRatesCalc runs, and 112 MOVESRatesAdj runs (for NO_x TxLED effect adjustments, for Harris 2002 I/M test-type switch effects modeling, which combines two sets of rates into one, and for extracting and storing only the rates for the inventory pollutants in a separate, smaller database for input to the emissions runs).

Summary of Control Programs Modeled

Table 24 shows the control measures modeled ("√**")** in each of the RFP control scenarios, Pre-1990 Controls (1CS) and Current Controls (CSS).

Table 24. Control Measure Modeling by RFP Control Scenario.

Individual Control Measures[1]	Method	RFP Control Scenario	
		Pre-1990 Controls (1CS)	Current Controls (CSS)
Pre-1990 CAA FMVCP	MOVES inputs	√	√
1992 Federal Controls on Gasoline Volatility	MOVES inputs	√	Not applied
RFG	MOVES inputs	Not applied	√
Post-1990 CAA FMVCP[1] Tier 1 National Low Emission Vehicle Program Tier 2 Heavy-Duty 2004 Diesel 2005 Gasoline 2007 Gasoline and Diesel Highway Motorcycle 2006	MOVES inputs	Not applied	√
I/M Program[1]	MOVES inputs	Not applied	√
TxLED Fuel[1]	Post-process diesel vehicle NOx rates	Not applied	√

[1] Post-1990 FMVCP was modeled all together per MOVES limitation, and I/M was modeled in Harris County for all years, and in 2008 and later years for the I/M expansion counties of Brazoria, Fort Bend, Galveston, and Montgomery. TxLED effects were modeled as a post-processing procedure adjustment to diesel vehicle NO_x emissions for all counties, for 2008 and later years.

MOVES Emissions Factor Aggregation Levels

The MOVES emissions factors for the analysis are produced at the following levels. The summer weekday emissions factor look-up tables provide the emission rates by:

- Up to 13 source types (i.e., vehicle types);
- Up to 4 fuel types;
- Up to 5 road types (four actual MOVES road categories and "off-network");
- Each of the 24 hours in a day;
- 16 speed bins (i.e., 2.5, 5, 10, 15,…. 75 mph) (only included in miles-based rate tables);

- Up to 38 pollutants; and
- Up to 13 emissions processes.

The vehicle fleet was assumed to be powered only by the predominant on-road fuels of gasoline or diesel. The five road type categories in MOVES are Off-Network (not actually a road type), Rural Restricted Access, Rural Unrestricted Access, Urban Restricted Access, and Urban Unrestricted Access. Of the two rate tables produced (by post-processing) for input to the emissions calculations; one rate table contains off-network rates, and the other includes rates for each of the actual four MOVES road types, indexed by 16 speeds. The speeds index corresponds to the 16 MOVES speed bin average speeds: 2.5, 5, 10, 15,…. 75 mph.

MOVES Run Specifications

The MRS (XML file) defines the place, time, vehicle, road, fuel, emissions producing process, and pollutant parameters for the modeling scenario. TTI developed the analysis MRS files by first creating an MRS template for each year using the MOVES Graphical User Interface (GUI), then looping through the templates with a basic file-building utility to create one MRS for each county, year, and control scenario. This process was used to produce the 113 MRSs for the analysis (two control scenarios x eight counties x seven years, plus one extra for the Harris County 2002 Control Strategy scenario needed for the I/M test-type switch effects modeling procedure).

Table 25 describes the MRS selections TTI used to produce MOVES emissions and activity output for calculating the emissions rates for the two main RFP control scenarios.

Table 25. Pre-1990 Controls and Control Strategy Scenarios – MRS GUI Panel Selections.

Navigation Panel	Detail Panel	Selection		
Scale[1]	Domain/Scale; Calculation Type	County; Emissions Rates		
Time Spans[1]	Time Aggregation Level; Years – Months – Days – Hours	Hour; 2002[1] - July - Weekday - All		
Geographic Bounds[1]	Region; Selections; Domain Input Database	Zone and Link; Brazoria[1]; <database name for county/year scenario>		
On-Road Vehicle Equipment	SUT/fuel combinations	SUT	Gasoline	Diesel
		Motorcycle	X	-
		Passenger Car	X	X
		Passenger Truck	X	X
		Light Commercial Truck	X	X
		Intercity Bus	-	X
		Transit Bus	-	X
		School Bus	X	X
		Refuse Truck	X	X
		Single Unit Short-Haul Truck	X	X
		Single Unit Long-Haul Truck	X	X
		Motor Home	X	X
		Combination Short-Haul Truck	X	X
		Combination Long-Haul Truck	-	X
Road Type	Selected Road Types	Off-Network – Rural Restricted Access – Rural Unrestricted Access – Urban Restricted Access – Urban Unrestricted Access		
Pollutants and Processes[2]	VOC; CO; NO_x; Atmospheric CO_2	Depending on pollutant, processes may include: Running Exhaust, Start Exhaust, Extended Idle Exhaust, Crankcase Running Exhaust, Crankcase Start Exhaust, Crankcase Extended Idle Exhaust, Evap Permeation, Fuel Vapor Venting, or Fuel Leaks		
Manage Input Data Sets	Additional input database selections	None		
Strategies[3]	Alternate Vehicle Fuels Technologies (AVFT)	"New" button is grayed out, which means that an AVFT data set (local fuel fractions) was imported to the Runspec		
	Rate-of-Progress	"No Clean Air Act Amendments" box is checked only for the Pre-1990 Control scenario runs		
General Output	Output Database; Units; Activity	<database name for county/year/ scenario>; Pounds, KiloJoules, Miles; Distance Traveled, Source Hours, Source Hours Idling, Source Hours Operating, Source Hours Parked, Population, Starts		
Output Emissions Detail	Always; For All Vehicles/Equipment; On Road	Time: Hour – Location: Link – Pollutant; Fuel Type, Emissions Process; Source Use Type		
Advanced Performance Measures	Aggregation and Data Handling	All check boxes are "un-checked"		

[1] County scale allows one county and year per run – the evaluation years and counties are 2002, 2008, 2011, 2014, 2017, 2018, and 2019; Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller.

[2] Chained pollutants require other pollutants (not listed in the table) to be selected (e.g., VOC requires Total Gaseous Hydrocarbons and Non-Methane Hydrocarbons: CO_2 requires Total Energy Consumption).

[3] Two full sets of county/year runs were performed – one set with the Strategies Rate-of-Progress panel "No Clean Air Act Amendments" check-box checked, and one set with this box un-checked.

Scale, Time Spans, and Geographic Bounds

The MOVES "County Domain/Scale" was selected as is required for SIP EI analyses. The MOVES Calculation Type "Emissions Rates" was selected (with other required selections) for MOVES to produce the activity and emissions output needed for input to the post-processing algorithms (see MOVESratescalc utility description in Appendix B) that calculate the emissions rate look-up tables with speed bin indexing, as needed for the detailed link-based emissions estimation process.

The Time Spans parameters were specified to provide the most detail available, which is the hourly aggregation level, for all hours of the day. One analysis year per run was selected, as MOVES allows only one "Years" selection for the County Domain Scale. For TTI's MOVES-based link emissions estimation process, which is for a single day, one "Months" (July for this analysis) and one "Days" (Weekdays) selection was made.

Under Geographic Bounds for the County Domain Scale, only one county may be selected. The user-produced CDB containing the scenario-specific input data for the county was specified as the County Domain Input Database, and under Region, "Zone & Link" was selected as required for the emissions rates calculation type. With these required set-ups, only one county, one year, and one day type was modeled per run.

On-Road Vehicle Equipment and Road Type

All of the SUTs associated with gasoline and diesel fuels were specified. Note that for this analysis, the MOVES default fuel/engine fractions were replaced with local inputs, which showed no compressed natural gas (CNG) vehicles in the fleet (the MOVES default database includes some CNG Transit Buses), and no gasoline Transit Buses. (The local SUT/fuel type VMT mixes developed for the study define the SUT/fuel type combinations included in the MOVES runs.) For emissions rate calculations, all five MOVES road type categories were selected.

Pollutants and Processes

In MOVES, VOC is a "chained" pollutant, meaning that it is calculated based on one or more other pollutants that must also be calculated. In addition to the pollutants called for in this analysis, the following pollutants were additionally required for MOVES to produce the VOC emissions rates: Total Gaseous Hydrocarbons (THC), Non-Methane Hydrocarbons (NMHC), and Methane. Additionally, Total Energy Consumption (TEC) was required for MOVES to calculate CO_2 rates. All of the associated processes available by the selected pollutants were included, except for the two refueling emissions processes.

Manage Input Data Sets and Strategies

The Manage Input Datasets feature allows alternate inputs other than those included in the CDB. No additional inputs were included via the Manage Input Datasets panel.

The Strategies, Alternative Vehicle Fuels & Technologies feature was used to import the local fuel/engine fractions (i.e., equivalent of diesel fractions inputs to MOBILE6) into the MOVES MRS. A year-specific fuel/engine fractions data set (e.g., year of local vehicle registration data extract used – 2002, 2008, and latest available 2011 for this analysis) was imported to each of three year-specific MRS templates (i.e., 2002, 2008, and 2011 for subsequent analysis years), prior to creating the individual scenario RunSpecs for each year.

The Strategies, Rate-of-Progress feature was used for the Pre-1990 Control emissions rates modeling scenario. The check-box *Compute Rate-of-Progress "No Clean Air Act Amendments" Emissions* was selected, which models a "No Clean Air Act Amendments" scenario by assigning 1993 model year emissions rates to all post-1993 vehicles.

Output

The output units were pounds (converted in a later step to grams), kilojoules, and miles. All of the activity categories were chosen for inclusion in the output database. The activity output was needed along with the emissions output to calculate the rates/activity emissions rates look-up tables via post-processing. The output detail level was by hour, link (i.e., county/road type/speed bin combination), pollutant, process, SUT and fuel type.

Appendix A lists the electronic data files provided in support of this analysis, which includes the MOVES RunSpecs used.

MOVES County Input Databases

Most of the locality-specific input data for the county scale runs are entered through the CDB (the exception is the alternate or local fuel/engine fractions which are input via the MRS). Additional user input data may be entered through separate databases via the Manage Input Datasets feature, although this feature was not used.

TTI developed procedures to facilitate building and checking CDBs for large scale EI projects. The basic procedure was to write a CDB builder-MySQL script that was then converted to a template by replacing particular scenario-specific values (e.g., year, input file paths, county name/FIPS) with variables. The template was looped through for each scenario (in this case for each year, county, and control scenario) to produce the MySQL scripts needed to create all of the required CDBs. After building the CDBs, a CDB checker utility was run to verify that 18 CDB tables (listed in Table 26) were built and populated as intended.

To build all of the CDBs needed for the analysis, the required data were first prepared and organized. The input data for populating the CDBs includes local data from prepared text files and databases (e.g., for local fuels and weather data), and MOVES default data from MOVESDB20100830 (e.g., for default activity data), and some values provided directly in the CDB builder MySQL script.

Table 26 provides an outline and brief description of the CDBs, followed by discussion of the development of the local data and the defaults contained therein. Unless otherwise stated, the CDB table data applies to all counties, years, and to both control scenarios.

Table 26. MOVES CDB Input Tables.

Input Table[1]	Category	Notes
Year	Time	Designated analysis year as a base year (i.e., specifies that local activity inputs were supplied rather than forecast by the model).
State	Geography	Identified the state (Texas) for the analysis.
County	Geography / Meteorology	Identified county of analysis. Contains local altitude and barometric pressure (TCEQ, September 2011).
Zonemonthhour	Meteorology	Hourly temperature and relative humidity (TCEQ, September 2011).
Roadtype[2]	Activity	Lists the MOVES road types and associated ramp activity fractions. Road type ramp fractions were set to 0.
Hpmsvtypeyear[3]	Activity (Defaults)	**Used MOVES defaults** – 1999 national annual VMT by HPMS vehicle category, except yearID was set to analysis year.
roadtypedistribution[3]		**Used MOVES default** road type VMT fractions.
monthvmtfraction[3]		**Used MOVES default** month VMT fractions.
dayvmtfraction[3]		**Used MOVES default** day VMT fractions.
Hourvmtfraction[3]		**Used MOVES default** hour VMT fractions.
Avgspeeddistribution[3]		**Used MOVES default** average speed distributions.
sourcetypeyear[3]	Fleet (Defaults)	**Used MOVES default** – 1999 national SUT populations, except yearID was set equal to the analysis year value.
sourcetypeage-distribution	Fleet	TTI estimated SUT age fractions using mid-year TxDOT/TxDMV vehicle registration data and MOVES defaults, as needed. Analysis year-specific registration data were used for historical years and latest available for future years.
Fuelengfraction (text file import)	Fleet	TTI estimated SUT fuel fractions using TxDOT/TxDMV vehicle registration data and defaults where needed. Analysis year-specific registration data were used for historical years and latest available for future years.
Zone	Activity	Start, idle, and SHP zone allocation factors. County = zone, and all factors were set to 1.0 (required for county scale analyses).
zoneroadtype	Activity	SHO zone/roadtype allocation factors. County = zone, and all factors were set to 1.0 (required for county scale analyses).
fuelsupply	Fuel	Control scenario-specific. Contains market share information for gasoline and diesel formations, developed by TTI in consultation with TCEQ. (7.8 RVP conventional gasoline for Pre-1990 Control scenario, and RFG for Current Control scenario.)
fuelformulation	Fuel	Control scenario-specific. Contains gasoline and diesel fuel formulations developed by TTI in consultation with TCEQ. (7.8 RVP conventional gasoline for Pre-1990 Control scenario, and RFG for Current Control scenario.)
imcoverage	I/M	Control scenario-specific. TTI prepared inputs to represent I/M program design for counties and years based on current I/M rules and modeling protocols, and on available MOVES I/M parameters (i.e., "teststandards" and "imfactors") across the domain of I/M vehicles. Regulatory class adjustments were made per *MOVES EI Preparation Guidance*. (No I/M modeled for Pre-1990 Controls.)

[1] All of these datasets are CDB tables except for the fuel/engine fractions, which are imported to RunSpecs.

[2] MOVES does not produce "ramp road type" rates in a single run with the other road types. To calculate emissions for particular travel model ramp links, MOVES unrestricted access road type rates were used.

[3] Use of default activity and population inputs to MOVES is basic to the inventory method. It allows simultaneous development of emissions factors and local activity parameters required in the external emissions calculations. The MOVES default activity is normalized in the emissions rates calculation post-processing procedure (i.e., emissions/activity), and the actual local activity estimates are used in the external emissions calculations.

User Inputs to MOVES via CDB – Locality-Specific Inputs and Defaults Used

All inputs discussed in this section are input via the CDB unless otherwise noted (e.g., fuel/engine fractions). Unless otherwise stated, the inputs apply to all counties, years, and the two base RFP control scenarios.

Year, State, and County Inputs to MOVES

The year, state, and county tables are populated with data identifying the subject year, state, and county of the run.

The yearID field of the "year" table was populated with the analysis year value, and the year was set as a base year (to specify that particular user-input fleet and activity data were to be used, rather than forecast by MOVES). StateID "48" (Texas) was inserted in the state table. The county table identifies the county of analysis and contains barometric pressure and altitude information (discussed further with other meteorological inputs). The county data was selected from a prepared local "meteorology" database containing tables of weather data records (i.e., "county" and "zonemonthhour" tables) for the analysis.

Roadtype Table Inputs to MOVES

Currently the MOVES model contains "ramp" emission rates, but not a road type for ramps specifically. In the roadtype table, MOVES provides a field "rampFraction" for including a fraction of estimated ramp activity as a fraction of SHO on each of the MOVES road types. For this analysis, the MOVES default roadtype table data were used, but with the ramp fractions set to zero (i.e., 100% of activity on each MOVES road type was based on the road type drive cycles assigned to that road type by MOVES, exclusive of ramp activity; currently the MOVES Unrestricted Access road type rates are used with activity for particular ramp links in the external emissions calculations). The treatment of ramps for subsequent EI development projects will be updated to incorporate use of ramp rates.

Default Activity and Population CDB Inputs to MOVES

The activity and vehicle population input parameters under the methodology use the MOVES defaults. The tables are: hpmsvtypeyear, roadtpyedistribution, monthvmtfaction, dayvmtfraction, hourvmtfraction, avgspeeddistribution, and sourcetypeyear. Data for all of these tables were selected and inserted from the MOVES default database. For the two tables dependent on year (i.e., hpmsvtypeyear and sourcetypeyear include yearID), the 1999 default data were used, and the yearID value was updated by setting it to the analysis year value.

The zone and zoneroadtype tables contain zonal sub-allocation activity factors. For county scale analyses, county is equal to zone, therefore these allocation factors were set to 1.0.

Local Fleet Age Distributions and Fuel Fractions Inputs to MOVES

The locality-specific fleet inputs to MOVES consist of age distributions and diesel fractions (or fuel/engine fractions). The age distributions and fuel fractions inputs were calculated and written to text files in preparation for loading the data into the appropriate model input files or tables. The MOVESfleetInputBuild utility was used to produce these fleet inputs to MOVES in the required formats (see utility description in Appendix B).

One statewide level fuel fractions data set was produced for each historical year and imported to its particular year-specific MRS template prior to creation of all of the MRS files for each year. For 2011 and all future analysis years MRS templates, the latest available (2011) local dataset was used. The county-level SUT age distribution inputs for each year were loaded into the appropriate county scenario CDB sourcetypeagedistribution tables via the CDB builder MySQL scripts.

The age distributions and fuel/engine fractions were based on TxDOT mid-year county registrations data and MOVES model defaults, as needed. The fuel/engine fractions were developed consistent with the SUT/fuel types in the VMT mix (e.g., no CNG vehicles are in the SUT/fuel type VMT mix resulting in fuel/engine fractions for CNG of zero). Locality-specific age distributions were produced based on the TxDOT county vehicle registration category aggregations consistent with the vehicle registration category aggregations used in estimating the SUT/fuel type VMT mix (see Appendix B). See age distributions and diesel fractions summaries in Appendix H.

Table 27 summarizes the data sources and aggregation levels used to estimate the HGB county sourcetypeagedistributions and fuel/engine fractions.

Table 27. Data Sources and Aggregations for SUT Age Distributions and Fuel/Engine Fractions.

SUT Name	SUT ID	TxDOT Category[1] Aggregations for Age Distributions and Fuel/Engine Fractions	Geographic Aggregation for Age Distributions	Geographic Aggregation for Fuel/Engine Fractions[2]
Motorcycle	11	Motorcycles	County	NA – 100 percent gas, no Fuel/Engine Fractions
Passenger Car	21	Passenger	County	MOVES default
Passenger Truck	31	Total Trucks<=8500	County	MOVES default
Light Commercial Truck	32	Total Trucks<=8500	County	MOVES default
Single-Unit Short-Haul Truck	52	>8500+ >10000+ >14000+>16000	HGB Region	Texas Statewide
Single-Unit Long-Haul Truck	53	>8500+ >10000+ >14000+>16000	Texas Statewide	Texas Statewide
Refuse Truck	51			
Motor Home	54			
Intercity Bus	41	MOVES default		
Transit Bus[2]	42			
School Bus	43			
Combination Short-Haul Truck	61	>19500+ >26000+ >33000+ >60000	HGB Region	Texas Statewide
Combination Long-Haul Truck	62	>19500+ >26000+ >33000+ >60000	Texas statewide	NA – 100 percent diesel, no Fuel/Engine Fractions

[1] TxDOT mid-year 2002, 2008, and 2011county vehicle registrations data (i.e., three-file data set: composite fuel light-duty categories; heavy-duty gas by eight weight categories; and heavy-duty diesel by eight weight categories) were used for developing local inputs for 2002, 2008 and 2011 (and future years), respectively (weights are gross vehicle weight rating [GVWR] in units of lbs.). Based on the current MOVES model and database, TTI updated the MOVES default age distributions from EPA's MOVES tools webpage, http://www.epa.gov/otaq/models/moves/tools.htm (which were based on the previous MOVES version), and used the updates in this analysis.

[2] MOVES default fuel/engine fractions for transit buses were revised to exclude the CNG and gasoline-fueled components, consistent with the local SUT/fuel type VMT mixes.

Local Meteorological (County and Zonemonthhour Table) Inputs to MOVES

The TCEQ provided the local meteorological inputs values, which TTI processed into the MOVES input format, and loaded into the "county" (barometric pressure) and "zonemonthhour" (temperature and relative humidity) tables. These input data were developed by TCEQ as one set of hourly temperature and relative humidity, and 24-hour barometric pressure averages for the HGB region, using recent multiple year, June through August hourly weather station data from the Houston George Bush Intercontinental Airport. These Houston peak-ozone season meteorological inputs are from the recently adopted HGB RFP SIP Revision for the 1997 Eight Hour Ozone Standard (TCEQ, March 2010). Low altitude was designated for all counties. Table 28 summarizes the temperatures, relative humidity, and barometric pressure input values.

Table 28. Meteorological Inputs to MOVES.

Hour	Temperature (Degrees Fahrenheit)	Relative Humidity (Percent)	24-Hour Average Barometric Pressure (Inches of Mercury)
1	77.1	73.0	29.87
2	75.7	77.2	
3	75.2	78.7	
4	74.1	80.1	
5	72.7	83.6	
6	72.5	84.4	
7	72.4	84.5	
8	76.0	78.0	
9	79.6	68.9	
10	83.1	59.5	
11	85.6	52.1	
12	87.8	47.3	
13	89.0	43.0	
14	90.1	40.6	
15	91.2	39.3	
16	91.2	39.5	
17	91.4	40.3	
18	90.9	40.2	
19	88.8	44.3	
20	85.4	51.4	
21	82.7	57.7	
22	81.0	60.1	

23	80.3	62.0	
24	78.8	66.6	

Fuels Inputs to MOVES

The local fuels inputs to MOVES are input via the CDB in the fuelsupply and fuelformulation tables. TTI prepared the HGB area level input data for each year in spreadsheets, saved the input data to text files in the MOVES-required format. These data were then imported to the fuelsupply and fuelformulation tables in the appropriate MOVES scenario CDBs. The following describes the procedure used to populate the fuels tables.

- Selected and inserted into the CDB fuelsupply table all MOVES default fuelsupply records associated with the scenario (i.e., for the countyID, fuelyearID, monthgroupID) and set their marketshare field values to zero (to prevent MOVES from applying the default fuels data in addition to the desired local fuels input data).
- Loaded all local fuel formulations from the specified local fuels inputs text files into the CDB fuelformulation table (these were given fuelformulationIDs different than the set of IDs used as MOVES defaults).
- Loaded the subject scenario (i.e., for the subject countyID, fuelyearID, monthgroupID) local fuel supply records (i.e., the market shares of the specified fuel formulations) from the input data text files into the CDB fuelsupply table.

Data Sources – The EPA provided TTI with the Houston RFG retail outlet survey samples by fuel grade for 2002, 2008, and 2011, collected by the RFG Survey Association (for more information see: http://www.epa.gov/otaq/regs/fuels/rfg/properf/perfmeth.htm). TTI processed the sample data to estimate the Houston summer season average RFG fuel property inputs by year, which were used for all counties. Other data sources used include regulated RVP limit value, and some historical and future year MOVES default fuel properties for the HGB counties. For average diesel sulfur content, various data sources were used including TCEQ summer retail fuel survey summaries, MOVES defaults, and other available information. See the Table 29 and Table 30 footnotes for data source specifics.

Development of Fuel Formulations Inputs from RFG Survey Samples – On average, each summer period survey included 345 total samples taken during June 1 – September 15 (by grade: Regular – 291, Mid-grade – 19, and Premium – 36). The RFG sample data used were already in the units specified for MOVES, except for the 2002 MTBE and TAME values, which TTI converted from oxygenate weight percent to the required oxygenate volume percent form using appropriate conversion factors (i.e., vol% oxygenate-per-wt% oxygenate factors of 1.0162 for MTBE, and 0.9572 for TAME, based on conversion factors used in MOVES and provided by EPA OTAQ). TTI used the standard method of averaging the fuel properties by grade, and combining them into overall RFG averages using relative sales volumes by grade as weights. The relative sales volumes by grade were estimated using annual average sales volumes per day through retail outlets statistics for Texas, taken from the Energy Information Administration's (EIA) Petroleum Marketing Annuals (for 2002, 2008 and latest available 2009).

The fuel supply value for each fuel formulation used was 1.0, meaning that for each modeling scenario there was only one diesel and one RFG fuel formulation used. The RFG and diesel fuel formulations used are shown in Table 29 and Table 30.

Table 29. MOVES Gasoline Inputs – HGB RFP Summer Emissions Rates Analysis.

Fuel Formulation Field[1]	Pre-1990	CSS 2002	CSS 2008	CSS 2011	CSS Future Years
fuelFormulationID	10001	10002	10003	10004	10005
fuelSubtypeID	10	11	12	12	12
RVP	7.8	6.85	6.93	7.06	7.06
sulfurLevel	402	131.11	29.38	29.42	29.42
ETOHVolume	0	0	9.85	9.76	10
MTBEVolume	0	11.13	0	0	0
ETBEVolume	0	0	0	0	0
TAMEVolume	0	0.81	0	0	0
aromaticContent	26.4	20.49	15.15	14.65	14.65
olefinContent	11.9	11.24	11.93	13.27	13.27
benzeneContent	1.64	0.601	0.582	0.532	0.55
e200	50	48.51	49.12	49.32	49.32
e300	83	83.27	86.25	84.61	84.61
volToWtPercentOxy	0	0.1786	0.3488	0.3488	0.3488
BioDieselEsterVolume	\N	\N	\N	\N	\N
CetaneIndex	\N	\N	\N	\N	\N
PAHContent	\N	\N	\N	\N	\N

[1] Data sources: Pre-1990 – July 1990 MOVES defaults; 2002, 2008, and 2011 – based on EPA Houston Summer 2002, 2008, and 2011 retail outlet RFG survey data; Future Years – all values are based on latest available summer (2011) Houston RFG survey data, except for benzene and ethanol, which are MOVES defaults for July 2012.

Table 30. MOVES Diesel Inputs – HGB RFP Summer Emissions Rates Analysis.

Fuel Formulation Field[1]	Pre-1990	CSS 2002	CSS 2008	CSS 2011	CSS Future Years
fuelFormulationID	32500	30307	30061	30006	30011
fuelSubtypeID	20	20	20	20	20
RVP	0	0	0	0	0
sulfurLevel	2500	306.7	60.5	6.0	11
ETOHVolume	0	0	0	0	0
MTBEVolume	0	0	0	0	0
ETBEVolume	0	0	0	0	0
TAMEVolume	0	0	0	0	0
aromaticContent	0	0	0	0	0
olefinContent	0	0	0	0	0
benzeneContent	0	0	0	0	0
e200	0	0	0	0	0
e300	0	0	0	0	0
volToWtPercentOxy	0	0	0	0	0
BioDieselEsterVolume	\N	\N	\N	\N	\N
CetaneIndex	\N	\N	\N	\N	\N
PAHContent	\N	\N	\N	\N	\N

[1] These are the diesel "sulfurLevel" data sources, beginning with "Pre-1990," respectively: an approximate, typical, post-1979/pre-1993 regulation average sulfur value (i.e., the low end of the range for average sulfur level in No. 2 diesel [2500-3000 parts per million (ppm)], based on National Institute for Petroleum and Energy Research [NIPER] U.S. refiner survey summary information, referenced in an article from Energy Information Administration/Monthly Energy Review, August 1993); TCEQ Summer diesel survey data for Houston from 2003, 2008, and 2011; MOVES default.

Local I/M Inputs to MOVES

The I/M program is required and administered to reduce vehicle emissions in five of the eight HGB counties. MOVES calculates county emissions rates that reflect the emissions-reducing benefits of the I/M program designs reflected in parameters specified in the MOVES IMcoverage table. TTI produced a new and updated set of Texas I/M county MOVES imcoverage records to replace the MOVES default imcoverage table records for Texas (that were populated using information from the EPA's 2005 National EI).

The imcoverage table data parameters (by field headers) are:

- polProcessID (pollutant and emission process affected by the program);
- stateID (state subject to the I/M program);
- countyID (subject county);
- yearID (year administered);
- sourceTypeID (SUT covered);
- fuelTypeID (fuel type subject to the program);
- IMProgramID (arbitrary ID number);
- begModelYearID (first model year covered);
- endModelYearID (last model year covered);
- inspectFreq (inspection frequency for the program);
- testStandardsID (I/M test type);
- useIMyn (a Y/N [yes/no] switch that specifies whether or not to use the record); and
- complianceFactor (an adjustment factor reducing the effects for compliance rate, waiver rates, or other adjustments).

TTI produced the new set of Texas counties imcoverage table input records for all MOVES analysis years and stored them in a database for use in building the CDBs for emissions rates modeling. In addition to selecting the appropriate local user-input imcoverage records for the modeling scenario from the Texas imcoverage database, all MOVES default imcoverage records pertaining to the modeling scenario must be excluded. To prepare the appropriate county imcoverage inputs, the following two general steps were performed for all eight counties:

- Selected and inserted all MOVES default imcoverage records for the scenario's countyID and yearID into the CDB imcoverage table, and flagged them for non-use (i.e., set useIMyn = N) in the modeling run; and
- From the current, updated Texas MOVES imcoverage database, selected and inserted the imcoverage records for the scenario's yearID and countyID into the CDB imcoverage table (with useIMyn = Y).

Data Sources – TTI produced the I/M coverage input parameters to best represent Texas I/M program designs as specified in the Texas I/M SIP and Texas rules (using current Texas I/M modeling protocol compliance and waiver rates), and where the pertinent I/M coverage modeling parameters existed in MOVES (e.g., only for SUT and fuel type categories for which MOVES contained I/M effects). The HGB I/M program requires annual emissions testing of gasoline vehicles within a 2-through-24 year vehicle age coverage window (motorcycles, military tactical vehicles, diesel-powered vehicles, and antique vehicles are excluded). A gas cap integrity test is required on all these vehicles, and, depending on the vehicle class and model year, the vehicle emissions testing may utilize on-board diagnostics (OBD), the Accelerated Simulated Mode (ASM-2) test, or the Two-speed Idle (TSI) test. For additional Texas I/M program details, see the current I/M SIP, *Revision to the State Implementation Plan Mobile Source Strategies, Texas Inspection and Maintenance State Implementation Plan*, TCEQ, November 18, 2010.

Approach – Following is the general approach used to build the current Texas imcoverage tables.

- Identified the MOVES I/M test standards applicable to Texas (see Table 31, column 5, which lists the five I/M test standards pertinent to this HGB analysis).
- Queried the MOVES default imfactor table (contains adjustments to emissions rates per various I/M scenarios by SUT/fuel type, age, etc.) on Texas I/M test frequency and fuel type (i.e., annual and gasoline) and on the imteststandards applicable to Texas – from this query, listed the SUTs, test standards, pollutant and emissions process combinations with non-zero MOVES imfactors and corresponding base rates with non-zero standard I/M difference (i.e., I/M effects) available in MOVES (see Table 31, note 4).
- Categorized counties and years in groups under the same MOVES test standards.
- Assigned MOVES improgramIDs such that: 1) all MOVES default improgramIDs were excluded, and 2) per MOVES User's Guide, for each yearID, each IMprogramID represented a unique combination of test standard, test frequency, begin model year, and end model year.

Table 31 and the associated table notes describe the MOVES imcoverage records developed by TTI and used for this HGB analysis. Note that a review of the pertinent MOVES data (IMfactors and mean base rates for non-I/M and reference-I/M) showed that in the current MOVES model there are no I/M effects included for heavy-duty vehicle categories (i.e., vehicles with GVWR > 8,500 pounds – see Table 31, note 4). Although the Texas I/M program design includes heavy-duty vehicles, the current version of MOVES provides no means to model a potential benefit.

Table 31. MOVES IMCoverage Table Input Descriptions for HGB I/M Counties.

<table>
<tr><th>YearID[1]</th><th>IMprogamID[2]</th><th>begModel YearID[3]</th><th>endModel YearID[3]</th><th>testStandardsID</th><th>Sourcetypeid[4]</th></tr>
<tr><td colspan="5">Harris County</td><td rowspan="11">21 (PC – Passenger Car)
31 (PT – Passenger Truck)
32 (LCT – Light Commercial Truck)</td></tr>
<tr><td rowspan="2">1999 through 4/2002</td><td>20</td><td>X</td><td>X</td><td>12 (2500 RPM/Idle)</td></tr>
<tr><td>50</td><td>X</td><td>X</td><td>41 (Evp Cap)</td></tr>
<tr><td colspan="5">Harris, Brazoria, Fort Bend, Galveston, Montgomery Counties</td></tr>
<tr><td rowspan="4">5/2003 (5/2002, for Harris) through 2019</td><td>30</td><td>X</td><td>1995</td><td>23 (A2525/5015 Phase)</td></tr>
<tr><td>51</td><td>X</td><td>1995</td><td>41 (Evp Cap)</td></tr>
<tr><td>40</td><td>1996</td><td>X</td><td>51 (Exh OBD)</td></tr>
<tr><td>60</td><td>1996</td><td>X</td><td>45 (Evp Cap, OBD)</td></tr>
<tr><td rowspan="2">2020 through 2050</td><td>41</td><td>X</td><td>X</td><td>51 (Exh OBD)</td></tr>
<tr><td>61</td><td>X</td><td>X</td><td>45 (Evp Cap, OBD)</td></tr>
</table>

[1] County I/M implementation dates: Harris – 1/1/1997 with transition to new I/M test types on 5/1/2002; Brazoria, Fort Bend, Galveston, Montgomery – 5/1/2003.

[2] Common parameters for Texas MOVES imcoverage records not shown include: annual test cycle, gasoline fuel type, use IMyn = Y. Aside from any non-standard adjustments, the compliancefactor values are common across areas: PC – 93.12%; PT – 87.53%; and LCT – 81.95%. Using the MOVES EI Technical Guidance compliance factor equation (Section 3.10.6), compliance factors were calculated as the product of the percent compliance rate, 100 – percent waiver rate, and the regulatory class coverage adjustment. The current Texas I/M program modeling protocol compliance and waiver rates are 96% and 3%. The regulatory class adjustments used were taken directly from the MOVES EI Technical Guidance, and for PC, PT, and LCT, respectively are 100%, 94%, and 88%.

[3] begmodelyearid and endmodelyearid, which define the range of vehicle model years covered, where represented by "x" are calculated as YearID – 24, and YearID – 2, respectively.

[4] For heavy-duty gasoline vehicles (i.e., > 8,500 pounds GVWR), MOVES does not contain any combinations of I/M factors and mean base rates that yield I/M effects; for light-duty (LD) gasoline vehicles, MOVES includes both exhaust and evaporative I/M factors and mean base rates with I/M effects, therefore, only LD gasoline vehicles (SUTs 21, 31, and 32) were included in the user input imcoverage records. The processes/pollutants affected by I/M are exhaust running and exhaust start total hydrocarbon (THC), CO, NO_x, and tank vapor venting THC.

The MOVES input files (MRSs and CDBs) were provided as a part of the electronic data submittal (Appendix A) of this Technical Note.

Checks and Runs

After completing the input data preparation, the CDBs were checked to verify that all 18 tables were in the appropriate CDBs and the tables were populated with data as intended. The MOVES RunSpecs were executed in batches using the MOVES command line tool. The batches were set up to write each MOVES run log to a text file for later access. After completion, TTI searched the MOVES run logs for error and warning messages, for which none were found. The MOVES run summaries are included as Appendix I.

Post-Processing Runs

- *Rates Per Activity*: Using the MOVESratescalc utility, TTI calculated "rates-per-activity" for each county from the MOVES output (i.e., emissions divided by activity, using the movesoutput [emissions] and movesactivityoutput [activity] tables). The process created two emissions rate tables (per run) that were added to the MOVES output database: "ttirateperdistance" containing mass/mile emissions rates, and "ttirateperactivity" containing mass/SHP, mass/SHI, and mass/start emissions rates. This was performed for each county, year, and control scenario. See MOVESratescalc utility description in Appendix B for more details.
- *Rates Adjustments*: From the two calculated rate tables output from each MOVESratescalc run, emissions rates were extracted for only those pollutants needed in the emissions calculations. For the Harris County 2002 base year, the pre-May and post-April I/M scenario rates were combined using factors representing the portion of the fleet estimated to have been tested under the previous and current I/M tests, during the prior complete I/M cycle (12 months). Using the July 1, 2002 evaluation reference, the proportions used were: 10/12 for the pre-May I/M proportion, and 2/12 for the post-April I/M proportion. For the 2008 and later year Control Strategy scenarios, TxLED adjustments were applied to all diesel vehicle NO_x emissions rates, and the extracted and adjusted rate tables for each county, year, and control scenario were placed in a separate database for input to the emissions calculations. Table 32 shows the TxLED factors used (provided by TCEQ). TCEQ produced these average diesel SUT NO_x adjustments using 4.8% and 6.2% reductions for 2002 and later, and 2001 and earlier model years, respectively. More details on TCEQ's TxLED factors analysis may be found at, ftp://amdaftp.tceq.texas.gov/pub/Mobile_EI/Statewide/mvs/TxLED/, in the files:
    - *mvs10a-statewide-txled-2010-analysis-06-08-11-12-13-18.zip,* and
    - *mvs10a-statewide-txled-2011-analysis-11-14-17-18-19-21.zip.*

Note that both TxLED analysis zip files contain different sets of estimated TxLED NO_x adjustment factors for future years. The distinction is that the "2011-analysis" fleet inputs (vehicle age distributions) used were based on the most current mid-year (2011) TxDMV vehicle registration data. The "txled-2011-analysis" zip file contains the analyses of 2011, 2014, 2017, 2018, and 2019 TxLED factors used in this RFP analysis. The "txled-2010-analysis" zip file listed contains the analysis of 2008 TxLED adjustment factors used in this RFP analysis.

Table 32. RFP Analysis Year TxLED Adjustment Factor Summary.

Diesel Fuel Source Use Type	2008	2011	2014	2017	2018	2019
Passenger Car	0.9499	0.9494	0.9509	0.9515	0.9516	0.9517
Passenger Truck	0.9445	0.9456	0.9479	0.9492	0.9496	0.9499
Light Commercial Truck	0.9452	0.9460	0.9479	0.9488	0.9491	0.9494
Intercity Bus	0.9410	0.9418	0.9426	0.9433	0.9438	0.9440
Transit Bus	0.9413	0.9422	0.9428	0.9442	0.9447	0.9452
School Bus	0.9416	0.9423	0.9430	0.9438	0.9444	0.9445
Refuse Truck	0.9422	0.9431	0.9438	0.9451	0.9461	0.9466
Single Unit Short-Haul Truck	0.9483	0.9491	0.9503	0.9508	0.9510	0.9512
Single Unit Long-Haul Truck	0.9479	0.9487	0.9499	0.9505	0.9507	0.9509
Motor Home	0.9435	0.9445	0.9454	0.9462	0.9465	0.9468
Combination Short-Haul Truck	0.9432	0.9445	0.9462	0.9476	0.9483	0.9487
Combination Long-Haul Truck	0.9431	0.9445	0.9465	0.9481	0.9488	0.9493

Source: TCEQ, Fall 2011. See ftp://amdaftp.tceq.texas.gov/pub/Mobile_EI/Statewide/mvs/TxLED/ for TCEQ's TxLED analysis spreadsheets and other information.

Appendix A describes the electronic data submittal for this RFP inventory analysis, which includes the TxLED and I/M test-type switch adjustment factor files used in the MOVESratesAdj utility runs that produced the final emissions rate look-up table inputs to the emissions calculations.

Emissions Factors for Estimation of Individual Control Reductions

The remaining emissions factor control scenarios (i.e., 2CS, 3CS, and 4CS) are covered in this section. The previous discussion on development of 1CS and CSS control scenario emissions factors included the general process used for all RFP analysis emissions factors estimates – the previous section may be referred to for any questions on the general process not included here.

The objective is to estimate emissions reductions by individual control measure (listed), for each county and the region. The method is to estimate incremental control emissions reductions for a single county (Harris), and apply the individual relative reductions to the total reductions (1CS – CSS) for each other county to produce the estimates for all counties. Two sets of relative reductions were developed: one with I/M and one without I/M, for use, respectively, with I/M and with non-I/M counties.

Table 33 summarizes the run sequence. Note that existing MOVES and MOVES post-processor utility runs from the 1CS and CSS scenarios were used in combination with output from the extra runs needed, to produce the required five scenarios of Harris County emissions estimates. Existing runs and new runs are summarized together for the overall emissions rates development process, which includes development of MOVES setups (MRSs, CDBs), MOVESratescalc set-ups, and MOVESratesadj set-ups. (MOVESemscalc runs to calculate the emissions estimates are discussed in the next section).

Table 33. Harris County Emissions Factor Modeling Control Scenarios and Sequence.

Scenario Label	Controls Increment	MOVES CDB	MRS	MOVES Runs	RatesCalc Runs	RatesAdj Runs
1cs	Pre-1990 Controls	Existing set-ups and runs				
2cs	1cs + RFG	Like "1cs" except for current fuels	"1cs" labels changed to "2cs"	√	√	√ (no TxLED)
3cs	2cs + post-FMVCP	"2cs" label changed to "3cs"	"2cs" labels changed to "3cs"; "No CAA" ROP switched off	√	√	√ (no TxLED)
4cs	3cs + I/M	Existing set-ups and runs (i.e., "css" set-ups and runs prior to TxLED adjustments, or CSS scenario - TxLED)				√ (no TxLED)
css	4cs +TxLED	Existing set-ups and runs				

As shown in Table 33, of the five control scenarios, three (2CS, 3CS, and 4CS) required some modeling set-ups and runs. The 2CS and 3CS control scenarios required the full process stream of set-ups and runs, whereas the 4CS control scenario only required set-ups and runs beginning with the MOVESratesAdj step. This is because 4CS is the same as CSS, except with no TxLED. Therefore, the CSS MOVESratesCalc step output was input to a new "4CS" MOVESratesAdj utility run with no TxLED adjustments applied to produce the 4CS scenario rate tables. This series of additional emissions factor modeling set-ups and runs was developed and executed for 2008, 2011, 2014, 2017, 2018 and 2019 analysis years.

The Harris County emissions factors for the 2CS, 3CS and 4CS scenarios for each year were input with appropriate activity inputs into MOVESemscalc to produce the emissions estimates needed, along with the 1CS and CSS scenario emissions, that were used to quantify the individual control measure emissions reductions, discussed in a later section.

The emissions factor MOVES set-ups used (MRS files and CDBs) were provided as a part of the electronic data submittal (see Appendix A).

EMISSIONS CALCULATIONS

TTI calculated hourly, ozone season weekday, link-based EIs by county for each RFP EI, and for Harris County for the additional incremental control scenarios needed to estimate emissions reductions by control measure, using the MOVESemscalc utility. The link-based emissions calculations fall into two categories: VMT-based emissions calculations and off-network emissions calculations. The VMT-based emissions calculations use the TDM VMT and speeds to estimate emissions at the TDM link (or roadway segment) level. The off-network emissions process calculations use off-network activity (SHP, starts, and SHI) to estimate emissions at the county level.

Hourly Link-Based Emissions Calculations

The ozone season weekday, hourly link-based emissions, by county, for each analysis year and inventory type, were calculated with the MOVESemscalc utility using the following major inputs:

- TxDOT district-level SUT/fuel type VMT mix by MOVES roadway type;
- TDM link and intrazonal link VMT and speeds estimates, which contain the link-specific, hourly, directional, operational VMT and speed estimates as developed by the TRANSVMT utility to include: A-node, B-node, county number, TDM road type (functional class) code, link length, congested (operational) speed, VMT, and TDM area type code;
- County-level hourly SUT/fuel type off-network activity estimates (SHP, starts, and SHI);
- MOVES-based off-network emissions factors by pollutant, process, hour, SUT, and fuel type;
- MOVES-based “on-network” (VMT-based) emissions factors by pollutant, process, hour, average speed, MOVES roadway type, SUT, and fuel type; and
- TDM road type/area type to MOVES road types designations (see Table 34).

The VMT-based emissions were calculated for each hour using the TxDOT district-level SUT/fuel type VMT mix, the TDM link and intrazonal link VMT and speeds estimates, the MOVES-based “on-network” emissions factors, and the TDM road type/area type to MOVES road types designations. For each link, the link was assigned a MOVES road type based on the link’s road type and area type (see Table 34). The link VMT was then distributed to each SUT/fuel type using the VMT mix, based on the link’s designated MOVES road type and its associated TxDOT district.

The emissions factors for each SUT/fuel type were selected based on the link’s designated MOVES road type and the link speed. For link speeds falling between MOVES speed bin average speeds, emissions factors were interpolated from bounding speeds. For link speeds falling outside of the MOVES speed range (less than 2.5 mph and greater than 75 mph), the emissions factors for the associated bounding speeds were used. The g/mi rates were multiplied by the link SUT/fuel type VMT producing the link-level emissions estimates.

Table 34. HGAC TDM Road Type/Area Type to MOVES Road Type Designations.

TDM Road Type (Code - Name)	TDM Area Type (Code - Name)	MOVES Road Type (Code - Name)
3 - Toll Roads	5 – Rural	2 – Rural Restricted Access
10 - Rural Interstate	5 – Rural	
11 - Rural Other Fwy.	5 – Rural	
4 - Ramps (Fwy/Toll/Frnt)	5 – Rural	3 – Rural Unrestricted Access
8 - Local (Cent. Conn.)	5 – Rural	
12 - Rural Prin. Art.	5 – Rural	
13 - Rural Other Art.	5 – Rural	
14 - Rural Major Col.	5 – Rural	
15 - Rural Collector	5 – Rural	
1 - Urban Interstate	1 – CBD; 2 – Urban; 3 – Urban Fringe	4 – Urban Restricted Access
2 - Urban Other Freeway	2 – Urban; 3 – Urban Fringe	
3 - Toll Roads	1 – CBD; 2 – Urban; 3 – Urban Fringe; 4 – Suburban	
10 - Rural Interstate	2 – Urban; 3 – Urban Fringe; 4 – Suburban	
11 - Rural Other Fwy.	3 - Urban Fringe; 4 – Suburban	
4 - Ramps (Fwy/Toll/Frnt)	1 – CBD; 2 – Urban; 3 – Urban Fringe; 4 – Suburban	5 – Urban Unrestricted Access
5 - Urban Prin. Art.	1 – CBD; 2 – Urban; 3 – Urban Fringe	
6 - Urban Other Art.	1 – CBD; 2 – Urban; 3 – Urban Fringe; 4 – Suburban	
7 - Urban Collector	1 – CBD; 2 – Urban; 3 – Urban Fringe	
8 - Local (Cent. Conn.)	1 – CBD; 2 – Urban; 3 – Urban Fringe; 4 – Suburban	
12 - Rural Prin. Art.	3 – Urban Fringe; 4 – Suburban	
13 - Rural Other Art.	3 – Urban Fringe; 4 – Suburban	
14 - Rural Major Col.	3 – Urban Fringe; 4 – Suburban	
15 - Rural Collector	3 – Urban Fringe; 4 – Suburban	
40 - Local (Intrazonal)	40 - LOCAL (INTRAZONAL)	

The off-network emissions were calculated for each hour using the hourly MOVES-based off-network emissions factors by SUT/fuel type and the county-level hourly SUT/fuel type off-network activity estimates (SHP, starts, and SHI). The off-network emissions were calculated at the county level by multiplying the hourly MOVES-based off-network emissions factors by the appropriate county-level hourly SUT/fuel type off-network activity, which was determined by the pollutant process.

The MOVESemscalc utility outputs for this RFP inventory project consist of a listing file (summarizing all pertinent information regarding the execution of the utility), and a tab-delimited emissions report summary file for each run including both hourly and 24-hour activity and emissions estimates by SUT/fuel type and TDM road type, with emissions tables of pollutant composites and individual emissions process totals.

See Appendix A (Electronic Data Submittal) for the listing of EI data files submitted as a part of this project report. See Appendix B for additional MOVESemscalc utility information and the emissions calculation process flow diagram.

HGB RFP Emissions Inventories

Table 35 lists the activity and emissions rate input data components (Pre-1990 Control or Control Strategy) used in calculating each of the 19 HGB RFP EIs. This represents 152 county-level EIs (not including the extra EIs produced to quantify the individual control measure emissions reductions).

Table 35. HGB RFP Emissions Inventories.

Number	RFP Inventory		Activity Year[1]	Emissions Factor Input[1]	
1	2002	Base Year	2002	2002	Control Strategy
2	2002	Adjusted Base Year		2002	Pre-1990 Control
3	2008			2008	
4	2011			2011	
5	2014			2014	
6	2017			2017	
7	2018			2018	
8	2008	Pre-1990 Control	2008	2008	Pre-1990 Control
9	2011		2011	2011	
10	2014		2014	2014	
11	2017		2017	2017	
12	2018		2018	2018	
13	2019		2019	2019	
14	2008	Control Strategy	2008	2008	Control Strategy
15	2011		2011	2011	
16	2014		2014	2014	
17	2017		2017	2017	
18	2018		2018	2018	
19	2019		2019	2019	

[1] "Pre-1990 Control" emissions factors model future evaluation year fleets with pre-1990 controls (no I/M program, with the MOVES model switched to "turn off" post-1990 FMVCP emissions standards, along with summer 1992 fuel parameters including 1992 RVP limit promulgated prior to enactment of the 1990 CAAA. "Control Strategy" emissions factors model the controls based on the current calendar year regulations (i.e., pre-1990 and all subsequent controls). Activity input includes VMT mix, link VMT/speeds, and off-network activity (SHP, starts, and SHI).

Individual Control Measure Emissions Reductions Estimation

Table 36 lists the five inventory control scenarios that were used to estimate the emissions reductions for individual control measures. With the EIs listed in this table, for each HGB county and for all the milestone years and the attainment and contingency years, emissions reductions were estimated attributable to RFG, post-1990 CAA FMVCP, I/M program, and TxLED fuel.

The general process outlined in Table 36, involved:

- calculation of total reductions for each county;
- calculation of Harris County individual control measure emissions reductions;

- calculation of individual control reduction distributions from Harris County individual control measure and total reductions; and
- multiplying individual control measure emissions reduction distributions estimated from Harris County to the total reductions for each of the other HGB counties.

To perform these calculations, the additional Harris County control scenario EIs (2CS, 3CS, and 4CS) were needed, consistent with the 1CS and CSS inventories (i.e., the TDM link-based EIs numbered 8 through 19 in Table 35). These additional Harris County extra control scenario EIs were produced (consistent with the inventory data and procedures previously discussed), and the EI results for all scenarios were applied with this process yielding the individual control measure emissions reductions estimates. Note that under the previous third bullet, two "emissions reduction distributions" were needed, one with I/M included, and one with I/M excluded (needed for non-I/M county emissions reduction estimation).

Table 36. HGB RFP EI Control Scenarios for Indvidual Control Measure Emissions Reductions Estimates.

Scenario Label	Inventory Control Measures[1]	Individual Control Measure Emission Reduction Calculation	Counties
1CS (or P90)	Pre-1990 Control	–	All HGB Counties
2CS	Pre-1990 Control + RFG	RFG (1CS – 2CS emissions)	Harris
3CS	Pre-1990 Control + RFG + Post-1990 FMVCP	Post-1990 FMVCP (2CS – 3CS emissions)	Harris
4CS	Pre-1990 Control + RFG + Post-1990 FMVCP + I/M Program	I/M Progam (3CS – 4CS emissions)	Harris
CSS	Control Strategy	TxLED (4CS – CSS)	All HGB Counties

[1] "Pre-1990 Control" emissions factors model future evaluation year fleets with pre-1990 controls (no I/M program), with the MOVES model switched to "turn off" post-1990 FMVCP emissions standards, along with summer 1992 fuel parameters including 1992 RVP limit promulgated prior to enactment of the 1990 CAAA. "Control Strategy" emissions factors model the controls based on the current calendar year regulations (i.e., pre-1990 and all subsequent controls).

The individual reduction distributions used for counties with I/M programs were calculated from the Harris County EIs as:

(1CS-2CS)/(1CS-CSS) = relative reductions from RFG;
(2CS-3CS)/(1CS-CSS) = relative reductions from Post-1990 FMVCP;
(3CS-4CS)/(1CS-CSSs) = relative reductions from I/M Program; and
(4CS-CSS)/(1CS-CSS) = relative reductions from TxLED fuel.

The individual reduction distributions used for non-I/M counties were calculated from the Harris County EIs as:

(1CS-2CS)/[(1CS-CSS)-(3CS-4CS)] = relative reductions from RFG;
(2CS-3CS)/[(1CS-CSS)-(3CS-4CS)] = relative reductions from Post-1990 FMVCP; and
(4CS-CSS)/[(1CS-CSS)-(3CS-4CS)] = relative reductions from TxLED fuel.

These factors were calculated and applied to county total reductions, at the SUT/fuel type and emissions-process level. The results were summed within reduction categories to produce the county and region pollutant total individual reduction estimates (as shown in Table 7 and Table 8). The calculations were performed in individual spreadsheets for each year, including 2008, 2011, 2014, 2017, 2018, and 2019.

The spreadsheet calculations, with county, SUT/fuel type, and emissions-process level results, as well as higher level aggregations, such as the HGB region estimates previously presented in Table 7 and Table 8, were included in Appendix A (Electronic Data Submittal).

QUALITY ASSURANCE

Analyses and results were subjected to appropriate internal review and QA/QC procedures, including independent verification and reasonableness checks. All work was completed consistent with applicable elements of ANSI/ASQ E4-2004: *Specifications and Guidelines for Quality Systems for Environmental Data Collection and Technology Programs* and the TCEQ Quality Management Plan.

Quality Assurance Project Plan (QAPP) Category II (Modeling for NAAQS Compliance) is the QAPP category that most closely matches these objectives and establishes QAPP requirements for projects involving applied research or technology evaluations. Internal review and quality control measures consistent with applicable NRML QAPP requirements, along with appropriate audits or assessments of data and reporting of findings, were employed. These include, but are not limited to, the elements outlined in the following description.

A. Project Management

The project management was as listed previously in the Acknowledgments section.

The definition and background of the problem addressed by this project, the project/task description, and project documents and records produced are as described previously in the Purpose, Background, Project Reporting, and Project Electronic Data sections. No special training or certifications were required. The TTI project manager assured that the appropriate project personnel had and used the most current, approved version of the QAPP.

After receiving the Notice to Commence (NTC) from TCEQ, the TTI project manager provided a detailed pre-analysis plan to the TCEQ project manager for review and concurrence. Upon concurrence of the pre-analysis plan, the TTI project manager distributed the pre-analysis plan to the TTI inventory developers for use in both the inventory development and QA review process. TTI maintains records of the project QA checks as a part of the project archive, for at least five years.

The objective was to produce the emissions inventory product of the quality suited to its purpose as specified (e.g., inventories to be processed for input to a photochemical model, for use in an attainment demonstration SIP revision, from which a motor vehicle emissions budget will be produced for transportation conformity purposes), in accordance with the appropriate guidance and methods documents as referenced, as detailed in the pre-analysis plan, and in consultation with the TCEQ project manager.

Basic criteria were used to assure that the acceptable quality of the product was met – product developers verified that the process and product were as specified, to include:

- The product met the purpose of the emissions analysis (e.g., photochemical modeling, reasonable further progress, transportation conformity, model comparison);
- The full extent of the modeling domain (e.g., analysis years, geographic coverage, seasonal periods, days, sources, pollutants) was included;
- Agreed methods, models, tools, and data were used (e.g., as listed in the Grant Activities Description, and as listed in the more detailed pre-analysis plan – any change from this plan, if needed, was made in consultation with the TCEQ Project Manager);
- The required output data sets were produced in the appropriate formats in accordance with the pre-analysis plan; and
- Any deficiencies found during development and end-product quality checks (as discussed in QAPP Section D) were corrected.

B. Data Generation and Acquisition

Note that no sampling of data was involved in the emissions inventory development, thus only existing data (non-direct measurements) were used for this project.

The data needed for project implementation were in the categories needed for development of emissions rate model inputs and adjustment factors, and development of the activity inputs for external emissions calculations. These emissions factor model inputs and activity inputs were developed using data sources as outlined previously and/or methods and procedures as detailed in the references listed, and as provided in the pre-analysis plan.

All data used either as direct input or to produce inputs (e.g., to the MOVES model or to TTI's emissions inventory development utilities used, which were listed in the pre-analysis plan) were reviewed by TTI for suitability before use. The data sets for the project were provided by the Texas Department of Transportation (TxDOT), a Metropolitan Planning Organization (MPO) or Council of Governments (COG), TCEQ, and/or the EPA, and in most cases were QA'd by the providing agency. The data needed may include: Highway Performance Monitoring System (HPMS) data (from TxDOT's Roadway Inventory Functional Classification Record [RIFCREC] report); regional travel demand model data; speed model data; vehicle registration data; automatic traffic recorder data; vehicle classification count data; meteorological data; fuels data; MOVES emissions model data; extended idling activity data; and vehicle inspection and maintenance program design data.

Any significant problems found during data review, verification, and/or validation (see QA criteria and methods discussion in section D) were to be corrected, and the QA procedure was repeated until satisfied. No significant problems were found.

Data Management: TTI emissions inventory data developers work as a closely coordinated team. The assigned staff used the same electronic project folder structure on their individual workstations. As various scripts, inputs, and outputs were developed in the emissions inventory development process, data were shared within the team for crosschecking via an intra-net, flash drive, or external hard drive. To perform the MOVES model runs, a computer cluster, or multiple computer configurations, was used. After input data were QA'd, depending on the size of the data set, the data sets were backed up and stored in compressed files. These activities were performed throughout the process until the final products were produced.

For MOVES model runs to produce emissions factor look-up tables for the emissions inventories, all run files (MOVES model inputs and batch files) were produced on an individual workstation. After the MOVES input data and batch files (i.e., Run Files) were QA'd, they were copied (via external hard drive) to the cluster's Master computer. Upon execution, completion, and error checking, the MOVES output databases and run log text files were copied to an individual workstation, archived and processed further in preparation for input to the emissions calculations.

After the final product was completed, all the project data archives were compiled on a set of optical data discs (CD-ROM or DVD, depending on size), or on an external drive for very large project data sets. A complete archive of the project data is kept by TTI (the computer models and emissions inventory development utilities used in the process are included). An electronic data submittal package (containing the project deliverables as listed in Appendix A) was produced along with data description (on CD-ROM, DVDs, or external hard drive, depending on needed storage space) and delivered to TCEQ.

C. Assessment and Oversight

The following assessments were performed.

- Verified that the overall scope was met (consistent with the intended purpose, for specified temporal resolution and geographic coverage, for specified sources, pollutants, and emissions processes).
- Checked input data preparation, and model or utility execution instructions (e.g., run specifications, scripts, JCFs, command files) were prepared according to the plan; and
- Checked that correct output data were produced (includes interim output [output that becomes input to a subsequent step in the inventory development process], as well as the final product). Records were kept of the checks performed.

In the case that any inconsistencies or deficiencies were found, the issue was directly communicated to the responsible staff for corrections (or the outside agency staff involved, if provided from outside of TTI, if needed). After a correction was made, the QA checks were performed again to ensure that the additional work resulted in the intended quality assured result, and the correction was noted in the QA record (process was performed until QA check was satisfied).

Any major problem was reported to the project manager and communicated to the project team as needed, as well as when the various data elements in the process passed QA checks and were ready for further processing according to the project pre-analysis plan. The project manager ensured that all of the QA checks performed were compiled, and maintained in the project archives.

In addition, technical systems audits were performed as appropriate. Audits of data quality at the requisite 25% level were performed for any data collected or produced as part of this study. QA findings were reported in both the draft and the final reports.

D. Data Validation and Usability

Development of the detailed on-road mobile source emissions estimates is a multi-staged process that involves many data sets and data processing steps. In the interest of product quality and process efficiency, thorough quality assurance checks were performed during emissions inventory development.

Data for the project, whether provided for direct use or processed by TTI, were reviewed, verified, and validated to ensure that they conform to their particular specifications and TCEQ's requirements for the intended use. The data specifications and requirements where not stated specifically, are included in the documents listed in the "References" section, or are outlined or referenced in the detailed pre-analysis plan.

The criteria for passing quality checks and the checks typically performed on each major inventory input component (i.e., estimates of source activity, activity distributions, and emissions factors) as well as on the resulting emissions estimates, are summarized in the following. These QA guidelines were used to ensure the development of emissions inventory estimates that are as accurate as possible and meet the requirements of TCEQ's intended use.

Verified that the overall scope of the emissions analysis has been met as prescribed in the pre-analysis plan, to include:

- Purpose of the emissions analysis (e.g., photochemical modeling, reasonable further progress, transportation conformity, model comparison);
- Extent of the modeling domain (e.g., analysis years, geographic coverage, seasonal periods, days, sources, pollutants);
- Methods, models, and data used (e.g., default versus local input data sources); and
- Procedures and tools used and all required emissions output data sets were produced.

Performed checks on input data preparation, model or utility execution instructions (e.g., run specifications, scripts, JCFs, command files), and output, as appropriate to the component:

- Input data preparation checks:
    - Verified the basis of input data sets against the pre-analysis plan: Actual historical or latest available data, validated model, expected values or regulated limits,

regulatory program design, model defaults, surrogates, professional judgment; check aggregation levels.

    - Data development: Depending on the procedure and particular input data set, calculations were verified (e.g., re-calculated independently and compared with originally prepared values – if spot-checking a series of results, included extremes and intermediate values).
    - Completeness: Verified that input data sets were within the required dimensions, and all required fields were populated and properly coded or labeled.
    - Format: Verified that formats were within required specifications (e.g., field positions, data types and formats, and file formats), if any.
    - Reasonability checks: (discussed in the next section).
    - Ensured that any inputs provided from external sources were quality assured, as listed previously.

- Checked the model or utility execution instructions:
    - Verified that the correct number of utility or model run specifications were prepared for each application (e.g., by year, county, season, day type).
    - Verified that each utility or model run script included the correct modeling specifications (e.g., commands, input values, input and output file paths, output options) for the application per applicable user guide.
- Checked for the successful completion of model and utility executions:
    - Verified that the correct number of each type of output file was produced by the particular model or utility.
    - Checked for any unusual output file sizes.
    - Searched output (e.g., utility listing files or model execution logs that contain error and warning records) for warnings/errors.
    - Checked the summary information provided in output listing files for any unusual results.

Performed further checks for consistency, completeness, and reasonability of data output from model or utility applications:

- Verified that the data distributions and allocation factors produced or used sum to 1.0, as appropriate (e.g., hourly travel factors within a time period, proportion of travel by vehicle categories on a particular roadway category).
- Verified that the required data fields were present, populated, and properly coded or labeled; verified that data and file formats were within specifications.
- Verified that any activity, emissions rate, or emissions adjustments were performed as intended (e.g., seasonal activity factor, emissions control program adjustment).
- For data sets prepared with temporal or geographic variation (e.g., activity distributions between weekends/weekdays, vehicle mix, or average speeds between

road types or time periods), compared and noted whether directional differences were as expected.

- Checked for consistency between data sets (e.g., compared detailed spatially and temporally disaggregated activity estimates [e.g., link VMT] to original aggregate totals, activity total summaries between utility applications [e.g., link-VMT producer and emissions calculator], and input hourly distributions versus hourly summaries from the link activity output data).
- Calculated county, 24-hour, aggregate emissions rates (from aggregate VMT and emissions output) and compared the rates between counties examining the results for outliers while assessing the reasonability of any relative and directional differences (e.g., qualify based on activity distributions by road type and speed, mix of vehicles by road type, meteorological variation, control program coverage). Compared the results to results from previous emissions analyses if available.
- Calculated county, 24-hour aggregate rates by vehicle class and compared between vehicle classes. Examined the results for consistent patterns, e.g., between gasoline versus diesel, heavy versus light.
- Verified summed link emissions output against tabular emissions output summaries – differences should be within rounding error (N/A).

Any additional data products required for the emissions analysis were subjected to the appropriate QA checks previously listed. Any issues found needing resolution were corrected and appropriate QA checks were performed until satisfied.

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APPENDIX A:
HGB RFP ON-ROAD INVENTORIES ELECTRONIC DATA SUBMITTAL

HGB RFP MOVES-Based, County-Level, EIs and Control Measure Emissions Reductions Estimates – Electronic Data Submittal

This appendix (electronic data set and description) contains a description of the electronic data package that TTI submitted to TCEQ, per Revised Proposal for Grant Activities No. 582-11-11226-FY12-01.

The MOVES rates-per-activity, TDM link-based method was used to produce ozone season weekday EIs of VOC, CO, NO_x, and CO_2. The 19 HGB RFP EIs (i.e., 152 county level EIs) submitted are described in the following table. The individual control measure reduction estimates submitted were produced for 2008, 2011, 2014, 2017, 2018, and 2019.

Table 37. HGB RFP On-road Mobile Inventory Scenario Descriptions and Data Labels.

<table>
<tr><th>Number</th><th>RFP Inventory</th><th>Activity[1]</th><th>Emissions Factors[1]</th></tr>
<tr><td>1</td><td>2002 Base Year (BYR or CSS)</td><td rowspan="7">2002</td><td>2002 CSS</td></tr>
<tr><td>2</td><td>2002 Adjusted Base Year (ABY)</td><td>2002 Pre-1990 Control (P90 or 1CS)</td></tr>
<tr><td>3</td><td>2008 ABY</td><td>2008 1CS</td></tr>
<tr><td>4</td><td>2011 ABY</td><td>2011 1CS</td></tr>
<tr><td>5</td><td>2014 ABY</td><td>2014 1CS</td></tr>
<tr><td>6</td><td>2017 ABY</td><td>2017 1CS</td></tr>
<tr><td>7</td><td>2018 ABY</td><td>2018 1CS</td></tr>
<tr><td>8</td><td>2008 Pre-1990 Control (P90)</td><td>2008</td><td>2008 1CS</td></tr>
<tr><td>9</td><td>2011 P90</td><td>2011</td><td>2011 1CS</td></tr>
<tr><td>10</td><td>2014 P90</td><td>2014</td><td>2014 1CS</td></tr>
<tr><td>11</td><td>2017 P90</td><td>2017</td><td>2017 1CS</td></tr>
<tr><td>12</td><td>2018 P90</td><td>2018</td><td>2018 1CS</td></tr>
<tr><td>13</td><td>2019 P90</td><td>2019</td><td>2019 1CS</td></tr>
<tr><td>14</td><td>2008 Control Strategy (CSS)</td><td>2008</td><td>2008 CSS</td></tr>
<tr><td>15</td><td>2011 CSS</td><td>2011</td><td>2011 CSS</td></tr>
<tr><td>16</td><td>2014 CSS</td><td>2014</td><td>2014 CSS</td></tr>
<tr><td>17</td><td>2017 CSS</td><td>2017</td><td>2017 CSS</td></tr>
<tr><td>18</td><td>2018 CSS</td><td>2018</td><td>2018 CSS</td></tr>
<tr><td>19</td><td>2019 CSS</td><td>2019</td><td>2019 CSS</td></tr>
</table>

[1] "Pre-1990 Control" emissions factors model future evaluation year fleets with pre-1990 controls: therefore no I/M program was modeled, post-1990 FMVCP emissions standards in MOVES were switched off, and summer 1992 fuel parameters were used (i.e., the 1992 RVP limit promulgated prior to enactment of the 1990 CAAA). "Control Strategy" emissions factors model the controls based on the current regulations (i.e., pre-1990 plus subsequent controls per analysis year). Activity input includes VMT mix, link VMT/speeds, and off-network activity (SHP, starts, SHI). Additional runs (Harris County only) that incrementally added in controls for estimating emissions reductions by individual control measure, were "2CS" switching to RFG, "3CS" adding post-1990 FMVCP, and "4CS" adding the I/M program.

Electronic Media

The electronic data submittal data files and databases, summarized in the following, were compressed into about 630 megabytes of memory space, and were submitted on one CD-ROM, entitled:

"*HGB RFP MOVES-Based On-Road Mobile Source EIs – TTI FY2012*".

- Emissions Files:
  - RFP EIs – MOVESemscalc utility TAB-delimited, hourly/24-hour EI report summary files;
  - 24-Hour RFP EI Report Extracts – 24-hour totals summaries extracted from MOVESemscalc EI data files listed in previous bullet;
  - Control measure reductions calculation spreadsheets.
- MOVES inputs (MOVES run specifications and county domain input databases); and
- Final, MOVES-based, TTI MOVES post-processor-utility-produced, rate-per-activity emissions factors (emissions factor database inputs to the emissions calculations), and TxLED adjustment factor files.

File-Naming Conventions

The following file naming conventions were used:

- ***SSSS*** is:
  - EI type – BYR, ABY, P90 (or 1CS), and CSS, respectively, are:
    - base year,
    - adjusted base year,
    - pre-1990 controls, and
    - control strategy; or for
  - control scenario – 1CS (or P90), 2CS, 3CS, 4CS, CSS, respectively, represent:
    - pre-1990 controls,
    - pre-1990 controls with RFG,
    - pre-1990 controls with RFG and post-1990 FMVCP,
    - pre-1990 controls with RFG and post-1990 FMVCP and I/M program, and
    - pre-1990 controls with RFG and post-1990 FMVCP and I/M program and TxLED fuel;
- ***YYYY*** is for analysis year (2002, 2008, 2011, 2014, 2017, 2018, 2019); and
- ***CCCC*** is county FIPS code (48039, 48071, 48157, 48167, 48201, 48291, 48339, 48473).

Note: databases are MySQL databases. Each MySQL database consists of one "db.opt" file and a set of tables, where each table is composed of three files of the type: *.frm, *.MYD, and *.MYI.

Emissions Data Files

RFP EIs – 19 MOVESemscalc utility RFP EI runs per county (see the previous table). Each run produced two file types (compressed in: "HGBrfp_mvs10a_19EIs.zip"):

- "HGBrfp_mvs10a_***SSSSYYYY***swkd_***CCCC***_ems.TAB" (152): tab-delimited county EI data summary report including hourly and 24-hour activity and emissions tables. For roadway-based processes by roadway and vehicle type (SUT/Fuel Type) – VMT, VHT (vehicle hours traveled), average speed (VMT/VHT), and pollutant/process emissions totals; for off-network-based processes by vehicle type – SHP, SHI, starts, and pollutant/process emissions totals (SHI for combination long-haul trucks only).
- "HGBrfp_mvs10a_***SSSSYYYY***swkd_***CCCC***_ems.LST" (152): list of execution times; run script; file locations; data descriptions; and varied data summaries including hourly and 24-hour activity, pollutant/process emissions totals, and average speed (VMT/VHT).

24-hour RFP EI Extracts – 24-hour EI totals by SUT/fuel type extracted from the MOVESemscalc tab-file output, used for emissions summaries and emissions reductions calculations. 19 RFP EI extracts were provided (compressed in "HGBrfp_mvs10a_19EIs.zip"):

- "HGBrfp_mvs10a_***SSSSYYYY***swkd_tabtots_ST.tab" (19): tab-delimited text file of 24-hour EI data summaries for eight counties, by SUT/fuel type, pollutant, and process.
- "HGBrfp_mvs10a_***SSSSYYYY***swkd_tabtots.tab" (19): tab-delimited text file of 24-hour EI data summaries for eight counties, by pollutant and process.

Control Measure Emissions Reduction Estimates –18 extra Harris County MOVESemscalc EI runs were performed, for 2008, 2011, 2014, 2017, 2018, 2019; and control scenarios 2CS, 3CS, and 4CS. 24-hour EI data extracts by SUT/fuel type were used in the calculations. The extra EI data files and spreadsheets are compressed in "hgbrfp_mvs10a_indred.zip" and include:

- "HGBrfp_mvs10a_***SSSSYYYY***swkd_48201_ems.TAB" (18): MOVESemscalc tab-delimited EI data summary report file (previously described) for Harris County;
- "HGBrfp_mvs10a_***SSSSYYYY***swkd_48201_ems. LST" (18): MOVESemscalc utility run list file (previously described);
- "HGBrfp_mvs10a_***SSSSYYYY***swkd_tabtots_ST.tab" (18): tab-delimited text file of Harris County 24-hour EI data by SUT/fuel type (MOVESemscalc EI TAB file extracts);
- "HGBrfp_mvs10a_***SSSSYYYY***swkd_tabtots.tab" (18): tab-delimited text file of Harris County 24-hour EI data totals (MOVESemscalc EI TAB file extracts);
- "HGBrfp_mvs10a_***YYYY***reductions.xlsx" (6): individual emissions control measure reduction calculations spreadsheet file; and
- "HGBrfp_mvs10a_allyrsreductions_summaries.xlsx" (1): emissions control measure reductions summary spreadsheet.

Emissions Factors – MOVES Input Files (MRSs and CDBs)

MOVES Input Files for RFP EIs: There were 113 MOVES runs performed for the EI development process of the 152 county level RFP EIs (i.e., One set of Pre-1990 Control [or 1CS] runs; and one set of Control Strategy [or CSS] runs including the 2002 base year). The MOVES inputs used – run specification files (RunSpec or MRS) and county input databases (CDB) – were provided (MOVESDB20100830, the MOVES model current default input database, is available at EPA's MOVES model website: http://www.epa.gov/otaq/models/moves/index.htm):

- "MVS10A_HGBRFP_***YYYY***SWKD_***SSSS_CCCC***_ER.MRS" (113): two RFP scenarios (i.e., 1cs and css) x eight counties x seven years + one extra Harris County 2002 MRS file for special I/M test-type switch effects post-processing procedure, compressed in "HGBrfp_mvs10a_1cs_css_MRSs.zip;" and
- "MVS10A_HGBRFP_***YYYY***SWKD_***SSSS_CCCC***_ER_CDB_IN" (113 MySQL database folders containing 6,215 total files). The CDBs are compressed in "HGBrfp_mvs10a_1cs_css_CDBs.zip."

Additional MOVES Input Files for Incremental Control Measure Emissions Reductions Estimates Procedure: To estimate control measure reductions, extra MOVES runs were performed for Harris County, for 2008, 2011, 2014, 2017, 2018, 2019, and control scenarios 2CS and 3CS. The extra RunSpecs and CDBs are:

- "MVS10A_HGBRFP_***YYYY***SWKD_***SSSS***_48201_ER.MRS" (12: 2 scenarios x 1 county x 6 years): compressed in "HGBrfp_mvs10a_2cs_3cs_MRSs.zip."
- "MVS10A_HGBRFP_***YYYY***SWKD_***SSSS***_48201_ER_CDB_IN" (12 corresponding MySQL database folders containing 660 total files). The CDBs are compressed in "HGBrfp_mvs10a_2cs_3cs_CDBs.zip."

Emissions Factors – Final, Adjusted MOVES-based Emission Rates

Final MOVES-based, Emissions Factor Look-up Tables: The MOVESratesAdj utility performed adjustments (e.g., NOx TxLED effects, I/M test-type switch effects) as specified, and produced the final emissions rate look-up table inputs to the emissions calculations – MySQL databases containing two emissions rate lookup tables, ttirateperdistance for roadway-based emissions processes, and ttirateperactivity for the "off-network" processes. The ttirateperactivity table fields are: pollutantID, processID, hourID, sourceTypeID, fuelTypeID, rateperactivity. The ttirateperdistance table fields are: pollutantID, avgSpeedBinID, processID, hourID, roadTypeID, sourceTypeID, fuelTypeID, ratePerDistance.

- "mvs10a_hgbrfp_ ***YYYY***SWKD_***SSSS_ CCCC***_er_outratesadj" (112 MySQL database folders containing 784 total files). This is the set of 1CS and CSS control scenario rates database look-up tables for all counties, used in the 19 RFP EIs. Each database contains the ttirateperdistance and ttirateperactivity emissions rate look-up tables used in the emissions calculations. They are compressed in "hgbrfp_mvs10a_ratesadj_outdbs.zip."

- "mvs10a_hgbrfp_ ***YYYY***SWKD_***SSSS***_48201_er_outratesadj" (18 MySQL database folders containing 126 total files). This is the set of 2CS, 3CS, and 4CS control scenario Harris County rates used in incremental control measure emissions reductions estimates. Each database contains the ttirateperdistance and ttirateperactivity emissions rate look-up tables used in the emissions calculations. They are compressed in "hgbrfp_mvs10a_xcs_ratesadj_outdbs.zip."
- "tx_mvs10a_***YYYY***_txled_facts.txt" (six TxLED adjustment factor files), and "48201im2002_hgbrfp_adjfactspath.txt" (one I/M test-type switch factor file used) are compressed in "hgbrfp_mvs10a_adjfacts.zip."

Note that the MOVES output databases were post-processed in two main steps to calculate the final emissions rates used in the external emissions calculations:

1) Rate Calculations: Using the TTI's MOVESratesCalc utility, TTI calculated "rates-per-activity" as "emissions/activity" from the movesoutput (emissions) and movesactivityoutput (activity) tables, performed unit conversions, and added two new tables to the MOVES output database: "ttirateperdistance" with grams/mile rates, and "ttirateperactivity" with grams/SHP, grams/SHI, and grams/start rates.
2) Final Rates Adjustments: Using TTI's MOVESratesAdj utility, TTI-calculated rates were extracted for only those pollutants needed in the emissions calculations. The I/M test-type switch effects adjustment (post-processing of rates from two-runs with different I/M test-types into a single set of rates with the combined I/M test-type effects) was performed for the Harris County 2002 Base Year, and TxLED adjustments were applied to diesel vehicle NO_x rates for all appropriate years/control scenarios, and the extracted and adjusted rate tables were placed in a separate database (by county/year/control scenario) for input to the emissions calculations.

APPENDIX B:
EMISSIONS ESTIMATION UTILITIES FOR MOVES-BASED EMISSIONS INVENTORIES

TTI EMISSIONS ESTIMATION UTILITIES FOR MOVES-BASED EMISSIONS INVENTORIES

The following is a summary of utilities developed by TTI (written in the Visual Basic programming language) for producing detailed, link-based, hourly, and 24-hour emissions estimates for on-road mobile sources using the latest version of EPA's MOVES model. These utilities produce inputs used with the MOVES model, make special adjustments to the emissions factors (when required), and multiply them with travel model link-based or HPMS-based (virtual link) activity estimates to produce emissions at user-specified temporal and spatial scales.

The main utilities for calculating hourly and 24-hour emissions using MOVES are TRANSVMT, VirtualLinkVMT, MOVESactivityInputBuild, MOVESpopulationBuild, MOVESfleetInputBuild, MOVESratesCalc, MOVESratesAdj, ShpExtIdleStartActBld, ExtIdleHrsCalc, MOVESemscalc, and MOVEStabcomb. The TRANSVMT and VirtualLinkVMT prepare the link VMT and speeds activity input. The MOVESactivityInputBuild, MOVESpopulationBuild, and MOVESfleetInputBuild utilities build inputs used in MOVES. The MOVESratesCalc utility calculates the emissions rates from the MOVES output in terms of grams per activity, rather than the grams per vehicle emissions rates produced by MOVES. The MOVESratesadj utility makes special adjustments to the emissions rates when required. The ShpExtIdleStartActBld utility builds the SHP and starts activity required to estimate emissions using the grams per activity emissions rates produced by the MOVESratesCalc utility. The ExtIdleHrsCalc utility builds the SHI activity required to estimate emissions using the grams per activity emissions rates produced by the MOVESratesCalc utility. The MOVESemscalc utility calculates emissions by hourly time periods, producing a tab-delimited summary file (including 24-hour totals) and hourly link emissions output files (optional). The MOVEStabcomb utility combines multiple MOVESemscalc tab-delimited output files into one regional tab-delimited output file.

A process flow diagram follows the utility descriptions.

TRANSVMT

The TRANSVMT utility post-processes TDMs to produce hourly, on-road vehicle, seasonal and day-of-week specific, directional link VMT, and speed estimates. The TRANSVMT utility processes a travel demand model (TDM) traffic assignment by multiplying the link volumes by the appropriate HPMS, seasonal, or other VMT factors. Hourly factors are then used to distribute the link VMT to each hour in the day. The TTI speed model is used to estimate the operational time-of-day link speeds for each direction. Since intrazonal links are not included in the TDM, special intrazonal links are created and the VMT and speeds for these special links are estimated using the intrazonal trips from the trip matrix and the zonal radii. The link VMT and speeds produced by TRANSVMT are subsequently input to the EMSCALC utility for applying the MOVES-based emissions factors.

VirtualLinkVMT

The VirtualLinkVMT utility post-processes county HPMS AADT VMT, centerline miles, and lane miles by functional classification and area type (from TxDOT's annual RIFCREC report) to produce hourly, on-road vehicle fleet, seasonal and day-of-week specific actual or projected

VMT, and directional operational speed estimates. These estimated VMT and speeds are produced for up to 42 directional HPMS functional classification/area type combinations, or "links." The VirtualLinkVMT utility was developed for use in areas that do not have TDM networks, as well as for EI applications for which network link-based detail is not required. The main inputs to VirtualLinkVMT are:

- County HPMS data sets, which include AADT VMT, centerline miles, and lane miles by HPMS area type and functional class;
- County-level VMT control totals;
- Hourly VMT distributions; and
- Speed model inputs to include volume/delay equation parameters adapted for HPMS, and free-flow speeds and lane capacities by HPMS functional classification and area type.

VirtualLinkVMT initially scales the county HPMS AADT VMT at the link level to the appropriate VMT (e.g., uses county-level VMT control total-to-AADT ratio to produce seasonal, day-of-week specific VMT). 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. Congested speed models, each for the high- and low-capacity links, 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. The virtual link VMT and speeds produced using the VirtualLinkVMT utility are an input to the emissions calculation utility, EMSCALC.

MOVESactivityInputBuild

The MOVESactivityInputBuild utility builds the roadtypedistribution, hourvmtfraction, avgspeeddistribution, roadtype, hpmsvtypeyear, year, state, zone, zoneroadtype, monthvmtfraction, and dayvmtfraction MOVES input database tables using the link-based hourly VMT and speeds developed with the TRANSVMT or VirtualLinkVMT utility, the VMT mix, and the MOVES defaults. The primary inputs to this utility are:

- Link-based hourly VMT and speeds developed with the TRANSVMT or VirtualLinkVMT utility;
- County ID file which specifies the county number in the link-based hourly VMT and speeds for which the output will be calculated;
- Link/MOVES roadway type designations, which lists associations of the link roadway types/area type combination to the MOVES roadway types (same as used with the MOVESemscalc utility);
- VMT mix by MOVES roadway type, MOVES source type, and MOVES fuel type (same as used with the MOVESemscalc utility);
- Day ID, which specifies the MOVES day ID for calculating the output;
- Year ID, which specifies the year for calculating the output;

- Link/Ramp designations, which designates each link roadway type/area type combination to either ramp or non-ramp, and
- MOVES default database.

For each link in the link-based hourly VMT and speeds in which the county number matches the desired county ID, the link VMT is saved in a VMT summary array based on hour, link functional class, and link area type. The link VHT (link VMT/link speed) is saved in a VHT summary array based on hour, link functional class, link area type, and MOVES average speed bin ID (determined using the MOVES average speed bins and the link speed). The link VHT is also saved in a road type VHT array based on link functional class and link area type, and if the link is specified as ramp by the link/ramp designations specified by the user, then the VHT is also saved in the ramp segment of the road type VHT array.

A MOVES roadway type array (by MOVES roadway type) is also formed using the data in the VMT summary array and the link/MOVES roadway type designations. An hourly VMT array (by MOVES SUT, MOVES roadway type, and hour) is formed using the data in the VMT summary array, the link/MOVES roadway type designations, and the VMT mix. An average speed distribution array (by MOVES SUT, MOVES roadway type, hour, and MOVES speed bin) is created using the VHT summary array and the VMT mix. Using the appropriate MySQL code, the MOVES roadtypedistribution, hourvmtfraction, and avgspeeddistribution default values are extracted and saved for later use.

The VMT in the hour VMT array is aggregated by hour to produce the roadway type distribution array by MOVES SUT and MOVES roadway type. This VMT is then converted to a distribution by MOVES SUT (i.e., the total for a SUT over the five MOVES roadway types should equal 1), with the distribution value for MOVES roadway type 0 (Off-Network) equal to 0. Using the appropriate MySQL code, the roadtypedistribution database table is written. A tab-delimited version is also written (optional).

The VMT in the hourly VMT array is added to the hourly VMT fraction array (by SUT, MOVES roadway type, and hour) and for those roadway types where the VMT for all hours is greater than 0, this VMT is converted to an hourly distribution. For those roadway types where the VMT is equal to 0, a value of 1 is placed in the first hour, followed by 0 in the remaining hours. Using the appropriate MySQL code, the hourvmtfraction database table is written. For those SUTs where the VMT mix is greater than 0, the hourly VMT fraction array is used. Otherwise, the MOVES hourvmtfraction default values are used. A tab-delimited version is also written (optional).

The VHT in the average speed distribution array is converted to a distribution by SUT, MOVES roadway type, hour/day (combination of hour and the day ID specified by the user), and MOVES average speed bin. Using the appropriate MySQL code, the avgspeeddistribution database table is written. For those SUTs where the VMT mix is greater than 0, the average speed distribution array is used. Otherwise, the MOVES avgspeeddistribution default values are used. A tab-delimited version is also written (optional).

The VHT in the road type VHT array is converted to a proportion of ramp VHT by dividing the ramp segment of the road type VHT array by the total VHT for the road type in the road type

VHT. Using the appropriate MySQL code, the road type database table is written using the proportions from the road type VHT array. A tab-delimited version is also written (optional).

The VMT in the hourly VMT array is aggregated to form the HPMS vehicle type VMT array. Each SUT is assigned an HPMS vehicle type (SUT 11 is HPMS vehicle type 10; SUT 21 is HPMS vehicle type 20; SUTs 31 and 32 are HPMS vehicle type 30; SUTs 41, 42, and 43 are HPMS vehicle type 40; SUTs 51, 52, 53, and 54 are HPMS vehicle type 50; and SUTs 61 and 62 are HPMS vehicle type 60). Using the appropriate MySQL code, the hpmsvtypeyear database table is written using the VMT from the HPMS vehicle type VMT array, along with the user supplied year ID, the VMT growth factor (automatically set to "Null"), and the base year Off-Network VMT (automatically set to 0). A tab-delimited version is also written (optional).

Using the appropriate MySQL code, the fuel year ID is extracted from the MOVES default year database table for the user-supplied year ID and the new year database table is written using the user-supplied year ID and the extracted fuel year ID. The "isbaseYear" data is written as well (automatically set to "Y"). A tab-delimited version is also written (optional).

The utility also produces two tab-delimited summary output files. A tab-delimited VMT summary is output by hour, link road type, and link area type for the user-specified county. A tab-delimited VHT summary is output by hour, link road type, link area type, and MOVES average speed bin for the user-specified county.

The utility outputs five other database tables (state, zone, zoneroadtype, monthvmtfraction, and dayvmtfraction) using the appropriate MySQL code and the user-supplied inputs. For the state database table, a new state database table is created and the data from the MOVES default state database table is copied to the new table for the state ID of 48. For the zone database table, a new zone database table is created and the data from the MOVES default zone data base table is copied to the new table for the county ID greater than 48000 and county ID less than 49000. The start allocation factors, idle allocation factors, and SHP allocation factors are all then replaced with values of 1 in the new table.

For the zoneroadtype database table, a new zoneroadtype database table is created and the data from the MOVES default zoneroadtype data base table is copied to the new table for the zone ID greater than 480000 and zone ID less than 490000. The SHO allocation factors are all then replaced with values of 1 in the new table. For the monthvmtfraction database table, a new monthvmtfraction database table is created and the data from the MOVES default monthvmtfraction database table is copied to the new database table and the month VMT fraction is set to 1 for the user-supplied month ID and 0 for all other months. For the dayvmtfraction database table, a new dayvmtfraction database table is created and the data from the MOVES default dayvmtfraction database table is copied to the new and the day VMT fraction is set to 1 for the user-supplied day ID and 0 for all other months.

MOVESpopulationBuild

The MOVESpopulationBuild utility builds the sourcetypeyear MOVES input database table and the source type/fuel type population input file used with the MOVESemscalc utility to estimate emissions using the VMT mix and the TxDOT registration data sets. The TxDOT registration data sets are three sets of registration data (an age registration data file, a gas trucks registration data file, and a diesel trucks registration data file) that list 31 years of registration data. The primary inputs to this utility are:

- County ID file, which specifies the county for which the output will be calculated;
- Age registration data file, which lists 31 years of registration data for the Passenger Vehicle, Motorcycles, Trucks <=6000, Trucks >6000 <=8500, Total Trucks <=8500, Gas Trucks >8500, Diesel Trucks >8500, Total Trucks >8500, and Total All Trucks vehicle categories;
- Gas trucks registration data file, which lists 31 years of registration data for the Gas > 8500, Gas > 10000, Gas > 14000, Gas > 16000, Gas > 19500, Gas > 26000, Gas > 33000, Gas > 60000, and Gas Totals gas truck categories;
- Diesel trucks registration data file, which lists 31 years of registration data for the Diesel > 8500, Diesel > 10000, Diesel > 14000, Diesel > 16000, Diesel > 19500, Diesel > 26000, Diesel > 33000, Diesel > 60000, and Diesel Totals diesel truck categories;
- VMT mix by TxDOT district, MOVES source type, and MOVES fuel type;
- TxDOT district name file, which specifies the VMT mix TxDOT district;
- MOVES default database;
- Population factor file (optional); and
- Year ID file (optional, only used if population factors are used), which specifies the year for calculating the output.

For the desired county (from the county ID file), the age registration data (for the Passenger Vehicle, Motorcycles, Trucks <=6000, Trucks >6000 <=8500, and Total Trucks <=8500 vehicle categories) are saved in an age registration data array. The gas truck registration data (for the Gas > 8500, Gas > 10000, Gas > 14000, Gas > 16000, Gas > 19500, Gas > 26000, Gas > 33000, and Gas > 60000 gas truck categories) are saved in the gas truck section of the diesel/gas registration data array. The diesel truck registration data (for the Diesel > 8500, Diesel > 10000, Diesel > 14000, Diesel > 16000, Diesel > 19500, Diesel > 26000, Diesel > 33000, and Diesel > 60000 diesel truck categories) are saved in the diesel truck section of the diesel/gas registration data array. The age registration data array and the diesel/gas registration data array are combined to form the registration category data array (a total of seven categories for 31 years of data and the total) using the combinations in Table 38.

Table 38. Registration Categories.

Registration Category	Vehicle Category	Data Location
1	Passenger Vehicle	Age registration data array
2	Motorcycles	
3	Total Trucks <=8500	
4	Diesel > 8500, Diesel > 10000, Diesel > 14000, Diesel > 16000	Diesel/gas registration data array
5	Diesel > 19500, Diesel > 26000, Diesel > 33000, Diesel > 60000	
6	Gas > 8500, Gas > 10000, Gas > 14000, Gas > 16000	
7	Gas > 19500, Gas > 26000, Gas > 33000, Gas > 60000	

The registration category data array is used to fill the SUT population array (by SUT and fuel type) for everything except the long-haul trucks. Each SUT/fuel type combination is assigned the total registrations from one or more of the registration categories in the registration category data array. Table 39 shows the SUTs and their associated registration category in the registration category data array.

Table 39. SUT/Registration Category Correlation.

SUT	Registration Category
11	2
21	1
31, 32	3
41, 42, 43, 51, 52, 54	4 + 6
61	5 + 7

SUT population factors are calculated by SUT/fuel type using the data from the VMT mix input for all SUTs except motorcycles (SUT 11) and the long-haul trucks (SUTs 53 and 62) and saved in the SUT population factors array. For SUT 21, the fuel type VMT mix is divided by the total VMT mix for SUT 21. For SUT 31, the fuel type VMT mix is divided by the total VMT mix for SUTs 31 and 32. The same process applies to SUT 32. For SUT 41, the fuel type VMT mix is divided by the total VMT mix for SUTs 41, 42, 43, 51, 52, and 54. The same process applies to SUTs42, 43, 51, 52, and 54. For SUT 61, the fuel type VMT mix is divided by the total VMT mix for SUT 61.

For SUT 11, the source type population factor for fuel type 1 (gasoline) is set 1 with all other factors set to 0. For SUT 53, the SUT population factors by fuel type are calculated by dividing the fuel type VMT mix for SUT 53 by the fuel type VMT mix for SUT 52. For SUT 62, the SUT population factors by fuel type are calculated by dividing the fuel type VMT mix for SUT

62 by the fuel type VMT mix for SUT 61, therefore creating a ratio of long-haul and short-haul trucks.

The SUT population factors and the population factor (if desired) are applied to the SUT population array for all SUTs except SUT 53 and 62. For SUT 53, the SUT population factors for SUT 53 are applied to the SUT population array for SUT 52. For SUT 62, the SUT population factors for SUT 62 are applied to the SUT population array for SUT 61.

Using the appropriate MySQL code, a new sourcetypeyear database table is created. The data in the SUT population array is aggregated by fuel type and used to fill the sourcetypeyear database table, along with the yearID, salesGrowthFactor, and migrationrate. For the yearID, the year of the registration data is used, unless a population factor is used, in which case the year from the year ID input is used. The salesGrowthFactor and migrationrate for each SUT is set 1. A text format of this database table is written by the utility as well. The source type/fuel type population input file used with the MOVESemscalc utility is written using the SUT population array.

MOVESfleetInputBuild

The MOVESfleetInputBuild utility builds the sourcetypeagedistribution database table and fuel/engine fraction inputs to MOVES using the TxDOT registration data sets and the MOVES default database tables. The TxDOT registration data sets are three sets of registration data (an age registration data file, a gas trucks registration data file, and a diesel trucks registration data file) that list 31 years of registration data. The primary inputs to this utility are:

- Age registration data file, which lists 31 years of registration data for the Passenger Vehicles, Motorcycles, Trucks <=6000, Trucks >6000 <=8500, Total Trucks <=8500, Gas Trucks >8500, Diesel Trucks >8500, Total Trucks >8500, and Total All Trucks vehicle categories;
- Gas trucks registration data file, which lists 31 years of registration data for the Gas > 8500, Gas > 10000, Gas > 14000, Gas > 16000, Gas > 19500, Gas > 26000, Gas > 33000, Gas > 60000, and Gas Totals gas truck categories;
- Diesel trucks registration data file, which lists 31 years of registration data for the Diesel > 8500, Diesel > 10000, Diesel > 14000, Diesel > 16000, Diesel > 19500, Diesel > 26000, Diesel > 33000, Diesel > 60000, and Diesel Totals diesel truck categories;
- SUT data sources input, which specifies the data source for each SUT to use when building the souretypeagedistribution database table;
- Fuel/engine fractions data sources input, which specifies the data source for each SUT to use when building the fuel/engine fractions;
- Default sourcetypeage distribution input;
- MOVES default database; and
- Year ID file (optional, only if year is not the registration data year as in a future year analysis), which specifies the year for calculating the output.

The SUT data sources input lists the data source for each SUT, either a single county, multiple counties, state, or MOVES default. As this input is processed, the utility keeps a list of the input sources. The same applies to the fuel/engine fractions, except data source inputs are only valid for source types 52, 53, and 61 (other are not valid due to data limitations and source type 62 are all considered diesel).

For each county (or state total) in the list of the input sources, the age registration data (for the Passenger Vehicle, Motorcycles, Trucks <=6000, Trucks >6000 <=8500, and Total Trucks <=8500 vehicle categories) are saved in an age registration data array. The gas truck registration data (for the Gas > 8500, Gas > 10000, Gas > 14000, Gas > 16000, Gas > 19500, Gas > 26000, Gas > 33000, and Gas > 60000 gas truck categories) are saved in the gas truck section of the diesel/gas registration data array. The diesel truck registration data (for the Diesel > 8500, Diesel > 10000, Diesel > 14000, Diesel > 16000, Diesel > 19500, Diesel > 26000, Diesel > 33000, and Diesel > 60000 diesel truck categories) are saved in the diesel truck section of the diesel/gas registration data array.

The age registration data array and the diesel/gas registration data array are combined to form the registration category data array (a total of seven categories for 31 years of data and the total) using the combinations in Table 38 (Registration Categories). The county is compared to the data sources for each SUT in the SUT data sources input. If the county is found for a given source type, then the 31 years of registration data from the source type's corresponding category in the registration category data array are added to the SUT age distribution array. Table 40 shows the source types and their corresponding registration categories.

Table 40. SUTs/Registration Categories Correlation for SUT Age Distribution.

SUT	Registration Category
11	2
21	1
31, 32	3
52, 53	4
61, 62	5

A similar process is followed for the fuel/engine fractions array. However, only SUTs 52, 53, 61, and 62 are processed due to data limitations. The registration data are saved in the fuel/engine fractions array based on fuel type. Table 41 shows the SUTs and their corresponding registration categories.

Table 41. SUTs/Registration Categories Correlation for Fuel/Engine Fractions.

SUT	Fuel Type	Registration Category
52, 53	Diesel	4
	Gas	6
61	Diesel	5
	Gas	7
62	Diesel	5 + 7
	Gas	None – all are assumed diesel

After processing all of the counties, the data from the default sourcetypeage distribution input are processed and the data for the registration data year are saved in the default age distribution array. For each source type in which the registration data are to be used for the age distribution, the 31 years of registration data in the SUT age distribution array are converted to a distribution by dividing the source type yearly registration data by the source type total registration data. For each source type in which the defaults are to be used, the defaults values from the default age distribution array are copied to the SUT age distribution array.

The MOVES default fuel/engine fractions are extracted from the MOVES default database (using the appropriate code for MySQL) and saved in the default fuel/engine fractions array. For source types 52, 53, and 61, the source type yearly registration data in the fuel/engine fractions array are converted to fuel/engine fractions by dividing the yearly source type diesel registration data by the sum of the yearly source type diesel registration data and the yearly source type gas registration data.

If the year ID input is used, then these fuel/engine fractions are adjusted to match the year from the year ID input. If the year from the year ID input is greater than the registration data year, then the first fuel/engine fraction is extended to match the year from the year ID input and the appropriate number of years is dropped from the end of the fuel/engine fractions to maintain the appropriate distribution. If the year from the year ID input is less than the registration data year, then the last fuel/engine fraction is extended to match the year from the year ID input and the appropriate number of years is dropped from the beginning of the fuel/engine fractions to maintain the appropriate distribution. For source type 62, all of the fuel/engine fractions in the fuel/engine fractions array are set to a value of 1.

Using the appropriate MySQL code, a new sourcetypeagedistribution database table is created and the data from the SUT age distribution array, along with the year ID (either from the registration data or the year ID input), are used to fill the new database table. A text format of this database table may be written as well. Using the appropriate MySQL code, a new AVFTfuelengfraction database table is created and the data from the fuel/engine fractions array are used to fill the new database table for SUTs 52, 53, 61, and 62. For all other SUTs, the default fuel/engine fraction array data for the appropriate year (either the registration data year or the year ID input) are used to fill the new database table. A text format of this database table may be written as well.

MOVESratesCalc

The MOVESratesCalc utility estimates emissions rates in terms of grams per activity (i.e., grams per mile, grams per SHP, grams per start, and grams per SHI) using the data in the movesoutput (emissions output) and movesactivityoutput (activity output) database tables produced by a MOVES emissions rate run. The utility also has the option of calculating the SHP, starts, and SHI activity per vehicle using the movesactivityoutput database table. If not specified, emissions rates are calculated for each pollutant and process combination (excluding total energy) in the movesoutput database table. The utility also uses the movesrun database table to determine the units of the emissions in the movesoutput table, which will then be converted to grams per activity during the emissions rate calculations; therefore allowing the user to specify any of the units available in MOVES for the MOVES emissions rate run. The type of activity used for the emissions rate calculation is determined by the process, as Table 42 shows.

Table 42. MOVES2010a Emissions Process and Corresponding Activity for Grams per Activity Emissions Rates.

MOVES2010a Emissions Process	Activity	Emissions Rate Units
Running Exhaust	Miles Traveled	Grams/Mile
Crankcase Running Exhaust	Miles Traveled	Grams/Mile
Start Exhaust	Starts	Grams/Start
Crankcase Start Exhaust	Starts	Grams/Start
Extended Idle Exhaust	Extended Idle Hours	Grams/Extended Idle Hour
Crankcase Extended Idle Exhaust	Extended Idle Hours	Grams/Extended Idle Hour
Evaporative Permeation	Miles Traveled Source Hours Parked	Grams/Mile Grams/ Source Hour Parked
Evaporative Fuel Vapor Venting	Miles Traveled Source Hours Parked	Grams/Mile Grams/ Source Hour Parked
Evaporative Fuel Leaks	Miles Traveled Source Hours Parked	Grams/Mile Grams/ Source Hour Parked
Brake Wear	Miles Traveled	Grams/Mile
Tire Wear	Miles Traveled	Grams/Mile

For the distance based emissions rates (i.e., grams per mile), the utility extracts the emissions data (by pollutant, pollutant process, roadway type, average speed bin, SUT, and fuel type) from the movesoutput database for the specified pollutants (or all of the pollutants if not specified) and the corresponding miles traveled activity (MOVES activityTypeID = 1) from the movesactivityoutput database table. The utility divides the emissions data by the corresponding activity data, applies the appropriate units conversion factor and saves the emissions rates in the ttirateperdistance database table.

For the off-network emissions rates (i.e., grams per SHP, grams per start, and grams per SHI) the utility calculates the emissions rates based on the pollutant process. For processID = 12 (evaporative fuel vapor venting), the utility extracts the emissions data (by hour, pollutant, pollutant process, source type, and fuel type) from the movesoutput database table for the specified pollutants pollutants (or all of the pollutants if not specified) where roadTypeID = 1 ("off-network" emissions) and the corresponding SHP activity (activityTypeID = 5) from the movesactivityoutput database table. The utility divides the emissions data by the corresponding activity data, applies the appropriate units conversion factor and saves the emissions rates in the ttirateperactivity database table.

Using the same calculation process, the utility also calcutes the emissions rates for processID = 17 (crankcase extended idle exhaust) and processID = 90 (extended idle exhaust) using the corresponding SHI activity (activityTypeID = 3), for processID = 11 (evaporative permeation) and processID = 13 (evaporative fuel leaks) using the corresponding SHP activity (activityTypeID = 5), and for processID = 2 (start exhaust) and processID = 16 (crankcase start exhaust) using the corresponding starts activity (activityTypeID = 7).

For the SHP, starts, and SHI activity per vehicle, the utility extracts the SHP, starts, SHI, and population activity data (by hour, SUT, and fuel type) from the movesactivityoutput database table. The utility divides the SHP activity by the population and saves the SHP per vehicle in the ttiactpervehicle database table. Using the same calculation process, the utility also calculates the starts per vehicle and SHI per vehicle using the starts and SHI activity data.

MOVESratesAdj

The MOVESratesAdj utility applies emissions rate adjustments to an emissions rate database table produced by MOVES (rateperdistance, ratepervehicle, rateperprofile), the MOVESratesCalc utility (ttirateperdistance, ttirateperactivity) or by this utility to produce a new emissions rate database table in the same format as the input emissions rate database table. The emissions rate adjustments can be linear adjustments that are applied to all emissions rates or can be applied by SUT, fuel type, pollutant, and process (adjustments may also include roadway type, average speed bin, and hour). The user has the option of selecting which pollutants will be in the new emissions rate database table. Otherwise, all of the pollutants in the input emissions rate database table will be in the new emissions rate database table. The utility also has the option for combining multiple emissions rate database tables into one new emissions rate database table, provided that the input emissions rate database tables are in the same format.

For the first input emissions rate database table, the utility extracts the emissions rates for the specified pollutants (or all the pollutants if not specified) from the input database emissions rate table, applies the emissions rate adjustments (if necessary) and saves these adjusted emissions rates. If more than one emissions rate database table is input, then the utility performs a similar calculation process to the first input emissions rate database table for each input emissions rate database table. If pollutants are found in more than one input emissions rate database table, the adjusted emissions rates are summed to produce one emissions rate.

After processing all of the input emissions rate database tables, the utility creates a new emissions rate database table in the same format as the first input emissions rate database table and writes the adjusted emissions rates to this new emissions rate database table. A tab-delimited form of this database table may also be output that includes the text description of the pollutant, process, and roadway type instead of the MOVES codes that are included in the database tables.

ShpExtIdleStartActBld

The ShpExtIdleStartActBld utility calculates the SHP and starts activity by hour, SUT, and fuel type used to estimate emissions using the MOVESratesCalc emissions rates. The SHP is calculated using the either the TDM or virtual link based link VMT and speeds (same as used in the distance-based emissions estimation), the VMT mix (by roadway type), and the SUT/fuel type population (from the MOVESpopulationBuild). The starts activity is calculated using the SUT/fuel type population and the starts per vehicle (typically from the ttiactpervehicle database table created by the MOVESratesCalc utility). The utility also has the option of calculating the SHI activity used to estimate emissions using the MOVESratesCalc emissions rates. However, this method of estimating the extended idle hours is a direct function of the SHO and does not consider the availability of locations where extended idling may occur. The suggested method for estimating the SHI is discussed in the "ExtIdleHrsCalc" section.

For each link in the first VMT and speeds input with the desired county code, the utility applies the appropriate VMT mix to distribute the link VMT to each SUT/fuel type, which is added to the hourly SUT/fuel type VMT. The link VMT by SUT/fuel type is divided by the link speed to calculate the link VHT (or SHO) by SUT/fuel type, which is added to the SUT fuel/type VHT. This calculation process is repeated for each VMT and speeds input; therefore producing 24-hourly values for VMT by SUT/fuel type and for VHT by SUT/fuel type.

The hourly SUT/fuel type speed, total hours (or source hours), and SHP are then calclulaed. For each hour and SUT/fuel type, the hourly SUT/fuel type VMT is divided by the hourly SUT/fuel type VHT to calculate the hourly SUT/fuel type speed. The hourly SUT/fuel type total hours are set equal to the SUT/fuel type population. The hourly SUT/fuel type SHP by are calculated subtracting the hourly SUT/fuel type VHT (or SHO) from the hourly SUT/fuel type total hours.

The hourly SUT/fuel type starts are calculated using the hourly starts per vehicle and the SUT/fuel type population. For each hour, the hourly SUT/fuel type starts are calculated by multiplying the hourly starts per vehicle by the SUT/fuel type population.

The hourly SUT/fuel type SHIs are calculated for source type 62, fuel type 2 (CLhT_Diesel) only. The CLhT_Diesel 24-hour SHI is calculated by multiplying the CLhT_Diesel 24-hour VHT (from the SHP calculation process) by the user-supplied extended idle factor, which represents the amount of extended idle time that must occur per SHO. The hourly CLhT_Diesel VHT (from the SHP calculation process) is converted to hourly VHT fractions. The hourly SHI fractions are calculated as the inverse of the hourly VHT fractions. The hourly SHI fractions are then applied to the CLhT_Diesel 24-hour SHI to calculate the hourly SUT/fuel type SHI.

ExtIdleHrsCalc

The ExtIdleHrsCalc utility calculates the SHI activity by hour for SUT 62, fuel type 2 (CLhT_Diesel) used to estimate emissions using the MOVESratesCalc emissions rates. This hourly SHI is calculated using a 24-hour base SHI for a specific year and day type, base link VMT and speeds, base VMT mix, future link VMT and speeds, future VMT mix, and the future tab-delimited hourly SHP by SUT/fuel type. All of the base data should be from the same year and day-type. Although the term future data is used, the future data can be a year previous to the base data (i.e., historical year) and should be from the same year and day type. The tab-delimited hourly SHP by SUT/fuel type is typically the output from the ShpExtIdleStartActBld utility.

For each link in the first base VMT and speeds input with the desired county code, the utility applies the appropriate base VMT mix for CLhT_Diesel to the link VMT to calculate the link CLhT_Diesel VMT, which is added to the hourly CLhT_Diesel VMT. The link CLhT_Diesel VMT is divided by the link speed to calculate the link CLhT_Diesel VHT, which is added to the hourly CLhT_Diesel VHT. This calculation process is repeated for each base VMT and speeds input; therefore producing 24-hourly values for base CLhT_Diesel VMT and for base CLhT_Diesel VHT by SUT/fuel type. The same calculation process is performed for the future data (future VMT and speeds, future VMT mix) to calculate the hourly future CLhT_Diesel VMT and the hourly future CLhT_Diesel VHT.

The 24-hour future SHI is calculated using the 24-hour base CLhT_Diesel VMT, the 24-hour future CLhT_Diesel VMT, and the 24-hour base SHI. The scaling factor is calculated by the dividing the 24-hour future CLhT_Diesel VMT by the 24-hour base CLhT_Diesel VMT. The scaling factor is multiplied by the 24-hour base SHI to estimate the 24-hour future SHI.

The 24-hour future SHI is distributed to each hour using SHI hourly factors. The SHI hourly factors are calculated using the hourly CLhT_Diesel VMT. The hourly CLhT_Diesel VMT is converted hourly CLhT_Diesel VMT fractions. The SHI hourly factors are calculated by taking the inverse of the hourly CLhT_Diesel VMT fractions (i.e., more VMT implies less SHI). The SHI hourly factors are applied to the 24-hour future SHI to calculate the initial hourly future SHI, therefore distributing the 24-hour future SHI to each hour of the day.

To form the final SHI activity by hour, the initial hourly future SHI is compared to the hourly CLhT_Diesel SHP. If the initial hourly future SHI is greater than the hourly CLhT_Diesel SHP, then the final SHI activity for that hour is set to the hourly CLhT_Diesel SHP. Otherwise, the final SHI activity for that hour is set to the initial hourly future SHI. This comparison is performed for each hour.

MOVESemscalc

The MOVESemscalc utility estimates the hourly link emissions for one user-specified county using the emissions factors (either from MOVES, MOVES ratesCalc or MOVESratesAdj), the VMT mix, the hourly link VMT and speeds activity estimates (either from TRANSVMT or VirtualLinkVMT), and the off-network activity (either vehicle population or SHP, starts, and SHI). This utility produces a tab-delimited output summary (including hourly and 24-hour totals) and hourly link emissions output files (optional). The primary inputs to MOVESemscalc are:

- Emissions factors from MOVES, MOVES ratesCalc or MOVESratesAdj;

- Link-based hourly VMT and speeds developed with the TRANSVMT or VirtualLinkVMT utility. For each link, the following information is input to MOVESemscalc: link start node, link end node, link county number, link roadway type number, link area type number, link VMT, and link operational speed estimate;
- VMT mix by MOVES roadway type, MOVES SUT, and MOVES fuel type;
- Off-network activity. If the emissions factors are in the MOVES format, vehicle population by SUT/fuel type is required. If the emissions factors are in the MOVESratesCalc format, the SHP, starts, and SHI by hour and SUT/fuel type are required; and
- Link/MOVES roadway type designations, which associates the link roadway/area type combination to the appropriate MOVES roadway type.

The emissions estimation can be categorized by two basic types based on the type of emissions factors: the VMT-based emissions and the off-network emissions. For the VMT-based emissions (rateperdistance or ttirateperdistance emissions factors), the VMT for each link is distributed to each of the SUT/fuel type combinations listed in the VMT mix by MOVES roadway type (as designated in the link/MOVES roadway type designations). The emissions factors are selected based on the MOVES roadway type and the link speed for each SUT/fuel type combinations listed in the VMT mix. For link speeds greater than 75 mph, the emissions factors for 75 mph are used. For link speeds less than 2.5 mph, the emissions factors for 2.5 mph are used. For those link speeds that fall between the 16 MOVES speeds, the emissions factors are interpolated using the emissions factor interpolation methodology in the following section. These SUT/fuel type combination-specific emissions factors are multiplied by the SUT/fuel type combination-specific VMT to estimate the mobile source emissions for that link by SUT/fuel type combination.

The off-network emissions calculation depends on the format of the input emissions factors. If the emissions factors are in the MOVES format (rateperprofile and ratepervehicle), the emissions factors by SUT/fuel type are multiplied by their associated vehicle population to estimate emissions. If the emissions factors are in the MOVESratesCalc format, the emissions factors by SUT/fuel type are multiplied by the appropriate activity, which is determined by the pollutant process (see Table 42).

The emissions estimates are output in a tab-delimited file (including all of the SUT/fuel type combinations listed in the VMT mix on a single line, separated by a tab character) for the specified county by pollutant, roadway type, and SUT/fuel type combination for each of the specified episode time periods. A 24-hour (or total if all 24 hours are not specified) output is also included in the tab-delimited file. This tab-delimited file also includes hourly and 24-hour summaries of the off-network activity and VMT, VHT, and speed by roadway. Link emissions may also be output by county, pollutant, process, and each SUT/fuel type combination.

Emissions Factor Interpolation Methodology

To calculate emissions factors for link speeds that fall between two of the 16 MOVES speed bin speeds, an interpolation methodology similar to the methodology used with MOBILE6 is used. This methodology interpolates each emissions factor using a factor developed from the inverse link speed and the inverse high and low bounding speed bin speeds. The following is an example for a link 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:

$EF_{LowSpeed}$ = emissions factor (EF) corresponding to the speed below the link speed;

$EF_{HighSpeed}$ = EF corresponding to the speed above the 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 g/mi - (0.26214) $\times$ (0.7413 g/mi - 0.7274 g/mi);

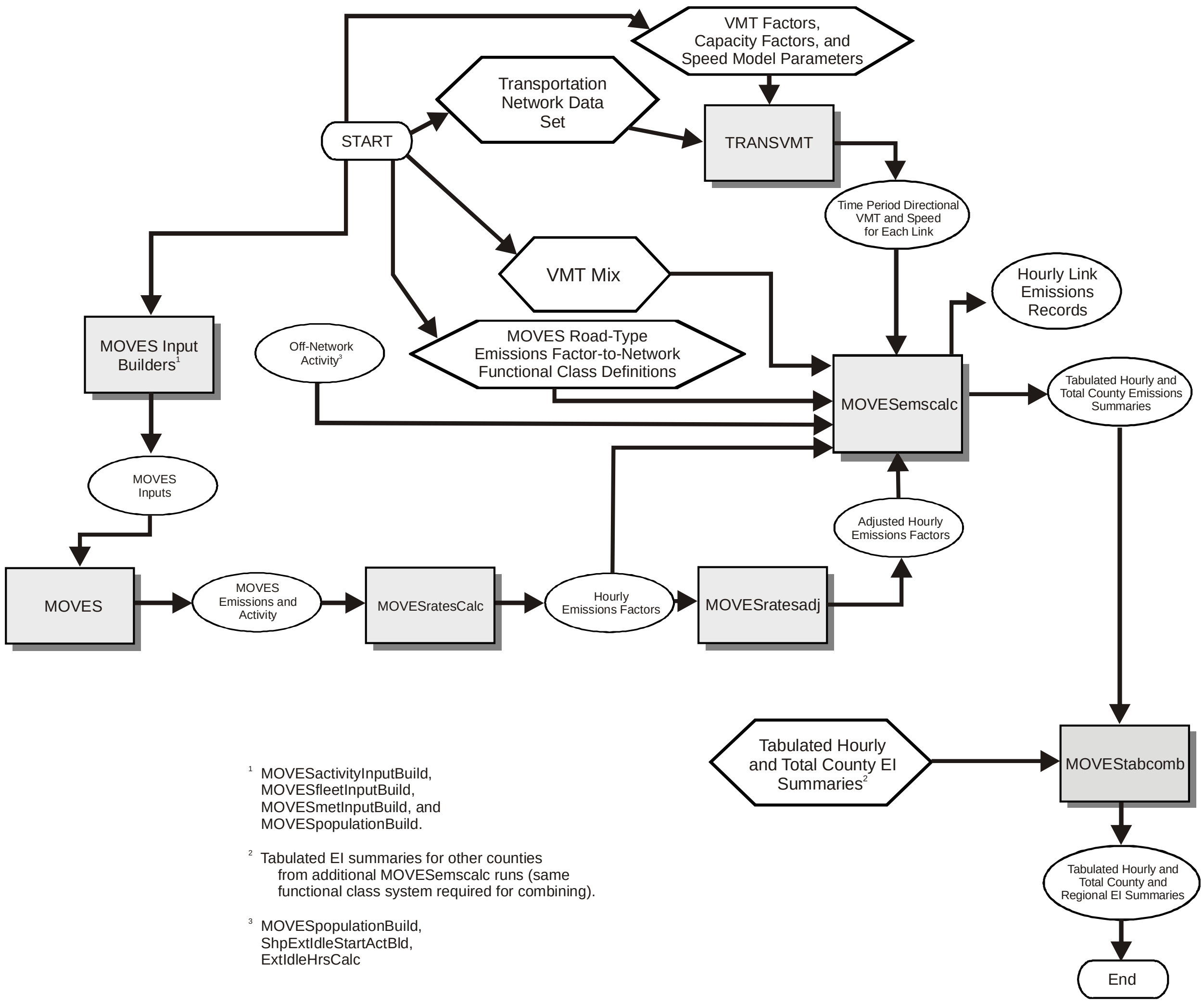
= 0.7377 g/mi.

MOVEStabcomb

The MOVEStabcomb utility combines the tab-delimited output from multiple runs of the MOVESemscac utility to produce a regional summary of the VMT, VHT, speed (VMT/VHT), off-network activity, and emissions for each hour along with a 24-hour summary. A maximum of 1,000 tab files can be combined in one run of the MOVEStabcomb utility. However, each tab file must have the same roadway types or the utility will not function properly.

The new regional tab-delimited file is in the same form as the individual county files taken as input, except that each time period includes the individual county data summaries plus the regional summary. The individual county summaries are taken directly from the input tab-delimited files. The regional data summaries are summations of the county data except for "speed," which is calculated as regional VMT/regional VHT.

Travel Demand Model Network Link-Based Hourly MOVES Emissions Estimates



[1] MOVESactivityInputBuild, MOVESfleetInputBuild, MOVESmetInputBuild, and MOVESpopulationBuild.

[2] Tabulated EI summaries for other counties from additional MOVESemscalc runs (same functional class system required for combining).

[3] MOVESpopulationBuild, ShpExtIdleStartActBld, ExtIdleHrsCalc

APPENDIX C:
TXDOT DISTRICT VMT MIX BY DAY OF WEEK

TxDOT District/HGB Counties

TxDOT District	HGB County
Beaumont	Liberty
	Chambers
Houston	Harris
	Galveston
	Fort Bend
	Brazoria
	Montgomery
	Waller

VMT Mix Year/Analysis Year Correlations

VMT Mix Year	Analysis Years
2000	1998 through 2002
2005	2003 through 2007
2010	2008 through 2012
2015	2013 through 2017
2020	2018 through 2022

2000 Weekday VMT Mix by TxDOT District (2002 Analysis Year)

SUT/FT	Beaumont				Houston			
	RT2	RT3	RT4	RT5	RT2	RT3	RT4	RT5
21_D	0.00218	0.00228	0.00232	0.00258	0.00199	0.00191	0.00223	0.00216
21_G	0.54312	0.56709	0.57688	0.64189	0.66078	0.63605	0.74264	0.71796
31_D	0.00248	0.00328	0.00263	0.00333	0.00244	0.00299	0.00216	0.00257
31_G	0.15223	0.20141	0.16175	0.20477	0.14991	0.18374	0.13311	0.15782
32_D	0.00449	0.00594	0.00477	0.00603	0.00442	0.00541	0.00392	0.00465
32_G	0.04708	0.06229	0.05003	0.06333	0.04637	0.05683	0.04117	0.04881
51_D	0.00131	0.00157	0.00117	0.00111	0.00080	0.00109	0.00069	0.00082
51_G	0.00033	0.00040	0.00030	0.00028	0.00041	0.00056	0.00035	0.00042
52_D	0.03591	0.04302	0.03215	0.03053	0.02090	0.02822	0.01797	0.02124
52_G	0.00920	0.01103	0.00824	0.00783	0.01067	0.01441	0.00917	0.01085
53_D	0.00173	0.00207	0.00155	0.00147	0.00230	0.00310	0.00197	0.00233
53_G	0.00044	0.00053	0.00040	0.00038	0.00117	0.00158	0.00101	0.00119
54_D	0.00188	0.00225	0.00168	0.00160	0.00116	0.00156	0.00099	0.00118
54_G	0.00048	0.00058	0.00043	0.00041	0.00059	0.00080	0.00051	0.00060
41_D	0.00188	0.00176	0.00164	0.00128	0.00090	0.00099	0.00121	0.00127
42_D	0.00072	0.00067	0.00062	0.00049	0.00034	0.00038	0.00046	0.00048
42_G	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
43_D	0.00215	0.00202	0.00188	0.00147	0.00103	0.00114	0.00138	0.00145
43_G	0.00002	0.00002	0.00002	0.00001	0.00001	0.00001	0.00001	0.00001
61_D	0.06570	0.03125	0.05171	0.01047	0.04660	0.02931	0.01915	0.01174
61_G	0.00738	0.00351	0.00581	0.00118	0.00362	0.00227	0.00149	0.00091
62_D	0.11873	0.05647	0.09345	0.01891	0.04295	0.02701	0.01765	0.01082
62_G	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

11_G	0.00055	0.00057	0.00058	0.00065	0.00066	0.00064	0.00075	0.00072

2010 Weekday VMT Mix by TxDOT District (2008 and 2011 Analysis Years)

SUT/FT	Beaumont				Houston			
	RT2	RT3	RT4	RT5	RT2	RT3	RT4	RT5
21_D	0.00055	0.00057	0.00058	0.00064	0.00066	0.00064	0.00074	0.00072
21_G	0.54475	0.56880	0.57862	0.64382	0.66211	0.63733	0.74413	0.71940
31_D	0.00495	0.00655	0.00526	0.00666	0.00503	0.00616	0.00446	0.00529
31_G	0.14976	0.19814	0.15912	0.20144	0.14732	0.18056	0.13081	0.15509
32_D	0.00340	0.00450	0.00362	0.00458	0.00335	0.00411	0.00298	0.00353
32_G	0.04817	0.06373	0.05118	0.06479	0.04743	0.05813	0.04212	0.04993
51_D	0.00065	0.00078	0.00058	0.00056	0.00040	0.00054	0.00035	0.00041
51_G	0.00017	0.00020	0.00015	0.00014	0.00021	0.00028	0.00018	0.00021
52_D	0.03650	0.04372	0.03267	0.03103	0.02124	0.02868	0.01826	0.02159
52_G	0.00935	0.01121	0.00837	0.00795	0.01084	0.01465	0.00932	0.01102
53_D	0.00176	0.00211	0.00158	0.00150	0.00233	0.00315	0.00201	0.00237
53_G	0.00045	0.00054	0.00040	0.00038	0.00119	0.00161	0.00102	0.00121
54_D	0.00192	0.00230	0.00172	0.00163	0.00118	0.00160	0.00102	0.00120
54_G	0.00049	0.00059	0.00044	0.00042	0.00060	0.00082	0.00052	0.00061
41_D	0.00196	0.00183	0.00170	0.00133	0.00093	0.00103	0.00125	0.00132
42_D	0.00061	0.00057	0.00053	0.00042	0.00029	0.00032	0.00039	0.00041
42_G	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
43_D	0.00218	0.00204	0.00190	0.00149	0.00104	0.00115	0.00140	0.00147
43_G	0.00002	0.00002	0.00002	0.00002	0.00001	0.00001	0.00001	0.00001
61_D	0.06570	0.03125	0.05171	0.01047	0.04660	0.02931	0.01915	0.01174
61_G	0.00738	0.00351	0.00581	0.00118	0.00362	0.00227	0.00149	0.00091
62_D	0.11873	0.05647	0.09345	0.01891	0.04295	0.02701	0.01765	0.01082
62_G	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

11_G	0.00055	0.00057	0.00058	0.00065	0.00066	0.00064	0.00075	0.00072

2015 Weekday VMT Mix by TxDOT District (2014 and 2017 Analysis Years)

SUT/FT	Beaumont				Houston			
	RT2	RT3	RT4	RT5	RT2	RT3	RT4	RT5
21_D	0.00055	0.00057	0.00058	0.00064	0.00066	0.00064	0.00074	0.00072
21_G	0.54475	0.56880	0.57862	0.64382	0.66211	0.63733	0.74413	0.71940
31_D	0.00696	0.00921	0.00740	0.00936	0.00701	0.00859	0.00622	0.00738
31_G	0.14775	0.19548	0.15698	0.19874	0.14534	0.17813	0.12905	0.15300
32_D	0.00315	0.00416	0.00334	0.00423	0.00305	0.00373	0.00271	0.00321
32_G	0.04842	0.06407	0.05145	0.06514	0.04774	0.05851	0.04239	0.05025
51_D	0.00049	0.00059	0.00044	0.00042	0.00030	0.00041	0.00026	0.00031
51_G	0.00013	0.00015	0.00011	0.00011	0.00015	0.00021	0.00013	0.00016
52_D	0.03665	0.04391	0.03281	0.03116	0.02133	0.02881	0.01834	0.02168
52_G	0.00939	0.01125	0.00841	0.00799	0.01089	0.01471	0.00936	0.01107
53_D	0.00177	0.00212	0.00158	0.00150	0.00234	0.00317	0.00201	0.00238
53_G	0.00045	0.00054	0.00041	0.00039	0.00120	0.00162	0.00103	0.00122
54_D	0.00192	0.00230	0.00172	0.00163	0.00118	0.00160	0.00102	0.00120
54_G	0.00049	0.00059	0.00044	0.00042	0.00060	0.00082	0.00052	0.00061
41_D	0.00198	0.00186	0.00172	0.00135	0.00094	0.00104	0.00127	0.00134
42_D	0.00059	0.00055	0.00051	0.00040	0.00028	0.00031	0.00038	0.00040
42_G	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
43_D	0.00218	0.00204	0.00190	0.00149	0.00104	0.00115	0.00140	0.00147
43_G	0.00002	0.00002	0.00002	0.00002	0.00001	0.00001	0.00001	0.00001
61_D	0.06570	0.03125	0.05171	0.01047	0.04660	0.02931	0.01915	0.01174
61_G	0.00738	0.00351	0.00581	0.00118	0.00362	0.00227	0.00149	0.00091
62_D	0.11873	0.05647	0.09345	0.01891	0.04295	0.02701	0.01765	0.01082
62_G	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

11_G	0.00055	0.00057	0.00058	0.00065	0.00066	0.00064	0.00075	0.00072

2020 Weekday VMT Mix by TxDOT District (2018 and 2019 Analysis Years)

SUT/FT	Beaumont				Houston			
	RT2	RT3	RT4	RT5	RT2	RT3	RT4	RT5
21_D	0.00164	0.00171	0.00174	0.00193	0.00199	0.00191	0.00223	0.00216
21_G	0.54366	0.56766	0.57746	0.64254	0.66078	0.63605	0.74264	0.71796
31_D	0.00866	0.01146	0.00921	0.01165	0.00868	0.01064	0.00771	0.00914
31_G	0.14604	0.19323	0.15517	0.19645	0.14367	0.17608	0.12756	0.15124
32_D	0.00346	0.00457	0.00367	0.00465	0.00340	0.00417	0.00302	0.00358
32_G	0.04811	0.06366	0.05112	0.06472	0.04738	0.05807	0.04207	0.04988
51_D	0.00037	0.00044	0.00033	0.00031	0.00023	0.00031	0.00019	0.00023
51_G	0.00009	0.00011	0.00008	0.00008	0.00012	0.00016	0.00010	0.00012
52_D	0.03681	0.04410	0.03295	0.03130	0.02142	0.02893	0.01841	0.02177
52_G	0.00943	0.01130	0.00844	0.00802	0.01093	0.01477	0.00940	0.01112
53_D	0.00177	0.00213	0.00159	0.00151	0.00235	0.00318	0.00202	0.00239
53_G	0.00045	0.00054	0.00041	0.00039	0.00120	0.00162	0.00103	0.00122
54_D	0.00188	0.00225	0.00168	0.00160	0.00116	0.00156	0.00099	0.00118
54_G	0.00048	0.00058	0.00043	0.00041	0.00059	0.00080	0.00051	0.00060
41_D	0.00199	0.00186	0.00173	0.00136	0.00095	0.00105	0.00128	0.00134
42_D	0.00057	0.00054	0.00050	0.00039	0.00027	0.00030	0.00037	0.00039
42_G	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
43_D	0.00219	0.00205	0.00191	0.00149	0.00104	0.00115	0.00140	0.00148
43_G	0.00002	0.00002	0.00002	0.00002	0.00001	0.00001	0.00001	0.00001
61_D	0.06570	0.03125	0.05171	0.01047	0.04660	0.02931	0.01915	0.01174
61_G	0.00738	0.00351	0.00581	0.00118	0.00362	0.00227	0.00149	0.00091
62_D	0.11873	0.05647	0.09345	0.01891	0.04295	0.02701	0.01765	0.01082
62_G	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

11_G	0.00055	0.00057	0.00058	0.00065	0.00066	0.00064	0.00075	0.00072

APPENDIX D:
TXDOT DISTRICT AGGREGATE WEEKDAY VMT MIX

TxDOT District/HGB Counties

TxDOT District	HGB County
Beaumont	Liberty
	Chambers
Houston	Harris
	Galveston
	Fort Bend
	Brazoria
	Montgomery
	Waller

VMT Mix Year/Analysis Year Correlations

VMT Mix Year	Analysis Years
2000	1998 through 2002
2005	2003 through 2007
2010	2008 through 2012
2015	2013 through 2017
2020	2018 through 2022

2000 Aggregate Weekday VMT Mix by TxDOT District (2002 Analysis Year)

SUT/FT	Beaumont	Houston
21_D	0.002280	0.002200
21_G	0.568760	0.732370
31_D	0.002820	0.002240
31_G	0.173240	0.137890
32_D	0.005110	0.004060
32_G	0.053580	0.042650
51_D	0.001320	0.000720
51_G	0.000340	0.000370
52_D	0.036230	0.018810
52_G	0.009280	0.009610
53_D	0.001750	0.002070
53_G	0.000450	0.001060
54_D	0.001890	0.001040
54_G	0.000490	0.000530
41_D	0.001720	0.001190
42_D	0.000660	0.000450
42_G	0.000000	0.000000
43_D	0.001970	0.001360
43_G	0.000020	0.000010
61_D	0.047110	0.020320
61_G	0.005290	0.001580
62_D	0.085140	0.018730
62_G	0.000000	0.000000
11_G	0.000570	0.000740

2010 Aggregate Weekday VMT Mix by TxDOT District (2008 and 2011 Analysis Years)

SUT/FT	Beaumont	Houston
21_D	0.000570	0.000730
21_G	0.570470	0.733840
31_D	0.005630	0.004620
31_G	0.170420	0.135500
32_D	0.003870	0.003080
32_G	0.054810	0.043630
51_D	0.000660	0.000360
51_G	0.000170	0.000190
52_D	0.036820	0.019120
52_G	0.009440	0.009760
53_D	0.001780	0.002100
53_G	0.000450	0.001070
54_D	0.001940	0.001060
54_G	0.000500	0.000540
41_D	0.001790	0.001230
42_D	0.000560	0.000390
42_G	0.000000	0.000000
43_D	0.002000	0.001380
43_G	0.000020	0.000010
61_D	0.047110	0.020320
61_G	0.005290	0.001580
62_D	0.085140	0.018730
62_G	0.000000	0.000000
11_G	0.000570	0.000740

2015 Aggregate Weekday VMT Mix by TxDOT District (2014 and 2017 Analysis Years)

SUT/FT	Beaumont	Houston
21_D	0.000570	0.000730
21_G	0.570470	0.733840
31_D	0.007920	0.006450
31_G	0.168130	0.133680
32_D	0.003580	0.002800
32_G	0.055100	0.043910
51_D	0.000490	0.000270
51_G	0.000130	0.000140
52_D	0.036970	0.019200
52_G	0.009480	0.009800
53_D	0.001780	0.002110
53_G	0.000460	0.001080
54_D	0.001940	0.001060
54_G	0.000500	0.000540
41_D	0.001810	0.001250
42_D	0.000540	0.000370
42_G	0.000000	0.000000
43_D	0.002000	0.001380
43_G	0.000020	0.000010
61_D	0.047110	0.020320
61_G	0.005290	0.001580
62_D	0.085140	0.018730
62_G	0.000000	0.000000
11_G	0.000570	0.000740

2020 Aggregate Weekday VMT Mix by TxDOT District (2018 and 2019 Analysis Years)

SUT/FT	Beaumont	Houston
21_D	0.001710	0.002200
21_G	0.569330	0.732370
31_D	0.009860	0.007990
31_G	0.166190	0.132140
32_D	0.003930	0.003130
32_G	0.054750	0.043580
51_D	0.000370	0.000200
51_G	0.000090	0.000100
52_D	0.037130	0.019280
52_G	0.009520	0.009850
53_D	0.001790	0.002120
53_G	0.000460	0.001080
54_D	0.001890	0.001040
54_G	0.000490	0.000530
41_D	0.001820	0.001260
42_D	0.000520	0.000360
42_G	0.000000	0.000000
43_D	0.002000	0.001380
43_G	0.000020	0.000010
61_D	0.047110	0.020320
61_G	0.005290	0.001580
62_D	0.085140	0.018730
62_G	0.000000	0.000000
11_G	0.000570	0.000740

APPENDIX E:
ANNUALLY COMPOUNDED GROWTH RATES AND INTERMEDIATE YEAR ADJUSTMENT FACTORS

AM Peak Annually Compounded Growth Rates

County	2008 TDM VMT[1]	2018 TDM VMT[1]	Growth Rate
Harris	24,137,211.21	29,515,078.89	1.020318323
Brazoria	1,504,752.74	1,988,154.87	1.028249500
Fort Bend	2,207,433.11	3,081,077.38	1.033907071
Waller	359,846.35	471,071.38	1.027299227
Montgomery	2,427,161.45	3,269,963.78	1.030254281
Liberty	517,099.36	655,835.29	1.024052160
Chambers	484,153.97	608,412.83	1.023108013
Galveston	1,262,864.80	1,559,277.90	1.021307841

[1] Includes the estimated intrazonal VMT.

Mid-Day Annually Compounded Growth Rates

County	2008 TDM VMT[1]	2018 TDM VMT[1]	Growth Rate
Harris	30,851,904.42	37,562,123.16	1.019874693
Brazoria	1,896,517.55	2,479,277.45	1.027156991
Fort Bend	2,978,232.52	4,105,286.25	1.03261513
Waller	705,159.90	895,385.68	1.02417048
Montgomery	3,318,067.86	4,417,901.72	1.029041948
Liberty	809,261.88	1,017,182.34	1.023130362
Chambers	977,163.57	1,212,901.34	1.021846875
Galveston	1,667,384.19	2,042,911.27	1.020519676

[1] Includes the estimated intrazonal VMT.

PM Peak Annually Compounded Growth Rates

County	2008 TDM VMT[1]	2018 TDM VMT[1]	Growth Rate
Harris	36,060,381.95	44,118,397.16	1.020372958
Brazoria	2,222,295.88	2,938,380.74	1.028325532
Fort Bend	3,384,832.85	4,718,385.09	1.033774025
Waller	630,829.33	818,256.13	1.026355324
Montgomery	3,740,962.99	5,061,203.06	1.030687562
Liberty	831,790.88	1,048,664.31	1.023439639
Chambers	846,945.89	1,059,706.50	1.022664059
Galveston	1,955,842.62	2,407,231.47	1.020982727

[1] Includes the estimated intrazonal VMT.

Overnight Annually Compounded Growth Rates

County	2008 TDM VMT[1]	2018 TDM VMT[1]	Growth Rate
Harris	17,219,249.68	21,096,620.00	1.020516112
Brazoria	1,090,172.36	1,435,327.50	1.027887498
Fort Bend	1,797,320.33	2,506,902.15	1.033834902
Waller	446,574.17	568,279.76	1.024393604
Montgomery	2,068,521.90	2,763,404.19	1.029386407
Liberty	521,237.32	655,479.32	1.023180724
Chambers	601,331.08	742,728.09	1.021343008
Galveston	968,034.86	1,184,996.23	1.020428541

[1] Includes the estimated intrazonal VMT.

2011 Intermediate Year Adjustment Factors

County	AM Peak	Mid-Day	PM Peak	Overnight
Harris	1.062201859	1.060816941	1.062372502	1.062819703
Brazoria	1.087165146	1.083703509	1.087406329	1.086017320
Fort Bend	1.105209263	1.101071326	1.104782654	1.104977842
Waller	1.084153769	1.074278198	1.081168086	1.074980471
Montgomery	1.093536499	1.089680642	1.094916764	1.090775280
Liberty	1.073905913	1.071008503	1.071980044	1.071166665
Chambers	1.070938319	1.066982909	1.069544799	1.065405317
Galveston	1.065295270	1.062830839	1.064278244	1.062546125

[1] Applied to 2008 TDM VMT (including intrazonal VMT) to estimate analysis year VMT.

2014 Intermediate Year Adjustment Factors

County	AM Peak	Mid-Day	PM Peak	Overnight
Harris	0.922693066	0.924299542	0.922495462	0.921977956
Brazoria	0.894552786	0.898364732	0.894288251	0.895813627
Fort Bend	0.875132834	0.879520695	0.875583437	0.875377221
Waller	0.897867299	0.908889286	0.901174808	0.908097682
Montgomery	0.887610210	0.891800447	0.886118614	0.890607369
Liberty	0.909309416	0.912590847	0.911488232	0.912411187
Chambers	0.912670589	0.917184519	0.914256437	0.918995786
Galveston	0.919122367	0.921965075	0.920293641	0.922294484

[1] Applied to 2018 TDM VMT (including intrazonal VMT) to estimate analysis year VMT.

2017 Intermediate Year Adjustment Factors

County	AM Peak	Mid-Day	PM Peak	Overnight
Harris	0.980086290	0.980512613	0.980033812	0.979896337
Brazoria	0.972526610	0.973561012	0.972454704	0.972869115
Fort Bend	0.967204915	0.968415018	0.967329393	0.967272432
Waller	0.973426217	0.976399944	0.974321443	0.976187274
Montgomery	0.970634162	0.971777683	0.970226126	0.971452502
Liberty	0.976512759	0.977392556	0.977097195	0.977344448
Chambers	0.977413907	0.978620207	0.977838217	0.979102997
Galveston	0.979136710	0.979892915	0.979448500	0.979980429

[1] Applied to 2018 TDM VMT (including intrazonal VMT) to estimate analysis year VMT.

2019 Intermediate Year Adjustment Factors

County	AM Peak	Mid-Day	PM Peak	Overnight
Harris	1.020318323	1.019874693	1.020372958	1.020516112
Brazoria	1.028249500	1.027156991	1.028325532	1.027887498
Fort Bend	1.033907071	1.032615130	1.033774025	1.033834902
Waller	1.027299227	1.024170480	1.026355324	1.024393604
Montgomery	1.030254281	1.029041948	1.030687562	1.029386407
Liberty	1.024052160	1.023130362	1.023439639	1.023180724
Chambers	1.023108013	1.021846875	1.022664059	1.021343008
Galveston	1.021307841	1.020519676	1.020982727	1.020428541

[1] Calculated as one year increment between 2008 and 2018 TDMs and applied to 2018 TDM VMT (including intrazonal VMT) to estimate analysis year VMT.

APPENDIX F: CAPACITY FACTORS, SPEED FACTORS, AND SPEED REDUCTION FACTORS

Capacity Factors

Time of Day Assignment	Capacity Factor[1]
AM Peak	0.3333333
Mid-Day	0.1666667
PM Peak	0.2500000
Overnight	0.0909091

Freeflow (Volume = 1) Speed Factors for Houston/Galveston Speed Model

Functional Group	Area Type				
	CBD	Urban	Urban Fringe	Suburban	Rural
Freeways, Interstates	1.147400	1.177508	1.157272	1.197842	1.137903
Principal Arterials	1.136702	0.860413	0.887801	1.002511	1.018546
Other Arterials, Major Collectors	1.145946	0.811981	0.813370	0.813370	1.112661
Collectors	1.235367	0.857297	0.889344	0.974734	1.033400
Toll Roads	1.054545	1.100000	1.081379	1.057097	1.077846
Ramps	1.235367	0.857297	0.889344	0.974734	1.033400
Locals	1.000000	1.000000	1.000000	1.000000	1.000000

[1] To obtain hourly capacities, a single capacity factor for each time-of-day assignment is used for all area types and function classes.

LOS E (V/C = 1.0) Speed Factors for Houston/Galveston Speed Model

Functional Group	Area Type				
	CBD	Urban	Urban Fringe	Suburban	Rural
Freeways, Interstates	0.700000	0.768691	0.737693	0.715108	0.645161
Principal Arterials	0.703191	0.578709	0.633464	0.750628	0.458973
Other Arterials, Major Collectors	0.677477	0.560596	0.613733	0.870193	0.517909
Collectors	0.727049	0.567228	0.642497	0.761987	0.554081
Toll Roads	0.636364	0.636364	0.689705	0.645161	0.615385
Ramps	0.727049	0.567228	0.642497	0.761987	0.554081
Locals	1.000000	1.000000	1.000000	1.000000	1.000000

Functional Classification to Functional Group Relationship for the Application of and Speed Factors

Functional Group	Corresponding Network Functional Classifications
Freeways, Interstates	1. Urban Interstate Freeways 2. Urban Other Freeways 10. Rural Interstate Freeways 11. Rural Other Freeways
Principal Arterials	5. Urban Principal Arterials 12. Rural Principal Arterials
Other Arterials, Major Collectors	6. Urban Other Arterials 13. Rural Other Arterials 14. Rural Major Collectors
Collectors	7. Urban Collectors 15. Rural Collectors
Toll Roads	3. Toll Roads
Ramps	4. Ramps
Locals	8. Locals (Centroid Connectors) 40. Locals (Intrazonals)

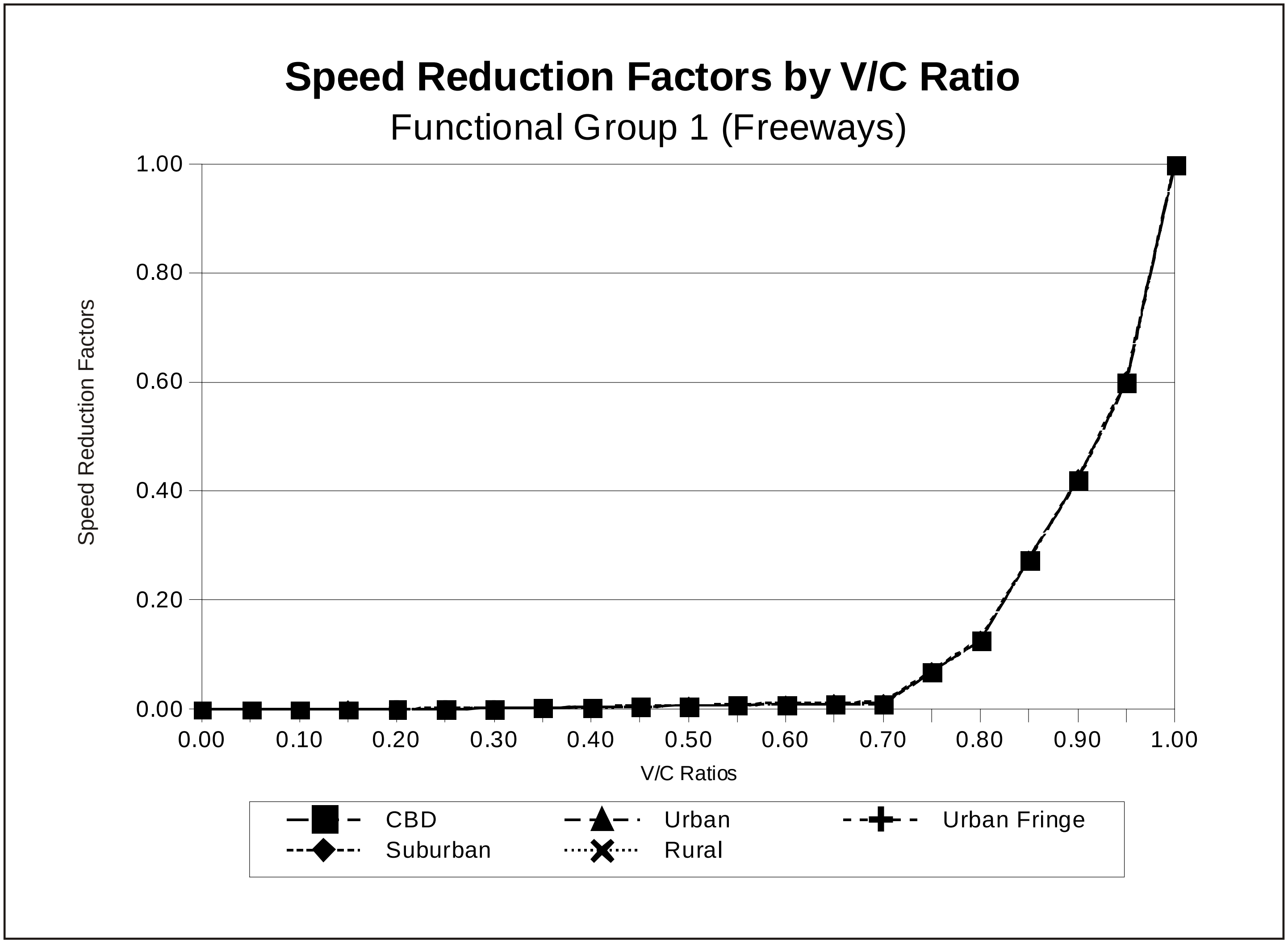


Figure 1. Freeway Speed Reduction Factors by V/C Ratio.

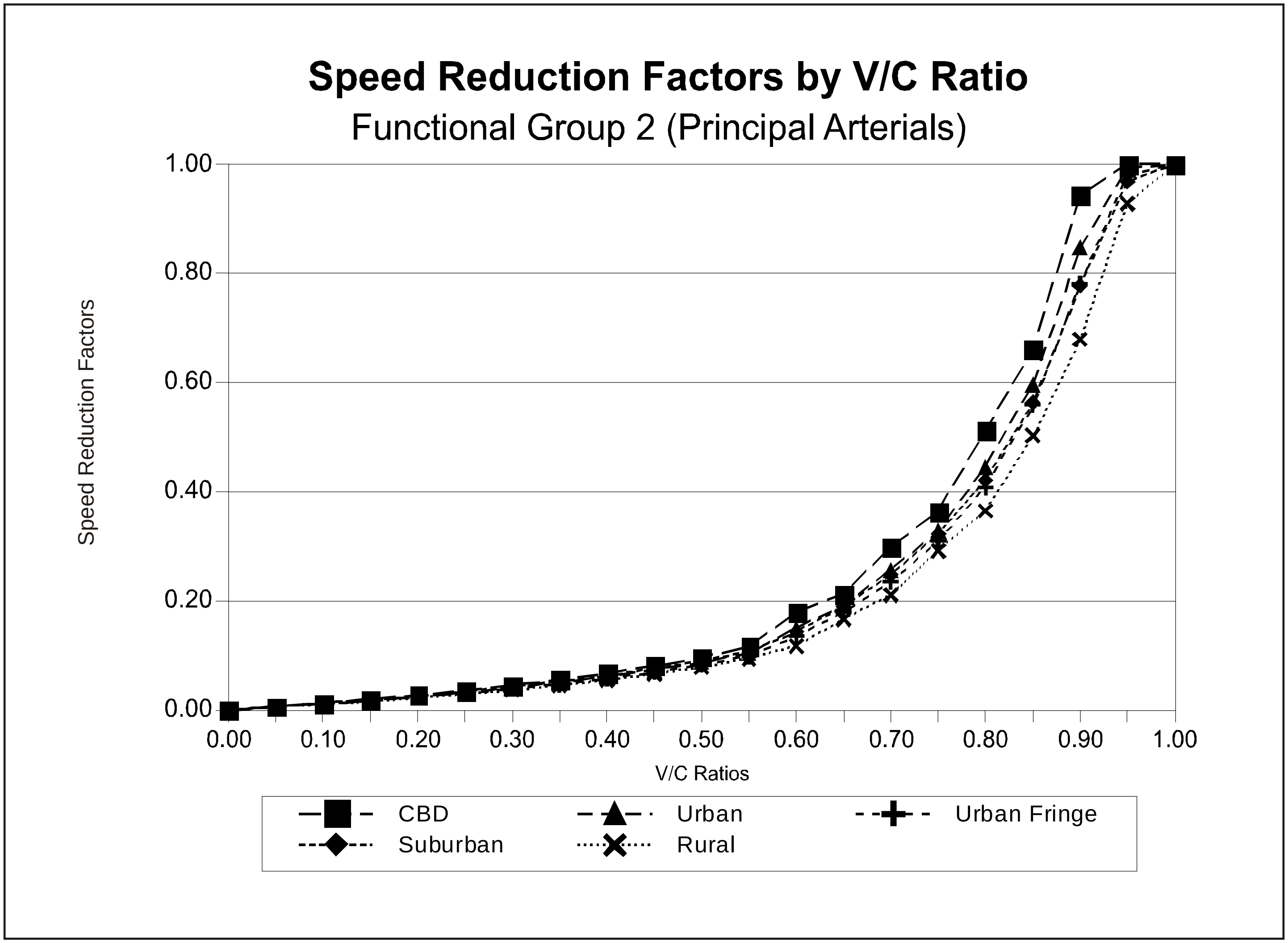


Figure 2. Principal Arterial Speed Reduction Factors by V/C Ratio.

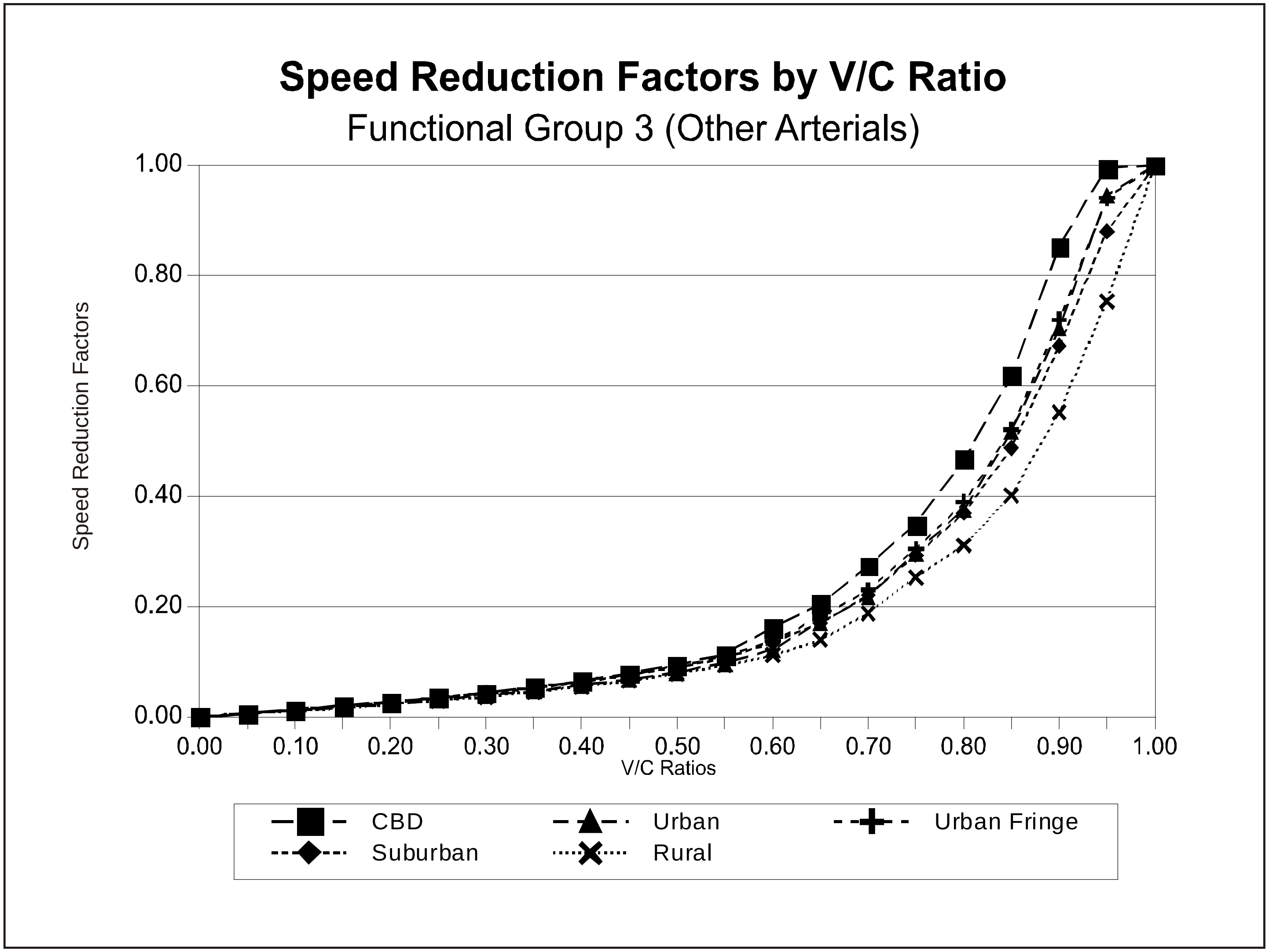


Figure 3. Other Arterial Speed Reduction Factors by V/C Ratio.

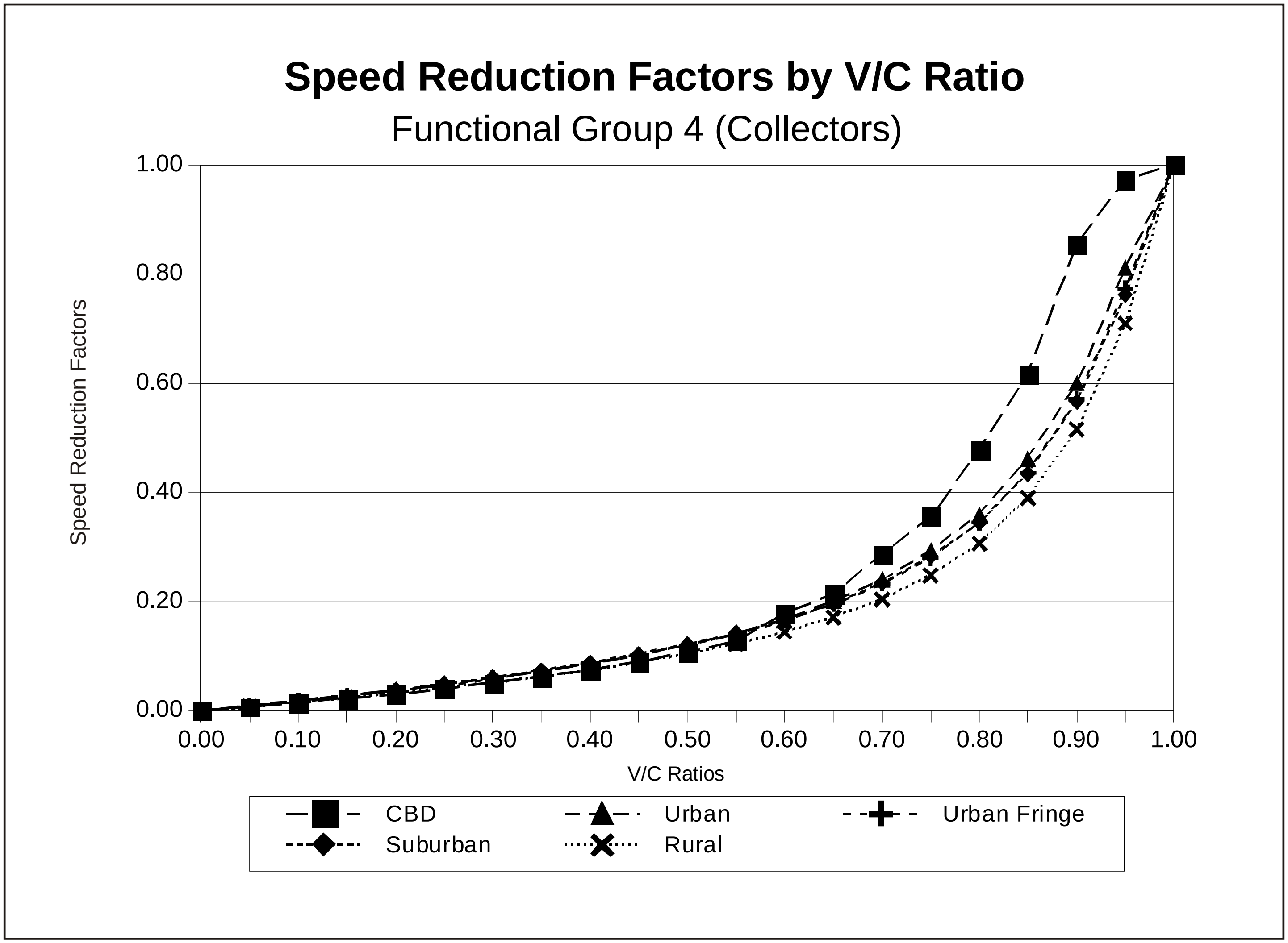


Figure 4. Collector Speed Reduction Factors by V/C Ratio.

Functional Classification to Functional Group Relationship for the Application of Speed Reduction Factors

Functional Group	Corresponding Network Functional Classifications
1. Freeways, Interstates	1. Urban Interstate Freeways 2. Urban Other Freeways 3. Toll Roads 10. Rural Interstate Freeways 11. Rural Other Freeways
2. Principal Arterials	5. Urban Principal Arterials 12. Rural Principal Arterials
3. Other Arterials, Major Collectors	6. Urban Other Arterials 13. Rural Other Arterials 14. Rural Major Collectors
4. Collectors	4. Ramps 7. Urban Collectors 15. Rural Collectors

APPENDIX G:
VEHICLE POPULATION ESTIMATES AND 24-HOUR SHP, STARTS, AND SHI SUMMARIES

2002 Vehicle Population Estimates

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	4,763	309	510	35	395	93	39	342
21_G	1,585,418	102,754	169,889	11,507	131,650	23,256	9,636	113,876
31_D	8,220	849	846	122	1,024	270	120	750
31_G	506,003	52,259	52,086	7,537	63,018	16,578	7,378	46,144
32_D	14,899	1,539	1,534	222	1,855	489	218	1,359
32_G	156,509	16,164	16,110	2,331	19,492	5,127	2,282	14,273
51_D	577	44	31	10	54	19	8	31
51_G	297	23	16	5	28	5	2	16
52_D	15,079	1,148	812	267	1,415	517	206	801
52_G	7,704	586	415	136	723	133	53	409
53_D	1,659	126	89	29	156	25	10	88
53_G	850	65	46	15	80	6	3	45
54_D	834	63	45	15	78	27	11	44
54_G	425	32	23	8	40	7	3	23
41_D	954	73	51	17	90	25	10	51
42_D	361	27	19	6	34	9	4	19
42_G	0	0	0	0	0	0	0	0
43_D	1,090	83	59	19	102	28	11	58
43_G	8	1	0	0	1	0	0	0
61_D	15,514	888	888	153	892	468	85	495
61_G	1,206	69	69	12	69	53	9	39
62_D	14,300	818	818	141	822	847	153	457
62_G	0	0	0	0	0	0	0	0
11_G	28,919	3,284	3,252	319	4,133	747	431	3,940

2008 Vehicle Population Estimates

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	1,745	125	256	14	178	26	12	126
21_G	1,753,810	125,864	257,492	14,088	179,043	25,656	12,490	126,955
31_D	19,567	1,978	2,324	311	2,629	602	300	1,777
31_G	573,871	58,015	68,174	9,124	77,117	18,231	9,095	52,119
32_D	13,044	1,319	1,550	207	1,753	414	207	1,185
32_G	184,782	18,680	21,951	2,938	24,831	5,863	2,925	16,782
51_D	465	49	40	13	66	22	10	33
51_G	246	26	21	7	35	6	3	17
52_D	24,713	2,629	2,145	677	3,479	1,215	583	1,759
52_G	12,615	1,342	1,095	345	1,776	312	149	898
53_D	2,714	289	236	74	382	59	28	193
53_G	1,383	147	120	38	195	15	7	98
54_D	1,370	146	119	38	193	64	31	98
54_G	698	74	61	19	98	17	8	50
41_D	1,590	169	138	44	224	59	28	113
42_D	504	54	44	14	71	18	9	36
42_G	0	0	0	0	0	0	0	0
43_D	1,784	190	155	49	251	66	32	127
43_G	13	1	1	0	2	1	0	1
61_D	16,454	952	1,260	215	1,349	541	138	531
61_G	1,279	74	98	17	105	61	15	41
62_D	15,166	877	1,161	198	1,244	978	249	489
62_G	0	0	0	0	0	0	0	0
11_G	48,344	7,324	6,738	848	10,178	1,932	1,021	8,214

2011 Vehicle Population Estimates

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	1,825	156	332	16	227	33	17	129
21_G	1,834,667	156,418	334,153	16,108	228,540	33,415	16,932	129,801
31_D	19,708	2,370	2,833	344	3,204	775	392	1,828
31_G	578,006	69,504	83,102	10,093	93,957	23,448	11,855	53,621
32_D	13,138	1,580	1,889	229	2,136	532	269	1,219
32_G	186,114	22,380	26,758	3,250	30,253	7,541	3,813	17,266
51_D	507	66	56	15	85	31	15	40
51_G	267	35	29	8	45	8	4	21
52_D	26,910	3,525	2,954	804	4,536	1,720	860	2,136
52_G	13,736	1,800	1,508	410	2,315	441	221	1,090
53_D	2,956	387	324	88	498	83	42	235
53_G	1,506	197	165	45	254	21	11	120
54_D	1,492	195	164	45	251	91	45	118
54_G	760	100	83	23	128	23	12	60
41_D	1,731	227	190	52	292	84	42	137
42_D	549	72	60	16	93	26	13	44
42_G	0	0	0	0	0	0	0	0
43_D	1,942	254	213	58	327	93	47	154
43_G	14	2	2	0	2	1	0	1
61_D	16,172	1,034	1,369	208	1,412	497	184	557
61_G	1,257	80	106	16	110	56	21	43
62_D	14,907	953	1,262	192	1,302	898	332	514
62_G	0	0	0	0	0	0	0	0
11_G	48,384	8,573	8,913	933	12,280	2,367	1,223	8,095

2014 Vehicle Population Estimates

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	1,938	169	367	17	248	36	18	137
21_G	1,948,348	169,883	368,853	17,367	249,654	35,818	18,084	138,082
31_D	29,217	3,593	4,366	518	4,885	1,168	588	2,715
31_G	605,544	74,470	90,494	10,734	101,253	24,796	12,492	56,273
32_D	12,683	1,560	1,895	225	2,121	528	266	1,179
32_G	198,904	24,461	29,725	3,526	33,259	8,126	4,094	18,484
51_D	404	54	46	12	70	25	12	32
51_G	209	28	24	6	36	7	3	17
52_D	28,714	3,847	3,276	871	4,979	1,852	923	2,283
52_G	14,656	1,964	1,672	444	2,541	475	237	1,165
53_D	3,156	423	360	96	547	89	44	251
53_G	1,615	216	184	49	280	23	11	128
54_D	1,585	212	181	48	275	97	48	126
54_G	808	108	92	24	140	25	12	64
41_D	1,869	250	213	57	324	91	45	149
42_D	553	74	63	17	96	27	13	44
42_G	0	0	0	0	0	0	0	0
43_D	2,064	277	235	63	358	100	50	164
43_G	15	2	2	0	3	1	0	1
61_D	17,174	1,123	1,511	224	1,543	533	196	593
61_G	1,335	87	117	17	120	60	22	46
62_D	15,830	1,035	1,393	207	1,422	963	355	547
62_G	0	0	0	0	0	0	0	0
11_G	51,382	9,311	9,839	1,006	13,414	2,537	1,306	8,612

2017 Vehicle Population Estimates

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	2,058	184	405	19	271	38	19	146
21_G	2,069,075	184,508	407,157	18,724	272,720	38,393	19,315	146,892
31_D	31,028	3,902	4,820	558	5,337	1,252	629	2,888
31_G	643,066	80,880	99,892	11,573	110,608	26,579	13,342	59,863
32_D	13,469	1,694	2,092	242	2,317	566	284	1,254
32_G	211,228	26,567	32,812	3,801	36,332	8,711	4,373	19,663
51_D	429	59	51	13	76	26	13	34
51_G	222	30	26	7	40	7	3	18
52_D	30,493	4,178	3,617	939	5,439	1,985	986	2,429
52_G	15,564	2,133	1,846	479	2,776	509	253	1,240
53_D	3,351	459	397	103	598	96	47	267
53_G	1,715	235	203	53	306	25	12	137
54_D	1,683	231	200	52	300	104	52	134
54_G	858	118	102	26	153	27	13	68
41_D	1,985	272	235	61	354	97	48	158
42_D	588	81	70	18	105	29	14	47
42_G	0	0	0	0	0	0	0	0
43_D	2,192	300	260	67	391	107	53	175
43_G	16	2	2	0	3	1	1	1
61_D	18,238	1,220	1,668	242	1,685	571	210	631
61_G	1,418	95	130	19	131	64	24	49
62_D	16,811	1,124	1,537	223	1,554	1,032	379	581
62_G	0	0	0	0	0	0	0	0
11_G	54,566	10,113	10,860	1,085	14,654	2,720	1,395	9,161

2018 Vehicle Population Estimates

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	6,328	569	1,261	58	842	118	59	450
21_G	2,106,728	189,277	419,947	19,161	280,310	39,214	19,704	149,652
31_D	39,214	4,969	6,170	709	6,809	1,595	800	3,653
31_G	648,524	82,180	102,047	11,730	112,602	26,888	13,481	60,406
32_D	15,362	1,947	2,417	278	2,667	636	319	1,431
32_G	213,884	27,103	33,655	3,869	37,136	8,858	4,441	19,922
51_D	324	45	39	10	58	20	10	26
51_G	162	22	19	5	29	5	2	13
52_D	31,249	4,314	3,754	967	5,626	2,042	1,013	2,490
52_G	15,965	2,204	1,918	494	2,874	523	260	1,272
53_D	3,436	474	413	106	619	98	49	274
53_G	1,750	242	210	54	315	25	13	140
54_D	1,686	233	203	52	303	104	52	134
54_G	859	119	103	27	155	27	13	68
41_D	2,042	282	245	63	368	100	50	163
42_D	583	81	70	18	105	29	14	47
42_G	0	0	0	0	0	0	0	0
43_D	2,237	309	269	69	403	110	55	178
43_G	16	2	2	1	3	1	1	1
61_D	18,607	1,254	1,723	248	1,736	584	214	644
61_G	1,447	97	134	19	135	66	24	50
62_D	17,151	1,156	1,589	228	1,600	1,056	387	594
62_G	0	0	0	0	0	0	0	0
11_G	55,670	10,395	11,224	1,113	15,092	2,783	1,426	9,352

2019 Vehicle Population Estimates

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	6,457	584	1,304	59	867	121	60	459
21_G	2,149,372	194,560	434,008	19,647	288,690	40,132	20,142	152,769
31_D	40,008	5,108	6,377	727	7,012	1,633	818	3,729
31_G	661,652	84,473	105,464	12,028	115,969	27,517	13,780	61,665
32_D	15,673	2,001	2,498	285	2,747	651	326	1,461
32_G	218,214	27,859	34,782	3,967	38,247	9,065	4,540	20,337
51_D	331	46	40	10	60	21	10	26
51_G	165	23	20	5	30	5	3	13
52_D	31,882	4,435	3,880	991	5,794	2,090	1,035	2,542
52_G	16,288	2,266	1,982	506	2,960	536	265	1,299
53_D	3,506	488	427	109	637	101	50	280
53_G	1,786	248	217	56	325	26	13	142
54_D	1,720	239	209	53	313	106	53	137
54_G	876	122	107	27	159	28	14	70
41_D	2,084	290	254	65	379	102	51	166
42_D	595	83	72	19	108	29	14	47
42_G	0	0	0	0	0	0	0	0
43_D	2,282	317	278	71	415	113	56	182
43_G	17	2	2	1	3	1	1	1
61_D	18,984	1,289	1,781	254	1,788	598	219	657
61_G	1,476	100	138	20	139	67	25	51
62_D	17,499	1,188	1,642	234	1,648	1,081	396	606
62_G	0	0	0	0	0	0	0	0
11_G	56,797	10,685	11,600	1,141	15,543	2,849	1,458	9,547

2002 24-Hour Weekday SHP Summaries

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	108,459	7,131	11,809	764	9,041	2,124	845	7,874
21_G	36,107,477	2,373,995	3,931,179	254,513	3,009,715	529,949	210,844	2,621,262
31_D	190,653	20,016	19,773	2,848	23,985	6,321	2,781	17,595
31_G	11,736,849	1,232,212	1,217,235	175,310	1,476,533	388,337	170,851	1,083,174
32_D	345,570	36,281	35,839	5,162	43,474	11,455	5,040	31,892
32_G	3,630,270	381,129	376,497	54,224	456,699	120,106	52,841	335,031
51_D	11,733	934	571	213	1,102	384	129	608
51_G	6,035	480	294	110	566	99	34	313
52_D	306,919	24,434	14,944	5,576	28,821	10,555	3,550	15,913
52_G	156,816	12,484	7,636	2,849	14,726	2,703	909	8,130
53_D	33,796	2,690	1,646	614	3,173	510	172	1,752
53_G	17,312	1,378	844	315	1,626	131	44	898
54_D	16,961	1,350	826	308	1,593	550	185	879
54_G	8,642	688	421	157	811	143	48	448
41_D	19,541	1,589	983	372	1,904	511	167	1,022
42_D	7,388	600	371	141	719	196	64	386
42_G	0	0	0	0	0	0	0	0
43_D	22,337	1,815	1,123	425	2,175	586	192	1,168
43_G	166	13	8	3	16	6	2	9
61_D	334,429	18,609	17,849	2,515	16,416	9,906	465	9,660
61_G	26,009	1,448	1,389	196	1,278	1,112	52	752
62_D	308,265	17,153	16,453	2,319	15,133	17,904	840	8,904
62_G	0	0	0	0	0	0	0	0
11_G	692,104	78,724	77,901	7,634	99,041	17,900	10,323	94,448

2008 24-Hour Weekday SHP Summaries

SUT/FT	Harris	Brazori a	Fort Bend	Walle r	Montgome ry	Libert y	Chamber s	Galvesto n
21_D	39,704	2,900	5,978	312	4,104	585	275	2,916
21_G	39,923,59 4	2,916,20 6	6,010,712	314,02 0	4,127,020	585,66 7	275,444	2,932,124
31_D	454,455	46,650	54,523	7,260	61,749	14,125	6,969	41,815
31_G	13,328,83 7	1,368,20 4	1,599,112	212,93 3	1,811,070	427,55 9	210,956	1,226,390
32_D	302,957	31,099	36,348	4,840	41,165	9,709	4,791	27,876
32_G	4,291,804	440,553	514,904	68,563	583,153	137,510	67,847	394,890
51_D	9,988	1,121	869	288	1,461	487	220	730
51_G	5,289	593	460	152	772	125	57	386
52_D	531,131	59,569	46,194	15,321	77,627	27,149	12,287	38,779
52_G	271,124	30,407	23,580	7,821	39,625	6,961	3,150	19,795
53_D	58,335	6,543	5,074	1,683	8,526	1,313	594	4,259
53_G	29,721	3,333	2,585	857	4,344	332	150	2,170
54_D	29,432	3,302	2,560	849	4,302	1,431	648	2,149
54_G	14,996	1,682	1,304	433	2,191	369	167	1,095
41_D	34,283	3,876	3,012	1,007	5,081	1,331	597	2,510
42_D	10,894	1,230	957	320	1,613	417	187	797
42_G	0	0	0	0	0	0	0	0
43_D	38,489	4,350	3,381	1,130	5,702	1,488	667	2,818
43_G	280	31	25	8	41	15	7	20
61_D	352,612	19,974	26,362	3,944	27,071	11,574	1,111	10,427
61_G	27,423	1,554	2,051	307	2,106	1,300	125	811
62_D	325,025	18,412	24,300	3,636	24,953	20,917	2,009	9,612
62_G	0	0	0	0	0	0	0	0
11_G	1,158,082	175,671	161,543	20,328	244,102	46,338	24,480	197,021

2011 24-Hour Weekday SHP Summaries

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	41,496	3,611	7,763	357	5,243	761	375	2,981
21_G	41,725,512	3,630,921	7,805,561	359,465	5,272,193	762,056	375,369	2,997,219
31_D	456,879	55,905	66,401	8,026	75,182	18,153	9,091	43,020
31_G	13,399,937	1,639,662	1,947,484	235,401	2,205,027	549,496	275,183	1,261,750
32_D	304,572	37,270	44,266	5,351	50,120	12,478	6,249	28,680
32_G	4,314,699	527,960	627,077	75,798	710,005	176,727	88,503	406,275
51_D	10,906	1,515	1,208	344	1,910	692	331	898
51_G	5,774	800	639	181	1,010	178	85	475
52_D	579,920	80,465	64,191	18,250	101,468	38,610	18,481	47,724
52_G	296,029	41,074	32,766	9,316	51,795	9,899	4,738	24,361
53_D	63,693	8,838	7,050	2,004	11,145	1,867	894	5,242
53_G	32,451	4,503	3,592	1,021	5,678	472	226	2,671
54_D	32,136	4,460	3,557	1,011	5,623	2,035	974	2,645
54_G	16,374	2,272	1,812	515	2,864	525	251	1,348
41_D	37,427	5,228	4,181	1,198	6,639	1,892	898	3,086
42_D	11,892	1,659	1,328	380	2,107	592	281	980
42_G	0	0	0	0	0	0	0	0
43_D	42,019	5,867	4,694	1,345	7,451	2,115	1,003	3,464
43_G	306	42	34	10	54	21	10	25
61_D	343,088	21,441	27,919	3,613	27,205	10,053	1,587	11,001
61_G	26,683	1,668	2,172	281	2,117	1,129	178	856
62_D	316,247	19,764	25,735	3,330	25,077	18,169	2,869	10,140
62_G	0	0	0	0	0	0	0	0
11_G	1,158,899	205,638	213,698	22,375	294,501	56,769	29,320	194,164

2014 24-Hour Weekday SHP Summaries

SUT/FT	Harris	Brazori a	Fort Bend	Walle r	Montgome ry	Libert y	Chamber s	Galvesto n
21_D	44,062	3,925	8,568	385	5,730	817	400	3,171
21_G	44,304,96 4	3,946,15 8	8,615,046	387,37 4	5,761,095	817,68 3	400,094	3,188,400
31_D	677,216	84,796	102,281	12,077	114,762	27,387	13,645	63,885
31_G	14,035,45 8	1,757,432	2,119,803	250,29 1	2,378,489	581,38 0	289,669	1,324,049
32_D	293,961	36,810	44,399	5,242	49,817	12,379	6,168	27,732
32_G	4,610,254	577,266	696,295	82,213	781,265	190,53 1	94,931	434,912
51_D	8,681	1,235	997	278	1,571	551	262	716
51_G	4,508	641	518	144	815	147	70	372
52_D	618,378	87,901	71,025	19,756	111,822	41,622	19,785	50,995
52_G	315,621	44,865	36,251	10,083	57,075	10,673	5,074	26,028
53_D	67,968	9,660	7,806	2,171	12,289	2,004	952	5,605
53_G	34,784	4,944	3,995	1,111	6,290	518	247	2,868
54_D	34,125	4,852	3,920	1,090	6,172	2,184	1,038	2,815
54_G	17,387	2,472	1,997	555	3,144	563	268	1,434
41_D	40,409	5,780	4,693	1,314	7,375	2,053	968	3,339
42_D	11,949	1,710	1,388	389	2,182	613	289	988
42_G	0	0	0	0	0	0	0	0
43_D	44,636	6,382	5,183	1,450	8,143	2,270	1,071	3,687
43_G	325	46	38	10	59	23	11	27
61_D	364,293	23,283	30,670	3,895	30,504	10,781	1,722	11,693
61_G	28,332	1,811	2,386	303	2,373	1,210	193	910
62_D	335,793	21,462	28,271	3,591	28,118	19,484	3,113	10,779
62_G	0	0	0	0	0	0	0	0
11_G	1,230,702	223,343	235,888	24,123	321,711	60,851	31,315	206,552

2017 24-Hour Weekday SHP Summaries

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	46,747	4,261	9,454	415	6,255	875	426	3,373
21_G	47,005,455	4,284,497	9,505,293	417,586	6,289,325	876,053	427,022	3,391,228
31_D	718,755	92,081	112,853	13,020	125,318	29,349	14,569	67,955
31_G	14,896,363	1,908,410	2,338,928	269,833	2,597,257	623,041	309,285	1,408,390
32_D	311,992	39,972	48,988	5,652	54,400	13,267	6,586	29,499
32_G	4,893,038	626,858	768,272	88,632	853,125	204,184	101,360	462,616
51_D	9,202	1,341	1,099	299	1,714	590	279	762
51_G	4,778	696	570	155	890	157	74	395
52_D	655,443	95,421	78,249	21,297	122,003	44,586	21,109	54,229
52_G	334,539	48,704	39,938	10,870	62,271	11,433	5,413	27,679
53_D	72,042	10,487	8,600	2,340	13,408	2,146	1,016	5,960
53_G	36,869	5,367	4,401	1,198	6,863	555	263	3,050
54_D	36,170	5,267	4,318	1,175	6,733	2,340	1,108	2,993
54_G	18,429	2,683	2,200	599	3,430	603	286	1,525
41_D	42,833	6,275	5,172	1,416	8,049	2,200	1,033	3,551
42_D	12,666	1,857	1,530	419	2,381	657	308	1,050
42_G	0	0	0	0	0	0	0	0
43_D	47,314	6,929	5,713	1,564	8,888	2,432	1,142	3,921
43_G	345	50	41	11	64	24	11	28
61_D	385,899	25,245	33,732	4,197	33,192	11,536	1,834	12,423
61_G	30,013	1,964	2,624	327	2,582	1,295	206	967
62_D	355,708	23,270	31,094	3,869	30,596	20,850	3,315	11,452
62_G	0	0	0	0	0	0	0	0
11_G	1,306,916	242,568	260,380	26,008	351,430	65,226	33,446	219,730

2018 24-Hour Weekday SHP Summaries

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	143,711	13,201	29,444	1,284	19,413	2,687	1,308	10,377
21_G	47,844,071	4,394,661	9,802,149	427,311	6,462,743	894,603	435,489	3,454,692
31_D	908,192	117,242	144,456	16,537	159,856	37,391	18,538	85,930
31_G	15,019,555	1,938,941	2,389,004	273,493	2,643,697	630,215	312,457	1,421,111
32_D	355,776	45,928	56,589	6,478	62,622	14,903	7,389	33,662
32_G	4,953,473	639,466	787,897	90,198	871,896	207,619	102,937	468,685
51_D	6,952	1,021	840	227	1,307	457	216	576
51_G	3,457	509	418	113	651	111	52	287
52_D	671,253	98,504	81,174	21,935	126,152	45,842	21,674	55,599
52_G	342,950	50,326	41,473	11,207	64,452	11,754	5,558	28,406
53_D	73,825	10,832	8,927	2,412	13,873	2,210	1,045	6,114
53_G	37,601	5,518	4,547	1,229	7,067	568	269	3,114
54_D	36,197	5,313	4,377	1,183	6,804	2,333	1,103	2,998
54_G	18,444	2,707	2,230	603	3,467	605	286	1,528
41_D	44,063	6,504	5,390	1,464	8,358	2,265	1,063	3,656
42_D	12,566	1,857	1,538	418	2,386	647	303	1,043
42_G	0	0	0	0	0	0	0	0
43_D	48,228	7,122	5,900	1,604	9,151	2,489	1,167	4,002
43_G	351	52	43	12	66	25	12	29
61_D	393,348	25,930	34,815	4,303	34,131	11,799	1,872	12,676
61_G	30,592	2,017	2,708	335	2,655	1,325	210	986
62_D	362,575	23,902	32,092	3,966	31,462	21,324	3,384	11,684
62_G	0	0	0	0	0	0	0	0
11_G	1,333,353	249,337	269,096	26,669	361,934	66,753	34,188	224,307

2019 24-Hour Weekday SHP Summaries

SUT/FT	Harris	Brazori a	Fort Bend	Walle r	Montgome ry	Libert y	Chamber s	Galvesto n
21_D	146,566	13,567	30,424	1,316	19,988	2,749	1,336	10,592
21_G	48,794,62 4	4,516,64 9	10,128,391	438,13 8	6,654,119	915,361	445,009	3,526,393
31_D	926,365	120,505	149,266	16,957	164,609	38,263	18,947	87,717
31_G	15,320,10 4	1,992,90 5	2,468,553	280,43 2	2,722,294	644,90 9	319,345	1,450,655
32_D	362,896	47,206	58,473	6,643	64,484	15,250	7,551	34,362
32_G	5,052,594	657,264	814,133	92,487	897,817	212,46 0	105,206	478,428
51_D	7,088	1,049	868	233	1,345	467	221	588
51_G	3,525	523	432	116	671	113	54	293
52_D	684,337	101,230	83,824	22,490	129,856	46,902	22,144	56,748
52_G	349,635	51,719	42,827	11,491	66,344	12,026	5,678	28,993
53_D	75,264	11,132	9,219	2,473	14,280	2,261	1,068	6,241
53_G	38,334	5,671	4,696	1,260	7,274	581	275	3,179
54_D	36,902	5,460	4,520	1,213	7,004	2,387	1,127	3,060
54_G	18,803	2,782	2,303	618	3,569	619	293	1,560
41_D	44,923	6,685	5,567	1,501	8,604	2,318	1,086	3,732
42_D	12,811	1,909	1,588	429	2,457	662	310	1,065
42_G	0	0	0	0	0	0	0	0
43_D	49,169	7,320	6,094	1,644	9,421	2,547	1,193	4,085
43_G	358	53	44	12	68	25	12	30
61_D	400,925	26,633	35,928	4,411	35,093	12,066	1,910	12,932
61_G	31,182	2,072	2,795	343	2,730	1,355	214	1,006
62_D	369,559	24,550	33,117	4,066	32,348	21,808	3,453	11,921
62_G	0	0	0	0	0	0	0	0
11_G	1,360,324	256,295	278,105	27,346	372,753	68,316	34,947	228,979

2002 24-Hour Weekday Starts Summaries

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	27,961	1,812	2,996	203	2,322	547	227	2,008
21_G	9,308,001	603,271	997,417	67,560	772,915	136,535	56,575	668,566
31_D	47,433	4,899	4,883	706	5,907	1,557	693	4,326
31_G	2,919,871	301,556	300,560	43,490	363,644	95,662	42,572	266,273
32_D	89,642	9,258	9,227	1,335	11,164	2,942	1,309	8,175
32_G	941,687	97,255	96,933	14,026	117,279	30,850	13,729	85,876
51_D	2,164	165	117	38	203	71	28	115
51_G	1,112	85	60	20	104	18	7	59
52_D	105,416	8,023	5,674	1,863	9,894	3,617	1,442	5,597
52_G	53,857	4,099	2,899	952	5,055	926	369	2,860
53_D	7,114	541	383	126	668	107	43	378
53_G	3,643	277	196	64	342	28	11	193
54_D	472	36	25	8	44	15	6	25
54_G	241	18	13	4	23	4	2	13
41_D	2,640	201	142	47	248	68	27	140
42_D	1,651	126	89	29	155	43	17	88
42_G	0	0	0	0	0	0	0	0
43_D	6,267	477	337	111	588	162	64	333
43_G	46	4	2	1	4	2	1	2
61_D	92,000	5,266	5,266	908	5,288	2,778	501	2,938
61_G	7,154	409	409	71	411	312	56	228
62_D	61,302	3,509	3,509	605	3,523	3,629	655	1,958
62_G	0	0	0	0	0	0	0	0
11_G	12,866	1,461	1,447	142	1,839	332	192	1,753

2008 24-Hour Weekday Starts Summaries

SUT/FT	Harris	Brazori a	Fort Bend	Walle r	Montgome ry	Libert y	Chamber s	Galvesto n
21_D	10,242	735	1,504	82	1,046	151	73	741
21_G	10,296,63 1	738,947	1,511,736	82,711	1,051,162	150,62 9	73,326	745,352
31_D	112,909	11,414	13,413	1,795	15,173	3,475	1,734	10,254
31_G	3,311,502	334,773	393,393	52,652	444,999	105,20 3	52,482	300,752
32_D	78,486	7,934	9,324	1,248	10,547	2,491	1,243	7,128
32_G	1,111,802	112,396	132,078	17,678	149,404	35,280	17,600	100,974
51_D	1,745	186	151	48	246	82	39	124
51_G	921	98	80	25	130	21	10	66
52_D	172,771	18,377	14,996	4,732	24,322	8,496	4,074	12,299
52_G	88,192	9,381	7,655	2,415	12,416	2,178	1,044	6,278
53_D	11,636	1,238	1,010	319	1,638	252	121	828
53_G	5,929	631	515	162	835	64	31	422
54_D	776	83	67	21	109	36	17	55
54_G	395	42	34	11	56	9	4	28
41_D	4,399	468	382	120	619	163	78	313
42_D	2,308	245	200	63	325	85	41	164
42_G	0	0	0	0	0	0	0	0
43_D	10,253	1,091	890	281	1,443	379	182	730
43_G	74	8	6	2	10	4	2	5
61_D	97,574	5,645	7,472	1,277	8,000	3,210	816	3,147
61_G	7,587	439	581	99	622	360	92	245
62_D	65,016	3,762	4,979	851	5,331	4,193	1,066	2,097
62_G	0	0	0	0	0	0	0	0
11_G	21,508	3,258	2,998	377	4,528	860	454	3,654

2011 24-Hour Weekday Starts Summaries

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	10,715	914	1,951	94	1,335	196	99	758
21_G	10,771,342	918,333	1,961,813	94,571	1,341,760	196,181	99,406	762,063
31_D	113,723	13,675	16,350	1,986	18,486	4,470	2,260	10,550
31_G	3,335,367	401,072	479,535	58,239	542,175	135,306	68,410	309,420
32_D	79,052	9,506	11,365	1,380	12,850	3,204	1,620	7,334
32_G	1,119,814	134,656	160,999	19,553	182,030	45,375	22,941	103,884
51_D	1,900	249	209	57	320	116	58	151
51_G	1,003	131	110	30	169	30	15	80
52_D	188,128	24,646	20,651	5,619	31,710	12,026	6,014	14,933
52_G	96,032	12,581	10,542	2,868	16,187	3,083	1,542	7,622
53_D	12,670	1,660	1,391	378	2,136	357	178	1,006
53_G	6,456	846	709	193	1,088	90	45	512
54_D	845	111	93	25	142	51	26	67
54_G	430	56	47	13	73	13	7	34
41_D	4,790	628	526	143	807	231	116	380
42_D	2,513	329	276	75	424	120	60	199
42_G	0	0	0	0	0	0	0	0
43_D	11,164	1,463	1,226	333	1,882	537	269	886
43_G	81	11	9	2	14	5	3	6
61_D	95,904	6,133	8,116	1,233	8,376	2,947	1,090	3,305
61_G	7,457	477	631	96	651	331	122	257
62_D	63,903	4,086	5,408	821	5,581	3,849	1,424	2,202
62_G	0	0	0	0	0	0	0	0
11_G	21,526	3,814	3,965	415	5,463	1,053	544	3,601

2014 24-Hour Weekday Starts Summaries

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	11,379	992	2,154	101	1,458	210	106	806
21_G	11,438,764	997,387	2,165,536	101,959	1,465,720	210,287	106,171	810,682
31_D	168,597	20,734	25,196	2,989	28,191	6,740	3,396	15,668
31_G	3,494,273	429,724	522,195	61,942	584,278	143,086	72,084	324,722
32_D	76,314	9,385	11,405	1,353	12,761	3,177	1,600	7,092
32_G	1,196,769	147,178	178,849	21,215	200,112	48,894	24,632	111,215
51_D	1,514	203	173	46	263	92	46	120
51_G	785	105	90	24	136	24	12	62
52_D	200,738	26,896	22,905	6,087	34,805	12,948	6,452	15,961
52_G	102,460	13,728	11,691	3,107	17,765	3,320	1,654	8,147
53_D	13,527	1,812	1,544	410	2,345	382	190	1,076
53_G	6,924	928	790	210	1,201	99	49	551
54_D	897	120	102	27	156	55	27	71
54_G	457	61	52	14	79	14	7	36
41_D	5,173	693	590	157	897	251	125	411
42_D	2,533	339	289	77	439	124	62	201
42_G	0	0	0	0	0	0	0	0
43_D	11,863	1,589	1,354	360	2,057	576	287	943
43_G	86	12	10	3	15	6	3	7
61_D	101,846	6,661	8,959	1,329	9,150	3,158	1,164	3,516
61_G	7,919	518	697	103	711	355	131	273
62_D	67,862	4,438	5,970	886	6,097	4,126	1,521	2,343
62_G	0	0	0	0	0	0	0	0
11_G	22,860	4,143	4,377	448	5,968	1,129	581	3,831

2017 24-Hour Weekday Starts Summaries

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	12,084	1,078	2,378	109	1,593	225	113	858
21_G	12,147,549	1,083,247	2,390,420	109,927	1,601,139	225,407	113,398	862,405
31_D	179,044	22,519	27,812	3,222	30,796	7,225	3,627	16,667
31_G	3,710,790	466,717	576,423	66,782	638,260	153,374	76,991	345,440
32_D	81,043	10,193	12,589	1,459	13,939	3,405	1,709	7,544
32_G	1,270,925	159,848	197,422	22,872	218,601	52,410	26,309	118,311
51_D	1,608	220	191	50	287	99	49	128
51_G	834	114	99	26	149	26	13	66
52_D	213,177	29,211	25,283	6,562	38,021	13,879	6,891	16,979
52_G	108,809	14,910	12,905	3,350	19,407	3,559	1,767	8,667
53_D	14,366	1,968	1,704	442	2,562	410	203	1,144
53_G	7,353	1,008	872	226	1,311	106	53	586
54_D	953	131	113	29	170	59	29	76
54_G	486	67	58	15	87	15	8	39
41_D	5,494	753	652	169	980	269	134	438
42_D	2,690	369	319	83	480	133	66	214
42_G	0	0	0	0	0	0	0	0
43_D	12,598	1,726	1,494	388	2,247	617	307	1,003
43_G	91	13	11	3	16	6	3	7
61_D	108,157	7,234	9,890	1,433	9,995	3,385	1,244	3,741
61_G	8,410	562	769	111	777	380	140	291
62_D	72,067	4,820	6,590	955	6,660	4,423	1,625	2,492
62_G	0	0	0	0	0	0	0	0
11_G	24,276	4,499	4,832	483	6,519	1,210	621	4,076

2018 24-Hour Weekday Starts Summaries

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	37,154	3,338	7,406	338	4,944	691	347	2,639
21_G	12,368,612	1,111,249	2,465,509	112,493	1,645,704	230,224	115,684	878,605
31_D	226,282	28,674	35,606	4,093	39,289	9,205	4,615	21,077
31_G	3,742,289	474,216	588,860	67,689	649,769	155,154	77,792	348,573
32_D	92,428	11,712	14,544	1,672	16,048	3,826	1,918	8,609
32_G	1,286,906	163,074	202,498	23,277	223,444	53,297	26,722	119,868
51_D	1,216	168	146	38	219	76	38	97
51_G	608	84	73	19	109	19	9	48
52_D	218,462	30,160	26,246	6,759	39,333	14,274	7,079	17,410
52_G	111,611	15,409	13,409	3,453	20,095	3,660	1,815	8,895
53_D	14,730	2,034	1,770	456	2,652	422	209	1,174
53_G	7,504	1,036	902	232	1,351	108	54	598
54_D	954	132	115	30	172	59	29	76
54_G	486	67	58	15	88	15	8	39
41_D	5,651	780	679	175	1,017	277	137	450
42_D	2,671	369	321	83	481	131	65	213
42_G	0	0	0	0	0	0	0	0
43_D	12,857	1,775	1,545	398	2,315	632	314	1,025
43_G	93	13	11	3	17	6	3	7
61_D	110,346	7,436	10,221	1,469	10,294	3,465	1,271	3,818
61_G	8,580	578	795	114	800	389	143	297
62_D	73,526	4,955	6,810	979	6,859	4,526	1,661	2,544
62_G	0	0	0	0	0	0	0	0
11_G	24,767	4,625	4,993	495	6,714	1,238	634	4,161

2019 24-Hour Weekday Starts Summaries

SUT/FT	Harris	Brazori a	Fort Bend	Walle r	Montgome ry	Libert y	Chamber s	Galvesto n
21_D	37,906	3,431	7,654	347	5,091	708	355	2,694
21_G	12,618,97 4	1,142,263	2,548,062	115,350	1,694,903	235,61 5	118,251	896,907
31_D	230,862	29,474	36,798	4,197	40,464	9,421	4,718	21,516
31_G	3,818,039	487,451	608,577	69,409	669,194	158,78 7	79,518	355,834
32_D	94,299	12,039	15,031	1,714	16,528	3,915	1,961	8,788
32_G	1,312,955	167,626	209,279	23,868	230,124	54,545	27,315	122,365
51_D	1,240	173	151	39	225	78	39	99
51_G	620	86	75	19	113	19	9	49
52_D	222,884	31,002	27,125	6,931	40,508	14,608	7,236	17,773
52_G	113,870	15,839	13,858	3,541	20,695	3,745	1,855	9,080
53_D	15,028	2,090	1,829	467	2,731	432	214	1,198
53_G	7,656	1,065	932	238	1,391	111	55	610
54_D	974	135	118	30	177	60	30	78
54_G	496	69	60	15	90	16	8	40
41_D	5,766	802	702	179	1,048	283	140	460
42_D	2,725	379	332	85	495	134	66	217
42_G	0	0	0	0	0	0	0	0
43_D	13,117	1,825	1,596	408	2,384	647	320	1,046
43_G	95	13	12	3	17	6	3	8
61_D	112,580	7,643	10,563	1,507	10,602	3,546	1,299	3,898
61_G	8,754	594	821	117	824	398	146	303
62_D	75,014	5,093	7,038	1,004	7,064	4,632	1,697	2,597
62_G	0	0	0	0	0	0	0	0
11_G	25,269	4,754	5,161	508	6,915	1,267	649	4,247

24-Hour Weekday SHI Summaries (CLhT_Diesel Only)

County	2002	2008	2011	2014	2017	2018	2019
Harris	17,032	19,490	20,474	21,667	23,010	23,475	23,951
Brazoria	153	157	182	200	218	224	230
Fort Bend	3,072	3,415	4,214	4,663	5,147	5,320	5,498
Waller	1,560	1,835	1,905	2,046	2,205	2,260	2,318
Montgomery	4,242	4,357	5,248	5,283	5,771	5,943	6,121
Liberty	449	466	600	652	699	715	732
Chambers	840	1,575	2,138	2,272	2,420	2,471	2,523
Galveston	481	503	517	550	585	597	609

APPENDIX H:
SOURCE TYPE AGE AND FUEL/ENGINE FRACTIONS INPUTS TO MOVES

Brazoria County 2002 Age Distributions Inputs to MOVES

Age	MC	PC	PT	LCT	IBus	TBus	SBus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.110231	0.056917	0.077390	0.077390	0.057086	0.044226	0.054177	0.027706	0.101906	0.102260	0.051473	0.039361	0.033087
1	0.139160	0.083299	0.106849	0.106849	0.067160	0.052030	0.063738	0.029896	0.137869	0.143115	0.060557	0.067005	0.059279
2	0.104446	0.097620	0.091753	0.091753	0.074487	0.057706	0.070691	0.043169	0.139706	0.123935	0.067163	0.084079	0.078329
3	0.081912	0.086239	0.088335	0.088335	0.076013	0.058889	0.072140	0.050515	0.117981	0.115521	0.068539	0.091826	0.078564
4	0.060901	0.078020	0.067279	0.067279	0.060030	0.072023	0.059327	0.039893	0.054890	0.055213	0.041990	0.066096	0.066623
5	0.055116	0.074382	0.074891	0.074891	0.050385	0.067887	0.057010	0.033484	0.081717	0.073413	0.066692	0.050839	0.052283
6	0.050244	0.065494	0.058156	0.058156	0.043430	0.065192	0.051257	0.073919	0.044630	0.040436	0.043052	0.048257	0.050489
7	0.035932	0.070753	0.060415	0.060415	0.058246	0.055131	0.067565	0.087457	0.062570	0.053893	0.052418	0.077861	0.070480
8	0.037454	0.058576	0.058029	0.058029	0.046777	0.050144	0.034008	0.056440	0.041229	0.037105	0.052131	0.050170	0.048179
9	0.030146	0.055878	0.045078	0.045078	0.040161	0.043380	0.042359	0.050280	0.034536	0.029449	0.037417	0.049692	0.046822
10	0.022838	0.044788	0.038469	0.038469	0.030868	0.039299	0.035652	0.022238	0.025730	0.021518	0.034250	0.038213	0.033984
11	0.015834	0.042236	0.036803	0.036803	0.036500	0.041479	0.047487	0.063049	0.021725	0.022132	0.026585	0.046726	0.041654
12	0.016748	0.034882	0.032086	0.032086	0.042298	0.062690	0.055385	0.055438	0.021122	0.020865	0.035957	0.047587	0.040577
13	0.017052	0.033426	0.030857	0.030857	0.043797	0.049789	0.032989	0.045171	0.016925	0.017194	0.048492	0.040891	0.033233
14	0.012485	0.023723	0.024615	0.024615	0.042540	0.040918	0.040951	0.063457	0.015937	0.015593	0.044900	0.032570	0.029600
15	0.013398	0.018067	0.016565	0.016565	0.045676	0.039103	0.042849	0.052492	0.010451	0.012053	0.045301	0.025348	0.027100
16	0.024665	0.015524	0.018232	0.018232	0.040017	0.034406	0.039061	0.067697	0.009848	0.016246	0.034884	0.020278	0.026394
17	0.022838	0.013225	0.014814	0.014814	0.036115	0.030509	0.034656	0.036794	0.009848	0.015724	0.038270	0.021952	0.029982
18	0.013398	0.010023	0.013572	0.013572	0.029365	0.024575	0.027654	0.039478	0.008449	0.011020	0.040114	0.019944	0.025329
19	0.013398	0.005967	0.007513	0.007513	0.011980	0.024091	0.010443	0.011694	0.004992	0.006199	0.026863	0.008417	0.011549
20	0.023752	0.004065	0.008050	0.008050	0.010437	0.013429	0.007905	0.013460	0.007105	0.010204	0.016211	0.012961	0.017771
21	0.015225	0.003619	0.006044	0.006044	0.009369	0.006026	0.009592	0.012328	0.006172	0.008081	0.009213	0.013248	0.018511
22	0.017966	0.002620	0.002994	0.002994	0.012480	0.016749	0.009645	0.003160	0.003566	0.005448	0.001241	0.010617	0.014015
23	0.012485	0.002950	0.003658	0.003658	0.007676	0.005071	0.008149	0.003332	0.004800	0.007735	0.009806	0.012052	0.017132
24	0.009744	0.002329	0.003305	0.003305	0.006146	0.002264	0.007108	0.003312	0.004142	0.005370	0.013354	0.007987	0.010966
25	0.007308	0.001611	0.002528	0.002528	0.006667	0.000458	0.007229	0.000000	0.002935	0.005128	0.018503	0.004591	0.007815
26	0.004066	0.001223	0.001447	0.001447	0.002553	0.000881	0.004887	0.006886	0.000953	0.003182	0.011604	0.001016	0.004190
27	0.005082	0.000828	0.001345	0.001345	0.003150	0.000601	0.006086	0.002022	0.001215	0.002707	0.003020	0.001656	0.003073
28	0.004193	0.000876	0.001289	0.001289	0.003099	0.000582	0.000000	0.005149	0.001045	0.002035	0.000000	0.001889	0.003322
29	0.003304	0.000693	0.000684	0.000684	0.002572	0.000150	0.000000	0.000084	0.000657	0.001589	0.000000	0.001389	0.002952
30	0.018678	0.010148	0.006956	0.006956	0.002922	0.000320	0.000000	0.000000	0.005346	0.015638	0.000000	0.005481	0.016715

Brazoria County 2008 Age Distributions Inputs to MOVES

Age	MC	PC	PT	LCT	IBus	TBus	SBus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.077826	0.056807	0.042579	0.042579	0.073317	0.062325	0.070930	0.028618	0.142370	0.136309	0.069827	0.030912	0.032667
1	0.137493	0.089254	0.075420	0.075420	0.075781	0.064419	0.073313	0.030575	0.113204	0.111540	0.072173	0.088500	0.087489
2	0.125341	0.086555	0.071932	0.071932	0.076500	0.065031	0.074009	0.051881	0.125541	0.126729	0.072858	0.069736	0.066595
3	0.090251	0.082936	0.065669	0.065669	0.077219	0.065643	0.074705	0.047316	0.115078	0.118261	0.073543	0.057804	0.057036
4	0.071682	0.074475	0.074120	0.074120	0.061728	0.052473	0.059718	0.038077	0.078008	0.081544	0.058789	0.048335	0.041313
5	0.085336	0.070974	0.080433	0.080433	0.049092	0.041732	0.047494	0.028053	0.067027	0.067105	0.046755	0.040164	0.036925
6	0.074413	0.070538	0.084096	0.084096	0.042638	0.036246	0.041250	0.028282	0.057280	0.053713	0.040608	0.039559	0.037541
7	0.060896	0.066625	0.077908	0.077908	0.048658	0.041363	0.047073	0.029602	0.059366	0.056490	0.046341	0.056636	0.053820
8	0.041917	0.068966	0.065919	0.065919	0.052347	0.044499	0.050642	0.041462	0.053000	0.048678	0.049855	0.076783	0.070148
9	0.036729	0.059799	0.060831	0.060831	0.051817	0.044049	0.050130	0.047062	0.045827	0.043835	0.049350	0.072849	0.065860
10	0.024031	0.050536	0.044867	0.044867	0.039682	0.052240	0.039977	0.036040	0.018276	0.021730	0.029318	0.057112	0.053164
11	0.018979	0.041900	0.046267	0.046267	0.032626	0.048235	0.037632	0.029632	0.025708	0.026547	0.045615	0.040597	0.040519
12	0.018433	0.032987	0.033691	0.033691	0.027262	0.044903	0.032799	0.063414	0.015108	0.014532	0.028545	0.038867	0.039695
13	0.016794	0.032566	0.033141	0.033141	0.035808	0.037190	0.042342	0.073481	0.019175	0.017464	0.034038	0.051102	0.049750
14	0.014746	0.024081	0.029440	0.029440	0.028164	0.033128	0.020873	0.046443	0.011956	0.011305	0.033154	0.035452	0.034067
15	0.010104	0.019930	0.020552	0.020552	0.023433	0.027774	0.025194	0.040094	0.009184	0.008309	0.023060	0.031820	0.031486
16	0.008329	0.015478	0.017052	0.017052	0.017635	0.024637	0.020763	0.017363	0.007402	0.006196	0.020669	0.023303	0.022304
17	0.005461	0.012033	0.014126	0.014126	0.020201	0.025191	0.026792	0.047690	0.005650	0.006110	0.015542	0.025032	0.026334
18	0.006144	0.008612	0.012226	0.012226	0.022918	0.037271	0.030590	0.041051	0.005787	0.006137	0.020578	0.023390	0.023247
19	0.005735	0.007405	0.010814	0.010814	0.022980	0.028666	0.017645	0.032392	0.004691	0.005234	0.026875	0.020406	0.019267
20	0.004642	0.005151	0.008626	0.008626	0.021616	0.022814	0.021212	0.044068	0.003701	0.004329	0.024099	0.015953	0.016249
21	0.003960	0.003373	0.004400	0.004400	0.022716	0.021339	0.021723	0.035678	0.002117	0.003009	0.023796	0.011760	0.013807
22	0.009421	0.002794	0.004638	0.004638	0.019266	0.018176	0.019171	0.044544	0.002741	0.003994	0.017740	0.007912	0.012199
23	0.004096	0.002254	0.003775	0.003775	0.017014	0.015771	0.016643	0.023689	0.002010	0.003636	0.019043	0.007004	0.013053
24	0.004506	0.001714	0.003188	0.003188	0.013536	0.012430	0.012995	0.024871	0.001630	0.002498	0.019531	0.006831	0.009886
25	0.005188	0.001095	0.001863	0.001863	0.005402	0.011921	0.004800	0.007207	0.001005	0.001297	0.012795	0.002335	0.004308
26	0.004322	0.000991	0.001541	0.001541	0.004604	0.006501	0.003555	0.008115	0.000735	0.001371	0.007554	0.001974	0.004519
27	0.005403	0.000671	0.001433	0.001433	0.004043	0.002854	0.004220	0.007271	0.001272	0.001835	0.004199	0.002960	0.006190
28	0.004457	0.000710	0.001364	0.001364	0.005267	0.007757	0.004150	0.001823	0.001026	0.001389	0.000553	0.004081	0.006416
29	0.003512	0.000562	0.000729	0.000729	0.003168	0.002297	0.003429	0.001880	0.000534	0.000994	0.004276	0.002509	0.004646
30	0.019854	0.008225	0.007360	0.007360	0.003562	0.001128	0.004233	0.002327	0.003591	0.007881	0.008922	0.008320	0.019502

Brazoria County 2011 Age Distribution Inputs to MOVES (2011, 2014, 2017, 2018, and 2019 Analysis Years)

Age	MC	PC	PT	LCT	IBus	TBus	SBus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.029489	0.041465	0.025332	0.025332	0.069073	0.061049	0.067376	0.028802	0.100184	0.104789	0.066877	0.022568	0.021517
1	0.035165	0.059996	0.041857	0.041857	0.063576	0.056190	0.062014	0.027620	0.051441	0.054592	0.061554	0.023917	0.018938
2	0.084868	0.058323	0.038005	0.038005	0.061072	0.053977	0.059571	0.027681	0.054203	0.051380	0.059130	0.035695	0.033960
3	0.097743	0.088039	0.069630	0.069630	0.067253	0.059440	0.065601	0.031074	0.152909	0.148094	0.065115	0.047339	0.047549
4	0.113526	0.091720	0.077310	0.077310	0.068818	0.060823	0.067127	0.032867	0.091936	0.091287	0.066630	0.108389	0.100800
5	0.102174	0.081450	0.069196	0.069196	0.068082	0.060172	0.066409	0.054654	0.098539	0.100234	0.065917	0.079662	0.075154
6	0.078222	0.075970	0.063213	0.063213	0.067348	0.059523	0.065693	0.048848	0.085962	0.091233	0.065206	0.068333	0.065321
7	0.059532	0.065633	0.070261	0.070261	0.052749	0.046621	0.051452	0.038516	0.059676	0.063794	0.051071	0.051025	0.044275
8	0.071577	0.061826	0.073680	0.073680	0.041523	0.036699	0.040503	0.028087	0.050670	0.051239	0.040203	0.042259	0.037609
9	0.064655	0.060152	0.075947	0.075947	0.035696	0.031549	0.034819	0.028027	0.043809	0.040653	0.034561	0.043562	0.037406
10	0.049702	0.054189	0.069147	0.069147	0.040316	0.035632	0.039325	0.029033	0.044015	0.042649	0.039034	0.056600	0.052107
11	0.033504	0.053452	0.056586	0.056586	0.042925	0.037938	0.041871	0.040246	0.038221	0.034783	0.041560	0.064916	0.064101
12	0.028243	0.043257	0.050776	0.050776	0.041615	0.036780	0.040592	0.044739	0.032016	0.031295	0.040292	0.057678	0.056536
13	0.022290	0.034683	0.035564	0.035564	0.031537	0.043166	0.032034	0.033904	0.013503	0.014618	0.023687	0.044327	0.046019
14	0.015368	0.027046	0.036060	0.036060	0.025659	0.039441	0.029841	0.027586	0.018346	0.016614	0.036470	0.036010	0.035234
15	0.015921	0.020837	0.025890	0.025890	0.021215	0.036330	0.025734	0.058414	0.011306	0.009689	0.022582	0.030435	0.032591
16	0.013014	0.019007	0.025506	0.025506	0.027572	0.029773	0.032872	0.066975	0.012102	0.010658	0.026644	0.040685	0.040969
17	0.011076	0.013489	0.021554	0.021554	0.021230	0.025963	0.015864	0.041439	0.007387	0.006977	0.025405	0.025310	0.026449
18	0.007615	0.010277	0.013849	0.013849	0.017475	0.021535	0.018944	0.035394	0.005165	0.005036	0.017483	0.022433	0.024074
19	0.007061	0.007808	0.011582	0.011582	0.012872	0.018696	0.015280	0.015002	0.004240	0.003477	0.015336	0.016634	0.017590
20	0.003323	0.006053	0.009291	0.009291	0.014586	0.018911	0.019505	0.040761	0.004278	0.003744	0.011408	0.016184	0.019591
21	0.004015	0.004439	0.007457	0.007457	0.016370	0.027679	0.022031	0.034709	0.004124	0.003655	0.014943	0.014431	0.017397
22	0.003738	0.003324	0.006937	0.006937	0.016236	0.021057	0.012570	0.027090	0.003726	0.003071	0.019303	0.012723	0.013278
23	0.003600	0.002372	0.005215	0.005215	0.015106	0.016577	0.014946	0.036454	0.002698	0.002499	0.017121	0.009710	0.010967
24	0.002769	0.001837	0.002564	0.002564	0.015702	0.015336	0.015140	0.029193	0.001747	0.001536	0.016722	0.007013	0.009105
25	0.004984	0.001398	0.002973	0.002973	0.013171	0.012919	0.013214	0.036047	0.001824	0.001835	0.012329	0.004046	0.008763
26	0.003600	0.001450	0.002155	0.002155	0.011504	0.011086	0.011346	0.018960	0.000951	0.001467	0.013089	0.003462	0.008281
27	0.003600	0.001034	0.002329	0.002329	0.009052	0.008642	0.008761	0.019687	0.000784	0.001153	0.013278	0.003731	0.006291
28	0.003184	0.000647	0.001102	0.001102	0.003572	0.008196	0.003201	0.005641	0.000450	0.000748	0.008601	0.001349	0.002814
29	0.004430	0.000565	0.001028	0.001028	0.003011	0.004420	0.002344	0.006282	0.000642	0.001073	0.005022	0.001708	0.004440
30	0.022013	0.008262	0.008002	0.008002	0.004084	0.003881	0.004023	0.006268	0.003148	0.006131	0.003427	0.007867	0.020875

Chambers County 2002 Age Distributions Inputs to MOVES

Age	MC	PC	PT	LCT	IBus	TBus	SBus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.118329	0.035245	0.050515	0.050515	0.057086	0.044226	0.054177	0.027706	0.101906	0.102260	0.051473	0.039361	0.033087
1	0.139211	0.069871	0.099530	0.099530	0.067160	0.052030	0.063738	0.029896	0.137869	0.143115	0.060557	0.067005	0.059279
2	0.146172	0.099845	0.098129	0.098129	0.074487	0.057706	0.070691	0.043169	0.139706	0.123935	0.067163	0.084079	0.078329
3	0.090487	0.091266	0.091127	0.091127	0.076013	0.058889	0.072140	0.050515	0.117981	0.115521	0.068539	0.091826	0.078564
4	0.078886	0.080517	0.076823	0.076823	0.060030	0.072023	0.059327	0.039893	0.054890	0.055213	0.041990	0.066096	0.066623
5	0.044084	0.076176	0.083025	0.083025	0.050385	0.067887	0.057010	0.033484	0.081717	0.073413	0.066692	0.050839	0.052283
6	0.062645	0.068320	0.059718	0.059718	0.043430	0.065192	0.051257	0.073919	0.044630	0.040436	0.043052	0.048257	0.050489
7	0.041763	0.072351	0.063919	0.063919	0.058246	0.055131	0.067565	0.087457	0.062570	0.053893	0.052418	0.077861	0.070480
8	0.027842	0.057778	0.061118	0.061118	0.046777	0.050144	0.034008	0.056440	0.041229	0.037105	0.052131	0.050170	0.048179
9	0.034803	0.057364	0.046314	0.046314	0.040161	0.043380	0.042359	0.050280	0.034536	0.029449	0.037417	0.049692	0.046822
10	0.020882	0.046305	0.041312	0.041312	0.030868	0.039299	0.035652	0.022238	0.025730	0.021518	0.034250	0.038213	0.033984
11	0.009281	0.041240	0.037111	0.037111	0.036500	0.041479	0.047487	0.063049	0.021725	0.022132	0.026585	0.046726	0.041654
12	0.011601	0.033592	0.032510	0.032510	0.042298	0.062690	0.055385	0.055438	0.021122	0.020865	0.035957	0.047587	0.040577
13	0.013921	0.036072	0.026308	0.026308	0.043797	0.049789	0.032989	0.045171	0.016925	0.017194	0.048492	0.040891	0.033233
14	0.011601	0.027390	0.023107	0.023107	0.042540	0.040918	0.040951	0.063457	0.015937	0.015593	0.044900	0.032570	0.029600
15	0.000000	0.019018	0.014704	0.014704	0.045676	0.039103	0.042849	0.052492	0.010451	0.012053	0.045301	0.025348	0.027100
16	0.009281	0.015917	0.016205	0.016205	0.040017	0.034406	0.039061	0.067697	0.009848	0.016246	0.034884	0.020278	0.026394
17	0.020882	0.015090	0.015105	0.015105	0.036115	0.030509	0.034656	0.036794	0.009848	0.015724	0.038270	0.021952	0.029982
18	0.013921	0.012610	0.014904	0.014904	0.029365	0.024575	0.027654	0.039478	0.008449	0.011020	0.040114	0.019944	0.025329
19	0.011601	0.007235	0.008903	0.008903	0.011980	0.024091	0.010443	0.011694	0.004992	0.006199	0.026863	0.008417	0.011549
20	0.023202	0.005478	0.008403	0.008403	0.010437	0.013429	0.007905	0.013460	0.007105	0.010204	0.016211	0.012961	0.017771
21	0.013921	0.004651	0.007202	0.007202	0.009369	0.006026	0.009592	0.012328	0.006172	0.008081	0.009213	0.013248	0.018511
22	0.009281	0.002791	0.003101	0.003101	0.012480	0.016749	0.009645	0.003160	0.003566	0.005448	0.001241	0.010617	0.014015
23	0.016241	0.003824	0.004201	0.004201	0.007676	0.005071	0.008149	0.003332	0.004800	0.007735	0.009806	0.012052	0.017132
24	0.004640	0.002687	0.003001	0.003001	0.006146	0.002264	0.007108	0.003312	0.004142	0.005370	0.013354	0.007987	0.010966
25	0.004640	0.002481	0.002401	0.002401	0.006667	0.000458	0.007229	0.000000	0.002935	0.005128	0.018503	0.004591	0.007815
26	0.000994	0.000986	0.001726	0.001726	0.002553	0.000881	0.004887	0.006886	0.000953	0.003182	0.011604	0.001016	0.004190
27	0.001989	0.000807	0.001683	0.001683	0.003150	0.000601	0.006086	0.002022	0.001215	0.002707	0.003020	0.001656	0.003073
28	0.001989	0.001435	0.001278	0.001278	0.003099	0.000582	0.000000	0.005149	0.001045	0.002035	0.000000	0.001889	0.003322
29	0.000994	0.000717	0.000879	0.000879	0.002572	0.000150	0.000000	0.000084	0.000657	0.001589	0.000000	0.001389	0.002952
30	0.014915	0.010939	0.005737	0.005737	0.002922	0.000320	0.000000	0.000000	0.005346	0.015638	0.000000	0.005481	0.016715

Chambers County 2008 Age Distributions Inputs to MOVES

Age	MC	PC	PT	LCT	IBus	TBus	SBus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.061704	0.051752	0.040313	0.040313	0.073317	0.062325	0.070930	0.028618	0.142370	0.136309	0.069827	0.030912	0.032667
1	0.142018	0.090625	0.078471	0.078471	0.075781	0.064419	0.073313	0.030575	0.113204	0.111540	0.072173	0.088500	0.087489
2	0.133203	0.099824	0.074958	0.074958	0.076500	0.065031	0.074009	0.051881	0.125541	0.126729	0.072858	0.069736	0.066595
3	0.084231	0.089266	0.066496	0.066496	0.077219	0.065643	0.074705	0.047316	0.115078	0.118261	0.073543	0.057804	0.057036
4	0.074437	0.074308	0.081025	0.081025	0.061728	0.052473	0.059718	0.038077	0.078008	0.081544	0.058789	0.048335	0.041313
5	0.092067	0.065110	0.077193	0.077193	0.049092	0.041732	0.047494	0.028053	0.067027	0.067105	0.046755	0.040164	0.036925
6	0.082272	0.068469	0.085575	0.085575	0.042638	0.036246	0.041250	0.028282	0.057280	0.053713	0.040608	0.039559	0.037541
7	0.055828	0.060790	0.079987	0.079987	0.048658	0.041363	0.047073	0.029602	0.059366	0.056490	0.046341	0.056636	0.053820
8	0.052889	0.064710	0.062744	0.062744	0.052347	0.044499	0.050642	0.041462	0.053000	0.048678	0.049855	0.076783	0.070148
9	0.054848	0.056391	0.061946	0.061946	0.051817	0.044049	0.050130	0.047062	0.045827	0.043835	0.049350	0.072849	0.065860
10	0.024486	0.046473	0.044145	0.044145	0.039682	0.052240	0.039977	0.036040	0.018276	0.021730	0.029318	0.057112	0.053164
11	0.020568	0.040793	0.044384	0.044384	0.032626	0.048235	0.037632	0.029632	0.025708	0.026547	0.045615	0.040597	0.040519
12	0.015671	0.033035	0.030893	0.030893	0.027262	0.044903	0.032799	0.063414	0.015108	0.014532	0.028545	0.038867	0.039695
13	0.013712	0.033515	0.030494	0.030494	0.035808	0.037190	0.042342	0.073481	0.019175	0.017464	0.034038	0.051102	0.049750
14	0.013712	0.020957	0.028419	0.028419	0.028164	0.033128	0.020873	0.046443	0.011956	0.011305	0.033154	0.035452	0.034067
15	0.008815	0.018957	0.020356	0.020356	0.023433	0.027774	0.025194	0.040094	0.009184	0.008309	0.023060	0.031820	0.031486
16	0.004897	0.014878	0.016444	0.016444	0.017635	0.024637	0.020763	0.017363	0.007402	0.006196	0.020669	0.023303	0.022304
17	0.005877	0.013438	0.013571	0.013571	0.020201	0.025191	0.026792	0.047690	0.005650	0.006110	0.015542	0.025032	0.026334
18	0.001959	0.011198	0.012453	0.012453	0.022918	0.037271	0.030590	0.041051	0.005787	0.006137	0.020578	0.023390	0.023247
19	0.006856	0.009518	0.009899	0.009899	0.022980	0.028666	0.017645	0.032392	0.004691	0.005234	0.026875	0.020406	0.019267
20	0.003918	0.005999	0.007663	0.007663	0.021616	0.022814	0.021212	0.044068	0.003701	0.004329	0.024099	0.015953	0.016249
21	0.000979	0.004319	0.004311	0.004311	0.022716	0.021339	0.021723	0.035678	0.002117	0.003009	0.023796	0.011760	0.013807
22	0.002938	0.003279	0.004470	0.004470	0.019266	0.018176	0.019171	0.044544	0.002741	0.003994	0.017740	0.007912	0.012199
23	0.008815	0.002960	0.004550	0.004550	0.017014	0.015771	0.016643	0.023689	0.002010	0.003636	0.019043	0.007004	0.013053
24	0.004897	0.002720	0.004071	0.004071	0.013536	0.012430	0.012995	0.024871	0.001630	0.002498	0.019531	0.006831	0.009886
25	0.001959	0.001680	0.002634	0.002634	0.005402	0.011921	0.004800	0.007207	0.001005	0.001297	0.012795	0.002335	0.004308
26	0.001259	0.000996	0.001938	0.001938	0.004604	0.006501	0.003555	0.008115	0.000735	0.001371	0.007554	0.001974	0.004519
27	0.002519	0.000815	0.001864	0.001864	0.004043	0.002854	0.004220	0.007271	0.001272	0.001835	0.004199	0.002960	0.006190
28	0.002519	0.001449	0.001373	0.001373	0.005267	0.007757	0.004150	0.001823	0.001026	0.001389	0.000553	0.004081	0.006416
29	0.001259	0.000725	0.000944	0.000944	0.003168	0.002297	0.003429	0.001880	0.000534	0.000994	0.004276	0.002509	0.004646
30	0.018889	0.011052	0.006415	0.006415	0.003562	0.001128	0.004233	0.002327	0.003591	0.007881	0.008922	0.008320	0.019502

Chambers County 2011 Age Distribution Inputs to MOVES (2011, 2014, 2017, 2018, and 2019 Analysis Years)

Age	MC	PC	PT	LCT	IBus	TBus	SBus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.016832	0.043599	0.026411	0.026411	0.069073	0.061049	0.067376	0.028802	0.100184	0.104789	0.066877	0.022568	0.021517
1	0.028713	0.062691	0.040891	0.040891	0.063576	0.056190	0.062014	0.027620	0.051441	0.054592	0.061554	0.023917	0.018938
2	0.086139	0.063048	0.046444	0.046444	0.061072	0.053977	0.059571	0.027681	0.054203	0.051380	0.059130	0.035695	0.033960
3	0.094059	0.103227	0.077431	0.077431	0.067253	0.059440	0.065601	0.031074	0.152909	0.148094	0.065115	0.047339	0.047549
4	0.130693	0.098597	0.083433	0.083433	0.068818	0.060823	0.067127	0.032867	0.091936	0.091287	0.066630	0.108389	0.100800
5	0.109901	0.091757	0.075180	0.075180	0.068082	0.060172	0.066409	0.054654	0.098539	0.100234	0.065917	0.079662	0.075154
6	0.080198	0.077652	0.066627	0.066627	0.067348	0.059523	0.065693	0.048848	0.085962	0.091233	0.065206	0.068333	0.065321
7	0.068317	0.062122	0.075405	0.075405	0.052749	0.046621	0.051452	0.038516	0.059676	0.063794	0.051071	0.051025	0.044275
8	0.075248	0.052148	0.073980	0.073980	0.041523	0.036699	0.040503	0.028087	0.050670	0.051239	0.040203	0.042259	0.037609
9	0.067327	0.055639	0.069928	0.069928	0.035696	0.031549	0.034819	0.028027	0.043809	0.040653	0.034561	0.043562	0.037406
10	0.045545	0.048372	0.067977	0.067977	0.040316	0.035632	0.039325	0.029033	0.044015	0.042649	0.039034	0.056600	0.052107
11	0.039604	0.045166	0.051170	0.051170	0.042925	0.037938	0.041871	0.040246	0.038221	0.034783	0.041560	0.064916	0.064101
12	0.040594	0.037900	0.045618	0.045618	0.041615	0.036780	0.040592	0.044739	0.032016	0.031295	0.040292	0.057678	0.056536
13	0.023762	0.028924	0.031813	0.031813	0.031537	0.043166	0.032034	0.033904	0.013503	0.014618	0.023687	0.044327	0.046019
14	0.010891	0.025219	0.031438	0.031438	0.025659	0.039441	0.029841	0.027586	0.018346	0.016614	0.036470	0.036010	0.035234
15	0.011881	0.019377	0.022209	0.022209	0.021215	0.036330	0.025734	0.058414	0.011306	0.009689	0.022582	0.030435	0.032591
16	0.006931	0.017953	0.024010	0.024010	0.027572	0.029773	0.032872	0.066975	0.012102	0.010658	0.026644	0.040685	0.040969
17	0.008911	0.011968	0.020408	0.020408	0.021230	0.025963	0.015864	0.041439	0.007387	0.006977	0.025405	0.025310	0.026449
18	0.007921	0.010401	0.013205	0.013205	0.017475	0.021535	0.018944	0.035394	0.005165	0.005036	0.017483	0.022433	0.024074
19	0.003960	0.007053	0.010579	0.010579	0.012872	0.018696	0.015280	0.015002	0.004240	0.003477	0.015336	0.016634	0.017590
20	0.004950	0.007124	0.008929	0.008929	0.014586	0.018911	0.019505	0.040761	0.004278	0.003744	0.011408	0.016184	0.019591
21	0.001980	0.005486	0.007428	0.007428	0.016370	0.027679	0.022031	0.034709	0.004124	0.003655	0.014943	0.014431	0.017397
22	0.003960	0.004203	0.006227	0.006227	0.016236	0.021057	0.012570	0.027090	0.003726	0.003071	0.019303	0.012723	0.013278
23	0.002970	0.002208	0.004727	0.004727	0.015106	0.016577	0.014946	0.036454	0.002698	0.002499	0.017121	0.009710	0.010967
24	0.001980	0.002636	0.002776	0.002776	0.015702	0.015336	0.015140	0.029193	0.001747	0.001536	0.016722	0.007013	0.009105
25	0.001980	0.001781	0.002701	0.002701	0.013171	0.012919	0.013214	0.036047	0.001824	0.001835	0.012329	0.004046	0.008763
26	0.001980	0.001781	0.002176	0.002176	0.011504	0.011086	0.011346	0.018960	0.000951	0.001467	0.013089	0.003462	0.008281
27	0.003960	0.001282	0.002326	0.002326	0.009052	0.008642	0.008761	0.019687	0.000784	0.001153	0.013278	0.003731	0.006291
28	0.000000	0.000427	0.001050	0.001050	0.003572	0.008196	0.003201	0.005641	0.000450	0.000748	0.008601	0.001349	0.002814
29	0.002970	0.000712	0.000975	0.000975	0.003011	0.004420	0.002344	0.006282	0.000642	0.001073	0.005022	0.001708	0.004440
30	0.015842	0.009546	0.006528	0.006528	0.004084	0.003881	0.004023	0.006268	0.003148	0.006131	0.003427	0.007867	0.020875

Fort Bend County 2002 Age Distributions Inputs to MOVES

Age	MC	PC	PT	LCT	IBus	TBus	SBus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.151907	0.060388	0.093630	0.093630	0.057086	0.044226	0.054177	0.027706	0.101906	0.102260	0.051473	0.039361	0.033087
1	0.141451	0.092442	0.123951	0.123951	0.067160	0.052030	0.063738	0.029896	0.137869	0.143115	0.060557	0.067005	0.059279
2	0.107626	0.110740	0.111809	0.111809	0.074487	0.057706	0.070691	0.043169	0.139706	0.123935	0.067163	0.084079	0.078329
3	0.091021	0.094678	0.100714	0.100714	0.076013	0.058889	0.072140	0.050515	0.117981	0.115521	0.068539	0.091826	0.078564
4	0.069188	0.085928	0.076485	0.076485	0.060030	0.072023	0.059327	0.039893	0.054890	0.055213	0.041990	0.066096	0.066623
5	0.046740	0.078293	0.075181	0.075181	0.050385	0.067887	0.057010	0.033484	0.081717	0.073413	0.066692	0.050839	0.052283
6	0.045510	0.071256	0.053658	0.053658	0.043430	0.065192	0.051257	0.073919	0.044630	0.040436	0.043052	0.048257	0.050489
7	0.037208	0.072659	0.056521	0.056521	0.058246	0.055131	0.067565	0.087457	0.062570	0.053893	0.052418	0.077861	0.070480
8	0.036593	0.056825	0.051887	0.051887	0.046777	0.050144	0.034008	0.056440	0.041229	0.037105	0.052131	0.050170	0.048179
9	0.031058	0.051550	0.040580	0.040580	0.040161	0.043380	0.042359	0.050280	0.034536	0.029449	0.037417	0.049692	0.046822
10	0.019065	0.042365	0.032561	0.032561	0.030868	0.039299	0.035652	0.022238	0.025730	0.021518	0.034250	0.038213	0.033984
11	0.014760	0.038568	0.028352	0.028352	0.036500	0.041479	0.047487	0.063049	0.021725	0.022132	0.026585	0.046726	0.041654
12	0.011993	0.032265	0.024668	0.024668	0.042298	0.062690	0.055385	0.055438	0.021122	0.020865	0.035957	0.047587	0.040577
13	0.013530	0.023938	0.022260	0.022260	0.043797	0.049789	0.032989	0.045171	0.016925	0.017194	0.048492	0.040891	0.033233
14	0.010455	0.018644	0.018179	0.018179	0.042540	0.040918	0.040951	0.063457	0.015937	0.015593	0.044900	0.032570	0.029600
15	0.011685	0.013797	0.012511	0.012511	0.045676	0.039103	0.042849	0.052492	0.010451	0.012053	0.045301	0.025348	0.027100
16	0.017528	0.011080	0.013432	0.013432	0.040017	0.034406	0.039061	0.067697	0.009848	0.016246	0.034884	0.020278	0.026394
17	0.013838	0.009930	0.012384	0.012384	0.036115	0.030509	0.034656	0.036794	0.009848	0.015724	0.038270	0.021952	0.029982
18	0.011070	0.007435	0.010811	0.010811	0.029365	0.024575	0.027654	0.039478	0.008449	0.011020	0.040114	0.019944	0.025329
19	0.016298	0.004378	0.005696	0.005696	0.011980	0.024091	0.010443	0.011694	0.004992	0.006199	0.026863	0.008417	0.011549
20	0.018143	0.003421	0.006844	0.006844	0.010437	0.013429	0.007905	0.013460	0.007105	0.010204	0.016211	0.012961	0.017771
21	0.012608	0.002430	0.005299	0.005299	0.009369	0.006026	0.009592	0.012328	0.006172	0.008081	0.009213	0.013248	0.018511
22	0.010148	0.001831	0.002919	0.002919	0.012480	0.016749	0.009645	0.003160	0.003566	0.005448	0.001241	0.010617	0.014015
23	0.008303	0.002171	0.004180	0.004180	0.007676	0.005071	0.008149	0.003332	0.004800	0.007735	0.009806	0.012052	0.017132
24	0.009225	0.001755	0.003089	0.003089	0.006146	0.002264	0.007108	0.003312	0.004142	0.005370	0.013354	0.007987	0.010966
25	0.004920	0.001291	0.002338	0.002338	0.006667	0.000458	0.007229	0.000000	0.002935	0.005128	0.018503	0.004591	0.007815
26	0.005119	0.000776	0.001003	0.001003	0.002553	0.000881	0.004887	0.006886	0.000953	0.003182	0.011604	0.001016	0.004190
27	0.006355	0.000784	0.001506	0.001506	0.003150	0.000601	0.006086	0.002022	0.001215	0.002707	0.003020	0.001656	0.003073
28	0.003884	0.000542	0.001288	0.001288	0.003099	0.000582	0.000000	0.005149	0.001045	0.002035	0.000000	0.001889	0.003322
29	0.004766	0.000537	0.000577	0.000577	0.002572	0.000150	0.000000	0.000084	0.000657	0.001589	0.000000	0.001389	0.002952
30	0.018006	0.007302	0.005686	0.005686	0.002922	0.000320	0.000000	0.000000	0.005346	0.015638	0.000000	0.005481	0.016715

Fort Bend County 2008 Age Distributions Inputs to MOVES

Age	MC	PC	PT	LCT	IBus	TBus	SBus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.078955	0.058895	0.043554	0.043554	0.073317	0.062325	0.070930	0.028618	0.142370	0.136309	0.069827	0.030912	0.032667
1	0.150193	0.088738	0.086139	0.086139	0.075781	0.064419	0.073313	0.030575	0.113204	0.111540	0.072173	0.088500	0.087489
2	0.132977	0.088532	0.075756	0.075756	0.076500	0.065031	0.074009	0.051881	0.125541	0.126729	0.072858	0.069736	0.066595
3	0.097952	0.082682	0.070267	0.070267	0.077219	0.065643	0.074705	0.047316	0.115078	0.118261	0.073543	0.057804	0.057036
4	0.072573	0.076672	0.087097	0.087097	0.061728	0.052473	0.059718	0.038077	0.078008	0.081544	0.058789	0.048335	0.041313
5	0.085040	0.074197	0.088320	0.088320	0.049092	0.041732	0.047494	0.028053	0.067027	0.067105	0.046755	0.040164	0.036925
6	0.076877	0.073211	0.090320	0.090320	0.042638	0.036246	0.041250	0.028282	0.057280	0.053713	0.040608	0.039559	0.037541
7	0.059068	0.069033	0.077746	0.077746	0.048658	0.041363	0.047073	0.029602	0.059366	0.056490	0.046341	0.056636	0.053820
8	0.044969	0.070445	0.063820	0.063820	0.052347	0.044499	0.050642	0.041462	0.053000	0.048678	0.049855	0.076783	0.070148
9	0.037103	0.057649	0.056341	0.056341	0.051817	0.044049	0.050130	0.047062	0.045827	0.043835	0.049350	0.072849	0.065860
10	0.025082	0.050363	0.046352	0.046352	0.039682	0.052240	0.039977	0.036040	0.018276	0.021730	0.029318	0.057112	0.053164
11	0.017067	0.041851	0.042256	0.042256	0.032626	0.048235	0.037632	0.029632	0.025708	0.026547	0.045615	0.040597	0.040519
12	0.017513	0.033812	0.028181	0.028181	0.027262	0.044903	0.032799	0.063414	0.015108	0.014532	0.028545	0.038867	0.039695
13	0.014248	0.031054	0.028202	0.028202	0.035808	0.037190	0.042342	0.073481	0.019175	0.017464	0.034038	0.051102	0.049750
14	0.008459	0.022681	0.024479	0.024479	0.028164	0.033128	0.020873	0.046443	0.011956	0.011305	0.033154	0.035452	0.034067
15	0.009795	0.018464	0.017064	0.017064	0.023433	0.027774	0.025194	0.040094	0.009184	0.008309	0.023060	0.031820	0.031486
16	0.005936	0.014417	0.013341	0.013341	0.017635	0.024637	0.020763	0.017363	0.007402	0.006196	0.020669	0.023303	0.022304
17	0.003265	0.011709	0.010266	0.010266	0.020201	0.025191	0.026792	0.047690	0.005650	0.006110	0.015542	0.025032	0.026334
18	0.003265	0.008664	0.009458	0.009458	0.022918	0.037271	0.030590	0.041051	0.005787	0.006137	0.020578	0.023390	0.023247
19	0.003710	0.005653	0.008011	0.008011	0.022980	0.028666	0.017645	0.032392	0.004691	0.005234	0.026875	0.020406	0.019267
20	0.003562	0.003926	0.006064	0.006064	0.021616	0.022814	0.021212	0.044068	0.003701	0.004329	0.024099	0.015953	0.016249
21	0.004156	0.002844	0.003830	0.003830	0.022716	0.021339	0.021723	0.035678	0.002117	0.003009	0.023796	0.011760	0.013807
22	0.004452	0.001948	0.003883	0.003883	0.019266	0.018176	0.019171	0.044544	0.002741	0.003994	0.017740	0.007912	0.012199
23	0.004452	0.001835	0.003138	0.003138	0.017014	0.015771	0.016643	0.023689	0.002010	0.003636	0.019043	0.007004	0.013053
24	0.003413	0.001501	0.003043	0.003043	0.013536	0.012430	0.012995	0.024871	0.001630	0.002498	0.019531	0.006831	0.009886
25	0.004601	0.000791	0.001500	0.001500	0.005402	0.011921	0.004800	0.007207	0.001005	0.001297	0.012795	0.002335	0.004308
26	0.004204	0.000658	0.001155	0.001155	0.004604	0.006501	0.003555	0.008115	0.000735	0.001371	0.007554	0.001974	0.004519
27	0.005219	0.000666	0.001733	0.001733	0.004043	0.002854	0.004220	0.007271	0.001272	0.001835	0.004199	0.002960	0.006190
28	0.003189	0.000460	0.001482	0.001482	0.005267	0.007757	0.004150	0.001823	0.001026	0.001389	0.000553	0.004081	0.006416
29	0.003914	0.000456	0.000664	0.000664	0.003168	0.002297	0.003429	0.001880	0.000534	0.000994	0.004276	0.002509	0.004646
30	0.014788	0.006195	0.006541	0.006541	0.003562	0.001128	0.004233	0.002327	0.003591	0.007881	0.008922	0.008320	0.019502

Fort Bend County 2011 Age Distribution Inputs to MOVES (2011, 2014, 2017, 2018, and 2019 Analysis Years)

Age	MC	PC	PT	LCT	IBus	TBus	SBus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.043366	0.046518	0.029637	0.029637	0.069073	0.061049	0.067376	0.028802	0.100184	0.104789	0.066877	0.022568	0.021517
1	0.048141	0.065960	0.053790	0.053790	0.063576	0.056190	0.062014	0.027620	0.051441	0.054592	0.061554	0.023917	0.018938
2	0.102478	0.064906	0.044450	0.044450	0.061072	0.053977	0.059571	0.027681	0.054203	0.051380	0.059130	0.035695	0.033960
3	0.101058	0.094485	0.079934	0.079934	0.067253	0.059440	0.065601	0.031074	0.152909	0.148094	0.065115	0.047339	0.047549
4	0.120289	0.096165	0.088972	0.088972	0.068818	0.060823	0.067127	0.032867	0.091936	0.091287	0.066630	0.108389	0.100800
5	0.103898	0.085778	0.072731	0.072731	0.068082	0.060172	0.066409	0.054654	0.098539	0.100234	0.065917	0.079662	0.075154
6	0.079375	0.075541	0.066153	0.066153	0.067348	0.059523	0.065693	0.048848	0.085962	0.091233	0.065206	0.068333	0.065321
7	0.059241	0.067667	0.078277	0.078277	0.052749	0.046621	0.051452	0.038516	0.059676	0.063794	0.051071	0.051025	0.044275
8	0.067759	0.063112	0.078099	0.078099	0.041523	0.036699	0.040503	0.028087	0.050670	0.051239	0.040203	0.042259	0.037609
9	0.056402	0.059721	0.078037	0.078037	0.035696	0.031549	0.034819	0.028027	0.043809	0.040653	0.034561	0.043562	0.037406
10	0.043753	0.053351	0.065736	0.065736	0.040316	0.035632	0.039325	0.029033	0.044015	0.042649	0.039034	0.056600	0.052107
11	0.032137	0.050441	0.050913	0.050913	0.042925	0.037938	0.041871	0.040246	0.038221	0.034783	0.041560	0.064916	0.064101
12	0.028653	0.038721	0.042448	0.042448	0.041615	0.036780	0.040592	0.044739	0.032016	0.031295	0.040292	0.057678	0.056536
13	0.019489	0.031594	0.032045	0.032045	0.031537	0.043166	0.032034	0.033904	0.013503	0.014618	0.023687	0.044327	0.046019
14	0.011745	0.024350	0.029011	0.029011	0.025659	0.039441	0.029841	0.027586	0.018346	0.016614	0.036470	0.036010	0.035234
15	0.011874	0.017987	0.019202	0.019202	0.021215	0.036330	0.025734	0.058414	0.011306	0.009689	0.022582	0.030435	0.032591
16	0.008776	0.015595	0.018680	0.018680	0.027572	0.029773	0.032872	0.066975	0.012102	0.010658	0.026644	0.040685	0.040969
17	0.006324	0.010355	0.015689	0.015689	0.021230	0.025963	0.015864	0.041439	0.007387	0.006977	0.025405	0.025310	0.026449
18	0.007486	0.007780	0.010508	0.010508	0.017475	0.021535	0.018944	0.035394	0.005165	0.005036	0.017483	0.022433	0.024074
19	0.003098	0.006066	0.008235	0.008235	0.012872	0.018696	0.015280	0.015002	0.004240	0.003477	0.015336	0.016634	0.017590
20	0.002710	0.004559	0.006130	0.006130	0.014586	0.018911	0.019505	0.040761	0.004278	0.003744	0.011408	0.016184	0.019591
21	0.001678	0.003633	0.005494	0.005494	0.016370	0.027679	0.022031	0.034709	0.004124	0.003655	0.014943	0.014431	0.017397
22	0.002194	0.002202	0.004555	0.004555	0.016236	0.021057	0.012570	0.027090	0.003726	0.003071	0.019303	0.012723	0.013278
23	0.002323	0.001756	0.003357	0.003357	0.015106	0.016577	0.014946	0.036454	0.002698	0.002499	0.017121	0.009710	0.010967
24	0.002710	0.001362	0.002450	0.002450	0.015702	0.015336	0.015140	0.029193	0.001747	0.001536	0.016722	0.007013	0.009105
25	0.002323	0.001013	0.002085	0.002085	0.013171	0.012919	0.013214	0.036047	0.001824	0.001835	0.012329	0.004046	0.008763
26	0.002581	0.000971	0.001939	0.001939	0.011504	0.011086	0.011346	0.018960	0.000951	0.001467	0.013089	0.003462	0.008281
27	0.002452	0.000847	0.001887	0.001887	0.009052	0.008642	0.008761	0.019687	0.000784	0.001153	0.013278	0.003731	0.006291
28	0.002839	0.000591	0.001136	0.001136	0.003572	0.008196	0.003201	0.005641	0.000450	0.000748	0.008601	0.001349	0.002814
29	0.003872	0.000505	0.001220	0.001220	0.003011	0.004420	0.002344	0.006282	0.000642	0.001073	0.005022	0.001708	0.004440
30	0.018973	0.006470	0.007203	0.007203	0.004084	0.003881	0.004023	0.006268	0.003148	0.006131	0.003427	0.007867	0.020875

Galveston County 2002 Age Distributions Inputs to MOVES

Age	MC	PC	PT	LCT	IBus	TBus	SBus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.118528	0.059071	0.086589	0.086589	0.057086	0.044226	0.054177	0.027706	0.101906	0.102260	0.051473	0.039361	0.033087
1	0.127157	0.082439	0.107589	0.107589	0.067160	0.052030	0.063738	0.029896	0.137869	0.143115	0.060557	0.067005	0.059279
2	0.102538	0.090599	0.088237	0.088237	0.074487	0.057706	0.070691	0.043169	0.139706	0.123935	0.067163	0.084079	0.078329
3	0.091624	0.084523	0.087677	0.087677	0.076013	0.058889	0.072140	0.050515	0.117981	0.115521	0.068539	0.091826	0.078564
4	0.061168	0.076398	0.068389	0.068389	0.060030	0.072023	0.059327	0.039893	0.054890	0.055213	0.041990	0.066096	0.066623
5	0.041878	0.071276	0.072179	0.072179	0.050385	0.067887	0.057010	0.033484	0.081717	0.073413	0.066692	0.050839	0.052283
6	0.052538	0.065498	0.053946	0.053946	0.043430	0.065192	0.051257	0.073919	0.044630	0.040436	0.043052	0.048257	0.050489
7	0.039340	0.070488	0.059576	0.059576	0.058246	0.055131	0.067565	0.087457	0.062570	0.053893	0.052418	0.077861	0.070480
8	0.034264	0.058099	0.056905	0.056905	0.046777	0.050144	0.034008	0.056440	0.041229	0.037105	0.052131	0.050170	0.048179
9	0.027157	0.055543	0.045886	0.045886	0.040161	0.043380	0.042359	0.050280	0.034536	0.029449	0.037417	0.049692	0.046822
10	0.015736	0.046219	0.039312	0.039312	0.030868	0.039299	0.035652	0.022238	0.025730	0.021518	0.034250	0.038213	0.033984
11	0.013452	0.043049	0.034738	0.034738	0.036500	0.041479	0.047487	0.063049	0.021725	0.022132	0.026585	0.046726	0.041654
12	0.019797	0.037236	0.031251	0.031251	0.042298	0.062690	0.055385	0.055438	0.021122	0.020865	0.035957	0.047587	0.040577
13	0.013959	0.033200	0.030180	0.030180	0.043797	0.049789	0.032989	0.045171	0.016925	0.017194	0.048492	0.040891	0.033233
14	0.013959	0.024593	0.023495	0.023495	0.042540	0.040918	0.040951	0.063457	0.015937	0.015593	0.044900	0.032570	0.029600
15	0.014721	0.019270	0.016809	0.016809	0.045676	0.039103	0.042849	0.052492	0.010451	0.012053	0.045301	0.025348	0.027100
16	0.024873	0.016652	0.017129	0.017129	0.040017	0.034406	0.039061	0.067697	0.009848	0.016246	0.034884	0.020278	0.026394
17	0.021320	0.014577	0.015402	0.015402	0.036115	0.030509	0.034656	0.036794	0.009848	0.015724	0.038270	0.021952	0.029982
18	0.016751	0.011846	0.015146	0.015146	0.029365	0.024575	0.027654	0.039478	0.008449	0.011020	0.040114	0.019944	0.025329
19	0.020305	0.006260	0.008221	0.008221	0.011980	0.024091	0.010443	0.011694	0.004992	0.006199	0.026863	0.008417	0.011549
20	0.019036	0.004614	0.008653	0.008653	0.010437	0.013429	0.007905	0.013460	0.007105	0.010204	0.016211	0.012961	0.017771
21	0.013706	0.003380	0.006190	0.006190	0.009369	0.006026	0.009592	0.012328	0.006172	0.008081	0.009213	0.013248	0.018511
22	0.018020	0.002863	0.003071	0.003071	0.012480	0.016749	0.009645	0.003160	0.003566	0.005448	0.001241	0.010617	0.014015
23	0.011675	0.003450	0.004558	0.004558	0.007676	0.005071	0.008149	0.003332	0.004800	0.007735	0.009806	0.012052	0.017132
24	0.010660	0.002793	0.003870	0.003870	0.006146	0.002264	0.007108	0.003312	0.004142	0.005370	0.013354	0.007987	0.010966
25	0.006345	0.001821	0.002879	0.002879	0.006667	0.000458	0.007229	0.000000	0.002935	0.005128	0.018503	0.004591	0.007815
26	0.004645	0.001285	0.001664	0.001664	0.002553	0.000881	0.004887	0.006886	0.000953	0.003182	0.011604	0.001016	0.004190
27	0.007047	0.001049	0.001511	0.001511	0.003150	0.000601	0.006086	0.002022	0.001215	0.002707	0.003020	0.001656	0.003073
28	0.005286	0.000865	0.001510	0.001510	0.003099	0.000582	0.000000	0.005149	0.001045	0.002035	0.000000	0.001889	0.003322
29	0.005606	0.000821	0.000654	0.000654	0.002572	0.000150	0.000000	0.000084	0.000657	0.001589	0.000000	0.001389	0.002952
30	0.026908	0.010225	0.006783	0.006783	0.002922	0.000320	0.000000	0.000000	0.005346	0.015638	0.000000	0.005481	0.016715

Galveston County 2008 Age Distributions Inputs to MOVES

Age	MC	PC	PT	LCT	IBus	TBus	SBus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.072924	0.057145	0.046797	0.046797	0.073317	0.062325	0.070930	0.028618	0.142370	0.136309	0.069827	0.030912	0.032667
1	0.133431	0.085064	0.084091	0.084091	0.075781	0.064419	0.073313	0.030575	0.113204	0.111540	0.072173	0.088500	0.087489
2	0.130022	0.085457	0.074642	0.074642	0.076500	0.065031	0.074009	0.051881	0.125541	0.126729	0.072858	0.069736	0.066595
3	0.095569	0.081664	0.065360	0.065360	0.077219	0.065643	0.074705	0.047316	0.115078	0.118261	0.073543	0.057804	0.057036
4	0.069028	0.073079	0.080097	0.080097	0.061728	0.052473	0.059718	0.038077	0.078008	0.081544	0.058789	0.048335	0.041313
5	0.084612	0.073127	0.082950	0.082950	0.049092	0.041732	0.047494	0.028053	0.067027	0.067105	0.046755	0.040164	0.036925
6	0.074142	0.072143	0.086804	0.086804	0.042638	0.036246	0.041250	0.028282	0.057280	0.053713	0.040608	0.039559	0.037541
7	0.052958	0.066761	0.078747	0.078747	0.048658	0.041363	0.047073	0.029602	0.059366	0.056490	0.046341	0.056636	0.053820
8	0.044680	0.066658	0.060977	0.060977	0.052347	0.044499	0.050642	0.041462	0.053000	0.048678	0.049855	0.076783	0.070148
9	0.036888	0.058152	0.058542	0.058542	0.051817	0.044049	0.050130	0.047062	0.045827	0.043835	0.049350	0.072849	0.065860
10	0.027149	0.048449	0.045141	0.045141	0.039682	0.052240	0.039977	0.036040	0.018276	0.021730	0.029318	0.057112	0.053164
11	0.019722	0.041108	0.041830	0.041830	0.032626	0.048235	0.037632	0.029632	0.025708	0.026547	0.045615	0.040597	0.040519
12	0.018505	0.033050	0.030906	0.030906	0.027262	0.044903	0.032799	0.063414	0.015108	0.014532	0.028545	0.038867	0.039695
13	0.018140	0.033357	0.030349	0.030349	0.035808	0.037190	0.042342	0.073481	0.019175	0.017464	0.034038	0.051102	0.049750
14	0.012053	0.024677	0.027497	0.027497	0.028164	0.033128	0.020873	0.046443	0.011956	0.011305	0.033154	0.035452	0.034067
15	0.008766	0.020042	0.020191	0.020191	0.023433	0.027774	0.025194	0.040094	0.009184	0.008309	0.023060	0.031820	0.031486
16	0.006696	0.015746	0.013999	0.013999	0.017635	0.024637	0.020763	0.017363	0.007402	0.006196	0.020669	0.023303	0.022304
17	0.006452	0.012803	0.012120	0.012120	0.020201	0.025191	0.026792	0.047690	0.005650	0.006110	0.015542	0.025032	0.026334
18	0.006087	0.010285	0.011480	0.011480	0.022918	0.037271	0.030590	0.041051	0.005787	0.006137	0.020578	0.023390	0.023247
19	0.004870	0.008310	0.010103	0.010103	0.022980	0.028666	0.017645	0.032392	0.004691	0.005234	0.026875	0.020406	0.019267
20	0.005722	0.005131	0.006248	0.006248	0.021616	0.022814	0.021212	0.044068	0.003701	0.004329	0.024099	0.015953	0.016249
21	0.005357	0.004092	0.004467	0.004467	0.022716	0.021339	0.021723	0.035678	0.002117	0.003009	0.023796	0.011760	0.013807
22	0.006331	0.003187	0.004731	0.004731	0.019266	0.018176	0.019171	0.044544	0.002741	0.003994	0.017740	0.007912	0.012199
23	0.007305	0.003037	0.003493	0.003493	0.017014	0.015771	0.016643	0.023689	0.002010	0.003636	0.019043	0.007004	0.013053
24	0.004626	0.002337	0.003646	0.003646	0.013536	0.012430	0.012995	0.024871	0.001630	0.002498	0.019531	0.006831	0.009886
25	0.006696	0.001479	0.002157	0.002157	0.005402	0.011921	0.004800	0.007207	0.001005	0.001297	0.012795	0.002335	0.004308
26	0.003873	0.001232	0.001730	0.001730	0.004604	0.006501	0.003555	0.008115	0.000735	0.001371	0.007554	0.001974	0.004519
27	0.005877	0.001006	0.001580	0.001580	0.004043	0.002854	0.004220	0.007271	0.001272	0.001835	0.004199	0.002960	0.006190
28	0.004408	0.000830	0.001552	0.001552	0.005267	0.007757	0.004150	0.001823	0.001026	0.001389	0.000553	0.004081	0.006416
29	0.004675	0.000788	0.000670	0.000670	0.003168	0.002297	0.003429	0.001880	0.000534	0.000994	0.004276	0.002509	0.004646
30	0.022439	0.009805	0.007103	0.007103	0.003562	0.001128	0.004233	0.002327	0.003591	0.007881	0.008922	0.008320	0.019502

Galveston County 2011 Age Distribution Inputs to MOVES (2011, 2014, 2017, 2018, and 2019 Analysis Years)

Age	MC	PC	PT	LCT	IBus	TBus	SBus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.025243	0.043574	0.026319	0.026319	0.069073	0.061049	0.067376	0.028802	0.100184	0.104789	0.066877	0.022568	0.021517
1	0.037738	0.058903	0.049632	0.049632	0.063576	0.056190	0.062014	0.027620	0.051441	0.054592	0.061554	0.023917	0.018938
2	0.100719	0.063386	0.042001	0.042001	0.061072	0.053977	0.059571	0.027681	0.054203	0.051380	0.059130	0.035695	0.033960
3	0.098574	0.088516	0.079627	0.079627	0.067253	0.059440	0.065601	0.031074	0.152909	0.148094	0.065115	0.047339	0.047549
4	0.108166	0.090634	0.082367	0.082367	0.068818	0.060823	0.067127	0.032867	0.091936	0.091287	0.066630	0.108389	0.100800
5	0.097816	0.083909	0.072569	0.072569	0.068082	0.060172	0.066409	0.054654	0.098539	0.100234	0.065917	0.079662	0.075154
6	0.080020	0.075971	0.063120	0.063120	0.067348	0.059523	0.065693	0.048848	0.085962	0.091233	0.065206	0.068333	0.065321
7	0.058437	0.064917	0.073910	0.073910	0.052749	0.046621	0.051452	0.038516	0.059676	0.063794	0.051071	0.051025	0.044275
8	0.073457	0.062605	0.074861	0.074861	0.041523	0.036699	0.040503	0.028087	0.050670	0.051239	0.040203	0.042259	0.037609
9	0.059447	0.059629	0.076888	0.076888	0.035696	0.031549	0.034819	0.028027	0.043809	0.040653	0.034561	0.043562	0.037406
10	0.044806	0.052487	0.068292	0.068292	0.040316	0.035632	0.039325	0.029033	0.044015	0.042649	0.039034	0.056600	0.052107
11	0.034709	0.050206	0.051254	0.051254	0.042925	0.037938	0.041871	0.040246	0.038221	0.034783	0.041560	0.064916	0.064101
12	0.030418	0.041696	0.045928	0.045928	0.041615	0.036780	0.040592	0.044739	0.032016	0.031295	0.040292	0.057678	0.056536
13	0.020825	0.033502	0.032860	0.032860	0.031537	0.043166	0.032034	0.033904	0.013503	0.014618	0.023687	0.044327	0.046019
14	0.015777	0.026784	0.031798	0.031798	0.025659	0.039441	0.029841	0.027586	0.018346	0.016614	0.036470	0.036010	0.035234
15	0.016534	0.020083	0.022671	0.022671	0.021215	0.036330	0.025734	0.058414	0.011306	0.009689	0.022582	0.030435	0.032591
16	0.009719	0.018745	0.021832	0.021832	0.027572	0.029773	0.032872	0.066975	0.012102	0.010658	0.026644	0.040685	0.040969
17	0.008709	0.012337	0.017681	0.017681	0.021230	0.025963	0.015864	0.041439	0.007387	0.006977	0.025405	0.025310	0.026449
18	0.007952	0.010034	0.012957	0.012957	0.017475	0.021535	0.018944	0.035394	0.005165	0.005036	0.017483	0.022433	0.024074
19	0.004670	0.007490	0.008889	0.008889	0.012872	0.018696	0.015280	0.015002	0.004240	0.003477	0.015336	0.016634	0.017590
20	0.004039	0.005813	0.007785	0.007785	0.014586	0.018911	0.019505	0.040761	0.004278	0.003744	0.011408	0.016184	0.019591
21	0.003786	0.005017	0.007548	0.007548	0.016370	0.027679	0.022031	0.034709	0.004124	0.003655	0.014943	0.014431	0.017397
22	0.004670	0.003564	0.005996	0.005996	0.016236	0.021057	0.012570	0.027090	0.003726	0.003071	0.019303	0.012723	0.013278
23	0.004670	0.002427	0.004025	0.004025	0.015106	0.016577	0.014946	0.036454	0.002698	0.002499	0.017121	0.009710	0.010967
24	0.003155	0.002056	0.002376	0.002376	0.015702	0.015336	0.015140	0.029193	0.001747	0.001536	0.016722	0.007013	0.009105
25	0.004670	0.001778	0.002404	0.002404	0.013171	0.012919	0.013214	0.036047	0.001824	0.001835	0.012329	0.004046	0.008763
26	0.003155	0.001662	0.002111	0.002111	0.011504	0.011086	0.011346	0.018960	0.000951	0.001467	0.013089	0.003462	0.008281
27	0.002524	0.001376	0.002264	0.002264	0.009052	0.008642	0.008761	0.019687	0.000784	0.001153	0.013278	0.003731	0.006291
28	0.003282	0.000873	0.001384	0.001384	0.003572	0.008196	0.003201	0.005641	0.000450	0.000748	0.008601	0.001349	0.002814
29	0.005301	0.000657	0.001132	0.001132	0.003011	0.004420	0.002344	0.006282	0.000642	0.001073	0.005022	0.001708	0.004440
30	0.027010	0.009369	0.007520	0.007520	0.004084	0.003881	0.004023	0.006268	0.003148	0.006131	0.003427	0.007867	0.020875

Harris County 2002 Age Distributions Inputs to MOVES

Age	MC	PC	PT	LCT	IBus	TBus	SBus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.133995	0.076273	0.100452	0.100452	0.057086	0.044226	0.054177	0.027706	0.101906	0.102260	0.051473	0.039361	0.033087
1	0.145925	0.093193	0.114137	0.114137	0.067160	0.052030	0.063738	0.029896	0.137869	0.143115	0.060557	0.067005	0.059279
2	0.114043	0.092654	0.096030	0.096030	0.074487	0.057706	0.070691	0.043169	0.139706	0.123935	0.067163	0.084079	0.078329
3	0.093503	0.080164	0.090982	0.090982	0.076013	0.058889	0.072140	0.050515	0.117981	0.115521	0.068539	0.091826	0.078564
4	0.066704	0.074951	0.072659	0.072659	0.060030	0.072023	0.059327	0.039893	0.054890	0.055213	0.041990	0.066096	0.066623
5	0.051592	0.070560	0.074424	0.074424	0.050385	0.067887	0.057010	0.033484	0.081717	0.073413	0.066692	0.050839	0.052283
6	0.049483	0.064047	0.052854	0.052854	0.043430	0.065192	0.051257	0.073919	0.044630	0.040436	0.043052	0.048257	0.050489
7	0.043293	0.069245	0.058809	0.058809	0.058246	0.055131	0.067565	0.087457	0.062570	0.053893	0.052418	0.077861	0.070480
8	0.033507	0.055981	0.054443	0.054443	0.046777	0.050144	0.034008	0.056440	0.041229	0.037105	0.052131	0.050170	0.048179
9	0.031087	0.052927	0.044816	0.044816	0.040161	0.043380	0.042359	0.050280	0.034536	0.029449	0.037417	0.049692	0.046822
10	0.018742	0.046193	0.036332	0.036332	0.030868	0.039299	0.035652	0.022238	0.025730	0.021518	0.034250	0.038213	0.033984
11	0.012656	0.042864	0.030902	0.030902	0.036500	0.041479	0.047487	0.063049	0.021725	0.022132	0.026585	0.046726	0.041654
12	0.013140	0.037605	0.025900	0.025900	0.042298	0.062690	0.055385	0.055438	0.021122	0.020865	0.035957	0.047587	0.040577
13	0.012241	0.031161	0.025331	0.025331	0.043797	0.049789	0.032989	0.045171	0.016925	0.017194	0.048492	0.040891	0.033233
14	0.012449	0.024683	0.020578	0.020578	0.042540	0.040918	0.040951	0.063457	0.015937	0.015593	0.044900	0.032570	0.029600
15	0.010685	0.018216	0.014423	0.014423	0.045676	0.039103	0.042849	0.052492	0.010451	0.012053	0.045301	0.025348	0.027100
16	0.020263	0.014785	0.014715	0.014715	0.040017	0.034406	0.039061	0.067697	0.009848	0.016246	0.034884	0.020278	0.026394
17	0.015664	0.012829	0.013796	0.013796	0.036115	0.030509	0.034656	0.036794	0.009848	0.015724	0.038270	0.021952	0.029982
18	0.012794	0.009622	0.011971	0.011971	0.029365	0.024575	0.027654	0.039478	0.008449	0.011020	0.040114	0.019944	0.025329
19	0.014074	0.005572	0.006788	0.006788	0.011980	0.024091	0.010443	0.011694	0.004992	0.006199	0.026863	0.008417	0.011549
20	0.017808	0.004139	0.008045	0.008045	0.010437	0.013429	0.007905	0.013460	0.007105	0.010204	0.016211	0.012961	0.017771
21	0.011515	0.003006	0.005852	0.005852	0.009369	0.006026	0.009592	0.012328	0.006172	0.008081	0.009213	0.013248	0.018511
22	0.011169	0.002237	0.003099	0.003099	0.012480	0.016749	0.009645	0.003160	0.003566	0.005448	0.001241	0.010617	0.014015
23	0.009267	0.002831	0.004308	0.004308	0.007676	0.005071	0.008149	0.003332	0.004800	0.007735	0.009806	0.012052	0.017132
24	0.007089	0.002124	0.003630	0.003630	0.006146	0.002264	0.007108	0.003312	0.004142	0.005370	0.013354	0.007987	0.010966
25	0.005913	0.001577	0.002999	0.002999	0.006667	0.000458	0.007229	0.000000	0.002935	0.005128	0.018503	0.004591	0.007815
26	0.003569	0.001136	0.001504	0.001504	0.002553	0.000881	0.004887	0.006886	0.000953	0.003182	0.011604	0.001016	0.004190
27	0.004734	0.000845	0.001815	0.001815	0.003150	0.000601	0.006086	0.002022	0.001215	0.002707	0.003020	0.001656	0.003073
28	0.002977	0.000729	0.001364	0.001364	0.003099	0.000582	0.000000	0.005149	0.001045	0.002035	0.000000	0.001889	0.003322
29	0.002903	0.000559	0.000656	0.000656	0.002572	0.000150	0.000000	0.000084	0.000657	0.001589	0.000000	0.001389	0.002952
30	0.017215	0.007291	0.006386	0.006386	0.002922	0.000320	0.000000	0.000000	0.005346	0.015638	0.000000	0.005481	0.016715

Harris County 2008 Age Distributions Inputs to MOVES

Age	MC	PC	PT	LCT	IBus	TBus	SBus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.081872	0.068454	0.053354	0.053354	0.073317	0.062325	0.070930	0.028618	0.142370	0.136309	0.069827	0.030912	0.032667
1	0.153339	0.085830	0.082236	0.082236	0.075781	0.064419	0.073313	0.030575	0.113204	0.111540	0.072173	0.088500	0.087489
2	0.125414	0.077150	0.069308	0.069308	0.076500	0.065031	0.074009	0.051881	0.125541	0.126729	0.072858	0.069736	0.066595
3	0.097075	0.074145	0.066264	0.066264	0.077219	0.065643	0.074705	0.047316	0.115078	0.118261	0.073543	0.057804	0.057036
4	0.070660	0.067001	0.077040	0.077040	0.061728	0.052473	0.059718	0.038077	0.078008	0.081544	0.058789	0.048335	0.041313
5	0.085678	0.066449	0.081121	0.081121	0.049092	0.041732	0.047494	0.028053	0.067027	0.067105	0.046755	0.040164	0.036925
6	0.070619	0.069134	0.085339	0.085339	0.042638	0.036246	0.041250	0.028282	0.057280	0.053713	0.040608	0.039559	0.037541
7	0.055353	0.067788	0.077288	0.077288	0.048658	0.041363	0.047073	0.029602	0.059366	0.056490	0.046341	0.056636	0.053820
8	0.043666	0.070361	0.065555	0.065555	0.052347	0.044499	0.050642	0.041462	0.053000	0.048678	0.049855	0.076783	0.070148
9	0.035041	0.060104	0.061776	0.061776	0.051817	0.044049	0.050130	0.047062	0.045827	0.043835	0.049350	0.072849	0.065860
10	0.026167	0.052937	0.048235	0.048235	0.039682	0.052240	0.039977	0.036040	0.018276	0.021730	0.029318	0.057112	0.053164
11	0.018555	0.045220	0.045049	0.045049	0.032626	0.048235	0.037632	0.029632	0.025708	0.026547	0.045615	0.040597	0.040519
12	0.018120	0.036434	0.029491	0.029491	0.027262	0.044903	0.032799	0.063414	0.015108	0.014532	0.028545	0.038867	0.039695
13	0.015079	0.035331	0.030662	0.030662	0.035808	0.037190	0.042342	0.073481	0.019175	0.017464	0.034038	0.051102	0.049750
14	0.012390	0.026143	0.025870	0.025870	0.028164	0.033128	0.020873	0.046443	0.011956	0.011305	0.033154	0.035452	0.034067
15	0.009412	0.021635	0.018621	0.018621	0.023433	0.027774	0.025194	0.040094	0.009184	0.008309	0.023060	0.031820	0.031486
16	0.006143	0.017066	0.014131	0.014131	0.017635	0.024637	0.020763	0.017363	0.007402	0.006196	0.020669	0.023303	0.022304
17	0.004282	0.013708	0.011442	0.011442	0.020201	0.025191	0.026792	0.047690	0.005650	0.006110	0.015542	0.025032	0.026334
18	0.004427	0.010557	0.009923	0.009923	0.022918	0.037271	0.030590	0.041051	0.005787	0.006137	0.020578	0.023390	0.023247
19	0.004054	0.007363	0.008943	0.008943	0.022980	0.028666	0.017645	0.032392	0.004691	0.005234	0.026875	0.020406	0.019267
20	0.004613	0.005087	0.006649	0.006649	0.021616	0.022814	0.021212	0.044068	0.003701	0.004329	0.024099	0.015953	0.016249
21	0.003516	0.003605	0.004179	0.004179	0.022716	0.021339	0.021723	0.035678	0.002117	0.003009	0.023796	0.011760	0.013807
22	0.006495	0.002820	0.004250	0.004250	0.019266	0.018176	0.019171	0.044544	0.002741	0.003994	0.017740	0.007912	0.012199
23	0.005606	0.002522	0.003756	0.003756	0.017014	0.015771	0.016643	0.023689	0.002010	0.003636	0.019043	0.007004	0.013053
24	0.004696	0.001931	0.003482	0.003482	0.013536	0.012430	0.012995	0.024871	0.001630	0.002498	0.019531	0.006831	0.009886
25	0.004261	0.001288	0.002136	0.002136	0.005402	0.011921	0.004800	0.007207	0.001005	0.001297	0.012795	0.002335	0.004308
26	0.003804	0.001069	0.001785	0.001785	0.004604	0.006501	0.003555	0.008115	0.000735	0.001371	0.007554	0.001974	0.004519
27	0.005046	0.000795	0.002155	0.002155	0.004043	0.002854	0.004220	0.007271	0.001272	0.001835	0.004199	0.002960	0.006190
28	0.003173	0.000686	0.001611	0.001611	0.005267	0.007757	0.004150	0.001823	0.001026	0.001389	0.000553	0.004081	0.006416
29	0.003095	0.000526	0.000785	0.000785	0.003168	0.002297	0.003429	0.001880	0.000534	0.000994	0.004276	0.002509	0.004646
30	0.018351	0.006859	0.007566	0.007566	0.003562	0.001128	0.004233	0.002327	0.003591	0.007881	0.008922	0.008320	0.019502

Harris County 2011 Age Distribution Inputs to MOVES (2011, 2014, 2017, 2018, and 2019 Analysis Years)

Age	MC	PC	PT	LCT	IBus	TBus	SBus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.035445	0.047178	0.027418	0.027418	0.069073	0.061049	0.067376	0.028802	0.100184	0.104789	0.066877	0.022568	0.021517
1	0.042013	0.057736	0.040492	0.040492	0.063576	0.056190	0.062014	0.027620	0.051441	0.054592	0.061554	0.023917	0.018938
2	0.102145	0.052988	0.035349	0.035349	0.061072	0.053977	0.059571	0.027681	0.054203	0.051380	0.059130	0.035695	0.033960
3	0.098830	0.078010	0.069539	0.069539	0.067253	0.059440	0.065601	0.031074	0.152909	0.148094	0.065115	0.047339	0.047549
4	0.117470	0.082164	0.077581	0.077581	0.068818	0.060823	0.067127	0.032867	0.091936	0.091287	0.066630	0.108389	0.100800
5	0.098789	0.076988	0.066823	0.066823	0.068082	0.060172	0.066409	0.054654	0.098539	0.100234	0.065917	0.079662	0.075154
6	0.077021	0.071964	0.064280	0.064280	0.067348	0.059523	0.065693	0.048848	0.085962	0.091233	0.065206	0.068333	0.065321
7	0.055649	0.062982	0.073246	0.073246	0.052749	0.046621	0.051452	0.038516	0.059676	0.063794	0.051071	0.051025	0.044275
8	0.068660	0.060872	0.076613	0.076613	0.041523	0.036699	0.040503	0.028087	0.050670	0.051239	0.040203	0.042259	0.037609
9	0.057818	0.061481	0.079337	0.079337	0.035696	0.031549	0.034819	0.028027	0.043809	0.040653	0.034561	0.043562	0.037406
10	0.044703	0.058503	0.071480	0.071480	0.040316	0.035632	0.039325	0.029033	0.044015	0.042649	0.039034	0.056600	0.052107
11	0.035425	0.057776	0.057650	0.057650	0.042925	0.037938	0.041871	0.040246	0.038221	0.034783	0.041560	0.064916	0.064101
12	0.028273	0.046624	0.051219	0.051219	0.041615	0.036780	0.040592	0.044739	0.032016	0.031295	0.040292	0.057678	0.056536
13	0.020850	0.039183	0.038065	0.038065	0.031537	0.043166	0.032034	0.033904	0.013503	0.014618	0.023687	0.044327	0.046019
14	0.014449	0.031811	0.035592	0.035592	0.025659	0.039441	0.029841	0.027586	0.018346	0.016614	0.036470	0.036010	0.035234
15	0.013490	0.024008	0.023130	0.023130	0.021215	0.036330	0.025734	0.058414	0.011306	0.009689	0.022582	0.030435	0.032591
16	0.011238	0.021505	0.023112	0.023112	0.027572	0.029773	0.032872	0.066975	0.012102	0.010658	0.026644	0.040685	0.040969
17	0.008924	0.015239	0.019319	0.019319	0.021230	0.025963	0.015864	0.041439	0.007387	0.006977	0.025405	0.025310	0.026449
18	0.006484	0.011823	0.013504	0.013504	0.017475	0.021535	0.018944	0.035394	0.005165	0.005036	0.017483	0.022433	0.024074
19	0.004962	0.009001	0.010016	0.010016	0.012872	0.018696	0.015280	0.015002	0.004240	0.003477	0.015336	0.016634	0.017590
20	0.003419	0.006878	0.007798	0.007798	0.014586	0.018911	0.019505	0.040761	0.004278	0.003744	0.011408	0.016184	0.019591
21	0.003482	0.005110	0.006732	0.006732	0.016370	0.027679	0.022031	0.034709	0.004124	0.003655	0.014943	0.014431	0.017397
22	0.003336	0.003481	0.005890	0.005890	0.016236	0.021057	0.012570	0.027090	0.003726	0.003071	0.019303	0.012723	0.013278
23	0.003607	0.002469	0.004190	0.004190	0.015106	0.016577	0.014946	0.036454	0.002698	0.002499	0.017121	0.009710	0.010967
24	0.002877	0.001852	0.002588	0.002588	0.015702	0.015336	0.015140	0.029193	0.001747	0.001536	0.016722	0.007013	0.009105
25	0.004253	0.001431	0.002746	0.002746	0.013171	0.012919	0.013214	0.036047	0.001824	0.001835	0.012329	0.004046	0.008763
26	0.004024	0.001468	0.002465	0.002465	0.011504	0.011086	0.011346	0.018960	0.000951	0.001467	0.013089	0.003462	0.008281
27	0.003440	0.001175	0.002283	0.002283	0.009052	0.008642	0.008761	0.019687	0.000784	0.001153	0.013278	0.003731	0.006291
28	0.002648	0.000789	0.001410	0.001410	0.003572	0.008196	0.003201	0.005641	0.000450	0.000748	0.008601	0.001349	0.002814
29	0.003982	0.000576	0.001734	0.001734	0.003011	0.004420	0.002344	0.006282	0.000642	0.001073	0.005022	0.001708	0.004440
30	0.022289	0.006934	0.008398	0.008398	0.004084	0.003881	0.004023	0.006268	0.003148	0.006131	0.003427	0.007867	0.020875

Liberty County 2002 Age Distributions Inputs to MOVES

Age	MC	PC	PT	LCT	IBus	TBus	SBus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.096386	0.042443	0.079282	0.079282	0.057086	0.044226	0.054177	0.027706	0.101906	0.102260	0.051473	0.039361	0.033087
1	0.129853	0.073665	0.103321	0.103321	0.067160	0.052030	0.063738	0.029896	0.137869	0.143115	0.060557	0.067005	0.059279
2	0.115127	0.087241	0.082888	0.082888	0.074487	0.057706	0.070691	0.043169	0.139706	0.123935	0.067163	0.084079	0.078329
3	0.100402	0.078119	0.081063	0.081063	0.076013	0.058889	0.072140	0.050515	0.117981	0.115521	0.068539	0.091826	0.078564
4	0.065596	0.070581	0.067530	0.067530	0.060030	0.072023	0.059327	0.039893	0.054890	0.055213	0.041990	0.066096	0.066623
5	0.048193	0.065527	0.075231	0.075231	0.050385	0.067887	0.057010	0.033484	0.081717	0.073413	0.066692	0.050839	0.052283
6	0.058902	0.059960	0.054220	0.054220	0.043430	0.065192	0.051257	0.073919	0.044630	0.040436	0.043052	0.048257	0.050489
7	0.048193	0.067926	0.058894	0.058894	0.058246	0.055131	0.067565	0.087457	0.062570	0.053893	0.052418	0.077861	0.070480
8	0.038822	0.055848	0.053953	0.053953	0.046777	0.050144	0.034008	0.056440	0.041229	0.037105	0.052131	0.050170	0.048179
9	0.029451	0.056876	0.043269	0.043269	0.040161	0.043380	0.042359	0.050280	0.034536	0.029449	0.037417	0.049692	0.046822
10	0.020080	0.047240	0.038105	0.038105	0.030868	0.039299	0.035652	0.022238	0.025730	0.021518	0.034250	0.038213	0.033984
11	0.010710	0.049081	0.035256	0.035256	0.036500	0.041479	0.047487	0.063049	0.021725	0.022132	0.026585	0.046726	0.041654
12	0.009371	0.042614	0.029870	0.029870	0.042298	0.062690	0.055385	0.055438	0.021122	0.020865	0.035957	0.047587	0.040577
13	0.010710	0.040558	0.031116	0.031116	0.043797	0.049789	0.032989	0.045171	0.016925	0.017194	0.048492	0.040891	0.033233
14	0.014726	0.030622	0.026309	0.026309	0.042540	0.040918	0.040951	0.063457	0.015937	0.015593	0.044900	0.032570	0.029600
15	0.014726	0.025440	0.016248	0.016248	0.045676	0.039103	0.042849	0.052492	0.010451	0.012053	0.045301	0.025348	0.027100
16	0.022758	0.021628	0.019275	0.019275	0.040017	0.034406	0.039061	0.067697	0.009848	0.016246	0.034884	0.020278	0.026394
17	0.021419	0.020686	0.019053	0.019053	0.036115	0.030509	0.034656	0.036794	0.009848	0.015724	0.038270	0.021952	0.029982
18	0.010710	0.015033	0.017673	0.017673	0.029365	0.024575	0.027654	0.039478	0.008449	0.011020	0.040114	0.019944	0.025329
19	0.018742	0.009422	0.011574	0.011574	0.011980	0.024091	0.010443	0.011694	0.004992	0.006199	0.026863	0.008417	0.011549
20	0.020080	0.006467	0.011619	0.011619	0.010437	0.013429	0.007905	0.013460	0.007105	0.010204	0.016211	0.012961	0.017771
21	0.021419	0.004411	0.008859	0.008859	0.009369	0.006026	0.009592	0.012328	0.006172	0.008081	0.009213	0.013248	0.018511
22	0.016064	0.003041	0.003962	0.003962	0.012480	0.016749	0.009645	0.003160	0.003566	0.005448	0.001241	0.010617	0.014015
23	0.004016	0.005097	0.007434	0.007434	0.007676	0.005071	0.008149	0.003332	0.004800	0.007735	0.009806	0.012052	0.017132
24	0.004016	0.004668	0.005253	0.005253	0.006146	0.002264	0.007108	0.003312	0.004142	0.005370	0.013354	0.007987	0.010966
25	0.005355	0.002398	0.003828	0.003828	0.006667	0.000458	0.007229	0.000000	0.002935	0.005128	0.018503	0.004591	0.007815
26	0.001893	0.001305	0.002325	0.002325	0.002553	0.000881	0.004887	0.006886	0.000953	0.003182	0.011604	0.001016	0.004190
27	0.006311	0.001395	0.002582	0.002582	0.003150	0.000601	0.006086	0.002022	0.001215	0.002707	0.003020	0.001656	0.003073
28	0.007573	0.001080	0.001763	0.001763	0.003099	0.000582	0.000000	0.005149	0.001045	0.002035	0.000000	0.001889	0.003322
29	0.006311	0.000720	0.000819	0.000819	0.002572	0.000150	0.000000	0.000084	0.000657	0.001589	0.000000	0.001389	0.002952
30	0.022088	0.008907	0.007424	0.007424	0.002922	0.000320	0.000000	0.000000	0.005346	0.015638	0.000000	0.005481	0.016715

Liberty County 2008 Age Distributions Inputs to MOVES

Age	MC	PC	PT	LCT	IBus	TBus	SBus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.083851	0.048322	0.042173	0.042173	0.073317	0.062325	0.070930	0.028618	0.142370	0.136309	0.069827	0.030912	0.032667
1	0.138199	0.075306	0.074469	0.074469	0.075781	0.064419	0.073313	0.030575	0.113204	0.111540	0.072173	0.088500	0.087489
2	0.127329	0.076435	0.067620	0.067620	0.076500	0.065031	0.074009	0.051881	0.125541	0.126729	0.072858	0.069736	0.066595
3	0.101967	0.075384	0.057027	0.057027	0.077219	0.065643	0.074705	0.047316	0.115078	0.118261	0.073543	0.057804	0.057036
4	0.067805	0.057550	0.067142	0.067142	0.061728	0.052473	0.059718	0.038077	0.078008	0.081544	0.058789	0.048335	0.041313
5	0.071946	0.056070	0.073275	0.073275	0.049092	0.041732	0.047494	0.028053	0.067027	0.067105	0.046755	0.040164	0.036925
6	0.072981	0.058446	0.072916	0.072916	0.042638	0.036246	0.041250	0.028282	0.057280	0.053713	0.040608	0.039559	0.037541
7	0.053830	0.061132	0.074310	0.074310	0.048658	0.041363	0.047073	0.029602	0.059366	0.056490	0.046341	0.056636	0.053820
8	0.044513	0.065727	0.060332	0.060332	0.052347	0.044499	0.050642	0.041462	0.053000	0.048678	0.049855	0.076783	0.070148
9	0.038820	0.062106	0.054916	0.054916	0.051817	0.044049	0.050130	0.047062	0.045827	0.043835	0.049350	0.072849	0.065860
10	0.034679	0.053617	0.049062	0.049062	0.039682	0.052240	0.039977	0.036040	0.018276	0.021730	0.029318	0.057112	0.053164
11	0.025362	0.049451	0.050496	0.050496	0.032626	0.048235	0.037632	0.029632	0.025708	0.026547	0.045615	0.040597	0.040519
12	0.018634	0.042286	0.036359	0.036359	0.027262	0.044903	0.032799	0.063414	0.015108	0.014532	0.028545	0.038867	0.039695
13	0.014493	0.041586	0.038509	0.038509	0.035808	0.037190	0.042342	0.073481	0.019175	0.017464	0.034038	0.051102	0.049750
14	0.013975	0.032747	0.034009	0.034009	0.028164	0.033128	0.020873	0.046443	0.011956	0.011305	0.033154	0.035452	0.034067
15	0.011387	0.028970	0.024531	0.024531	0.023433	0.027774	0.025194	0.040094	0.009184	0.008309	0.023060	0.031820	0.031486
16	0.008282	0.024531	0.020389	0.020389	0.017635	0.024637	0.020763	0.017363	0.007402	0.006196	0.020669	0.023303	0.022304
17	0.003623	0.020559	0.017801	0.017801	0.020201	0.025191	0.026792	0.047690	0.005650	0.006110	0.015542	0.025032	0.026334
18	0.003623	0.015653	0.014496	0.014496	0.022918	0.037271	0.030590	0.041051	0.005787	0.006137	0.020578	0.023390	0.023247
19	0.005694	0.012032	0.014336	0.014336	0.022980	0.028666	0.017645	0.032392	0.004691	0.005234	0.026875	0.020406	0.019267
20	0.006211	0.009423	0.010633	0.010633	0.021616	0.022814	0.021212	0.044068	0.003701	0.004329	0.024099	0.015953	0.016249
21	0.005176	0.005529	0.007009	0.007009	0.022716	0.021339	0.021723	0.035678	0.002117	0.003009	0.023796	0.011760	0.013807
22	0.004141	0.004945	0.007248	0.007248	0.019266	0.018176	0.019171	0.044544	0.002741	0.003994	0.017740	0.007912	0.012199
23	0.006729	0.004244	0.006013	0.006013	0.017014	0.015771	0.016643	0.023689	0.002010	0.003636	0.019043	0.007004	0.013053
24	0.005694	0.003543	0.006093	0.006093	0.013536	0.012430	0.012995	0.024871	0.001630	0.002498	0.019531	0.006831	0.009886
25	0.003106	0.001635	0.003066	0.003066	0.005402	0.011921	0.004800	0.007207	0.001005	0.001297	0.012795	0.002335	0.004308
26	0.001198	0.001243	0.002495	0.002495	0.004604	0.006501	0.003555	0.008115	0.000735	0.001371	0.007554	0.001974	0.004519
27	0.003993	0.001329	0.002741	0.002741	0.004043	0.002854	0.004220	0.007271	0.001272	0.001835	0.004199	0.002960	0.006190
28	0.004791	0.001029	0.001850	0.001850	0.005267	0.007757	0.004150	0.001823	0.001026	0.001389	0.000553	0.004081	0.006416
29	0.003993	0.000686	0.000891	0.000891	0.003168	0.002297	0.003429	0.001880	0.000534	0.000994	0.004276	0.002509	0.004646
30	0.013975	0.008486	0.007792	0.007792	0.003562	0.001128	0.004233	0.002327	0.003591	0.007881	0.008922	0.008320	0.019502

Liberty County 2011 Age Distribution Inputs to MOVES (2011, 2014, 2017, 2018, and 2019 Analysis Years)

Age	MC	PC	PT	LCT	IBus	TBus	SBus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.023510	0.031586	0.022295	0.022295	0.069073	0.061049	0.067376	0.028802	0.100184	0.104789	0.066877	0.022568	0.021517
1	0.029524	0.046288	0.032190	0.032190	0.063576	0.056190	0.062014	0.027620	0.051441	0.054592	0.061554	0.023917	0.018938
2	0.083652	0.045982	0.031827	0.031827	0.061072	0.053977	0.059571	0.027681	0.054203	0.051380	0.059130	0.035695	0.033960
3	0.092947	0.079865	0.065471	0.065471	0.067253	0.059440	0.065601	0.031074	0.152909	0.148094	0.065115	0.047339	0.047549
4	0.107709	0.080018	0.072378	0.072378	0.068818	0.060823	0.067127	0.032867	0.091936	0.091287	0.066630	0.108389	0.100800
5	0.109896	0.074275	0.065269	0.065269	0.068082	0.060172	0.066409	0.054654	0.098539	0.100234	0.065917	0.079662	0.075154
6	0.082559	0.070868	0.054768	0.054768	0.067348	0.059523	0.065693	0.048848	0.085962	0.091233	0.065206	0.068333	0.065321
7	0.061236	0.056013	0.062038	0.062038	0.052749	0.046621	0.051452	0.038516	0.059676	0.063794	0.051071	0.051025	0.044275
8	0.061782	0.054520	0.069147	0.069147	0.041523	0.036699	0.040503	0.028087	0.050670	0.051239	0.040203	0.042259	0.037609
9	0.064516	0.052950	0.070883	0.070883	0.035696	0.031549	0.034819	0.028027	0.043809	0.040653	0.034561	0.043562	0.037406
10	0.057408	0.057736	0.069712	0.069712	0.040316	0.035632	0.039325	0.029033	0.044015	0.042649	0.039034	0.056600	0.052107
11	0.041006	0.056893	0.054606	0.054606	0.042925	0.037938	0.041871	0.040246	0.038221	0.034783	0.041560	0.064916	0.064101
12	0.035539	0.051725	0.051133	0.051133	0.041615	0.036780	0.040592	0.044739	0.032016	0.031295	0.040292	0.057678	0.056536
13	0.025150	0.042536	0.042974	0.042974	0.031537	0.043166	0.032034	0.033904	0.013503	0.014618	0.023687	0.044327	0.046019
14	0.019683	0.038707	0.044428	0.044428	0.025659	0.039441	0.029841	0.027586	0.018346	0.016614	0.036470	0.036010	0.035234
15	0.015309	0.030476	0.030373	0.030373	0.021215	0.036330	0.025734	0.058414	0.011306	0.009689	0.022582	0.030435	0.032591
16	0.009841	0.028294	0.032635	0.032635	0.027572	0.029773	0.032872	0.066975	0.012102	0.010658	0.026644	0.040685	0.040969
17	0.007654	0.021134	0.027546	0.027546	0.021230	0.025963	0.015864	0.041439	0.007387	0.006977	0.025405	0.025310	0.026449
18	0.006014	0.017191	0.017812	0.017812	0.017475	0.021535	0.018944	0.035394	0.005165	0.005036	0.017483	0.022433	0.024074
19	0.003827	0.013668	0.016156	0.016156	0.012872	0.018696	0.015280	0.015002	0.004240	0.003477	0.015336	0.016634	0.017590
20	0.002734	0.011716	0.011753	0.011753	0.014586	0.018911	0.019505	0.040761	0.004278	0.003744	0.011408	0.016184	0.019591
21	0.002734	0.008002	0.010663	0.010663	0.016370	0.027679	0.022031	0.034709	0.004124	0.003655	0.014943	0.014431	0.017397
22	0.004921	0.006394	0.009088	0.009088	0.016236	0.021057	0.012570	0.027090	0.003726	0.003071	0.019303	0.012723	0.013278
23	0.004374	0.005054	0.007634	0.007634	0.015106	0.016577	0.014946	0.036454	0.002698	0.002499	0.017121	0.009710	0.010967
24	0.002187	0.002948	0.004241	0.004241	0.015702	0.015336	0.015140	0.029193	0.001747	0.001536	0.016722	0.007013	0.009105
25	0.009841	0.002259	0.003918	0.003918	0.013171	0.012919	0.013214	0.036047	0.001824	0.001835	0.012329	0.004046	0.008763
26	0.003827	0.002106	0.003958	0.003958	0.011504	0.011086	0.011346	0.018960	0.000951	0.001467	0.013089	0.003462	0.008281
27	0.004374	0.001646	0.003110	0.003110	0.009052	0.008642	0.008761	0.019687	0.000784	0.001153	0.013278	0.003731	0.006291
28	0.003827	0.000536	0.001494	0.001494	0.003572	0.008196	0.003201	0.005641	0.000450	0.000748	0.008601	0.001349	0.002814
29	0.001640	0.000689	0.001535	0.001535	0.003011	0.004420	0.002344	0.006282	0.000642	0.001073	0.005022	0.001708	0.004440
30	0.020776	0.007925	0.008966	0.008966	0.004084	0.003881	0.004023	0.006268	0.003148	0.006131	0.003427	0.007867	0.020875

Montgomery County 2002 Age Distributions Inputs to MOVES

Age	MC	PC	PT	LCT	IBus	TBus	SBus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.100411	0.058798	0.088606	0.088606	0.057086	0.044226	0.054177	0.027706	0.101906	0.102260	0.051473	0.039361	0.033087
1	0.145899	0.091847	0.120742	0.120742	0.067160	0.052030	0.063738	0.029896	0.137869	0.143115	0.060557	0.067005	0.059279
2	0.126301	0.102367	0.099240	0.099240	0.074487	0.057706	0.070691	0.043169	0.139706	0.123935	0.067163	0.084079	0.078329
3	0.098476	0.088076	0.093396	0.093396	0.076013	0.058889	0.072140	0.050515	0.117981	0.115521	0.068539	0.091826	0.078564
4	0.072103	0.079640	0.071707	0.071707	0.060030	0.072023	0.059327	0.039893	0.054890	0.055213	0.041990	0.066096	0.066623
5	0.049117	0.074316	0.073276	0.073276	0.050385	0.067887	0.057010	0.033484	0.081717	0.073413	0.066692	0.050839	0.052283
6	0.049601	0.065947	0.054375	0.054375	0.043430	0.065192	0.051257	0.073919	0.044630	0.040436	0.043052	0.048257	0.050489
7	0.042342	0.070309	0.059036	0.059036	0.058246	0.055131	0.067565	0.087457	0.062570	0.053893	0.052418	0.077861	0.070480
8	0.035325	0.056640	0.052114	0.052114	0.046777	0.050144	0.034008	0.056440	0.041229	0.037105	0.052131	0.050170	0.048179
9	0.027583	0.052346	0.043073	0.043073	0.040161	0.043380	0.042359	0.050280	0.034536	0.029449	0.037417	0.049692	0.046822
10	0.015485	0.042947	0.034196	0.034196	0.030868	0.039299	0.035652	0.022238	0.025730	0.021518	0.034250	0.038213	0.033984
11	0.012098	0.039221	0.030835	0.030835	0.036500	0.041479	0.047487	0.063049	0.021725	0.022132	0.026585	0.046726	0.041654
12	0.015727	0.033928	0.026268	0.026268	0.042298	0.062690	0.055385	0.055438	0.021122	0.020865	0.035957	0.047587	0.040577
13	0.014759	0.029263	0.023856	0.023856	0.043797	0.049789	0.032989	0.045171	0.016925	0.017194	0.048492	0.040891	0.033233
14	0.010888	0.023000	0.019675	0.019675	0.042540	0.040918	0.040951	0.063457	0.015937	0.015593	0.044900	0.032570	0.029600
15	0.014275	0.017373	0.013550	0.013550	0.045676	0.039103	0.042849	0.052492	0.010451	0.012053	0.045301	0.025348	0.027100
16	0.020082	0.013995	0.015377	0.015377	0.040017	0.034406	0.039061	0.067697	0.009848	0.016246	0.034884	0.020278	0.026394
17	0.019114	0.012844	0.014627	0.014627	0.036115	0.030509	0.034656	0.036794	0.009848	0.015724	0.038270	0.021952	0.029982
18	0.016211	0.009557	0.014053	0.014053	0.029365	0.024575	0.027654	0.039478	0.008449	0.011020	0.040114	0.019944	0.025329
19	0.016453	0.005915	0.007718	0.007718	0.011980	0.024091	0.010443	0.011694	0.004992	0.006199	0.026863	0.008417	0.011549
20	0.018872	0.004264	0.008514	0.008514	0.010437	0.013429	0.007905	0.013460	0.007105	0.010204	0.016211	0.012961	0.017771
21	0.013549	0.003135	0.006324	0.006324	0.009369	0.006026	0.009592	0.012328	0.006172	0.008081	0.009213	0.013248	0.018511
22	0.012098	0.002507	0.002939	0.002939	0.012480	0.016749	0.009645	0.003160	0.003566	0.005448	0.001241	0.010617	0.014015
23	0.011130	0.003181	0.005446	0.005446	0.007676	0.005071	0.008149	0.003332	0.004800	0.007735	0.009806	0.012052	0.017132
24	0.006049	0.002810	0.004345	0.004345	0.006146	0.002264	0.007108	0.003312	0.004142	0.005370	0.013354	0.007987	0.010966
25	0.005081	0.001772	0.003115	0.003115	0.006667	0.000458	0.007229	0.000000	0.002935	0.005128	0.018503	0.004591	0.007815
26	0.004757	0.001184	0.001721	0.001721	0.002553	0.000881	0.004887	0.006886	0.000953	0.003182	0.011604	0.001016	0.004190
27	0.004272	0.000897	0.001642	0.001642	0.003150	0.000601	0.006086	0.002022	0.001215	0.002707	0.003020	0.001656	0.003073
28	0.003592	0.000791	0.001323	0.001323	0.003099	0.000582	0.000000	0.005149	0.001045	0.002035	0.000000	0.001889	0.003322
29	0.002815	0.000654	0.000714	0.000714	0.002572	0.000150	0.000000	0.000084	0.000657	0.001589	0.000000	0.001389	0.002952
30	0.015534	0.010477	0.008197	0.008197	0.002922	0.000320	0.000000	0.000000	0.005346	0.015638	0.000000	0.005481	0.016715

Montgomery County 2008 Age Distributions Inputs to MOVES

Age	MC	PC	PT	LCT	IBus	TBus	SBus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.074573	0.064362	0.048791	0.048791	0.073317	0.062325	0.070930	0.028618	0.142370	0.136309	0.069827	0.030912	0.032667
1	0.133229	0.094632	0.089232	0.089232	0.075781	0.064419	0.073313	0.030575	0.113204	0.111540	0.072173	0.088500	0.087489
2	0.129102	0.091875	0.078125	0.078125	0.076500	0.065031	0.074009	0.051881	0.125541	0.126729	0.072858	0.069736	0.066595
3	0.100511	0.085342	0.071626	0.071626	0.077219	0.065643	0.074705	0.047316	0.115078	0.118261	0.073543	0.057804	0.057036
4	0.077029	0.076827	0.083382	0.083382	0.061728	0.052473	0.059718	0.038077	0.078008	0.081544	0.058789	0.048335	0.041313
5	0.087542	0.071816	0.086617	0.086617	0.049092	0.041732	0.047494	0.028053	0.067027	0.067105	0.046755	0.040164	0.036925
6	0.071625	0.071660	0.085479	0.085479	0.042638	0.036246	0.041250	0.028282	0.057280	0.053713	0.040608	0.039559	0.037541
7	0.057379	0.067542	0.078144	0.078144	0.048658	0.041363	0.047073	0.029602	0.059366	0.056490	0.046341	0.056636	0.053820
8	0.046178	0.066783	0.061563	0.061563	0.052347	0.044499	0.050642	0.041462	0.053000	0.048678	0.049855	0.076783	0.070148
9	0.039497	0.056500	0.055055	0.055055	0.051817	0.044049	0.050130	0.047062	0.045827	0.043835	0.049350	0.072849	0.065860
10	0.027609	0.046903	0.043083	0.043083	0.039682	0.052240	0.039977	0.036040	0.018276	0.021730	0.029318	0.057112	0.053164
11	0.020829	0.040509	0.041503	0.041503	0.032626	0.048235	0.037632	0.029632	0.025708	0.026547	0.045615	0.040597	0.040519
12	0.019257	0.030158	0.029314	0.029314	0.027262	0.044903	0.032799	0.063414	0.015108	0.014532	0.028545	0.038867	0.039695
13	0.013166	0.029037	0.029042	0.029042	0.035808	0.037190	0.042342	0.073481	0.019175	0.017464	0.034038	0.051102	0.049750
14	0.012380	0.021621	0.023784	0.023784	0.028164	0.033128	0.020873	0.046443	0.011956	0.011305	0.033154	0.035452	0.034067
15	0.010808	0.017013	0.017718	0.017718	0.023433	0.027774	0.025194	0.040094	0.009184	0.008309	0.023060	0.031820	0.031486
16	0.006583	0.013732	0.012678	0.012678	0.017635	0.024637	0.020763	0.017363	0.007402	0.006196	0.020669	0.023303	0.022304
17	0.004618	0.010724	0.010938	0.010938	0.020201	0.025191	0.026792	0.047690	0.005650	0.006110	0.015542	0.025032	0.026334
18	0.004421	0.008543	0.009630	0.009630	0.022918	0.037271	0.030590	0.041051	0.005787	0.006137	0.020578	0.023390	0.023247
19	0.003930	0.006645	0.008163	0.008163	0.022980	0.028666	0.017645	0.032392	0.004691	0.005234	0.026875	0.020406	0.019267
20	0.004225	0.004352	0.005850	0.005850	0.021616	0.022814	0.021212	0.044068	0.003701	0.004329	0.024099	0.015953	0.016249
21	0.003242	0.003392	0.003668	0.003668	0.022716	0.021339	0.021723	0.035678	0.002117	0.003009	0.023796	0.011760	0.013807
22	0.006976	0.002617	0.003564	0.003564	0.019266	0.018176	0.019171	0.044544	0.002741	0.003994	0.017740	0.007912	0.012199
23	0.004421	0.002159	0.003546	0.003546	0.017014	0.015771	0.016643	0.023689	0.002010	0.003636	0.019043	0.007004	0.013053
24	0.005306	0.001914	0.003470	0.003470	0.013536	0.012430	0.012995	0.024871	0.001630	0.002498	0.019531	0.006831	0.009886
25	0.004618	0.001060	0.002003	0.002003	0.005402	0.011921	0.004800	0.007207	0.001005	0.001297	0.012795	0.002335	0.004308
26	0.004754	0.001038	0.001781	0.001781	0.004604	0.006501	0.003555	0.008115	0.000735	0.001371	0.007554	0.001974	0.004519
27	0.004269	0.000787	0.001699	0.001699	0.004043	0.002854	0.004220	0.007271	0.001272	0.001835	0.004199	0.002960	0.006190
28	0.003590	0.000694	0.001371	0.001371	0.005267	0.007757	0.004150	0.001823	0.001026	0.001389	0.000553	0.004081	0.006416
29	0.002814	0.000574	0.000730	0.000730	0.003168	0.002297	0.003429	0.001880	0.000534	0.000994	0.004276	0.002509	0.004646
30	0.015523	0.009189	0.008451	0.008451	0.003562	0.001128	0.004233	0.002327	0.003591	0.007881	0.008922	0.008320	0.019502

Montgomery County 2011 Age Distribution Inputs to MOVES (2011, 2014, 2017, 2018, and 2019 Analysis Years)

Age	MC	PC	PT	LCT	IBus	TBus	SBus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.040452	0.047069	0.031806	0.031806	0.069073	0.061049	0.067376	0.028802	0.100184	0.104789	0.066877	0.022568	0.021517
1	0.035805	0.066982	0.050435	0.050435	0.063576	0.056190	0.062014	0.027620	0.051441	0.054592	0.061554	0.023917	0.018938
2	0.089468	0.060890	0.043266	0.043266	0.061072	0.053977	0.059571	0.027681	0.054203	0.051380	0.059130	0.035695	0.033960
3	0.087281	0.093845	0.077591	0.077591	0.067253	0.059440	0.065601	0.031074	0.152909	0.148094	0.065115	0.047339	0.047549
4	0.110787	0.092229	0.083330	0.083330	0.068818	0.060823	0.067127	0.032867	0.091936	0.091287	0.066630	0.108389	0.100800
5	0.105047	0.083485	0.068758	0.068758	0.068082	0.060172	0.066409	0.054654	0.098539	0.100234	0.065917	0.079662	0.075154
6	0.082088	0.074366	0.064179	0.064179	0.067348	0.059523	0.065693	0.048848	0.085962	0.091233	0.065206	0.068333	0.065321
7	0.061771	0.066269	0.073435	0.073435	0.052749	0.046621	0.051452	0.038516	0.059676	0.063794	0.051071	0.051025	0.044275
8	0.074708	0.060237	0.076143	0.076143	0.041523	0.036699	0.040503	0.028087	0.050670	0.051239	0.040203	0.042259	0.037609
9	0.056669	0.058257	0.073597	0.073597	0.035696	0.031549	0.034819	0.028027	0.043809	0.040653	0.034561	0.043562	0.037406
10	0.047103	0.052050	0.068659	0.068659	0.040316	0.035632	0.039325	0.029033	0.044015	0.042649	0.039034	0.056600	0.052107
11	0.038539	0.049792	0.050687	0.050687	0.042925	0.037938	0.041871	0.040246	0.038221	0.034783	0.041560	0.064916	0.064101
12	0.028972	0.040304	0.044102	0.044102	0.041615	0.036780	0.040592	0.044739	0.032016	0.031295	0.040292	0.057678	0.056536
13	0.019679	0.032307	0.033524	0.033524	0.031537	0.043166	0.032034	0.033904	0.013503	0.014618	0.023687	0.044327	0.046019
14	0.015853	0.025846	0.032391	0.032391	0.025659	0.039441	0.029841	0.027586	0.018346	0.016614	0.036470	0.036010	0.035234
15	0.015306	0.018497	0.023396	0.023396	0.021215	0.036330	0.025734	0.058414	0.011306	0.009689	0.022582	0.030435	0.032591
16	0.011935	0.017126	0.021777	0.021777	0.027572	0.029773	0.032872	0.066975	0.012102	0.010658	0.026644	0.040685	0.040969
17	0.008746	0.012005	0.017801	0.017801	0.021230	0.025963	0.015864	0.041439	0.007387	0.006977	0.025405	0.025310	0.026449
18	0.008200	0.009174	0.012323	0.012323	0.017475	0.021535	0.018944	0.035394	0.005165	0.005036	0.017483	0.022433	0.024074
19	0.006013	0.007304	0.009139	0.009139	0.012872	0.018696	0.015280	0.015002	0.004240	0.003477	0.015336	0.016634	0.017590
20	0.003462	0.005529	0.007088	0.007088	0.014586	0.018911	0.019505	0.040761	0.004278	0.003744	0.011408	0.016184	0.019591
21	0.003371	0.004268	0.006494	0.006494	0.016370	0.027679	0.022031	0.034709	0.004124	0.003655	0.014943	0.014431	0.017397
22	0.003644	0.003410	0.005325	0.005325	0.016236	0.021057	0.012570	0.027090	0.003726	0.003071	0.019303	0.012723	0.013278
23	0.003735	0.002438	0.003562	0.003562	0.015106	0.016577	0.014946	0.036454	0.002698	0.002499	0.017121	0.009710	0.010967
24	0.003098	0.001875	0.002276	0.002276	0.015702	0.015336	0.015140	0.029193	0.001747	0.001536	0.016722	0.007013	0.009105
25	0.004191	0.001436	0.002546	0.002546	0.013171	0.012919	0.013214	0.036047	0.001824	0.001835	0.012329	0.004046	0.008763
26	0.004282	0.001256	0.002393	0.002393	0.011504	0.011086	0.011346	0.018960	0.000951	0.001467	0.013089	0.003462	0.008281
27	0.003735	0.001077	0.002357	0.002357	0.009052	0.008642	0.008761	0.019687	0.000784	0.001153	0.013278	0.003731	0.006291
28	0.003735	0.000858	0.001520	0.001520	0.003572	0.008196	0.003201	0.005641	0.000450	0.000748	0.008601	0.001349	0.002814
29	0.004191	0.000653	0.001250	0.001250	0.003011	0.004420	0.002344	0.006282	0.000642	0.001073	0.005022	0.001708	0.004440
30	0.018130	0.009169	0.008851	0.008851	0.004084	0.003881	0.004023	0.006268	0.003148	0.006131	0.003427	0.007867	0.020875

Waller County 2002 Age Distributions Inputs to MOVES

Age	MC	PC	PT	LCT	IBus	TBus	SBus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.081505	0.041587	0.074618	0.074618	0.057086	0.044226	0.054177	0.027706	0.101906	0.102260	0.051473	0.039361	0.033087
1	0.115987	0.068359	0.098903	0.098903	0.067160	0.052030	0.063738	0.029896	0.137869	0.143115	0.060557	0.067005	0.059279
2	0.094044	0.086294	0.084508	0.084508	0.074487	0.057706	0.070691	0.043169	0.139706	0.123935	0.067163	0.084079	0.078329
3	0.090909	0.070612	0.085879	0.085879	0.076013	0.058889	0.072140	0.050515	0.117981	0.115521	0.068539	0.091826	0.078564
4	0.056426	0.071391	0.066882	0.066882	0.060030	0.072023	0.059327	0.039893	0.054890	0.055213	0.041990	0.066096	0.066623
5	0.062696	0.067233	0.071582	0.071582	0.050385	0.067887	0.057010	0.033484	0.081717	0.073413	0.066692	0.050839	0.052283
6	0.053292	0.061601	0.058167	0.058167	0.043430	0.065192	0.051257	0.073919	0.044630	0.040436	0.043052	0.048257	0.050489
7	0.053292	0.061428	0.061105	0.061105	0.058246	0.055131	0.067565	0.087457	0.062570	0.053893	0.052418	0.077861	0.070480
8	0.031348	0.055623	0.055817	0.055817	0.046777	0.050144	0.034008	0.056440	0.041229	0.037105	0.052131	0.050170	0.048179
9	0.043887	0.054757	0.045339	0.045339	0.040161	0.043380	0.042359	0.050280	0.034536	0.029449	0.037417	0.049692	0.046822
10	0.006270	0.045833	0.036428	0.036428	0.030868	0.039299	0.035652	0.022238	0.025730	0.021518	0.034250	0.038213	0.033984
11	0.018809	0.046959	0.033000	0.033000	0.036500	0.041479	0.047487	0.063049	0.021725	0.022132	0.026585	0.046726	0.041654
12	0.021944	0.046266	0.028692	0.028692	0.042298	0.062690	0.055385	0.055438	0.021122	0.020865	0.035957	0.047587	0.040577
13	0.025078	0.035609	0.027810	0.027810	0.043797	0.049789	0.032989	0.045171	0.016925	0.017194	0.048492	0.040891	0.033233
14	0.028213	0.036475	0.024089	0.024089	0.042540	0.040918	0.040951	0.063457	0.015937	0.015593	0.044900	0.032570	0.029600
15	0.015674	0.028331	0.018606	0.018606	0.045676	0.039103	0.042849	0.052492	0.010451	0.012053	0.045301	0.025348	0.027100
16	0.012539	0.020880	0.017235	0.017235	0.040017	0.034406	0.039061	0.067697	0.009848	0.016246	0.034884	0.020278	0.026394
17	0.031348	0.020447	0.016843	0.016843	0.036115	0.030509	0.034656	0.036794	0.009848	0.015724	0.038270	0.021952	0.029982
18	0.028213	0.017848	0.018410	0.018410	0.029365	0.024575	0.027654	0.039478	0.008449	0.011020	0.040114	0.019944	0.025329
19	0.018809	0.011090	0.011653	0.011653	0.011980	0.024091	0.010443	0.011694	0.004992	0.006199	0.026863	0.008417	0.011549
20	0.015674	0.007971	0.012241	0.012241	0.010437	0.013429	0.007905	0.013460	0.007105	0.010204	0.016211	0.012961	0.017771
21	0.012539	0.005372	0.009792	0.009792	0.009369	0.006026	0.009592	0.012328	0.006172	0.008081	0.009213	0.013248	0.018511
22	0.015674	0.005285	0.005092	0.005092	0.012480	0.016749	0.009645	0.003160	0.003566	0.005448	0.001241	0.010617	0.014015
23	0.015674	0.006585	0.007736	0.007736	0.007676	0.005071	0.008149	0.003332	0.004800	0.007735	0.009806	0.012052	0.017132
24	0.009404	0.003726	0.006365	0.006365	0.006146	0.002264	0.007108	0.003312	0.004142	0.005370	0.013354	0.007987	0.010966
25	0.006270	0.002253	0.004015	0.004015	0.006667	0.000458	0.007229	0.000000	0.002935	0.005128	0.018503	0.004591	0.007815
26	0.009512	0.002779	0.003055	0.003055	0.002553	0.000881	0.004887	0.006886	0.000953	0.003182	0.011604	0.001016	0.004190
27	0.005945	0.001902	0.002788	0.002788	0.003150	0.000601	0.006086	0.002022	0.001215	0.002707	0.003020	0.001656	0.003073
28	0.003567	0.001243	0.002874	0.002874	0.003099	0.000582	0.000000	0.005149	0.001045	0.002035	0.000000	0.001889	0.003322
29	0.002378	0.001170	0.001145	0.001145	0.002572	0.000150	0.000000	0.000084	0.000657	0.001589	0.000000	0.001389	0.002952
30	0.013080	0.013092	0.009332	0.009332	0.002922	0.000320	0.000000	0.000000	0.005346	0.015638	0.000000	0.005481	0.016715

Waller County 2008 Age Distributions Inputs to MOVES

Age	MC	PC	PT	LCT	IBus	TBus	SBus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.075472	0.044178	0.037914	0.037914	0.073317	0.062325	0.070930	0.028618	0.142370	0.136309	0.069827	0.030912	0.032667
1	0.133255	0.064246	0.067880	0.067880	0.075781	0.064419	0.073313	0.030575	0.113204	0.111540	0.072173	0.088500	0.087489
2	0.108491	0.073039	0.068596	0.068596	0.076500	0.065031	0.074009	0.051881	0.125541	0.126729	0.072858	0.069736	0.066595
3	0.095519	0.072968	0.058183	0.058183	0.077219	0.065643	0.074705	0.047316	0.115078	0.118261	0.073543	0.057804	0.057036
4	0.064858	0.059850	0.076385	0.076385	0.061728	0.052473	0.059718	0.038077	0.078008	0.081544	0.058789	0.048335	0.041313
5	0.091981	0.056942	0.079803	0.079803	0.049092	0.041732	0.047494	0.028053	0.067027	0.067105	0.046755	0.040164	0.036925
6	0.066038	0.061197	0.077657	0.077657	0.042638	0.036246	0.041250	0.028282	0.057280	0.053713	0.040608	0.039559	0.037541
7	0.055425	0.058573	0.073444	0.073444	0.048658	0.041363	0.047073	0.029602	0.059366	0.056490	0.046341	0.056636	0.053820
8	0.047170	0.067295	0.055560	0.055560	0.052347	0.044499	0.050642	0.041462	0.053000	0.048678	0.049855	0.076783	0.070148
9	0.043632	0.057793	0.056514	0.056514	0.051817	0.044049	0.050130	0.047062	0.045827	0.043835	0.049350	0.072849	0.065860
10	0.027123	0.050418	0.046419	0.046419	0.039682	0.052240	0.039977	0.036040	0.018276	0.021730	0.029318	0.057112	0.053164
11	0.017689	0.049638	0.048804	0.048804	0.032626	0.048235	0.037632	0.029632	0.025708	0.026547	0.045615	0.040597	0.040519
12	0.023585	0.041271	0.035291	0.035291	0.027262	0.044903	0.032799	0.063414	0.015108	0.014532	0.028545	0.038867	0.039695
13	0.012972	0.045029	0.037199	0.037199	0.035808	0.037190	0.042342	0.073481	0.019175	0.017464	0.034038	0.051102	0.049750
14	0.017689	0.034818	0.031873	0.031873	0.028164	0.033128	0.020873	0.046443	0.011956	0.011305	0.033154	0.035452	0.034067
15	0.015330	0.032903	0.024163	0.024163	0.023433	0.027774	0.025194	0.040094	0.009184	0.008309	0.023060	0.031820	0.031486
16	0.005896	0.025599	0.021540	0.021540	0.017635	0.024637	0.020763	0.017363	0.007402	0.006196	0.020669	0.023303	0.022304
17	0.010613	0.023188	0.016056	0.016056	0.020201	0.025191	0.026792	0.047690	0.005650	0.006110	0.015542	0.025032	0.026334
18	0.008255	0.017373	0.013512	0.013512	0.022918	0.037271	0.030590	0.041051	0.005787	0.006137	0.020578	0.023390	0.023247
19	0.005896	0.010708	0.012320	0.012320	0.022980	0.028666	0.017645	0.032392	0.004691	0.005234	0.026875	0.020406	0.019267
20	0.003538	0.010069	0.010730	0.010730	0.021616	0.022814	0.021212	0.044068	0.003701	0.004329	0.024099	0.015953	0.016249
21	0.009434	0.007446	0.007392	0.007392	0.022716	0.021339	0.021723	0.035678	0.002117	0.003009	0.023796	0.011760	0.013807
22	0.007075	0.003971	0.006120	0.006120	0.019266	0.018176	0.019171	0.044544	0.002741	0.003994	0.017740	0.007912	0.012199
23	0.005896	0.005815	0.007233	0.007233	0.017014	0.015771	0.016643	0.023689	0.002010	0.003636	0.019043	0.007004	0.013053
24	0.008255	0.003971	0.006438	0.006438	0.013536	0.012430	0.012995	0.024871	0.001630	0.002498	0.019531	0.006831	0.009886
25	0.004717	0.002766	0.003259	0.003259	0.005402	0.011921	0.004800	0.007207	0.001005	0.001297	0.012795	0.002335	0.004308
26	0.009434	0.002607	0.003069	0.003069	0.004604	0.006501	0.003555	0.008115	0.000735	0.001371	0.007554	0.001974	0.004519
27	0.005896	0.001784	0.003078	0.003078	0.004043	0.002854	0.004220	0.007271	0.001272	0.001835	0.004199	0.002960	0.006190
28	0.003538	0.001166	0.002854	0.002854	0.005267	0.007757	0.004150	0.001823	0.001026	0.001389	0.000553	0.004081	0.006416
29	0.002358	0.001098	0.001215	0.001215	0.003168	0.002297	0.003429	0.001880	0.000534	0.000994	0.004276	0.002509	0.004646
30	0.012972	0.012279	0.009496	0.009496	0.003562	0.001128	0.004233	0.002327	0.003591	0.007881	0.008922	0.008320	0.019502

Waller County 2011 Age Distribution Inputs to MOVES (2011, 2014, 2017, 2018, and 2019 Analysis Years)

Age	MC	PC	PT	LCT	IBus	TBus	SBus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.032184	0.023292	0.017334	0.017334	0.069073	0.061049	0.067376	0.028802	0.100184	0.104789	0.066877	0.022568	0.021517
1	0.031034	0.039236	0.032092	0.032092	0.063576	0.056190	0.062014	0.027620	0.051441	0.054592	0.061554	0.023917	0.018938
2	0.078161	0.041730	0.029125	0.029125	0.061072	0.053977	0.059571	0.027681	0.054203	0.051380	0.059130	0.035695	0.033960
3	0.072414	0.072239	0.061138	0.061138	0.067253	0.059440	0.065601	0.031074	0.152909	0.148094	0.065115	0.047339	0.047549
4	0.120690	0.071583	0.069415	0.069415	0.068818	0.060823	0.067127	0.032867	0.091936	0.091287	0.066630	0.108389	0.100800
5	0.101149	0.070009	0.063012	0.063012	0.068082	0.060172	0.066409	0.054654	0.098539	0.100234	0.065917	0.079662	0.075154
6	0.083908	0.068959	0.057469	0.057469	0.067348	0.059523	0.065693	0.048848	0.085962	0.091233	0.065206	0.068333	0.065321
7	0.058621	0.055902	0.071133	0.071133	0.052749	0.046621	0.051452	0.038516	0.059676	0.063794	0.051071	0.051025	0.044275
8	0.074713	0.054130	0.069806	0.069806	0.041523	0.036699	0.040503	0.028087	0.050670	0.051239	0.040203	0.042259	0.037609
9	0.050575	0.059051	0.073007	0.073007	0.035696	0.031549	0.034819	0.028027	0.043809	0.040653	0.034561	0.043562	0.037406
10	0.044828	0.059839	0.069962	0.069962	0.040316	0.035632	0.039325	0.029033	0.044015	0.042649	0.039034	0.056600	0.052107
11	0.042529	0.062594	0.050051	0.050051	0.042925	0.037938	0.041871	0.040246	0.038221	0.034783	0.041560	0.064916	0.064101
12	0.032184	0.054721	0.052393	0.052393	0.041615	0.036780	0.040592	0.044739	0.032016	0.031295	0.040292	0.057678	0.056536
13	0.025287	0.043435	0.042008	0.042008	0.031537	0.043166	0.032034	0.033904	0.013503	0.014618	0.023687	0.044327	0.046019
14	0.013793	0.038843	0.044741	0.044741	0.025659	0.039441	0.029841	0.027586	0.018346	0.016614	0.036470	0.036010	0.035234
15	0.016092	0.033134	0.031233	0.031233	0.021215	0.036330	0.025734	0.058414	0.011306	0.009689	0.022582	0.030435	0.032591
16	0.018391	0.031560	0.033497	0.033497	0.027572	0.029773	0.032872	0.066975	0.012102	0.010658	0.026644	0.040685	0.040969
17	0.009195	0.024014	0.026860	0.026860	0.021230	0.025963	0.015864	0.041439	0.007387	0.006977	0.025405	0.025310	0.026449
18	0.011494	0.020471	0.017569	0.017569	0.017475	0.021535	0.018944	0.035394	0.005165	0.005036	0.017483	0.022433	0.024074
19	0.004598	0.016141	0.016710	0.016710	0.012872	0.018696	0.015280	0.015002	0.004240	0.003477	0.015336	0.016634	0.017590
20	0.004598	0.012204	0.010541	0.010541	0.014586	0.018911	0.019505	0.040761	0.004278	0.003744	0.011408	0.016184	0.019591
21	0.005747	0.008792	0.009916	0.009916	0.016370	0.027679	0.022031	0.034709	0.004124	0.003655	0.014943	0.014431	0.017397
22	0.004598	0.007086	0.008745	0.008745	0.016236	0.021057	0.012570	0.027090	0.003726	0.003071	0.019303	0.012723	0.013278
23	0.006897	0.005118	0.007340	0.007340	0.015106	0.016577	0.014946	0.036454	0.002698	0.002499	0.017121	0.009710	0.010967
24	0.004598	0.004462	0.004919	0.004919	0.015702	0.015336	0.015140	0.029193	0.001747	0.001536	0.016722	0.007013	0.009105
25	0.008046	0.001968	0.004216	0.004216	0.013171	0.012919	0.013214	0.036047	0.001824	0.001835	0.012329	0.004046	0.008763
26	0.006897	0.002428	0.004216	0.004216	0.011504	0.011086	0.011346	0.018960	0.000951	0.001467	0.013089	0.003462	0.008281
27	0.004598	0.002493	0.003904	0.003904	0.009052	0.008642	0.008761	0.019687	0.000784	0.001153	0.013278	0.003731	0.006291
28	0.009195	0.001378	0.002342	0.002342	0.003572	0.008196	0.003201	0.005641	0.000450	0.000748	0.008601	0.001349	0.002814
29	0.004598	0.001115	0.002577	0.002577	0.003011	0.004420	0.002344	0.006282	0.000642	0.001073	0.005022	0.001708	0.004440
30	0.018391	0.012073	0.012727	0.012727	0.004084	0.003881	0.004023	0.006268	0.003148	0.006131	0.003427	0.007867	0.020875

Texas Statewide 2002 Fuel/Engine Fractions Summary[1]

SUT	Fuel Type	Model Year															
		2002	2001	2000	1999	1998	1997	1996	1995	1994	1993	1992	1991	1900	1989	1988	1987
PC	Gas	0.996	0.996	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
PC	Diesel	0.004	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PT	Gas	0.987	0.987	0.977	0.977	0.990	0.981	0.980	0.985	0.982	0.979	0.979	0.980	0.987	0.992	0.995	0.990
PT	Diesel	0.013	0.013	0.023	0.023	0.010	0.019	0.020	0.015	0.018	0.021	0.021	0.020	0.013	0.008	0.005	0.010
PT	Gas	0.987	0.987	0.977	0.977	0.990	0.981	0.980	0.985	0.982	0.979	0.979	0.980	0.987	0.992	0.995	0.990
PT	Diesel	0.013	0.013	0.023	0.023	0.010	0.019	0.020	0.015	0.018	0.021	0.021	0.020	0.013	0.008	0.005	0.010
LCT	Gas	0.843	0.827	0.877	0.833	0.962	0.864	0.911	0.881	0.898	0.915	0.930	0.932	0.916	0.907	0.923	0.939
LCT	Diesel	0.157	0.173	0.123	0.167	0.038	0.136	0.089	0.119	0.102	0.085	0.070	0.068	0.084	0.093	0.077	0.061
LCT	Gas	0.843	0.827	0.877	0.833	0.962	0.864	0.911	0.881	0.898	0.915	0.930	0.932	0.916	0.907	0.923	0.939
LCT	Diesel	0.157	0.173	0.123	0.167	0.038	0.136	0.089	0.119	0.102	0.085	0.070	0.068	0.084	0.093	0.077	0.061
IBus	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
TBus	Gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TBus	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SBus	Gas	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.114	0.147	0.121	0.010	0.090	0.124	0.229	0.250	0.266
SBus	Diesel	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.886	0.853	0.879	0.990	0.910	0.876	0.771	0.750	0.734
RT	Gas	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040
RT	Diesel	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960
SUShT	Gas	0.202	0.265	0.346	0.330	0.413	0.450	0.456	0.703	0.492	0.493	0.504	0.517	0.570	0.606	0.723	0.775
SUShT	Diesel	0.798	0.735	0.654	0.670	0.587	0.550	0.544	0.297	0.508	0.507	0.496	0.483	0.430	0.394	0.277	0.225
SULhT	Gas	0.202	0.265	0.346	0.330	0.413	0.450	0.456	0.703	0.492	0.493	0.504	0.517	0.570	0.606	0.723	0.775
SULhT	Diesel	0.798	0.735	0.654	0.670	0.587	0.550	0.544	0.297	0.508	0.507	0.496	0.483	0.430	0.394	0.277	0.225
MH	Gas	0.600	0.630	0.660	0.680	0.710	0.740	0.770	0.790	0.820	0.850	0.850	0.850	0.850	0.850	0.850	0.850
MH	Diesel	0.400	0.370	0.340	0.320	0.290	0.260	0.230	0.210	0.180	0.150	0.150	0.150	0.150	0.150	0.150	0.150
CShT	Gas	0.062	0.102	0.094	0.100	0.131	0.202	0.156	0.403	0.125	0.135	0.213	0.175	0.159	0.155	0.199	0.207
CShT	Diesel	0.938	0.898	0.906	0.900	0.869	0.798	0.844	0.597	0.875	0.865	0.787	0.825	0.841	0.845	0.801	0.793
CLhT	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

[1] Conventional internal combustion engine technology only.

Texas Statewide 2002 Fuel/Engine Fractions Summary[1] (Continued)

SUT	Fuel Type	Model Year														
		1986	1985	1984	1983	1982	1981	1980	1979	1978	1977	1976	1975	1974	1973	1972
PC	Gas	1.000	0.988	0.981	0.969	0.939	0.924	0.953	0.969	0.985	0.987	0.983	0.982	0.993	0.993	0.993
PC	Diesel	0.000	0.012	0.019	0.031	0.061	0.076	0.047	0.031	0.015	0.013	0.017	0.018	0.007	0.007	0.007
PT	Gas	0.978	0.983	0.985	0.979	0.960	0.982	0.988	0.986	0.986	0.986	0.986	0.986	0.986	0.986	0.986
PT	Diesel	0.022	0.017	0.015	0.021	0.040	0.018	0.012	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
PT	Gas	0.978	0.983	0.985	0.979	0.960	0.982	0.988	0.986	0.986	0.986	0.986	0.986	0.986	0.986	0.986
PT	Diesel	0.022	0.017	0.015	0.021	0.040	0.018	0.012	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
LCT	Gas	0.919	0.900	0.852	0.795	0.780	0.929	0.893	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958
LCT	Diesel	0.081	0.100	0.148	0.205	0.220	0.071	0.107	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042
LCT	Gas	0.919	0.900	0.852	0.795	0.780	0.929	0.893	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958
LCT	Diesel	0.081	0.100	0.148	0.205	0.220	0.071	0.107	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042
IBus	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
TBus	Gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TBus	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SBus	Gas	0.327	0.485	0.615	0.676	0.674	0.736	0.941	0.954	0.971	0.976	0.991	0.991	0.991	0.991	0.991
SBus	Diesel	0.673	0.515	0.385	0.324	0.326	0.264	0.059	0.046	0.029	0.024	0.009	0.009	0.009	0.009	0.009
RT	Gas	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040
RT	Diesel	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960
SUShT	Gas	0.775	0.814	0.791	0.806	0.839	0.932	0.968	0.969	0.984	0.977	0.969	0.993	0.987	0.994	0.999
SUShT	Diesel	0.225	0.186	0.209	0.194	0.161	0.068	0.032	0.031	0.016	0.023	0.031	0.007	0.013	0.006	0.001
SULhT	Gas	0.775	0.814	0.791	0.806	0.839	0.932	0.968	0.969	0.984	0.977	0.969	0.993	0.987	0.994	0.999
SULhT	Diesel	0.225	0.186	0.209	0.194	0.161	0.068	0.032	0.031	0.016	0.023	0.031	0.007	0.013	0.006	0.001
MH	Gas	0.850	0.850	0.850	0.850	0.850	0.850	0.850	0.850	0.850	0.850	0.850	0.850	0.850	0.850	0.850
MH	Diesel	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150
CShT	Gas	0.254	0.277	0.282	0.351	0.348	0.311	0.590	0.647	0.640	0.697	0.734	0.614	0.577	0.802	0.894
CShT	Diesel	0.746	0.723	0.718	0.649	0.652	0.689	0.410	0.353	0.360	0.303	0.266	0.386	0.423	0.198	0.106
CLhT	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

[1] Conventional internal combustion engine technology only.

Texas Statewide 2008 Fuel/Engine Fractions Summary[1]

SUT	Fuel Type	Model Year															
		2002	2001	2000	1999	1998	1997	1996	1995	1994	1993	1992	1991	1900	1989	1988	1987
PC	Gas	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
PC	Diesel	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PT	Gas	0.977	0.977	0.977	0.987	0.987	0.987	0.987	0.987	0.977	0.977	0.990	0.981	0.980	0.985	0.982	0.979
PT	Diesel	0.023	0.023	0.023	0.013	0.013	0.013	0.013	0.013	0.023	0.023	0.010	0.019	0.020	0.015	0.018	0.021
PT	Gas	0.977	0.977	0.977	0.987	0.987	0.987	0.987	0.987	0.977	0.977	0.990	0.981	0.980	0.985	0.982	0.979
PT	Diesel	0.023	0.023	0.023	0.013	0.013	0.013	0.013	0.013	0.023	0.023	0.010	0.019	0.020	0.015	0.018	0.021
LCT	Gas	0.895	0.913	0.921	0.891	0.819	0.867	0.843	0.827	0.877	0.833	0.962	0.864	0.911	0.881	0.898	0.915
LCT	Diesel	0.105	0.087	0.079	0.109	0.181	0.133	0.157	0.173	0.123	0.167	0.038	0.136	0.089	0.119	0.102	0.085
LCT	Gas	0.895	0.913	0.921	0.891	0.819	0.867	0.843	0.827	0.877	0.833	0.962	0.864	0.911	0.881	0.898	0.915
LCT	Diesel	0.105	0.087	0.079	0.109	0.181	0.133	0.157	0.173	0.123	0.167	0.038	0.136	0.089	0.119	0.102	0.085
IBus	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
TBus	Gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TBus	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SBus	Gas	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.114	0.147	0.121
SBus	Diesel	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.886	0.853	0.879
RT	Gas	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040
RT	Diesel	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960
SUShT	Gas	0.284	0.211	0.212	0.193	0.202	0.248	0.281	0.309	0.373	0.369	0.472	0.479	0.469	0.688	0.513	0.521
SUShT	Diesel	0.716	0.789	0.788	0.807	0.798	0.752	0.719	0.691	0.627	0.631	0.528	0.521	0.531	0.312	0.487	0.479
SULhT	Gas	0.284	0.211	0.212	0.193	0.202	0.248	0.281	0.309	0.373	0.369	0.472	0.479	0.469	0.688	0.513	0.521
SULhT	Diesel	0.716	0.789	0.788	0.807	0.798	0.752	0.719	0.691	0.627	0.631	0.528	0.521	0.531	0.312	0.487	0.479
MH	Gas	0.510	0.530	0.540	0.560	0.570	0.590	0.600	0.630	0.660	0.680	0.710	0.740	0.770	0.790	0.820	0.850
MH	Diesel	0.490	0.470	0.460	0.440	0.430	0.410	0.400	0.370	0.340	0.320	0.290	0.260	0.230	0.210	0.180	0.150
CShT	Gas	0.046	0.024	0.065	0.059	0.057	0.054	0.084	0.073	0.085	0.095	0.122	0.154	0.133	0.303	0.108	0.111
CShT	Diesel	0.954	0.976	0.935	0.941	0.943	0.946	0.916	0.927	0.915	0.905	0.878	0.846	0.867	0.697	0.892	0.889
CLhT	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

[1] Conventional internal combustion engine technology only.

Texas Statewide 2008 Fuel/Engine Fractions Summary[1] (Continued)

SUT	Fuel Type	Model Year														
		1986	1985	1984	1983	1982	1981	1980	1979	1978	1977	1976	1975	1974	1973	1972
PC	Gas	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.988	0.981	0.969	0.939	0.924	0.953	0.969	0.985
PC	Diesel	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.019	0.031	0.061	0.076	0.047	0.031	0.015
PT	Gas	0.979	0.980	0.987	0.992	0.995	0.990	0.978	0.983	0.985	0.979	0.960	0.982	0.988	0.986	0.986
PT	Diesel	0.021	0.020	0.013	0.008	0.005	0.010	0.022	0.017	0.015	0.021	0.040	0.018	0.012	0.014	0.014
PT	Gas	0.979	0.980	0.987	0.992	0.995	0.990	0.978	0.983	0.985	0.979	0.960	0.982	0.988	0.986	0.986
PT	Diesel	0.021	0.020	0.013	0.008	0.005	0.010	0.022	0.017	0.015	0.021	0.040	0.018	0.012	0.014	0.014
LCT	Gas	0.930	0.932	0.916	0.907	0.923	0.939	0.919	0.900	0.852	0.795	0.780	0.929	0.893	0.958	0.958
LCT	Diesel	0.070	0.068	0.084	0.093	0.077	0.061	0.081	0.100	0.148	0.205	0.220	0.071	0.107	0.042	0.042
LCT	Gas	0.930	0.932	0.916	0.907	0.923	0.939	0.919	0.900	0.852	0.795	0.780	0.929	0.893	0.958	0.958
LCT	Diesel	0.070	0.068	0.084	0.093	0.077	0.061	0.081	0.100	0.148	0.205	0.220	0.071	0.107	0.042	0.042
IBus	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
TBus	Gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TBus	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SBus	Gas	0.010	0.090	0.124	0.229	0.250	0.266	0.327	0.485	0.615	0.676	0.674	0.736	0.941	0.954	0.971
SBus	Diesel	0.990	0.910	0.876	0.771	0.750	0.734	0.673	0.515	0.385	0.324	0.326	0.264	0.059	0.046	0.029
RT	Gas	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040
RT	Diesel	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960
SUShT	Gas	0.526	0.505	0.517	0.554	0.702	0.757	0.808	0.817	0.809	0.808	0.882	0.889	0.926	0.974	0.993
SUShT	Diesel	0.474	0.495	0.483	0.446	0.298	0.243	0.192	0.183	0.191	0.192	0.118	0.111	0.074	0.026	0.007
SULhT	Gas	0.526	0.505	0.517	0.554	0.702	0.757	0.808	0.817	0.809	0.808	0.882	0.889	0.926	0.974	0.993
SULhT	Diesel	0.474	0.495	0.483	0.446	0.298	0.243	0.192	0.183	0.191	0.192	0.118	0.111	0.074	0.026	0.007
MH	Gas	0.850	0.850	0.850	0.850	0.850	0.850	0.850	0.850	0.850	0.850	0.850	0.850	0.850	0.850	0.850
MH	Diesel	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150
CShT	Gas	0.167	0.161	0.140	0.121	0.178	0.145	0.261	0.260	0.276	0.329	0.478	0.308	0.292	0.592	0.747
CShT	Diesel	0.833	0.839	0.860	0.879	0.822	0.855	0.739	0.740	0.724	0.671	0.522	0.692	0.708	0.408	0.253
CLhT	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

[1] Conventional internal combustion engine technology only.

Texas Statewide 2011 Fuel/Engine Fractions Summary[1]

SUT	Fuel Type	Model Year															
		2002	2001	2000	1999	1998	1997	1996	1995	1994	1993	1992	1991	1900	1989	1988	1987
PC	Gas	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	1.000	1.000	1.000	1.000	1.000
PC	Diesel	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.000	0.000	0.000	0.000	0.000
PT	Gas	0.977	0.977	0.977	0.977	0.977	0.977	0.987	0.987	0.987	0.987	0.987	0.977	0.977	0.990	0.981	0.980
PT	Diesel	0.023	0.023	0.023	0.023	0.023	0.023	0.013	0.013	0.013	0.013	0.013	0.023	0.023	0.010	0.019	0.020
PT	Gas	0.977	0.977	0.977	0.977	0.977	0.977	0.987	0.987	0.987	0.987	0.987	0.977	0.977	0.990	0.981	0.980
PT	Diesel	0.023	0.023	0.023	0.023	0.023	0.023	0.013	0.013	0.013	0.013	0.013	0.023	0.023	0.010	0.019	0.020
LCT	Gas	0.895	0.895	0.895	0.895	0.913	0.921	0.891	0.819	0.867	0.843	0.827	0.877	0.833	0.962	0.864	0.911
LCT	Diesel	0.105	0.105	0.105	0.105	0.087	0.079	0.109	0.181	0.133	0.157	0.173	0.123	0.167	0.038	0.136	0.089
LCT	Gas	0.895	0.895	0.895	0.895	0.913	0.921	0.891	0.819	0.867	0.843	0.827	0.877	0.833	0.962	0.864	0.911
LCT	Diesel	0.105	0.105	0.105	0.105	0.087	0.079	0.109	0.181	0.133	0.157	0.173	0.123	0.167	0.038	0.136	0.089
IBus	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
TBus	Gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TBus	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SBus	Gas	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042
SBus	Diesel	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958
RT	Gas	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040
RT	Diesel	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960
SUShT	Gas	0.211	0.221	0.307	0.256	0.238	0.219	0.211	0.229	0.250	0.266	0.312	0.348	0.359	0.426	0.423	0.435
SUShT	Diesel	0.789	0.779	0.693	0.744	0.762	0.781	0.789	0.771	0.750	0.734	0.688	0.652	0.641	0.574	0.577	0.565
SULhT	Gas	0.211	0.221	0.307	0.256	0.238	0.219	0.211	0.229	0.250	0.266	0.312	0.348	0.359	0.426	0.423	0.435
SULhT	Diesel	0.789	0.779	0.693	0.744	0.762	0.781	0.789	0.771	0.750	0.734	0.688	0.652	0.641	0.574	0.577	0.565
MH	Gas	0.500	0.500	0.500	0.510	0.530	0.540	0.560	0.570	0.590	0.600	0.630	0.660	0.680	0.710	0.740	0.770
MH	Diesel	0.500	0.500	0.500	0.490	0.470	0.460	0.440	0.430	0.410	0.400	0.370	0.340	0.320	0.290	0.260	0.230
CShT	Gas	0.046	0.071	0.047	0.053	0.026	0.059	0.048	0.050	0.050	0.078	0.077	0.083	0.102	0.131	0.152	0.146
CShT	Diesel	0.954	0.929	0.953	0.947	0.974	0.941	0.952	0.950	0.950	0.922	0.923	0.917	0.898	0.869	0.848	0.854
CLhT	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

[1] Conventional internal combustion engine technology only.

Texas Statewide 2011 Fuel/Engine Fractions Summary[1] (Continued)

SUT	Fuel Type	Model Year														
		1986	1985	1984	1983	1982	1981	1980	1979	1978	1977	1976	1975	1974	1973	1972
PC	Gas	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.988	0.981	0.969	0.939	0.924
PC	Diesel	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.019	0.031	0.061	0.076
PT	Gas	0.985	0.982	0.979	0.979	0.980	0.987	0.992	0.995	0.990	0.978	0.983	0.985	0.979	0.960	0.982
PT	Diesel	0.015	0.018	0.021	0.021	0.020	0.013	0.008	0.005	0.010	0.022	0.017	0.015	0.021	0.040	0.018
PT	Gas	0.985	0.982	0.979	0.979	0.980	0.987	0.992	0.995	0.990	0.978	0.983	0.985	0.979	0.960	0.982
PT	Diesel	0.015	0.018	0.021	0.021	0.020	0.013	0.008	0.005	0.010	0.022	0.017	0.015	0.021	0.040	0.018
LCT	Gas	0.881	0.898	0.915	0.930	0.932	0.916	0.907	0.923	0.939	0.919	0.900	0.852	0.795	0.780	0.929
LCT	Diesel	0.119	0.102	0.085	0.070	0.068	0.084	0.093	0.077	0.061	0.081	0.100	0.148	0.205	0.220	0.071
LCT	Gas	0.881	0.898	0.915	0.930	0.932	0.916	0.907	0.923	0.939	0.919	0.900	0.852	0.795	0.780	0.929
LCT	Diesel	0.119	0.102	0.085	0.070	0.068	0.084	0.093	0.077	0.061	0.081	0.100	0.148	0.205	0.220	0.071
IBus	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
TBus	Gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TBus	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SBus	Gas	0.114	0.147	0.121	0.010	0.090	0.124	0.229	0.250	0.266	0.327	0.485	0.615	0.676	0.674	0.736
SBus	Diesel	0.886	0.853	0.879	0.990	0.910	0.876	0.771	0.750	0.734	0.673	0.515	0.385	0.324	0.326	0.264
RT	Gas	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040
RT	Diesel	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960
SUShT	Gas	0.674	0.516	0.523	0.515	0.497	0.530	0.540	0.658	0.719	0.768	0.767	0.825	0.773	0.847	0.976
SUShT	Diesel	0.326	0.484	0.477	0.485	0.503	0.470	0.460	0.342	0.281	0.232	0.233	0.175	0.227	0.153	0.024
SULhT	Gas	0.674	0.516	0.523	0.515	0.497	0.530	0.540	0.658	0.719	0.768	0.767	0.825	0.773	0.847	0.976
SULhT	Diesel	0.326	0.484	0.477	0.485	0.503	0.470	0.460	0.342	0.281	0.232	0.233	0.175	0.227	0.153	0.024
MH	Gas	0.790	0.820	0.850	0.850	0.850	0.850	0.850	0.850	0.850	0.850	0.850	0.850	0.850	0.850	0.850
MH	Diesel	0.210	0.180	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150
CShT	Gas	0.306	0.112	0.123	0.164	0.161	0.153	0.124	0.170	0.148	0.250	0.239	0.284	0.384	0.311	0.626
CShT	Diesel	0.694	0.888	0.877	0.836	0.839	0.847	0.876	0.830	0.852	0.750	0.761	0.716	0.616	0.689	0.374
CLhT	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

[1] Conventional internal combustion engine technology only.

Texas Statewide 2014 Fuel/Engine Fractions Summary[1]

SUT	Fuel Type	Model Year															
		2002	2001	2000	1999	1998	1997	1996	1995	1994	1993	1992	1991	1900	1989	1988	1987
PC	Gas	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	1.000	1.000
PC	Diesel	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.000	0.000
PT	Gas	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.987	0.987	0.987	0.987	0.987	0.977	0.977
PT	Diesel	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.013	0.013	0.013	0.013	0.013	0.023	0.023
PT	Gas	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.987	0.987	0.987	0.987	0.987	0.977	0.977
PT	Diesel	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.013	0.013	0.013	0.013	0.013	0.023	0.023
LCT	Gas	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.913	0.921	0.891	0.819	0.867	0.843	0.827	0.877	0.833
LCT	Diesel	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.087	0.079	0.109	0.181	0.133	0.157	0.173	0.123	0.167
LCT	Gas	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.913	0.921	0.891	0.819	0.867	0.843	0.827	0.877	0.833
LCT	Diesel	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.087	0.079	0.109	0.181	0.133	0.157	0.173	0.123	0.167
IBus	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
TBus	Gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TBus	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SBus	Gas	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042
SBus	Diesel	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958
RT	Gas	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040
RT	Diesel	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960
SUShT	Gas	0.211	0.211	0.211	0.211	0.221	0.307	0.256	0.238	0.219	0.211	0.229	0.250	0.266	0.312	0.348	0.359
SUShT	Diesel	0.789	0.789	0.789	0.789	0.779	0.693	0.744	0.762	0.781	0.789	0.771	0.750	0.734	0.688	0.652	0.641
SULhT	Gas	0.211	0.211	0.211	0.211	0.221	0.307	0.256	0.238	0.219	0.211	0.229	0.250	0.266	0.312	0.348	0.359
SULhT	Diesel	0.789	0.789	0.789	0.789	0.779	0.693	0.744	0.762	0.781	0.789	0.771	0.750	0.734	0.688	0.652	0.641
MH	Gas	0.500	0.500	0.500	0.500	0.500	0.500	0.510	0.530	0.540	0.560	0.570	0.590	0.600	0.630	0.660	0.680
MH	Diesel	0.500	0.500	0.500	0.500	0.500	0.500	0.490	0.470	0.460	0.440	0.430	0.410	0.400	0.370	0.340	0.320
CShT	Gas	0.046	0.046	0.046	0.046	0.071	0.047	0.053	0.026	0.059	0.048	0.050	0.050	0.078	0.077	0.083	0.102
CShT	Diesel	0.954	0.954	0.954	0.954	0.929	0.953	0.947	0.974	0.941	0.952	0.950	0.950	0.922	0.923	0.917	0.898
CLhT	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

[1] Conventional internal combustion engine technology only.

Texas Statewide 2014 Fuel/Engine Fractions Summary[1] (Continued)

SUT	Fuel Type	Model Year														
		1986	1985	1984	1983	1982	1981	1980	1979	1978	1977	1976	1975	1974	1973	1972
PC	Gas	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.988	0.981
PC	Diesel	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.019
PT	Gas	0.990	0.981	0.980	0.985	0.982	0.979	0.979	0.980	0.987	0.992	0.995	0.990	0.978	0.983	0.985
PT	Diesel	0.010	0.019	0.020	0.015	0.018	0.021	0.021	0.020	0.013	0.008	0.005	0.010	0.022	0.017	0.015
PT	Gas	0.990	0.981	0.980	0.985	0.982	0.979	0.979	0.980	0.987	0.992	0.995	0.990	0.978	0.983	0.985
PT	Diesel	0.010	0.019	0.020	0.015	0.018	0.021	0.021	0.020	0.013	0.008	0.005	0.010	0.022	0.017	0.015
LCT	Gas	0.962	0.864	0.911	0.881	0.898	0.915	0.930	0.932	0.916	0.907	0.923	0.939	0.919	0.900	0.852
LCT	Diesel	0.038	0.136	0.089	0.119	0.102	0.085	0.070	0.068	0.084	0.093	0.077	0.061	0.081	0.100	0.148
LCT	Gas	0.962	0.864	0.911	0.881	0.898	0.915	0.930	0.932	0.916	0.907	0.923	0.939	0.919	0.900	0.852
LCT	Diesel	0.038	0.136	0.089	0.119	0.102	0.085	0.070	0.068	0.084	0.093	0.077	0.061	0.081	0.100	0.148
IBus	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
TBus	Gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TBus	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SBus	Gas	0.042	0.042	0.042	0.114	0.147	0.121	0.010	0.090	0.124	0.229	0.250	0.266	0.327	0.485	0.615
SBus	Diesel	0.958	0.958	0.958	0.886	0.853	0.879	0.990	0.910	0.876	0.771	0.750	0.734	0.673	0.515	0.385
RT	Gas	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040
RT	Diesel	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960
SUShT	Gas	0.426	0.423	0.435	0.674	0.516	0.523	0.515	0.497	0.530	0.540	0.658	0.719	0.768	0.767	0.825
SUShT	Diesel	0.574	0.577	0.565	0.326	0.484	0.477	0.485	0.503	0.470	0.460	0.342	0.281	0.232	0.233	0.175
SULhT	Gas	0.426	0.423	0.435	0.674	0.516	0.523	0.515	0.497	0.530	0.540	0.658	0.719	0.768	0.767	0.825
SULhT	Diesel	0.574	0.577	0.565	0.326	0.484	0.477	0.485	0.503	0.470	0.460	0.342	0.281	0.232	0.233	0.175
MH	Gas	0.710	0.740	0.770	0.790	0.820	0.850	0.850	0.850	0.850	0.850	0.850	0.850	0.850	0.850	0.850
MH	Diesel	0.290	0.260	0.230	0.210	0.180	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150
CShT	Gas	0.131	0.152	0.146	0.306	0.112	0.123	0.164	0.161	0.153	0.124	0.170	0.148	0.250	0.239	0.284
CShT	Diesel	0.869	0.848	0.854	0.694	0.888	0.877	0.836	0.839	0.847	0.876	0.830	0.852	0.750	0.761	0.716
CLhT	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

[1] Conventional internal combustion engine technology only.

Texas Statewide 2017 Fuel/Engine Fractions Summary[1]

SUT	Fuel Type	Model Year															
		2002	**2001**	**2000**	**1999**	**1998**	**1997**	**1996**	**1995**	**1994**	**1993**	**1992**	**1991**	**1900**	**1989**	**1988**	**1987**
PC	Gas	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996
PC	Diesel	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
PT	Gas	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.987	0.987	0.987	0.987
PT	Diesel	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.013	0.013	0.013	0.013
PT	Gas	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.987	0.987	0.987	0.987
PT	Diesel	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.013	0.013	0.013	0.013
LCT	Gas	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.913	0.921	0.891	0.819	0.867	0.843
LCT	Diesel	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.087	0.079	0.109	0.181	0.133	0.157
LCT	Gas	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.913	0.921	0.891	0.819	0.867	0.843
LCT	Diesel	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.087	0.079	0.109	0.181	0.133	0.157
IBus	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
TBus	Gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TBus	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SBus	Gas	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042
SBus	Diesel	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958
RT	Gas	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040
RT	Diesel	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960
SUShT	Gas	0.211	0.211	0.211	0.211	0.211	0.211	0.211	0.221	0.307	0.256	0.238	0.219	0.211	0.229	0.250	0.266
SUShT	Diesel	0.789	0.789	0.789	0.789	0.789	0.789	0.789	0.779	0.693	0.744	0.762	0.781	0.789	0.771	0.750	0.734
SULhT	Gas	0.211	0.211	0.211	0.211	0.211	0.211	0.211	0.221	0.307	0.256	0.238	0.219	0.211	0.229	0.250	0.266
SULhT	Diesel	0.789	0.789	0.789	0.789	0.789	0.789	0.789	0.779	0.693	0.744	0.762	0.781	0.789	0.771	0.750	0.734
MH	Gas	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.510	0.530	0.540	0.560	0.570	0.590	0.600
MH	Diesel	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.490	0.470	0.460	0.440	0.430	0.410	0.400
CShT	Gas	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.071	0.047	0.053	0.026	0.059	0.048	0.050	0.050	0.078
CShT	Diesel	0.954	0.954	0.954	0.954	0.954	0.954	0.954	0.929	0.953	0.947	0.974	0.941	0.952	0.950	0.950	0.922
CLhT	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

[1] Conventional internal combustion engine technology only.

Texas Statewide 2017 Fuel/Engine Fractions Summary[1] (Continued)

SUT	Fuel Type	Model Year														
		1986	1985	1984	1983	1982	1981	1980	1979	1978	1977	1976	1975	1974	1973	1972
PC	Gas	0.996	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
PC	Diesel	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PT	Gas	0.987	0.977	0.977	0.990	0.981	0.980	0.985	0.982	0.979	0.979	0.980	0.987	0.992	0.995	0.990
PT	Diesel	0.013	0.023	0.023	0.010	0.019	0.020	0.015	0.018	0.021	0.021	0.020	0.013	0.008	0.005	0.010
PT	Gas	0.987	0.977	0.977	0.990	0.981	0.980	0.985	0.982	0.979	0.979	0.980	0.987	0.992	0.995	0.990
PT	Diesel	0.013	0.023	0.023	0.010	0.019	0.020	0.015	0.018	0.021	0.021	0.020	0.013	0.008	0.005	0.010
LCT	Gas	0.827	0.877	0.833	0.962	0.864	0.911	0.881	0.898	0.915	0.930	0.932	0.916	0.907	0.923	0.939
LCT	Diesel	0.173	0.123	0.167	0.038	0.136	0.089	0.119	0.102	0.085	0.070	0.068	0.084	0.093	0.077	0.061
LCT	Gas	0.827	0.877	0.833	0.962	0.864	0.911	0.881	0.898	0.915	0.930	0.932	0.916	0.907	0.923	0.939
LCT	Diesel	0.173	0.123	0.167	0.038	0.136	0.089	0.119	0.102	0.085	0.070	0.068	0.084	0.093	0.077	0.061
IBus	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
TBus	Gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TBus	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SBus	Gas	0.042	0.042	0.042	0.042	0.042	0.042	0.114	0.147	0.121	0.010	0.090	0.124	0.229	0.250	0.266
SBus	Diesel	0.958	0.958	0.958	0.958	0.958	0.958	0.886	0.853	0.879	0.990	0.910	0.876	0.771	0.750	0.734
RT	Gas	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040
RT	Diesel	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960
SUShT	Gas	0.312	0.348	0.359	0.426	0.423	0.435	0.674	0.516	0.523	0.515	0.497	0.530	0.540	0.658	0.719
SUShT	Diesel	0.688	0.652	0.641	0.574	0.577	0.565	0.326	0.484	0.477	0.485	0.503	0.470	0.460	0.342	0.281
SULhT	Gas	0.312	0.348	0.359	0.426	0.423	0.435	0.674	0.516	0.523	0.515	0.497	0.530	0.540	0.658	0.719
SULhT	Diesel	0.688	0.652	0.641	0.574	0.577	0.565	0.326	0.484	0.477	0.485	0.503	0.470	0.460	0.342	0.281
MH	Gas	0.630	0.660	0.680	0.710	0.740	0.770	0.790	0.820	0.850	0.850	0.850	0.850	0.850	0.850	0.850
MH	Diesel	0.370	0.340	0.320	0.290	0.260	0.230	0.210	0.180	0.150	0.150	0.150	0.150	0.150	0.150	0.150
CShT	Gas	0.077	0.083	0.102	0.131	0.152	0.146	0.306	0.112	0.123	0.164	0.161	0.153	0.124	0.170	0.148
CShT	Diesel	0.923	0.917	0.898	0.869	0.848	0.854	0.694	0.888	0.877	0.836	0.839	0.847	0.876	0.830	0.852
CLhT	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

[1] Conventional internal combustion engine technology only.

Texas Statewide 2018 Fuel/Engine Fractions Summary[1]

SUT	Fuel Type	Model Year															
		2002	**2001**	**2000**	**1999**	**1998**	**1997**	**1996**	**1995**	**1994**	**1993**	**1992**	**1991**	**1900**	**1989**	**1988**	**1987**
PC	Gas	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996
PC	Diesel	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
PT	Gas	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.987	0.987	0.987
PT	Diesel	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.013	0.013	0.013
PT	Gas	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.987	0.987	0.987
PT	Diesel	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.013	0.013	0.013
LCT	Gas	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.913	0.921	0.891	0.819	0.867
LCT	Diesel	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.087	0.079	0.109	0.181	0.133
LCT	Gas	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.913	0.921	0.891	0.819	0.867
LCT	Diesel	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.087	0.079	0.109	0.181	0.133
IBus	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
TBus	Gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TBus	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SBus	Gas	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042
SBus	Diesel	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958
RT	Gas	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040
RT	Diesel	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960
SUShT	Gas	0.211	0.211	0.211	0.211	0.211	0.211	0.211	0.211	0.221	0.307	0.256	0.238	0.219	0.211	0.229	0.250
SUShT	Diesel	0.789	0.789	0.789	0.789	0.789	0.789	0.789	0.789	0.779	0.693	0.744	0.762	0.781	0.789	0.771	0.750
SULhT	Gas	0.211	0.211	0.211	0.211	0.211	0.211	0.211	0.211	0.221	0.307	0.256	0.238	0.219	0.211	0.229	0.250
SULhT	Diesel	0.789	0.789	0.789	0.789	0.789	0.789	0.789	0.789	0.779	0.693	0.744	0.762	0.781	0.789	0.771	0.750
MH	Gas	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.510	0.530	0.540	0.560	0.570	0.590
MH	Diesel	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.490	0.470	0.460	0.440	0.430	0.410
CShT	Gas	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.071	0.047	0.053	0.026	0.059	0.048	0.050	0.050
CShT	Diesel	0.954	0.954	0.954	0.954	0.954	0.954	0.954	0.954	0.929	0.953	0.947	0.974	0.941	0.952	0.950	0.950
CLhT	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

[1] Conventional internal combustion engine technology only.

Texas Statewide 2018 Fuel/Engine Fractions Summary[1] (Continued)

SUT	Fuel Type	Model Year														
		1986	1985	1984	1983	1982	1981	1980	1979	1978	1977	1976	1975	1974	1973	1972
PC	Gas	0.996	0.996	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
PC	Diesel	0.004	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PT	Gas	0.987	0.987	0.977	0.977	0.990	0.981	0.980	0.985	0.982	0.979	0.979	0.980	0.987	0.992	0.995
PT	Diesel	0.013	0.013	0.023	0.023	0.010	0.019	0.020	0.015	0.018	0.021	0.021	0.020	0.013	0.008	0.005
PT	Gas	0.987	0.987	0.977	0.977	0.990	0.981	0.980	0.985	0.982	0.979	0.979	0.980	0.987	0.992	0.995
PT	Diesel	0.013	0.013	0.023	0.023	0.010	0.019	0.020	0.015	0.018	0.021	0.021	0.020	0.013	0.008	0.005
LCT	Gas	0.843	0.827	0.877	0.833	0.962	0.864	0.911	0.881	0.898	0.915	0.930	0.932	0.916	0.907	0.923
LCT	Diesel	0.157	0.173	0.123	0.167	0.038	0.136	0.089	0.119	0.102	0.085	0.070	0.068	0.084	0.093	0.077
LCT	Gas	0.843	0.827	0.877	0.833	0.962	0.864	0.911	0.881	0.898	0.915	0.930	0.932	0.916	0.907	0.923
LCT	Diesel	0.157	0.173	0.123	0.167	0.038	0.136	0.089	0.119	0.102	0.085	0.070	0.068	0.084	0.093	0.077
IBus	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
TBus	Gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TBus	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SBus	Gas	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.114	0.147	0.121	0.010	0.090	0.124	0.229	0.250
SBus	Diesel	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.886	0.853	0.879	0.990	0.910	0.876	0.771	0.750
RT	Gas	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040
RT	Diesel	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960
SUShT	Gas	0.266	0.312	0.348	0.359	0.426	0.423	0.435	0.674	0.516	0.523	0.515	0.497	0.530	0.540	0.658
SUShT	Diesel	0.734	0.688	0.652	0.641	0.574	0.577	0.565	0.326	0.484	0.477	0.485	0.503	0.470	0.460	0.342
SULhT	Gas	0.266	0.312	0.348	0.359	0.426	0.423	0.435	0.674	0.516	0.523	0.515	0.497	0.530	0.540	0.658
SULhT	Diesel	0.734	0.688	0.652	0.641	0.574	0.577	0.565	0.326	0.484	0.477	0.485	0.503	0.470	0.460	0.342
MH	Gas	0.600	0.630	0.660	0.680	0.710	0.740	0.770	0.790	0.820	0.850	0.850	0.850	0.850	0.850	0.850
MH	Diesel	0.400	0.370	0.340	0.320	0.290	0.260	0.230	0.210	0.180	0.150	0.150	0.150	0.150	0.150	0.150
CShT	Gas	0.078	0.077	0.083	0.102	0.131	0.152	0.146	0.306	0.112	0.123	0.164	0.161	0.153	0.124	0.170
CShT	Diesel	0.922	0.923	0.917	0.898	0.869	0.848	0.854	0.694	0.888	0.877	0.836	0.839	0.847	0.876	0.830
CLhT	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

[1] Conventional internal combustion engine technology only.

Texas Statewide 2019 Fuel/Engine Fractions Summary[1]

SUT	Fuel Type	Model Year															
		2002	**2001**	**2000**	**1999**	**1998**	**1997**	**1996**	**1995**	**1994**	**1993**	**1992**	**1991**	**1900**	**1989**	**1988**	**1987**
PC	Gas	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996
PC	Diesel	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
PT	Gas	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.987	0.987
PT	Diesel	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.013	0.013
PT	Gas	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.987	0.987
PT	Diesel	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.013	0.013
LCT	Gas	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.913	0.921	0.891	0.819
LCT	Diesel	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.087	0.079	0.109	0.181
LCT	Gas	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.913	0.921	0.891	0.819
LCT	Diesel	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.087	0.079	0.109	0.181
IBus	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
TBus	Gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TBus	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SBus	Gas	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042
SBus	Diesel	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958
RT	Gas	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040
RT	Diesel	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960
SUShT	Gas	0.211	0.211	0.211	0.211	0.211	0.211	0.211	0.211	0.211	0.221	0.307	0.256	0.238	0.219	0.211	0.229
SUShT	Diesel	0.789	0.789	0.789	0.789	0.789	0.789	0.789	0.789	0.789	0.779	0.693	0.744	0.762	0.781	0.789	0.771
SULhT	Gas	0.211	0.211	0.211	0.211	0.211	0.211	0.211	0.211	0.211	0.221	0.307	0.256	0.238	0.219	0.211	0.229
SULhT	Diesel	0.789	0.789	0.789	0.789	0.789	0.789	0.789	0.789	0.789	0.779	0.693	0.744	0.762	0.781	0.789	0.771
MH	Gas	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.510	0.530	0.540	0.560	0.570
MH	Diesel	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.490	0.470	0.460	0.440	0.430
CShT	Gas	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.071	0.047	0.053	0.026	0.059	0.048	0.050
CShT	Diesel	0.954	0.954	0.954	0.954	0.954	0.954	0.954	0.954	0.954	0.929	0.953	0.947	0.974	0.941	0.952	0.950
CLhT	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

[1] Conventional internal combustion engine technology only.

Texas Statewide 2019 Fuel/Engine Fractions Summary[1] (Continued)

SUT	Fuel Type	Model Year														
		1986	1985	1984	1983	1982	1981	1980	1979	1978	1977	1976	1975	1974	1973	1972
PC	Gas	0.996	0.996	0.996	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
PC	Diesel	0.004	0.004	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PT	Gas	0.987	0.987	0.987	0.977	0.977	0.990	0.981	0.980	0.985	0.982	0.979	0.979	0.980	0.987	0.992
PT	Diesel	0.013	0.013	0.013	0.023	0.023	0.010	0.019	0.020	0.015	0.018	0.021	0.021	0.020	0.013	0.008
PT	Gas	0.987	0.987	0.987	0.977	0.977	0.990	0.981	0.980	0.985	0.982	0.979	0.979	0.980	0.987	0.992
PT	Diesel	0.013	0.013	0.013	0.023	0.023	0.010	0.019	0.020	0.015	0.018	0.021	0.021	0.020	0.013	0.008
LCT	Gas	0.867	0.843	0.827	0.877	0.833	0.962	0.864	0.911	0.881	0.898	0.915	0.930	0.932	0.916	0.907
LCT	Diesel	0.133	0.157	0.173	0.123	0.167	0.038	0.136	0.089	0.119	0.102	0.085	0.070	0.068	0.084	0.093
LCT	Gas	0.867	0.843	0.827	0.877	0.833	0.962	0.864	0.911	0.881	0.898	0.915	0.930	0.932	0.916	0.907
LCT	Diesel	0.133	0.157	0.173	0.123	0.167	0.038	0.136	0.089	0.119	0.102	0.085	0.070	0.068	0.084	0.093
IBus	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
TBus	Gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TBus	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SBus	Gas	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.114	0.147	0.121	0.010	0.090	0.124	0.229
SBus	Diesel	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.886	0.853	0.879	0.990	0.910	0.876	0.771
RT	Gas	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040
RT	Diesel	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960
SUShT	Gas	0.250	0.266	0.312	0.348	0.359	0.426	0.423	0.435	0.674	0.516	0.523	0.515	0.497	0.530	0.540
SUShT	Diesel	0.750	0.734	0.688	0.652	0.641	0.574	0.577	0.565	0.326	0.484	0.477	0.485	0.503	0.470	0.460
SULhT	Gas	0.250	0.266	0.312	0.348	0.359	0.426	0.423	0.435	0.674	0.516	0.523	0.515	0.497	0.530	0.540
SULhT	Diesel	0.750	0.734	0.688	0.652	0.641	0.574	0.577	0.565	0.326	0.484	0.477	0.485	0.503	0.470	0.460
MH	Gas	0.590	0.600	0.630	0.660	0.680	0.710	0.740	0.770	0.790	0.820	0.850	0.850	0.850	0.850	0.850
MH	Diesel	0.410	0.400	0.370	0.340	0.320	0.290	0.260	0.230	0.210	0.180	0.150	0.150	0.150	0.150	0.150
CShT	Gas	0.050	0.078	0.077	0.083	0.102	0.131	0.152	0.146	0.306	0.112	0.123	0.164	0.161	0.153	0.124
CShT	Diesel	0.950	0.922	0.923	0.917	0.898	0.869	0.848	0.854	0.694	0.888	0.877	0.836	0.839	0.847	0.876
CLhT	Diesel	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

[1] Conventional internal combustion engine technology only.

APPENDIX I:
MOVES RUN SUMMARIES

Appendix I is being transmitted electronically.