APPENDIX E

DEVELOPMENT OF HGB ON-ROAD EMISSIONS INVENTORIES FOR THE YEARS 2012, 2014, 2017, 2020, 2023, 2026, AND 2028

ON-ROAD MOBILE SOURCE EMISSIONS INVENTORIES FOR THE HGB 1997 EIGHT-HOUR OZONE NONATTAINMENT COUNTIES: 2012, 2014, 2017, 2020, 2023, 2026, AND 2028.

This appendix documents the development of the on-road mobile emissions inventory (EI) for the Houston-Galveston-Brazoria (HGB) 1997 Eight Hour Ozone Nonattainment Area Re-designation Substitution (RS) State Implementation Plan Revision.

The development of the RS EIs was done by the Texas Transportation Institute (TTI) at the request and under the direction of the Texas Commission on Environmental Quality (TCEQ). The on-road mobile source EIs and control strategy reduction estimates reflect the most recent planning assumptions for the HGB transportation network. Complete documentation of the development and resulting EI is provided in the attached document, *On-Road Mobile Source Emissions Inventories for the HGB 1997 Eight-Hour Ozone Nonattainment Counties: 2012, 2014, 2017, 2020, 2023, 2026, and 2028*. The final emissions estimates are summarized in the "Summary of Results" section, Table 1, *HGB Eight-County Area Re-Designation Inventories–Summer Weekday (Tons per Day)*. The supporting electronic documents for the EI development, including MOVES2014 input and output files and the post processing spreadsheets used to summarize the inventories are available upon request in electronic format. Please contact the TCEQ, Air Quality Division, Area and Mobile Source Inventory and Data Support Team if a copy of the electronic information is needed.

The report also documents the development of year-to-year control strategy reduction estimates for each of the RS milestone years between 2012 and 2028. Control strategy emission reduction estimates include the effects of the Federal Motor Vehicle Control Program, the HGB vehicle inspection and maintenance program, federal reformulated gasoline Phase 1 and Phase 2, and the Texas Low Emission Diesel Program. The control scenarios are the basis for quantifying the year-to-year reductions.

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

On-Road Mobile Source Emissions Inventories for the HGB 1997 Eight-Hour Ozone Nonattainment Counties: 2012, 2014, 2017, 2020, 2023, 2026, and 2028

Prepared by the Texas A&M Transportation Institute

March 2015

PRODUCTION OF 2011, 2012, 2014, 2017, 2020, 2023, 2026, AND 2028 ON-ROAD MOBILE SOURCE EMISSIONS INVENTORIES FOR THE EIGHT HOUSTON-GALVESTON AREA COUNTIES PREVIOUSLY DESINGATED AS NONATTAINMENT FOR THE ONE-HOUR AND THE 1997 EIGHT-HOUR OZONE STANDARD

1997 Eight-Hour Re-Designation and Maintenance: 2012, 2014, 2017, 2020, 2023, 2026, and 2028

TECHNICAL REPORT

FINAL

Prepared for the
Texas Commission on Environmental Quality
Air Quality Planning and Implementation Division

Prepared by the
Transportation Modeling Program
Texas A&M Transportation Institute
TTI Study No.: 604561-0001
Study Title: Air Quality Technical Support
(Umbrella Contract: 582-11-11226 – PGA: 582-15-51346-16)

March 2015

TEXAS A&M TRANSPORTATION INSTITUTE
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EXECUTIVE SUMMARY

This project, performed by the Texas A&M Transportation Institute (TTI) for the Texas Commission on Environmental Quality (TCEQ), used the U.S. Environmental Protection Agency's (EPA) most recent Motor Vehicle Emission Simulator (MOVES) model version, MOVES2014 October Release,[1] to develop on-road mobile emissions inventories for the eight Houston-Galveston-Brazoria (HGB) counties designated nonattainment for the 1997 eight-hour ozone standard. TTI produced average summer weekday inventory estimates for 2012, 2014, 2017, 2020, 2023, 2026, and 2028 needed for the TCEQ's development of the HGB 1997 Eight-Hour Ozone Re-Designation Substitute report and/or State Implementation Plan (SIP) revision. (Additionally under this task, but documented separately, TTI produced inventories for TCEQ's one-hour ozone standard re-designation analysis.)

These MOVES2014-based inventories, developed by TTI using its detailed link-based on-road inventory development utilities (recently adapted specifically for use with MOVES2014),[2] are very similar to the other set of MOVES2014-based HGB inventories developed as part of this project (i.e., for TCEQ's one-hour ozone standard re-designation analysis).[3] MOVES2014 October Release (referred to in this report as "MOVES," unless otherwise stated) incorporates significant changes to the emissions rates for each vehicle type. For the 2017-and-later calendar years, a substantial difference with MOVES2014 is the incorporation of new federal standards for Tier 3 light-duty vehicles and gasoline with a sulfur content of 10 parts per million (ppm). The currently available MOVES-based inventories incorporate 30 ppm sulfur gasoline and Tier 2 light-duty vehicle standards that began with the 2004 model year.

To support the HGB area 1997 eight-hour ozone re-designation analysis, base and horizon year inventories were required with four inventory years in between. These years provide a basis for establishing the inventory when attainment is achieved, the inventory for a horizon year at least 10 years after the re-designation, and the inventory trend between attainment and the horizon year. Inventory development used the latest planning assumptions and the most recent version of the EPA's emissions factor model for on-road sources. Emissions were estimated for volatile organic compounds (VOC), carbon monoxide (CO), oxides of nitrogen (NO_x), particulate matter (PM) with diameter of 10 microns or less (PM_{10}), PM with diameter of 2.5 microns or less ($PM_{2.5}$), atmospheric carbon dioxide (CO_2), sulfur dioxide (SO_2), and ammonia (NH_3). The following table presents the HGB area aggregate inventory summary for particular pollutants, VMT and average speed.

[1] MOVES2014 October Release is the latest version of MOVES, released in October, 2014. It follows the initial July, 2014 release of MOVES2014.

[2] The TTI's on-road inventory development tools newly updated for use with MOVES2014, and used in this analysis, are documented in *Update of On-road Inventory Development Methodologies for Compatibility with the 2014 Version of the Motor Vehicle Emission Simulator Model*, TTI, December 2014.

[3] The main difference between these two sets of inventories are analysis years (2011 versus 2012 base years and the additional 2028 future year) and the meteorological inputs to MOVES (based on local weather station data from the respective base years).

HGB Eight-County Area Re-Designation Inventories – Summer Weekday (Tons per Day).

Year	VMT	Speed[1]	VOC	CO	NO_x	PM_{10}[2]	$PM_{2.5}$[2]	CO_2
2012	151,333,456	38.7	74.51	852.69	159.08	12.03	5.59	81,856.99
2014	144,546,685	39.2	61.48	728.00	124.64	10.43	4.48	76,652.90
2017	156,018,423	39.1	47.36	635.74	82.96	9.76	3.44	79,269.97
2020	167,051,752	38.9	40.38	587.43	61.06	9.71	2.93	79,752.34
2023	178,917,689	38.8	36.12	542.46	48.94	9.76	2.53	79,002.36
2026	190,707,272	38.5	31.71	474.28	40.24	10.13	2.37	77,660.33
2028	197,675,678	38.4	28.99	430.65	37.04	10.38	2.29	76,817.46

[1] System speed in miles-per-hour.
[2] Within each size category, the PM estimates are the aggregate of the MOVES direct vehicle PM emissions (primary PM total exhaust plus brake wear and tire wear), i.e., re-suspended dust is not included.

The hourly, MOVES rates-per-activity, detailed traffic demand model (TDM) link-based inventory method was used (consistent with previously-developed HGB area MOVES2010b-based inventories[4]), with the latest available data, models, and procedures. In general, MOVES emissions rates reflecting local conditions were produced and combined with local activity factors outside of the MOVES model to produce the emissions estimates externally. The inventory results were estimated by MOVES source use type (SUT) and fuel type combination (i.e., vehicle type) and TDM roadway class, for the gasoline and diesel-powered vehicle fleet (with alternative power sources treated as *de minimis*). Data sets extracted from the latest, regional HGB travel models (extracted and provided by the Houston-Galveston Area Council), were used to estimate hourly, directional, link (roadway segment)-level vehicle miles of travel (VMT) and operational speeds for the roadway-based emissions calculations. Using vehicle operating hours (VHT) estimates derived from the link data, local vehicle registrations, MOVES defaults, and other data, the hourly off-network activity factors were estimated for the off-network emissions calculations. The off-network activity factors are: source-hours-parked (SHP); starts; and for combination long-haul trucks only, hotelling hours, comprised of extended idling hours (SHI) and auxiliary power unit (APU) hours. The emissions rates were produced reflecting local conditions and multiplied by the associated local activity factors in the external emissions calculations. The emissions rates (e.g., grams/mile, grams/shp, grams/start, grams/shi, and grams/APU hour) were all available from the MOVES output, except grams/shp, estimated by post-processing particular MOVES input and output data. Texas Low Emissions Diesel (TxLED) fuel effects were incorporated in the MOVES emissions rates via post-processing.

[4] *MOVES2010b-Based On-Road Inventories in Support of the HGB Ozone Nonattainment Area Re-Designation Substitute Analysis*, TTI, June 2014.

The inventories were produced using utilities[5] developed by TTI to process on-road vehicle activity, off-network vehicle activity, and MOVES emissions rate data into spatially and temporally detailed emissions estimates. The EPA's *Technical Guidance*[6] is the primary technical reference used for guidance on appropriate inputs and use of MOVES.

[5] Updated for MOVES2014 from the MOVES2010b-based utilities as documented in *TTI Emissions Inventory Estimation Utilities Using MOVES: MOVES2010bUtl User's Guide*, TTI, August 2013.

[6] *Using MOVES to Prepare Emission Inventories in State Implementation Plans and Transportation Conformity: Technical Guidance for MOVES2010, 2010a, and 2010b*, EPA, April 2012. (Note that EPA released new guidance in January 2015, which was too late for use in this analysis.)

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PURPOSE

This project developed and produced Motor Vehicle Emission Simulator (MOVES) 2014-based, on-road mobile, link-based emissions inventories for the eight Houston-Galveston-Brazoria (HGB) counties, for analysis years 2011, 2012, 2014, 2017, 2020, 2023, 2026 and 2028. These emissions inventories were needed to support re-designation and maintenance analyses for the eight HGB ozone nonattainment area counties required for the development of the one-hour and 1997 eight-hour HGB Re-Designation Substitute reports and/or state implementation plans (SIPs) revisions.

As a two-part project, two individual sets of inventories were developed and documented separately, one set for the one-hour re-designation substitute (RS) SIP analysis and one for the 1997 eight-hour ozone SIP analysis. This document provides the details on development of the inventories to support the 1997 eight-hour ozone SIP revision. The inventory years for the 1997-eight-hour SIP revision are 2012, 2014, 2017, 2020, 2023, 2026, and 2028.

BACKGROUND

The Texas Commission on Environmental Quality (TCEQ) works with local planning districts, the Texas Department of Transportation (TxDOT) and the Texas A&M Transportation Institute (TTI) to provide on-road mobile source emissions inventories of air pollutants. TxDOT typically funds transportation conformity determinations required under 40 Code of Federal Regulations Part 93. TCEQ funds mobile source inventory work in support of Federal Clean Air Act (CAA) requirements, such as attainment of the National Ambient Air Quality Standards (NAAQS), 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).

To support the development of the one-hour and 1997 eight-hour ozone re-designation substitution reports and/or SIP revisions for the HGB area, inventories needed to be developed for the one-hour and 1997 eight-hour base years, the horizon years, and four years between the base and horizon years. These inventories provide a basis for establishing: the inventory when attainment is achieved; the inventory for a horizon year at least 10 years after the re-designation; and the inventory trend between attainment and the horizon year. The inventory development included use of: the latest available fleet characterization data; the latest available transportation planning information; and the most recent version of the U.S. Environmental Protection Agency's (EPA) emissions factor model for on-road sources.

PRODUCTION OF 2011, 2012, 2014, 2017, 2020, 2023, 2026 AND 2028 ON-ROAD MOBILE SOURCE EMISSIONS INVENTORIES FOR THE EIGHT HOUSTON-GALVESTON AREA COUNTIES PREVIOUSLY DESIGNATED AS NONATTAINMENT FOR THE ONE-HOUR AND THE 1997 EIGHT-HOUR OZONE STANDARD

TTI produced hourly, link-based on-road mobile emissions inventory estimates for the eight Houston-Galveston counties previously designated as nonattainment for the one-hour ozone standard, and designated as nonattainment for the 1997 eight-hour ozone standard, which included the combined analysis years 2011, 2012, 2014, 2017, 2020, 2023, 2026, and 2028. For the inventories to be consistent with inventory development for other SIP analyses, TTI used the most recent activity information, based on current travel demand modeling, and the newest version of the EPA's on-road emissions model. The inventories were produced based on methods agreed upon in consultation with the TCEQ Project Representative. The methods used to produce the inventories were consistent with EPA guidance on the production of emissions inventories. The various inventory production parameters described below were used directly, or estimated as noted. TTI adhered to the following.

- The emissions factor model used in developing inventories for this task was the most recent version of EPA's on-road emissions model, MOVES2014 October Release.
- Emissions inventories were developed for the eight HGB counties previously designated as nonattainment for the one-hour and 1997 eight-hour ozone standards. The counties are: Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller counties.
- The analysis years for the one-hour re-designation and maintenance included: 2011, 2014, 2017, 2020, 2023, and 2026.
- The analysis years for the 1997 eight-hour re-designation and maintenance included: 2012, 2014, 2017, 2020, 2023, 2026, and 2028.
- The pollutants included to complete this task were volatile organic compounds (VOC), carbon monoxide (CO), oxides of nitrogen (NO_x), carbon dioxide (CO_2), sulfur dioxide (SO_2), ammonia (NH_3), particulate matter (PM) with aerodynamic diameters equal to or less than 10 microns (PM_{10}), and PM with aerodynamic diameters equal to or less than 2.5 microns ($PM_{2.5}$).
- The day type for all the inventories was average summer weekday. Activity levels were adjusted for summer season and for average weekday, Monday through Friday.
- The temperatures were average summer 2011 temperatures for the one-hour analysis years and average summer 2012 temperatures for the 1997 eight-hour analysis years. The temperature information was provided by TCEQ.
- The humidity was average summer 2011 humidity for the one-hour analysis years and average summer 2012 humidity for the 1997 eight-hour analysis years. The humidity information was provided by TCEQ.
- The barometric pressure was average summer 2011 barometric pressure for the one-hour analysis years and average summer 2012 barometric pressure for the 1997 eight-hour analysis years. The barometric pressure information was provided by TCEQ.
- The vehicle miles traveled (VMT) mixes was consistent with the EPA MOVES source use types (SUTs). The most current VMT mix for the HGB area was used.
- TTI used vehicle registration distributions developed from the Texas Department of Motor Vehicles (TxDMV) registration data as input for locality specific MOVES age distributions. For historical years, TTI used registration data for each historical year. For future analysis years, TTI used the most recent year vehicle registration distributions.
- TTI used a link-based, time-of-day emissions analysis methodology for all of the referenced counties.

- For the off-network activity development process, TTI used historical year data for historical years. For future years the most recent data available adjusted as appropriate for future years was used. The development of the off-network activity inputs was based on current Texas on-road inventory development processes and was documented in the pre-analysis plan.
- TTI developed control program parameters, including Reid Vapor Pressure (RVP) and fuel settings based upon HGB control strategies in effect for each analysis year.
- TTI used year-specific Texas Low Emissions Diesel (TxLED) adjustment factors developed using the benefit information described in the EPA *Memorandum on Texas Low Emission Diesel Fuel Benefits*, and the method as documented in previous Texas on-road inventory development reports.

Two reports were written and provided to TCEQ: this report which documents development of the 2012, 2014, 2017, 2020, 2023, 2026, and 2028 emissions estimates for the eight HGB counties designated as nonattainment for the 1997 eight-hour ozone standard; and a second report documenting development of the 2011, 2014, 2017, 2020, 2023, and 2026 emissions estimates for the eight HGB counties previously designated as nonattainment for the one-hour ozone standard.

The following 1997 eight-hour ozone standard inventory analysis activities were completed.

- Prepared county-level hourly and 24-hour day tables that provide SUT and fuel type combination (i.e., vehicle type) and roadway summaries of VMT, vehicle hours traveled (VHT), average speed, source hours parked (SHP), vehicle starts, extended idle hours (SHI), auxiliary power unit (APU) hours, and totals for the pollutants of VOC, CO, NO_x, CO_2, SO_2, NH_3, Primary Exhaust PM_{10} – Total, Primary Exhaust $PM_{2.5}$ – Total (plus PM2.5 primary exhaust species: composite non-elemental carbon PM [NonECPM], elemental carbon [EC], organic carbon [OC], and sulfate [SO_4]), and PM_{10} and $PM_{2.5}$ brakewear and tirewear, by associated emissions processes. These files are tab-delimited for ease of loading into spreadsheet software such as Microsoft® Excel.
- Prepared the inventory summaries in the format for uploading to TCEQ's Texas Air Emissions Repository (TexAER), which is consistent with the EPA's National Emissions Inventory (NEI) Format (the Consolidated Emissions Reporting Schema [CERS] written in Extensible Markup Language [XML]). In consultation with TCEQ, TTI used the EPA's new source classification codes (SCCs) that are compatible with MOVES fuel types, SUTs, road types and emissions processes, and are available in the MOVES database. Two formats of the SCC-based inventory summaries were prepared, the NEI CERS XML format, and the tab-delimited text file format.
- Prepared a set of MOVES county database files (CDBs) with county-specific tables sufficient for the CDBs to be used in MOVES inventory mode to produce results consistent with, though not necessarily identical to, the results produced using MOVES rates output and the TTI post-processing inventory development utility.
- Prepared this documentation, complete and self-contained, including electronic data files and detailed descriptions thereof.

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, and includes: a document listing all the files submitted and the file naming conventions; MOVES CDB files, MOVES run spec files, and MySQL files used to process data files for MOVES runs; all pertinent data relating to task activities; two standard sets of activity and inventory summary files: one with the typical labeling (e.g., MOVES SUT, fuel type, TDM road type), and one using the EPA's new SCCs (which are now consistent with the MOVES SUTs); and TexAER-ready formatted inventory files.

Acknowledgments

Dennis Perkinson, Ph.D., L.D. White, Stacey Schrank, and Martin Boardman, all of TTI, contributed to the development of the MOVES link-based emissions estimates. Houston-Galveston Area Council (H-GAC) staff provided data sets extracted from the latest available HGB regional Travel Demand Models (TDMs). Daniel Perry, of TCEQ, provided meteorological input data. 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. White processed roadway based activity (VMT and speeds) and produced the vehicle population estimates. Boardman produced MOVES model and MOVES output post-processor set-ups, and the MOVES-based emissions factors with adjustments for TxLED fuel. Schrank produced the off-network activity estimates and the emissions run set-ups and performed the emissions runs. White produced the extra set of MOVES CDBs that may be used with MOVES in inventory mode. Gary Lobaugh, of TTI, was responsible for editing, design, and production of this Technical Report. Each member of the assigned TTI staff contributed to the quality assurance of the inventory 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 VMT Mix, Estimation of VMT, Estimation of Link Speeds, Estimation of Off-Network Activity, Estimation of Emissions Factors, Emissions Calculations, Quality Assurance, and References.

SUMMARY OF RESULTS

Table 1 summarizes the resulting emissions inventories estimated for the HGB region.

Table 1. HGB Eight-County Area Re-Designation Inventories – Summer Weekday (Tons per Day).

Year	VMT	Speed[1]	VOC	CO	NO_x	PM_{10}[2]	$PM_{2.5}$[2]	CO_2
2012	151,333,456	38.7	74.51	852.69	159.08	12.03	5.59	81,856.99
2014	144,546,685	39.2	61.48	728.00	124.64	10.43	4.48	76,652.90
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2020	167,051,752	38.9	40.38	587.43	61.06	9.71	2.93	79,752.34
2023	178,917,689	38.8	36.12	542.46	48.94	9.76	2.53	79,002.36
2026	190,707,272	38.5	31.71	474.28	40.24	10.13	2.37	77,660.33
2028	197,675,678	38.4	28.99	430.65	37.04	10.38	2.29	76,817.46

[1] System speed in miles-per-hour.
[2] Within each size category, the PM estimates are the aggregate MOVES direct vehicle PM emissions (primary PM total exhaust plus brake wear and tire wear), i.e., re-suspended dust is not included.

Two methods are used to establish VMT, a federal system — the Highway Performance Monitoring System (HPMS) — and locality-specific TDMs. The HPMS is a federally-mandated program used by the Federal Highway Administration (FHWA) to provide data to Congress concerning the nation's streets and highways. Congress uses the data to allocate funds to the states. Every state collects, maintains, and reports specified data to the FHWA each year according to the methods prescribed in the *Highway Performance Monitoring System Field Manual*. For historical years, the HPMS data constitutes the official measurement of highway performance, including VMT. The TDM estimate of VMT distributes VMT to each roadway link within the local travel network, and, for future years, includes planned changes to the network. The TDM represents the best method for distributing VMT to the roadway links within the local travel network and for predicting future year VMT. To provide consistency between the estimates for the two systems, the TDM VMT estimates are adjusted to HMPS levels using an historical year for which the TDM was validated and for which the HPMS data has been made available. The TDM forecasts VMT growth from the TDM validation year.

As noted in the following, for 2012, 2014, 2017, 2020, 2023, 2026, and 2028, TDM VMT was developed, and adjusted for HPMS consistency, seasonality (i.e., summer), and day type (i.e., weekday). However, HPMS data exist for 2012, making it by definition a "historical" year. For years where HPMS data exist, the use of "historical" (i.e., actual) VMT data is mandated and supersedes the use of travel model estimated VMT. As a result of this procedural requirement, any difference between a series of TDM VMT forecasts provided by the travel modeling process and actual observed HPMS VMT is evident in the VMT for the historically-based years (in this case, 2012). In other words, the "historical" year is the intersection of observed conditions and the travel demand modeling process. The HPMS VMT for historical years may be inconsistent with projected TDM VMT trends. Despite inconsistency, 2012 HPMS VMT is mandated and TDM forecast VMT is mandated for all the future years.

Inventory estimates with more detail (e.g., by county, SUT/fuel type, road type) may be found in the electronic data submittal (see description in Appendix A).

OVERVIEW OF METHODOLOGY

TTI used the established MOVES-based, detailed emissions inventory methodology, used in fiscal years 2012 through 2014 to produce on-road mobile inventories in support of the HGB one-hour ozone standard RS report analysis,[7] the HGB reasonable further progress SIP[8] and its VMT offset analysis component,[9] and as originally used to develop baseline and base case modeling inventories in support of HGB attainment demonstration analyses.[10]

The method is the detailed, hourly, MOVES rates-per-activity, TDM link-based method, which produces hourly emissions estimates by vehicle type (Table 2), pollutant, and emissions process (Table 3) for each county inventory. It is an adaptation of the previous TDM link-based emissions inventory method used with MOBILE6, which applied emissions rates for all emissions processes in terms of miles-traveled activity (e.g., grams/mile).

In addition to the VMT-based calculations of roadway-based emissions estimates, the TTI MOVES emissions inventory process uses off-network activity measures (i.e., starts, SHP, SHI, and APU hours). Associated emissions rates must be produced in these terms for the off-network emissions process calculations. Previous versions of MOVES provided the off-network start, evaporative and extended idling rates only in “per vehicle” units, not applicable to the TTI activity-based inventory process; TTI post-processing utilities were used to produce the MOVES off-network rates in the needed activity units. One of the changes with MOVES2014, however, was the addition of several new types of emissions rates (i.e., off-network process rates in terms of mass per unit of activity). In fact, all the activity-based rates required in the TTI inventory process are now directly available from MOVES, except for the SHP-based rates; these are produced using TTI inventory utilities, recently updated for use with MOVES2014 (see Appendix B for more information on inventory utilities).

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[7] *MOVES2010b-Based On-Road Inventories in Support of the HGB Ozone Nonattainment Area Re-Designation Substitute Analysis,* TTI, June 2014.
[8] *HGB MOVES-Based RFP On-Road Inventories and Control Strategy Reductions,* TTI, March 2012.
[9] *VMT-Offset Emissions Inventories for the HGB Eight-Hour Ozone Nonattainment Counties,* TTI, January 2013.
[10] *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 2. MOVES Source Use Type/Fuel Types (Vehicle 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, or vehicle type, labels are the combined 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, respectively).

Table 3. MOVES Model On-Road Fleet 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[2]	Extended Idle Exhaust
91[2]	Auxiliary Power Unit Exhaust

[1] These emissions processes apply only to refueling emissions.
[2] These emissions processes are associated only with the diesel long-haul combination trucks and are directly related to use of the main engine (i.e., extended idling) or a trucks APU during hotelling periods. APU exhaust is new in MOVES2014.

Table 4 shows emissions factors with associated processes and activity factors used.

Table 4. Emissions Rates by Process and Activity Factor.

Emissions Processes	Activity[1]	Emissions Factor[2]
Running Exhaust Crankcase Running Exhaust Brake Wear Tire Wear	VMT	mass/mile
Evaporative Permeation Evaporative Fuel Vapor Venting Evaporative Fuel Leaks	VMT	mass/mile
	SHP	mass/shp
Start Exhaust Crankcase Start Exhaust	starts	mass/start
Auxiliary Power Exhaust	APU hours	mass/APU hour
Extended Idle Exhaust Crankcase Extended Idle Exhaust	SHI	mass/shi

[1] SHI and APU hours are for Combination Long-Haul Trucks only.
[2] All of the rates are directly available from MOVES, except mass/shp, which is produced by the TTI RatesCalc utility using MOVES rates mode input and output data.

Major Components

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

- District, four-period, time-of-day, vehicle type VMT mix;
- County, hourly, on-road fleet link VMT and average speeds;
- County vehicle type populations;
- County, hourly vehicle type SHP;
- County, hourly vehicle type starts;
- County, hourly combination long-haul truck SHI and APU hours;
- County, hourly vehicle type emissions rates: mass/mile, mass/SHP, mass/start, mass/SHI and mass/APU hour; and
- On-road SCCs from MOVES.

The TTI utilities used to develop or process these inventory components are outlined and described in Appendix B, which also includes an inventory production process flow diagram.

VMT Mix

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

The VMT mixes were estimated based on TTI's 24-hour average VMT mix method,[11] expanded to produce the four-period, time-of-day estimates. The VMT mix method sets Texas vehicle registration category aggregations for MOVES SUT categories to be used in the VMT mix estimates, as well as for developing other fleet parameter inputs needed in the process (e.g., vehicle age distributions). The current VMT mix method produced a set of four time-of-day period average vehicle type VMT allocations by MOVES road type, estimated for each TxDOT district associated with the eight-county HGB area (i.e., Houston and Beaumont districts). The data sources used were recent, multi-year TxDOT vehicle classification counts, year-end TxDOT/DMV registration data, and MOVES default data, where needed.

On-Road Fleet Link-VMT and Speeds

Summer weekday fleet VMT and average operational speed inputs to the roadway-based emissions calculations (product of "mass per mile" emissions factors and VMT) were required.

TTI used data sets extracted from the latest, four-period, time-of-day, directional, regional HGB travel models (data sets extracted and provided by the H-GAC), along with growth (for inventories between TDM years), seasonal adjustment, and hourly allocation factors estimated by TTI to estimate the summer weekday hourly, directional, link-VMT (consistent with HPMS VMT) and associated average fleet speed inputs to the emissions calculations. 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 estimates operational speeds based on a link's estimated free-flow speed and congestion-related speed reduction.

Vehicle Population and Off-Network Vehicle Activity Estimates

The non-roadway, travel-related, on-road mobile source emissions estimates (e.g., from vehicle starts, parked vehicle evaporative processes, hotelling activity consisting of extended idling and APU usage) were calculated as the product of the amount of associated activity and the pollutant mass per unit of activity (emissions factor terms as shown in Table 4). To estimate the SHP and vehicle starts activity, SUT/fuel type category population estimates were needed. Hotelling activity estimates (comprising the SHI and APU hours) were based on HGB county-specific actual estimates.[12]

Vehicle Type Populations: TTI based the vehicle population estimates on vehicle registration data, vehicle population factors derived from VMT mix, and VMT-based growth estimates (for future years). For historical years, the vehicle type vehicle population estimates were based solely on mid-year TxDOT (or TxDMV) county registrations data and regional, all roads-weekday VMT mix-based population factors for the analysis year. For the future years, vehicle type populations were estimated as a function of base (e.g., latest available, mid-year)

[11] *Methodologies for Conversion of Data Sets for MOVES Model Compatibility*, TTI, August 2009.
[12] *Heavy-Duty Vehicle Idle Activity and Emissions Characterization Study*, ERG, August 2004.

registrations, grown to the future value (growth as a function of base and future VMT), and all roads-weekday VMT mix-based vehicle type population factors applicable to the analysis year.

***SHP*:** The SHP is estimated as a function of total hours (hours a vehicle exists) minus its hours of operation on roads (SHO, which is the same as VHT). For historical years, the vehicle 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 vehicle 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 vehicle 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 vehicle type population estimates. MOVES default weekday starts per vehicle were used. The starts were calculated as the product of starts/vehicle from MOVES, and the county vehicle type population estimates. This was performed for each analysis year by county and hour.

SHI and APU Hours: The SHI and APU hours comprise the diesel combination long-haul truck hotelling hours, estimated based on information from the TCEQ *Extended Idling Study* (ERG, August 2004), and additional factors developed by TTI. Hotelling activity for a 2004 base year was derived from the 2004 idle activity study summer weekday extended idling hours estimates by Texas county. TTI used summer weekday 24-hour 2004 base hotelling estimates derived from this study in combination with 2004 base year and inventory analysis year link VMT and VMT mixes to produce county, hourly hotelling activity estimates for each analysis year. Hotelling hourly factors (estimated by inverting hourly VMT factors) were then applied to allocate the 24-hour hotelling hours estimates for each year to each hour of the day. Estimated proportions of SHI and APU hours were used to divide hourly hotelling hours into SHI and APU hours activity.

MOVES Emissions Factors

TTI produced the emissions rate look-up table inputs to the emissions calculations in three basic steps: set up and execute the MOVES emissions rate mode runs; perform the initial post-processing, which calculates particular rates in the form needed that are not directly available from MOVES; and perform the final post-processing to screen out unneeded pollutants and make needed adjustments.

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 inspection and maintenance (I/M) program). MOVES county scale, emissions rate mode rates were produced by pollutant, process, speed (for roadway-based processes), hour, road type, and average SUT/fuel type. MOVES data were post-processed: first to produce the emissions rates from emissions and activity input/output (i.e., the mass/SHP form of off-network evaporative rates not available from MOVES) and tabulated with the other MOVES-produced activity-based rates needed (mass/mile, mass/hour, mass/start) into databases of emissions rate look-up tables; and finally to extract the rates from the previous step for only those pollutants needed in the emissions calculations, and to make required adjustments (i.e., apply estimated TxLED effects on diesel vehicle NO_x rates).

County-level hourly emissions factors were developed for the MOVES weekday day type for each year. Actual, local, scenario-specific activity estimates for each county were then combined with the associated emissions rates in the emissions calculations outside of, or external to the MOVES model.

Emissions Calculations

Average summer weekday emissions were calculated for each county using the previously described major inputs: TxDOT district-level time-of-day VMT mix by MOVES road type; county, hourly on-road fleet link VMT and speed estimates; county hourly off-network activity estimates by vehicle type of SHP, starts, SHI and APU hours (for CLHT diesel only); and county-level look-up tables of hourly emissions rates by MOVES road type, speed bin, vehicle type (SUT/fuel type) and emissions process.

For the VMT-based calculations, county-to-TxDOT district, TDM road type/area type-to-MOVES road type, and hour-of-day to time-of-day period designations were used to match the appropriate VMT mixes with the link VMT. The VMT mixes by MOVES road type were multiplied by the link fleet VMT to distribute each link's VMT to the different vehicle type categories. Emissions rates for each link's average speed were interpolated (see procedure in Appendix B) from the appropriate set of look-up table emissions factors 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 vehicle type and 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 performed for each county, hour and analysis year.

For the off-network emissions calculations, which are county level, the vehicle type emissions factors were multiplied by the associated county total activity estimate, as determined by the pollutant process. This process was performed for each county, hour, and analysis year.

There are two types of tab-delimited output: a standard output and an SCC-based output. The standard tab-delimited output file for each county organizes the emissions estimated 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, VHT, and speed by roadway. The SCC-based output organizes the 24-hour activity and emissions by the SCCs in MOVES retaining fuel type, source type, road type, and emissions process level of detail. The SCC-based inventory summaries were converted to NEI CERS XML-type format for uploading to TCEQ's TexAER. Appendix A contains more detailed output definitions and specifications.

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

DEVELOPMENT OF VEHICLE TYPE VMT MIX

The vehicle 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 vehicle type. These hourly VMT estimates by vehicle type are combined with the appropriate emissions factors in the link-emissions calculations.

On-road mobile emissions are dependent upon the VMT assigned to each vehicle category. The VMT mix is used to distribute link VMT values to each vehicle category. Since the VMT mix can vary by time-of-day (and thus have an effect of the emissions totals), the TTI VMT mix procedure allows the option to develop VMT mix by time period. Time period VMT mix (by MOVES roadway type and vehicle type) consists of four time periods: morning rush hour (AM peak), mid-day, evening rush hour (PM peak), and overnight.

TxDOT district-level, time period, day-of-week vehicle type VMT mixes (for gasoline-powered and diesel-powered vehicles) were estimated by the four MOVES road-type categories following the TTI methodology.[13] This methodology characterizes VMT by vehicle 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.
- Redefine Roadway Functional Classifications from 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.
- 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).
- 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 MOVES default value taken from the combined FHWA single-unit truck category total (SU2, SU3, and SU4).
- Define MOVES vehicle categories - Buses — These are assigned MOVES defaults, which vary by analysis year.

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[13] *Methodologies for Conversion of Data Sets for MOVES Model Compatibility*, TTI, August 2009, and *Update of On-Road Inventory Development Methodologies for MOVES2010b*, TTI, August 2013.

- Define MOVES vehicle categories - Combination Trucks Short-Haul versus Long-Haul (CSH61 and CLH62) — 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).
- Fuel Type Allocation - PV and LDT fuel type allocation per TxDOT registration data and MOVES defaults (21, 31, and 32) — 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 — 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 vehicle 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 vehicle 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 5.

Table 5. VMT Mix Year/Analysis Year Correlations.

VMT Mix Year	Analysis Years
2005	2003 through 2007
2010	2008 through 2012
2015	2013 through 2017
2020	2018 through 2022
2025	2023 through 2027
2030	2028 through 2032
2035	2033 through 2037
2040	2038 +

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 weekday. The TRANSVMT utility (see Appendix B for a description of the utility), the latest available data sets from the HGB 2012, 2015, 2017, 2025, and 2035 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 link data, trips data, and zonal radii data sets extracted from the HGB 2012, 2015, 2017, 2025, and 2035 TDMs (as provided by H-GAC) 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 data sets.

Several other data sources were used to adjust the VMT for HPMS consistency and to estimate the summer weekday VMT. 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 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 (2004 through 2013) 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 within the Houston TxDOT District was combined from those stations 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 within the eight-county region were combined.

VMT Adjustments

For each analysis year, the designated TDM VMT (see Table 6) was adjusted for HPMS consistency and for seasonality (i.e., summer weekday). For 2012, which by definition is a historical year (i.e., HPMS VMT data exists for those years), county-level VMT control totals were used to develop VMT adjustment factors, which were applied to the 2012 TDM. For the remaining analysis years (2014, 2017, 2020, 2023, 2026, and 2028), 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 2014, 2020, 2023, 2026, and 2028. For those analysis years, intermediate year factors were developed using the bounding TDMs (i.e., 2012 and 2015) and applied to the analysis year's respective TDM. Hourly travel factors were also applied to distribute this adjusted VMT over each hour of the day.

Table 6. Analysis Year/TDM Year Designation.

Analysis Year	TDM Year
2012	2012
2014	2015
2017	2017
2020	2017
2023	2025
2026	2025
2028	2025

2012 Historical Year Analysis – VMT Control Totals and VMT Adjustments

To estimate the 2012 HPMS-consistent summer weekday VMT, 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 2012 county-level HPMS AADT VMT and the AADT-to-summer weekday adjustment factors.

The AADT-to-summer weekday adjustment factors were developed using aggregated ATR data for the years 2004 through 2013. Since the HGB area spans two TxDOT districts, two 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. Table 7 shows the HGB AADT-to-summer weekday factors used in developing the VMT control totals.

Table 7. HGB AADT-to-Summer Weekday Factors for Control Total Development.

TxDOT District	Weekday Adjustment Factor
Beaumont[1]	1.07154
Houston[2]	1.06045

[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 2012 HPMS AADT VMT for each county by the appropriate summer weekday adjustment factor to produce eight VMT control totals (one for each county). 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 2012 TDM to produce eight county-level VMT adjustment factors. 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 2012 link-level HPMS consistent, summer weekday VMT estimates. Table 8 shows the weekday VMT control totals, the total TDM VMT, and the VMT adjustment factors for 2012.

Table 8. HGB 2012 Weekday VMT Control Totals and VMT Adjustment Factors.

County	VMT Control Total	TDM VMT[1]	VMT Adjustment Factor
Harris	110,390,055	108,085,538	1.021321236
Brazoria	6,223,667	7,041,215	0.883891104
Fort Bend	9,780,265	10,813,386	0.904459052
Waller	2,030,133	1,717,709	1.181883969
Montgomery	12,052,458	12,214,725	0.986715453
Liberty	2,271,286	2,287,729	0.992812700
Chambers	2,706,685	3,014,332	0.897938568
Galveston	5,878,907	5,506,546	1.067621511

[1] 2012 TDM, including intrazonal VMT.

Future Year Analyses – HPMS Adjustment Factor

For the future year analyses, an HPMS adjustment factor is used to adjust the total VMT (TDM assignment VMT plus intrazonal VMT estimate) from each TDM for HPMS consistency. While TTI typically calculates this factor, the HPMS factor used in this analysis (0.905954) was provided directly by H-GAC. This factor was developed using the total TDM VMT from the 2012 validation year TDM, the 2012 HGB HPMS VMT reported by TxDOT, and annual non-summer weekday traffic (ANSWT) adjustment factor. The formula for the HPMS factor calculation is:

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

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:

$$142{,}658{,}108.70 \times 1.06796 = 152{,}353{,}153.77 \text{ (HPMS ANSWT VMT)}$$
$$152{,}353{,}153.77 / 168{,}168{,}737.87 = 0.905954 \text{ (HPMS Factor)}$$

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 summer weekday VMT. The seasonal adjustment factors were developed using aggregated ATR data for the years 2004 through 2013. 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 annual non-summer weekday traffic (ANSWT) traffic count. Table 9 shows the seasonal adjustment factors by TxDOT district.

Table 9. HGB Weekday Seasonal Adjustment Factors for Future Year Analyses.

TxDOT District	Weekday Seasonal Adjustment Factor
Beaumont[1]	1.03609
Houston[2]	0.99135

[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., 2014, 2020, 2023, 2026, and 2028), 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 (2012 and 2015 TDMs for 2014 analysis year, 2017 and 2025 TDMs for 2020 and 2023 analysis years, and 2025 and 2035 TDMs for 2026 and 2028 analysis years) and applied to the TDM as specified in Table 6. The intermediate year adjustment factors were based on the annually compounded growth rates between the bounding year TDMs. 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 consistency between counties and the four time periods in the TDM, these adjustment factors were developed for each time period and county. Appendix E 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., 2014, 2017, 2020, 2023, 2026, and 2028), 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., 2014, 2020, 2023, 2026, and 2028), 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 10 and Table 11 show the TDM and ozone season weekday VMT summaries.

Table 10. HGB 2014, 2017, and 2020 VMT Summary.

County	2014[1]		2017		2020[2]	
	TDM[3]	Weekday	TDM[3]	Weekday	TDM[3]	Weekday
Harris	117,759,558	102,731,928	122,411,193	109,939,634	122,411,193	116,845,148
Brazoria	7,702,582	6,709,285	8,063,140	7,241,647	8,063,140	7,788,218
Fort Bend	12,452,496	10,667,217	13,230,861	11,882,868	13,230,861	13,311,222
Waller	2,037,695	1,723,040	2,013,525	1,808,382	2,013,525	1,894,337
Montgomery	14,382,456	12,225,024	15,581,522	13,994,038	15,581,522	15,328,159
Liberty	2,505,102	2,277,922	2,597,957	2,438,572	2,597,957	2,513,257
Chambers	3,252,261	2,968,619	3,360,929	3,154,735	3,360,929	3,343,192
Galveston	6,016,596	5,243,650	6,189,109	5,558,547	6,189,109	6,028,219

[1] Based on 2015 TDM with intermediate year VMT factors.
[2] Based on 2017 TDM with intermediate year VMT factors.
[3] Includes intrazonal VMT.

Table 11. HGB 2023 and 2026 VMT Summary.

County	2023[1]		2026[1]		2028[1]	
	TDM[2]	Weekday	TDM[2]	Weekday	TDM[2]	Weekday
Harris	144,003,330	124,184,541	144,003,330	131,244,237	144,003,330	135,154,185
Brazoria	9,791,217	8,376,595	9,791,217	9,041,656	9,791,217	9,558,864
Fort Bend	17,908,186	14,911,356	17,908,186	16,523,426	17,908,186	17,439,521
Waller	2,279,178	1,984,465	2,279,178	2,088,555	2,279,178	2,174,317
Montgomery	19,864,623	16,789,676	19,864,623	18,301,534	19,864,623	19,259,335
Liberty	2,816,047	2,590,420	2,816,047	2,678,909	2,816,047	2,751,692
Chambers	3,923,582	3,543,008	3,923,582	3,736,098	3,923,582	3,844,950
Galveston	7,683,804	6,537,627	7,683,804	7,092,857	7,683,804	7,492,814

[1] Based on 2025 TDM with intermediate year VMT factors.
[2] Includes intrazonal VMT.

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 (2004 through 2013) aggregated ATR station data for the eight-county HGB region. To maintain VMT proportions within each of the four assignment time periods, the hourly fractions were normalized within each time period to produce the time period hourly travel factors. 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, 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 12 shows the weekday time period hourly travel factors.

Table 12. Weekday Time Period Hourly Travel Factors.

Assignment	Hour	Base Factor	Time Period Factor[1]
AM Peak	6:00 a.m.	0.060573	0.323515
	7:00 a.m.	0.068299	0.364779
	8:00 a.m.	0.058362	0.311706
Mid-Day	9:00 a.m.	0.051748	0.160346
	10:00 a.m.	0.050344	0.155995
	11:00 a.m.	0.052612	0.163023
	12:00 p.m.	0.054542	0.169003
	1:00 p.m.	0.055429	0.171751
	2:00 p.m.	0.058053	0.179882
PM Peak	3:00 p.m.	0.063528	0.239907
	4:00 p.m.	0.068832	0.259937
	5:00 p.m.	0.072506	0.273807
	6:00 p.m.	0.059938	0.226349
Overnight	7:00 p.m.	0.045678	0.202803
	8:00 p.m.	0.035581	0.157973
	9:00 p.m.	0.031653	0.140533
	10:00 p.m.	0.024891	0.110511
	11:00 p.m.	0.016882	0.074953
	12:00 a.m.	0.009371	0.041605
	1:00 a.m.	0.006249	0.027744
	2:00 a.m.	0.005828	0.025875
	3:00 a.m.	0.005792	0.025715
	4:00 a.m.	0.010984	0.048767
	5:00 a.m.	0.032326	0.143521

[1] Used in the VMT calculation process.

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 link-level travel model (input) speed to a free-flow speed and an LOS E speed (i.e., application of these factors results in two speeds). The free-flow speed factors (grouped by functional class and area type) were calculated by dividing the distance-weighted free-flow speed by the distance-weighted input speed for each functional class/area type combination. The distance-weighted free-flow speeds were calculated using output from the detailed speed model used by H-GAC in the travel model development process (as provided by H-GAC) with link volumes set to 0 (i.e., V/C = 0). The LOS E speed factors were calculated in a similar manner (distance-weighted LOS E speed divided by distance-weighted input speed) using the detailed speed model output with link volumes set equal to capacity (i.e., V/C = 1). Appendix F 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 F shows these SRFs. 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 the V/C ratio equal to 0.0;
- $S_{1.0}$ = estimated LOS E speed for the V/C ratio equal to 1.0; and
- $SRF_{V/C}$ = SRF 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 speed model extension was used:

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

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 mass per activity emissions rates (i.e., mass per SHP, mass per start, and mass per SHI), county-level estimates of the SHP, starts, SHI, and APU hours are required by hour and vehicle type for each inventory year (SHI and APU hours are for diesel combination long-haul trucks only). One of the main components of the SHP and starts off-network activity estimation is the analysis year county-level vehicle population. Summaries of the vehicle population and 24-hour SHP, starts, SHI, and APU hours off-network activity are included as Appendix G. Hourly SHP, starts, SHI, and APU hours activity estimates are included with the detailed inventory 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, starts, SHI, and APU hours of off-network activity were developed using the OffNetActCalc utility. Appendix B contains a description of the utilities.

Estimation of Vehicle Population

The vehicle type population estimates 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 (TxDMV registration data sets), population scaling factors (where applicable), and VMT mix.

For estimating vehicle populations, a historical analysis year is defined as any year where actual TxDMV registration data and HPMS VMT data (used in developing population scaling factors) exists. Therefore, the 2012 analysis year was considered a historical year and the vehicle population estimates were based on the TxDMV registration data for the analysis year. Since HPMS VMT data were not available for the 2014, 2017, 2020, 2023, 2026, and 2028 analysis years, these years were considered future analysis years (i.e., TxDMV registration data and HPMS VMT data do not exist). For the future analysis years, the vehicle population estimates were based on the most recent year (2012) TxDMV 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 VMT mix. The development of the VMT mix is described in more detail in the "Development of Vehicle Type VMT Mix" section and included as Appendix D.

Historical Vehicle Population Estimates

The county-level vehicle population estimates for the historical analysis year (2012) were calculated using the analysis year county-level, mid-year TxDMV vehicle registrations and the assigned aggregate VMT mix (see Table 5 and Appendix D). The vehicle population 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 population estimation process: registration data category aggregation, calculation of the vehicle type population factors, and estimation of the county-level vehicle population by vehicle 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 13 shows these five categories.

Table 13. 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 vehicle type population factors. Using the assigned aggregate VMT mix, population factors were calculated for each vehicle type. For the non-long-haul SUT categories, the population factors were calculated by dividing the vehicle type VMT mix by the summed total of the 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 vehicle 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 14 shows the vehicle registration aggregations and their associated MOVES SUT/fuel types.

Table 14. TxDMV Vehicle Registration Aggregations and Associated Vehicle Types for Estimating Vehicle Populations.

Vehicle Registration[1] Aggregation	Associated Vehicle 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 TxDMV 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 type population. The non-long-haul vehicle type populations were estimated by applying their vehicle 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 (2014, 2017, 2020, 2023, 2026, and 2028) is very similar to the historical vehicle population estimates except that instead of using the analysis year registration data sets, the most recent (2012) mid-year TxDMV registration data sets for which HPMS data exists were used. Using these registration data sets and the assigned VMT mix, the base vehicle type population for 2012 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 vehicle type population for 2012. 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 (2012) mid-year TxDMV 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 mass per activity emissions rates are county-level weekday estimates of SHP by hour and vehicle type for each analysis year. For each hour, the county-level vehicle type SHP was calculated by taking the difference between the vehicle type total available hours minus the vehicle type SHO. Since this calculation was performed at the hourly level, the vehicle type total available hours was set equal to the vehicle type population. The SHO was calculated using the link VMT and speeds and the TxDOT district-level vehicle type VMT mixes by MOVES road-type category (see the "Development of Vehicle 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 vehicle type for each analysis year (hourly summaries were provided electronically to TCEQ; see Appendix A for electronic data descriptions).

Vehicle Type Total Available Hours

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

Vehicle Type SHO

To calculate the VHT (or SHO) for a given link, the VMT was allocated to each vehicle type using the TxDOT district-level vehicle type VMT mixes by MOVES road-type category, which was then divided by the link speed to calculate the link vehicle type SHO. These VMT mixes are the same VMT mixes used to estimate emissions in the emissions estimation process (see Table 5 and Appendix C). This SHO calculation was performed for each link in a given hour, aggregating the SHO to one value per vehicle type per hour.

Estimation of Starts

The second activity measure needed to estimate the off-network emissions using the mass per activity emissions rates are county-level weekday estimates of starts by hour and vehicle type for each analysis year. The vehicle type hourly default starts per vehicle were multiplied by the analysis year county-level vehicle type vehicle population to estimate the county-level vehicle type starts by hour. Appendix G includes the 24-hour summaries of the county-level vehicle type starts by hour 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 run by dividing the MOVES start output by the MOVES vehicle population output. These MOVES national default starts per vehicle do not vary by year, only by MOVES day type. For this summer weekday analysis, the MOVES national default “weekday” starts per vehicle were used.

Estimation of SHI and APU Hours

The remaining activity measures needed to estimate the off-network emissions using the mass per activity emissions rates are the hourly, county-level weekday heavy-duty diesel truck (SUT 62, fuel type 2 [CLhT_Diesel]) hotelling activity (comprised of SHI and APU hours) for each analysis year. During hotelling, the truck’s main engine is assumed to be in idling mode or its auxiliary power unit is in use. For each analysis year, hotelling hours activity are first estimated, and then it is allocated to the SHI and APU hours components.

The hotelling activity was based on information from a TCEQ extended idling study, which produced 2004 summer weekday extended idling estimates for each Texas county, and hotelling activity data from MOVES. Hotelling scaling factors (by analysis year) were applied to the base 2004 summer weekday hotelling values from the study to estimate the 24-hour hotelling by analysis year. Hotelling hourly factors were then applied to allocate the 24-hour hotelling by analysis year to each hour of the day. To ensure valid hourly hotelling values are used, the hourly hotelling activity was compared to the CLhT_Diesel hourly SHP (i.e., hourly hotelling values cannot exceed the hourly SHP values). SHI and APU hours factors were then applied to the hotelling hours to produce the hourly SHI and APU hours of activity for each analysis year. Appendix G incudes the 24-hour summaries of the county-level estimates of hotelling hours, SHI, and APU hours for each analysis year (hourly summaries were provided electronically to TCEQ; see Appendix A for electronic data descriptions).

Hotelling Activity Scaling Factors

To estimate the county-level 24-hour hotelling activity by analysis year, county-level hotelling activity scaling factors were developed using the county-level 2004 summer weekday link-level VMT and speeds, the TxDOT district-level base weekday vehicle 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 vehicle type VMT mix (by MOVES road type). The 2004 summer weekday link-level VMT and speeds were developed using a process similar to the historical analysis year summer weekday link-level VMT speed estimation, except using a 2004 summer weekday VMT control total. The vehicle type VMT mixes were the same VMT mixes used to estimate emissions in the emissions estimation process (see Table 5 and Appendix C). For the base weekday vehicle type VMT mix, the 2005 weekday vehicle 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 vehicle 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 vehicle type VMT mix. The county-level 24-hour hotelling activity 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.

Hotelling Activity Hourly Factors

To allocate the analysis year weekday county-level 24-hour hotelling activity to each hour of the day, hotelling activity hourly factors were used. These hotelling activity 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 hourly analysis year weekday CLhT_Diesel VMT. The hourly analysis year weekday CLhT_Diesel VMT was 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 hotelling activity hourly factors.

County-Level CLhT_Diesel Hotelling Activity by Hour Estimation

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

County-Level CLhT_Diesel SHI and APU Hours Estimation

The hourly county-level hotelling activity for each analysis year was then allocated to SHI and APU hours activity components using aggregate extended idle mode and APU mode fractions. For each hour, the analysis year hotelling activity was multiplied by the SHI fraction to calculate the analysis year hourly SHI activity and by the APU fraction to calculate the analysis year hourly APU activity.

The aggregate SHI and the APU fractions were estimated using model year travel fractions (based on source type age distribution and relative mileage accumulation rates used in the MOVES runs) and the MOVES default hotelling activity distribution (i.e., a bi-modal distribution of 1.0 SHI prior to the 2010 model year and a 0.7/0.3 SHI/APU activity allocation for 2010 and later model years). The associated travel fractions were applied to the appropriate extended idle and APU operating mode fractions (of the hotelling operating mode distribution) by model year and summed within each mode to estimate the aggregate (across model years) individual SHI and APU fractions (which sum to 1.0).

ESTIMATION OF EMISSIONS FACTORS

TTI developed the summer weekday emissions factors consistent with TTI's MOVES detailed link-based emissions estimation method that was established as an upgrade of the MOBILE6-

based inventory process for producing SIP and conformity quality emissions estimates. TTI used EPA's latest MOVES version, the MOVES2014 October Release.[14]

The emissions factors were developed based on the TTI's *Updated Inventory Methods for MOVES*[15] and the EPA's MOVES inventory development *Technical Guidance*[16] and *User's Guide.*[17] (More information may found in these main references, if desired.) TTI's MOVES data post-processing utilities, RatesCalc and RatesAdj used to produce databases of emissions rate look-up tables for input to the emissions calculations, are also summarized in Appendix B of this Technical Report.

The detailed link-based emissions estimation method of analysis requires emissions rates by speed in look-up table form. Emissions rate mode was therefore used to produce emissions rates indexed by 16 MOVES speed bin average speeds. Another requirement of the method is that all rates be in terms of mass per activity unit for the external emissions calculations, thus the appropriate alternatives to the MOVES off-network mass per vehicle rates were used. Table 15 (which was included in a previous section, but is provided again here for convenience) shows the emissions rates types and associated activity factors.

Table 15. Emissions Rates by Process and Activity Factor.

Emissions Processes	Activity[1]	Emissions Factor[2]
Running Exhaust Crankcase Running Exhaust Brake Wear Tire Wear	VMT	mass/mile
Evaporative Permeation Evaporative Fuel Vapor Venting Evaporative Fuel Leaks	VMT	mass/mile
	SHP	mass/shp
Start Exhaust Crankcase Start Exhaust	starts	mass/start
Auxiliary Power Exhaust	APU hours	mass/APU hour
Extended Idle Exhaust Crankcase Extended Idle Exhaust	SHI	mass/shi

[1] SHI and APU hours are for Combination Long-Haul Trucks only.
[2] All of the rates are directly available from MOVES, except mass/shp, which is produced by the TTI RatesCalc utility using MOVES rates mode input and output data.

[14] Software and database (MOVESDB20141021) downloadable from http://www.epa.gov/otaq/models/moves/index.htm.
[15] *Update of On-Road Inventory Development Methodologies for MOVES2014,* TTI, December 2014.
[16] *Using MOVES to Prepare Emission Inventories in State Implementation Plans and Transportation Conformity: Technical Guidance for MOVES2010, 2010a, and 2010b,* EPA, April 2012, was used in this analysis. This document was superseded by a newer release by EPA (January 2015), which was late for use in this work, but will be used in future analyses.
[17] *Motor Vehicle Emission Simulator (MOVES) User Guide for MOVES1014,* EPA, July 2014.

MOVES Inputs, Outputs and Post-Processing

The MOVES model is equipped with default modeling values for the range of conditions that affect emissions. MOVES defaults may be replaced by alternate input data sets that better reflect local scenario conditions. Where local data were available and consistent with the methodology, MOVES defaults were replaced by local input values via the MOVES Run Specification input file (RunSpec or MRS) and MOVES CDB (county input database). (The MRS, CDB, and MOVES default database provide the data for each local scenario model run.) Inputs were developed and used to produce emissions factors reflecting local conditions including area June through August period average weather conditions, summer fuel properties, vehicle fleet characteristics (e.g., age), and emissions control programs. 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 (e.g., default activity is normalized in the emissions rates, and the emissions rates are later multiplied by the local activity estimates to calculate emissions external to MOVES).

There is one RunSpec required per county and analysis year, and a corresponding number of CDBs and output databases (i.e., one output database per run). Therefore, for eight counties and seven calendar years there are 56 each RunSpec input files, CDB inputs, MOVES output databases, RatesCalc output databases, and RatesAdj final rate output databases. RatesAdj produces the final rates by performing NO_x TxLED effect adjustments to diesel vehicle NO_x rates and extracting and storing the rates for the inventoried pollutants in a separate, smaller database for input to the emissions runs.

The RatesCalc and RatesAdj utilities used to produce the emissions rates from the MOVES data are described in Appendix B.

Summary of Control Programs Modeled

Table 16 summarizes the control measures and modeling approaches (e.g., MOVES model defaults versus alternative local inputs, or post-processing of MOVES output).

Table 16. Emissions Control Strategies and Modeling Approaches.

Individual Control Measures	Approach
Federal Motor Vehicle Control Program Standards	MOVES model – defaults.
Federal Heavy-Duty Diesel Engines Rebuild and 2004 Pull-Ahead Programs to Mitigate NO_x Off-Cycle Effects	MOVES model – defaults.
Reformulated Gasoline (RFG)	MOVES model – region-specific RFG fuel formulation inputs, based on the EPA's 2012 summer season Houston retail outlet RFG survey data for 2012, and based on EPA's latest available (2014) summer season Houston retail outlet RFG survey data for 2014 and later years, with average sulfur content for 2017 and later set for consistency with the Tier 3 sulfur standard.
Texas Low-Emission Diesel	MOVES model – 2012 and 2014 historical year sulfur content based on local summer season fuel survey data (TCEQ summer 2011 [no 2012 survey data available] and summer 2014 fuel survey); 2017 and later analysis years used MOVES default diesel sulfur content value, consistent with the federal (Ultra-Low Sulfur) rule. Post-processing of diesel vehicle NO_x rates – diesel vehicle NO_x emissions factors for all counties were adjusted using evaluation year and SUT-specific average NO_x reduction factors produced following TCEQ's procedure (which calculates the average NO_x percent reduction based on 4.8% and 6.2% reductions for 2002 and later, and 2001 and earlier model years, respectively).
Inspection and Maintenance (I/M) Program	MOVES model – locality specific inputs to model I/M effects for the five I/M Program counties (Brazoria, Fort Bend, Galveston, Harris, and Montgomery). Used available MOVES I/M parameters (in terms of MOVES I/M "teststandards" and associated "imfactors") pertaining to the domain of I/M vehicles, consistent with current program descriptions and latest I/M modeling protocols, using MOVES I/M compliance factors input calculated per MOVES *Technical Guidance* (EPA, April 2012) to include the regulatory class adjustments provided for Passenger Trucks and Light Commercial Trucks.

MOVES Emissions Factor Aggregation Levels

The MOVES model produces results at different aggregation levels that may be specified in the MRS. The detailed, hourly, link-based inventory method required MOVES weekday day type emissions rates at the following MOVES output detail level:

- Up to 13 source types (i.e., vehicle types);
- Up to six fuel types;
- Up to five road types (four actual MOVES road categories and "off-network");
- Each of the 24 hours in a day;
- 16 speed bins (only included in miles-based rate tables);
- Up to 135 pollutants; and
- Up to 14 emissions processes.

The vehicle fleet was modeled as powered only by the predominant on-road fuels of gasoline and diesel (alternate fuels considered *de minimis*). The five road type categories in MOVES are Off-Network (not actually a road type, this category is for parked vehicle activity), Rural Restricted Access, Rural Unrestricted Access, Urban Restricted Access, and Urban Unrestricted Access.[18] The rates for each of the actual four MOVES road types are indexed by the 16 MOVES speed bin average speeds: 2.5, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, and 75 mph.

MOVES Run Specifications

- The MRS defines the place, time, road categories, vehicle and fuel types, pollutants and emissions processes, and the overall scale and level of output detail for the modeling scenario. TTI created an MRS for one county scenario using the MOVES graphical user interface (GUI), which was then converted to a template and used as a base MRS from which to build the MRSs for the analysis.
- Table 17 describes the MRS selections TTI used, with further details on the selections provided after the table.

[18] The "separate ramps" feature intended for MOVES2014 October Release was not activated for emissions rates mode, but is expected to be available for emissions rates output in the next release of MOVES.

Table 17. RunSpec Selections by MOVES GUI Navigation Panel.

<table>
<tr><th>Navigation Panel</th><th>Detail Panel</th><th colspan="3">Selection</th></tr>
<tr><td>Scale[1]</td><td>Model; Domain/Scale;
Calculation Type</td><td colspan="3">On-Road; County;
Emissions Rates</td></tr>
<tr><td>Time Spans[1]</td><td>Time Aggregation Level;
Years – Months – Days – Hours</td><td colspan="3">Hour;
2012[1] - July - Weekday - All</td></tr>
<tr><td>Geographic Bounds[1]</td><td>Region;
Selections;
Domain Input Database</td><td colspan="3">Zone and Link;
<COUNTY>;[1]
<COUNTY INPUT DATABASE (CDB) NAME>[1]</td></tr>
<tr><td rowspan="14">On-Road Vehicle Equipment</td><td rowspan="14">SUT/Fuel Combinations</td><td>SUT</td><td>Gasoline</td><td>Diesel</td></tr>
<tr><td>Motorcycle</td><td>X</td><td>-</td></tr>
<tr><td>Passenger Car</td><td>X</td><td>X</td></tr>
<tr><td>Passenger Truck</td><td>X</td><td>X</td></tr>
<tr><td>Light Commercial Truck</td><td>X</td><td>X</td></tr>
<tr><td>Intercity Bus</td><td>-</td><td>X</td></tr>
<tr><td>Transit Bus</td><td>-</td><td>X</td></tr>
<tr><td>School Bus</td><td>X</td><td>X</td></tr>
<tr><td>Refuse Truck</td><td>X</td><td>X</td></tr>
<tr><td>Single Unit Short-Haul Truck</td><td>X</td><td>X</td></tr>
<tr><td>Single Unit Long-Haul Truck</td><td>X</td><td>X</td></tr>
<tr><td>Motor Home</td><td>X</td><td>X</td></tr>
<tr><td>Combination Short-Haul Truck</td><td>X</td><td>X</td></tr>
<tr><td>Combination Long-Haul Truck</td><td>-</td><td>X</td></tr>
<tr><td>Road Type</td><td>Selected Road Types</td><td colspan="3">Off-Network –
Rural Restricted Access – Rural Unrestricted Access –
Urban Restricted Access – Urban Unrestricted Access</td></tr>
<tr><td>Pollutants and Processes[2]</td><td>Total Energy Consumption; VOC; CO; NO_x; Atmospheric CO_2; SO_2; NH_3; PM_{10} Total Exhaust, Brakewear, Tirewear; $PM_{2.5}$ Total Exhaust, Brakewear, Tirewear, and $PM_{2.5}$ exhaust species NonECPM, EC, OC, and SO_4</td><td colspan="3">Dependent on pollutant:
Running Exhaust, Start Exhaust, Extended Idle Exhaust, Auxiliary Power Exhaust, Crankcase Running Exhaust, Crankcase Start Exhaust, Crankcase Extended Idle Exhaust, Evap Permeation, Fuel Vapor Venting, Fuel Leaks; Refueling Displacement Vapor Loss, Refueling Spillage Loss, Brakewear, Tirewear</td></tr>
<tr><td>Manage Input Data Sets</td><td>Additional Input Database Selections</td><td colspan="3">None</td></tr>
<tr><td>Strategies</td><td>Rate-of-Progress</td><td colspan="3">Not Applicable</td></tr>
<tr><td>General Output</td><td>Output Database;
Units;
Activity</td><td colspan="3"><MOVES OUTPUT DATABASE NAME>;[1]
Pounds, KiloJoules, Miles;
Hotelling Hours, Population, Starts (not adjustable, pre-selected)</td></tr>
<tr><td>Output Emissions Detail</td><td>Always;
For All Vehicles/Equipment;
On Road</td><td colspan="3">Time: Hour – Location: Link – Pollutant;
Fuel Type, Emissions Process;
Source Use Type</td></tr>
<tr><td>Advanced Performance Measures</td><td>Aggregation and Data Handling</td><td colspan="3">All check boxes are to be “un-checked”</td></tr>
</table>

[1] County scale allows one county and year per run – the evaluation years and counties are 2012, 2014, 2017, 2020, 2023, 2026, and 2028; 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 [THC] and Non-Methane Hydrocarbons: CO_2 requires Total Energy Consumption [TEC]).

Scale, Time Spans, and Geographic Bounds

The MOVES Domain/Scale "County" was selected as is required for SIP inventory estimates. The MOVES Calculation Type "Emissions Rates" was selected for MOVES to produce the emissions rates 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, for the selected year, month, and day type. 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) and one "Days" (Weekdays) selection was made.

Under Geographic Bounds for the County Domain Scale, only one county may be selected. The local CDB containing the calendar year 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, one county, one year, one day type, and 16 (speed bin) average speeds were modeled per run.

On-Road Vehicle Equipment and Road Type

The local VMT mixes developed for the study define the SUT/fuel type combinations included in the MOVES runs. The VMT mixes specify the vehicle fleet as the 22 gasoline and diesel SUTs designated as "on-road vehicle equipment" selections in Table 17. These SUT/fuel type combinations were chosen in all the MOVES RunSpecs. Note that, as required, the MOVES default fuel engine fractions (discussed later) were also replaced with local input data consistent with the SUT/fuel type selections shown in Table 17.

All five MOVES road type categories were selected (the "provide separate ramps output" box is not active when using emissions rates mode in the MOVES2014 October Release model).

Pollutants and Processes

In addition to the required pollutants within the scope of the inventory, MOVES requires that additional pollutants be selected for particular "chained" pollutants (i.e., pollutants that are calculated as a function of another MOVES pollutant). Of the pollutants listed for the inventory, the following additional pollutants were selected, as required by the model, due to chaining: non-methane hydrocarbons and THC (for VOC), and TEC (for CO_2 and SO_4). All of the associated processes available by the selected pollutants were included, including the two refueling emissions processes (although emissions for these "area source" category processes were not estimated for this inventory).

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 feature is for modeling an alternate control program option, which was not applicable to this inventory analysis

Output

The output units were pounds, kilojoules, and miles. The activity categories were pre-set by MOVES (and not adjustable) for inclusion in the output database. The output detail level was by hour, link (e.g., for MOVES rates mode, 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 MRSs used.

MOVES County Input Databases

The locality-specific input data for the county scale runs were entered through the CDB.

TTI developed procedures to accommodate building and checking CDBs for large scale emissions inventory estimation projects. The basic procedure was to write a MySQL script to produce one county scenario CDB and convert it to a template from which all of the CDB scripts were built. The MySQL scripts were then run in batch mode to produce all CDBs for the analysis.

Data for populating the CDBs were first prepared in the form of text files and/or MySQL databases (e.g., for local fuels and weather data), and some values provided directly in the CDB builder MySQL script. Any default data used was selected from the latest MOVES default database, MOVESDB20141021 (e.g., for default activity data). After running the scripts to produce the CDBs, a CDB checker utility written by TTI was run to verify that all CDB tables were built and populated as intended.

Table 18 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 and years.

Table 18. CDB Input Tables.

MOVES Input Table	Data Category	Notes
year	Time	Designates analysis year as a base year (base year means that local activity inputs are supplied rather than forecast by the model).
state	Geography	Identifies the state (Texas) for the analysis.
county	Geography/ Meteorology	Identifies county of analysis, local altitude, and barometric pressure (base year 2012 summer period data were provided by TCEQ).
zonemonthhour	Meteorology	Local, hourly temperature, and relative humidity for the county (base year 2012 summer period data were provided by TCEQ).
roadtype[1]	Activity	Lists the MOVES road types and associated ramp activity fractions. Road type ramp fractions were set to 0.
hpmsvtypeyear[2]	Activity	Used MOVES default national annual VMT by HPMS vehicle type.
roadtypedistribution[2]		Used MOVES default road type VMT fractions.
monthvmtfraction[2]		Used MOVES default month VMT fractions.
dayvmtfraction[2]		Used MOVES default day VMT fractions.
hourvmtfraction[2]		Used MOVES default hour VMT fractions.
avgspeeddistribution[2]		Used MOVES default average speed distributions.
sourcetypeyear[2]	Fleet	Used MOVES default national SUT populations.
sourcetypeage-distribution	Fleet	TTI estimated SUT age fractions using TxDOT/TxDMV vehicle registration data and MOVES defaults, as needed. TTI used the 2012 mid-year registration data for 2012, and used the latest available (2014) mid-year registration data for 2014 and later years.
avft	Fleet	TTI estimated SUT fuel fractions using TxDOT/TxDMV vehicle registration data and defaults where needed. Local data sets used by analysis year were consistent with sourcetypeagedistribution tables.
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	The fuel supply, or market shares, reflected one gasoline and one diesel fuel formulation for each county and year.
fuelformulation	Fuel	For 2012 and 2014, based on local retail outlet data (i.e., summer 2011/2014 TCEQ surveys [for diesel sulfur] and EPA summer 2012/2014 RFG surveys). For future year diesel sulfur content, MOVES defaults were used. For future year RFG, used EPA summer 2014 RFG survey sample data, and (for 2017 and later) set average sulfur content to the Tier 3 Rule annual average standard (10 parts per million [ppm]).
imcoverage	I/M	TTI prepared locality-specific set-ups to represent I/M program design/description for each county and analysis year based on current I/M rules, prior modeling set-ups, and available MOVES I/M parameters (in terms of MOVES I/M "teststandards" and associated "imfactors") for the I/M vehicles. Regulatory class adjustments were made per *MOVES Technical Guidance* (EPA, April 2012).
countyyear	Stage II	Table included in CDB as standard procedure, but not applicable to this analysis, and with no effect on resulting emissions inventories.

[1] MOVES will not produce "ramp road type" rates in a single run with all road types. To calculate emissions for certain travel model links coded as ramps, MOVES Unrestricted Access road type emissions rates were used.

[2] Use of a default set of activity and population inputs for all MOVES runs is basic to the inventory method, e.g., MOVES default activity is normalized in the calculated emissions rates for pertinent emissions processes, and actual local activity estimates are used in the external emissions calculations.

User Inputs – Locality Specific Inputs and Defaults Used

All inputs discussed in this section are input via the CDB. Unless otherwise stated, the inputs apply to all counties and years.

Year, State, and County Inputs to MOVES – The year, state, and county tables are populated with data identifying the 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 during the model runs). As part of designating the appropriate fuel supply for the modeling scenario, the fuelyearID in the year table was also set to the analysis year.

StateID "48" (Texas) was inserted in the state table. In addition to identifying the county of analysis, the county table contains barometric pressure and altitude information (discussed further with other meteorological inputs). The county data were selected from a prepared local "meteorology" database containing tables of weather data records (i.e., "county" and "zonemonthhour" tables) for the analysis.

Roadtype Inputs to MOVES – Currently the MOVES model contains "ramp" emissions rates, but not an (activated) individual road type for separate ramps output (when using MOVES rates mode). 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, except the ramp fractions were set to zero (i.e., 100 percent 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).

Activity and Vehicle Population Inputs to MOVES – The activity and vehicle population input parameters under the methodology use the MOVES defaults. The tables are: hpmsvtypeyear, roadtypedistribution, monthvmtfaction, dayvmtfraction, hourvmtfraction, avgspeeddistribution, and sourcetypeyear. Data for all of these tables were selected and inserted from the MOVES default database.

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.

Age Distributions and Fuel Engine Fractions Inputs to MOVES – The locality-specific fleet characteristics inputs to MOVES consist of county age distributions input datasets and statewide fuel engine fractions (formerly known as diesel sales fractions) input data sets. The age distributions and fuel engine fractions inputs were calculated and written to text files in preparation for loading the data into the appropriate CDB input tables: the sourcetypeagedistribution table for vehicle age distributions, and the AVFT table for fuel engine fractions. The MOVESfleetInputBuild utility was used to produce these fleet inputs to MOVES in the required formats (see utility description in Appendix B), and MySQL scripts were used to populate the CDB input tables.

The age distributions and fuel engine fractions were based on TxDMV mid-year county registrations data and MOVES model defaults, where needed. The fuel engine fractions were developed consistent with the local VMT mix estimate (e.g., no CNG vehicles, no E-85 fuel type, and no gasoline transit buses in the VMT mix was reflected in the local fuel engine fractions estimates). Locality-specific SUT age distributions were produced based on the TxDMV county vehicle registration category aggregations, consistent with the vehicle registration category aggregations of the VMT mix (see Appendix B). Appendix H includes the age distributions and fuel engine fractions summaries.

Table 19 summarizes the data sources and aggregation levels used to estimate the HGB county sourcetypeagedistributions and fuel engine fractions.

Table 19. Sources and Aggregations for SUT Age Distributions and Fuel Engine Fractions.

<table>
<tr><th>SUT Name</th><th>SUT ID</th><th>TxDMV Category[1] Aggregations for Age Distributions and Fuel Engine Fractions</th><th>Geographic Aggregation for Age Distributions</th><th>Geographic Aggregation for Fuel Engine Fractions[2]</th></tr>
<tr><td>Motorcycle</td><td>11</td><td>Motorcycles</td><td>County</td><td>NA – 100 percent gas, no Fuel Engine Fractions</td></tr>
<tr><td>Passenger Car</td><td>21</td><td>Passenger</td><td>County</td><td>MOVES default[2]</td></tr>
<tr><td>Passenger Truck</td><td>31</td><td>Total Trucks<=8500</td><td>County</td><td>MOVES default[2]</td></tr>
<tr><td>Light Commercial Truck</td><td>32</td><td>Total Trucks<=8500</td><td>County</td><td>MOVES default[2]</td></tr>
<tr><td>Single Unit Short-Haul Truck</td><td>52</td><td>>8500+ >10000+ >14000+>16000</td><td>HGB Region</td><td>Texas Statewide</td></tr>
<tr><td>Single Unit Long-Haul Truck</td><td>53</td><td>>8500+ >10000+ >14000+>16000</td><td>Texas Statewide</td><td>Texas Statewide</td></tr>
<tr><td>Refuse Truck</td><td>51</td><td rowspan="5" colspan="3">MOVES default</td></tr>
<tr><td>Motor Home</td><td>54</td></tr>
<tr><td>Intercity Bus</td><td>41</td></tr>
<tr><td>Transit Bus[2]</td><td>42</td></tr>
<tr><td>School Bus</td><td>43</td></tr>
<tr><td>Combination Short-Haul Truck</td><td>61</td><td>>19500+ >26000+ >33000+ >60000</td><td>HGB Region</td><td>Texas Statewide</td></tr>
<tr><td>Combination Long-Haul Truck</td><td>62</td><td>>19500+ >26000+ >33000+ >60000</td><td>Texas statewide</td><td>NA – 100 percent diesel, no Fuel Engine Fractions</td></tr>
</table>

[1] TxDOT mid-year 2012 and 2014 (latest available for 2014 and later years) county vehicle registrations data (i.e., three-file data set: composite fuel light-duty categories; heavy-duty gasoline by eight weight categories; and heavy-duty diesel by eight weight categories) were used for developing local inputs (weights are gross vehicle weight rating [GVWR] in units of lbs.). The MOVES2014 model default age distributions are from the MOVESDB20141021 database.

[2] MOVES default fuel engine fractions for transit buses were revised to exclude the CNG and gasoline-fueled components, and light duty categories were revised to exclude E-85 fuel type, consistent with the local vehicle type VMT mixes. MOVES2014 default fuel engine fractions were taken from the MOVESDB20141021 sample vehicle population table.

Local Meteorological (County and Zonemonthhour Table) Inputs to MOVES – The meteorological inputs, provided by TCEQ, were input via the "county" (barometric pressure) and "zonemonthhour" (temperature and relative humidity) tables. These input data were developed as June 1 through August 31, 2012 hourly temperature and relative humidity, and 24-hour barometric pressure averages, using the hourly observations over this period from the George Bush Intercontinental Airport weather station in Houston, TX. Altitude, also an input of the county table, was set to "low" for all counties. Table 20 summarizes the temperatures, relative humidity, and barometric pressure input values.

Table 20. Meteorological Inputs to MOVES.

Hour	Temperature (Degrees Fahrenheit)	Relative Humidity (Percent)	Barometric Pressure (Inches of Mercury)
1	78.85	82.26	29.83
2	78.27	83.88	
3	77.71	85.25	
4	77.19	86.86	
5	76.86	88.00	
6	76.57	88.50	
7	76.57	88.51	
8	78.76	84.92	
9	81.79	77.01	
10	84.02	70.29	
11	86.37	63.91	
12	88.05	58.71	
13	89.21	55.48	
14	89.73	54.18	
15	90.13	53.20	
16	90.21	53.07	
17	89.71	54.25	
18	88.72	56.19	
19	87.49	58.81	
20	85.01	64.92	
21	82.84	70.35	
22	81.63	73.74	
23	80.62	76.94	
24	79.74	79.42	

Source: Provided by TCEQ – developed from George Bush Intercontinental Airport, Houston, TX weather station hourly observations. Data are from the period June through August 2012.

Fuels Inputs to MOVES – The local fuels inputs to MOVES were input in the CDB fuelsupply and fuelformulation tables. The summer season fuel supply for each county and year consisted of one average RFG and one average diesel fuel formulation (and therefore gasoline and diesel fuel supply market share values were 1.0 for each). The data sources for these fuel formulations were largely local survey data, although for average sulfur content, default values reflecting regulatory standards were used as the expected values for certain future years. TTI prepared the HGB fuels input data in spreadsheets, saved them to text files, and imported these local HGB fuels inputs to storage database tables (fuelformulation and fuelsupply), using IDs for the local fuel formulations outside the range of MOVES default fuel formulation IDs. County-fuel scenario data were selected from storage and inserted into the CDB fuelsupply and fuelformulation tables, and converted from MOVES2010b to MOVES2014 specification as needed for input to MOVES emissions rate runs.[19]

The following describes the procedure used to populate the CDB fuels tables for each CDB (county and year).

- Selected all MOVES default fuelsupply records associated with the county-fuel scenario (i.e., for the county's pertinent fuelRegionID [1370011000], and scenario's fuelyearID [analysis year] and monthgroupID [7 for July, or summer season fuel]), inserted the data into the CDB fuelsupply table, and set their market share field values to zero. (This was to prevent MOVES from applying its default fuels data in addition to the desired local fuels input data).
- Selected the local fuel supply records for the county-fuel scenario from the local storage database (i.e., the fuel formulation market shares of the specified locally developed fuel formulations for the analysis), renaming countyID field as fuelRegionID (as newly required with MOVES2014), inserted the data into the CDB fuelsupply table, and updated fuelRegionID value (from the MOVES2010b-based FIPS county code to the required MOVES2014 fuelRegionID).
- Selected all of the local fuel formulation records for the county-fuel scenario from the storage database, where stored fuelformulationID corresponded with the CDB fuelsupply table's fuelformulationID, and inserted the data into the CDB fuelformulation table.

The MOVES2014 fuel property fields and units (of the fuelformulation table) are:

- RVP (psi);
- sulfurLevel (ppm);
- ETOHVolume (volume percent);
- MTBEVolume (volume percent);
- ETBEVolume (volume percent);

[19] In previous MOVES versions (e.g., MOVES2010b) the fuelsupply fields were countyID, fuelyearID, monthgroupID, fuelformulationID, marketshare, and marketshareCV. MOVES2014 replaced countyID with fuelRegionID. The HGB county fuelsupply records used in the analysis were stored in MOVES2010b form, and were changed in each input CDB for use with MOVES2014 (i.e., fuelsupply table countyID field and values were replaced with fuelRegionID field and appropriate values).

- TAMEVolume (volume percent);
- aromaticContent (volume percent);
- olefinContent (volume percent);
- benzeneContent (volume percent);
- e200 (vapor percent at 200 degrees Fahrenheit);
- e300 (vapor percent at 300 degrees Fahrenheit);
- T50 (degrees Fahrenheit at 50 percent vapor); and
- T90 (degrees Fahrenheit at 90 percent vapor).

Although not listed above the fields, BioDieselEsterVolume, CetaneIndex, and PAHContent are also included in the fuelformulation table, but were not used. Additionally, note that when the T50/T90 values are input to MOVES, as was the case in this analysis, they are used instead of E200/E300 values.

Data Sources – The EPA Office of Transportation and Air Quality (OTAQ) provided TTI with the Houston RFG retail outlet survey samples by fuel grade (regular, mid-grade, and premium) collected by the RFG Survey Association.[20] TTI processed the sample data to estimate the Houston summer season average RFG fuel property inputs by year, which were used for all counties. The Houston summer 2012 survey data set was the basis of the 2012 analysis year RFG input parameter values, and the Houston summer 2014 data set (latest available) was the basis of the 2014 and later analysis year RFG input parameter values. For 2017 and later analysis years, the sulfur content value of the survey-based fuel property estimates was set for consistency with the Tier 3 rule gasoline sulfur standard (sulfur standard implementation date is January 1, 2017). For average diesel sulfur content, data sources include the TCEQ summer 2011/2014 retail fuel survey summaries for 2012/2014 analysis years (2011 data were used for 2012 since no local 2012 diesel fuel survey data were readily available) and MOVES default for 2017 and later analysis years.

Development of Fuel Formulations Inputs from RFG Survey Samples – On average, each summer period Houston survey data set included 263 total samples taken during June 1 – September 15 (by grade: regular – 237, mid-grade – 6, and premium – 20). The RFG sample data used were already in the units specified for MOVES. 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 were estimated using annual average sales volumes per day through retail outlet statistics for Texas.[21]

The fuel supply value for each fuel formulation used was 1.0, as previously stated, meaning that for each county modeling scenario there was only one diesel and one gasoline (RFG) fuel formulation. Table 21 shows the RFG fuel formulations used.

[20] For more information see: http://www.epa.gov/otaq/fuels/rfgsurvey.htm.

[21] Sales volumes by grade were from the Energy Information Administration's (EIA) Petroleum Marketing Annuals. 2009 sales (latest available at the time of original analysis) were used to produce the 2012 average RFG formulation, and 2011 sales (current latest available) were used for 2014 average RFG.

Diesel Fuel Formulations – The diesel fuel formulation input consists basically of average sulfur content. (The effects of TxLED were incorporated by emissions factor post-processing, discussed later.) The 2012 average sulfur content values were based on the TCEQ summer 2011 fuel survey summary. The averages were, by district: 6.04 ppm for the Houston District counties, and 6.36 ppm for the Beaumont District counties. The 2014 values, taken from the TCEQ summer 2014 survey summary, for the Houston and Beaumont Districts are, respectively, 5.13 ppm and 7.06 ppm. For 2014 and later years, the MOVES default value of 11 ppm was used for all counties.

Table 21. MOVES (RFG) Gasoline Inputs – HGB Summer Emissions Rates Analysis.

Fuel Formulation Field	2012[1]	2014[2]	2017 and Later Years[3]
fuelFormulationID	10707	10714	10717
fuelSubtypeID	12	12	12
RVP	7.06	7.11	7.11
sulfurLevel	32.16	28.15	10.00
ETOHVolume	9.737	9.699	9.699
MTBEVolume	0	0	0
ETBEVolume	0	0	0
TAMEVolume	0	0	0
aromaticContent	14.614	14.711	14.711
olefinContent	13.098	13.558	13.558
benzeneContent	0.469	0.457	0.457
e200	49.283	49.138	49.138
e300	84.450	84.209	84.209
volToWtPercentOxy	0.3488	0.3488	0.3488
BioDieselEsterVolume	\N	\N	\N
CetaneIndex	\N	\N	\N
PAHContent	\N	\N	\N
T50	202.351	203.079	203.079
T90	329.348	330.028	330.028

[1] 2012 – based on EPA Houston Summer 2012 retail outlet RFG survey data.
[2] 2014 – based on EPA Houston Summer 2014 retail outlet RFG survey data.
[3] 2017 and later – based on EPA Houston Summer 2014 retail outlet RFG survey data except sulfur content was set to 10 ppm for Tier 3 gasoline sulfur standard consistency.

Local I/M Inputs to MOVES – The current I/M program is administered to reduce gasoline 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 design reflected in parameters specified in the MOVES IMcoverage table. TTI previously produced a set of Texas I/M county MOVES imcoverage records (for all years in MOVES and I/M areas in Texas) to replace the MOVES default imcoverage table records for Texas. These inputs, used in previous MOVES2010b-based HGB inventories (TTI, June 2014), were also applied in this analysis except for one modification that does not affect results, but was made strictly to eliminate conflicts with the new MOVES2014 defaults. (A review of the MOVES defaults found that imcoverage table records were updated since MOVES2010b and use some IMProgramIDs that overlap with the previously developed local input records. Additionally, it was noted that the updated MOVES default records do not accurately reflect Texas I/M program model year coverages.[22])

The imcoverage table data parameters are:

- polProcessID (pollutant and emissions process affected by the program);
- stateID (state subject to the I/M program);
- countyID (FIPS county code);
- 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 adjusted the previously produced the set of Texas counties imcoverage table input records by changing all IMprogramID values to exclude all MOVES default IMprogramIDs (the adjustment used was IMprogramID = IMprogramID + 100). The new set of Texas imcoverage table records for all MOVES analysis years were stored in a new imcoverage database for use in building the CDBs for MOVES emissions modeling.

[22] Additionally in MOVES2014, evaporative tank vapor venting hot soak base rates with a standard I/M difference were added for regulatory class ID 40 (Class 2b, two-axle, four-wheel vehicles), previously (in MOVES2010b these rates had a standard I/M difference of 0, i.e., no I/M effects.

In addition to selecting the appropriate local imcoverage records for the modeling scenario from the Texas imcoverage database, all MOVES defaults for the modeling scenario had to 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
- Selected the imcoverage records from the local Texas MOVES imcoverage database for the scenario's yearID and countyID and inserted the data 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, for the most part, where the I/M coverage modeling parameters existed in MOVES (e.g., 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) or the Accelerated Simulated Mode (ASM-2) test. For additional Texas I/M program details, see the current I/M SIP revision.[23]

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 22, column 5).
- Queried the MOVES default imfactor table (contains adjustments to emissions rates per various I/M scenarios by SUT/fuel type, age, etc.) on the 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.
- 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 22 and the associated table notes describe the MOVES imcoverage records developed and used for the HGB analyses. Note that a review of the pertinent MOVES data (IMfactors and

[23] *Revision to the State Implementation Plan Mobile Source Strategies, Inspection and Maintenance State Implementation Plan Revision*, TCEQ, adopted February 12, 2014.

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 22, note 4) except for evaporative tank vapor venting for a small fraction of the heavy-duty class that MOVES2014 attributes to SUTs 31 and 32 (passenger and light commercial trucks), which are characterized mainly as light-duty class. Although the Texas I/M program design includes heavy-duty vehicles, the current version of MOVES has limited capability for modeling different I/M test standards attributed to multiple regulatory classes (e.g., a combination of light and heavy) in a single SUT.[24]

[24] MOVES contains potential heavy-duty I/M effects only for evaporative tank vapor venting (i.e., non-zero standard I/M difference in associated heavy class base rates in combination with pertinent non-zero I/M factors for SUTs to which MOVES attributes any heavy-duty fraction). For this evaporative process, MOVES, however, includes non-zero I/M factors only for SUTs 21, 31, and 32, and attributes a small fraction of heavy-duty class to SUTs 31 and 32. Note that since MOVES does not contain heavy-duty exhaust I/M effects, the regulatory class fraction part of the I/M compliance factor (see Table 22, note 2) was used to prevent a heavy-duty exhaust I/M benefit being applied to SUTs 31 and 32. This may result in an overall conservative I/M effects estimate, since excluding a heavy-duty exhaust I/M effect in SUTs 31 and 32 effectively excludes a potential evaporative I/M benefit for heavy-duty (e.g., from gas cap check) as well.

Table 22. 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="10">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>120</td><td>X</td><td>X</td><td>12 (2500 RPM/Idle)</td></tr>
<tr><td>150</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>130</td><td>X</td><td>1995</td><td>23 (A2525/5015 Phase)</td></tr>
<tr><td>151</td><td>X</td><td>1995</td><td>41 (Evp Cap)</td></tr>
<tr><td>140</td><td>1996</td><td>X</td><td>51 (Exh OBD)</td></tr>
<tr><td>160</td><td>1996</td><td>X</td><td>45 (Evp Cap, OBD)</td></tr>
<tr><td rowspan="2">2020 through 2050</td><td>141</td><td>X</td><td>X</td><td>51 (Exh OBD)</td></tr>
<tr><td>161</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 the 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 inventory development *Technical Guidance* (EPA, 2012) compliance factor equation (Section 3.10.6), compliance factors were calculated as the product of the percent compliance rate, 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 inventory *Technical Guidance*, and for PC, PT, and LCT, the adjustments 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, except for the evaporative tank venting process; for light-duty gasoline vehicles, MOVES includes both exhaust and evaporative I/M factors and mean base rates with I/M effects. Via the imcompliance factor (note 2) the heavy-duty class I/M effects were not included and only light-duty 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 THC, CO, NO_x, and tank vapor venting THC.

Note that the updated activity estimates in MOVES2014 affect the regulatory class activity proportions associated with each SUT. The regulatory class coverage adjustments (see Table 22, note 2) should be updated based on the new guidance (EPA, January 2015) for subsequent analyses.

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 20 tables were in the CDBs and the tables were populated with data as intended. The MOVES RunSpecs were run in batches using the MOVES command line tool. The batches were designed to write each MOVES run log to a text file for subsequent error/warning checking, of which none were found. The MOVES run summaries are included as Appendix I.

Post-Processing Runs

Each MOVES output database was post-processed using a two-step process – for each county and year, an interim RatesCalc rate database was produced, followed by the final rates RatesAdj database containing the emissions rate tables for input to the emissions inventory calculations. The following post-processing steps were performed on each MOVES output database. See the utility descriptions in Appendix B for more information.

- RatesCalc – Interim Rates Databases: Using RatesCalc, the mass/SHP off-network evaporative process rates were calculated using data from the CDB, the MOVES default database, and the MOVES rateperprofile and ratepervehicle emissions rate output. The utility also copied the mass/mile, mass/start, mass/hour rates along with the units into emissions rate tables. This utility does not perform any unit conversions, and excludes total energy and refueling processes. It created an output database containing the rates tables input to the RatesAdj utility. In addition to a table containing the run information and one with the activity data, there were four emissions rate look-up tables produced for each scenario: ttirateperdistance, ttirateperstart, ttirateperhour (for extended idle and auxiliary power exhaust), and ttiratepershp.
- RatesAdj – Final Rate Databases: Using RatesAdj, TTI produced the final emissions rates for input to the EmsCalc emissions calculator. RatesAdj extracted emissions rates from the RatesCalc rate tables for only those pollutants needed in the emissions calculations, and applied TxLED adjustments (see factors in Table 23) to the diesel vehicle NO_x emissions rates for all counties and years. The ratesadj output databases, one for each county and year created for input to the emissions calculations, contain a ratesadjrun table of utility execution information, and the four emissions rate tables: ttirateperdistance, ttirateperstart, ttirateperhour, and ttiratepershp.

See Appendix B for more information on the TTI MOVES on-road rates development utilities.

NO_x Adjustment for TxLED Effects

TTI produced the TxLED NO_x adjustment factors shown in Table 23 according to a TCEQ procedure that produces each diesel-powered SUT's average adjustment factor as a combination of a 4.8% reduction and a 6.2% reduction, for the 2002 and newer and for the 2001 and older model year vehicles, respectively.[25]

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[25] "Memorandum: Texas Low Emission Diesel (LED) Fuel Benefits." To Karl Edlund, EPA, Region VI, from Robert Larson, EPA, Office of Transportation and Air Quality (OTAQ), National Vehicle and Fuel Emissions Laboratory at Ann Arbor, Michigan. September 27, 2001.

The procedure involves MOVES runs that produce by-model year output data that are processed in a spreadsheet to calculate the aggregate, average NO_x adjustment factors (across all model years). The resulting average NO_x adjustment factors (by diesel SUT and calendar year of evaluation) are especially sensitive to the age distributions and calendar year inputs, which directly affect the relative NO_x emissions contributions between the earlier and later model year groups. For 2012, Texas statewide vehicle age distribution estimates were used that were based on mid-year 2012 statewide TxDMV vehicle registrations data. For 2014 and later years, statewide age distribution estimates were based on the latest available mid-year (2014) statewide TxDMV vehicle registrations data.

Table 23. Analysis Year TxLED Adjustment Factors Summary.

Vehicle Type	TxLED-Fueled Vehicle NO_x Adjustment Factors[1]						
	2012	2014	2017	2020	2023	2026	2028
Passenger Car	0.9413	0.9439	0.9483	0.9508	0.9514	0.9516	0.9515
Passenger Truck	0.9466	0.9473	0.9492	0.9499	0.9505	0.9506	0.9513
Light Commercial Truck	0.9434	0.9440	0.9465	0.9479	0.9493	0.9500	0.9503
Intercity Bus	0.9416	0.9419	0.9431	0.9439	0.9449	0.9461	0.9477
Transit Bus	0.9420	0.9423	0.9434	0.9449	0.9460	0.9477	0.9491
School Bus	0.9420	0.9423	0.9433	0.9443	0.9455	0.9470	0.9485
Refuse Truck	0.9438	0.9444	0.9462	0.9476	0.9497	0.9507	0.9515
Single Unit Short-Haul Truck	0.9496	0.9500	0.9511	0.9515	0.9517	0.9518	0.9519
Single Unit Long-Haul Truck	0.9497	0.9501	0.9510	0.9514	0.9516	0.9517	0.9518
Motor Home	0.9443	0.9447	0.9462	0.9471	0.9479	0.9484	0.9495
Combination Short-Haul Truck	0.9456	0.9465	0.9481	0.9489	0.9502	0.9510	0.9514
Combination Long-Haul Truck	0.9445	0.9454	0.9474	0.9488	0.9503	0.9512	0.9516

[1] Source: Developed by TTI using the TCEQ procedure and MOVES2014 October Release.

Appendix A describes the electronic data submittal for this inventory analysis, which includes the MRS files, CDBs, TxLED adjustment factor files used and calculation spreadsheets, and the final adjusted emissions rate look-up database table inputs to the emissions calculations.

EMISSIONS CALCULATIONS

TTI calculated hourly, summer weekday, link-based emissions inventories by county for each year using the EmsCalc utility. Emissions calculations fall into two categories: VMT-based and off-network. The VMT-based emissions calculations use the roadway-based rates and the TDM-based VMT and speeds to estimate emissions at the TDM network link (or roadway segment) level. The off-network emissions process calculations use off-network rates and off-network activity (SHP, starts, SHI, and APU hours) to estimate emissions at the county level.

EmsCalc output for each county and year included three files: a listing file (of run execution information), a standard tab-delimited inventory summary (with both hourly and 24-hour summary tables), and a tab-delimited 24-hour inventory summary by SCC. The county SCC inventory summaries for each year were input to TTI's MOVESsccXMLformat utility, which converted them into an EPA CERS XML inventory format for each year for loading in TCEQ's TexAER.

Hourly Link-Based Emissions Calculations

The county, analysis year, summer weekday, hourly emissions were calculated with the EmsCalc utility using the following major inputs:

- Vehicle type VMT mix – TxDOT district-level, weekday, by MOVES roadway type for four time-of-day periods;
- Time period designation – the four VMT mix time periods to hour-of-day associations;
- Roadway-based activity – link (and intrazonal 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;
- Roadway-based emissions factors – MOVES-based, county level by pollutant, process, hour, average speed, MOVES road type, SUT, and fuel type;
- Off-network activity – county, hourly SHP, starts, SHI, and APU hours by vehicle type;
- Off-network (parked vehicle) emissions factors – MOVES-based, county level by pollutant, process, hour, SUT, and fuel type;
- TDM road type designations – TDM road type and area type codes to MOVES road type codes (and to VMT mix road type, and to rates road type codes) (see Table 24); and
- On-road SCCs – from the MOVES2014 default database corresponding to MOVES SUT, fuel type, road type, and emissions process categories.

The VMT-based emissions were calculated for each hour using the TxDOT district-level vehicle type VMT mix with time period-to-hour designations, 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 (and VMT mix road type and rates road type, which for this analysis were the same as the MOVES road type) based on the link's road type and area type. The link VMT was then distributed to each vehicle type using the appropriate VMT mix, based on the link's designated VMT mix road type, its associated TxDOT district, and time-of-day period to hour-of-day designation.

The emissions factors for each vehicle type for each hour were selected based on the link's designated rates road type code (same as MOVES road type code) 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. For each pollutant and process, the mass/mile rates were multiplied by the link VMT producing the link-level emissions estimates for each vehicle type.

Table 24. H-GAC TDM Road Type/Area Type to MOVES Road Type Designations.

TDM Road Type (Code - Name)[1]	TDM Area Type (Code - Name)[1]	MOVES Road Type (Code - Name)[1, 2]
3 - Toll Roads	5 – Rural	2 – Rural Restricted Access
10 - Rural Interstate	5 – Rural	
11 - Rural Other Freeway	5 – Rural	
4 - Ramps (Fwy/Toll/Frnt)	5 – Rural	3 – Rural Unrestricted Access
8 - Local (Centroid Connector)	5 – Rural	
12 - Rural Principal Arterial	5 – Rural	
13 - Rural Other Arterial	5 – Rural	
14 - Rural Major Collector	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 Freeway	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 Principal Arterial	1 – CBD; 2 – Urban; 3 – Urban Fringe	
6 - Urban Other Arterial	1 – CBD; 2 – Urban; 3 – Urban Fringe; 4 – Suburban	
7 - Urban Collector	1 – CBD; 2 – Urban; 3 – Urban Fringe	
8 - Local (Centroid Connector)	1 – CBD; 2 – Urban; 3 – Urban Fringe; 4 – Suburban	
12 - Rural Principal Arterial	3 – Urban Fringe; 4 – Suburban	
13 - Rural Other Arterial	3 – Urban Fringe; 4 – Suburban	
14 - Rural Major Collector	3 – Urban Fringe; 4 – Suburban	
15 - Rural Collector	3 – Urban Fringe; 4 – Suburban	
40 - Local (Intrazonal)	40 – Local (Intrazonal)	

[1] The TDM road type and area type code combinations are also correlated to VMT mix road type codes and emissions rate road type codes, which, for this analysis, are identical to the MOVES road type codes.

[2] The four period, time-of-day VMT mix to hour-of-day designations are: AM peak – three hours of 6 a.m. to 9 a.m.; mid-day – six hours of 9 a.m. to 3 p.m.; PM peak – four hours of 3 p.m. to 7 p.m.; and overnight – 11 hours of 7 p.m. to 6 a.m.

The off-network emissions were calculated for each hour using the hourly MOVES-based off-network emissions factors by vehicle type and the county-level hourly vehicle type off-network activity estimates (SHP, starts, SHI, and APU hours). The emissions factors were multiplied by the appropriate off-network activity, as determined by the pollutant process-activity association (shown previously in Table 15).

The EmsCalc utility outputs for the analysis consist of the listing file (summarizing information regarding running the utility), the standard tab-delimited inventory report summary file including both hourly and 24-hour activity and pollutant process emissions estimates by vehicle type and TDM road type, and the MOVES SCC tab-delimited 24-hour inventory report summary.

Conversion of Emissions Inventories to XML Format

TTI converted the 24-hour emissions and activity results for each year to a format compatible for uploading to the TCEQ's TexAER – based on the EPA's EIS NEI CERS XML format, which uses EPA's EIS inventory data codes, except that the new SCCs and the NEI pollutant codes available in the MOVES2014 default database (MOVESdb20141021) "scc" and "pollutant" tables were used. To make the conversion of the EmsCalc utility's SCC-based inventory output to the specified XML format, TTI used its MOVESsccXMLformat utility and the following inputs:

- Pollutants file – list of input pollutant labels (as written in the EmsCalc SCC-based inventory file to be processed, e.g., "Pounds of CO Emissions"), and corresponding EIS pollutant codes (e.g., "CO") and units codes (e.g., "LB") for each pollutant to be included in the XML output;
- XML header input file – specifies the data used in the header portion of the XML output file, along with the reporting period and the VMT units; and
- Inventory data files to be converted – one EmsCalc-produced, MOVES SCC-based, 24-hour emissions inventory summary file for each county to be included in the XML file. Contains a county code record and the following fields: SCC, Activity Type, Activity, followed by an emissions field for each pollutant using field headers labeled consistent with the EmsCalc emissions summary tables (e.g., Pounds of CO Emissions, Pounds of PM10_Total_Exh Emissions, Pounds of PM10_Brakewear Emissions).

TTI performed one MOVESsccXMLformat utility run per analysis year producing one XML document file per year containing the EIS CERS coded inventories for all eight counties. Thus, seven XML files were produced, one for each inventory year. The SCCs are 10 digits, composed of "22" (code for on-road mobile source) followed respectively by the four, two digit MOVES category IDs: fuelTypeID, sourceTypeID, roadTypeID, processID. Thus, all these dimensions were retained in the XML inventory summary, although off-network activity codes were not available. In the absence of EIS codes for off-network activity, the practice of coding these activity types (SHP, starts, SHI, and APU hours) as "VMT" with their values set to zero was applied. The pollutants included in the XML files were: VOC, CO, NO_x, SO_2, NH_3, $PM_{2.5}$, PM_{10} (exhaust, tirewear and brakewear), and CO_2.

Each run produced a LST file (execution information, input/output file listings, input summaries, and input and output totals summaries with calculated differences for QA checks), the XML file, and one XML output summary of SCC-labeled inventory data in a tab-delimited text file form for each county included in the run. All these files were included in the electronic data submittal (Appendix A).

Additional CDBs for MOVES Inventory Mode

The MOVES CDBs used to produce emissions rates for the link-based inventory analyses were designed only for use in MOVES rates mode runs. TTI developed an extra set of CDBs consistent with the link-based inventory data that may be used with MOVES in the inventory mode. These inventory mode CDBs were designed to input summer weekday (daily) activity data, and with the appropriate MRSs, produce summer weekday (daily) output inventory estimates. One inventory mode CDB was built corresponding to each link-based inventory, or one per county per year, for a total of 56.

These inventory CDBs include the 26 input data tables shown in Table 25 with corresponding data sources. The inventory CDBs include the same 20 MOVES tables used in the link-based inventory analysis rates mode CDBs (see Table 18), plus six additional tables (hotellingactivitydistribution, hotellinghours, sourcetypeage, starts, monthofanyyear, and dayofanyweek).

The inventory mode CDB data source categories are:

- Rates CDB (mainly local data directly from the link-based inventory analysis rates CDBs);
- MOVESactivityInputBuild utility output (for activity inputs built from the pertinent link-based inventory data);
- OffNetActCalc utility output with adjustments (for hotellinghours, starts);
- VehiclePopulationBuild utility output (for vehicle population estimates);
- MOVES defaults (only for hotellingactivitydistribution), and
- Adjusted MOVES defaults (for activity allocation factors modified as needed to produce daily output from daily activity input, and for sourcetypeage table relativeMAR adjustments to produce VMT proportions between HPMS vehicle categories that more closely reflect the local VMT Mix).

The inventory development utilities descriptions, to include MOVESactivityInputBuild, OffNetActCalc, and VehiclePopulationBuild utilities are included in Appendix B.

Table 25. MOVES Inventory Mode CDB Data Sources.

Table	Data Source
avft	Rates CDB
avgspeeddistribution	MOVESactivityInputBuild utility output
county	Rates CDB
countyyear	Rates CDB
dayvmtfraction	MOVES default with dayVMTFraction = 1 (dayID = 5) and dayVMTFraction = 0 (dayID = 2)
fuelsupply	Rates CDB
fuelformulation	Rates CDB
hotellingactivitydistribution	MOVES defaults
hotellinghours	OffNetActCalc utility output with travel fractions (developed using the age distribution and relative MAR) applied to distribute to ageID
hourvmtfraction	MOVESactivityInputBuild utility output
hpmsvtypeyear	MOVESactivityInputBuild utility output
imcoverage	Rates CDB
monthvmtfraction	Rates CDB with monthVMTFraction = 1
roadtype	MOVESactivityInputBuild utility output
roadtypedistribution	MOVESactivityInputBuild utility output
sourcetypeage	MOVES default with relativeMAR adjusted for VMT Mix (travel fractions calculated using relativeMAR adjusted to match 24-hour VMT from link-level inventory)
sourcetypeagedistribution	Rates CDB
sourcetypeyear	VehiclePopulationBuild utility output
starts	OffNetActCalc utility output with age distribution applied to distribute to ageID
state	Rates CDB
year	Rates CDB
zone	Rates CDB
zonemonthhour	Rates CDB
zoneroadtype	Rates CDB
monthofanyyear	MOVES default with noOfDay = 7
dayofanyweek	MOVES default with noOfRealDays = 1

TTI built the MOVES inventory mode CDBs, checked that each one contained all the required tables, and that they were populated as intended. These MOVES inventory mode CDBs along with the MySQL scripts used to create them, were provided as a part of the electronic data submittal.

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

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 conducted. These included, but were not limited to, the elements outlined in the following description.

A. Project Management

The project management was as listed previously in the Acknowledgements 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 and Background 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 in the quality suited to its purpose as specified (i.e., inventories needed for HGB re-designation analyses purposes), informed by, and consistent with, the appropriate guidance and methods provided in the listed references, 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 (i.e., for use in the HGB eight-county area re-designation analysis);
- The full extent of the modeling domain (i.e., analysis years, geographic coverage, seasonal periods, days, sources, pollutants) was included;
- Agreed methods, models, tools, and data were used (i.e., as listed in the detailed pre-analysis plan);
- The required output data sets were produced in the appropriate formats in accordance with the pre-analysis plan;
- Any deficiencies found during development and end-product quality checks (as discussed in QAPP Section D) were corrected; and
- Aggregate emissions estimate results were assessed for comparability with available, similarly produced emissions estimates.

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 for 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 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: HPMS data (from TxDOT's Roadway Inventory Functional Classification Record [RIFCREC] report); regional travel demand model data; speed model data; vehicle registration data; ATR data; vehicle classification count data; meteorological data; fuels data; MOVES emissions model data; extended idling activity data; and vehicle I/M 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 (multiple computer) configuration or individual workstation configuration 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 either executed on an individual workstation, or they were copied (via external hard drive) to the cluster's master computer and executed. Upon execution, completion, and error checking, the MOVES output databases and run log text files were (for cluster runs first 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 descriptions (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).

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 this draft report and will also be in the final reports.

D. Data Validation and Usability

Erroneous or improper inputs at any point during the emissions inventory development process may produce resulting emissions estimates that are inaccurate and may not be suitable for their intended purpose. Adherence to the inventory process flow with performance of the integrated QA checks at each step of the process was of the utmost importance to ensure that the results met the project objectives.

Therefore, the QA checks listed were performed until satisfied to ensure that the resulting emissions inventories met the TCEQ's requirements of intended use.

TTI 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 (i.e., needed for the HGB re-designation analysis);
- 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.

TTI 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; 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); and
    - 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); and

    - 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; and
    - Checked the summary information provided in output listing files for any unusual results.

TTI 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 by day type, 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 where available; and
- Calculated county, 24-hour aggregate rates by vehicle class and compared between vehicle classes. Examined the results for consistent patterns.

Any additional data products required for the emissions analysis were subjected to the appropriate QA checks previously listed.

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APPENDIX A:
ELECTRONIC DATA SUBMITTAL

Electronic Data Submittal — HGB MOVES2014 Inventories for the 1997 Eight-Hour Ozone Re-Designation Analysis

Described herein is the electronic data submittal for one of two HGB inventory analyses TTI submitted to TCEQ, per Proposal for Grant Activities No. 582-15-51346-16. (The other electronic data submittal was for the one-hour re-designation substitute inventories.)

The MOVES rates-per-activity, TDM link-based method produced HGB ozone season weekday inventories of VOC, CO, NO_x, PM_{10}, $PM_{2.5}$, SO_2, NH_3, and CO_2 for the seven years 2012, 2014, 2017, 2020, 2023, 2026, and 2028, or 56 county-level inventories.

Electronic Media
Files and databases were compressed and submitted on one DVD, entitled: "*HGB 1997 Eight-Hour Ozone Analysis MOVES2014 On-Road Inventories – TTI FY2015.*" In addition to this data description, the DVD includes:

- Emissions inventory files (tab-delimited output and extracts, XML files);
- Emissions factors (MOVES emissions rate mode input files and final TxLED-adjusted emissions rates used in inventory development); and
- Additional data files (MOVES CDBs developed for use in MOVES model inventory mode runs, vehicle population summaries, VHT and VMT summaries, etc.).

File-Naming Conventions

- ***YYYY*** is the analysis year (i.e., 2012, 2014, 2017, 2020, 2023, 2026, and 2028), and
- ***FFFF*** is FIPS county code (48039, 48071, 48157, 48167, 48201, 48339, and 48473 for Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller).

Note: MySQL database tables are composed of three files: "*.frm," "*.MYD," and "*.MYI."

Emissions Inventory Files
The following lists the emissions inventory files contained in the electronic data submittal.

Emissions Inventory Output – Each EmsCalc utility run (56) produced three output files (two "*.TAB" files and an "*.LST") compressed in "hgb8hr97_mvs14_emscalc.zip:"

- "hgb8hr97_mvs14***_FFFF _YYYY***swkd_ems.TAB" are tab-delimited text files of county emissions inventory data summary reports including hourly and 24-hour activity and emissions tables. By roadway and vehicle type (SUT/Fuel Type), the reports include VMT, VHT, average speed (VMT/VHT), and pollutant/process emissions totals. For off-network-based processes by vehicle type, the reports include SHP, starts, SHI and APU hours, and pollutant/process emissions totals;

- “hgb8hr97_mvs14_***FFFF*** _***YYYY***swkd_sccoutput_ems.TAB” are tab-delimited 24-hour inventory summaries by on-road SCCs available in MOVES (by fuel type, source type, road type, and process). The first row is descriptive text, the second row is the FIPS county code, the third row are column headers: SCC, Activity Type, Activity, then emissions headers for each pollutant, followed by the data records beginning in the fourth row; and
- “*.LST” are utility execution listing text files corresponding to the above “*.TAB” files and have similar file name prefixes as the “*.TABs,” listing the run 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).

Six Inventory Extracts – Using the tabfiletotals utility, data were extracted from the EmsCalc output to produce six different inventory aggregations (activity and emissions by pollutant and process) per year in tab-delimited text file form. Each extract (or “tabtots”) file contains county-level data for all eight counties. These “tabtots” and the “*.LST” files (49) were provided in “hgb8hr97_mvs14_tabtots.zip:”

- “hgb8hr97_mvs14_***YYYY***swkd_tabtots.lst” (tabfiletotals execution record); and
- “hgb8hr97_mvs14_***YYYY***swkd_***????***.tab” (six different extract files per year).

  Where the “***????***” descriptor is:

  - “tabtots” (24-hr totals);
  - “tabtots_Hr” (hourly totals);
  - “tabtots_HrST” (hourly, SUT/fuel type totals);
  - “tabtots_RdType” (hourly, road type totals);
  - “tabtots_ST” (24-hr SUT/fuel type totals); and
  - “tabtots_24hourRdTypeST” (24 hour, road type, SUT/fuel type totals).

XML Files for TexAER and Tab-Delimited SCC-Based Inventory Summary Files – MOVESsccXMLformat utility 24-Hour output for each year: one LST text file (execution record with input/output summaries including input/output comparisons); one XML file (inventory data coded for uploading to TCEQ’s TexAER); and eight county-level SCC-based inventory summary files (each tab-delimited text file includes a county summary by SCC from the XML-coded results). The following 70 output files were provided in “hgb8hr97_mvs14_xmlformat.zip:”

- MOVESsccXMLformat_hgb8hr97_mvs14_***YYYY***swkd.lst;
- MOVESsccXMLformat_hgb8hr97_mvs14_***YYYY***swkd.xml; and
- MOVESsccXMLformat_hgb8hr97_mvs14_***YYYY***swkd_***FFFF***_summary.tab.

Emissions Factors – MOVES Input Files and Final TxLED-Adjusted Emissions Rates
The following emissions factor files are contained in the electronic data submittal.

MOVES Input Files – The 56 MOVES runs required 56 MRS XML files and 56 CDBs. The default database (MOVESDB20141021), also required but not included in this submittal, is available from the EPA's MOVES website. The MRSs and CDBs were provided in: "hgb8hr97_mvs14_MRSs.zip" and "hgb8hr97_mvs14_CDBs_ermode.zip:"

- "MVS14_HGB8HR97_***YYYY***SWKD_***FFFF***_ER.MRS," (56 MRS files); and
- "mvs14_hgb8hr97_***YYYY***s_***FFFF***_er_cdb_in" (56 CDBs each, containing 20 database tables, consisting of three files per table, plus one db.opt file per CDB).

*MySQL Scripts, Databases and Files for Building CDB*s – CDBs were built using MySQL scripts, data files, and databases provided in "hgb8hr97_mvs14_CDBscripts_data.zip" (144 files):

- "MVS14_HGB8HR97_***YYYY***S_***FFFF***_ER_CDB_IN.SQL" (56 text files containing MySQL scripts for building the 56 CDBs);
- "hgb_metinputs_summer2012tceq" (database with meteorological inputs – county and zonemonthhour tables – and development files – 12 files);
- "_fuels_hgb2012s_mvs10b," "_fuels_hgb2014s_mvs10b," and "_fuels_hgb2014s_2017t3sulfur_mvs10b" (three fuels inputs databases with fuelsupply and fuelformulation tables, used respectively for 2012, 2014, and 2017 and later years – survey data spreadsheets and other development files – 33 files);
- "_tx1990_19992050_mvs14_imcoverage_213132" (imcoverage database table used and a readme file – 5 files);
- "mvs14_movesdb20141021_HGB***FFFF_XXXX***j_SUTage.tab" and "*.LST" (tab-delimited, county sourcetypeagedistribution text files, where ***XXXX*** is 2012 and 2014, which are registration data years, and the associated "*.LST" text files are from each MOVESfleetbuilder utility run – 32 files);
- "mvs14_movesdb20141021_TX_***XXXX***j_SUTage.tab," "mvs14_movesdb20141021_TX_***XXXX***j_SUTfef.tab," and "*.LST" (tab-delimited, statewide "sourcetypeagedistribution" files [SUTage] and "avft" files [SUTfef], where ***XXXX*** is 2012 and 2014, which are registration data years, and the associated "*.LST" files are from each MOVESfleetbuilder utility run – 6 text files); and
- "MOVESDB20141021" (the MOVES default database, although not provided in this submittal, was also used in building the CDBs).

Final MOVES-Based, TxLED-Adjusted Emissions Factor Look-Up Tables – The RatesAdj utility performed NO_x TxLED effects adjustments and produced the final emissions rates inputs to the emissions calculations – 56 MySQL databases each containing a "ratesadjrun" table (a run log) and the four rate tables: "ttirateperdistance" for roadway-based emissions processes, and "ttirateperhour," "ttiratepershp," and "ttirateperstart" for off-network processes. Each rate table contains the emissions rate field that it is named for: ratePerDistance, ratePerHour, ratePerSHP, or ratePerStart. Rate table fields in common are: pollutantID, processID, hourID, sourceTypeID, fuelTypeID, and Units_Per_Activity. The ttirateperdistance table also includes the avgSpeedBinID and roadTypeID fields. Emissions rates are in pounds per unit of activity.

- "mvs14_hgb8hr97_***YYYY***swkd_***FFFF***_er_outratesadj," (56 MySQL database folders each containing five tables and one db.opt file). Each database contains the emissions rate look-up tables used in the emissions calculations. They are compressed in "hgb8hr97_mvs14_outratesadjDBs.zip."

TxLED Factors – The seven TxLED factor files used (plus one for 2011) were provided along with a readme file, the TxLED factor development spreadsheets, and other files (e.g., MOVES runs input/output, CDB scripts, etc.). These files were provided in "hgb8hr97_mvs14_txledFactors.zip." The TxLED factor input files used with MOVESRatesAdj are:

- "***YYYY***_NOx_txledFactors*.tab" (TxLED factor input text files by analysis year).

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. <u>Rate Calculations</u>: Using the TTI's RatesCalc utility, TTI produced "rates-per-activity" emissions rate look-up tables, including rates directly from the MOVES rate tables output (i.e., "per mile," "per hour," "per start"), plus the evaporative "per SHP" rates not directly available from MOVES output, but calculated by RatesCalc.
2. <u>Final Rates Adjustments</u>: Using TTI's RatesAdj utility, rates from RatesCalc output were extracted for only those pollutants needed in the emissions calculations. TxLED adjustments were applied to diesel vehicle NO_x rates for all analysis years, and the extracted and adjusted rate tables were placed in a separate database (by county and year) for input to the emissions calculations.

Additional Data Files

TTI post-processed the inventory activity and other data (e.g., vehicle registrations) to produce data summaries and some data (vehicle population and VMT factors) in MOVES-specified formats. (These data were not used in the MOVES emissions rate mode runs, but include, or are based on, data that were used externally in activity factor and emissions calculations).

The *VehPopulationBuild* utility runs produced the vehicle population estimates used externally in the emissions estimation process. The following county-level text files were produced (contained in the zip file "hgb8hr97_mvs14 VehPop.zip," with 224 files):

- "****FFFF***_VEHPOP_***YYYY***_sourcetypeyear.tab" (MOVES sourcetypeyear files);
- "****FFFF***_VEHPOP_ ***YYYY***_regdata.tab" (registrations by type and model year);
- "****FFFF***_VEHPOP_ ***YYYY***_StFtPop.tab" (SUT/fuel type population summaries); and

- "***FFFF***_VEHPOP_ ***YYYY***.lst" (utility run list files).

The *MOVESactivityinputbuild* utility runs produced the MOVES table data tab-delimited text files listed (contained in the zip file "hgb8hr97_mvs14 ActInput.zip," with 504 files):

- Year: "***FFFF_YYYY_***swk_MOVESactInputBld_year.tab;"
- Roadtype: "***FFFF_YYYY_***swk_MOVESactInputBld_roadtypetable.tab;"
- Hpmsvtypeyear: "***FFFF_YYYY_***swk_MOVESactInputBld_hpmsvtypeyear.tab;"
- Roadtypedistribution: "***FFFF_YYYY_***swk_MOVESactInputBld_rtdist.tab;"
- Hourvmtfraction: "***FFFF_YYYY_***swk_MOVESactInputBld_hrvmtfract.tab;" and
- Avgspeeddistribution: "***FFFF_YYYY_***swk_MOVESactInputBld_avgspddist.tab."

Additional data summary output text files from the *MOVESactivityinputbuild* runs include:

- "***FFFF_YYYY***swkd_MOVESactinput.lst" (run list with various data summaries);
- "***FFFF_YYYY***swkd_MOVESactinput_linkVHTsumm.tab" (VHT by hour, road type, area type, and avgspeedbinID); and
- "***FFFF_YYYY***swkd_MOVESactinput_linkVMTsumm.tab" (VMT by hour, road type, area type).

Additional MOVES Inventory Mode CDBs

TTI developed an extra set of CDBs consistent with the link-based inventory data that may be used with MOVES in inventory mode. These inventory mode CDBs were designed to input summer weekday (daily) activity data, and with the appropriate MRSs, produce summer weekday (daily) output inventory estimates. One inventory mode CDB was built corresponding to each link-based inventory, or one per county per year, for a total of 56. The CDBs and MySQL script file for building them (contained in hgb8hr97_mvs14_cdbs_eimode.zip) are:

- "mvs14_hgb8hr97_***YYYY***swkd_***FFFF***_ei_cdb_in" (56 CDBs each, containing 26 database tables, consisting of three files per table, plus one db.opt file per CDB); and
- "MVS14_HGB8HR97_***YYYY***SWKD_***FFFF***_EI_CDB_IN.SQL" (56 text files containing MySQL scripts for building the 56 MOVES inventory mode CDBs).

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

TTI EMISSIONS ESTIMATION UTILITIES FOR MOVES2014-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 (MOVES2014). 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 Highway Performance Monitoring System (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, VehPopulationBuild, OffNetActCalc, MOVESactivityInputBuild, MOVESfleetInputBuild, RatesCalc, RatesAdj, and EmsCalc. The TRANSVMT and VirtualLinkVMT prepare the link VMT and speeds activity input. The VehPopulationBuild utility builds the vehicle population used to calculate the off-network activity. The OffNetActCalc utility builds the SHP, starts, SHI, and APU hours required to estimate emissions using the rate-per-activity emissions rates produced by the RatesCalc or RatesAdj utilities. The MOVESactivityInputBuild and MOVESfleetInputBuild utilities build inputs used in MOVES. The RatesCalc utility assembles the emissions rates from the MOVES output in terms of rate-per-activity, including rate-per-SHP for the evaporative emissions processes. The RatesAdj utility makes special adjustments to the emissions rates when required. The EmsCalc utility calculates emissions by hourly time periods, producing a tab-delimited summary file (including 24-hour totals), hourly link emissions output files (optional), and an optional tab-delimited summary file by MOVES source classification code (SCC).

A process flow diagram follows the utility descriptions.

TRANSVMT

The TRANSVMT utility post-processes travel demand models (TDMs) to produce hourly, on-road vehicle, seasonal and day-of-week specific, directional link VMT, and speed estimates. The TRANSVMT utility processes a 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 (as well as with other utilities to develop off-network activity estimates).

VirtualLinkVMT

The VirtualLinkVMT utility post-processes county HPMS average annual daily traffic (AADT) VMT, centerline miles, and lane miles by functional classification and area type (from the Texas Department of Transportation's [TxDOT's] annual Roadway Inventory Functional Classification Record [RIFCREC]) 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 inventory 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 a 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 volume/capacity (v/c)-derived directional delay (minutes/mile) applied to the estimated free-flow speeds for each link. The virtual link VMT and speeds produced using the VirtualLinkVMT utility are an input to the emissions calculation utility, EmsCalc (as well as with other utilities to develop off-network activity estimates).

VehPopulationBuild

The VehPopulationBuild utility builds the sourcetypeyear data files in a format consistent with the MOVES input database table and the SUT/fuel type population input file (can be used with the EmsCalc utility to estimate emissions or the OffNetActCalc utility to estimate starts and SHP) using the VMT mix and the Texas Department of Motor Vehicles (TxDMV) registration data sets. The TxDMV 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 SUT, 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 (seven categories for 31 years of data and the total) using the combinations in Table 26.

Table 26. 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 all vehicles except 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 27 shows the SUTs and their associated registration category in the registration category data array.

Table 27. 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 SUTs 42, 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 SUT 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 SUT/fuel type population input file is written using the SUT population array.

OffNetActCalc

The OffNetActCalc calculates the analysis scenario (i.e., year, season, day type) SHP, starts, SHI, and APU hours by hour, SUT, and fuel type used to estimate emissions using the EmsCalc utility. The SHI and APU hours are only calculated for SUT 62, fuel type 2 (CLhT_Diesel). The SHP is calculated using either the TDM or the virtual link-based link VMT and speeds (same as used in the distance-based emissions estimation), the 24-hour or time period VMT mix (by roadway type and SUT/fuel type), and the SUT/fuel type population (from the VehiclePopulationBuild utility). The starts activity is calculated using the SUT/fuel type population and the starts per vehicle (typically the MOVES default). The SHI and APU hours are a function of hotelling hours. This utility has two options for calculating the hotelling hours. Using the first option, the analysis scenario 24-hour hotelling hours is calculated using a user-supplied extended idle factor to the source hours operating (SHO). However, this method of estimating the hotelling hours as a direct function of the SHO does not consider the availability of locations where extended idling may occur. The second option (and suggested method) uses base data (24-hour hotelling, link VMT and speeds, and VMT mix), the analysis scenario data used to calculate the SHP, and the analysis scenario SHP to calculate the analysis scenario 24-hour hotelling hours.

For the analysis scenario first hourly VMT and speeds input, the utility applies the appropriate VMT mix (either the 24-hour VMT mix or the appropriate time period VMT mix as assigned by the user) to each link that has the desired county code; thus distributing 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 analysis scenario VMT and speeds input; therefore producing the analysis scenario hourly values for VMT by SUT/fuel type and for VHT by SUT/fuel type.

The analysis scenario hourly SUT/fuel type speed, total hours (or source hours), and SHP are then calculated. 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 is calculated by subtracting the hourly SUT/fuel type VHT (or SHO) from the hourly SUT/fuel type total hours. If the calculated SHP is negative (i.e., SHO is greater than the total hours), the SHP is set to 0.

To calculate the analysis scenario 24-hour hotelling hours under option 1 (as a direct function of SHO), the utility multiplies the CLhT_Diesel analysis scenario 24-hour SHO by the user-supplied extended idle factor, which represents the amount of extended idle time that must occur per SHO. For option 2 (as a function of base hotelling data), the utility calculates the base 24-hour CLhT_Diesel VMT using the base VMT and speeds inputs and the base VMT mix with the same procedure used in the analysis scenario SHP calculations. The 24-hour analysis scenario CLhT_Diesel VMT is then divided by the 24-hour base CLhT_Diesel VMT to create a scaling factor, which is then applied to the base 24-hour hotelling hours to calculate the analysis scenario 24-hour hotelling hours.

The utility then calculates the analysis scenario hourly hotelling hours. The analysis scenario hourly CLhT_Diesel SHO (from the SHP calculation process) is converted to hourly VHT fractions. The hourly hotelling fractions are calculated as the inverse of the hourly VHT fractions. The hourly hotelling fractions are then applied to the analysis scenario 24-hour hotelling hours to calculate the hourly hotelling hours. For each hour, the hourly hotelling hours are then compared to the hourly CLhT_Diesel SHP. For those hours where the hotelling hours are greater than the SHP, hotelling hours are set to the SHP for that hour.

The utility then calculates the SHI fraction and the APU fraction using the source type age distribution (same distribution used in the MOVES runs), the relative mileage accumulation rates, and the hotelling activity distribution. Travel fractions for SUT 62 (CLhT) by ageID (0 through 30) are calculated by multiplying the age distribution by the appropriate relative mileage accumulation rate, which is then converted into a distribution by dividing the individual travel fraction (ageID 0 through 30) by the sum of the travel fractions. These travel fractions are then applied to the appropriate operating mode fractions from the hotelling activity distribution (operating mode 200) and summed to calculate the SHI fraction. Using a similar process, the APU fraction is calculated using the operating mode fractions for operating mode 201. For each hour the analysis scenario hotelling hours are multiplied by the SHI fraction to calculate the analysis scenario SHI activity and by the APU fraction to calculate the analysis scenario APU hours.

MOVESactivityInputBuild

The MOVESactivityInputBuild utility builds the roadtypedistribution, hourvmtfraction, avgspeeddistribution, roadtype, hpmsvtypeyear, year, state, zone, zoneroadtype, monthvmtfraction, and dayvmtfraction data files in a format consistent with the 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;
- VMT roadway type designations, which lists associations of the link roadway types/area type combination to the VMT mix, emissions rate, and MOVES roadway types (same as used with the EmsCalc utility);
- 24-hour or time period VMT mix by roadway type, MOVES source type, and MOVES fuel type (same as used with the EmsCalc 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, the VHT is additionally saved in the ramp segment of the road type VHT array.

A MOVES roadway type array by MOVES roadway type (roadTypeID codes 2 through 5) is also created using the data in the VMT summary array and VMT roadway type designations. For the link road types designated a MOVES road type of 6 or 8, the VMT is added to MOVES road type 2 in the MOVES roadway type array. For the link road types designated a MOVES road type of 7 or 9, the VMT is added to MOVES road type 4 in the MOVES roadway type array. An hourly VMT array (by MOVES SUT, MOVES roadway type, and hour) is formed using the data in the VMT summary array, the VMT roadway type designations, and the VMT mix. If the time period VMT mix is used, each hour is assigned a time period by the user. Otherwise, the same 24-hour VMT mix is used for all hours. 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 MOVES roadway type array is used to produce the roadway type distribution array by MOVES SUT and MOVES roadway type. This VMT is 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 roadtype database table is written using the proportions from the road type VHT array. If the ramp fraction for roadTypeID 2 is greater than 0, then roadTypeID 6 (with rampFraction equal to 0) and roadTypeID 8 (with rampFraction equal to 1) are also added to the roadtype database table. If the ramp fraction for roadTypeID 4 is greater than 0, then roadTypeID 7 (with rampFraction equal to 0) and roadTypeID 9 (with rampFraction equal to 1) are also added to the roadtype database table. A tab-delimited version is also written (optional).

The VMT in the hourly VMT array is aggregated to create the HPMS vehicle type VMT array. Each SUT is assigned an HPMS vehicle type (SUT 11 is HPMS vehicle type 10; SUTs 21, 31 and 32 are HPMS vehicle type 25; 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 table and the day VMT fraction is set to 1 for the user-supplied day ID and 0 for all other months.

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 maintains 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 create the registration category data array (a total of seven categories for 31 years of data and the total) using the combinations in Table 26 (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 28 shows the source types and their corresponding registration categories.

Table 28. 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 29 shows the SUTs and their corresponding registration categories.

Table 29. 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.

RatesCalc

The RatesCalc utility calculates emissions rates in terms of rate/SHP for the evaporative emissions processes using the data in the CDB used in the MOVES emissions rates run and the MOVES default database. The utility also creates copies of the rateperdistance, rateperhour, rateperstart, rateperprofile (optional), and ratepervehicle (optional) emissions rate tables to include the units for each pollutant. If not specified, emissions rates are assembled for each pollutant and process combination (excluding total energy and the refueling emissions processes) in the MOVES emissions rate tables. The utility also uses the movesrun database table, along with a pollutant energy or mass lookup table (mass, TEQ, or gmole), to determine the units of the emissions rates, which are added to the emissions rate tables, which will allow 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 30 shows.

Table 30. MOVES2014 Emissions Process and Corresponding Activity for Rate-per-Activity Emissions Rates.

MOVES2014 Emissions Process	Activity	Emissions Rate Units
Running Exhaust	Miles Traveled	Rate/Mile
Crankcase Running Exhaust	Miles Traveled	Rate/Mile
Start Exhaust	Starts	Rate/Start
Crankcase Start Exhaust	Starts	Rate/Start
Extended Idle Exhaust	Extended Idle Hours	Rate/Extended Idle Hour
Crankcase Extended Idle Exhaust	Extended Idle Hours	Rate/Extended Idle Hour
Auxiliary Power Exhaust	APU Hours	Rate/APU Hour
Evaporative Permeation	Miles Traveled Source Hours Parked	Rate/Mile Rate/SHP
Evaporative Fuel Vapor Venting	Miles Traveled Source Hours Parked	Rate/Mile Rate/SHP
Evaporative Fuel Leaks	Miles Traveled Source Hours Parked	Rate/Mile Rate/SHP
Brake Wear	Miles Traveled	Rate/Mile
Tire Wear	Miles Traveled	Rate/Mile

For the rateperdistance (rate/mile emissions rates) emissions rate table, the utility creates a copy of the emissions rates in the specified output database with the table name ttirateperdistance. If specific pollutants are specified, only the emissions rates for those pollutants are copied to the ttirateperdistance table. Otherwise, the entire rateperdistance table is copied to the ttirateperdistance table. The utility also adds a "Units_Per_Activity" field to the ttirateperdistance table and fills that field based on the pollutants energy or mass designation (mass, TEQ, or gmole). For those pollutants designated as mass, the mass units from the movesrun table are added to the "Units_Per_Activity" field. For those pollutants designated as gmole, the mass units from the movesrun table, along with the text "-mole" (i.e., pound-mole or gram-mole) are added to the "Units_Per_Activity" field. For those pollutants designated as TEQ, the text "TEQ" is added to the "Units_Per_Activity" field. No unit conversions are performed in this utility. The rateperstart, rateperhour, rateperprofile (optional), and ratepervehicle (optional) emissions rate tables are processed in a similar manner to produce the ttirateperstart, ttirateperhour, ttirateperprofile, and ttiratepervehicle emissions rate tables.

The utility also includes a crankcase extended idle flag, which signals the utility how to calculate the crankcase extended idle emissions rates. If these emissions rates are not included in the rateperhour emissions rate table (as was the case with the July 2014 release of MOVES2014), then the flag is set to "YES" or the crankcase extended idle rates will not be included the emissions rates. In this case, the utility creates a copy of the crankcase extended idle emissions rates in the baserateoutput table (located in the output database of the MOVES run) and places them in the ttirateperhour table. If these rates are included in the rateperhour emissions rate table, the flag should be set to "NO" and no other processing is performed by the utility.

For the evaporative emissions rates, the utility uses the CDB from the MOVES run and the MOVES default database to replicate the MOVES vehicle population and SHP calculation process. Using the emissions rates from the rateperprofile and ratepervehicle emissions rate tables, the utility calculates the rate-per-SHP emissions rates by multiplying the emissions rate by the appropriate vehicle population and dividing by the appropriate SHP value. These rate-per-SHP emissions rates are then saved in the ttiratepershp emissions rate table. Similar to the previous RatesCalc emissions rate tables, the "Units_Per_Activity" field is added to the ttiratepershp table and filled based on the pollutants energy or mass designation.

RatesAdj

The RatesAdj utility applies emissions rate adjustments to an emissions rate database table produced by RatesCalc utility (ttirateperdistance, ttirateperstart, ttirateperhour, ttiratepershp, ttiratepervehicle or ttirateperprofile) 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, along with the output units of the emissions rates. This allows the user to perform any unit conversions between mass units (i.e., pounds to grams or pound-mole to gram-mole) without providing any addition adjustment factors. Unit conversions between unit types (i.e., gram-moles to grams or TEQ to grams) are not performed internally by the utility. These types of conversions must be made using the emissions rate adjustment factors. The utility also has the option for combining multiple emissions rate database tables into one new emissions rate database table, if 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 any unit conversion adjustments, 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. Using MySQL code, the utility also creates a minimum and maximum emissions rate summary for each input emissions rate table and the output emissions rate table by pollutant, process, and source type/fuel type, which is written to a tab-delimited file specified by the user.

EmsCalc

The EmsCalc utility estimates the hourly link emissions for one user-specified county using the emissions factors (either from RatesCalc or RatesAdj), the 24-hour or time period 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 RatesCalc or RatesAdj;
- 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;
- 24-hour or time period VMT mix by roadway type, MOVES SUT, and MOVES fuel type;
- Off-network activity. If the emissions factors are in grams-per-vehicle (i.e., the ttiratepervehicle or ttirateperprofile emissions rates), then vehicle population by SUT/fuel type is required. If the emissions factors are in grams-per-activity (i.e., the ttirateperstart, ttirateperhour, or ttiratepershp emissions rates), then the SHP, starts, SHI, and APU hours by hour and SUT/fuel type are required;
- VMT roadway type designations, which lists associations of the link roadway types/area type combination to the VMT mix, emissions rate, and MOVES roadway types;
- Pollutants input file, which specifies which pollutant/process combinations for which the emissions calculations will be performed and their respective units in the tab-delimited output; and
- SCC input file (optional, only if the activity and emissions by SCC are to be created).

The emissions estimation can be categorized by two basic types based on the type of emissions factors: the roadway-based emissions and the off-network-based emissions. For the roadway-based emissions (ttirateperdistance emissions factors), the VMT for each link is distributed to each of the SUT/fuel type combinations listed in the VMT mix by roadway type (as designated in the VMT roadway type designations). If the time period VMT mix is input, each hour is assigned a time period by the user. Otherwise, the 24-hour VMT mix is used for all hours. For each pollutant/process combination in the pollutants input file, the emissions factors are selected based on the emissions rate roadway type (as designated in the VMT roadway type designations) 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. If the activity and emissions by SCC are to be created, the activity and emissions are also aggregated by SCC using the SCC input file.

The off-network emissions calculation depends on the format of the input emissions factors. If the emissions factors are the ttiratepervehicle or ttirateperprofile emissions rates, the emissions factors by SUT/fuel type are multiplied by their associated vehicle population to estimate emissions. If the emissions factors are the ttirateperstart, ttirateperhour, or ttiratepershp emissions rates, the emissions factors by SUT/fuel type are multiplied by the appropriate activity, which is determined by the emissions process (see Table 30). If the activity and emissions by SCC are to be created, the activity and emissions are also aggregated by SCC using the SCC input file.

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, link 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. Only those pollutant/process combinations in the pollutants input file with tab-delimited output units other than "NONE" will appear in the tab-delimited output file. Prior to output, any unit conversions between mass units (i.e., pounds to grams or pound-mole to gram-mole) are performed by the utility. Unit conversions between unit types (i.e., gram-moles to grams or TEQ to grams) are not performed internally by the utility (these type of unit conversions must be done using the RatesAdj utility). This tab-delimited file also includes hourly and 24-hour summaries of the off-network activity and VMT, VHT, and speed by link road type. Link emissions may also be output by county, pollutant, process, and each SUT/fuel type combination. If specified, the tab-delimited activity and emissions by SCC output file is also created, which lists the activity and emissions for each pollutant by SCC.

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:

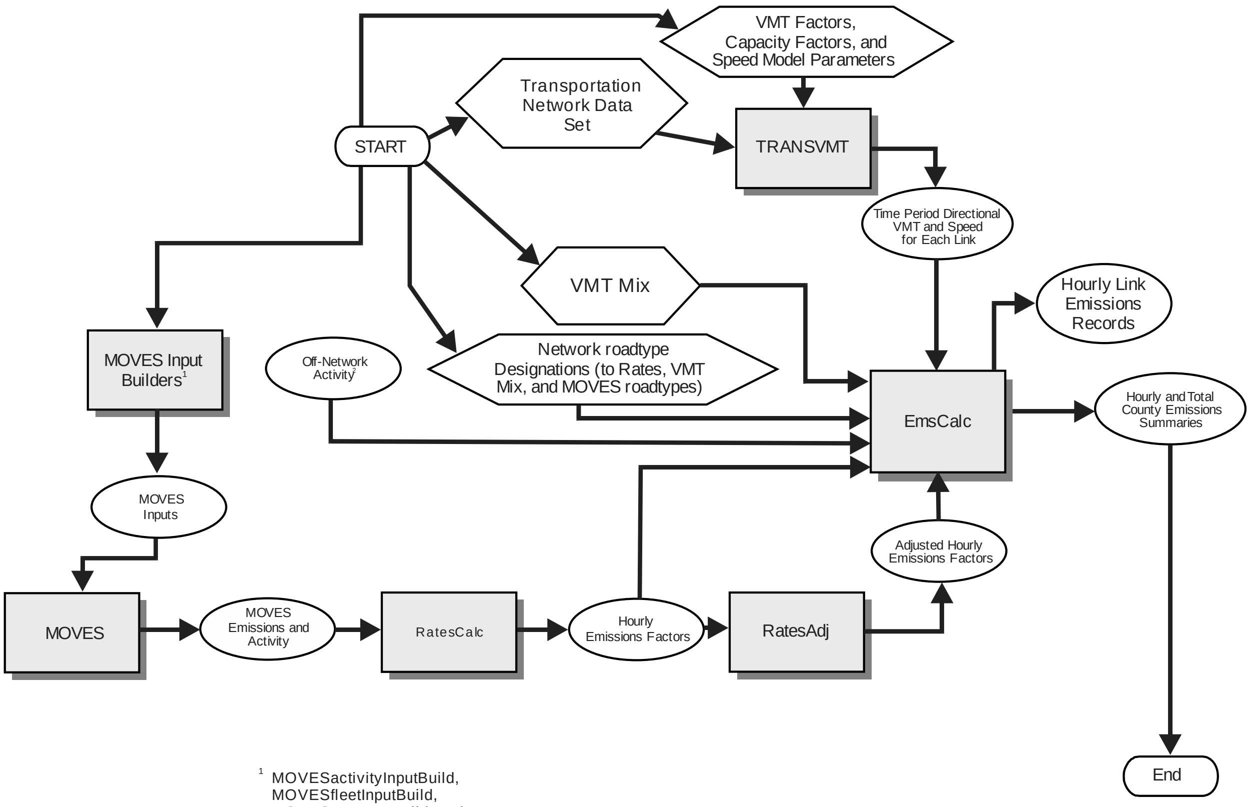
$EF_{LowSpeed}$ = 0.7413 g/mi;
$EF_{HighSpeed}$ = 0.7274 g/mi;
$Speed_{lnk}$ = 41.2 mph;
$Speed_{low}$ = 40 mph; and
$Speed_{high}$ = 45 mph.

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

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

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

Travel Demand Model Network Link-Based Hourly MOVES Emissions Estimates



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

[2] VehPopulationBuild, and OffNetActCalc.

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
2025	2023 through 2027
2030	2028 through 2032

2010 Weekday VMT Mix - Beaumont TxDOT District (2012 Analysis Year)

SUT/FT	AM Peak				Mid-Day				PM Peak				Overnight			
	RT2	RT3	RT4	RT5	RT2	RT3	RT4	RT5	RT2	RT3	RT4	RT5	RT2	RT3	RT4	RT5
21_D	0.00228	0.00221	0.00228	0.00257	0.00224	0.00221	0.00226	0.00252	0.00236	0.00243	0.00241	0.00267	0.00197	0.00222	0.00203	0.00237
21_G	0.56668	0.54935	0.56885	0.64101	0.55861	0.54988	0.56329	0.62854	0.58798	0.60397	0.60077	0.66436	0.48965	0.55180	0.50530	0.58990
31_D	0.00246	0.00316	0.00268	0.00313	0.00226	0.00301	0.00247	0.00303	0.00229	0.00319	0.00236	0.00319	0.00186	0.00305	0.00247	0.00383
31_G	0.17350	0.22225	0.18840	0.22025	0.15902	0.21223	0.17407	0.21368	0.16130	0.22451	0.16603	0.22442	0.13069	0.21446	0.17408	0.26952
32_D	0.00242	0.00310	0.00263	0.00307	0.00222	0.00296	0.00243	0.00298	0.00225	0.00313	0.00232	0.00313	0.00182	0.00299	0.00243	0.00376
32_G	0.04323	0.05538	0.04695	0.05488	0.03962	0.05288	0.04338	0.05325	0.04019	0.05594	0.04137	0.05592	0.03257	0.05344	0.04338	0.06716
51_D	0.00174	0.00232	0.00175	0.00132	0.00191	0.00230	0.00176	0.00171	0.00122	0.00156	0.00110	0.00097	0.00123	0.00159	0.00145	0.00096
51_G	0.00049	0.00065	0.00049	0.00037	0.00054	0.00064	0.00049	0.00048	0.00034	0.00044	0.00031	0.00027	0.00034	0.00045	0.00041	0.00027
52_D	0.03754	0.04992	0.03773	0.02841	0.04112	0.04943	0.03787	0.03681	0.02635	0.03368	0.02358	0.02094	0.02644	0.03425	0.03124	0.02063
52_G	0.01053	0.01400	0.01058	0.00797	0.01153	0.01386	0.01062	0.01032	0.00739	0.00944	0.00661	0.00587	0.00741	0.00960	0.00876	0.00578
53_D	0.00193	0.00257	0.00194	0.00146	0.00212	0.00255	0.00195	0.00190	0.00136	0.00174	0.00121	0.00108	0.00136	0.00176	0.00161	0.00106
53_G	0.00054	0.00072	0.00055	0.00041	0.00059	0.00071	0.00055	0.00053	0.00038	0.00049	0.00034	0.00030	0.00038	0.00049	0.00045	0.00030
54_D	0.00132	0.00175	0.00133	0.00100	0.00144	0.00174	0.00133	0.00129	0.00093	0.00118	0.00083	0.00074	0.00093	0.00120	0.00110	0.00072
54_G	0.00037	0.00049	0.00037	0.00028	0.00041	0.00049	0.00037	0.00036	0.00026	0.00033	0.00023	0.00021	0.00026	0.00034	0.00031	0.00020
41_D	0.00150	0.00297	0.00154	0.00146	0.00173	0.00182	0.00153	0.00117	0.00153	0.00075	0.00129	0.00105	0.00313	0.00110	0.00170	0.00097
42_D	0.00062	0.00122	0.00063	0.00060	0.00071	0.00075	0.00063	0.00048	0.00063	0.00031	0.00053	0.00043	0.00129	0.00046	0.00070	0.00040
42_G	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
43_D	0.00193	0.00382	0.00198	0.00187	0.00222	0.00233	0.00197	0.00151	0.00197	0.00096	0.00165	0.00135	0.00402	0.00142	0.00218	0.00124
43_G	0.00002	0.00004	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00001	0.00002	0.00001	0.00004	0.00001	0.00002	0.00001
61_D	0.05088	0.02827	0.04357	0.00991	0.05793	0.03373	0.05160	0.01312	0.05439	0.01873	0.04958	0.00421	0.09956	0.04022	0.07443	0.01027
61_G	0.00503	0.00280	0.00431	0.00098	0.00573	0.00334	0.00510	0.00130	0.00538	0.00185	0.00490	0.00042	0.00985	0.00398	0.00736	0.00102
62_D	0.09440	0.05245	0.08084	0.01838	0.10746	0.06257	0.09573	0.02435	0.10089	0.03475	0.09197	0.00780	0.18470	0.07462	0.13808	0.01904
62_G	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
11_G	0.00057	0.00055	0.00057	0.00064	0.00056	0.00055	0.00057	0.00063	0.00059	0.00061	0.00060	0.00067	0.00049	0.00055	0.00051	0.00059

2010 Weekday VMT Mix - Houston TxDOT District (2012 Analysis Year)

SUF/FT	AM Peak				Mid-Day				PM Peak				Overnight			
	RT2	RT3	RT4	RT5	RT2	RT3	RT4	RT5	RT2	RT3	RT4	RT5	RT2	RT3	RT4	RT5
21_D	0.00281	0.00259	0.00310	0.00296	0.00257	0.00238	0.00292	0.00278	0.00286	0.00262	0.00314	0.00300	0.00243	0.00239	0.00295	0.00299
21_G	0.70085	0.64459	0.77230	0.73720	0.64013	0.59328	0.72744	0.69270	0.71156	0.65196	0.78070	0.74642	0.60611	0.59560	0.73334	0.74362
31_D	0.00215	0.00277	0.00181	0.00228	0.00230	0.00289	0.00199	0.00241	0.00218	0.00307	0.00189	0.00232	0.00193	0.00334	0.00202	0.00224
31_G	0.15174	0.19532	0.12758	0.16054	0.16232	0.20358	0.14035	0.16948	0.15341	0.21619	0.13313	0.16371	0.13581	0.23496	0.14209	0.15792
32_D	0.00216	0.00278	0.00181	0.00228	0.00231	0.00289	0.00199	0.00241	0.00218	0.00307	0.00189	0.00233	0.00193	0.00334	0.00202	0.00224
32_G	0.03777	0.04862	0.03176	0.03996	0.04040	0.05068	0.03494	0.04219	0.03819	0.05381	0.03314	0.04075	0.03381	0.05849	0.03537	0.03931
51_D	0.00104	0.00135	0.00080	0.00084	0.00122	0.00171	0.00110	0.00141	0.00066	0.00092	0.00051	0.00063	0.00086	0.00105	0.00061	0.00057
51_G	0.00062	0.00080	0.00048	0.00050	0.00073	0.00102	0.00066	0.00084	0.00040	0.00055	0.00030	0.00038	0.00051	0.00063	0.00036	0.00034
52_D	0.01972	0.02555	0.01524	0.01595	0.02319	0.03242	0.02089	0.02669	0.01258	0.01750	0.00968	0.01199	0.01630	0.01993	0.01157	0.01091
52_G	0.01178	0.01526	0.00910	0.00953	0.01386	0.01937	0.01248	0.01594	0.00752	0.01045	0.00578	0.00716	0.00974	0.01191	0.00691	0.00652
53_D	0.00381	0.00494	0.00295	0.00308	0.00448	0.00627	0.00404	0.00516	0.00243	0.00338	0.00187	0.00232	0.00315	0.00385	0.00224	0.00211
53_G	0.00228	0.00295	0.00176	0.00184	0.00268	0.00374	0.00241	0.00308	0.00145	0.00202	0.00112	0.00138	0.00188	0.00230	0.00134	0.00126
54_D	0.00079	0.00102	0.00061	0.00064	0.00092	0.00129	0.00083	0.00106	0.00050	0.00070	0.00039	0.00048	0.00065	0.00079	0.00046	0.00043
54_G	0.00047	0.00061	0.00036	0.00038	0.00055	0.00077	0.00050	0.00064	0.00030	0.00042	0.00023	0.00029	0.00039	0.00047	0.00028	0.00026
41_D	0.00077	0.00163	0.00157	0.00201	0.00081	0.00100	0.00104	0.00125	0.00080	0.00054	0.00112	0.00101	0.00092	0.00090	0.00098	0.00086
42_D	0.00032	0.00067	0.00065	0.00083	0.00033	0.00041	0.00043	0.00051	0.00033	0.00022	0.00046	0.00042	0.00038	0.00037	0.00040	0.00035
42_G	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
43_D	0.00099	0.00209	0.00202	0.00258	0.00104	0.00129	0.00134	0.00160	0.00103	0.00070	0.00144	0.00130	0.00118	0.00116	0.00126	0.00111
43_G	0.00001	0.00002	0.00002	0.00003	0.00001	0.00001	0.00001	0.00002	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
61_D	0.02946	0.02279	0.01259	0.00787	0.04951	0.03702	0.02185	0.01450	0.03031	0.01553	0.01115	0.00665	0.09028	0.02881	0.02741	0.01304
61_G	0.00239	0.00185	0.00102	0.00064	0.00401	0.00300	0.00177	0.00118	0.00246	0.00126	0.00090	0.00054	0.00732	0.00234	0.00222	0.00106
62_D	0.02735	0.02116	0.01169	0.00731	0.04596	0.03436	0.02028	0.01346	0.02814	0.01442	0.01035	0.00617	0.08381	0.02675	0.02544	0.01210
62_G	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
11_G	0.00070	0.00065	0.00078	0.00074	0.00064	0.00060	0.00073	0.00070	0.00072	0.00066	0.00078	0.00075	0.00061	0.00060	0.00074	0.00075

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

SUT/FT	AM Peak				Mid-Day				PM Peak				Overnight			
	RT2	RT3	RT4	RT5	RT2	RT3	RT4	RT5	RT2	RT3	RT4	RT5	RT2	RT3	RT4	RT5
21_D	0.00398	0.00386	0.00400	0.00451	0.00393	0.00386	0.00396	0.00442	0.00413	0.00424	0.00422	0.00467	0.00344	0.00388	0.00355	0.00415
21_G	0.56497	0.54770	0.56714	0.63908	0.55693	0.54823	0.56160	0.62665	0.58621	0.60215	0.59896	0.66236	0.48817	0.55013	0.50378	0.58813
31_D	0.00300	0.00385	0.00326	0.00381	0.00275	0.00367	0.00301	0.00370	0.00279	0.00389	0.00287	0.00388	0.00226	0.00371	0.00301	0.00466
31_G	0.17363	0.22241	0.18854	0.22041	0.15913	0.21238	0.17420	0.21383	0.16142	0.22467	0.16615	0.22458	0.13078	0.21461	0.17421	0.26971
32_D	0.00238	0.00305	0.00259	0.00303	0.00219	0.00292	0.00239	0.00294	0.00222	0.00309	0.00228	0.00308	0.00180	0.00295	0.00239	0.00370
32_G	0.04260	0.05458	0.04626	0.05408	0.03905	0.05211	0.04274	0.05247	0.03961	0.05513	0.04077	0.05511	0.03209	0.05266	0.04275	0.06618
51_D	0.00179	0.00238	0.00180	0.00135	0.00196	0.00235	0.00180	0.00175	0.00125	0.00160	0.00112	0.00100	0.00126	0.00163	0.00149	0.00098
51_G	0.00050	0.00067	0.00050	0.00038	0.00055	0.00066	0.00051	0.00049	0.00035	0.00045	0.00031	0.00028	0.00035	0.00046	0.00042	0.00028
52_D	0.03742	0.04976	0.03761	0.02831	0.04099	0.04927	0.03775	0.03670	0.02626	0.03357	0.02350	0.02087	0.02635	0.03414	0.03114	0.02056
52_G	0.01049	0.01395	0.01055	0.00794	0.01149	0.01382	0.01059	0.01029	0.00736	0.00941	0.00659	0.00585	0.00739	0.00957	0.00873	0.00577
53_D	0.00193	0.00256	0.00194	0.00146	0.00211	0.00254	0.00194	0.00189	0.00135	0.00173	0.00121	0.00108	0.00136	0.00176	0.00160	0.00106
53_G	0.00054	0.00072	0.00054	0.00041	0.00059	0.00071	0.00055	0.00053	0.00038	0.00049	0.00034	0.00030	0.00038	0.00049	0.00045	0.00030
54_D	0.00140	0.00187	0.00141	0.00106	0.00154	0.00185	0.00142	0.00138	0.00099	0.00126	0.00088	0.00078	0.00099	0.00128	0.00117	0.00077
54_G	0.00039	0.00052	0.00040	0.00030	0.00043	0.00052	0.00040	0.00039	0.00028	0.00035	0.00025	0.00022	0.00028	0.00036	0.00033	0.00022
41_D	0.00048	0.00094	0.00049	0.00046	0.00055	0.00058	0.00049	0.00037	0.00049	0.00024	0.00041	0.00033	0.00099	0.00035	0.00054	0.00031
42_D	0.00095	0.00188	0.00098	0.00092	0.00110	0.00115	0.00097	0.00074	0.00097	0.00047	0.00082	0.00067	0.00199	0.00070	0.00108	0.00061
42_G	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
43_D	0.00261	0.00517	0.00268	0.00254	0.00301	0.00316	0.00267	0.00204	0.00266	0.00130	0.00224	0.00183	0.00545	0.00192	0.00296	0.00168
43_G	0.00003	0.00005	0.00003	0.00003	0.00003	0.00003	0.00003	0.00002	0.00003	0.00001	0.00002	0.00002	0.00006	0.00002	0.00003	0.00002
61_D	0.05088	0.02827	0.04357	0.00991	0.05793	0.03373	0.05160	0.01312	0.05439	0.01873	0.04958	0.00421	0.09956	0.04022	0.07443	0.01027
61_G	0.00503	0.00280	0.00431	0.00098	0.00573	0.00334	0.00510	0.00130	0.00538	0.00185	0.00490	0.00042	0.00985	0.00398	0.00736	0.00102
62_D	0.09440	0.05245	0.08084	0.01838	0.10746	0.06257	0.09573	0.02435	0.10089	0.03475	0.09197	0.00780	0.18470	0.07462	0.13808	0.01904
62_G	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
11_G	0.00057	0.00055	0.00057	0.00064	0.00056	0.00055	0.00057	0.00063	0.00059	0.00061	0.00060	0.00067	0.00049	0.00055	0.00051	0.00059

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

SUT/FT	AM Peak				Mid-Day				PM Peak				Overnight			
	RT2	RT3	RT4	RT5	RT2	RT3	RT4	RT5	RT2	RT3	RT4	RT5	RT2	RT3	RT4	RT5
21_D	0.00493	0.00453	0.00543	0.00518	0.00450	0.00417	0.00511	0.00487	0.00500	0.00458	0.00549	0.00525	0.00426	0.00419	0.00515	0.00523
21_G	0.69874	0.64265	0.76997	0.73498	0.63820	0.59149	0.72525	0.69061	0.70941	0.65000	0.77835	0.74417	0.60428	0.59381	0.73113	0.74138
31_D	0.00263	0.00338	0.00221	0.00278	0.00281	0.00352	0.00243	0.00293	0.00266	0.00374	0.00230	0.00283	0.00235	0.00407	0.00246	0.00273
31_G	0.15185	0.19546	0.12767	0.16065	0.16243	0.20373	0.14045	0.16960	0.15352	0.21634	0.13323	0.16383	0.13591	0.23513	0.14219	0.15804
32_D	0.00205	0.00263	0.00172	0.00216	0.00219	0.00274	0.00189	0.00229	0.00207	0.00291	0.00180	0.00221	0.00183	0.00317	0.00192	0.00213
32_G	0.03730	0.04801	0.03136	0.03946	0.03990	0.05004	0.03450	0.04166	0.03771	0.05314	0.03273	0.04024	0.03338	0.05776	0.03493	0.03882
51_D	0.00107	0.00138	0.00082	0.00086	0.00125	0.00175	0.00113	0.00144	0.00068	0.00095	0.00052	0.00065	0.00088	0.00108	0.00062	0.00059
51_G	0.00064	0.00082	0.00049	0.00051	0.00075	0.00105	0.00067	0.00086	0.00041	0.00056	0.00031	0.00039	0.00053	0.00064	0.00037	0.00035
52_D	0.01966	0.02546	0.01519	0.01590	0.02312	0.03232	0.02082	0.02660	0.01254	0.01744	0.00965	0.01195	0.01625	0.01987	0.01153	0.01087
52_G	0.01174	0.01521	0.00907	0.00950	0.01381	0.01931	0.01244	0.01589	0.00749	0.01042	0.00576	0.00714	0.00971	0.01187	0.00689	0.00649
53_D	0.00380	0.00492	0.00294	0.00307	0.00447	0.00625	0.00402	0.00514	0.00242	0.00337	0.00186	0.00231	0.00314	0.00384	0.00223	0.00210
53_G	0.00227	0.00294	0.00175	0.00184	0.00267	0.00373	0.00240	0.00307	0.00145	0.00201	0.00111	0.00138	0.00188	0.00229	0.00133	0.00126
54_D	0.00084	0.00108	0.00065	0.00068	0.00098	0.00138	0.00089	0.00113	0.00053	0.00074	0.00041	0.00051	0.00069	0.00085	0.00049	0.00046
54_G	0.00050	0.00065	0.00039	0.00040	0.00059	0.00082	0.00053	0.00068	0.00032	0.00044	0.00025	0.00030	0.00041	0.00051	0.00029	0.00028
41_D	0.00025	0.00052	0.00050	0.00064	0.00026	0.00032	0.00033	0.00040	0.00025	0.00017	0.00036	0.00032	0.00029	0.00029	0.00031	0.00027
42_D	0.00049	0.00103	0.00100	0.00127	0.00051	0.00064	0.00066	0.00079	0.00051	0.00034	0.00071	0.00064	0.00058	0.00057	0.00062	0.00055
42_G	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
43_D	0.00135	0.00283	0.00274	0.00350	0.00141	0.00175	0.00181	0.00217	0.00139	0.00094	0.00195	0.00176	0.00160	0.00157	0.00171	0.00150
43_G	0.00001	0.00003	0.00003	0.00004	0.00001	0.00002	0.00002	0.00002	0.00001	0.00001	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002
61_D	0.02946	0.02279	0.01259	0.00787	0.04951	0.03702	0.02185	0.01450	0.03031	0.01553	0.01115	0.00665	0.09028	0.02881	0.02741	0.01304
61_G	0.00239	0.00185	0.00102	0.00064	0.00401	0.00300	0.00177	0.00118	0.00246	0.00126	0.00090	0.00054	0.00732	0.00234	0.00222	0.00106
62_D	0.02735	0.02116	0.01169	0.00731	0.04596	0.03436	0.02028	0.01346	0.02814	0.01442	0.01035	0.00617	0.08381	0.02675	0.02544	0.01210
62_G	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
11_G	0.00070	0.00065	0.00078	0.00074	0.00064	0.00060	0.00073	0.00070	0.00072	0.00066	0.00078	0.00075	0.00061	0.00060	0.00074	0.00075

2020 Weekday VMT Mix - Beaumont TxDOT District (2020 Analysis Year)

SUT/FT	AM Peak				Mid-Day				PM Peak				Overnight			
	RT2	RT3	RT4	RT5	RT2	RT3	RT4	RT5	RT2	RT3	RT4	RT5	RT2	RT3	RT4	RT5
21_D	0.00512	0.00496	0.00514	0.00579	0.00505	0.00497	0.00509	0.00568	0.00531	0.00546	0.00543	0.00600	0.00442	0.00499	0.00457	0.00533
21_G	0.56384	0.54660	0.56600	0.63780	0.55581	0.54712	0.56046	0.62539	0.58503	0.60094	0.59775	0.66103	0.48719	0.54903	0.50276	0.58694
31_D	0.00318	0.00407	0.00345	0.00404	0.00291	0.00389	0.00319	0.00392	0.00296	0.00411	0.00304	0.00411	0.00239	0.00393	0.00319	0.00494
31_G	0.17345	0.22219	0.18835	0.22019	0.15897	0.21216	0.17402	0.21362	0.16126	0.22445	0.16598	0.22435	0.13065	0.21440	0.17403	0.26944
32_D	0.00234	0.00300	0.00254	0.00297	0.00214	0.00286	0.00235	0.00288	0.00217	0.00303	0.00224	0.00303	0.00176	0.00289	0.00235	0.00363
32_G	0.04265	0.05463	0.04631	0.05414	0.03909	0.05217	0.04279	0.05253	0.03965	0.05519	0.04081	0.05516	0.03213	0.05272	0.04279	0.06625
51_D	0.00174	0.00232	0.00175	0.00132	0.00191	0.00230	0.00176	0.00171	0.00122	0.00156	0.00110	0.00097	0.00123	0.00159	0.00145	0.00096
51_G	0.00049	0.00065	0.00049	0.00037	0.00054	0.00064	0.00049	0.00048	0.00034	0.00044	0.00031	0.00027	0.00034	0.00045	0.00041	0.00027
52_D	0.03754	0.04992	0.03773	0.02841	0.04112	0.04943	0.03787	0.03681	0.02635	0.03368	0.02358	0.02094	0.02644	0.03425	0.03124	0.02063
52_G	0.01053	0.01400	0.01058	0.00797	0.01153	0.01386	0.01062	0.01032	0.00739	0.00944	0.00661	0.00587	0.00741	0.00960	0.00876	0.00578
53_D	0.00193	0.00257	0.00194	0.00146	0.00212	0.00255	0.00195	0.00190	0.00136	0.00174	0.00121	0.00108	0.00136	0.00176	0.00161	0.00106
53_G	0.00054	0.00072	0.00055	0.00041	0.00059	0.00071	0.00055	0.00053	0.00038	0.00049	0.00034	0.00030	0.00038	0.00049	0.00045	0.00030
54_D	0.00132	0.00175	0.00133	0.00100	0.00144	0.00174	0.00133	0.00129	0.00093	0.00118	0.00083	0.00074	0.00093	0.00120	0.00110	0.00072
54_G	0.00037	0.00049	0.00037	0.00028	0.00041	0.00049	0.00037	0.00036	0.00026	0.00033	0.00023	0.00021	0.00026	0.00034	0.00031	0.00020
41_D	0.00048	0.00094	0.00049	0.00046	0.00055	0.00058	0.00049	0.00037	0.00049	0.00024	0.00041	0.00033	0.00099	0.00035	0.00054	0.00031
42_D	0.00096	0.00189	0.00098	0.00093	0.00110	0.00116	0.00098	0.00075	0.00097	0.00047	0.00082	0.00067	0.00199	0.00070	0.00108	0.00061
42_G	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
43_D	0.00261	0.00516	0.00268	0.00253	0.00301	0.00316	0.00266	0.00204	0.00266	0.00130	0.00224	0.00183	0.00544	0.00192	0.00295	0.00168
43_G	0.00003	0.00005	0.00003	0.00003	0.00003	0.00003	0.00003	0.00002	0.00003	0.00001	0.00002	0.00002	0.00005	0.00002	0.00003	0.00002
61_D	0.05088	0.02827	0.04357	0.00991	0.05793	0.03373	0.05160	0.01312	0.05439	0.01873	0.04958	0.00421	0.09956	0.04022	0.07443	0.01027
61_G	0.00503	0.00280	0.00431	0.00098	0.00573	0.00334	0.00510	0.00130	0.00538	0.00185	0.00490	0.00042	0.00985	0.00398	0.00736	0.00102
62_D	0.09440	0.05245	0.08084	0.01838	0.10746	0.06257	0.09573	0.02435	0.10089	0.03475	0.09197	0.00780	0.18470	0.07462	0.13808	0.01904
62_G	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
11_G	0.00057	0.00055	0.00057	0.00064	0.00056	0.00055	0.00057	0.00063	0.00059	0.00061	0.00060	0.00067	0.00049	0.00055	0.00051	0.00059

2020 Weekday VMT Mix - Houston TxDOT District (2020 Analysis Year)

SUT/FT	AM Peak				Mid-Day				PM Peak				Overnight			
	RT2	RT3	RT4	RT5	RT2	RT3	RT4	RT5	RT2	RT3	RT4	RT5	RT2	RT3	RT4	RT5
21_D	0.00633	0.00582	0.00698	0.00666	0.00578	0.00536	0.00657	0.00626	0.00643	0.00589	0.00705	0.00674	0.00548	0.00538	0.00663	0.00672
21_G	0.69733	0.64135	0.76842	0.73350	0.63692	0.59030	0.72379	0.68922	0.70799	0.64869	0.77678	0.74267	0.60306	0.59261	0.72966	0.73989
31_D	0.00294	0.00378	0.00247	0.00311	0.00314	0.00394	0.00271	0.00328	0.00297	0.00418	0.00258	0.00317	0.00263	0.00454	0.00275	0.00305
31_G	0.15154	0.19507	0.12741	0.16032	0.16210	0.20331	0.14017	0.16926	0.15321	0.21590	0.13296	0.16349	0.13563	0.23465	0.14190	0.15771
32_D	0.00205	0.00263	0.00172	0.00216	0.00219	0.00274	0.00189	0.00229	0.00207	0.00291	0.00180	0.00221	0.00183	0.00317	0.00192	0.00213
32_G	0.03730	0.04801	0.03136	0.03946	0.03990	0.05004	0.03450	0.04166	0.03771	0.05314	0.03273	0.04024	0.03338	0.05776	0.03493	0.03882
51_D	0.00104	0.00135	0.00080	0.00084	0.00122	0.00171	0.00110	0.00141	0.00066	0.00092	0.00051	0.00063	0.00086	0.00105	0.00061	0.00057
51_G	0.00062	0.00080	0.00048	0.00050	0.00073	0.00102	0.00066	0.00084	0.00040	0.00055	0.00030	0.00038	0.00051	0.00063	0.00036	0.00034
52_D	0.01972	0.02555	0.01524	0.01595	0.02319	0.03242	0.02089	0.02669	0.01258	0.01750	0.00968	0.01199	0.01630	0.01993	0.01157	0.01091
52_G	0.01178	0.01526	0.00910	0.00953	0.01386	0.01937	0.01248	0.01594	0.00752	0.01045	0.00578	0.00716	0.00974	0.01191	0.00691	0.00652
53_D	0.00381	0.00494	0.00295	0.00308	0.00448	0.00627	0.00404	0.00516	0.00243	0.00338	0.00187	0.00232	0.00315	0.00385	0.00224	0.00211
53_G	0.00228	0.00295	0.00176	0.00184	0.00268	0.00374	0.00241	0.00308	0.00145	0.00202	0.00112	0.00138	0.00188	0.00230	0.00134	0.00126
54_D	0.00079	0.00102	0.00061	0.00064	0.00092	0.00129	0.00083	0.00106	0.00050	0.00070	0.00039	0.00048	0.00065	0.00079	0.00046	0.00043
54_G	0.00047	0.00061	0.00036	0.00038	0.00055	0.00077	0.00050	0.00064	0.00030	0.00042	0.00023	0.00029	0.00039	0.00047	0.00028	0.00026
41_D	0.00025	0.00052	0.00050	0.00064	0.00026	0.00032	0.00033	0.00040	0.00025	0.00017	0.00036	0.00032	0.00029	0.00029	0.00031	0.00027
42_D	0.00049	0.00104	0.00100	0.00128	0.00052	0.00064	0.00066	0.00079	0.00051	0.00034	0.00071	0.00064	0.00058	0.00058	0.00062	0.00055
42_G	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
43_D	0.00134	0.00283	0.00273	0.00350	0.00141	0.00174	0.00181	0.00217	0.00139	0.00094	0.00195	0.00176	0.00160	0.00157	0.00170	0.00150
43_G	0.00001	0.00003	0.00003	0.00004	0.00001	0.00002	0.00002	0.00002	0.00001	0.00001	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002
61_D	0.02946	0.02279	0.01259	0.00787	0.04951	0.03702	0.02185	0.01450	0.03031	0.01553	0.01115	0.00665	0.09028	0.02881	0.02741	0.01304
61_G	0.00239	0.00185	0.00102	0.00064	0.00401	0.00300	0.00177	0.00118	0.00246	0.00126	0.00090	0.00054	0.00732	0.00234	0.00222	0.00106
62_D	0.02735	0.02116	0.01169	0.00731	0.04596	0.03436	0.02028	0.01346	0.02814	0.01442	0.01035	0.00617	0.08381	0.02675	0.02544	0.01210
62_G	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
11_G	0.00070	0.00065	0.00078	0.00074	0.00064	0.00060	0.00073	0.00070	0.00072	0.00066	0.00078	0.00075	0.00061	0.00060	0.00074	0.00075

2025 Weekday VMT Mix - Beaumont TxDOT District (2023 and 2026 Analysis Years)

SUT/FT	AM Peak				Mid-Day				PM Peak				Overnight			
	RT2	RT3	RT4	RT5	RT2	RT3	RT4	RT5	RT2	RT3	RT4	RT5	RT2	RT3	RT4	RT5
21_D	0.00626	0.00607	0.00628	0.00708	0.00617	0.00607	0.00622	0.00694	0.00649	0.00667	0.00663	0.00734	0.00541	0.00609	0.00558	0.00652
21_G	0.56270	0.54549	0.56486	0.63651	0.55469	0.54602	0.55933	0.62412	0.58385	0.59972	0.59655	0.65969	0.48621	0.54792	0.50175	0.58576
31_D	0.00336	0.00430	0.00364	0.00426	0.00308	0.00410	0.00337	0.00413	0.00312	0.00434	0.00321	0.00434	0.00253	0.00415	0.00337	0.00521
31_G	0.17328	0.22196	0.18816	0.21996	0.15881	0.21195	0.17384	0.21340	0.16109	0.22422	0.16581	0.22412	0.13052	0.21418	0.17385	0.26917
32_D	0.00238	0.00305	0.00259	0.00303	0.00219	0.00292	0.00239	0.00294	0.00222	0.00309	0.00228	0.00308	0.00180	0.00295	0.00239	0.00370
32_G	0.04260	0.05458	0.04626	0.05408	0.03905	0.05211	0.04274	0.05247	0.03961	0.05513	0.04077	0.05511	0.03209	0.05266	0.04275	0.06618
51_D	0.00174	0.00232	0.00175	0.00132	0.00191	0.00230	0.00176	0.00171	0.00122	0.00156	0.00110	0.00097	0.00123	0.00159	0.00145	0.00096
51_G	0.00049	0.00065	0.00049	0.00037	0.00054	0.00064	0.00049	0.00048	0.00034	0.00044	0.00031	0.00027	0.00034	0.00045	0.00041	0.00027
52_D	0.03762	0.05003	0.03781	0.02847	0.04121	0.04954	0.03795	0.03689	0.02640	0.03375	0.02363	0.02098	0.02650	0.03432	0.03131	0.02067
52_G	0.01055	0.01403	0.01060	0.00798	0.01156	0.01389	0.01064	0.01035	0.00740	0.00946	0.00663	0.00588	0.00743	0.00962	0.00878	0.00580
53_D	0.00194	0.00258	0.00195	0.00147	0.00212	0.00255	0.00196	0.00190	0.00136	0.00174	0.00122	0.00108	0.00137	0.00177	0.00161	0.00107
53_G	0.00054	0.00072	0.00055	0.00041	0.00060	0.00072	0.00055	0.00053	0.00038	0.00049	0.00034	0.00030	0.00038	0.00050	0.00045	0.00030
54_D	0.00123	0.00164	0.00124	0.00093	0.00135	0.00162	0.00124	0.00121	0.00087	0.00111	0.00077	0.00069	0.00087	0.00113	0.00103	0.00068
54_G	0.00035	0.00046	0.00035	0.00026	0.00038	0.00046	0.00035	0.00034	0.00024	0.00031	0.00022	0.00019	0.00024	0.00032	0.00029	0.00019
41_D	0.00048	0.00094	0.00049	0.00046	0.00055	0.00058	0.00049	0.00037	0.00049	0.00024	0.00041	0.00033	0.00099	0.00035	0.00054	0.00031
42_D	0.00096	0.00191	0.00099	0.00094	0.00111	0.00117	0.00098	0.00075	0.00098	0.00048	0.00083	0.00067	0.00201	0.00071	0.00109	0.00062
42_G	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
43_D	0.00260	0.00515	0.00267	0.00253	0.00300	0.00315	0.00265	0.00203	0.00265	0.00129	0.00223	0.00182	0.00543	0.00192	0.00294	0.00167
43_G	0.00003	0.00005	0.00003	0.00003	0.00003	0.00003	0.00003	0.00002	0.00003	0.00001	0.00002	0.00002	0.00005	0.00002	0.00003	0.00002
61_D	0.05088	0.02827	0.04357	0.00991	0.05793	0.03373	0.05160	0.01312	0.05439	0.01873	0.04958	0.00421	0.09956	0.04022	0.07443	0.01027
61_G	0.00503	0.00280	0.00431	0.00098	0.00573	0.00334	0.00510	0.00130	0.00538	0.00185	0.00490	0.00042	0.00985	0.00398	0.00736	0.00102
62_D	0.09440	0.05245	0.08084	0.01838	0.10746	0.06257	0.09573	0.02435	0.10089	0.03475	0.09197	0.00780	0.18470	0.07462	0.13808	0.01904
62_G	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
11_G	0.00057	0.00055	0.00057	0.00064	0.00056	0.00055	0.00057	0.00063	0.00059	0.00061	0.00060	0.00067	0.00049	0.00055	0.00051	0.00059

2025 Weekday VMT Mix - Houston TxDOT District (2023 and 2026 Analysis Years)

SUT/FT	AM Peak				Mid-Day				PM Peak				Overnight			
	RT2	RT3	RT4	RT5	RT2	RT3	RT4	RT5	RT2	RT3	RT4	RT5	RT2	RT3	RT4	RT5
21_D	0.00774	0.00712	0.00853	0.00814	0.00707	0.00655	0.00803	0.00765	0.00786	0.00720	0.00862	0.00824	0.00669	0.00658	0.00810	0.00821
21_G	0.69592	0.64006	0.76687	0.73202	0.63563	0.58911	0.72233	0.68783	0.70656	0.64738	0.77521	0.74117	0.60185	0.59142	0.72819	0.73839
31_D	0.00294	0.00378	0.00247	0.00311	0.00314	0.00394	0.00271	0.00328	0.00297	0.00418	0.00258	0.00317	0.00263	0.00454	0.00275	0.00305
31_G	0.15154	0.19507	0.12741	0.16032	0.16210	0.20331	0.14017	0.16926	0.15321	0.21590	0.13296	0.16349	0.13563	0.23465	0.14190	0.15771
32_D	0.00209	0.00268	0.00175	0.00221	0.00223	0.00280	0.00193	0.00233	0.00211	0.00297	0.00183	0.00225	0.00187	0.00323	0.00195	0.00217
32_G	0.03726	0.04796	0.03133	0.03942	0.03986	0.04999	0.03446	0.04162	0.03767	0.05309	0.03269	0.04020	0.03335	0.05769	0.03489	0.03878
51_D	0.00104	0.00135	0.00080	0.00084	0.00122	0.00171	0.00110	0.00141	0.00066	0.00092	0.00051	0.00063	0.00086	0.00105	0.00061	0.00057
51_G	0.00062	0.00080	0.00048	0.00050	0.00073	0.00102	0.00066	0.00084	0.00040	0.00055	0.00030	0.00038	0.00051	0.00063	0.00036	0.00034
52_D	0.01976	0.02560	0.01527	0.01599	0.02324	0.03249	0.02093	0.02674	0.01261	0.01754	0.00970	0.01202	0.01634	0.01997	0.01159	0.01093
52_G	0.01181	0.01530	0.00912	0.00955	0.01389	0.01941	0.01251	0.01598	0.00753	0.01048	0.00579	0.00718	0.00976	0.01193	0.00693	0.00653
53_D	0.00382	0.00495	0.00295	0.00309	0.00449	0.00628	0.00405	0.00517	0.00244	0.00339	0.00187	0.00232	0.00316	0.00386	0.00224	0.00211
53_G	0.00228	0.00296	0.00176	0.00185	0.00268	0.00375	0.00242	0.00309	0.00146	0.00203	0.00112	0.00139	0.00189	0.00231	0.00134	0.00126
54_D	0.00074	0.00095	0.00057	0.00059	0.00086	0.00121	0.00078	0.00100	0.00047	0.00065	0.00036	0.00045	0.00061	0.00074	0.00043	0.00041
54_G	0.00044	0.00057	0.00034	0.00036	0.00052	0.00072	0.00047	0.00059	0.00028	0.00039	0.00022	0.00027	0.00036	0.00044	0.00026	0.00024
41_D	0.00025	0.00052	0.00050	0.00064	0.00026	0.00032	0.00033	0.00040	0.00025	0.00017	0.00036	0.00032	0.00029	0.00029	0.00031	0.00027
42_D	0.00050	0.00105	0.00101	0.00129	0.00052	0.00064	0.00067	0.00080	0.00051	0.00035	0.00072	0.00065	0.00059	0.00058	0.00063	0.00055
42_G	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
43_D	0.00134	0.00282	0.00273	0.00348	0.00141	0.00174	0.00180	0.00216	0.00139	0.00094	0.00194	0.00175	0.00159	0.00157	0.00170	0.00149
43_G	0.00001	0.00003	0.00003	0.00004	0.00001	0.00002	0.00002	0.00002	0.00001	0.00001	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002
61_D	0.02946	0.02279	0.01259	0.00787	0.04951	0.03702	0.02185	0.01450	0.03031	0.01553	0.01115	0.00665	0.09028	0.02881	0.02741	0.01304
61_G	0.00239	0.00185	0.00102	0.00064	0.00401	0.00300	0.00177	0.00118	0.00246	0.00126	0.00090	0.00054	0.00732	0.00234	0.00222	0.00106
62_D	0.02735	0.02116	0.01169	0.00731	0.04596	0.03436	0.02028	0.01346	0.02814	0.01442	0.01035	0.00617	0.08381	0.02675	0.02544	0.01210
62_G	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
11_G	0.00070	0.00065	0.00078	0.00074	0.00064	0.00060	0.00073	0.00070	0.00072	0.00066	0.00078	0.00075	0.00061	0.00060	0.00074	0.00075

2025 Weekday VMT Mix - Beaumont TxDOT District (2028 Analysis Years)

SUT/FT	AM Peak				Mid-Day				PM Peak				Overnight			
	RT2	RT3	RT4	RT5	RT2	RT3	RT4	RT5	RT2	RT3	RT4	RT5	RT2	RT3	RT4	RT5
21_D	0.00626	0.00607	0.00628	0.00708	0.00617	0.00607	0.00622	0.00694	0.00649	0.00667	0.00663	0.00734	0.00541	0.00609	0.00558	0.00652
21_G	0.56270	0.54549	0.56486	0.63651	0.55469	0.54602	0.55933	0.62412	0.58385	0.59972	0.59655	0.65969	0.48621	0.54792	0.50175	0.58576
31_D	0.00353	0.00453	0.00384	0.00448	0.00324	0.00432	0.00354	0.00435	0.00328	0.00457	0.00338	0.00457	0.00266	0.00437	0.00354	0.00549
31_G	0.17310	0.22174	0.18797	0.21974	0.15865	0.21173	0.17367	0.21318	0.16093	0.22399	0.16564	0.22389	0.13039	0.21396	0.17368	0.26889
32_D	0.00238	0.00305	0.00259	0.00303	0.00219	0.00292	0.00239	0.00294	0.00222	0.00309	0.00228	0.00308	0.00180	0.00295	0.00239	0.00370
32_G	0.04260	0.05458	0.04626	0.05408	0.03905	0.05211	0.04274	0.05247	0.03961	0.05513	0.04077	0.05511	0.03209	0.05266	0.04275	0.06618
51_D	0.00174	0.00232	0.00175	0.00132	0.00191	0.00230	0.00176	0.00171	0.00122	0.00156	0.00110	0.00097	0.00123	0.00159	0.00145	0.00096
51_G	0.00049	0.00065	0.00049	0.00037	0.00054	0.00064	0.00049	0.00048	0.00034	0.00044	0.00031	0.00027	0.00034	0.00045	0.00041	0.00027
52_D	0.03762	0.05003	0.03781	0.02847	0.04121	0.04954	0.03795	0.03689	0.02640	0.03375	0.02363	0.02098	0.02650	0.03432	0.03131	0.02067
52_G	0.01055	0.01403	0.01060	0.00798	0.01156	0.01389	0.01064	0.01035	0.00740	0.00946	0.00663	0.00588	0.00743	0.00962	0.00878	0.00580
53_D	0.00194	0.00258	0.00195	0.00147	0.00212	0.00255	0.00196	0.00190	0.00136	0.00174	0.00122	0.00108	0.00137	0.00177	0.00161	0.00107
53_G	0.00054	0.00072	0.00055	0.00041	0.00060	0.00072	0.00055	0.00053	0.00038	0.00049	0.00034	0.00030	0.00038	0.00050	0.00045	0.00030
54_D	0.00123	0.00164	0.00124	0.00093	0.00135	0.00162	0.00124	0.00121	0.00087	0.00111	0.00077	0.00069	0.00087	0.00113	0.00103	0.00068
54_G	0.00035	0.00046	0.00035	0.00026	0.00038	0.00046	0.00035	0.00034	0.00024	0.00031	0.00022	0.00019	0.00024	0.00032	0.00029	0.00019
41_D	0.00048	0.00094	0.00049	0.00046	0.00055	0.00058	0.00049	0.00037	0.00049	0.00024	0.00041	0.00033	0.00099	0.00035	0.00054	0.00031
42_D	0.00098	0.00193	0.00100	0.00095	0.00112	0.00118	0.00100	0.00076	0.00100	0.00049	0.00084	0.00068	0.00204	0.00072	0.00110	0.00063
42_G	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
43_D	0.00259	0.00512	0.00266	0.00251	0.00298	0.00313	0.00264	0.00203	0.00264	0.00129	0.00222	0.00181	0.00540	0.00191	0.00293	0.00167
43_G	0.00003	0.00005	0.00003	0.00003	0.00003	0.00003	0.00003	0.00002	0.00003	0.00001	0.00002	0.00002	0.00005	0.00002	0.00003	0.00002
61_D	0.05088	0.02827	0.04357	0.00991	0.05793	0.03373	0.05160	0.01312	0.05439	0.01873	0.04958	0.00421	0.09956	0.04022	0.07443	0.01027
61_G	0.00503	0.00280	0.00431	0.00098	0.00573	0.00334	0.00510	0.00130	0.00538	0.00185	0.00490	0.00042	0.00985	0.00398	0.00736	0.00102
62_D	0.09440	0.05245	0.08084	0.01838	0.10746	0.06257	0.09573	0.02435	0.10089	0.03475	0.09197	0.00780	0.18470	0.07462	0.13808	0.01904
62_G	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
11_G	0.00057	0.00055	0.00057	0.00064	0.00056	0.00055	0.00057	0.00063	0.00059	0.00061	0.00060	0.00067	0.00049	0.00055	0.00051	0.00059

2025 Weekday VMT Mix - Houston TxDOT District (2028 Analysis Years)

SUT/FT	AM Peak				Mid-Day				PM Peak				Overnight			
	RT2	RT3	RT4	RT5	RT2	RT3	RT4	RT5	RT2	RT3	RT4	RT5	RT2	RT3	RT4	RT5
21_D	0.00844	0.00777	0.00930	0.00888	0.00771	0.00715	0.00876	0.00835	0.00857	0.00785	0.00941	0.00899	0.00730	0.00718	0.00884	0.00896
21_G	0.69522	0.63941	0.76609	0.73128	0.63499	0.58852	0.72160	0.68713	0.70584	0.64673	0.77443	0.74042	0.60124	0.59082	0.72745	0.73765
31_D	0.00309	0.00398	0.00260	0.00327	0.00330	0.00415	0.00286	0.00345	0.00312	0.00440	0.00271	0.00333	0.00277	0.00478	0.00289	0.00322
31_G	0.15139	0.19487	0.12728	0.16016	0.16194	0.20311	0.14002	0.16908	0.15305	0.21568	0.13282	0.16333	0.13549	0.23441	0.14176	0.15755
32_D	0.00209	0.00268	0.00175	0.00221	0.00223	0.00280	0.00193	0.00233	0.00211	0.00297	0.00183	0.00225	0.00187	0.00323	0.00195	0.00217
32_G	0.03726	0.04796	0.03133	0.03942	0.03986	0.04999	0.03446	0.04162	0.03767	0.05309	0.03269	0.04020	0.03335	0.05769	0.03489	0.03878
51_D	0.00104	0.00135	0.00080	0.00084	0.00122	0.00171	0.00110	0.00141	0.00066	0.00092	0.00051	0.00063	0.00086	0.00105	0.00061	0.00057
51_G	0.00062	0.00080	0.00048	0.00050	0.00073	0.00102	0.00066	0.00084	0.00040	0.00055	0.00030	0.00038	0.00051	0.00063	0.00036	0.00034
52_D	0.01976	0.02560	0.01527	0.01599	0.02324	0.03249	0.02093	0.02674	0.01261	0.01754	0.00970	0.01202	0.01634	0.01997	0.01159	0.01093
52_G	0.01181	0.01530	0.00912	0.00955	0.01389	0.01941	0.01251	0.01598	0.00753	0.01048	0.00579	0.00718	0.00976	0.01193	0.00693	0.00653
53_D	0.00382	0.00495	0.00295	0.00309	0.00449	0.00628	0.00405	0.00517	0.00244	0.00339	0.00187	0.00232	0.00316	0.00386	0.00224	0.00211
53_G	0.00228	0.00296	0.00176	0.00185	0.00268	0.00375	0.00242	0.00309	0.00146	0.00203	0.00112	0.00139	0.00189	0.00231	0.00134	0.00126
54_D	0.00074	0.00095	0.00057	0.00059	0.00086	0.00121	0.00078	0.00100	0.00047	0.00065	0.00036	0.00045	0.00061	0.00074	0.00043	0.00041
54_G	0.00044	0.00057	0.00034	0.00036	0.00052	0.00072	0.00047	0.00059	0.00028	0.00039	0.00022	0.00027	0.00036	0.00044	0.00026	0.00024
41_D	0.00025	0.00052	0.00050	0.00064	0.00026	0.00032	0.00033	0.00040	0.00025	0.00017	0.00036	0.00032	0.00029	0.00029	0.00031	0.00027
42_D	0.00050	0.00106	0.00102	0.00131	0.00053	0.00065	0.00068	0.00081	0.00052	0.00035	0.00073	0.00066	0.00060	0.00059	0.00064	0.00056
42_G	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
43_D	0.00133	0.00281	0.00271	0.00347	0.00140	0.00173	0.00179	0.00215	0.00138	0.00093	0.00194	0.00175	0.00158	0.00156	0.00169	0.00149
43_G	0.00001	0.00003	0.00003	0.00004	0.00001	0.00002	0.00002	0.00002	0.00001	0.00001	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002
61_D	0.02946	0.02279	0.01259	0.00787	0.04951	0.03702	0.02185	0.01450	0.03031	0.01553	0.01115	0.00665	0.09028	0.02881	0.02741	0.01304
61_G	0.00239	0.00185	0.00102	0.00064	0.00401	0.00300	0.00177	0.00118	0.00246	0.00126	0.00090	0.00054	0.00732	0.00234	0.00222	0.00106
62_D	0.02735	0.02116	0.01169	0.00731	0.04596	0.03436	0.02028	0.01346	0.02814	0.01442	0.01035	0.00617	0.08381	0.02675	0.02544	0.01210
62_G	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
11_G	0.00070	0.00065	0.00078	0.00074	0.00064	0.00060	0.00073	0.00070	0.00072	0.00066	0.00078	0.00075	0.00061	0.00060	0.00074	0.00075

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
2025	2023 through 2027
2030	2028 through 2032

Aggregate Weekday VMT Mix - Beaumont TxDOT District

SUT/FT	2010[1]	2015[2]	2020[3]	2025[4]	2030[5]
21_D	0.00225	0.00395	0.00507	0.00620	0.00620
21_G	0.56144	0.55975	0.55862	0.55749	0.55749
31_D	0.00266	0.00324	0.00343	0.00362	0.00381
31_G	0.18700	0.18714	0.18695	0.18676	0.18656
32_D	0.00261	0.00257	0.00252	0.00257	0.00257
32_G	0.04660	0.04592	0.04597	0.04592	0.04592
51_D	0.00169	0.00173	0.00169	0.00169	0.00169
51_G	0.00047	0.00048	0.00047	0.00047	0.00047
52_D	0.03632	0.03620	0.03632	0.03640	0.03640
52_G	0.01018	0.01015	0.01018	0.01021	0.01021
53_D	0.00187	0.00187	0.00187	0.00188	0.00188
53_G	0.00052	0.00052	0.00052	0.00053	0.00053
54_D	0.00128	0.00136	0.00128	0.00119	0.00119
54_G	0.00036	0.00038	0.00036	0.00033	0.00033
41_D	0.00165	0.00052	0.00052	0.00052	0.00052
42_D	0.00068	0.00104	0.00105	0.00106	0.00107
42_G	0.00000	0.00000	0.00000	0.00000	0.00000
43_D	0.00212	0.00287	0.00286	0.00285	0.00284
43_G	0.00002	0.00003	0.00003	0.00003	0.00003
61_D	0.04730	0.04730	0.04730	0.04730	0.04730
61_G	0.00468	0.00468	0.00468	0.00468	0.00468
62_D	0.08775	0.08775	0.08775	0.08775	0.08775
62_G	0.00000	0.00000	0.00000	0.00000	0.00000
11_G	0.00056	0.00056	0.00056	0.00056	0.00056

[1] 2012 analysis year.
[2] 2014 and 2017 analysis years.
[3] 2020 analysis year.
[4] 2023 and 2026 analysis years.
[5] 2028 analysis year.

Aggregate Weekday VMT Mix - Houston TxDOT District

SUT/FT	2010[1]	2015[2]	2020[3]	2025[4]	2030[5]
21_D	0.00295	0.00516	0.00663	0.00811	0.00884
21_G	0.73387	0.73166	0.73019	0.72872	0.72798
31_D	0.00204	0.00248	0.00278	0.00278	0.00292
31_G	0.14351	0.14361	0.14332	0.14332	0.14317
32_D	0.00204	0.00193	0.00193	0.00197	0.00197
32_G	0.03572	0.03528	0.03528	0.03524	0.03524
51_D	0.00090	0.00092	0.00090	0.00090	0.00090
51_G	0.00054	0.00055	0.00054	0.00054	0.00054
52_D	0.01709	0.01703	0.01709	0.01712	0.01712
52_G	0.01021	0.01017	0.01021	0.01023	0.01023
53_D	0.00330	0.00329	0.00330	0.00331	0.00331
53_G	0.00197	0.00197	0.00197	0.00198	0.00198
54_D	0.00068	0.00073	0.00068	0.00064	0.00064
54_G	0.00041	0.00043	0.00041	0.00038	0.00038
41_D	0.00114	0.00036	0.00036	0.00036	0.00036
42_D	0.00047	0.00072	0.00072	0.00073	0.00074
42_G	0.00000	0.00000	0.00000	0.00000	0.00000
43_D	0.00146	0.00198	0.00198	0.00197	0.00196
43_G	0.00001	0.00002	0.00002	0.00002	0.00002
61_D	0.02038	0.02038	0.02038	0.02038	0.02038
61_G	0.00165	0.00165	0.00165	0.00165	0.00165
62_D	0.01892	0.01892	0.01892	0.01892	0.01892
62_G	0.00000	0.00000	0.00000	0.00000	0.00000
11_G	0.00074	0.00074	0.00074	0.00074	0.00074

[1] 2011 analysis year.
[2] 2014 and 2017 analysis years.
[3] 2020 analysis year.
[4] 2023 and 2026 analysis years.
[5] 2028 analysis year.

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

2014 AM Peak Intermediate Year Adjustment Factors

County	2012 TDM VMT[1]	2015 TDM VMT[1]	Annual Compounded Growth Rate	Intermediate Year Factor[2]
Harris	21,870,586.66	21,138,868.57	0.988721023	1.011407644
Brazoria	1,402,912.73	1,331,413.08	0.982714552	1.01758949
Fort Bend	2,189,145.73	2,338,420.62	1.022231641	0.978251856
Waller	330,014.65	352,663.70	1.022372555	0.978117023
Montgomery	2,434,641.66	2,624,961.74	1.025406288	0.975223199
Liberty	441,882.04	437,656.83	0.996802505	1.003207752
Chambers	548,926.00	530,940.20	0.988956679	1.011166638
Galveston	1,077,170.19	1,034,065.22	0.986479053	1.013706268

[1] Includes the estimated intrazonal VMT.
[2] Applied to 2015 TDM VMT (including intrazonal VMT) to estimate analysis year VMT.

2014 Mid-Day Intermediate Year Adjustment Factors

County	2012 TDM VMT[1]	2015 TDM VMT[1]	Annual Compounded Growth Rate	Intermediate Year Factor[2]
Harris	34,459,569.08	39,574,751.65	1.047215637	0.954913166
Brazoria	2,306,149.72	2,627,024.41	1.044380777	0.957505177
Fort Bend	3,406,600.06	4,044,980.51	1.058924739	0.944354177
Waller	623,496.46	701,153.15	1.039903321	0.961627855
Montgomery	3,986,222.47	4,738,010.69	1.059281777	0.944035876
Liberty	801,842.66	859,334.12	1.023350248	0.977182545
Chambers	1,106,579.88	1,122,057.23	1.004640650	0.995380786
Galveston	1,813,996.18	2,065,663.78	1.044257866	0.957617877

[1] Includes the estimated intrazonal VMT.
[2] Applied to 2015 TDM VMT (including intrazonal VMT) to estimate analysis year VMT.

2014 PM Peak Intermediate Year Adjustment Factors

County	2012 TDM VMT[1]	2015 TDM VMT[1]	Annual Compounded Growth Rate	Intermediate Year Factor[2]
Harris	31,734,604.69	33,879,599.29	1.022041171	0.978434166
Brazoria	2,050,019.33	2,199,943.75	1.023806479	0.976747091
Fort Bend	3,247,054.36	3,659,500.05	1.040664483	0.960924502
Waller	518,324.28	560,549.03	1.026448943	0.974232578
Montgomery	3,598,311.14	4,061,822.00	1.041215740	0.960415754
Liberty	668,153.49	687,455.45	1.009538236	0.990551883
Chambers	830,110.32	829,885.09	0.999909553	1.000090455
Galveston	1,591,439.81	1,714,381.26	1.025114551	0.975500737

[1] Includes the estimated intrazonal VMT.
[2] Applied to 2015 TDM VMT (including intrazonal VMT) to estimate analysis year VMT.

2014 Overnight Intermediate Year Adjustment Factors

County	2012 TDM VMT[1]	2015 TDM VMT[1]	Annual Compounded Growth Rate	Intermediate Year Factor[2]
Harris	20,020,777.29	23,166,338.30	1.049845731	0.9525209
Brazoria	1,282,132.88	1,544,201.22	1.063955877	0.9398886
Fort Bend	1,970,586.02	2,409,594.33	1.069340902	0.935155476
Waller	245,873.84	423,328.84	1.198547300	0.834343376
Montgomery	2,195,549.81	2,957,661.99	1.104422082	0.905450929
Liberty	375,850.40	520,655.42	1.114752512	0.8970601
Chambers	528,715.85	769,378.75	1.133198398	0.882458007
Galveston	1,023,939.85	1,202,485.55	1.055038904	0.947832347

[1] Includes the estimated intrazonal VMT.
[2] Applied to 2015 TDM VMT (including intrazonal VMT) to estimate analysis year VMT.

2020 AM Peak Intermediate Year Adjustment Factors

County	2017 TDM VMT[1]	2025 TDM VMT[1]	Annual Compounded Growth Rate	Intermediate Year Factor[2]
Harris	22,024,435.65	25,846,694.12	1.020205186	1.061848555
Brazoria	1,401,663.22	1,747,120.72	1.027921393	1.086124759
Fort Bend	2,487,416.07	3,381,488.93	1.039130140	1.12204384
Waller	354,095.94	393,205.96	1.013181833	1.040069072
Montgomery	2,851,286.38	3,682,423.74	1.032491810	1.100676884
Liberty	452,093.75	501,420.27	1.013028522	1.039597005
Chambers	549,086.47	648,445.70	1.021007916	1.064357018
Galveston	1,067,511.06	1,339,743.81	1.028800513	1.088913837

[1] Includes the estimated intrazonal VMT.
[2] Applied to 2017 TDM VMT (including intrazonal VMT) to estimate analysis year VMT.

2020 Mid-Day Intermediate Year Adjustment Factors

County	2017 TDM VMT[1]	2025 TDM VMT[1]	Annual Compounded Growth Rate	Intermediate Year Factor[2]
Harris	41,098,864.26	48,244,708.31	1.020240320	1.061958265
Brazoria	2,740,896.38	3,266,568.41	1.022174147	1.068008424
Fort Bend	4,288,641.01	5,751,335.12	1.037363880	1.116331982
Waller	698,444.18	782,800.42	1.014354870	1.043685754
Montgomery	5,122,093.25	6,466,658.97	1.029565686	1.091345291
Liberty	894,778.06	952,745.32	1.007877354	1.023818709
Chambers	1,159,126.82	1,350,731.02	1.019306374	1.059044527
Galveston	2,121,061.05	2,608,436.60	1.026191444	1.080650275

[1] Includes the estimated intrazonal VMT.
[2] Applied to 2017 TDM VMT (including intrazonal VMT) to estimate analysis year VMT.

2020 PM Peak Intermediate Year Adjustment Factors

County	2017 TDM VMT[1]	2025 TDM VMT[1]	Annual Compounded Growth Rate	Intermediate Year Factor[2]
Harris	35,332,107.95	41,591,356.78	1.020596777	1.06307175
Brazoria	2,313,185.57	2,869,368.83	1.027299289	1.084153967
Fort Bend	3,891,909.07	5,282,843.49	1.038934415	1.12140993
Waller	563,862.21	655,791.00	1.019058364	1.058271679
Montgomery	4,407,544.92	5,662,097.01	1.031804862	1.098481405
Liberty	710,301.63	790,388.39	1.013443912	1.040876381
Chambers	859,128.92	1,018,671.02	1.021520183	1.065959869
Galveston	1,766,947.09	2,201,050.32	1.027840683	1.085868939

[1] Includes the estimated intrazonal VMT.
[2] Applied to 2017 TDM VMT (including intrazonal VMT) to estimate analysis year VMT.

2020 Overnight Intermediate Year Adjustment Factors

County	2017 TDM VMT[1]	2025 TDM VMT[1]	Annual Compounded Growth Rate	Intermediate Year Factor[2]
Harris	23,955,784.79	28,320,570.85	1.021142731	1.064778688
Brazoria	1,607,394.69	1,908,159.20	1.021672044	1.066435342
Fort Bend	2,562,895.17	3,492,518.31	1.039443723	1.123059959
Waller	397,122.45	447,380.33	1.015007042	1.045700141
Montgomery	3,200,597.68	4,053,443.67	1.029968949	1.092628177
Liberty	540,783.79	571,492.71	1.006927911	1.020928053
Chambers	793,586.36	905,733.97	1.016660165	1.050817802
Galveston	1,233,589.86	1,534,573.14	1.027666264	1.085316236

[1] Includes the estimated intrazonal VMT.
[2] Applied to 2017 TDM VMT (including intrazonal VMT) to estimate analysis year VMT.

2023 AM Peak Intermediate Year Adjustment Factors

County	2017 TDM VMT[1]	2025 TDM VMT[1]	Annual Compounded Growth Rate	Intermediate Year Factor[2]
Harris	22,024,435.65	25,846,694.12	1.020205186	0.960782195
Brazoria	1,401,663.22	1,747,120.72	1.027921393	0.946411896
Fort Bend	2,487,416.07	3,381,488.93	1.039130140	0.92610476
Waller	354,095.94	393,205.96	1.013181833	0.974148603
Montgomery	2,851,286.38	3,682,423.74	1.032491810	0.938051689
Liberty	452,093.75	501,420.27	1.013028522	0.974443479
Chambers	549,086.47	648,445.70	1.021007916	0.959272029
Galveston	1,067,511.06	1,339,743.81	1.028800513	0.944795151

[1] Includes the estimated intrazonal VMT.
[2] Applied to 2025 TDM VMT (including intrazonal VMT) to estimate analysis year VMT.

2023 Mid-Day Intermediate Year Adjustment Factors

County	2017 TDM VMT[1]	2025 TDM VMT[1]	Annual Compounded Growth Rate	Intermediate Year Factor[2]
Harris	41,098,864.26	48,244,708.31	1.020240320	0.960716023
Brazoria	2,740,896.38	3,266,568.41	1.022174147	0.957084349
Fort Bend	4,288,641.01	5,751,335.12	1.037363880	0.929261095
Waller	698,444.18	782,800.42	1.014354870	0.971896824
Montgomery	5,122,093.25	6,466,658.97	1.029565686	0.943391330
Liberty	894,778.06	952,745.32	1.007877354	0.984429514
Chambers	1,159,126.82	1,350,731.02	1.019306374	0.962477354
Galveston	2,121,061.05	2,608,436.60	1.026191444	0.949605499

[1] Includes the estimated intrazonal VMT.
[2] Applied to 2025 TDM VMT (including intrazonal VMT) to estimate analysis year VMT.

2023 PM Peak Intermediate Year Adjustment Factors

County	2017 TDM VMT[1]	2025 TDM VMT[1]	Annual Compounded Growth Rate	Intermediate Year Factor[2]
Harris	35,332,107.95	41,591,356.78	1.020596777	0.960045055
Brazoria	2,313,185.57	2,869,368.83	1.027299289	0.947558484
Fort Bend	3,891,909.07	5,282,843.49	1.038934415	0.926453732
Waller	563,862.21	655,791.00	1.019058364	0.962945891
Montgomery	4,407,544.92	5,662,097.01	1.031804862	0.939301164
Liberty	710,301.63	790,388.39	1.013443912	0.973644834
Chambers	859,128.92	1,018,671.02	1.021520183	0.958310169
Galveston	1,766,947.09	2,201,050.32	1.027840683	0.946560534

[1] Includes the estimated intrazonal VMT.
[2] Applied to 2025 TDM VMT (including intrazonal VMT) to estimate analysis year VMT.

2023 Overnight Intermediate Year Adjustment Factors

County	2017 TDM VMT[1]	2025 TDM VMT[1]	Annual Compounded Growth Rate	Intermediate Year Factor[2]
Harris	23,955,784.79	28,320,570.85	1.021142731	0.959018754
Brazoria	1,607,394.69	1,908,159.20	1.021672044	0.958025305
Fort Bend	2,562,895.17	3,492,518.31	1.039443723	0.925546063
Waller	397,122.45	447,380.33	1.015007042	0.970648279
Montgomery	3,200,597.68	4,053,443.67	1.029968949	0.942652744
Liberty	540,783.79	571,492.71	1.006927911	0.986286848
Chambers	793,586.36	905,733.97	1.016660165	0.967494234
Galveston	1,233,589.86	1,534,573.14	1.027666264	0.946881867

[1] Includes the estimated intrazonal VMT.
[2] Applied to 2025 TDM VMT (including intrazonal VMT) to estimate analysis year VMT.

2026 AM Peak Intermediate Year Adjustment Factors

County	2025 TDM VMT[1]	2035 TDM VMT[1]	Annual Compounded Growth Rate	Intermediate Year Factor[2]
Harris	25,846,694.12	29,839,938.85	1.014470196	1.014470196
Brazoria	1,747,120.72	2,367,314.01	1.030844826	1.030844826
Fort Bend	3,381,488.93	4,576,728.58	1.030729530	1.03072953
Waller	393,205.96	498,875.24	1.024087783	1.024087783
Montgomery	3,682,423.74	4,908,977.22	1.029166700	1.0291667
Liberty	501,420.27	590,942.96	1.016563162	1.016563162
Chambers	648,445.70	765,239.57	1.016698962	1.016698962
Galveston	1,339,743.81	1,766,471.62	1.028036396	1.028036396

[1] Includes the estimated intrazonal VMT.
[2] Applied to 2025 TDM VMT (including intrazonal VMT) to estimate analysis year VMT.

2026 Mid-Day Intermediate Year Adjustment Factors

County	2025 TDM VMT[1]	2035 TDM VMT[1]	Annual Compounded Growth Rate	Intermediate Year Factor[2]
Harris	48,244,708.31	55,773,030.06	1.014606068	1.014606068
Brazoria	3,266,568.41	4,271,756.75	1.027191639	1.027191639
Fort Bend	5,751,335.12	7,416,620.51	1.025755226	1.025755226
Waller	782,800.42	941,170.57	1.018595443	1.018595443
Montgomery	6,466,658.97	8,179,425.08	1.023774439	1.023774439
Liberty	952,745.32	1,063,458.13	1.011054013	1.011054013
Chambers	1,350,731.02	1,530,153.38	1.012550306	1.012550306
Galveston	2,608,436.60	3,426,363.47	1.027650208	1.027650208

[1] Includes the estimated intrazonal VMT.
[2] Applied to 2025 TDM VMT (including intrazonal VMT) to estimate analysis year VMT.

2026 PM Peak Intermediate Year Adjustment Factors

County	2025 TDM VMT[1]	2035 TDM VMT[1]	Annual Compounded Growth Rate	Intermediate Year Factor[2]
Harris	41,591,356.78	48,139,520.05	1.014728520	1.01472852
Brazoria	2,869,368.83	3,788,285.14	1.028171659	1.028171659
Fort Bend	5,282,843.49	6,890,720.98	1.026927283	1.026927283
Waller	655,791.00	816,946.28	1.022216306	1.022216306
Montgomery	5,662,097.01	7,410,468.19	1.027275272	1.027275272
Liberty	790,388.39	936,417.88	1.017098268	1.017098268
Chambers	1,018,671.02	1,216,749.90	1.017927241	1.017927241
Galveston	2,201,050.32	2,909,145.37	1.028285105	1.028285105

[1] Includes the estimated intrazonal VMT.
[2] Applied to 2025 TDM VMT (including intrazonal VMT) to estimate analysis year VMT.

2026 Overnight Intermediate Year Adjustment Factors

County	2025 TDM VMT[1]	2035 TDM VMT[1]	Annual Compounded Growth Rate	Intermediate Year Factor[2]
Harris	28,320,570.85	33,018,433.49	1.015466139	1.015466139
Brazoria	1,908,159.20	2,504,146.30	1.027553657	1.027553657
Fort Bend	3,492,518.31	4,572,335.55	1.027306274	1.027306274
Waller	447,380.33	530,689.76	1.017223495	1.017223495
Montgomery	4,053,443.67	5,140,509.47	1.024043021	1.024043021
Liberty	571,492.71	630,080.13	1.009807306	1.009807306
Chambers	905,733.97	1,018,214.50	1.011774809	1.011774809
Galveston	1,534,573.14	2,006,758.64	1.027189934	1.027189934

[1] Includes the estimated intrazonal VMT.
[2] Applied to 2025 TDM VMT (including intrazonal VMT) to estimate analysis year VMT.

2028 AM Peak Intermediate Year Adjustment Factors

County	2025 TDM VMT[1]	2035 TDM VMT[1]	Annual Compounded Growth Rate	Intermediate Year Factor[2]
Harris	25,846,694.12	29,839,938.85	1.014470196	1.044041778
Brazoria	1,747,120.72	2,367,314.01	1.030844826	1.095418033
Fort Bend	3,381,488.93	4,576,728.58	1.030729530	1.095050521
Waller	393,205.96	498,875.24	1.024087783	1.07401799
Montgomery	3,682,423.74	4,908,977.22	1.029166700	1.090077
Liberty	501,420.27	590,942.96	1.016563162	1.050517045
Chambers	648,445.70	765,239.57	1.016698962	1.050938108
Galveston	1,339,743.81	1,766,471.62	1.028036396	1.086489345

[1] Includes the estimated intrazonal VMT.
[2] Applied to 2025 TDM VMT (including intrazonal VMT) to estimate analysis year VMT.

2028 Mid-Day Intermediate Year Adjustment Factors

County	2025 TDM VMT[1]	2035 TDM VMT[1]	Annual Compounded Growth Rate	Intermediate Year Factor[2]
Harris	48,244,708.31	55,773,030.06	1.014606068	1.044461333
Brazoria	3,266,568.41	4,271,756.75	1.027191639	1.083813177
Fort Bend	5,751,335.12	7,416,620.51	1.025755226	1.079272758
Waller	782,800.42	941,170.57	1.018595443	1.056830131
Montgomery	6,466,658.97	8,179,425.08	1.023774439	1.073032426
Liberty	952,745.32	1,063,458.13	1.011054013	1.033529962
Chambers	1,350,731.02	1,530,153.38	1.012550306	1.038125426
Galveston	2,608,436.60	3,426,363.47	1.027650208	1.085265366

[1] Includes the estimated intrazonal VMT.
[2] Applied to 2025 TDM VMT (including intrazonal VMT) to estimate analysis year VMT.

2028 PM Peak Intermediate Year Adjustment Factors

County	2025 TDM VMT[1]	2035 TDM VMT[1]	Annual Compounded Growth Rate	Intermediate Year Factor[2]
Harris	41,591,356.78	48,139,520.05	1.014728520	1.044839543
Brazoria	2,869,368.83	3,788,285.14	1.028171659	1.086918261
Fort Bend	5,282,843.49	6,890,720.98	1.026927283	1.082976608
Waller	655,791.00	816,946.28	1.022216306	1.068140575
Montgomery	5,662,097.01	7,410,468.19	1.027275272	1.084077929
Liberty	790,388.39	936,417.88	1.017098268	1.052176854
Chambers	1,018,671.02	1,216,749.90	1.017927241	1.054751643
Galveston	2,201,050.32	2,909,145.37	1.028285105	1.087278087

[1] Includes the estimated intrazonal VMT.
[2] Applied to 2025 TDM VMT (including intrazonal VMT) to estimate analysis year VMT.

2028 Overnight Intermediate Year Adjustment Factors

County	2025 TDM VMT[1]	2035 TDM VMT[1]	Annual Compounded Growth Rate	Intermediate Year Factor[2]
Harris	28,320,570.85	33,018,433.49	1.015466139	1.04711972
Brazoria	1,908,159.20	2,504,146.30	1.027553657	1.084959502
Fort Bend	3,492,518.31	4,572,335.55	1.027306274	1.08417608
Waller	447,380.33	530,689.76	1.017223495	1.052565541
Montgomery	4,053,443.67	5,140,509.47	1.024043021	1.073877162
Liberty	571,492.71	630,080.13	1.009807306	1.029711412
Chambers	905,733.97	1,018,214.50	1.011774809	1.035741999
Galveston	1,534,573.14	2,006,758.64	1.027189934	1.083807781

[1] Includes the estimated intrazonal VMT.
[2] Applied to 2025 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

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

Free-Flow (V/C=0) Speed Factors for Houston/Galveston Speed Model

Functional Class		Area Type		Distance Weighted Input Speeds[1]	Distance Weighted Free-Flow Speeds[2]	Free-Flow Speed Factor[3]
Code	Description	Code	Description			
1	Urban Interstate	1	CBD	50.85	56.40	1.10906
1	Urban Interstate	2	Urban	52.55	61.40	1.16842
2	Urban Other Freeway	1	CBD	N/A	58.00	1.21154
2	Urban Other Freeway	2	Urban	52.00	63.00	1.21154
3	Toll Road	1	CBD	N/A	34.50	0.62652
3	Toll Road	2	Urban	57.58	36.08	0.62652
3	Toll Road	3	Urban Fringe	61.69	36.14	0.58577
3	Toll Road	4	Suburban	64.34	37.99	0.59040
3	Toll Road	5	Rural	59.13	38.43	0.64991
4	Ramp	1	CBD	28.62	35.13	1.22734
4	Ramp	2	Urban	40.06	36.26	0.90509
4	Ramp	3	Urban Fringe	43.22	38.52	0.89119
4	Ramp	4	Suburban	44.82	45.71	1.01987
4	Ramp	5	Rural	55.16	52.11	0.94478
5	Urban Principal Arterial	1	CBD	24.72	26.52	1.07262
5	Urban Principal Arterial	2	Urban	35.78	29.69	0.82974
6	Urban Other Arterial	1	CBD	22.00	24.64	1.11996
6	Urban Other Arterial	2	Urban	34.57	27.31	0.79001
7	Urban Collector	1	CBD	20.94	24.17	1.15413
7	Urban Collector	2	Urban	35.36	25.78	0.72901
10	Rural Interstate	3	Urban Fringe	57.84	61.40	1.06152
10	Rural Interstate	4	Suburban	59.15	67.20	1.13613
10	Rural Interstate	5	Rural	62.00	68.57	1.10599
11	Rural Other Freeway	3	Urban Fringe	62.00	63.00	1.01613
11	Rural Other Freeway	4	Suburban	62.00	69.00	1.11290
11	Rural Other Freeway	5	Rural	64.00	71.00	1.10938
12	Rural Principal Arterial	3	Urban Fringe	40.23	33.75	0.83890
12	Rural Principal Arterial	4	Suburban	46.12	42.48	0.92125
12	Rural Principal Arterial	5	Rural	60.00	55.53	0.92536
13	Rural Other Arterial	3	Urban Fringe	39.05	30.51	0.78131
13	Rural Other Arterial	4	Suburban	43.03	39.85	0.92612
13	Rural Other Arterial	5	Rural	53.97	54.07	1.00194

Free-Flow (V/C=0) Speed Factors for Houston/Galveston Speed Model - Continued

Functional Class		Area Type		Distance Weighted Input Speeds[1]	Distance Weighted Free-Flow Speeds[2]	Free-Flow Speed Factor[3]
Code	Description	Code	Description			
14	Rural Major Collector	3	Urban Fringe	38.00	27.76	0.73061
14	Rural Major Collector	4	Suburban	41.00	49.22	1.20059
14	Rural Major Collector	5	Rural	53.00	54.06	1.02009
15	Rural Collector	3	Urban Fringe	36.00	24.07	0.66864
15	Rural Collector	4	Suburban	40.00	35.58	0.88938
15	Rural Collector	5	Rural	49.00	49.86	1.01762

[1] Based on 2012 TDM data.
[2] Calculated from detailed speed model runs by HGAC with link volumes set to 0 (V/C=0).
[3] When inputs speeds are not available, speed factors are taken from the nearest area type.

LOS E (V/C=1) Speed Factors for Houston/Galveston Speed Model

Functional Class		Area Type		Distance Weighted Input Speeds[1]	Distance Weighted Free-Flow Speeds[2]	Free-Flow Speed Factor[3]
Code	Description	Code	Description			
1	Urban Interstate	1	CBD	50.85	34.35	0.67549
1	Urban Interstate	2	Urban	52.55	34.35	0.65370
2	Urban Other Freeway	1	CBD	N/A	35.00	0.67308
2	Urban Other Freeway	2	Urban	52.00	35.00	0.67308
3	Toll Road	1	CBD	N/A	24.77	0.43011
3	Toll Road	2	Urban	57.58	24.77	0.43011
3	Toll Road	3	Urban Fringe	61.69	26.52	0.42983
3	Toll Road	4	Suburban	64.34	29.54	0.45920
3	Toll Road	5	Rural	59.13	29.70	0.50229
4	Ramp	1	CBD	28.62	31.68	1.10692
4	Ramp	2	Urban	40.06	30.03	0.74952
4	Ramp	3	Urban Fringe	43.22	33.24	0.76908
4	Ramp	4	Suburban	44.82	41.22	0.91979
4	Ramp	5	Rural	55.16	49.01	0.88861
5	Urban Principal Arterial	1	CBD	24.72	22.13	0.89529
5	Urban Principal Arterial	2	Urban	35.78	24.44	0.68294
6	Urban Other Arterial	1	CBD	22.00	20.80	0.94565
6	Urban Other Arterial	2	Urban	34.57	22.76	0.65833
7	Urban Collector	1	CBD	20.94	20.06	0.95782
7	Urban Collector	2	Urban	35.36	21.23	0.60033
10	Rural Interstate	3	Urban Fringe	57.84	39.25	0.67860
10	Rural Interstate	4	Suburban	59.15	49.08	0.82973
10	Rural Interstate	5	Rural	62.00	49.08	0.79157
11	Rural Other Freeway	3	Urban Fringe	62.00	40.00	0.64516
11	Rural Other Freeway	4	Suburban	62.00	50.00	0.80645
11	Rural Other Freeway	5	Rural	64.00	50.00	0.78125
12	Rural Principal Arterial	3	Urban Fringe	40.23	27.30	0.67871
12	Rural Principal Arterial	4	Suburban	46.12	32.64	0.70784
12	Rural Principal Arterial	5	Rural	60.00	38.32	0.63858
13	Rural Other Arterial	3	Urban Fringe	39.05	24.81	0.63540
13	Rural Other Arterial	4	Suburban	43.03	30.15	0.70070
13	Rural Other Arterial	5	Rural	53.97	38.46	0.71270

LOS E (V/C=1) Speed Factors for Houston/Galveston Speed Model - Continued

Functional Class		Area Type		Distance Weighted Input Speeds[1]	Distance Weighted Free-Flow Speeds[2]	Free-Flow Speed Factor[3]
Code	Description	Code	Description			
14	Rural Major Collector	3	Urban Fringe	38.00	22.22	0.58465
14	Rural Major Collector	4	Suburban	41.00	34.09	0.83151
14	Rural Major Collector	5	Rural	53.00	36.83	0.69499
15	Rural Collector	3	Urban Fringe	36.00	19.74	0.54845
15	Rural Collector	4	Suburban	40.00	26.40	0.65994
15	Rural Collector	5	Rural	49.00	34.33	0.70057

[1] Based on 2012 TDM data.
[2] Calculated from detailed speed model runs by HGAC with link volumes set to 0 (V/C=0).
[3] When inputs speeds are not available, speed factors are taken from the nearest area type.

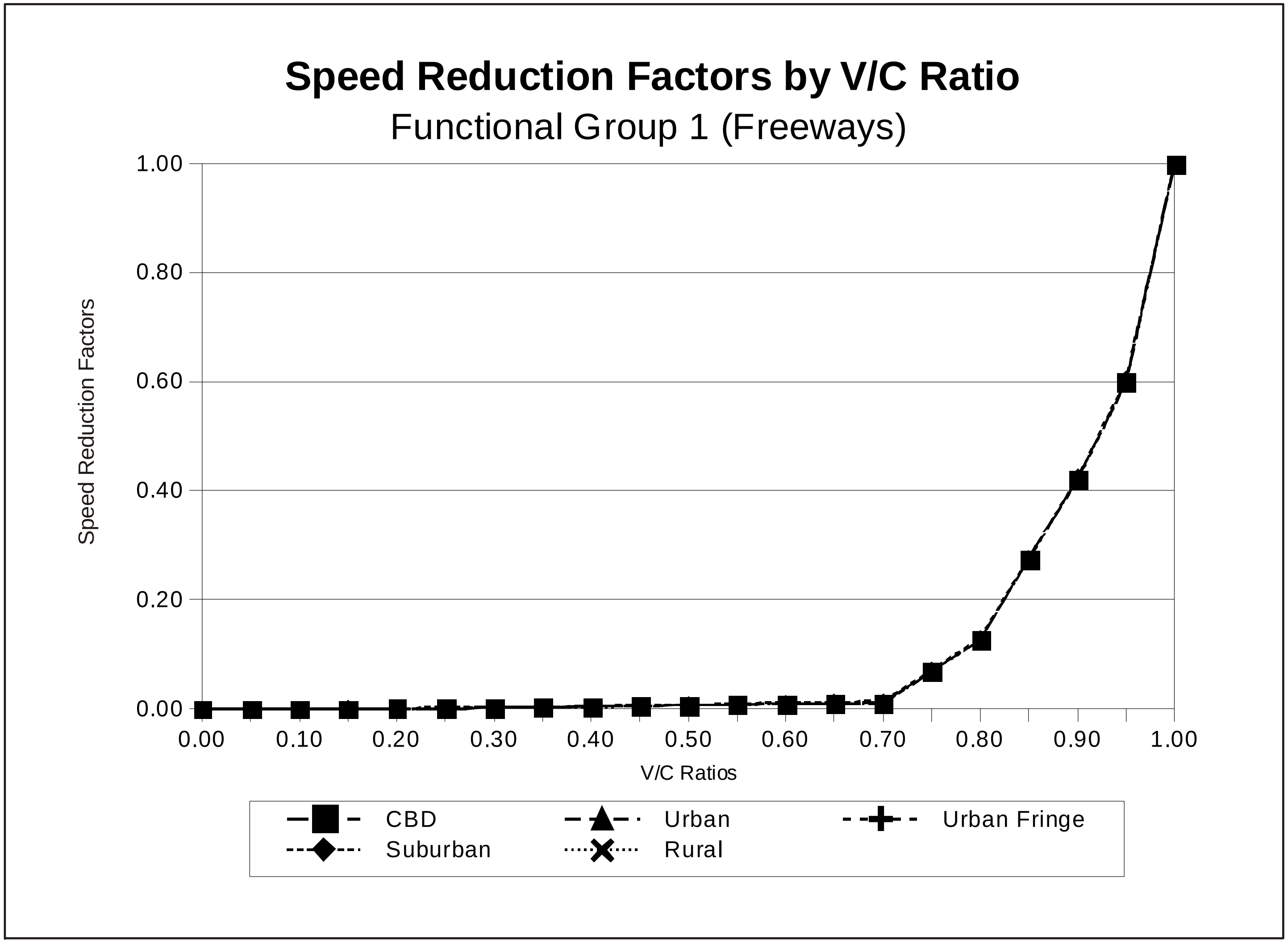


Figure 1. Freeway Speed Reduction Factors by V/C Ratio.

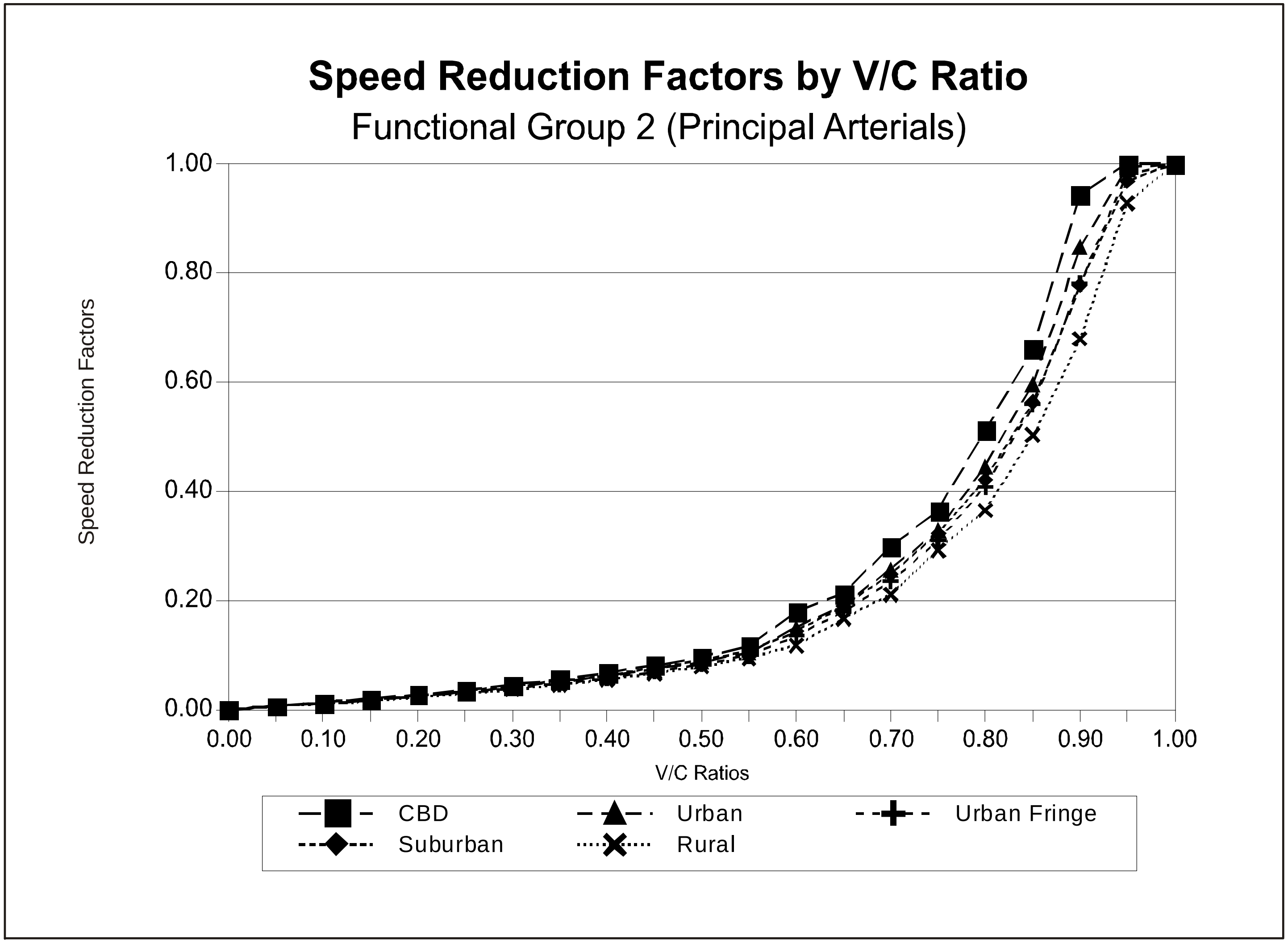


Figure 2. Principal Arterial Speed Reduction Factors by V/C Ratio.

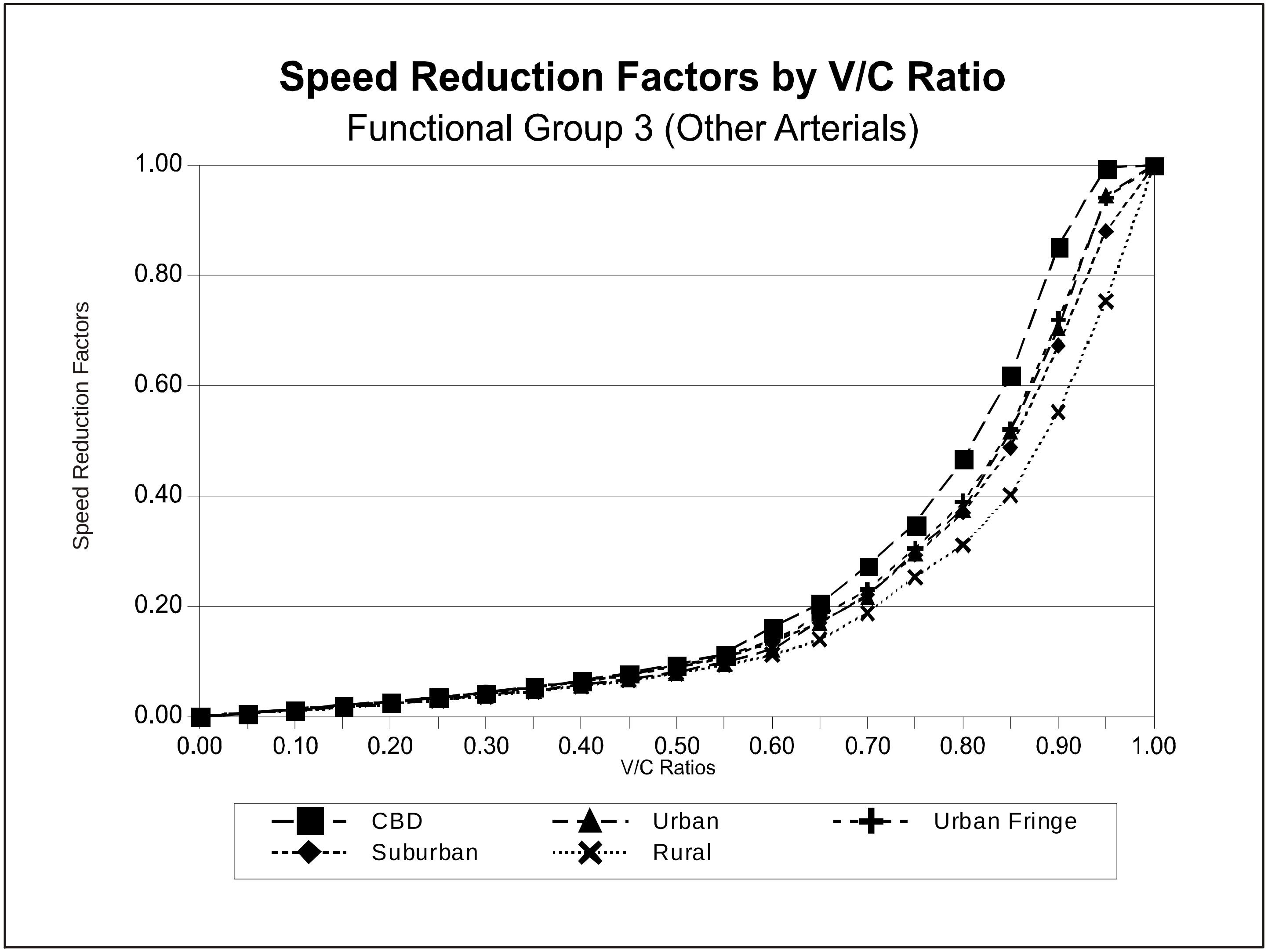


Figure 3. Other Arterial Speed Reduction Factors by V/C Ratio.

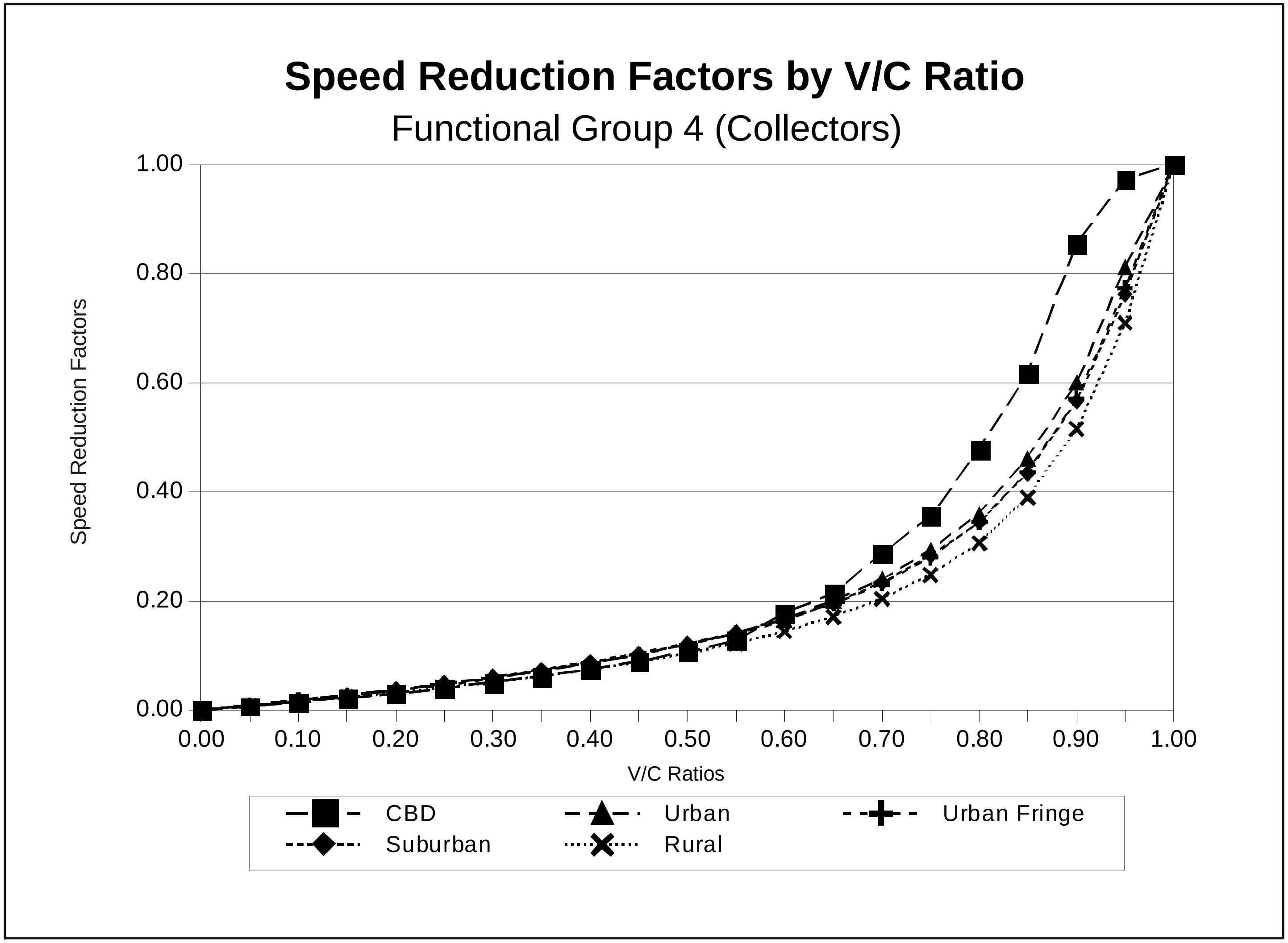


Figure 4. Collector Speed Reduction Factors by V/C Ratio.

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

2012 Vehicle Population Estimates

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	7,554	556	1,223	62	838	107	59	536
21_G	1,879,113	138,422	304,294	15,527	208,541	26,804	14,664	133,343
31_D	8,715	910	1,084	145	1,258	274	149	797
31_G	613,116	64,014	76,248	10,225	88,478	19,248	10,462	56,087
32_D	8,715	910	1,084	145	1,258	269	146	797
32_G	152,606	15,933	18,978	2,545	22,022	4,797	2,607	13,960
51_D	1,564	178	142	41	227	74	38	122
51_G	939	107	85	24	136	21	10	73
52_D	29,706	3,386	2,697	772	4,309	1,585	810	2,311
52_G	17,747	2,023	1,611	461	2,574	444	227	1,381
53_D	5,736	654	521	149	832	82	42	446
53_G	3,424	390	311	89	497	23	12	266
54_D	1,182	135	107	31	171	56	29	92
54_G	713	81	65	19	103	16	8	55
41_D	1,982	226	180	51	287	72	37	154
42_D	817	93	74	21	118	30	15	64
42_G	0	0	0	0	0	0	0	0
43_D	2,538	289	230	66	368	93	47	197
43_G	17	2	2	0	3	1	0	1
61_D	16,346	902	1,177	210	1,221	374	158	514
61_G	1,323	73	95	17	99	37	16	42
62_D	15,175	837	1,092	195	1,134	694	294	478
62_G	0	0	0	0	0	0	0	0
11_G	49,104	7,255	7,940	851	10,925	1,758	974	7,906

2014 Vehicle Population Estimates

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	12,296	1,049	2,334	93	1,487	189	113	836
21_G	1,743,488	148,773	330,890	13,138	210,890	26,801	16,035	118,576
31_D	9,861	1,193	1,437	150	1,551	334	199	865
31_G	571,011	69,061	83,225	8,685	89,812	19,319	11,483	50,064
32_D	7,674	928	1,118	117	1,207	265	158	673
32_G	140,278	16,966	20,446	2,134	22,064	4,740	2,818	12,299
51_D	1,488	196	158	35	235	76	42	111
51_G	890	117	95	21	141	21	12	66
52_D	27,548	3,637	2,931	653	4,355	1,585	886	2,054
52_G	16,451	2,172	1,751	390	2,601	444	248	1,227
53_D	5,322	703	566	126	841	82	46	397
53_G	3,187	421	339	75	504	23	13	238
54_D	1,181	156	126	28	187	60	33	88
54_G	696	92	74	16	110	17	9	52
41_D	582	77	62	14	92	23	13	43
42_D	1,165	154	124	28	184	46	25	87
42_G	0	0	0	0	0	0	0	0
43_D	3,203	423	341	76	506	126	70	239
43_G	32	4	3	1	5	1	1	2
61_D	15,212	972	1,283	178	1,239	375	174	459
61_G	1,232	79	104	14	100	37	17	37
62_D	14,122	903	1,192	165	1,150	696	322	426
62_G	0	0	0	0	0	0	0	0
11_G	45,698	7,821	8,660	722	11,081	1,763	1,068	7,052

2017 Vehicle Population Estimates

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	13,158	1,132	2,599	97	1,702	202	120	886
21_G	1,865,811	160,578	368,599	13,789	241,406	28,691	17,040	125,697
31_D	10,553	1,287	1,601	157	1,775	358	211	916
31_G	611,073	74,540	92,710	9,115	102,809	20,681	12,203	53,071
32_D	8,212	1,002	1,246	123	1,382	284	168	713
32_G	150,120	18,312	22,776	2,239	25,257	5,075	2,994	13,038
51_D	1,593	212	176	37	269	81	45	118
51_G	952	127	105	22	161	22	12	70
52_D	29,481	3,926	3,266	685	4,985	1,696	942	2,178
52_G	17,606	2,344	1,950	409	2,977	476	264	1,301
53_D	5,695	758	631	132	963	88	49	421
53_G	3,410	454	378	79	577	24	14	252
54_D	1,264	168	140	29	214	64	35	93
54_G	744	99	82	17	126	18	10	55
41_D	623	83	69	14	105	24	14	46
42_D	1,246	166	138	29	211	49	27	92
42_G	0	0	0	0	0	0	0	0
43_D	3,428	456	380	80	580	134	75	253
43_G	35	5	4	1	6	1	1	3
61_D	16,279	1,050	1,430	187	1,418	402	185	486
61_G	1,318	85	116	15	115	40	18	39
62_D	15,113	974	1,327	174	1,316	745	342	451
62_G	0	0	0	0	0	0	0	0
11_G	48,904	8,442	9,647	758	12,685	1,887	1,135	7,475

2020 Vehicle Population Estimates

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	17,969	1,565	3,742	131	2,396	268	164	1,235
21_G	1,979,021	172,350	412,076	14,415	263,889	29,510	18,022	136,044
31_D	12,571	1,552	2,010	185	2,180	391	237	1,114
31_G	648,109	80,000	103,638	9,529	112,376	21,293	12,919	57,436
32_D	8,728	1,077	1,396	128	1,513	287	174	773
32_G	159,540	19,693	25,512	2,346	27,663	5,236	3,177	14,138
51_D	1,656	223	193	38	289	82	47	125
51_G	994	134	116	23	173	23	13	75
52_D	31,443	4,237	3,671	720	5,480	1,754	1,001	2,370
52_G	18,785	2,531	2,193	430	3,274	492	281	1,416
53_D	6,072	818	709	139	1,058	90	52	458
53_G	3,625	488	423	83	632	25	14	273
54_D	1,251	169	146	29	218	62	35	94
54_G	754	102	88	17	131	17	10	57
41_D	662	89	77	15	115	25	14	50
42_D	1,325	179	155	30	231	51	29	100
42_G	0	0	0	0	0	0	0	0
43_D	3,643	491	425	83	635	138	79	275
43_G	37	5	4	1	6	1	1	3
61_D	17,301	1,129	1,602	196	1,553	414	196	527
61_G	1,401	91	130	16	126	41	19	43
62_D	16,062	1,048	1,487	182	1,442	768	363	490
62_G	0	0	0	0	0	0	0	0
11_G	51,975	9,079	10,807	794	13,894	1,945	1,203	8,107

2023 Vehicle Population Estimates

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	23,361	2,059	5,127	168	3,210	338	212	1,639
21_G	2,099,066	184,995	460,676	15,071	288,465	30,355	19,060	147,241
31_D	13,361	1,669	2,252	194	2,388	425	265	1,208
31_G	688,818	86,044	116,097	9,982	123,091	21,924	13,677	62,289
32_D	9,468	1,183	1,596	137	1,692	302	188	856
32_G	169,369	21,157	28,546	2,454	30,266	5,391	3,363	15,316
51_D	1,761	240	217	40	316	84	49	135
51_G	1,057	144	130	24	190	23	14	81
52_D	33,497	4,568	4,122	756	6,016	1,812	1,063	2,576
52_G	20,016	2,729	2,463	452	3,595	508	298	1,540
53_D	6,476	883	797	146	1,163	94	55	498
53_G	3,874	528	477	87	696	26	15	298
54_D	1,252	171	154	28	225	59	35	96
54_G	744	101	91	17	134	16	10	57
41_D	704	96	87	16	127	26	15	54
42_D	1,428	195	176	32	257	53	31	110
42_G	0	0	0	0	0	0	0	0
43_D	3,855	526	474	87	692	142	83	296
43_G	39	5	5	1	7	1	1	3
61_D	18,388	1,214	1,794	205	1,701	427	207	572
61_G	1,489	98	145	17	138	42	21	46
62_D	17,071	1,127	1,666	191	1,579	791	384	531
62_G	0	0	0	0	0	0	0	0
11_G	55,240	9,765	12,106	832	15,219	2,005	1,275	8,792

2026 Vehicle Population Estimates

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	24,689	2,222	5,681	177	3,499	349	224	1,778
21_G	2,218,396	199,683	510,479	15,861	314,440	31,392	20,099	159,746
31_D	14,121	1,802	2,495	204	2,603	439	280	1,311
31_G	727,977	92,875	128,648	10,506	134,175	22,673	14,422	67,579
32_D	10,006	1,277	1,768	144	1,844	312	198	929
32_G	178,997	22,836	31,632	2,583	32,991	5,575	3,546	16,617
51_D	1,861	259	240	42	345	87	52	147
51_G	1,117	156	144	25	207	24	14	88
52_D	35,402	4,930	4,568	796	6,558	1,874	1,121	2,795
52_G	21,154	2,946	2,729	476	3,919	526	315	1,670
53_D	6,845	953	883	154	1,268	97	58	540
53_G	4,094	570	528	92	758	27	16	323
54_D	1,323	184	171	30	245	61	37	104
54_G	786	109	101	18	146	17	10	62
41_D	744	104	96	17	138	27	16	59
42_D	1,510	210	195	34	280	55	33	119
42_G	0	0	0	0	0	0	0	0
43_D	4,074	567	526	92	755	147	88	322
43_G	41	6	5	1	8	2	1	3
61_D	19,434	1,310	1,988	216	1,854	441	219	621
61_G	1,573	106	161	17	150	44	22	50
62_D	18,041	1,217	1,846	201	1,721	818	405	576
62_G	0	0	0	0	0	0	0	0
11_G	58,380	10,540	13,414	875	16,590	2,074	1,344	9,539

2028 Vehicle Population Estimates

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	27,713	2,561	6,536	200	4,014	359	230	2,047
21_G	2,282,196	210,894	538,242	16,496	330,565	32,244	20,685	168,585
31_D	15,274	2,001	2,767	223	2,877	475	303	1,455
31_G	748,921	98,091	135,646	10,926	141,057	23,265	14,827	71,319
32_D	10,305	1,350	1,866	150	1,941	320	204	981
32_G	184,340	24,144	33,388	2,689	34,720	5,727	3,650	17,555
51_D	1,917	274	253	44	363	89	54	155
51_G	1,150	164	152	26	218	25	15	93
52_D	36,456	5,213	4,821	828	6,901	1,925	1,154	2,953
52_G	21,784	3,115	2,881	495	4,124	540	324	1,764
53_D	7,049	1,008	932	160	1,334	99	60	571
53_G	4,216	603	558	96	798	28	17	342
54_D	1,363	195	180	31	258	63	38	110
54_G	809	116	107	18	153	17	10	66
41_D	767	110	101	17	145	28	16	62
42_D	1,576	225	208	36	298	57	34	128
42_G	0	0	0	0	0	0	0	0
43_D	4,174	597	552	95	790	150	90	338
43_G	43	6	6	1	8	2	1	3
61_D	20,012	1,385	2,098	225	1,951	453	225	656
61_G	1,620	112	170	18	158	45	22	53
62_D	18,579	1,286	1,948	209	1,812	841	417	609
62_G	0	0	0	0	0	0	0	0
11_G	60,120	11,143	14,158	911	17,458	2,130	1,384	10,076

2012 24-Hour Weekday SHP Summaries

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	172,505	12,972	28,610	1,402	19,345	2,469	1,311	12,440
21_G	42,912,570	3,226,916	7,117,261	348,683	4,812,369	616,171	327,064	3,094,689
31_D	202,632	21,504	25,405	3,391	29,530	6,430	3,460	18,805
31_G	14,254,085	1,512,697	1,787,164	238,536	2,077,288	451,994	243,222	1,322,845
32_D	202,626	21,503	25,405	3,391	29,529	6,309	3,395	18,804
32_G	3,547,866	376,514	444,829	59,372	517,041	112,636	60,611	329,259
51_D	34,972	4,142	3,168	933	5,179	1,688	831	2,790
51_G	20,991	2,486	1,901	560	3,108	469	231	1,675
52_D	664,069	78,653	60,153	17,718	98,353	36,283	17,846	52,985
52_G	396,738	46,989	35,938	10,585	58,759	10,169	5,002	31,655
53_D	128,216	15,187	11,614	3,421	18,990	1,868	919	10,230
53_G	76,543	9,066	6,934	2,042	11,337	519	255	6,107
54_D	26,420	3,129	2,393	705	3,913	1,279	629	2,108
54_G	15,934	1,887	1,443	425	2,360	360	177	1,271
41_D	43,916	5,267	4,008	1,201	6,585	1,658	805	3,524
42_D	18,108	2,172	1,653	495	2,715	683	332	1,453
42_G	0	0	0	0	0	0	0	0
43_D	56,228	6,745	5,131	1,537	8,432	2,130	1,034	4,512
43_G	371	46	34	10	57	20	10	30
61_D	353,507	18,952	24,542	3,895	24,387	7,684	1,529	10,423
61_G	28,613	1,534	1,986	315	1,974	760	151	843
62_D	328,188	17,595	22,785	3,616	22,640	14,256	2,838	9,677
62_G	0	0	0	0	0	0	0	0
11_G	1,176,296	174,024	190,373	20,400	262,006	42,165	23,351	189,638

2014 24-Hour Weekday SHP Summaries

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	281,032	24,454	54,585	2,085	34,314	4,349	2,524	19,410
21_G	39,849,544	3,467,491	7,740,110	295,641	4,865,563	616,176	357,605	2,752,303
31_D	229,358	28,179	33,687	3,505	36,409	7,855	4,622	20,391
31_G	13,281,878	1,631,808	1,950,788	202,950	2,108,404	453,674	266,955	1,180,811
32_D	178,479	21,929	26,215	2,727	28,333	6,230	3,666	15,868
32_G	3,262,910	400,880	479,242	49,858	517,963	111,322	65,505	290,085
51_D	33,278	4,563	3,530	812	5,367	1,735	933	2,543
51_G	19,899	2,728	2,111	485	3,209	481	259	1,521
52_D	616,121	84,470	65,359	15,025	99,369	36,296	19,524	47,083
52_G	367,928	50,444	39,030	8,972	59,340	10,177	5,474	28,117
53_D	119,027	16,319	12,627	2,903	19,197	1,875	1,009	9,096
53_G	71,283	9,772	7,562	1,738	11,496	521	280	5,447
54_D	26,423	3,622	2,803	644	4,261	1,364	734	2,019
54_G	15,547	2,132	1,649	379	2,508	381	205	1,188
41_D	12,926	1,792	1,380	322	2,108	524	277	993
42_D	25,861	3,585	2,761	644	4,218	1,048	555	1,986
42_G	0	0	0	0	0	0	0	0
43_D	71,124	9,858	7,594	1,772	11,599	2,894	1,532	5,461
43_G	714	99	76	18	117	30	16	55
61_D	328,371	20,436	26,630	3,249	24,614	7,695	1,610	9,274
61_G	26,579	1,654	2,155	263	1,992	761	159	750
62_D	304,853	18,972	24,723	3,016	22,851	14,276	2,986	8,610
62_G	0	0	0	0	0	0	0	0
11_G	1,094,728	187,602	207,638	17,315	265,756	42,288	25,611	169,146

2017 24-Hour Weekday SHP Summaries

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	300,752	26,391	60,810	2,185	39,238	4,655	2,683	20,575
21_G	42,645,808	3,742,209	8,622,767	309,861	5,563,818	659,647	380,108	2,917,502
31_D	245,454	30,415	37,525	3,675	41,658	8,409	4,912	21,615
31_G	14,213,966	1,761,266	2,173,035	212,790	2,412,344	485,658	283,724	1,251,679
32_D	191,004	23,669	29,202	2,860	32,418	6,669	3,896	16,821
32_G	3,491,892	432,683	533,841	52,275	592,631	119,170	69,620	307,495
51_D	35,608	4,925	3,932	851	6,138	1,857	992	2,696
51_G	21,292	2,944	2,351	509	3,670	515	275	1,612
52_D	659,263	91,170	72,793	15,748	113,635	38,859	20,759	49,904
52_G	393,691	54,444	43,470	9,404	67,860	10,895	5,821	29,801
53_D	127,361	17,613	14,063	3,042	21,953	2,008	1,073	9,641
53_G	76,274	10,547	8,422	1,822	13,147	558	298	5,773
54_D	28,273	3,909	3,122	675	4,873	1,460	780	2,140
54_G	16,636	2,301	1,837	397	2,868	408	218	1,260
41_D	13,839	1,934	1,538	338	2,411	561	294	1,052
42_D	27,687	3,869	3,078	675	4,823	1,122	589	2,105
42_G	0	0	0	0	0	0	0	0
43_D	76,147	10,641	8,464	1,858	13,263	3,098	1,626	5,790
43_G	764	107	85	19	133	32	17	58
61_D	351,062	22,038	29,600	3,416	28,057	8,227	1,685	9,819
61_G	28,415	1,784	2,395	276	2,271	814	167	795
62_D	325,918	20,459	27,480	3,172	26,047	15,262	3,127	9,116
62_G	0	0	0	0	0	0	0	0
11_G	1,171,534	202,487	231,302	18,172	304,207	45,270	27,217	179,304

2020 24-Hour Weekday SHP Summaries

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	410,572	36,467	87,509	2,941	55,198	6,157	3,648	28,669
21_G	45,218,091	4,016,209	9,637,759	323,917	6,079,199	678,430	401,959	3,157,429
31_D	292,372	36,665	47,111	4,315	51,136	9,174	5,511	26,275
31_G	15,072,411	1,890,198	2,428,711	222,436	2,636,212	500,004	300,349	1,354,576
32_D	202,949	25,453	32,704	2,995	35,498	6,740	4,049	18,240
32_G	3,710,273	465,297	597,859	54,756	648,938	122,948	73,854	333,446
51_D	37,015	5,182	4,307	872	6,575	1,870	1,027	2,860
51_G	22,217	3,109	2,585	523	3,946	520	285	1,716
52_D	702,868	98,394	81,789	16,555	124,848	40,180	22,069	54,308
52_G	419,918	58,783	48,863	9,890	74,588	11,262	6,185	32,446
53_D	135,707	18,999	15,792	3,197	24,106	2,069	1,136	10,486
53_G	81,015	11,342	9,427	1,908	14,391	575	316	6,260
54_D	27,964	3,915	3,254	659	4,967	1,416	778	2,161
54_G	16,865	2,361	1,963	397	2,996	398	219	1,303
41_D	14,700	2,080	1,722	354	2,639	578	312	1,141
42_D	29,407	4,161	3,445	707	5,279	1,168	631	2,283
42_G	0	0	0	0	0	0	0	0
43_D	80,891	11,443	9,476	1,946	14,519	3,181	1,717	6,279
43_G	812	115	95	20	146	33	18	63
61_D	372,877	23,704	33,128	3,579	30,690	8,480	1,787	10,647
61_G	30,181	1,919	2,681	290	2,484	839	177	862
62_D	346,171	22,006	30,755	3,323	28,492	15,733	3,315	9,885
62_G	0	0	0	0	0	0	0	0
11_G	1,245,104	217,770	259,103	19,036	333,205	46,657	28,842	194,454

2023 24-Hour Weekday SHP Summaries

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	533,755	47,971	119,963	3,756	73,953	7,762	4,726	38,037
21_G	47,957,578	4,310,269	10,778,868	337,516	6,644,690	697,958	424,948	3,417,618
31_D	310,715	39,432	52,785	4,515	56,010	9,982	6,163	28,497
31_G	16,018,018	2,032,825	2,721,199	232,776	2,887,474	514,968	317,939	1,469,125
32_D	220,166	27,942	37,403	3,199	39,689	7,086	4,375	20,193
32_G	3,938,564	499,838	669,097	57,236	709,982	126,619	78,174	361,233
51_D	39,358	5,576	4,830	912	7,206	1,928	1,088	3,104
51_G	23,623	3,346	2,899	548	4,325	536	302	1,863
52_D	748,656	106,062	91,878	17,356	137,071	41,531	23,435	59,049
52_G	447,361	63,377	54,902	10,371	81,907	11,649	6,574	35,285
53_D	144,752	20,506	17,765	3,356	26,502	2,145	1,211	11,417
53_G	86,591	12,267	10,627	2,007	15,854	605	341	6,830
54_D	27,992	3,965	3,435	649	5,125	1,358	766	2,208
54_G	16,612	2,354	2,039	385	3,042	376	212	1,311
41_D	15,633	2,238	1,933	370	2,892	596	331	1,239
42_D	31,712	4,540	3,922	751	5,866	1,215	675	2,512
42_G	0	0	0	0	0	0	0	0
43_D	85,583	12,251	10,584	2,027	15,830	3,267	1,813	6,780
43_G	863	124	107	21	160	34	19	69
61_D	395,898	25,505	36,927	3,654	33,654	8,683	1,869	11,562
61_G	32,045	2,064	2,988	296	2,723	859	185	936
62_D	367,544	23,678	34,282	3,392	31,244	16,109	3,468	10,734
62_G	0	0	0	0	0	0	0	0
11_G	1,323,310	234,221	290,254	19,940	364,975	48,089	30,566	210,887

2026 24-Hour Weekday SHP Summaries

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	563,887	51,772	132,892	3,953	80,570	8,027	4,983	41,264
21_G	50,664,919	4,651,759	11,940,544	355,204	7,239,228	721,738	448,066	3,707,581
31_D	328,306	42,559	58,476	4,752	61,038	10,323	6,498	30,916
31_G	16,924,895	2,194,067	3,014,587	244,982	3,146,655	532,539	335,251	1,593,834
32_D	232,631	30,158	41,435	3,367	43,251	7,328	4,613	21,907
32_G	4,161,550	539,485	741,237	60,237	773,710	130,939	82,431	391,897
51_D	41,577	6,018	5,348	960	7,851	1,994	1,147	3,368
51_G	24,955	3,611	3,210	576	4,712	554	319	2,021
52_D	790,866	114,471	101,737	18,267	149,336	42,948	24,711	64,060
52_G	472,583	68,402	60,793	10,915	89,236	12,047	6,931	38,279
53_D	152,913	22,132	19,671	3,532	28,873	2,218	1,277	12,386
53_G	91,473	13,239	11,767	2,113	17,272	626	360	7,409
54_D	29,570	4,280	3,804	683	5,584	1,404	808	2,395
54_G	17,549	2,541	2,258	405	3,314	389	224	1,422
41_D	16,511	2,416	2,140	390	3,150	616	349	1,344
42_D	33,495	4,899	4,342	791	6,390	1,257	711	2,725
42_G	0	0	0	0	0	0	0	0
43_D	90,395	13,221	11,717	2,134	17,243	3,379	1,912	7,355
43_G	912	134	118	22	174	36	20	74
61_D	418,108	27,523	40,863	3,847	36,630	8,982	1,973	12,542
61_G	33,842	2,228	3,307	311	2,964	889	195	1,015
62_D	388,163	25,552	37,937	3,572	34,007	16,663	3,660	11,644
62_G	0	0	0	0	0	0	0	0
11_G	1,398,519	252,816	321,629	20,986	397,836	49,732	32,232	228,797

2028 24-Hour Weekday SHP Summaries

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	632,755	59,649	152,844	4,486	92,374	8,244	5,128	47,509
21_G	52,109,173	4,912,250	12,587,099	369,405	7,607,272	741,299	461,091	3,912,459
31_D	355,061	47,258	64,814	5,196	67,454	11,160	7,039	34,304
31_G	17,409,313	2,317,123	3,177,953	254,786	3,307,367	546,428	344,653	1,681,981
32_D	239,540	31,883	43,727	3,506	45,508	7,527	4,748	23,143
32_G	4,285,149	570,339	782,225	62,713	814,079	134,498	84,833	414,005
51_D	42,803	6,361	5,642	1,000	8,258	2,048	1,181	3,557
51_G	25,691	3,817	3,386	600	4,956	569	328	2,135
52_D	814,186	121,004	107,318	19,017	157,088	44,113	25,430	67,666
52_G	486,518	72,306	64,128	11,363	93,868	12,374	7,133	40,434
53_D	157,422	23,395	20,750	3,677	30,372	2,279	1,314	13,083
53_G	94,170	13,995	12,413	2,199	18,169	642	370	7,826
54_D	30,442	4,524	4,013	711	5,874	1,442	831	2,530
54_G	18,066	2,686	2,382	422	3,486	400	230	1,502
41_D	16,997	2,553	2,257	406	3,313	633	359	1,419
42_D	34,950	5,250	4,642	834	6,812	1,303	739	2,918
42_G	0	0	0	0	0	0	0	0
43_D	92,564	13,904	12,293	2,210	18,042	3,458	1,961	7,728
43_G	939	142	125	23	183	37	21	79
61_D	430,356	29,084	43,086	4,007	38,503	9,227	2,032	13,246
61_G	34,834	2,354	3,487	324	3,116	913	201	1,072
62_D	399,533	27,001	40,000	3,720	35,746	17,118	3,769	12,297
62_G	0	0	0	0	0	0	0	0
11_G	1,440,170	267,277	339,458	21,848	418,654	51,083	33,171	241,698

2012 24-Hour Weekday Starts Summaries

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	40,620	2,992	6,578	336	4,508	578	316	2,882
21_G	10,105,106	744,375	1,636,368	83,496	1,121,447	144,139	78,858	717,064
31_D	48,604	5,075	6,044	811	7,014	1,527	830	4,446
31_G	3,419,188	356,989	425,215	57,023	493,420	107,341	58,344	312,784
32_D	52,439	5,475	6,521	875	7,567	1,616	879	4,797
32_G	918,204	95,867	114,189	15,313	132,505	28,860	15,687	83,996
51_D	6,021	686	547	156	873	284	145	468
51_G	3,613	412	328	94	524	79	40	281
52_D	212,188	24,184	19,266	5,512	30,776	11,321	5,788	16,510
52_G	126,766	14,448	11,510	3,293	18,386	3,173	1,622	9,863
53_D	25,510	2,907	2,316	663	3,700	363	186	1,985
53_G	15,228	1,736	1,383	396	2,209	101	52	1,185
54_D	674	77	61	18	98	32	16	52
54_G	407	46	37	11	59	9	5	32
41_D	5,705	650	518	148	827	207	106	444
42_D	3,884	443	353	101	563	141	72	302
42_G	0	0	0	0	0	0	0	0
43_D	14,928	1,701	1,355	388	2,165	544	278	1,162
43_G	102	12	9	3	15	5	3	8
61_D	99,206	5,474	7,142	1,275	7,411	2,270	961	3,122
61_G	8,032	443	578	103	600	225	95	253
62_D	65,052	3,590	4,683	836	4,860	2,974	1,259	2,047
62_G	0	0	0	0	0	0	0	0
11_G	22,245	3,287	3,597	386	4,949	796	441	3,582

2014 24-Hour Weekday Starts Summaries

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	66,120	5,642	12,549	498	7,998	1,017	608	4,497
21_G	9,375,766	800,040	1,779,393	70,652	1,134,079	144,122	86,228	637,654
31_D	54,991	6,651	8,015	836	8,649	1,865	1,109	4,821
31_G	3,184,380	385,133	464,125	48,434	500,860	107,735	64,038	279,195
32_D	46,172	5,584	6,730	702	7,262	1,596	949	4,048
32_G	844,026	102,080	123,017	12,837	132,754	28,522	16,954	74,001
51_D	5,728	756	610	136	905	291	163	427
51_G	3,424	452	364	81	541	81	45	255
52_D	196,774	25,980	20,939	4,662	31,107	11,318	6,329	14,674
52_G	117,510	15,515	12,505	2,784	18,576	3,174	1,774	8,763
53_D	23,668	3,125	2,519	561	3,741	364	204	1,765
53_G	14,172	1,871	1,508	336	2,240	101	57	1,057
54_D	674	89	72	16	106	34	19	50
54_G	397	52	42	9	63	9	5	30
41_D	1,677	221	178	40	265	66	37	125
42_D	5,538	731	589	131	875	216	121	413
42_G	0	0	0	0	0	0	0	0
43_D	18,841	2,488	2,005	446	2,978	739	413	1,405
43_G	190	25	20	5	30	8	4	14
61_D	92,323	5,901	7,790	1,082	7,517	2,277	1,054	2,784
61_G	7,475	478	631	88	609	225	104	225
62_D	60,539	3,870	5,108	709	4,929	2,983	1,381	1,826
62_G	0	0	0	0	0	0	0	0
11_G	20,702	3,543	3,923	327	5,020	799	484	3,195

2017 24-Hour Weekday Starts Summaries

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	70,759	6,090	13,979	523	9,155	1,089	647	4,767
21_G	10,033,572	863,521	1,982,174	74,151	1,298,184	154,286	91,634	675,948
31_D	58,849	7,179	8,928	878	9,901	1,997	1,178	5,111
31_G	3,407,797	415,692	517,018	50,833	573,337	115,333	68,053	295,961
32_D	49,412	6,027	7,497	737	8,313	1,709	1,008	4,291
32_G	903,243	110,180	137,036	13,473	151,964	30,534	18,016	78,445
51_D	6,130	816	679	142	1,037	312	173	453
51_G	3,665	488	406	85	620	87	48	271
52_D	210,580	28,041	23,326	4,893	35,608	12,117	6,725	15,555
52_G	125,755	16,746	13,930	2,922	21,264	3,397	1,886	9,289
53_D	25,328	3,373	2,806	588	4,283	390	216	1,871
53_G	15,166	2,020	1,680	352	2,565	108	60	1,120
54_D	721	96	80	17	122	36	20	53
54_G	425	57	47	10	72	10	6	31
41_D	1,794	239	199	42	303	70	39	133
42_D	5,926	789	656	138	1,002	232	129	438
42_G	0	0	0	0	0	0	0	0
43_D	20,163	2,685	2,233	468	3,409	791	439	1,489
43_G	204	27	23	5	34	8	5	15
61_D	98,801	6,370	8,677	1,135	8,605	2,437	1,120	2,952
61_G	7,999	516	703	92	697	241	111	239
62_D	64,787	4,177	5,690	744	5,643	3,193	1,468	1,935
62_G	0	0	0	0	0	0	0	0
11_G	22,155	3,824	4,370	343	5,747	855	514	3,386

2020 24-Hour Weekday Starts Summaries

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	96,631	8,415	20,121	704	12,885	1,440	880	6,643
21_G	10,642,366	926,830	2,215,976	77,520	1,419,090	158,693	96,913	731,589
31_D	70,108	8,654	11,211	1,031	12,156	2,179	1,322	6,213
31_G	3,614,334	446,140	577,964	53,139	626,694	118,745	72,045	320,303
32_D	52,513	6,482	8,397	772	9,105	1,727	1,048	4,654
32_G	959,924	118,489	153,500	14,113	166,442	31,503	19,114	85,069
51_D	6,373	859	744	146	1,111	314	179	480
51_G	3,824	515	446	88	666	87	50	288
52_D	224,595	30,264	26,221	5,143	39,140	12,529	7,151	16,929
52_G	134,179	18,080	15,665	3,073	23,383	3,512	2,004	10,114
53_D	27,001	3,638	3,152	618	4,705	402	229	2,035
53_G	16,119	2,172	1,882	369	2,809	112	64	1,215
54_D	714	96	83	16	124	35	20	54
54_G	430	58	50	10	75	10	6	32
41_D	1,907	257	223	44	332	72	41	144
42_D	6,298	849	735	144	1,098	241	138	475
42_G	0	0	0	0	0	0	0	0
43_D	21,429	2,888	2,502	491	3,734	812	464	1,615
43_G	216	29	25	5	38	9	5	16
61_D	105,007	6,850	9,720	1,189	9,426	2,512	1,187	3,201
61_G	8,502	555	787	96	763	249	117	259
62_D	68,856	4,492	6,374	780	6,181	3,291	1,555	2,099
62_G	0	0	0	0	0	0	0	0
11_G	23,546	4,113	4,896	360	6,294	881	545	3,673

2023 24-Hour Weekday Starts Summaries

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	125,626	11,072	27,571	902	17,264	1,815	1,140	8,812
21_G	11,287,920	994,829	2,477,325	81,044	1,551,247	163,235	102,498	791,803
31_D	74,511	9,308	12,559	1,080	13,315	2,370	1,478	6,738
31_G	3,841,361	479,844	647,440	55,667	686,448	122,266	76,273	347,370
32_D	56,968	7,116	9,602	826	10,180	1,815	1,132	5,152
32_G	1,019,063	127,296	171,758	14,768	182,106	32,435	20,234	92,153
51_D	6,778	924	834	153	1,217	324	190	521
51_G	4,067	555	500	92	730	90	53	313
52_D	239,267	32,627	29,443	5,401	42,973	12,945	7,596	18,403
52_G	142,974	19,496	17,594	3,227	25,679	3,631	2,131	10,997
53_D	28,802	3,927	3,544	650	5,173	416	244	2,215
53_G	17,229	2,349	2,120	389	3,094	117	69	1,325
54_D	714	97	88	16	128	34	20	55
54_G	424	58	52	10	76	9	5	33
41_D	2,028	277	250	46	364	75	44	156
42_D	6,791	926	836	153	1,220	251	147	522
42_G	0	0	0	0	0	0	0	0
43_D	22,674	3,092	2,790	512	4,072	835	490	1,744
43_G	230	31	28	5	41	9	5	18
61_D	111,603	7,368	10,889	1,246	10,324	2,589	1,258	3,472
61_G	9,036	597	882	101	836	256	124	281
62_D	73,181	4,831	7,140	817	6,770	3,392	1,648	2,276
62_G	0	0	0	0	0	0	0	0
11_G	25,025	4,424	5,484	377	6,895	908	578	3,983

2026 24-Hour Weekday Starts Summaries

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	132,768	11,951	30,551	949	18,819	1,877	1,202	9,561
21_G	11,929,628	1,073,814	2,745,150	85,294	1,690,932	168,811	108,084	859,049
31_D	78,747	10,047	13,916	1,136	14,514	2,451	1,559	7,310
31_G	4,059,739	517,942	717,435	58,587	748,261	126,443	80,430	376,871
32_D	60,206	7,681	10,640	869	11,097	1,877	1,194	5,589
32_G	1,076,996	137,403	190,326	15,542	198,504	33,543	21,337	99,979
51_D	7,163	998	924	161	1,327	335	200	566
51_G	4,298	599	555	97	796	93	56	339
52_D	252,869	35,218	32,626	5,684	46,843	13,387	8,010	19,966
52_G	151,101	21,044	19,496	3,396	27,991	3,755	2,247	11,931
53_D	30,439	4,239	3,927	684	5,639	430	258	2,403
53_G	18,208	2,536	2,349	409	3,373	121	73	1,438
54_D	755	105	97	17	140	35	21	60
54_G	448	62	58	10	83	10	6	35
41_D	2,143	298	277	48	397	77	46	169
42_D	7,177	1,000	926	161	1,330	259	155	567
42_G	0	0	0	0	0	0	0	0
43_D	23,963	3,337	3,092	539	4,439	863	516	1,892
43_G	243	34	31	5	45	9	5	19
61_D	117,947	7,953	12,066	1,311	11,254	2,677	1,326	3,766
61_G	9,549	644	977	106	911	265	131	305
62_D	77,341	5,215	7,912	860	7,380	3,508	1,738	2,470
62_G	0	0	0	0	0	0	0	0
11_G	26,448	4,775	6,077	397	7,515	939	609	4,321

2028 24-Hour Weekday Starts Summaries

SUT/FT	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
21_D	149,028	13,771	35,147	1,077	21,586	1,928	1,237	11,009
21_G	12,272,719	1,134,101	2,894,445	88,708	1,777,644	173,397	111,233	906,581
31_D	85,182	11,157	15,428	1,243	16,044	2,650	1,689	8,112
31_G	4,176,535	547,026	756,460	60,932	786,639	129,745	82,689	397,728
32_D	62,003	8,121	11,230	905	11,678	1,928	1,229	5,905
32_G	1,109,141	145,271	200,889	16,181	208,904	34,456	21,959	105,623
51_D	7,376	1,055	975	168	1,396	344	206	597
51_G	4,426	633	585	101	838	96	57	358
52_D	260,403	37,232	34,435	5,917	49,295	13,750	8,244	21,092
52_G	155,603	22,248	20,576	3,536	29,456	3,857	2,312	12,603
53_D	31,346	4,482	4,145	712	5,934	442	265	2,539
53_G	18,751	2,681	2,480	426	3,550	125	75	1,519
54_D	777	111	103	18	147	36	22	63
54_G	462	66	61	10	87	10	6	37
41_D	2,207	316	292	50	418	79	47	179
42_D	7,492	1,071	991	170	1,418	269	161	607
42_G	0	0	0	0	0	0	0	0
43_D	24,551	3,510	3,247	558	4,648	884	530	1,989
43_G	251	36	33	6	47	9	6	20
61_D	121,461	8,408	12,735	1,365	11,843	2,750	1,365	3,979
61_G	9,834	681	1,031	111	959	272	135	322
62_D	79,645	5,513	8,351	895	7,766	3,603	1,789	2,609
62_G	0	0	0	0	0	0	0	0
11_G	27,236	5,048	6,414	413	7,909	965	627	4,565

2011 and 2014 24-Hour Weekday SHI and APU Hours Summaries (CLhT_Diesel Only)

County	2011			2014		
	Hotelling	SHI	APU	Hotelling	SHI	APU
Harris	19,766	19,405	362	18,755	17,059	1,695
Brazoria	170	167	3	187	170	17
Fort Bend	3,384	3,322	62	3,724	3,387	337
Waller	1,687	1,657	31	1,634	1,486	148
Montgomery	4,505	4,423	82	4,626	4,208	418
Liberty	463	454	8	458	417	41
Chambers	1,721	1,690	31	2,203	2,004	199
Galveston	477	468	9	439	399	40

2017 and 2020 24-Hour Weekday SHI and APU Hours Summaries (CLhT_Diesel Only)

County	2017			2020		
	Hotelling	SHI	APU	Hotelling	SHI	APU
Harris	20,238	17,058	3,180	21,511	16,860	4,652
Brazoria	202	170	32	216	170	47
Fort Bend	4,204	3,543	661	4,708	3,690	1,018
Waller	1,703	1,435	268	1,781	1,396	385
Montgomery	5,286	4,455	831	5,784	4,533	1,251
Liberty	494	417	78	508	398	110
Chambers	2,379	2,005	374	2,516	1,972	544
Galveston	467	393	73	506	397	109

2023 and 2026 24-Hour Weekday SHI and APU Hours Summaries (CLhT_Diesel Only)

County	2023			2026		
	Hotelling	SHI	APU	Hotelling	SHI	APU
Harris	22,987	17,340	5,647	24,297	17,646	6,651
Brazoria	228	172	56	246	179	67
Fort Bend	5,467	4,124	1,343	6,056	4,398	1,658
Waller	1,890	1,426	464	1,986	1,442	544
Montgomery	6,233	4,702	1,531	6,785	4,928	1,857
Liberty	543	409	133	560	407	153
Chambers	2,658	2,005	653	2,799	2,033	766
Galveston	545	411	134	591	429	162

2028 24-Hour Weekday SHI and APU Hours Summaries (CLhT_Diesel Only)

County	2023		
	Hotelling	SHI	APU
Harris	25,024	17,946	7,078
Brazoria	260	186	73
Fort Bend	6,388	4,581	1,807
Waller	2,063	1,479	583
Montgomery	7,131	5,114	2,017
Liberty	574	412	162
Chambers	2,878	2,064	814
Galveston	624	448	177

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

Brazoria County 2012 Age Distribution Inputs to MOVES

Age	MC	PC	PT	LCT	IBus	Tbus	Sbus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.035148	0.047410	0.024423	0.024423	0.049423	0.049425	0.049424	0.058824	0.097608	0.099113	0.058831	0.042515	0.038264
1	0.042178	0.063593	0.048063	0.048063	0.045329	0.059714	0.035028	0.031880	0.126779	0.136008	0.043831	0.033445	0.030980
2	0.036664	0.064298	0.043025	0.043025	0.040021	0.036554	0.038290	0.025261	0.045306	0.047248	0.038698	0.024642	0.019216
3	0.083115	0.057973	0.037827	0.037827	0.033552	0.037391	0.045610	0.033512	0.047438	0.044614	0.032443	0.034463	0.033439
4	0.093728	0.085697	0.068646	0.068646	0.043562	0.052738	0.050298	0.026019	0.132945	0.128003	0.042122	0.046983	0.046805
5	0.105445	0.086589	0.074174	0.074174	0.057084	0.051227	0.052116	0.090902	0.079617	0.078341	0.055025	0.105601	0.098738
6	0.101034	0.076487	0.066812	0.066812	0.058637	0.036948	0.061244	0.068069	0.086083	0.086493	0.056346	0.077818	0.074498
7	0.075534	0.071170	0.060893	0.060893	0.060621	0.057742	0.054563	0.064173	0.074270	0.077526	0.058252	0.068306	0.064294
8	0.055410	0.060945	0.067802	0.067802	0.058898	0.047342	0.053753	0.038437	0.051737	0.054670	0.056420	0.052380	0.043968
9	0.066988	0.057103	0.069857	0.069857	0.054588	0.046391	0.046283	0.037755	0.044384	0.044263	0.052291	0.039152	0.036893
10	0.060786	0.055253	0.072976	0.072976	0.051128	0.047023	0.048610	0.027369	0.038057	0.034819	0.048976	0.041099	0.035878
11	0.043005	0.048583	0.066115	0.066115	0.049164	0.054162	0.044361	0.033663	0.037538	0.036367	0.046947	0.051584	0.049421
12	0.029773	0.047993	0.053310	0.053310	0.046755	0.036642	0.048269	0.046006	0.032663	0.029381	0.044646	0.061272	0.060453
13	0.027981	0.037898	0.047574	0.047574	0.045451	0.035523	0.044662	0.065891	0.027050	0.026411	0.043265	0.052513	0.053011
14	0.020675	0.029918	0.032801	0.032801	0.034444	0.041691	0.035245	0.060566	0.011652	0.012393	0.025435	0.040701	0.042901
15	0.014473	0.023594	0.032886	0.032886	0.028025	0.038094	0.032832	0.029272	0.015536	0.013865	0.039162	0.033313	0.033084
16	0.015438	0.017398	0.023775	0.023775	0.023170	0.035089	0.028314	0.037973	0.009070	0.008000	0.024172	0.028181	0.030027
17	0.013784	0.015420	0.023396	0.023396	0.030114	0.028755	0.036168	0.048730	0.010004	0.008690	0.028520	0.037073	0.038139
18	0.010200	0.010944	0.019666	0.019666	0.023187	0.025076	0.017454	0.034209	0.005878	0.005700	0.027108	0.023182	0.024847
19	0.006478	0.008383	0.012731	0.012731	0.019086	0.020799	0.020843	0.015577	0.004068	0.003981	0.018654	0.020837	0.022345
20	0.004824	0.006274	0.010762	0.010762	0.014059	0.018057	0.016812	0.013865	0.003216	0.002807	0.016312	0.014688	0.016097
21	0.003446	0.004663	0.007998	0.007998	0.015931	0.018265	0.021460	0.021702	0.003354	0.003026	0.012134	0.014113	0.017751
22	0.004273	0.003691	0.006445	0.006445	0.017879	0.026733	0.024239	0.015397	0.003262	0.002931	0.015893	0.012387	0.015312
23	0.003584	0.002821	0.005956	0.005956	0.017733	0.020338	0.013830	0.023721	0.002732	0.002358	0.020466	0.011370	0.011890
24	0.002481	0.001828	0.004452	0.004452	0.016499	0.016010	0.016445	0.013653	0.002086	0.001936	0.018152	0.008760	0.009838
25	0.002757	0.001605	0.002263	0.002263	0.017150	0.014812	0.016658	0.012243	0.001441	0.001212	0.017729	0.005795	0.008080
26	0.005238	0.001122	0.002397	0.002397	0.014386	0.012478	0.014539	0.006260	0.001441	0.001462	0.013030	0.003451	0.007797
27	0.002619	0.001295	0.001896	0.001896	0.012564	0.010708	0.012483	0.006290	0.000715	0.001166	0.013833	0.002876	0.007107
28	0.002068	0.000986	0.001945	0.001945	0.009886	0.008347	0.009640	0.005160	0.000726	0.000970	0.014032	0.003274	0.005442
29	0.003722	0.000597	0.000881	0.000881	0.003902	0.007916	0.003521	0.002322	0.000415	0.000591	0.009061	0.000929	0.002480
30	0.027154	0.008469	0.008255	0.008255	0.007748	0.008017	0.007005	0.005296	0.002927	0.005654	0.008214	0.007300	0.021006

Brazoria County 2014 Age Distribution Inputs to MOVES (2014, 2017, 2020, 2023, 2006, and 2028 Analysis Years)

Age	MC	PC	PT	LCT	IBus	Tbus	Sbus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.034051	0.049888	0.026692	0.026692	0.055550	0.055650	0.055556	0.064759	0.084720	0.080736	0.064928	0.040776	0.044007
1	0.058353	0.082092	0.050348	0.050348	0.049845	0.049946	0.049851	0.058272	0.099024	0.097975	0.058445	0.045307	0.048909
2	0.051368	0.076969	0.045098	0.045098	0.046006	0.046100	0.046012	0.053507	0.139229	0.150497	0.053673	0.043397	0.050486
3	0.037398	0.066351	0.048366	0.048366	0.042195	0.055697	0.032610	0.028999	0.095185	0.104892	0.039988	0.031182	0.032874
4	0.033469	0.060897	0.042381	0.042381	0.037253	0.034095	0.035647	0.022977	0.034371	0.036093	0.035305	0.020122	0.017742
5	0.072905	0.052089	0.034989	0.034989	0.031055	0.034678	0.042221	0.030317	0.035143	0.034013	0.029436	0.028828	0.031415
6	0.082800	0.076409	0.063810	0.063810	0.039993	0.048515	0.046183	0.023359	0.101750	0.093698	0.037928	0.045973	0.043640
7	0.093277	0.075794	0.068950	0.068950	0.052281	0.047012	0.047736	0.081433	0.059089	0.057695	0.049441	0.104962	0.094086
8	0.086147	0.065460	0.063712	0.063712	0.053396	0.033713	0.055776	0.060642	0.066056	0.064010	0.050348	0.074224	0.070679
9	0.066938	0.060303	0.056247	0.056247	0.055068	0.052558	0.049572	0.057049	0.057215	0.057569	0.051939	0.068094	0.061342
10	0.053842	0.050644	0.062244	0.062244	0.053504	0.043092	0.048835	0.034170	0.040706	0.040882	0.050306	0.053036	0.041119
11	0.062427	0.045919	0.064202	0.064202	0.049302	0.041983	0.041807	0.033378	0.033980	0.033007	0.046365	0.034735	0.032913
12	0.054424	0.043597	0.066490	0.066490	0.046065	0.042452	0.043802	0.024143	0.029049	0.026419	0.043333	0.034069	0.032437
13	0.038271	0.037030	0.057875	0.057875	0.044039	0.048613	0.039741	0.029530	0.028527	0.027473	0.041306	0.044819	0.043530
14	0.026193	0.035876	0.046175	0.046175	0.041778	0.032808	0.043136	0.040271	0.025129	0.021921	0.039197	0.055168	0.052520
15	0.024447	0.027141	0.040423	0.040423	0.040614	0.031806	0.039913	0.057676	0.020569	0.019697	0.037984	0.042464	0.044225
16	0.018626	0.020587	0.028099	0.028099	0.030599	0.037111	0.031314	0.052718	0.008941	0.009478	0.022205	0.034913	0.037120
17	0.013097	0.016206	0.028393	0.028393	0.024835	0.033826	0.029099	0.025424	0.010264	0.010221	0.034115	0.026429	0.028101
18	0.013242	0.011191	0.020022	0.020022	0.020413	0.030975	0.024947	0.032795	0.005473	0.005665	0.020938	0.024519	0.025898
19	0.011496	0.010260	0.018614	0.018614	0.026465	0.025322	0.031789	0.041994	0.006415	0.006044	0.024651	0.033048	0.032080
20	0.009313	0.006635	0.015628	0.015628	0.020257	0.021951	0.015251	0.029313	0.003919	0.003876	0.023297	0.021543	0.020867
21	0.005384	0.005164	0.009974	0.009974	0.016634	0.018163	0.018167	0.013318	0.002726	0.002748	0.015998	0.017856	0.017990
22	0.004220	0.003598	0.007979	0.007979	0.012252	0.015769	0.014653	0.011855	0.002065	0.001875	0.013989	0.012970	0.012870
23	0.003783	0.003078	0.005936	0.005936	0.013802	0.015855	0.018594	0.018450	0.001774	0.002168	0.010346	0.013059	0.014209
24	0.003929	0.002369	0.005054	0.005054	0.015451	0.023149	0.020950	0.013061	0.001594	0.001735	0.013522	0.011060	0.012572
25	0.003347	0.001822	0.004699	0.004699	0.015325	0.017611	0.011953	0.020123	0.001333	0.001442	0.017413	0.009550	0.009605
26	0.002474	0.001390	0.003525	0.003525	0.014173	0.013781	0.014128	0.011515	0.001143	0.001180	0.015355	0.007596	0.007859
27	0.001455	0.001188	0.001799	0.001799	0.014696	0.012718	0.014276	0.010304	0.000561	0.000678	0.014965	0.004842	0.006202
28	0.002910	0.000769	0.001775	0.001775	0.012327	0.010714	0.012460	0.005268	0.000601	0.000875	0.010998	0.003243	0.006083
29	0.002328	0.000918	0.001493	0.001493	0.010702	0.009139	0.010634	0.005263	0.000652	0.000762	0.011609	0.002710	0.005596
30	0.028085	0.008363	0.009007	0.009007	0.014149	0.015191	0.013386	0.008114	0.002797	0.004677	0.020675	0.009506	0.021026

Chambers County 2012 Age Distribution Inputs to MOVES

Age	MC	PC	PT	LCT	IBus	Tbus	Sbus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.032854	0.057461	0.025441	0.025441	0.049423	0.049425	0.049424	0.058824	0.097608	0.099113	0.058831	0.042515	0.038264
1	0.030801	0.069076	0.052380	0.052380	0.045329	0.059714	0.035028	0.031880	0.126779	0.136008	0.043831	0.033445	0.030980
2	0.036961	0.068396	0.043400	0.043400	0.040021	0.036554	0.038290	0.025261	0.045306	0.047248	0.038698	0.024642	0.019216
3	0.081109	0.061604	0.043924	0.043924	0.033552	0.037391	0.045610	0.033512	0.047438	0.044614	0.032443	0.034463	0.033439
4	0.091376	0.096380	0.074379	0.074379	0.043562	0.052738	0.050298	0.026019	0.132945	0.128003	0.042122	0.046983	0.046805
5	0.111910	0.090946	0.083957	0.083957	0.057084	0.051227	0.052116	0.090902	0.079617	0.078341	0.055025	0.105601	0.098738
6	0.110883	0.084562	0.072134	0.072134	0.058637	0.036948	0.061244	0.068069	0.086083	0.086493	0.056346	0.077818	0.074498
7	0.066735	0.069619	0.062332	0.062332	0.060621	0.057742	0.054563	0.064173	0.074270	0.077526	0.058252	0.068306	0.064294
8	0.068789	0.057189	0.071685	0.071685	0.058898	0.047342	0.053753	0.038437	0.051737	0.054670	0.056420	0.052380	0.043968
9	0.072895	0.045915	0.068692	0.068692	0.054588	0.046391	0.046283	0.037755	0.044384	0.044263	0.052291	0.039152	0.036893
10	0.054415	0.050397	0.068393	0.068393	0.051128	0.047023	0.048610	0.027369	0.038057	0.034819	0.048976	0.041099	0.035878
11	0.042094	0.041432	0.063903	0.063903	0.049164	0.054162	0.044361	0.033663	0.037538	0.036367	0.046947	0.051584	0.049421
12	0.044148	0.038919	0.048788	0.048788	0.046755	0.036642	0.048269	0.046006	0.032663	0.029381	0.044646	0.061272	0.060453
13	0.037988	0.032534	0.042353	0.042353	0.045451	0.035523	0.044662	0.065891	0.027050	0.026411	0.043265	0.052513	0.053011
14	0.021561	0.026082	0.028435	0.028435	0.034444	0.041691	0.035245	0.060566	0.011652	0.012393	0.025435	0.040701	0.042901
15	0.008214	0.021803	0.028884	0.028884	0.028025	0.038094	0.032832	0.029272	0.015536	0.013865	0.039162	0.033313	0.033084
16	0.012320	0.017252	0.019979	0.019979	0.023170	0.035089	0.028314	0.037973	0.009070	0.008000	0.024172	0.028181	0.030027
17	0.006160	0.014467	0.021925	0.021925	0.030114	0.028755	0.036168	0.048730	0.010004	0.008690	0.028520	0.037073	0.038139
18	0.009240	0.010256	0.019306	0.019306	0.023187	0.025076	0.017454	0.034209	0.005878	0.005700	0.027108	0.023182	0.024847
19	0.005133	0.008830	0.012796	0.012796	0.019086	0.020799	0.020843	0.015577	0.004068	0.003981	0.018654	0.020837	0.022345
20	0.003080	0.006452	0.008680	0.008680	0.014059	0.018057	0.016812	0.013865	0.003216	0.002807	0.016312	0.014688	0.016097
21	0.005133	0.005298	0.007857	0.007857	0.015931	0.018265	0.021460	0.021702	0.003354	0.003026	0.012134	0.014113	0.017751
22	0.002053	0.003871	0.006585	0.006585	0.017879	0.026733	0.024239	0.015397	0.003262	0.002931	0.015893	0.012387	0.015312
23	0.004107	0.003804	0.004340	0.004340	0.017733	0.020338	0.013830	0.023721	0.002732	0.002358	0.020466	0.011370	0.011890
24	0.004107	0.001970	0.003667	0.003667	0.016499	0.016010	0.016445	0.013653	0.002086	0.001936	0.018152	0.008760	0.009838
25	0.002053	0.002038	0.001871	0.001871	0.017150	0.014812	0.016658	0.012243	0.001441	0.001212	0.017729	0.005795	0.008080
26	0.001027	0.000815	0.001796	0.001796	0.014386	0.012478	0.014539	0.006260	0.001441	0.001462	0.013030	0.003451	0.007797
27	0.004107	0.001562	0.002394	0.002394	0.012564	0.010708	0.012483	0.006290	0.000715	0.001166	0.013833	0.002876	0.007107
28	0.002053	0.001019	0.001497	0.001497	0.009886	0.008347	0.009640	0.005160	0.000726	0.000970	0.014032	0.003274	0.005442
29	0.001027	0.000611	0.001122	0.001122	0.003902	0.007916	0.003521	0.002322	0.000415	0.000591	0.009061	0.000929	0.002480
30	0.025667	0.009441	0.007109	0.007109	0.007748	0.008017	0.007005	0.005296	0.002927	0.005654	0.008214	0.007300	0.021006

Chambers County 2014 Age Distribution Inputs to MOVES (2014, 2017, 2020, 2023, 2026, and 2028 Analysis Years)

Age	MC	PC	PT	LCT	IBus	Tbus	Sbus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.026205	0.056954	0.034963	0.034963	0.055550	0.055650	0.055556	0.064759	0.084720	0.080736	0.064928	0.040776	0.044007
1	0.041929	0.098149	0.057648	0.057648	0.049845	0.049946	0.049851	0.058272	0.099024	0.097975	0.058445	0.045307	0.048909
2	0.062893	0.095394	0.053231	0.053231	0.046006	0.046100	0.046012	0.053507	0.139229	0.150497	0.053673	0.043397	0.050486
3	0.036688	0.071753	0.059444	0.059444	0.042195	0.055697	0.032610	0.028999	0.095185	0.104892	0.039988	0.031182	0.032874
4	0.037736	0.063809	0.044546	0.044546	0.037253	0.034095	0.035647	0.022977	0.034371	0.036093	0.035305	0.020122	0.017742
5	0.080713	0.054904	0.042674	0.042674	0.031055	0.034678	0.042221	0.030317	0.035143	0.034013	0.029436	0.028828	0.031415
6	0.070231	0.079185	0.070150	0.070150	0.039993	0.048515	0.046183	0.023359	0.101750	0.093698	0.037928	0.045973	0.043640
7	0.094340	0.072202	0.073070	0.073070	0.052281	0.047012	0.047736	0.081433	0.059089	0.057695	0.049441	0.104962	0.094086
8	0.106918	0.068038	0.064910	0.064910	0.053396	0.033713	0.055776	0.060642	0.066056	0.064010	0.050348	0.074224	0.070679
9	0.068134	0.054328	0.054503	0.054503	0.055068	0.052558	0.049572	0.057049	0.057215	0.057569	0.051939	0.068094	0.061342
10	0.057652	0.043308	0.059370	0.059370	0.053504	0.043092	0.048835	0.034170	0.040706	0.040882	0.050306	0.053036	0.041119
11	0.064990	0.034595	0.059744	0.059744	0.049302	0.041983	0.041807	0.033378	0.033980	0.033007	0.046365	0.034735	0.032913
12	0.045073	0.037927	0.056300	0.056300	0.046065	0.042452	0.043802	0.024143	0.029049	0.026419	0.043333	0.034069	0.032437
13	0.032495	0.031136	0.052931	0.052931	0.044039	0.048613	0.039741	0.029530	0.028527	0.027473	0.041306	0.044819	0.043530
14	0.039832	0.028894	0.041102	0.041102	0.041778	0.032808	0.043136	0.040271	0.025129	0.021921	0.039197	0.055168	0.052520
15	0.028302	0.022551	0.035487	0.035487	0.040614	0.031806	0.039913	0.057676	0.020569	0.019697	0.037984	0.042464	0.044225
16	0.016771	0.016849	0.024931	0.024931	0.030599	0.037111	0.031314	0.052718	0.008941	0.009478	0.022205	0.034913	0.037120
17	0.012579	0.013582	0.022161	0.022161	0.024835	0.033826	0.029099	0.025424	0.010264	0.010221	0.034115	0.026429	0.028101
18	0.014675	0.010827	0.016096	0.016096	0.020413	0.030975	0.024947	0.032795	0.005473	0.005665	0.020938	0.024519	0.025898
19	0.006289	0.008393	0.017219	0.017219	0.026465	0.025322	0.031789	0.041994	0.006415	0.006044	0.024651	0.033048	0.032080
20	0.009434	0.007111	0.012802	0.012802	0.020257	0.021951	0.015251	0.029313	0.003919	0.003876	0.023297	0.021543	0.020867
21	0.005241	0.005061	0.009882	0.009882	0.016634	0.018163	0.018167	0.013318	0.002726	0.002748	0.015998	0.017856	0.017990
22	0.006289	0.003075	0.007112	0.007112	0.012252	0.015769	0.014653	0.011855	0.002065	0.001875	0.013989	0.012970	0.012870
23	0.001048	0.002691	0.005465	0.005465	0.013802	0.015855	0.018594	0.018450	0.001774	0.002168	0.010346	0.013059	0.014209
24	0.003145	0.002306	0.004567	0.004567	0.015451	0.023149	0.020950	0.013061	0.001594	0.001735	0.013522	0.011060	0.012572
25	0.003145	0.002306	0.003743	0.003743	0.015325	0.017611	0.011953	0.020123	0.001333	0.001442	0.017413	0.009550	0.009605
26	0.002096	0.001345	0.002770	0.002770	0.014173	0.013781	0.014128	0.011515	0.001143	0.001180	0.015355	0.007596	0.007859
27	0.001048	0.001217	0.001348	0.001348	0.014696	0.012718	0.014276	0.010304	0.000561	0.000678	0.014965	0.004842	0.006202
28	0.001048	0.000641	0.001872	0.001872	0.012327	0.010714	0.012460	0.005268	0.000601	0.000875	0.010998	0.003243	0.006083
29	0.004193	0.001217	0.002171	0.002171	0.010702	0.009139	0.010634	0.005263	0.000652	0.000762	0.011609	0.002710	0.005596
30	0.018868	0.010250	0.007786	0.007786	0.014149	0.015191	0.013386	0.008114	0.002797	0.004677	0.020675	0.009506	0.021026

Fort Bend County 2012 Age Distribution Inputs to MOVES

Age	MC	PC	PT	LCT	IBus	Tbus	Sbus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.046851	0.053758	0.030330	0.030330	0.049423	0.049425	0.049424	0.058824	0.097608	0.099113	0.058831	0.042515	0.038264
1	0.057431	0.071312	0.059501	0.059501	0.045329	0.059714	0.035028	0.031880	0.126779	0.136008	0.043831	0.033445	0.030980
2	0.051763	0.070497	0.054767	0.054767	0.040021	0.036554	0.038290	0.025261	0.045306	0.047248	0.038698	0.024642	0.019216
3	0.094584	0.064229	0.043843	0.043843	0.033552	0.037391	0.045610	0.033512	0.047438	0.044614	0.032443	0.034463	0.033439
4	0.094458	0.092627	0.077315	0.077315	0.043562	0.052738	0.050298	0.026019	0.132945	0.128003	0.042122	0.046983	0.046805
5	0.114987	0.091304	0.085057	0.085057	0.057084	0.051227	0.052116	0.090902	0.079617	0.078341	0.055025	0.105601	0.098738
6	0.094081	0.080117	0.068916	0.068916	0.058637	0.036948	0.061244	0.068069	0.086083	0.086493	0.056346	0.077818	0.074498
7	0.074811	0.070150	0.063454	0.063454	0.060621	0.057742	0.054563	0.064173	0.074270	0.077526	0.058252	0.068306	0.064294
8	0.052771	0.061728	0.073516	0.073516	0.058898	0.047342	0.053753	0.038437	0.051737	0.054670	0.056420	0.052380	0.043968
9	0.063980	0.056799	0.072222	0.072222	0.054588	0.046391	0.046283	0.037755	0.044384	0.044263	0.052291	0.039152	0.036893
10	0.053149	0.052662	0.072551	0.072551	0.051128	0.047023	0.048610	0.027369	0.038057	0.034819	0.048976	0.041099	0.035878
11	0.037028	0.046587	0.060076	0.060076	0.049164	0.054162	0.044361	0.033663	0.037538	0.036367	0.046947	0.051584	0.049421
12	0.029849	0.043415	0.046697	0.046697	0.046755	0.036642	0.048269	0.046006	0.032663	0.029381	0.044646	0.061272	0.060453
13	0.027078	0.032826	0.038770	0.038770	0.045451	0.035523	0.044662	0.065891	0.027050	0.026411	0.043265	0.052513	0.053011
14	0.018136	0.026532	0.028667	0.028667	0.034444	0.041691	0.035245	0.060566	0.011652	0.012393	0.025435	0.040701	0.042901
15	0.011209	0.020441	0.026747	0.026747	0.028025	0.038094	0.032832	0.029272	0.015536	0.013865	0.039162	0.033313	0.033084
16	0.010076	0.014271	0.017250	0.017250	0.023170	0.035089	0.028314	0.037973	0.009070	0.008000	0.024172	0.028181	0.030027
17	0.008564	0.012307	0.016941	0.016941	0.030114	0.028755	0.036168	0.048730	0.010004	0.008690	0.028520	0.037073	0.038139
18	0.005164	0.008049	0.014087	0.014087	0.023187	0.025076	0.017454	0.034209	0.005878	0.005700	0.027108	0.023182	0.024847
19	0.005542	0.006009	0.009354	0.009354	0.019086	0.020799	0.020843	0.015577	0.004068	0.003981	0.018654	0.020837	0.022345
20	0.002897	0.004550	0.007177	0.007177	0.014059	0.018057	0.016812	0.013865	0.003216	0.002807	0.016312	0.014688	0.016097
21	0.002645	0.003548	0.005031	0.005031	0.015931	0.018265	0.021460	0.021702	0.003354	0.003026	0.012134	0.014113	0.017751
22	0.001763	0.002835	0.004980	0.004980	0.017879	0.026733	0.024239	0.015397	0.003262	0.002931	0.015893	0.012387	0.015312
23	0.002519	0.001738	0.003840	0.003840	0.017733	0.020338	0.013830	0.023721	0.002732	0.002358	0.020466	0.011370	0.011890
24	0.002393	0.001378	0.002967	0.002967	0.016499	0.016010	0.016445	0.013653	0.002086	0.001936	0.018152	0.008760	0.009838
25	0.002645	0.001146	0.001930	0.001930	0.017150	0.014812	0.016658	0.012243	0.001441	0.001212	0.017729	0.005795	0.008080
26	0.003275	0.000831	0.001797	0.001797	0.014386	0.012478	0.014539	0.006260	0.001441	0.001462	0.013030	0.003451	0.007797
27	0.002015	0.000825	0.001612	0.001612	0.012564	0.010708	0.012483	0.006290	0.000715	0.001166	0.013833	0.002876	0.007107
28	0.003023	0.000694	0.001591	0.001591	0.009886	0.008347	0.009640	0.005160	0.000726	0.000970	0.014032	0.003274	0.005442
29	0.003401	0.000520	0.000852	0.000852	0.003902	0.007916	0.003521	0.002322	0.000415	0.000591	0.009061	0.000929	0.002480
30	0.021914	0.006317	0.008163	0.008163	0.007748	0.008017	0.007005	0.005296	0.002927	0.005654	0.008214	0.007300	0.021006

Fort Bend County 2014 Age Distribution Inputs to MOVES (2014, 2017, 2020, 2023, 2026, and 2028 Analysis Years)

Age	MC	PC	PT	LCT	IBus	Tbus	Sbus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.050696	0.058337	0.032080	0.032080	0.055550	0.055650	0.055556	0.064759	0.084720	0.080736	0.064928	0.040776	0.044007
1	0.073662	0.090001	0.064914	0.064914	0.049845	0.049946	0.049851	0.058272	0.099024	0.097975	0.058445	0.045307	0.048909
2	0.068043	0.083425	0.056273	0.056273	0.046006	0.046100	0.046012	0.053507	0.139229	0.150497	0.053673	0.043397	0.050486
3	0.050452	0.073275	0.058103	0.058103	0.042195	0.055697	0.032610	0.028999	0.095185	0.104892	0.039988	0.031182	0.032874
4	0.041656	0.066488	0.051514	0.051514	0.037253	0.034095	0.035647	0.022977	0.034371	0.036093	0.035305	0.020122	0.017742
5	0.080015	0.057682	0.038498	0.038498	0.031055	0.034678	0.042221	0.030317	0.035143	0.034013	0.029436	0.028828	0.031415
6	0.074884	0.080274	0.070114	0.070114	0.039993	0.048515	0.046183	0.023359	0.101750	0.093698	0.037928	0.045973	0.043640
7	0.096995	0.077799	0.074872	0.074872	0.052281	0.047012	0.047736	0.081433	0.059089	0.057695	0.049441	0.104962	0.094086
8	0.080625	0.066166	0.061161	0.061161	0.053396	0.033713	0.055776	0.060642	0.066056	0.064010	0.050348	0.074224	0.070679
9	0.062790	0.056728	0.056222	0.056222	0.055068	0.052558	0.049572	0.057049	0.057215	0.057569	0.051939	0.068094	0.061342
10	0.046787	0.048539	0.063535	0.063535	0.053504	0.043092	0.048835	0.034170	0.040706	0.040882	0.050306	0.053036	0.041119
11	0.053872	0.043165	0.062248	0.062248	0.049302	0.041983	0.041807	0.033378	0.033980	0.033007	0.046365	0.034735	0.032913
12	0.043000	0.038870	0.062761	0.062761	0.046065	0.042452	0.043802	0.024143	0.029049	0.026419	0.043333	0.034069	0.032437
13	0.032861	0.033461	0.051736	0.051736	0.044039	0.048613	0.039741	0.029530	0.028527	0.027473	0.041306	0.044819	0.043530
14	0.026631	0.030643	0.040127	0.040127	0.041778	0.032808	0.043136	0.040271	0.025129	0.021921	0.039197	0.055168	0.052520
15	0.021500	0.022460	0.031838	0.031838	0.040614	0.031806	0.039913	0.057676	0.020569	0.019697	0.037984	0.042464	0.044225
16	0.016003	0.017884	0.023579	0.023579	0.030599	0.037111	0.031314	0.052718	0.008941	0.009478	0.022205	0.034913	0.037120
17	0.009406	0.013139	0.021809	0.021809	0.024835	0.033826	0.029099	0.025424	0.010264	0.010221	0.034115	0.026429	0.028101
18	0.008307	0.008985	0.014224	0.014224	0.020413	0.030975	0.024947	0.032795	0.005473	0.005665	0.020938	0.024519	0.025898
19	0.006719	0.007194	0.013731	0.013731	0.026465	0.025322	0.031789	0.041994	0.006415	0.006044	0.024651	0.033048	0.032080
20	0.004520	0.004944	0.011025	0.011025	0.020257	0.021951	0.015251	0.029313	0.003919	0.003876	0.023297	0.021543	0.020867
21	0.005375	0.003593	0.007585	0.007585	0.016634	0.018163	0.018167	0.013318	0.002726	0.002748	0.015998	0.017856	0.017990
22	0.003298	0.002656	0.005553	0.005553	0.012252	0.015769	0.014653	0.011855	0.002065	0.001875	0.013989	0.012970	0.012870
23	0.001832	0.002039	0.003953	0.003953	0.013802	0.015855	0.018594	0.018450	0.001774	0.002168	0.010346	0.013059	0.014209
24	0.001344	0.001697	0.003802	0.003802	0.015451	0.023149	0.020950	0.013061	0.001594	0.001735	0.013522	0.011060	0.012572
25	0.002077	0.001082	0.003159	0.003159	0.015325	0.017611	0.011953	0.020123	0.001333	0.001442	0.017413	0.009550	0.009605
26	0.002199	0.000933	0.002223	0.002223	0.014173	0.013781	0.014128	0.011515	0.001143	0.001180	0.015355	0.007596	0.007859
27	0.002443	0.000837	0.001418	0.001418	0.014696	0.012718	0.014276	0.010304	0.000561	0.000678	0.014965	0.004842	0.006202
28	0.003176	0.000641	0.001398	0.001398	0.012327	0.010714	0.012460	0.005268	0.000601	0.000875	0.010998	0.003243	0.006083
29	0.001099	0.000664	0.001207	0.001207	0.010702	0.009139	0.010634	0.005263	0.000652	0.000762	0.011609	0.002710	0.005596
30	0.027730	0.006398	0.009335	0.009335	0.014149	0.015191	0.013386	0.008114	0.002797	0.004677	0.020675	0.009506	0.021026

Galveston County 2012 Age Distribution Inputs to MOVES

Age	MC	PC	PT	LCT	IBus	Tbus	Sbus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.032127	0.050060	0.023687	0.023687	0.049423	0.049425	0.049424	0.058824	0.097608	0.099113	0.058831	0.042515	0.038264
1	0.043258	0.064476	0.049915	0.049915	0.045329	0.059714	0.035028	0.031880	0.126779	0.136008	0.043831	0.033445	0.030980
2	0.039464	0.062459	0.049245	0.049245	0.040021	0.036554	0.038290	0.025261	0.045306	0.047248	0.038698	0.024642	0.019216
3	0.096509	0.061257	0.041219	0.041219	0.033552	0.037391	0.045610	0.033512	0.047438	0.044614	0.032443	0.034463	0.033439
4	0.091955	0.086048	0.076896	0.076896	0.043562	0.052738	0.050298	0.026019	0.132945	0.128003	0.042122	0.046983	0.046805
5	0.102707	0.085570	0.079339	0.079339	0.057084	0.051227	0.052116	0.090902	0.079617	0.078341	0.055025	0.105601	0.098738
6	0.095244	0.078593	0.070350	0.070350	0.058637	0.036948	0.061244	0.068069	0.086083	0.086493	0.056346	0.077818	0.074498
7	0.074627	0.071102	0.060830	0.060830	0.060621	0.057742	0.054563	0.064173	0.074270	0.077526	0.058252	0.068306	0.064294
8	0.054263	0.060256	0.071341	0.071341	0.058898	0.047342	0.053753	0.038437	0.051737	0.054670	0.056420	0.052380	0.043968
9	0.067417	0.057380	0.071676	0.071676	0.054588	0.046391	0.046283	0.037755	0.044384	0.044263	0.052291	0.039152	0.036893
10	0.057172	0.054370	0.072932	0.072932	0.051128	0.047023	0.048610	0.027369	0.038057	0.034819	0.048976	0.041099	0.035878
11	0.041108	0.047095	0.064878	0.064878	0.049164	0.054162	0.044361	0.033663	0.037538	0.036367	0.046947	0.051584	0.049421
12	0.033898	0.044413	0.047444	0.047444	0.046755	0.036642	0.048269	0.046006	0.032663	0.029381	0.044646	0.061272	0.060453
13	0.028712	0.036862	0.043047	0.043047	0.045451	0.035523	0.044662	0.065891	0.027050	0.026411	0.043265	0.052513	0.053011
14	0.019732	0.029108	0.030597	0.030597	0.034444	0.041691	0.035245	0.060566	0.011652	0.012393	0.025435	0.040701	0.042901
15	0.014799	0.023327	0.029466	0.029466	0.028025	0.038094	0.032832	0.029272	0.015536	0.013865	0.039162	0.033313	0.033084
16	0.015431	0.017329	0.020979	0.020979	0.023170	0.035089	0.028314	0.037973	0.009070	0.008000	0.024172	0.028181	0.030027
17	0.011257	0.015798	0.020798	0.020798	0.030114	0.028755	0.036168	0.048730	0.010004	0.008690	0.028520	0.037073	0.038139
18	0.008095	0.010644	0.016261	0.016261	0.023187	0.025076	0.017454	0.034209	0.005878	0.005700	0.027108	0.023182	0.024847
19	0.006957	0.008097	0.011041	0.011041	0.019086	0.020799	0.020843	0.015577	0.004068	0.003981	0.018654	0.020837	0.022345
20	0.005059	0.006244	0.008221	0.008221	0.014059	0.018057	0.016812	0.013865	0.003216	0.002807	0.016312	0.014688	0.016097
21	0.003921	0.004631	0.006784	0.006784	0.015931	0.018265	0.021460	0.021702	0.003354	0.003026	0.012134	0.014113	0.017751
22	0.003036	0.003951	0.006379	0.006379	0.017879	0.026733	0.024239	0.015397	0.003262	0.002931	0.015893	0.012387	0.015312
23	0.003795	0.002831	0.005597	0.005597	0.017733	0.020338	0.013830	0.023721	0.002732	0.002358	0.020466	0.011370	0.011890
24	0.004301	0.002002	0.003392	0.003392	0.016499	0.016010	0.016445	0.013653	0.002086	0.001936	0.018152	0.008760	0.009838
25	0.003542	0.001696	0.001884	0.001884	0.017150	0.014812	0.016658	0.012243	0.001441	0.001212	0.017729	0.005795	0.008080
26	0.003289	0.001471	0.002219	0.002219	0.014386	0.012478	0.014539	0.006260	0.001441	0.001462	0.013030	0.003451	0.007797
27	0.003668	0.001292	0.001940	0.001940	0.012564	0.010708	0.012483	0.006290	0.000715	0.001166	0.013833	0.002876	0.007107
28	0.002403	0.001218	0.002052	0.002052	0.009886	0.008347	0.009640	0.005160	0.000726	0.000970	0.014032	0.003274	0.005442
29	0.003289	0.000807	0.001312	0.001312	0.003902	0.007916	0.003521	0.002322	0.000415	0.000591	0.009061	0.000929	0.002480
30	0.028965	0.009613	0.008277	0.008277	0.007748	0.008017	0.007005	0.005296	0.002927	0.005654	0.008214	0.007300	0.021006

Galveston County 2014 Age Distribution Inputs to MOVES (2014, 2017, 2020, 2023, 2026, and 2028 Analysis Years)

Age	MC	PC	PT	LCT	IBus	Tbus	Sbus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.032675	0.050373	0.031659	0.031659	0.055550	0.055650	0.055556	0.064759	0.084720	0.080736	0.064928	0.040776	0.044007
1	0.064163	0.084895	0.058659	0.058659	0.049845	0.049946	0.049851	0.058272	0.099024	0.097975	0.058445	0.045307	0.048909
2	0.054941	0.076401	0.045384	0.045384	0.046006	0.046100	0.046012	0.053507	0.139229	0.150497	0.053673	0.043397	0.050486
3	0.040580	0.065228	0.049650	0.049650	0.042195	0.055697	0.032610	0.028999	0.095185	0.104892	0.039988	0.031182	0.032874
4	0.033597	0.059393	0.045749	0.045749	0.037253	0.034095	0.035647	0.022977	0.034371	0.036093	0.035305	0.020122	0.017742
5	0.083267	0.054553	0.038002	0.038002	0.031055	0.034678	0.042221	0.030317	0.035143	0.034013	0.029436	0.028828	0.031415
6	0.079842	0.074858	0.068974	0.068974	0.039993	0.048515	0.046183	0.023359	0.101750	0.093698	0.037928	0.045973	0.043640
7	0.091304	0.073456	0.072187	0.072187	0.052281	0.047012	0.047736	0.081433	0.059089	0.057695	0.049441	0.104962	0.094086
8	0.081686	0.066351	0.062813	0.062813	0.053396	0.033713	0.055776	0.060642	0.066056	0.064010	0.050348	0.074224	0.070679
9	0.064032	0.059954	0.054126	0.054126	0.055068	0.052558	0.049572	0.057049	0.057215	0.057569	0.051939	0.068094	0.061342
10	0.049407	0.049882	0.063950	0.063950	0.053504	0.043092	0.048835	0.034170	0.040706	0.040882	0.050306	0.053036	0.041119
11	0.060079	0.045968	0.064146	0.064146	0.049302	0.041983	0.041807	0.033378	0.033980	0.033007	0.046365	0.034735	0.032913
12	0.048090	0.042939	0.064708	0.064708	0.046065	0.042452	0.043802	0.024143	0.029049	0.026419	0.043333	0.034069	0.032437
13	0.035046	0.036829	0.057621	0.057621	0.044039	0.048613	0.039741	0.029530	0.028527	0.027473	0.041306	0.044819	0.043530
14	0.031489	0.034073	0.041553	0.041553	0.041778	0.032808	0.043136	0.040271	0.025129	0.021921	0.039197	0.055168	0.052520
15	0.024506	0.027557	0.037301	0.037301	0.040614	0.031806	0.039913	0.057676	0.020569	0.019697	0.037984	0.042464	0.044225
16	0.020158	0.020845	0.025190	0.025190	0.030599	0.037111	0.031314	0.052718	0.008941	0.009478	0.022205	0.034913	0.037120
17	0.015020	0.016188	0.024643	0.024643	0.024835	0.033826	0.029099	0.025424	0.010264	0.010221	0.034115	0.026429	0.028101
18	0.012516	0.011650	0.017359	0.017359	0.020413	0.030975	0.024947	0.032795	0.005473	0.005665	0.020938	0.024519	0.025898
19	0.009486	0.010535	0.016980	0.016980	0.026465	0.025322	0.031789	0.041994	0.006415	0.006044	0.024651	0.033048	0.032080
20	0.006192	0.006895	0.013360	0.013360	0.020257	0.021951	0.015251	0.029313	0.003919	0.003876	0.023297	0.021543	0.020867
21	0.005929	0.005043	0.008869	0.008869	0.016634	0.018163	0.018167	0.013318	0.002726	0.002748	0.015998	0.017856	0.017990
22	0.004480	0.003928	0.006217	0.006217	0.012252	0.015769	0.014653	0.011855	0.002065	0.001875	0.013989	0.012970	0.012870
23	0.003162	0.003086	0.005080	0.005080	0.013802	0.015855	0.018594	0.018450	0.001774	0.002168	0.010346	0.013059	0.014209
24	0.002767	0.002490	0.005094	0.005094	0.015451	0.023149	0.020950	0.013061	0.001594	0.001735	0.013522	0.011060	0.012572
25	0.003557	0.002083	0.004182	0.004182	0.015325	0.017611	0.011953	0.020123	0.001333	0.001442	0.017413	0.009550	0.009605
26	0.002635	0.001557	0.002624	0.002624	0.014173	0.013781	0.014128	0.011515	0.001143	0.001180	0.015355	0.007596	0.007859
27	0.002240	0.001164	0.001431	0.001431	0.014696	0.012718	0.014276	0.010304	0.000561	0.000678	0.014965	0.004842	0.006202
28	0.004216	0.001108	0.001628	0.001628	0.012327	0.010714	0.012460	0.005268	0.000601	0.000875	0.010998	0.003243	0.006083
29	0.002899	0.000996	0.001473	0.001473	0.010702	0.009139	0.010634	0.005263	0.000652	0.000762	0.011609	0.002710	0.005596
30	0.030040	0.009721	0.009388	0.009388	0.014149	0.015191	0.013386	0.008114	0.002797	0.004677	0.020675	0.009506	0.021026

Harris County 2012 Age Distribution Inputs to MOVES

Age	MC	PC	PT	LCT	IBus	Tbus	Sbus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.045882	0.056954	0.027448	0.027448	0.049423	0.049425	0.049424	0.058824	0.097608	0.099113	0.058831	0.042515	0.038264
1	0.053886	0.058891	0.048330	0.048330	0.045329	0.059714	0.035028	0.031880	0.126779	0.136008	0.043831	0.033445	0.030980
2	0.039223	0.057738	0.039544	0.039544	0.040021	0.036554	0.038290	0.025261	0.045306	0.047248	0.038698	0.024642	0.019216
3	0.096000	0.052304	0.034800	0.034800	0.033552	0.037391	0.045610	0.033512	0.047438	0.044614	0.032443	0.034463	0.033439
4	0.091194	0.077445	0.068786	0.068786	0.043562	0.052738	0.050298	0.026019	0.132945	0.128003	0.042122	0.046983	0.046805
5	0.110500	0.079320	0.075463	0.075463	0.057084	0.051227	0.052116	0.090902	0.079617	0.078341	0.055025	0.105601	0.098738
6	0.092660	0.074111	0.065119	0.065119	0.058637	0.036948	0.061244	0.068069	0.086083	0.086493	0.056346	0.077818	0.074498
7	0.072255	0.068847	0.062347	0.062347	0.060621	0.057742	0.054563	0.064173	0.074270	0.077526	0.058252	0.068306	0.064294
8	0.053173	0.060142	0.071715	0.071715	0.058898	0.047342	0.053753	0.038437	0.051737	0.054670	0.056420	0.052380	0.043968
9	0.064781	0.057433	0.073917	0.073917	0.054588	0.046391	0.046283	0.037755	0.044384	0.044263	0.052291	0.039152	0.036893
10	0.054028	0.057165	0.075757	0.075757	0.051128	0.047023	0.048610	0.027369	0.038057	0.034819	0.048976	0.041099	0.035878
11	0.040200	0.053090	0.067240	0.067240	0.049164	0.054162	0.044361	0.033663	0.037538	0.036367	0.046947	0.051584	0.049421
12	0.031525	0.051822	0.053864	0.053864	0.046755	0.036642	0.048269	0.046006	0.032663	0.029381	0.044646	0.061272	0.060453
13	0.025721	0.041288	0.047382	0.047382	0.045451	0.035523	0.044662	0.065891	0.027050	0.026411	0.043265	0.052513	0.053011
14	0.018634	0.033807	0.034697	0.034697	0.034444	0.041691	0.035245	0.060566	0.011652	0.012393	0.025435	0.040701	0.042901
15	0.013115	0.027118	0.032633	0.032633	0.028025	0.038094	0.032832	0.029272	0.015536	0.013865	0.039162	0.033313	0.033084
16	0.013054	0.019911	0.021189	0.021189	0.023170	0.035089	0.028314	0.037973	0.009070	0.008000	0.024172	0.028181	0.030027
17	0.010793	0.017480	0.021057	0.021057	0.030114	0.028755	0.036168	0.048730	0.010004	0.008690	0.028520	0.037073	0.038139
18	0.008227	0.012141	0.017385	0.017385	0.023187	0.025076	0.017454	0.034209	0.005878	0.005700	0.027108	0.023182	0.024847
19	0.006822	0.009349	0.012007	0.012007	0.019086	0.020799	0.020843	0.015577	0.004068	0.003981	0.018654	0.020837	0.022345
20	0.004093	0.006942	0.008639	0.008639	0.014059	0.018057	0.016812	0.013865	0.003216	0.002807	0.016312	0.014688	0.016097
21	0.003401	0.005354	0.006729	0.006729	0.015931	0.018265	0.021460	0.021702	0.003354	0.003026	0.012134	0.014113	0.017751
22	0.003238	0.003949	0.005774	0.005774	0.017879	0.026733	0.024239	0.015397	0.003262	0.002931	0.015893	0.012387	0.015312
23	0.002831	0.002701	0.005151	0.005151	0.017733	0.020338	0.013830	0.023721	0.002732	0.002358	0.020466	0.011370	0.011890
24	0.003421	0.001982	0.003483	0.003483	0.016499	0.016010	0.016445	0.013653	0.002086	0.001936	0.018152	0.008760	0.009838
25	0.002566	0.001486	0.002231	0.002231	0.017150	0.014812	0.016658	0.012243	0.001441	0.001212	0.017729	0.005795	0.008080
26	0.004114	0.001196	0.002535	0.002535	0.014386	0.012478	0.014539	0.006260	0.001441	0.001462	0.013030	0.003451	0.007797
27	0.003849	0.001219	0.002143	0.002143	0.012564	0.010708	0.012483	0.006290	0.000715	0.001166	0.013833	0.002876	0.007107
28	0.003095	0.000985	0.002053	0.002053	0.009886	0.008347	0.009640	0.005160	0.000726	0.000970	0.014032	0.003274	0.005442
29	0.002464	0.000755	0.001334	0.001334	0.003902	0.007916	0.003521	0.002322	0.000415	0.000591	0.009061	0.000929	0.002480
30	0.025253	0.007077	0.009249	0.009249	0.007748	0.008017	0.007005	0.005296	0.002927	0.005654	0.008214	0.007300	0.021006

Harris County 2014 Age Distribution Inputs to MOVES (2014, 2017, 2020, 2023, 2026, and 2028 Analysis Years)

Age	MC	PC	PT	LCT	IBus	Tbus	Sbus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.041700	0.065600	0.031518	0.031518	0.055550	0.055650	0.055556	0.064759	0.084720	0.080736	0.064928	0.040776	0.044007
1	0.074575	0.076227	0.050539	0.050539	0.049845	0.049946	0.049851	0.058272	0.099024	0.097975	0.058445	0.045307	0.048909
2	0.064531	0.068965	0.043006	0.043006	0.046006	0.046100	0.046012	0.053507	0.139229	0.150497	0.053673	0.043397	0.050486
3	0.043713	0.058501	0.045770	0.045770	0.042195	0.055697	0.032610	0.028999	0.095185	0.104892	0.039988	0.031182	0.032874
4	0.033668	0.055270	0.037853	0.037853	0.037253	0.034095	0.035647	0.022977	0.034371	0.036093	0.035305	0.020122	0.017742
5	0.080294	0.048562	0.033218	0.033218	0.031055	0.034678	0.042221	0.030317	0.035143	0.034013	0.029436	0.028828	0.031415
6	0.076032	0.070340	0.064775	0.064775	0.039993	0.048515	0.046183	0.023359	0.101750	0.093698	0.037928	0.045973	0.043640
7	0.094751	0.071820	0.071330	0.071330	0.052281	0.047012	0.047736	0.081433	0.059089	0.057695	0.049441	0.104962	0.094086
8	0.080786	0.066148	0.061027	0.061027	0.053396	0.033713	0.055776	0.060642	0.066056	0.064010	0.050348	0.074224	0.070679
9	0.063717	0.060102	0.058713	0.058713	0.055068	0.052558	0.049572	0.057049	0.057215	0.057569	0.051939	0.068094	0.061342
10	0.045983	0.051641	0.066065	0.066065	0.053504	0.043092	0.048835	0.034170	0.040706	0.040882	0.050306	0.053036	0.041119
11	0.057506	0.048348	0.067479	0.067479	0.049302	0.041983	0.041807	0.033378	0.033980	0.033007	0.046365	0.034735	0.032913
12	0.048853	0.046294	0.068120	0.068120	0.046065	0.042452	0.043802	0.024143	0.029049	0.026419	0.043333	0.034069	0.032437
13	0.035232	0.041390	0.060118	0.060118	0.044039	0.048613	0.039741	0.029530	0.028527	0.027473	0.041306	0.044819	0.043530
14	0.027479	0.039102	0.047321	0.047321	0.041778	0.032808	0.043136	0.040271	0.025129	0.021921	0.039197	0.055168	0.052520
15	0.022403	0.030110	0.040584	0.040584	0.040614	0.031806	0.039913	0.057676	0.020569	0.019697	0.037984	0.042464	0.044225
16	0.015785	0.023947	0.029053	0.029053	0.030599	0.037111	0.031314	0.052718	0.008941	0.009478	0.022205	0.034913	0.037120
17	0.011351	0.018569	0.027243	0.027243	0.024835	0.033826	0.029099	0.025424	0.010264	0.010221	0.034115	0.026429	0.028101
18	0.010966	0.013123	0.017448	0.017448	0.020413	0.030975	0.024947	0.032795	0.005473	0.005665	0.020938	0.024519	0.025898
19	0.009274	0.010889	0.017264	0.017264	0.026465	0.025322	0.031789	0.041994	0.006415	0.006044	0.024651	0.033048	0.032080
20	0.007068	0.007378	0.013932	0.013932	0.020257	0.021951	0.015251	0.029313	0.003919	0.003876	0.023297	0.021543	0.020867
21	0.005569	0.005564	0.009254	0.009254	0.016634	0.018163	0.018167	0.013318	0.002726	0.002748	0.015998	0.017856	0.017990
22	0.003641	0.004043	0.006578	0.006578	0.012252	0.015769	0.014653	0.011855	0.002065	0.001875	0.013989	0.012970	0.012870
23	0.002699	0.003098	0.005093	0.005093	0.013802	0.015855	0.018594	0.018450	0.001774	0.002168	0.010346	0.013059	0.014209
24	0.002741	0.002350	0.004350	0.004350	0.015451	0.023149	0.020950	0.013061	0.001594	0.001735	0.013522	0.011060	0.012572
25	0.002420	0.001633	0.003927	0.003927	0.015325	0.017611	0.011953	0.020123	0.001333	0.001442	0.017413	0.009550	0.009605
26	0.002484	0.001253	0.002622	0.002622	0.014173	0.013781	0.014128	0.011515	0.001143	0.001180	0.015355	0.007596	0.007859
27	0.001928	0.001002	0.001749	0.001749	0.014696	0.012718	0.014276	0.010304	0.000561	0.000678	0.014965	0.004842	0.006202
28	0.003491	0.000833	0.001985	0.001985	0.012327	0.010714	0.012460	0.005268	0.000601	0.000875	0.010998	0.003243	0.006083
29	0.002806	0.000826	0.001763	0.001763	0.010702	0.009139	0.010634	0.005263	0.000652	0.000762	0.011609	0.002710	0.005596
30	0.026558	0.007070	0.010301	0.010301	0.014149	0.015191	0.013386	0.008114	0.002797	0.004677	0.020675	0.009506	0.021026

Liberty County 2012 Age Distribution Inputs to MOVES

Age	MC	PC	PT	LCT	IBus	Tbus	Sbus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.023891	0.042696	0.024444	0.024444	0.049423	0.049425	0.049424	0.058824	0.097608	0.099113	0.058831	0.042515	0.038264
1	0.039249	0.050351	0.043519	0.043519	0.045329	0.059714	0.035028	0.031880	0.126779	0.136008	0.043831	0.033445	0.030980
2	0.034130	0.052283	0.032334	0.032334	0.040021	0.036554	0.038290	0.025261	0.045306	0.047248	0.038698	0.024642	0.019216
3	0.080205	0.047453	0.031480	0.031480	0.033552	0.037391	0.045610	0.033512	0.047438	0.044614	0.032443	0.034463	0.033439
4	0.081342	0.076363	0.066010	0.066010	0.043562	0.052738	0.050298	0.026019	0.132945	0.128003	0.042122	0.046983	0.046805
5	0.102389	0.074691	0.068898	0.068898	0.057084	0.051227	0.052116	0.090902	0.079617	0.078341	0.055025	0.105601	0.098738
6	0.097270	0.070083	0.062472	0.062472	0.058637	0.036948	0.061244	0.068069	0.086083	0.086493	0.056346	0.077818	0.074498
7	0.080774	0.068931	0.053362	0.053362	0.060621	0.057742	0.054563	0.064173	0.074270	0.077526	0.058252	0.068306	0.064294
8	0.059158	0.053658	0.061496	0.061496	0.058898	0.047342	0.053753	0.038437	0.051737	0.054670	0.056420	0.052380	0.043968
9	0.065415	0.052172	0.067393	0.067393	0.054588	0.046391	0.046283	0.037755	0.044384	0.044263	0.052291	0.039152	0.036893
10	0.069397	0.051132	0.069305	0.069305	0.051128	0.047023	0.048610	0.027369	0.038057	0.034819	0.048976	0.041099	0.035878
11	0.051763	0.052729	0.068288	0.068288	0.049164	0.054162	0.044361	0.033663	0.037538	0.036367	0.046947	0.051584	0.049421
12	0.034699	0.054067	0.051613	0.051613	0.046755	0.036642	0.048269	0.046006	0.032663	0.029381	0.044646	0.061272	0.060453
13	0.033561	0.048345	0.050433	0.050433	0.045451	0.035523	0.044662	0.065891	0.027050	0.026411	0.043265	0.052513	0.053011
14	0.024460	0.038051	0.039818	0.039818	0.034444	0.041691	0.035245	0.060566	0.011652	0.012393	0.025435	0.040701	0.042901
15	0.018203	0.033444	0.041811	0.041811	0.028025	0.038094	0.032832	0.029272	0.015536	0.013865	0.039162	0.033313	0.033084
16	0.015358	0.025937	0.028714	0.028714	0.023170	0.035089	0.028314	0.037973	0.009070	0.008000	0.024172	0.028181	0.030027
17	0.011945	0.023671	0.029365	0.029365	0.030114	0.028755	0.036168	0.048730	0.010004	0.008690	0.028520	0.037073	0.038139
18	0.008532	0.017539	0.024810	0.024810	0.023187	0.025076	0.017454	0.034209	0.005878	0.005700	0.027108	0.023182	0.024847
19	0.005688	0.014418	0.015211	0.015211	0.019086	0.020799	0.020843	0.015577	0.004068	0.003981	0.018654	0.020837	0.022345
20	0.002844	0.011631	0.013503	0.013503	0.014059	0.018057	0.016812	0.013865	0.003216	0.002807	0.016312	0.014688	0.016097
21	0.002844	0.009513	0.010087	0.010087	0.015931	0.018265	0.021460	0.021702	0.003354	0.003026	0.012134	0.014113	0.017751
22	0.002844	0.005983	0.008582	0.008582	0.017879	0.026733	0.024239	0.015397	0.003262	0.002931	0.015893	0.012387	0.015312
23	0.004551	0.004905	0.008012	0.008012	0.017733	0.020338	0.013830	0.023721	0.002732	0.002358	0.020466	0.011370	0.011890
24	0.004551	0.004013	0.006223	0.006223	0.016499	0.016010	0.016445	0.013653	0.002086	0.001936	0.018152	0.008760	0.009838
25	0.004551	0.002453	0.003172	0.003172	0.017150	0.014812	0.016658	0.012243	0.001441	0.001212	0.017729	0.005795	0.008080
26	0.007395	0.001895	0.003213	0.003213	0.014386	0.012478	0.014539	0.006260	0.001441	0.001462	0.013030	0.003451	0.007797
27	0.003413	0.001858	0.003172	0.003172	0.012564	0.010708	0.012483	0.006290	0.000715	0.001166	0.013833	0.002876	0.007107
28	0.001706	0.001524	0.002684	0.002684	0.009886	0.008347	0.009640	0.005160	0.000726	0.000970	0.014032	0.003274	0.005442
29	0.003413	0.000520	0.001708	0.001708	0.003902	0.007916	0.003521	0.002322	0.000415	0.000591	0.009061	0.000929	0.002480
30	0.024460	0.007692	0.008866	0.008866	0.007748	0.008017	0.007005	0.005296	0.002927	0.005654	0.008214	0.007300	0.021006

Liberty County 2014 Age Distribution Inputs to MOVES (2014, 2017, 2020, 2023, 2026, and 2028 Analysis Years)

Age	MC	PC	PT	LCT	IBus	Tbus	Sbus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.035294	0.045784	0.025960	0.025960	0.055550	0.055650	0.055556	0.064759	0.084720	0.080736	0.064928	0.040776	0.044007
1	0.051393	0.072277	0.047689	0.047689	0.049845	0.049946	0.049851	0.058272	0.099024	0.097975	0.058445	0.045307	0.048909
2	0.044582	0.065762	0.043050	0.043050	0.046006	0.046100	0.046012	0.053507	0.139229	0.150497	0.053673	0.043397	0.050486
3	0.035913	0.055592	0.041626	0.041626	0.042195	0.055697	0.032610	0.028999	0.095185	0.104892	0.039988	0.031182	0.032874
4	0.031579	0.051321	0.033407	0.033407	0.037253	0.034095	0.035647	0.022977	0.034371	0.036093	0.035305	0.020122	0.017742
5	0.081115	0.041911	0.030843	0.030843	0.031055	0.034678	0.042221	0.030317	0.035143	0.034013	0.029436	0.028828	0.031415
6	0.074303	0.068404	0.059774	0.059774	0.039993	0.048515	0.046183	0.023359	0.101750	0.093698	0.037928	0.045973	0.043640
7	0.092879	0.068006	0.061849	0.061849	0.052281	0.047012	0.047736	0.081433	0.059089	0.057695	0.049441	0.104962	0.094086
8	0.085449	0.065364	0.061646	0.061646	0.053396	0.033713	0.055776	0.060642	0.066056	0.064010	0.050348	0.074224	0.070679
9	0.078638	0.059428	0.050781	0.050781	0.055068	0.052558	0.049572	0.057049	0.057215	0.057569	0.051939	0.068094	0.061342
10	0.052012	0.048136	0.057292	0.057292	0.053504	0.043092	0.048835	0.034170	0.040706	0.040882	0.050306	0.053036	0.041119
11	0.050774	0.046797	0.064860	0.064860	0.049302	0.041983	0.041807	0.033378	0.033980	0.033007	0.046365	0.034735	0.032913
12	0.060681	0.045277	0.062785	0.062785	0.046065	0.042452	0.043802	0.024143	0.029049	0.026419	0.043333	0.034069	0.032437
13	0.043344	0.044915	0.061727	0.061727	0.044039	0.048613	0.039741	0.029530	0.028527	0.027473	0.041306	0.044819	0.043530
14	0.029721	0.043540	0.047933	0.047933	0.041778	0.032808	0.043136	0.040271	0.025129	0.021921	0.039197	0.055168	0.052520
15	0.023529	0.036518	0.042074	0.042074	0.040614	0.031806	0.039913	0.057676	0.020569	0.019697	0.037984	0.042464	0.044225
16	0.022291	0.028882	0.035360	0.035360	0.030599	0.037111	0.031314	0.052718	0.008941	0.009478	0.022205	0.034913	0.037120
17	0.014861	0.022367	0.035726	0.035726	0.024835	0.033826	0.029099	0.025424	0.010264	0.010221	0.034115	0.026429	0.028101
18	0.016718	0.018277	0.024414	0.024414	0.020413	0.030975	0.024947	0.032795	0.005473	0.005665	0.020938	0.024519	0.025898
19	0.008669	0.015201	0.024618	0.024618	0.026465	0.025322	0.031789	0.041994	0.006415	0.006044	0.024651	0.033048	0.032080
20	0.012384	0.012052	0.020955	0.020955	0.020257	0.021951	0.015251	0.029313	0.003919	0.003876	0.023297	0.021543	0.020867
21	0.004954	0.008578	0.013916	0.013916	0.016634	0.018163	0.018167	0.013318	0.002726	0.002748	0.015998	0.017856	0.017990
22	0.003715	0.007419	0.010295	0.010295	0.012252	0.015769	0.014653	0.011855	0.002065	0.001875	0.013989	0.012970	0.012870
23	0.002477	0.005718	0.007446	0.007446	0.013802	0.015855	0.018594	0.018450	0.001774	0.002168	0.010346	0.013059	0.014209
24	0.002477	0.003511	0.006266	0.006266	0.015451	0.023149	0.020950	0.013061	0.001594	0.001735	0.013522	0.011060	0.012572
25	0.005573	0.003004	0.005656	0.005656	0.015325	0.017611	0.011953	0.020123	0.001333	0.001442	0.017413	0.009550	0.009605
26	0.003096	0.002316	0.004232	0.004232	0.014173	0.013781	0.014128	0.011515	0.001143	0.001180	0.015355	0.007596	0.007859
27	0.000619	0.001810	0.002523	0.002523	0.014696	0.012718	0.014276	0.010304	0.000561	0.000678	0.014965	0.004842	0.006202
28	0.004334	0.001194	0.002319	0.002319	0.012327	0.010714	0.012460	0.005268	0.000601	0.000875	0.010998	0.003243	0.006083
29	0.000619	0.001484	0.002075	0.002075	0.010702	0.009139	0.010634	0.005263	0.000652	0.000762	0.011609	0.002710	0.005596
30	0.026006	0.009157	0.010905	0.010905	0.014149	0.015191	0.013386	0.008114	0.002797	0.004677	0.020675	0.009506	0.021026

Montgomery County 2012 Age Distribution Inputs to MOVES

Age	MC	PC	PT	LCT	IBus	Tbus	Sbus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.046041	0.057957	0.029836	0.029836	0.049423	0.049425	0.049424	0.058824	0.097608	0.099113	0.058831	0.042515	0.038264
1	0.050343	0.070848	0.058195	0.058195	0.045329	0.059714	0.035028	0.031880	0.126779	0.136008	0.043831	0.033445	0.030980
2	0.036247	0.069773	0.050798	0.050798	0.040021	0.036554	0.038290	0.025261	0.045306	0.047248	0.038698	0.024642	0.019216
3	0.088330	0.058850	0.041676	0.041676	0.033552	0.037391	0.045610	0.033512	0.047438	0.044614	0.032443	0.034463	0.033439
4	0.084943	0.088791	0.073653	0.073653	0.043562	0.052738	0.050298	0.026019	0.132945	0.128003	0.042122	0.046983	0.046805
5	0.107368	0.086174	0.079387	0.079387	0.057084	0.051227	0.052116	0.090902	0.079617	0.078341	0.055025	0.105601	0.098738
6	0.094279	0.077066	0.066106	0.066106	0.058637	0.036948	0.061244	0.068069	0.086083	0.086493	0.056346	0.077818	0.074498
7	0.073135	0.068928	0.061257	0.061257	0.060621	0.057742	0.054563	0.064173	0.074270	0.077526	0.058252	0.068306	0.064294
8	0.058490	0.060971	0.070167	0.070167	0.058898	0.047342	0.053753	0.038437	0.051737	0.054670	0.056420	0.052380	0.043968
9	0.070389	0.054432	0.071353	0.071353	0.054588	0.046391	0.046283	0.037755	0.044384	0.044263	0.052291	0.039152	0.036893
10	0.054462	0.051801	0.069875	0.069875	0.051128	0.047023	0.048610	0.027369	0.038057	0.034819	0.048976	0.041099	0.035878
11	0.042380	0.046953	0.064371	0.064371	0.049164	0.054162	0.044361	0.033663	0.037538	0.036367	0.046947	0.051584	0.049421
12	0.034783	0.043572	0.047754	0.047754	0.046755	0.036642	0.048269	0.046006	0.032663	0.029381	0.044646	0.061272	0.060453
13	0.028650	0.034769	0.041445	0.041445	0.045451	0.035523	0.044662	0.065891	0.027050	0.026411	0.043265	0.052513	0.053011
14	0.020686	0.027505	0.030898	0.030898	0.034444	0.041691	0.035245	0.060566	0.011652	0.012393	0.025435	0.040701	0.042901
15	0.013730	0.021970	0.029660	0.029660	0.028025	0.038094	0.032832	0.029272	0.015536	0.013865	0.039162	0.033313	0.033084
16	0.012082	0.015756	0.020811	0.020811	0.023170	0.035089	0.028314	0.037973	0.009070	0.008000	0.024172	0.028181	0.030027
17	0.010069	0.014089	0.019227	0.019227	0.030114	0.028755	0.036168	0.048730	0.010004	0.008690	0.028520	0.037073	0.038139
18	0.007414	0.009805	0.015803	0.015803	0.023187	0.025076	0.017454	0.034209	0.005878	0.005700	0.027108	0.023182	0.024847
19	0.007048	0.007126	0.011060	0.011060	0.019086	0.020799	0.020843	0.015577	0.004068	0.003981	0.018654	0.020837	0.022345
20	0.005309	0.005636	0.008070	0.008070	0.014059	0.018057	0.016812	0.013865	0.003216	0.002807	0.016312	0.014688	0.016097
21	0.002654	0.004509	0.006265	0.006265	0.015931	0.018265	0.021460	0.021702	0.003354	0.003026	0.012134	0.014113	0.017751
22	0.003295	0.003424	0.005495	0.005495	0.017879	0.026733	0.024239	0.015397	0.003262	0.002931	0.015893	0.012387	0.015312
23	0.003295	0.002718	0.004637	0.004637	0.017733	0.020338	0.013830	0.023721	0.002732	0.002358	0.020466	0.011370	0.011890
24	0.003387	0.001958	0.003088	0.003088	0.016499	0.016010	0.016445	0.013653	0.002086	0.001936	0.018152	0.008760	0.009838
25	0.003478	0.001595	0.002017	0.002017	0.017150	0.014812	0.016658	0.012243	0.001441	0.001212	0.017729	0.005795	0.008080
26	0.003844	0.001261	0.002106	0.002106	0.014386	0.012478	0.014539	0.006260	0.001441	0.001462	0.013030	0.003451	0.007797
27	0.003661	0.001122	0.002150	0.002150	0.012564	0.010708	0.012483	0.006290	0.000715	0.001166	0.013833	0.002876	0.007107
28	0.003387	0.000879	0.002088	0.002088	0.009886	0.008347	0.009640	0.005160	0.000726	0.000970	0.014032	0.003274	0.005442
29	0.003295	0.000683	0.001274	0.001274	0.003902	0.007916	0.003521	0.002322	0.000415	0.000591	0.009061	0.000929	0.002480
30	0.023524	0.009079	0.009477	0.009477	0.007748	0.008017	0.007005	0.005296	0.002927	0.005654	0.008214	0.007300	0.021006

Montgomery County 2014 Age Distribution Inputs to MOVES (2014, 2017, 2020, 2023, 2026, and 2028 Analysis Years)

Age	MC	PC	PT	LCT	IBus	Tbus	Sbus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.039192	0.062061	0.031242	0.031242	0.055550	0.055650	0.055556	0.064759	0.084720	0.080736	0.064928	0.040776	0.044007
1	0.073451	0.096070	0.059737	0.059737	0.049845	0.049946	0.049851	0.058272	0.099024	0.097975	0.058445	0.045307	0.048909
2	0.062945	0.084156	0.054686	0.054686	0.046006	0.046100	0.046012	0.053507	0.139229	0.150497	0.053673	0.043397	0.050486
3	0.044034	0.068771	0.055112	0.055112	0.042195	0.055697	0.032610	0.028999	0.095185	0.104892	0.039988	0.031182	0.032874
4	0.033894	0.061796	0.046689	0.046689	0.037253	0.034095	0.035647	0.022977	0.034371	0.036093	0.035305	0.020122	0.017742
5	0.072355	0.051148	0.037301	0.037301	0.031055	0.034678	0.042221	0.030317	0.035143	0.034013	0.029436	0.028828	0.031415
6	0.076192	0.074088	0.066309	0.066309	0.039993	0.048515	0.046183	0.023359	0.101750	0.093698	0.037928	0.045973	0.043640
7	0.092363	0.070885	0.069620	0.069620	0.052281	0.047012	0.047736	0.081433	0.059089	0.057695	0.049441	0.104962	0.094086
8	0.080395	0.063575	0.059763	0.059763	0.053396	0.033713	0.055776	0.060642	0.066056	0.064010	0.050348	0.074224	0.070679
9	0.065047	0.056213	0.055086	0.055086	0.055068	0.052558	0.049572	0.057049	0.057215	0.057569	0.051939	0.068094	0.061342
10	0.050978	0.048773	0.062753	0.062753	0.053504	0.043092	0.048835	0.034170	0.040706	0.040882	0.050306	0.053036	0.041119
11	0.061392	0.042868	0.062527	0.062527	0.049302	0.041983	0.041807	0.033378	0.033980	0.033007	0.046365	0.034735	0.032913
12	0.047597	0.040514	0.061693	0.061693	0.046065	0.042452	0.043802	0.024143	0.029049	0.026419	0.043333	0.034069	0.032437
13	0.037091	0.034744	0.055790	0.055790	0.044039	0.048613	0.039741	0.029530	0.028527	0.027473	0.041306	0.044819	0.043530
14	0.027864	0.031977	0.041743	0.041743	0.041778	0.032808	0.043136	0.040271	0.025129	0.021921	0.039197	0.055168	0.052520
15	0.023479	0.024845	0.034797	0.034797	0.040614	0.031806	0.039913	0.057676	0.020569	0.019697	0.037984	0.042464	0.044225
16	0.015257	0.019141	0.025722	0.025722	0.030599	0.037111	0.031314	0.052718	0.008941	0.009478	0.022205	0.034913	0.037120
17	0.011785	0.014755	0.025244	0.025244	0.024835	0.033826	0.029099	0.025424	0.010264	0.010221	0.034115	0.026429	0.028101
18	0.010963	0.010269	0.017516	0.017516	0.020413	0.030975	0.024947	0.032795	0.005473	0.005665	0.020938	0.024519	0.025898
19	0.009410	0.009168	0.015882	0.015882	0.026465	0.025322	0.031789	0.041994	0.006415	0.006044	0.024651	0.033048	0.032080
20	0.007126	0.006100	0.012857	0.012857	0.020257	0.021951	0.015251	0.029313	0.003919	0.003876	0.023297	0.021543	0.020867
21	0.006578	0.004421	0.008606	0.008606	0.016634	0.018163	0.018167	0.013318	0.002726	0.002748	0.015998	0.017856	0.017990
22	0.004202	0.003329	0.006537	0.006537	0.012252	0.015769	0.014653	0.011855	0.002065	0.001875	0.013989	0.012970	0.012870
23	0.002467	0.002654	0.004937	0.004937	0.013802	0.015855	0.018594	0.018450	0.001774	0.002168	0.010346	0.013059	0.014209
24	0.002832	0.002324	0.004485	0.004485	0.015451	0.023149	0.020950	0.013061	0.001594	0.001735	0.013522	0.011060	0.012572
25	0.003746	0.001832	0.003781	0.003781	0.015325	0.017611	0.011953	0.020123	0.001333	0.001442	0.017413	0.009550	0.009605
26	0.003289	0.001392	0.002747	0.002747	0.014173	0.013781	0.014128	0.011515	0.001143	0.001180	0.015355	0.007596	0.007859
27	0.002284	0.001157	0.001695	0.001695	0.014696	0.012718	0.014276	0.010304	0.000561	0.000678	0.014965	0.004842	0.006202
28	0.002558	0.000918	0.001886	0.001886	0.012327	0.010714	0.012460	0.005268	0.000601	0.000875	0.010998	0.003243	0.006083
29	0.003198	0.000814	0.001886	0.001886	0.010702	0.009139	0.010634	0.005263	0.000652	0.000762	0.011609	0.002710	0.005596
30	0.026037	0.009242	0.011370	0.011370	0.014149	0.015191	0.013386	0.008114	0.002797	0.004677	0.020675	0.009506	0.021026

Waller County 2012 Age Distribution Inputs to MOVES

Age	MC	PC	PT	LCT	IBus	Tbus	Sbus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.029377	0.036244	0.017916	0.017916	0.049423	0.049425	0.049424	0.058824	0.097608	0.099113	0.058831	0.042515	0.038264
1	0.045828	0.042338	0.038129	0.038129	0.045329	0.059714	0.035028	0.031880	0.126779	0.136008	0.043831	0.033445	0.030980
2	0.043478	0.048175	0.037133	0.037133	0.040021	0.036554	0.038290	0.025261	0.045306	0.047248	0.038698	0.024642	0.019216
3	0.075206	0.042273	0.028482	0.028482	0.033552	0.037391	0.045610	0.033512	0.047438	0.044614	0.032443	0.034463	0.033439
4	0.084606	0.070755	0.059184	0.059184	0.043562	0.052738	0.050298	0.026019	0.132945	0.128003	0.042122	0.046983	0.046805
5	0.108108	0.069985	0.067070	0.067070	0.057084	0.051227	0.052116	0.090902	0.079617	0.078341	0.055025	0.105601	0.098738
6	0.082256	0.069408	0.062400	0.062400	0.058637	0.036948	0.061244	0.068069	0.086083	0.086493	0.056346	0.077818	0.074498
7	0.075206	0.065495	0.055662	0.055662	0.060621	0.057742	0.054563	0.064173	0.074270	0.077526	0.058252	0.068306	0.064294
8	0.052879	0.053756	0.069750	0.069750	0.058898	0.047342	0.053753	0.038437	0.051737	0.054670	0.056420	0.052380	0.043968
9	0.069330	0.050741	0.067682	0.067682	0.054588	0.046391	0.046283	0.037755	0.044384	0.044263	0.052291	0.039152	0.036893
10	0.050529	0.058374	0.072506	0.072506	0.051128	0.047023	0.048610	0.027369	0.038057	0.034819	0.048976	0.041099	0.035878
11	0.048179	0.056386	0.067836	0.067836	0.049164	0.054162	0.044361	0.033663	0.037538	0.036367	0.046947	0.051584	0.049421
12	0.035253	0.057990	0.049154	0.049154	0.046755	0.036642	0.048269	0.046006	0.032663	0.029381	0.044646	0.061272	0.060453
13	0.035253	0.048881	0.050685	0.050685	0.045451	0.035523	0.044662	0.065891	0.027050	0.026411	0.043265	0.052513	0.053011
14	0.028202	0.042658	0.038588	0.038588	0.034444	0.041691	0.035245	0.060566	0.011652	0.012393	0.025435	0.040701	0.042901
15	0.014101	0.034383	0.041421	0.041421	0.028025	0.038094	0.032832	0.029272	0.015536	0.013865	0.039162	0.033313	0.033084
16	0.014101	0.029380	0.029783	0.029783	0.023170	0.035089	0.028314	0.037973	0.009070	0.008000	0.024172	0.028181	0.030027
17	0.014101	0.024055	0.030626	0.030626	0.030114	0.028755	0.036168	0.048730	0.010004	0.008690	0.028520	0.037073	0.038139
18	0.015276	0.020720	0.022893	0.022893	0.023187	0.025076	0.017454	0.034209	0.005878	0.005700	0.027108	0.023182	0.024847
19	0.012926	0.015973	0.015849	0.015849	0.019086	0.020799	0.020843	0.015577	0.004068	0.003981	0.018654	0.020837	0.022345
20	0.002350	0.012124	0.014624	0.014624	0.014059	0.018057	0.016812	0.013865	0.003216	0.002807	0.016312	0.014688	0.016097
21	0.003525	0.010135	0.010413	0.010413	0.015931	0.018265	0.021460	0.021702	0.003354	0.003026	0.012134	0.014113	0.017751
22	0.004700	0.006928	0.009647	0.009647	0.017879	0.026733	0.024239	0.015397	0.003262	0.002931	0.015893	0.012387	0.015312
23	0.005875	0.005453	0.007963	0.007963	0.017733	0.020338	0.013830	0.023721	0.002732	0.002358	0.020466	0.011370	0.011890
24	0.007051	0.004811	0.006431	0.006431	0.016499	0.016010	0.016445	0.013653	0.002086	0.001936	0.018152	0.008760	0.009838
25	0.003525	0.003464	0.003598	0.003598	0.017150	0.014812	0.016658	0.012243	0.001441	0.001212	0.017729	0.005795	0.008080
26	0.004700	0.001283	0.003675	0.003675	0.014386	0.012478	0.014539	0.006260	0.001441	0.001462	0.013030	0.003451	0.007797
27	0.003525	0.001860	0.003369	0.003369	0.012564	0.010708	0.012483	0.006290	0.000715	0.001166	0.013833	0.002876	0.007107
28	0.003525	0.001668	0.003598	0.003598	0.009886	0.008347	0.009640	0.005160	0.000726	0.000970	0.014032	0.003274	0.005442
29	0.003525	0.001283	0.001761	0.001761	0.003902	0.007916	0.003521	0.002322	0.000415	0.000591	0.009061	0.000929	0.002480
30	0.023502	0.013022	0.012174	0.012174	0.007748	0.008017	0.007005	0.005296	0.002927	0.005654	0.008214	0.007300	0.021006

Waller County 2014 Age Distribution Inputs to MOVES (2014, 2017, 2020, 2023, 2026, and 2028 Analysis Years)

Age	MC	PC	PT	LCT	IBus	Tbus	Sbus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.032768	0.039187	0.020653	0.020653	0.055550	0.055650	0.055556	0.064759	0.084720	0.080736	0.064928	0.040776	0.044007
1	0.051977	0.063437	0.044613	0.044613	0.049845	0.049946	0.049851	0.058272	0.099024	0.097975	0.058445	0.045307	0.048909
2	0.054237	0.062910	0.038365	0.038365	0.046006	0.046100	0.046012	0.053507	0.139229	0.150497	0.053673	0.043397	0.050486
3	0.038418	0.048559	0.039247	0.039247	0.042195	0.055697	0.032610	0.028999	0.095185	0.104892	0.039988	0.031182	0.032874
4	0.032768	0.049379	0.035352	0.035352	0.037253	0.034095	0.035647	0.022977	0.034371	0.036093	0.035305	0.020122	0.017742
5	0.070056	0.042701	0.027561	0.027561	0.031055	0.034678	0.042221	0.030317	0.035143	0.034013	0.029436	0.028828	0.031415
6	0.072316	0.061856	0.057695	0.057695	0.039993	0.048515	0.046183	0.023359	0.101750	0.093698	0.037928	0.045973	0.043640
7	0.092655	0.063730	0.059827	0.059827	0.052281	0.047012	0.047736	0.081433	0.059089	0.057695	0.049441	0.104962	0.094086
8	0.067797	0.063730	0.059018	0.059018	0.053396	0.033713	0.055776	0.060642	0.066056	0.064010	0.050348	0.074224	0.070679
9	0.074576	0.060918	0.050860	0.050860	0.055068	0.052558	0.049572	0.057049	0.057215	0.057569	0.051939	0.068094	0.061342
10	0.049718	0.049965	0.066956	0.066956	0.053504	0.043092	0.048835	0.034170	0.040706	0.040882	0.050306	0.053036	0.041119
11	0.056497	0.047680	0.065192	0.065192	0.049302	0.041983	0.041807	0.033378	0.033980	0.033007	0.046365	0.034735	0.032913
12	0.055367	0.048676	0.064971	0.064971	0.046065	0.042452	0.043802	0.024143	0.029049	0.026419	0.043333	0.034069	0.032437
13	0.041808	0.047856	0.062987	0.062987	0.044039	0.048613	0.039741	0.029530	0.028527	0.027473	0.041306	0.044819	0.043530
14	0.035028	0.050199	0.049831	0.049831	0.041778	0.032808	0.043136	0.040271	0.025129	0.021921	0.039197	0.055168	0.052520
15	0.036158	0.038425	0.045201	0.045201	0.040614	0.031806	0.039913	0.057676	0.020569	0.019697	0.037984	0.042464	0.044225
16	0.023729	0.033271	0.033588	0.033588	0.030599	0.037111	0.031314	0.052718	0.008941	0.009478	0.022205	0.034913	0.037120
17	0.011299	0.027413	0.036601	0.036601	0.024835	0.033826	0.029099	0.025424	0.010264	0.010221	0.034115	0.026429	0.028101
18	0.015819	0.020326	0.025503	0.025503	0.020413	0.030975	0.024947	0.032795	0.005473	0.005665	0.020938	0.024519	0.025898
19	0.007910	0.017690	0.025062	0.025062	0.026465	0.025322	0.031789	0.041994	0.006415	0.006044	0.024651	0.033048	0.032080
20	0.012429	0.011949	0.018668	0.018668	0.020257	0.021951	0.015251	0.029313	0.003919	0.003876	0.023297	0.021543	0.020867
21	0.006780	0.009489	0.012568	0.012568	0.016634	0.018163	0.018167	0.013318	0.002726	0.002748	0.015998	0.017856	0.017990
22	0.003390	0.007146	0.011392	0.011392	0.012252	0.015769	0.014653	0.011855	0.002065	0.001875	0.013989	0.012970	0.012870
23	0.005650	0.005858	0.007350	0.007350	0.013802	0.015855	0.018594	0.018450	0.001774	0.002168	0.010346	0.013059	0.014209
24	0.004520	0.003925	0.007497	0.007497	0.015451	0.023149	0.020950	0.013061	0.001594	0.001735	0.013522	0.011060	0.012572
25	0.004520	0.003222	0.005806	0.005806	0.015325	0.017611	0.011953	0.020123	0.001333	0.001442	0.017413	0.009550	0.009605
26	0.003390	0.003163	0.004777	0.004777	0.014173	0.013781	0.014128	0.011515	0.001143	0.001180	0.015355	0.007596	0.007859
27	0.003390	0.002402	0.003454	0.003454	0.014696	0.012718	0.014276	0.010304	0.000561	0.000678	0.014965	0.004842	0.006202
28	0.004520	0.000879	0.002499	0.002499	0.012327	0.010714	0.012460	0.005268	0.000601	0.000875	0.010998	0.003243	0.006083
29	0.002260	0.001289	0.002278	0.002278	0.010702	0.009139	0.010634	0.005263	0.000652	0.000762	0.011609	0.002710	0.005596
30	0.028249	0.012769	0.014626	0.014626	0.014149	0.015191	0.013386	0.008114	0.002797	0.004677	0.020675	0.009506	0.021026

Texas Statewide 2012 Fuel Engine Fractions Summary

SUT	Fuel Type	Model Year															
		2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998	1997
PC	Gas	0.988	0.988	0.990	0.993	0.999	1.000	0.993	0.995	0.997	0.996	0.996	0.997	0.997	0.998	0.998	0.999
PC	Diesel	0.012	0.012	0.010	0.007	0.001	0.000	0.007	0.005	0.003	0.004	0.004	0.003	0.003	0.002	0.002	0.001
PT	Gas	0.980	0.980	0.987	0.985	0.977	0.981	0.975	0.979	0.982	0.982	0.983	0.989	0.992	0.981	0.993	0.992
PT	Diesel	0.020	0.020	0.013	0.015	0.023	0.019	0.025	0.021	0.018	0.018	0.017	0.011	0.008	0.019	0.007	0.008
PT	Gas	0.980	0.980	0.987	0.985	0.977	0.981	0.975	0.979	0.982	0.982	0.983	0.989	0.992	0.981	0.993	0.992
PT	Diesel	0.020	0.020	0.013	0.015	0.023	0.019	0.025	0.021	0.018	0.018	0.017	0.011	0.008	0.019	0.007	0.008
LCT	Gas	0.947	0.947	0.962	0.955	0.941	0.948	0.938	0.946	0.951	0.951	0.956	0.908	0.949	0.929	0.950	0.927
LCT	Diesel	0.053	0.053	0.038	0.045	0.059	0.052	0.062	0.054	0.049	0.049	0.044	0.092	0.051	0.071	0.050	0.073
LCT	Gas	0.947	0.947	0.962	0.955	0.941	0.948	0.938	0.946	0.951	0.951	0.956	0.908	0.949	0.929	0.950	0.927
LCT	Diesel	0.053	0.053	0.038	0.045	0.059	0.052	0.062	0.054	0.049	0.049	0.044	0.092	0.051	0.071	0.050	0.073
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	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
SBus	Diesel	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990
RT	Gas	0.003	0.003	0.002	0.002	0.005	0.001	0.003	0.003	0.005	0.004	0.005	0.006	0.002	0.169	0.404	0.019
RT	Diesel	0.997	0.997	0.998	0.998	0.995	0.999	0.997	0.997	0.995	0.996	0.995	0.994	0.998	0.831	0.596	0.981
SUShT	Gas	0.207	0.210	0.237	0.324	0.270	0.245	0.226	0.218	0.236	0.253	0.266	0.311	0.344	0.353	0.421	0.421
SUShT	Diesel	0.793	0.790	0.763	0.676	0.730	0.755	0.774	0.782	0.764	0.747	0.734	0.689	0.656	0.647	0.579	0.579
SULhT	Gas	0.207	0.210	0.237	0.324	0.270	0.245	0.226	0.218	0.236	0.253	0.266	0.311	0.344	0.353	0.421	0.421
SULhT	Diesel	0.793	0.790	0.763	0.676	0.730	0.755	0.774	0.782	0.764	0.747	0.734	0.689	0.656	0.647	0.579	0.579
MH	Gas	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	0.710	0.740
MH	Diesel	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	0.290	0.260
CShT	Gas	0.103	0.056	0.078	0.052	0.057	0.027	0.053	0.049	0.047	0.052	0.075	0.079	0.089	0.102	0.131	0.147
CShT	Diesel	0.897	0.944	0.922	0.948	0.943	0.973	0.947	0.951	0.953	0.948	0.925	0.921	0.911	0.898	0.869	0.853
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 2012 Fuel Engine Fractions Summary - Continued

SUT	Fuel Type	Model Year														
		1996	1995	1994	1993	1992	1991	1990	1989	1988	1987	1986	1985	1984	1983	1982
PC	Gas	0.999	0.999	1.000	0.999	0.999	0.997	0.999	0.999	1.000	0.987	0.991	0.966	0.956	0.923	0.893
PC	Diesel	0.001	0.001	0.000	0.001	0.001	0.003	0.001	0.001	0.000	0.013	0.009	0.034	0.044	0.077	0.107
PT	Gas	0.981	0.995	0.991	0.986	0.985	0.994	0.989	0.992	0.997	0.996	0.986	0.984	0.979	0.972	0.943
PT	Diesel	0.019	0.005	0.009	0.014	0.015	0.006	0.011	0.008	0.003	0.004	0.014	0.016	0.021	0.028	0.057
PT	Gas	0.981	0.995	0.991	0.986	0.985	0.994	0.989	0.992	0.997	0.996	0.986	0.984	0.979	0.972	0.943
PT	Diesel	0.019	0.005	0.009	0.014	0.015	0.006	0.011	0.008	0.003	0.004	0.014	0.016	0.021	0.028	0.057
LCT	Gas	0.971	0.932	0.974	0.974	0.951	0.937	0.984	0.976	0.952	0.986	0.956	0.958	0.948	0.933	0.892
LCT	Diesel	0.029	0.068	0.026	0.026	0.049	0.063	0.016	0.024	0.048	0.014	0.044	0.042	0.052	0.067	0.108
LCT	Gas	0.971	0.932	0.974	0.974	0.951	0.937	0.984	0.976	0.952	0.986	0.956	0.958	0.948	0.933	0.892
LCT	Diesel	0.029	0.068	0.026	0.026	0.049	0.063	0.016	0.024	0.048	0.014	0.044	0.042	0.052	0.067	0.108
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	0.114	0.147	0.121	0.010	0.090	0.124	0.229	0.250	0.265	0.327	0.484	0.615	0.676	0.674
SBus	Diesel	0.958	0.886	0.853	0.879	0.990	0.910	0.876	0.771	0.750	0.735	0.673	0.516	0.385	0.324	0.326
RT	Gas	0.012	0.010	0.105	0.031	0.210	0.101	0.204	0.029	0.106	0.106	0.062	0.051	0.054	0.099	0.090
RT	Diesel	0.988	0.990	0.895	0.969	0.790	0.899	0.796	0.971	0.894	0.894	0.938	0.949	0.946	0.901	0.910
SUShT	Gas	0.437	0.675	0.506	0.510	0.518	0.487	0.532	0.550	0.658	0.725	0.774	0.755	0.811	0.746	0.955
SUShT	Diesel	0.563	0.325	0.494	0.490	0.482	0.513	0.468	0.450	0.342	0.275	0.226	0.245	0.189	0.254	0.045
SULhT	Gas	0.437	0.675	0.506	0.510	0.518	0.487	0.532	0.550	0.658	0.725	0.774	0.755	0.811	0.746	0.955
SULhT	Diesel	0.563	0.325	0.494	0.490	0.482	0.513	0.468	0.450	0.342	0.275	0.226	0.245	0.189	0.254	0.045
MH	Gas	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	0.850	0.850
MH	Diesel	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	0.150	0.150
CShT	Gas	0.143	0.293	0.120	0.122	0.159	0.166	0.140	0.122	0.159	0.152	0.247	0.239	0.294	0.346	0.554
CShT	Diesel	0.857	0.707	0.880	0.878	0.841	0.834	0.860	0.878	0.841	0.848	0.753	0.761	0.706	0.654	0.446
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

SUT	Fuel Type	Model Year															
		2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999
PC	Gas	0.988	0.988	0.988	0.988	0.990	0.993	0.999	1.000	0.993	0.995	0.997	0.996	0.996	0.997	0.997	0.998
PC	Diesel	0.012	0.012	0.012	0.012	0.010	0.007	0.001	0.000	0.007	0.005	0.003	0.004	0.004	0.003	0.003	0.002
PT	Gas	0.980	0.980	0.980	0.980	0.987	0.985	0.977	0.981	0.975	0.979	0.982	0.982	0.983	0.989	0.992	0.981
PT	Diesel	0.020	0.020	0.020	0.020	0.013	0.015	0.023	0.019	0.025	0.021	0.018	0.018	0.017	0.011	0.008	0.019
PT	Gas	0.980	0.980	0.980	0.980	0.987	0.985	0.977	0.981	0.975	0.979	0.982	0.982	0.983	0.989	0.992	0.981
PT	Diesel	0.020	0.020	0.020	0.020	0.013	0.015	0.023	0.019	0.025	0.021	0.018	0.018	0.017	0.011	0.008	0.019
LCT	Gas	0.947	0.947	0.947	0.947	0.962	0.955	0.941	0.948	0.938	0.946	0.951	0.951	0.956	0.908	0.949	0.929
LCT	Diesel	0.053	0.053	0.053	0.053	0.038	0.045	0.059	0.052	0.062	0.054	0.049	0.049	0.044	0.092	0.051	0.071
LCT	Gas	0.947	0.947	0.947	0.947	0.962	0.955	0.941	0.948	0.938	0.946	0.951	0.951	0.956	0.908	0.949	0.929
LCT	Diesel	0.053	0.053	0.053	0.053	0.038	0.045	0.059	0.052	0.062	0.054	0.049	0.049	0.044	0.092	0.051	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	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	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
SBus	Diesel	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990
RT	Gas	0.003	0.003	0.003	0.003	0.002	0.002	0.005	0.001	0.003	0.003	0.005	0.004	0.005	0.006	0.002	0.169
RT	Diesel	0.997	0.997	0.997	0.997	0.998	0.998	0.995	0.999	0.997	0.997	0.995	0.996	0.995	0.994	0.998	0.831
SUShT	Gas	0.396	0.371	0.219	0.234	0.274	0.351	0.287	0.256	0.238	0.232	0.245	0.260	0.268	0.311	0.350	0.348
SUShT	Diesel	0.604	0.629	0.781	0.766	0.726	0.649	0.713	0.744	0.762	0.768	0.755	0.740	0.732	0.689	0.650	0.652
SULhT	Gas	0.396	0.371	0.219	0.234	0.274	0.351	0.287	0.256	0.238	0.232	0.245	0.260	0.268	0.311	0.350	0.348
SULhT	Diesel	0.604	0.629	0.781	0.766	0.726	0.649	0.713	0.744	0.762	0.768	0.755	0.740	0.732	0.689	0.650	0.652
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	0.094	0.199	0.110	0.057	0.081	0.052	0.058	0.031	0.050	0.051	0.052	0.055	0.077	0.084	0.090	0.107
CShT	Diesel	0.906	0.801	0.890	0.943	0.919	0.948	0.942	0.969	0.950	0.949	0.948	0.945	0.923	0.916	0.910	0.893
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 - Continued

SUT	Fuel Type	Model Year														
		1998	1997	1996	1995	1994	1993	1992	1991	1990	1989	1988	1987	1986	1985	1984
PC	Gas	0.998	0.999	0.999	0.999	1.000	0.999	0.999	0.997	0.999	0.999	1.000	0.987	0.991	0.966	0.956
PC	Diesel	0.002	0.001	0.001	0.001	0.000	0.001	0.001	0.003	0.001	0.001	0.000	0.013	0.009	0.034	0.044
PT	Gas	0.993	0.992	0.981	0.995	0.991	0.986	0.985	0.994	0.989	0.992	0.997	0.996	0.986	0.984	0.979
PT	Diesel	0.007	0.008	0.019	0.005	0.009	0.014	0.015	0.006	0.011	0.008	0.003	0.004	0.014	0.016	0.021
PT	Gas	0.993	0.992	0.981	0.995	0.991	0.986	0.985	0.994	0.989	0.992	0.997	0.996	0.986	0.984	0.979
PT	Diesel	0.007	0.008	0.019	0.005	0.009	0.014	0.015	0.006	0.011	0.008	0.003	0.004	0.014	0.016	0.021
LCT	Gas	0.950	0.927	0.971	0.932	0.974	0.974	0.951	0.937	0.984	0.976	0.952	0.986	0.956	0.958	0.948
LCT	Diesel	0.050	0.073	0.029	0.068	0.026	0.026	0.049	0.063	0.016	0.024	0.048	0.014	0.044	0.042	0.052
LCT	Gas	0.950	0.927	0.971	0.932	0.974	0.974	0.951	0.937	0.984	0.976	0.952	0.986	0.956	0.958	0.948
LCT	Diesel	0.050	0.073	0.029	0.068	0.026	0.026	0.049	0.063	0.016	0.024	0.048	0.014	0.044	0.042	0.052
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	0.010	0.042	0.114	0.147	0.121	0.010	0.090	0.124	0.229	0.250	0.265	0.327	0.484	0.615
SBus	Diesel	0.990	0.990	0.958	0.886	0.853	0.879	0.990	0.910	0.876	0.771	0.750	0.735	0.673	0.516	0.385
RT	Gas	0.404	0.019	0.012	0.010	0.105	0.031	0.210	0.101	0.204	0.029	0.106	0.106	0.062	0.051	0.054
RT	Diesel	0.596	0.981	0.988	0.990	0.895	0.969	0.790	0.899	0.796	0.971	0.894	0.894	0.938	0.949	0.946
SUShT	Gas	0.435	0.436	0.427	0.673	0.508	0.519	0.511	0.465	0.539	0.572	0.640	0.654	0.742	0.731	0.920
SUShT	Diesel	0.565	0.564	0.573	0.327	0.492	0.481	0.489	0.535	0.461	0.428	0.360	0.346	0.258	0.269	0.080
SULhT	Gas	0.435	0.436	0.427	0.673	0.508	0.519	0.511	0.465	0.539	0.572	0.640	0.654	0.742	0.731	0.920
SULhT	Diesel	0.565	0.564	0.573	0.327	0.492	0.481	0.489	0.535	0.461	0.428	0.360	0.346	0.258	0.269	0.080
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	0.134	0.147	0.146	0.275	0.117	0.117	0.160	0.161	0.144	0.114	0.157	0.163	0.227	0.252	0.491
CShT	Diesel	0.866	0.853	0.854	0.725	0.883	0.883	0.840	0.839	0.856	0.886	0.843	0.837	0.773	0.748	0.509
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

SUT	Fuel Type	Model Year															
		2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002
PC	Gas	0.988	0.988	0.988	0.988	0.988	0.988	0.988	0.990	0.993	0.999	1.000	0.993	0.995	0.997	0.996	0.996
PC	Diesel	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.010	0.007	0.001	0.000	0.007	0.005	0.003	0.004	0.004
PT	Gas	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.987	0.985	0.977	0.981	0.975	0.979	0.982	0.982	0.983
PT	Diesel	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.013	0.015	0.023	0.019	0.025	0.021	0.018	0.018	0.017
PT	Gas	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.987	0.985	0.977	0.981	0.975	0.979	0.982	0.982	0.983
PT	Diesel	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.013	0.015	0.023	0.019	0.025	0.021	0.018	0.018	0.017
LCT	Gas	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.962	0.955	0.941	0.948	0.938	0.946	0.951	0.951	0.956
LCT	Diesel	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.038	0.045	0.059	0.052	0.062	0.054	0.049	0.049	0.044
LCT	Gas	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.962	0.955	0.941	0.948	0.938	0.946	0.951	0.951	0.956
LCT	Diesel	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.038	0.045	0.059	0.052	0.062	0.054	0.049	0.049	0.044
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	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
SBus	Diesel	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990
RT	Gas	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.002	0.002	0.005	0.001	0.003	0.003	0.005	0.004	0.005
RT	Diesel	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.998	0.998	0.995	0.999	0.997	0.997	0.995	0.996	0.995
SUShT	Gas	0.396	0.396	0.396	0.396	0.371	0.219	0.234	0.274	0.351	0.287	0.256	0.238	0.232	0.245	0.260	0.268
SUShT	Diesel	0.604	0.604	0.604	0.604	0.629	0.781	0.766	0.726	0.649	0.713	0.744	0.762	0.768	0.755	0.740	0.732
SULhT	Gas	0.396	0.396	0.396	0.396	0.371	0.219	0.234	0.274	0.351	0.287	0.256	0.238	0.232	0.245	0.260	0.268
SULhT	Diesel	0.604	0.604	0.604	0.604	0.629	0.781	0.766	0.726	0.649	0.713	0.744	0.762	0.768	0.755	0.740	0.732
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	0.094	0.094	0.094	0.094	0.199	0.110	0.057	0.081	0.052	0.058	0.031	0.050	0.051	0.052	0.055	0.077
CShT	Diesel	0.906	0.906	0.906	0.906	0.801	0.890	0.943	0.919	0.948	0.942	0.969	0.950	0.949	0.948	0.945	0.923
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 - Continued

SUT	Fuel Type	Model Year														
		2001	2000	1999	1998	1997	1996	1995	1994	1993	1992	1991	1990	1989	1988	1987
PC	Gas	0.997	0.997	0.998	0.998	0.999	0.999	0.999	1.000	0.999	0.999	0.997	0.999	0.999	1.000	0.987
PC	Diesel	0.003	0.003	0.002	0.002	0.001	0.001	0.001	0.000	0.001	0.001	0.003	0.001	0.001	0.000	0.013
PT	Gas	0.989	0.992	0.981	0.993	0.992	0.981	0.995	0.991	0.986	0.985	0.994	0.989	0.992	0.997	0.996
PT	Diesel	0.011	0.008	0.019	0.007	0.008	0.019	0.005	0.009	0.014	0.015	0.006	0.011	0.008	0.003	0.004
PT	Gas	0.989	0.992	0.981	0.993	0.992	0.981	0.995	0.991	0.986	0.985	0.994	0.989	0.992	0.997	0.996
PT	Diesel	0.011	0.008	0.019	0.007	0.008	0.019	0.005	0.009	0.014	0.015	0.006	0.011	0.008	0.003	0.004
LCT	Gas	0.908	0.949	0.929	0.950	0.927	0.971	0.932	0.974	0.974	0.951	0.937	0.984	0.976	0.952	0.986
LCT	Diesel	0.092	0.051	0.071	0.050	0.073	0.029	0.068	0.026	0.026	0.049	0.063	0.016	0.024	0.048	0.014
LCT	Gas	0.908	0.949	0.929	0.950	0.927	0.971	0.932	0.974	0.974	0.951	0.937	0.984	0.976	0.952	0.986
LCT	Diesel	0.092	0.051	0.071	0.050	0.073	0.029	0.068	0.026	0.026	0.049	0.063	0.016	0.024	0.048	0.014
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	0.010	0.010	0.010	0.010	0.042	0.114	0.147	0.121	0.010	0.090	0.124	0.229	0.250	0.265
SBus	Diesel	0.990	0.990	0.990	0.990	0.990	0.958	0.886	0.853	0.879	0.990	0.910	0.876	0.771	0.750	0.735
RT	Gas	0.006	0.002	0.169	0.404	0.019	0.012	0.010	0.105	0.031	0.210	0.101	0.204	0.029	0.106	0.106
RT	Diesel	0.994	0.998	0.831	0.596	0.981	0.988	0.990	0.895	0.969	0.790	0.899	0.796	0.971	0.894	0.894
SUShT	Gas	0.311	0.350	0.348	0.435	0.436	0.427	0.673	0.508	0.519	0.511	0.465	0.539	0.572	0.640	0.654
SUShT	Diesel	0.689	0.650	0.652	0.565	0.564	0.573	0.327	0.492	0.481	0.489	0.535	0.461	0.428	0.360	0.346
SULhT	Gas	0.311	0.350	0.348	0.435	0.436	0.427	0.673	0.508	0.519	0.511	0.465	0.539	0.572	0.640	0.654
SULhT	Diesel	0.689	0.650	0.652	0.565	0.564	0.573	0.327	0.492	0.481	0.489	0.535	0.461	0.428	0.360	0.346
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	0.084	0.090	0.107	0.134	0.147	0.146	0.275	0.117	0.117	0.160	0.161	0.144	0.114	0.157	0.163
CShT	Diesel	0.916	0.910	0.893	0.866	0.853	0.854	0.725	0.883	0.883	0.840	0.839	0.856	0.886	0.843	0.837
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 2020 Fuel Engine Fractions Summary

SUT	Fuel Type	Model Year															
		2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005
PC	Gas	0.988	0.988	0.988	0.988	0.988	0.988	0.988	0.988	0.988	0.988	0.990	0.993	0.999	1.000	0.993	0.995
PC	Diesel	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.010	0.007	0.001	0.000	0.007	0.005
PT	Gas	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.987	0.985	0.977	0.981	0.975	0.979
PT	Diesel	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.013	0.015	0.023	0.019	0.025	0.021
PT	Gas	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.987	0.985	0.977	0.981	0.975	0.979
PT	Diesel	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.013	0.015	0.023	0.019	0.025	0.021
LCT	Gas	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.962	0.955	0.941	0.948	0.938	0.946
LCT	Diesel	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.038	0.045	0.059	0.052	0.062	0.054
LCT	Gas	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.962	0.955	0.941	0.948	0.938	0.946
LCT	Diesel	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.038	0.045	0.059	0.052	0.062	0.054
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	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
SBus	Diesel	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990
RT	Gas	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.002	0.002	0.005	0.001	0.003	0.003
RT	Diesel	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.998	0.998	0.995	0.999	0.997	0.997
SUShT	Gas	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.371	0.219	0.234	0.274	0.351	0.287	0.256	0.238	0.232
SUShT	Diesel	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.629	0.781	0.766	0.726	0.649	0.713	0.744	0.762	0.768
SULhT	Gas	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.371	0.219	0.234	0.274	0.351	0.287	0.256	0.238	0.232
SULhT	Diesel	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.629	0.781	0.766	0.726	0.649	0.713	0.744	0.762	0.768
MH	Gas	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.510	0.530	0.540	0.560
MH	Diesel	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.490	0.470	0.460	0.440
CShT	Gas	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.199	0.110	0.057	0.081	0.052	0.058	0.031	0.050	0.051
CShT	Diesel	0.906	0.906	0.906	0.906	0.906	0.906	0.906	0.801	0.890	0.943	0.919	0.948	0.942	0.969	0.950	0.949
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 2020 Fuel Engine Fractions Summary - Continued

SUT	Fuel type	Model Year														
		2004	2003	2002	2001	2000	1999	1998	1997	1996	1995	1994	1993	1992	1991	1990
PC	Gas	0.997	0.996	0.996	0.997	0.997	0.998	0.998	0.999	0.999	0.999	1.000	0.999	0.999	0.997	0.999
PC	Diesel	0.003	0.004	0.004	0.003	0.003	0.002	0.002	0.001	0.001	0.001	0.000	0.001	0.001	0.003	0.001
PT	Gas	0.982	0.982	0.983	0.989	0.992	0.981	0.993	0.992	0.981	0.995	0.991	0.986	0.985	0.994	0.989
PT	Diesel	0.018	0.018	0.017	0.011	0.008	0.019	0.007	0.008	0.019	0.005	0.009	0.014	0.015	0.006	0.011
PT	Gas	0.982	0.982	0.983	0.989	0.992	0.981	0.993	0.992	0.981	0.995	0.991	0.986	0.985	0.994	0.989
PT	Diesel	0.018	0.018	0.017	0.011	0.008	0.019	0.007	0.008	0.019	0.005	0.009	0.014	0.015	0.006	0.011
LCT	Gas	0.951	0.951	0.956	0.908	0.949	0.929	0.950	0.927	0.971	0.932	0.974	0.974	0.951	0.937	0.984
LCT	Diesel	0.049	0.049	0.044	0.092	0.051	0.071	0.050	0.073	0.029	0.068	0.026	0.026	0.049	0.063	0.016
LCT	Gas	0.951	0.951	0.956	0.908	0.949	0.929	0.950	0.927	0.971	0.932	0.974	0.974	0.951	0.937	0.984
LCT	Diesel	0.049	0.049	0.044	0.092	0.051	0.071	0.050	0.073	0.029	0.068	0.026	0.026	0.049	0.063	0.016
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	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.042	0.114	0.147	0.121	0.010	0.090	0.124
SBus	Diesel	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.958	0.886	0.853	0.879	0.990	0.910	0.876
RT	Gas	0.005	0.004	0.005	0.006	0.002	0.169	0.404	0.019	0.012	0.010	0.105	0.031	0.210	0.101	0.204
RT	Diesel	0.995	0.996	0.995	0.994	0.998	0.831	0.596	0.981	0.988	0.990	0.895	0.969	0.790	0.899	0.796
SUShT	Gas	0.245	0.260	0.268	0.311	0.350	0.348	0.435	0.436	0.427	0.673	0.508	0.519	0.511	0.465	0.539
SUShT	Diesel	0.755	0.740	0.732	0.689	0.650	0.652	0.565	0.564	0.573	0.327	0.492	0.481	0.489	0.535	0.461
SULhT	Gas	0.245	0.260	0.268	0.311	0.350	0.348	0.435	0.436	0.427	0.673	0.508	0.519	0.511	0.465	0.539
SULhT	Diesel	0.755	0.740	0.732	0.689	0.650	0.652	0.565	0.564	0.573	0.327	0.492	0.481	0.489	0.535	0.461
MH	Gas	0.570	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
MH	Diesel	0.430	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
CShT	Gas	0.052	0.055	0.077	0.084	0.090	0.107	0.134	0.147	0.146	0.275	0.117	0.117	0.160	0.161	0.144
CShT	Diesel	0.948	0.945	0.923	0.916	0.910	0.893	0.866	0.853	0.854	0.725	0.883	0.883	0.840	0.839	0.856
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 2023 Fuel Engine Fractions Summary

SUT	Fuel Type	Model Year															
		2023	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008
PC	Gas	0.988	0.988	0.988	0.988	0.988	0.988	0.988	0.988	0.988	0.988	0.988	0.988	0.988	0.990	0.993	0.999
PC	Diesel	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.010	0.007	0.001
PT	Gas	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.987	0.985	0.977
PT	Diesel	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.013	0.015	0.023
PT	Gas	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.987	0.985	0.977
PT	Diesel	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.013	0.015	0.023
LCT	Gas	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.962	0.955	0.941
LCT	Diesel	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.038	0.045	0.059
LCT	Gas	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.962	0.955	0.941
LCT	Diesel	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.038	0.045	0.059
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	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
SBus	Diesel	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990
RT	Gas	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.002	0.002	0.005
RT	Diesel	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.998	0.998	0.995
SUShT	Gas	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.371	0.219	0.234	0.274	0.351	0.287
SUShT	Diesel	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.629	0.781	0.766	0.726	0.649	0.713
SULhT	Gas	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.371	0.219	0.234	0.274	0.351	0.287
SULhT	Diesel	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.629	0.781	0.766	0.726	0.649	0.713
MH	Gas	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.510
MH	Diesel	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.490
CShT	Gas	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.199	0.110	0.057	0.081	0.052	0.058
CShT	Diesel	0.906	0.906	0.906	0.906	0.906	0.906	0.906	0.906	0.906	0.906	0.801	0.890	0.943	0.919	0.948	0.942
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 2023 Fuel Engine Fractions Summary - Continued

SUT	Fuel Type	Model Year														
		2007	2006	2005	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995	1994	1993
PC	Gas	1.000	0.993	0.995	0.997	0.996	0.996	0.997	0.997	0.998	0.998	0.999	0.999	0.999	1.000	0.999
PC	Diesel	0.000	0.007	0.005	0.003	0.004	0.004	0.003	0.003	0.002	0.002	0.001	0.001	0.001	0.000	0.001
PT	Gas	0.981	0.975	0.979	0.982	0.982	0.983	0.989	0.992	0.981	0.993	0.992	0.981	0.995	0.991	0.986
PT	Diesel	0.019	0.025	0.021	0.018	0.018	0.017	0.011	0.008	0.019	0.007	0.008	0.019	0.005	0.009	0.014
PT	Gas	0.981	0.975	0.979	0.982	0.982	0.983	0.989	0.992	0.981	0.993	0.992	0.981	0.995	0.991	0.986
PT	Diesel	0.019	0.025	0.021	0.018	0.018	0.017	0.011	0.008	0.019	0.007	0.008	0.019	0.005	0.009	0.014
LCT	Gas	0.948	0.938	0.946	0.951	0.951	0.956	0.908	0.949	0.929	0.950	0.927	0.971	0.932	0.974	0.974
LCT	Diesel	0.052	0.062	0.054	0.049	0.049	0.044	0.092	0.051	0.071	0.050	0.073	0.029	0.068	0.026	0.026
LCT	Gas	0.948	0.938	0.946	0.951	0.951	0.956	0.908	0.949	0.929	0.950	0.927	0.971	0.932	0.974	0.974
LCT	Diesel	0.052	0.062	0.054	0.049	0.049	0.044	0.092	0.051	0.071	0.050	0.073	0.029	0.068	0.026	0.026
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	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.042	0.114	0.147	0.121
SBus	Diesel	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.958	0.886	0.853	0.879
RT	Gas	0.001	0.003	0.003	0.005	0.004	0.005	0.006	0.002	0.169	0.404	0.019	0.012	0.010	0.105	0.031
RT	Diesel	0.999	0.997	0.997	0.995	0.996	0.995	0.994	0.998	0.831	0.596	0.981	0.988	0.990	0.895	0.969
SUShT	Gas	0.256	0.238	0.232	0.245	0.260	0.268	0.311	0.350	0.348	0.435	0.436	0.427	0.673	0.508	0.519
SUShT	Diesel	0.744	0.762	0.768	0.755	0.740	0.732	0.689	0.650	0.652	0.565	0.564	0.573	0.327	0.492	0.481
SULhT	Gas	0.256	0.238	0.232	0.245	0.260	0.268	0.311	0.350	0.348	0.435	0.436	0.427	0.673	0.508	0.519
SULhT	Diesel	0.744	0.762	0.768	0.755	0.740	0.732	0.689	0.650	0.652	0.565	0.564	0.573	0.327	0.492	0.481
MH	Gas	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	0.470	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	0.031	0.050	0.051	0.052	0.055	0.077	0.084	0.090	0.107	0.134	0.147	0.146	0.275	0.117	0.117
CShT	Diesel	0.969	0.950	0.949	0.948	0.945	0.923	0.916	0.910	0.893	0.866	0.853	0.854	0.725	0.883	0.883
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 2026 Fuel Engine Fractions Summary

SUT	Fuel Type	Model Year															
		2026	2025	2024	2023	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011
PC	Gas	0.988	0.988	0.988	0.988	0.988	0.988	0.988	0.988	0.988	0.988	0.988	0.988	0.988	0.988	0.988	0.988
PC	Diesel	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012
PT	Gas	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980
PT	Diesel	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020
PT	Gas	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980
PT	Diesel	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020
LCT	Gas	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947
LCT	Diesel	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053
LCT	Gas	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947
LCT	Diesel	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053
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	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
SBus	Diesel	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990
RT	Gas	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
RT	Diesel	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.997
SUShT	Gas	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.371	0.219	0.234
SUShT	Diesel	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.629	0.781	0.766
SULhT	Gas	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.371	0.219	0.234
SULhT	Diesel	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.629	0.781	0.766
MH	Gas	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500
MH	Diesel	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500
CShT	Gas	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.199	0.110	0.057
CShT	Diesel	0.906	0.906	0.906	0.906	0.906	0.906	0.906	0.906	0.906	0.906	0.906	0.906	0.906	0.801	0.890	0.943
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 2026 Fuel Engine Fractions Summary - Continued

SUT	Fuel Type	Model Year														
		2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998	1997	1996
PC	Gas	0.990	0.993	0.999	1.000	0.993	0.995	0.997	0.996	0.996	0.997	0.997	0.998	0.998	0.999	0.999
PC	Diesel	0.010	0.007	0.001	0.000	0.007	0.005	0.003	0.004	0.004	0.003	0.003	0.002	0.002	0.001	0.001
PT	Gas	0.987	0.985	0.977	0.981	0.975	0.979	0.982	0.982	0.983	0.989	0.992	0.981	0.993	0.992	0.981
PT	Diesel	0.013	0.015	0.023	0.019	0.025	0.021	0.018	0.018	0.017	0.011	0.008	0.019	0.007	0.008	0.019
PT	Gas	0.987	0.985	0.977	0.981	0.975	0.979	0.982	0.982	0.983	0.989	0.992	0.981	0.993	0.992	0.981
PT	Diesel	0.013	0.015	0.023	0.019	0.025	0.021	0.018	0.018	0.017	0.011	0.008	0.019	0.007	0.008	0.019
LCT	Gas	0.962	0.955	0.941	0.948	0.938	0.946	0.951	0.951	0.956	0.908	0.949	0.929	0.950	0.927	0.971
LCT	Diesel	0.038	0.045	0.059	0.052	0.062	0.054	0.049	0.049	0.044	0.092	0.051	0.071	0.050	0.073	0.029
LCT	Gas	0.962	0.955	0.941	0.948	0.938	0.946	0.951	0.951	0.956	0.908	0.949	0.929	0.950	0.927	0.971
LCT	Diesel	0.038	0.045	0.059	0.052	0.062	0.054	0.049	0.049	0.044	0.092	0.051	0.071	0.050	0.073	0.029
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	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.042
SBus	Diesel	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.958
RT	Gas	0.002	0.002	0.005	0.001	0.003	0.003	0.005	0.004	0.005	0.006	0.002	0.169	0.404	0.019	0.012
RT	Diesel	0.998	0.998	0.995	0.999	0.997	0.997	0.995	0.996	0.995	0.994	0.998	0.831	0.596	0.981	0.988
SUShT	Gas	0.274	0.351	0.287	0.256	0.238	0.232	0.245	0.260	0.268	0.311	0.350	0.348	0.435	0.436	0.427
SUShT	Diesel	0.726	0.649	0.713	0.744	0.762	0.768	0.755	0.740	0.732	0.689	0.650	0.652	0.565	0.564	0.573
SULhT	Gas	0.274	0.351	0.287	0.256	0.238	0.232	0.245	0.260	0.268	0.311	0.350	0.348	0.435	0.436	0.427
SULhT	Diesel	0.726	0.649	0.713	0.744	0.762	0.768	0.755	0.740	0.732	0.689	0.650	0.652	0.565	0.564	0.573
MH	Gas	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	0.490	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	0.081	0.052	0.058	0.031	0.050	0.051	0.052	0.055	0.077	0.084	0.090	0.107	0.134	0.147	0.146
CShT	Diesel	0.919	0.948	0.942	0.969	0.950	0.949	0.948	0.945	0.923	0.916	0.910	0.893	0.866	0.853	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] Conventional internal combustion engine technology only.

Texas Statewide 2028 Fuel Engine Fractions Summary

SUT	Fuel Type	Model Year															
		2028	2027	2026	2025	2024	2023	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013
PC	Gas	0.988	0.988	0.988	0.988	0.988	0.988	0.988	0.988	0.988	0.988	0.988	0.988	0.988	0.988	0.988	0.988
PC	Diesel	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012
PT	Gas	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980
PT	Diesel	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020
PT	Gas	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980
PT	Diesel	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020
LCT	Gas	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947
LCT	Diesel	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053
LCT	Gas	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947
LCT	Diesel	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053
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	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
SBus	Diesel	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990
RT	Gas	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
RT	Diesel	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.997
SUShT	Gas	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.371
SUShT	Diesel	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.629
SULhT	Gas	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.371
SULhT	Diesel	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.629
MH	Gas	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500
MH	Diesel	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500
CShT	Gas	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.199
CShT	Diesel	0.906	0.906	0.906	0.906	0.906	0.906	0.906	0.906	0.906	0.906	0.906	0.906	0.906	0.906	0.906	0.801
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 2028 Fuel Engine Fractions Summary - Continued

SUT	Fuel Type	Model Year														
		2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998
PC	Gas	0.988	0.988	0.990	0.993	0.999	1.000	0.993	0.995	0.997	0.996	0.996	0.997	0.997	0.998	0.998
PC	Diesel	0.012	0.012	0.010	0.007	0.001	0.000	0.007	0.005	0.003	0.004	0.004	0.003	0.003	0.002	0.002
PT	Gas	0.980	0.980	0.987	0.985	0.977	0.981	0.975	0.979	0.982	0.982	0.983	0.989	0.992	0.981	0.993
PT	Diesel	0.020	0.020	0.013	0.015	0.023	0.019	0.025	0.021	0.018	0.018	0.017	0.011	0.008	0.019	0.007
PT	Gas	0.980	0.980	0.987	0.985	0.977	0.981	0.975	0.979	0.982	0.982	0.983	0.989	0.992	0.981	0.993
PT	Diesel	0.020	0.020	0.013	0.015	0.023	0.019	0.025	0.021	0.018	0.018	0.017	0.011	0.008	0.019	0.007
LCT	Gas	0.947	0.947	0.962	0.955	0.941	0.948	0.938	0.946	0.951	0.951	0.956	0.908	0.949	0.929	0.950
LCT	Diesel	0.053	0.053	0.038	0.045	0.059	0.052	0.062	0.054	0.049	0.049	0.044	0.092	0.051	0.071	0.050
LCT	Gas	0.947	0.947	0.962	0.955	0.941	0.948	0.938	0.946	0.951	0.951	0.956	0.908	0.949	0.929	0.950
LCT	Diesel	0.053	0.053	0.038	0.045	0.059	0.052	0.062	0.054	0.049	0.049	0.044	0.092	0.051	0.071	0.050
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	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
SBus	Diesel	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990
RT	Gas	0.003	0.003	0.002	0.002	0.005	0.001	0.003	0.003	0.005	0.004	0.005	0.006	0.002	0.169	0.404
RT	Diesel	0.997	0.997	0.998	0.998	0.995	0.999	0.997	0.997	0.995	0.996	0.995	0.994	0.998	0.831	0.596
SUShT	Gas	0.219	0.234	0.274	0.351	0.287	0.256	0.238	0.232	0.245	0.260	0.268	0.311	0.350	0.348	0.435
SUShT	Diesel	0.781	0.766	0.726	0.649	0.713	0.744	0.762	0.768	0.755	0.740	0.732	0.689	0.650	0.652	0.565
SULhT	Gas	0.219	0.234	0.274	0.351	0.287	0.256	0.238	0.232	0.245	0.260	0.268	0.311	0.350	0.348	0.435
SULhT	Diesel	0.781	0.766	0.726	0.649	0.713	0.744	0.762	0.768	0.755	0.740	0.732	0.689	0.650	0.652	0.565
MH	Gas	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	0.710
MH	Diesel	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	0.290
CShT	Gas	0.110	0.057	0.081	0.052	0.058	0.031	0.050	0.051	0.052	0.055	0.077	0.084	0.090	0.107	0.134
CShT	Diesel	0.890	0.943	0.919	0.948	0.942	0.969	0.950	0.949	0.948	0.945	0.923	0.916	0.910	0.893	0.866
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.