Texas A&M Transportation Institute

El Paso County 2015-Eight-Hour Ozone Nonattainment Area Reasonable Further Progress (RFP) On-Road Mobile Emissions Inventories

FINAL REPORT

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Texas A&M Transportation Institute

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Abstract: The report titled El Paso County 2015-Eight-Hour Ozone Nonattainment Area Reasonable Further Progress (RFP) On-Road Mobile Emissions Inventories focuses on developing on-road mobile emissions inventories for the El Paso County ozone nonattainment area. The Texas A&M Transportation Institute (TTI) prepared this report for the Texas Commission on Environmental Quality (TCEQ) to support the 2015 eight-hour ozone standard compliance. The inventories cover the base year 2017, attainment year 2023, and contingency year 2024, estimating emissions for

volatile organic compounds (VOC), nitrogen oxides (NOx), and other pollutants. TTI used the latest EPA MOVES (Motor Vehicle Emission Simulator) model and state data for vehicle miles traveled (VMT), speeds, and vehicle population to calculate on-road and off-network activity emissions. The report outlines the control strategies implemented, including pre-1990 fuel controls, post-1990 fuel standards, and inspection and maintenance (I/M) programs, with projections of emissions reductions through these measures.

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EXECUTIVE SUMMARY

The Texas Commission on Environmental Quality (TCEQ) sponsored work by the Texas A&M Transportation Institute (TTI) to develop and produce on-road emissions inventory data needed in support of the TCEQ's El Paso County 2015-eight-hour ozone nonattainment area reasonable further progress (RFP) state implementation plan (SIP) revision. The Clean Air Act (CAA) requires states to submit RFP plans that demonstrate progress in reducing emissions for areas that are not attaining the NAAQS within their jurisdictions. This work by TTI produced ozone season, summer weekday on-road mobile source RFP scenario emissions inventories, and individual control strategy reduction estimates needed for El Paso County.

The El Paso RFP analysis requires three years - base, attainment, and attainment contingency years (i.e., 2017, 2023, and 2024, respectively) - and includes the seven RFP inventory scenarios, as shown in Table 1.

Table 1. RFP Inventory Scenarios.

No.	RFP Inventory	Activity Input	Emissions Rates Input
1	2017 Base Year	2017 (Base Year)	Base Year
2	2023 Pre-1990 Control	2023 (Attainment Year)	Pre-1990 Controls Except Full Federal Motor Vehicle Control Program (FMVCP) (CS1)
3	2023 Control Strategy		CS1+ current fuels (CS2)
4	2023 Full Control Strategy		CS2 + (Inspection and Maintenance) I/M (CSC)
5	2024 Pre-1990 Control	2024 (Attainment Contingency Year)	Pre-1990 Controls Except Full FMVCP (CS1)
6	2024 Control Strategy		CS1+ current fuels (CS2)
7	2024 Full Control Strategy		CS2 + I/M (CSC)

TTI produced inventory estimates of six gaseous pollutants - volatile organic compounds (VOC), carbon monoxide (CO), oxides of nitrogen (NO_x), sulfur dioxide (SO_2), ammonia (NH_3), and carbon dioxide (CO_2) - and of particulate matter (PM) pollutants in both 2.5 and 10-micron size categories ($PM_{2.5}$ and PM_{10}). Individual control strategy reduction estimates of VOC and NO_X were also required.

A new methodology was used for incrementally modeling control programs, as needed for estimating the individual control strategy reductions. This new modeling method replaced the "Pre-1990 controls only" scenario with the "Pre-1990 controls except for full FMVCP" scenario due to limitations in the MOVES4 model[1]. Subsequent incremented control strategy scenarios focus on the impacts of post-1990 (current) gasoline and diesel fuel properties and the vehicle inspection and maintenance (I/M) program. With the growing significance of electric vehicles in the on-road fleet, in addition to the predominant gasoline and diesel vehicles, electricity-powered vehicles are now explicitly included in the modeling of vehicle populations with their associated activity, which is new in Texas on-road emissions inventories for SIPs.

TTI used the latest, official version of the U.S. Environmental Protection Agency's (EPA) Motor Vehicle Emission Simulator (MOVES) model (MOVES4), as required for SIP analyses, in combination with TTI's SIP-quality inventory development methodology for use with MOVES.[2] This is the detailed, disaggregate, travel demand model (TDM) link-based rates-per-activity inventory process. It produces MOVES-based emissions rate look-up tables for external emissions calculations performed at detailed, disaggregate, temporal, and spatial levels, using the latest (readily) available data, models, and procedures. The latest planning assumptions were used to assure that motor vehicle emissions budgets to be established by TCEQ in the SIP will be consistent with transportation conformity analysis requirements.

Hourly inventories were estimated by the MOVES source use type (SUT) and fuel type (FT) combinations (or vehicle type – see Table 2) and TDM roadway class. TDMs were post-processed to estimate hourly, directional, link (roadway segment)-level fleetwide vehicle miles traveled (VMT) and operational speeds for use in combination with time-of-day VMT mix estimates (fractional VMT by vehicle type) for the roadway-based emissions calculations. Using estimates of vehicle operating hours, vehicle populations, truck hotelling activity, and other data, TTI estimated hourly off-network activity factors for the parked or idling (not on roads) vehicle-based emissions calculations. Off-network activity type factors are off-network idling (ONI) hours: source-hours-parked (SHP); starts; and source hours extended idling (SHEI) and auxiliary power unit (APU) hours (emissions-producing components of combination long-haul truck hotelling hours). Particular off-network evaporative rates, in mass/SHP form, not directly available from

[1] Although TTI previously developed and used a method to approximate the post-1990 FMVCP effects, in lieu of the no-longer-available MOVES pre-1990 FMVCP feature, this prior approximation method is not recommended.
[2] EPA's latest January 2024 MOVES4.0.1 release was used in this analysis.

MOVES, were produced by a post-processing method and compiled with other rates produced directly by MOVES to yield look-up tables of all rates in the appropriate activity terms, as needed in the external emissions calculations. The analysis used TTI's MOVES-based inventory development utilities recently updated for use with MOVES4.[3] EPA's *Technical Guidance*[4] is the primary technical reference for guidance.

Table 2 shows the vehicle SUT and FT combinations that are included in this work. Gasoline, diesel, and electricity were the predominant fuel types that were estimated, with other alternative fuels, such as compressed natural gas (CNG) and ethanol (E85), treated as *de minimis*.

Table 2. MOVES SUT/FT (Vehicle Types)

SUT ID	SUT Description	SUT/FT Abbreviation
11	Motorcycle	MC_Gas
21	Passenger Car	PC_Gas, PC_Diesel, PC_Electricity
31	Passenger Truck	PT_Gas, PT_Diesel, PT_Electricity
32	Light Commercial Truck	LCT_Gas, LCT_Diesel, LCT_Electricity
41	Other Buses	OBus_Gas, OBus_Diesel, OBus_Electricity
42	Transit Bus	TBus_Gas, TBus_Diesel, TBus_Electricity
43	School Bus	SBus_Gas, SBus_Diesel, SBus_Electricity
51	Refuse Truck	RT_Gas, RT_Diesel, RT_Electricity
52	Single Unit Short-Haul Truck	SUShT_Gas, SUShT_Diesel, SUSht_Electricity
53	Single Unit Long-Haul Truck	SULhT_Gas, SULhT_Diesel, SULhT_Electricity
54	Motor Home	MH_Gas, MH_Diesel, MH_Electricity
61	Combination Short-Haul Truck	CShT_Gas, CShT_Diesel, CShT_Electricity
62	Combination Long-Haul Truck	CLhT_Diesel, CLhT_Electricity

Table 3 and Table 4 summarize the inventory estimates and individual control strategy reduction estimates for the El Paso County area. More detailed discussions were provided in the report, along with methodologies as well as model input and development.

[3] TTI's MOVES2014a-compatible inventory estimation utilities are detailed in: *TTI Emissions Inventory Estimation Utilities Using MOVES: MOVES2014aUTL User's Guide,* TTI, August 2016. Note that the TTI utilities have been updated for use with MOVES4, however, the main inventory process and procedures are consistent with TTI's MOVES2014a-based utilities, and its user guide is provided for reference until the TTI's MOVES4 utilities document is available. The MOVES4 utilities emission estimation process is similar to the MOVES2014a-based utilities.
[4] *MOVES4 Technical Guidance: Using MOVES to Prepare Emission Inventories for Sate Implementation Plans and Transportation Conformity*, EPA, August 2023.

Table 3. El Paso County Summer Weekday On-Road Mobile Source RFP Emissions Inventories (Tons).

Inventory Type	Year	VMT	Speed	VOC	CO	NO_X	SO_2	NH_3	CO_2	$PM_{2.5}$	PM_{10}
Base Year[1]	2017	17,243,814	39.2	7.44	102.93	20.17	0.11	1.28	10,858.93	0.62	1.53
CS1[2]	2023	19,453,166	38.7	6.58	168.06	15.45	6.91	1.10	10,795.13	3.11	4.37
	2024	19,631,066	38.5	6.23	161.38	14.14	6.85	1.08	10,688.87	2.73	3.96
CS2[3]	2023	19,453,166	38.7	5.90	94.44	12.79	0.06	1.10	10,876.66	0.38	1.39
	2024	19,631,066	38.5	5.51	90.22	11.57	0.05	1.08	10,769.53	0.35	1.38
CSC[4]	2023	19,453,166	38.7	5.30	81.65	12.46	0.06	1.10	10,876.66	0.38	1.39
	2024	19,631,066	38.5	4.94	77.96	11.31	0.05	1.08	10,769.53	0.35	1.38

[1] Base year inventory: 2017 activity inputs and 2017 control strategy emissions rates.
[2] CS1 Pre-1990 Controls Except for Full FMVCP: All pre-1990 controls except FMVCP are current as of each year.
[3] CS2 Incremental control strategy inventories: analysis year activity inputs and analysis year control strategy emissions rates. Rates include effects of control strategies for analysis year (i.e., post-1990 FMVCP, Tier 3 gasoline).
[4] CSC Full control strategy: analysis year activity inputs and analysis year control strategy emissions rates. Rates include effects of control strategies for analysis year (i.e., post-1990 FMVCP, Tier 3 gasoline, and I/M programs).

Table 4. Summer Weekday RFP Control Scenario Inventories and Reductions (Tons).

Emissions Analysis		VOC			NO_X		
		2017	2023	2024	2017	2023	2024
Inventory	Pre-90 Control Except for Full FMVCP	-	6.58	6.23	-	15.45	14.14
	Control Strategy	7.44	5.30	4.94	20.17	12.46	11.31
Reductions	Total (CSC – CS1)	-	1.28	1.30	-	2.99	2.83
	Tier 3 Fuels and ULSD (CS2 – CS1)	-	0.68	0.72	-	2.66	2.56
	I/M (CSC – CS2)	-	0.60	0.58	-	0.33	0.26

Note: Reductions are step by step from CS1 to CSC. Columns may not total due to rounding.

1 INTRODUCTION

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

The TCEQ is planning to update the SIP, which will require an RFP analysis from the base year to an attainment year, as determined in the final implementation rule, to demonstrate continued progress toward the attainment of EPA's 2015 eight-hour ozone standard. RFP emissions inventories must be developed for the El Paso County non-attainment area. The El Paso County RFP emissions inventories were developed using the latest version of EPA's MOVES and the latest planning assumptions to ensure that motor vehicle emissions budgets to be set by the SIP revision will be consistent with transportation conformity emissions analysis requirements.

1.1 PURPOSE AND OBJECTIVE

The purpose of this work was to develop and produce on-road mobile emissions inventories necessary to support the El Paso County RFP SIP revision for the 2015 eight-hour ozone NAAQS. Specifically, TTI developed and produced on-road mobile link-based emissions inventories for the El Paso County ozone non-attainment area for analysis years 2017, 2023, and 2024.

To complete the El Paso County RFP SIP analysis, RFP emissions inventories were required for a base year, attainment year, and attainment contingency year, as well as individual control measure reduction estimates, and contingency measure control reduction estimates.

TTI accomplished this work in two main parts:

- Development of On-Road Mobile Source RFP Emissions Inventories for the El Paso County Ozone Nonattainment Area and
- Quantification of Individual On-Road Mobile Source RFP Control Reductions for the El Paso County Ozone Nonattainment Area Emissions Inventory.

The objectives for each of these parts are described in the following sections.

1.1.1 Development of On-Road Mobile Source RFP Emissions Inventories for the El Paso County Ozone Nonattainment Area

For this part of the work, TTI developed link-based on-road mobile emissions estimates for El Paso County for three RFP analysis years: 2017, 2023, and 2024. For the 2017 RFP base year, one emissions inventory was required, an RFP base year emissions inventory. The base year inventory is an actual historical year inventory for the analysis year.

For the 2023 attainment year, three emissions inventories were required:

i. An RFP emissions inventory with pre-1990 controls except for current FMVCP EIs (i.e., pre-1990 fuels, no I/M program, but with full FMVCP),

ii. An RFP emissions inventory with post-1990 individual control strategies excluding the I/M program, and

iii. An RFP emissions inventory with post-1990 control strategies, including the I/M program.

For the 2024 RFP attainment contingency year, three emissions inventories were required:

i. An RFP emissions inventory with pre-1990 controls only except for current FMVCP EIs (i.e., pre-1990 fuels, no I/M program, but with full FMVCP),

ii. An RFP emissions inventory with post-1990 control strategies excluding the I/M program, and

iii. An RFP emissions inventory with post-1990 control strategies, including the I/M program.

Table 5 lists the RFP inventories with activity and emissions rate components.

Table 5. RFP Inventory Scenarios.

No.	RFP Inventory	Activity Input	Emissions Rates Input
1	2017 Base Year	2017 (Base Year)	Base Year
2	2023 Pre-1990 Control	2023 (Attainment Year)	Pre-1990 Controls Except Full FMVCP (CS1)
3	2023 Control Strategy		CS1+ current fuels (CS2)
4	2023 Full Control Strategy		CS2 + I/M (CSC)
5	2024 Pre-1990 Control	2024 (Attainment Contingency Year)	Pre-1990 Controls Except Full FMVCP (CS1)
6	2024 Control Strategy		CS1+ current fuels (CS2)
7	2024 Full Control Strategy		CS2 + I/M (CSC)

For the emissions inventories to be consistent with EPA emissions inventory development guidance, the TTI used the most recent activity information, based upon current travel demand modeling, and the most recent version of the EPA's on-road emissions model to complete this work. TTI produced the RFP emissions inventories using methods agreed upon in consultation with the TCEQ Project Manager. TTI ensured the methods were consistent with the EPA's applicable RFP guidance. TTI ensured that individual control reduction calculations were consistent with the capabilities of MOVES.

TTI also adhered to the following requirements using methods, data, and procedures as detailed in the later sections:

- Used the most recent version of the EPA's MOVES model (MOVES4.0.1), as specified by the TCEQ Project Manager, as the emissions factor model for developing emissions inventories for this work.
- The geographic scope for the emissions inventories is El Paso County (48141).
- The emissions inventories include the following criteria pollutants and ozone precursors: VOC, CO, NO_X, SO_2, NH_3, CO_2, $PM_{2.5}$, and PM_{10}.
- Used summer work weekday as the day type for emissions inventories. Adjusted average annual daily activity levels to account for both seasonal differences for summer months (June, July, and August; monthIDs 6, 7, and 8, respectively) and weekdays (Monday through Friday).

- Used 2017 climate inputs. Used temperature, humidity, barometric pressure, and other data, as agreed upon and provided by the TCEQ (TCEQ monitoring operations or national climatic data, for El Paso County).
- Used the most current vehicle miles traveled (VMT) mixes. The VMT mixes were consistent with the EPA MOVES source use types and three of the five MOVES fuel types, gasoline, diesel, and electricity, with CNG and E85, assumed *de minimis*.
- Used El Paso County registration data as input for locality-specific age distributions. The age distribution derived from 2018 end-of-year registration data was used for the base year 2017; the age distribution derived from latest registration data (2021 end-of-year) was used for the 2023 and 2024 analysis years (as no actual registration data for 2023 and 2024 was available).
- A link-based, time-of-day emissions analysis methodology was used for El Paso County. TTI used a travel demand model network link-based VMT for El Paso County reflecting summer work weekday traffic activity.
- Used 2017 and most recently available data for the off-network activity development. Developed 2017 and future year off-network activity inputs based on the current Texas on-road emissions inventory development processes.
- Used MOVES individual fuel parameter inputs consistent with CFR Title 40 – Protection of the Environment, Part 80 – Regulation of Fuels and Fuel Additives, Section 27 – Controls and Prohibitions on Gasoline Volatility (40 CFR § 80.27), as appropriate for RFP control scenarios.
- Used the TCEQ fuel property survey data, including Reid vapor pressure, to develop model inputs where appropriate. The TCEQ provided the 2017 and 2020 Summer Fuel Field Study Final Report and associated electronic files, while the latest 2023 Summer Fuel Field Study was conducted by TTI. The use of EPA's reformulated gasoline compliance data was not applicable.
- Modeled the effects of all the federal motor vehicle control programs as appropriate for RFP control scenarios.
- Modeled either federally regulated gasoline and diesel sulfur levels or the latest available fuel survey data for RFP control scenarios in consultation with and as approved by the TCEQ Project Manager.

- Used control program parameters, including Reid vapor pressure and other fuel settings and the I/M program, based upon the emission inventory type as defined by the RFP analysis control scenarios.

TTI provided data products to TCEQ in one electronic data submittal, described in Appendix B.

1.1.2 Quantification of Individual On-Road Mobile Source RFP Control Reductions for the El Paso County Ozone Nonattainment Area Emissions Inventory

To complete this part of the work, TTI developed emissions reduction estimates for each on-road mobile source control strategy for the 2023 and 2024 El Paso County RFP analysis years. TTI subdivided the entire MOVES-based control strategy reduction into individual control reductions using a MOVES-based methodology submitted to and approved by the TCEQ Project Manager. TTI ensured the methods were consistent with the standard Texas on-road mobile source control strategy quantification methods and the EPA's RFP guidance[5]. Unlike previous RFP analyses, individual control reductions for post-1990 FMVCP will not be estimated because MOVES4 is only capable of modeling full FVMCP effects for each RFP analysis year.

For the El Paso RFP control reduction estimates to be consistent with the requirements for RFP emissions inventory analysis listed in the previous section, TTI developed the emissions reduction estimates using the same version of the EPA's MOVES model, MOVES4.0.1, and methods and inputs consistent with the methods and inputs mentioned Section 1.1.1 and detailed more thoroughly in later sections.

1.1.3 Report Organization

This report is divided into the sections as described below.

- Section 2.0 presents an overview of the county-level, TDM link-based emission inventory development process and describes its key components. A description of the additional emissions modeling for attainment and contingency years performed to estimate emissions reductions by individual control strategy is also included.

[5] EPA (1995). Reasonable Further Progress, Attainment Demonstration, and related Requirements for Ozone Nonattainment Areas Meeting the Ozone National Ambient Air Quality Standards. Available at: https://www3.epa.gov/ttn/naaqs/aqmguide/collection/cp2/19950510_seitz_rfp_attainment_demos.pdf.

- Section 3.0 describes the procedure for estimating the El Paso county on-road emissions inventory for both on-network and off-network activity.
- Section 4.0 provides an overview of the estimation of the emission rates process and provides descriptions of the preparation of the MOVES run specification files, the county input database files, modeling run procedures, and post-run processing activities.
- Section 5.0 describes the on-network and off-network emissions calculations, and the information and format of the emission output files.
- Section 6.0 completes the narrative with a discussion of quality assurance and quality control.
- The list of references and bibliography are followed by the set of appendices to complete the report.

TTI provided all pertinent data relating to project activities in specified electronic formats (i.e., supporting electronic document files) along with this report. TTI maintains a record of all electronic files developed or used in conjunction with the completion of this project.

2 OVERVIEW OF METHODOLOGY

The detailed travel demand model (TDM) link-based, rates-per-activity inventory methodology was used to produce MOVES-based, on-road vehicle, historical, and future case inventories by county. The inventories are composed of emissions estimates based on vehicle activity on the roadway network and off of the roadway network. For the roadway-based component of the analysis, emission rates look-up tables (e.g., grams/mile [g/mi]) produced using MOVES were combined externally with each TDM network link (or roadway segment) VMT estimate to calculate the roadway-based inventories. The off-network activity factors were estimated for the off-network emission calculations using estimates of vehicle operating hours, vehicle type populations, combination long-haul truck hotelling, and other data. TTI developed and maintains a series of computer utilities/procedures used to calculate and summarize detailed on-road mobile source, emissions inventories in various formats, such as those used in this analysis. Appendix A (electronic only) describes these applications.

The emission inventory estimation process requires the development of the following major inventory components. All are inputs to the emissions calculation utility, except vehicle populations, which are an intermediate input needed for calculating estimates of off-network activity.

- On-road fleet link VMT and average speeds.
- Vehicle population and off-network activity.
- VMT mix
- MOVES-based emission rates
- Inventory calculations

2.1 ON-ROAD FLEET LINK-VMT AND SPEEDS

TTI used data sets extracted from the latest, four-period, time-of-day, directional, regional El Paso travel models[6], seasonal day-type adjustments, HPMS VMT-consistency adjustments, and hourly allocation factors to estimate the hourly, directional, link-VMT and associated average fleet speed inputs to the inventory calculations. The seasonal period, day type, and hourly distributions used were based on factors developed with TxDOT automatic traffic recorder (ATR) data from the project nonattainment area. The HPMS consistency factor was applied to the total model link-level VMT for all county and partial county areas for each analysis year. The validation year HPMS adjustment

[6] The El Paso travel model datasets were provided by the El Paso MPO.

factor was calculated as 2017 El Paso County HPMS VMT (first adjusted to average non-summer weekday traffic [ANSWT] form using the ANSWT/ Annual Average Daily Traffic [AADT] ATR count ratio) divided by the 2017 validation year total model VMT for El Paso County. (See Table 6)

Table 6. HPMS Factor.

2017 HPMS AADT VMT[1]	AADT-to-ANSWT Factor	HPMS-Based ANSWT VMT	2017 TDM VMT[1]	HPMS Factor[2]
17,191,534	1.090110	18,740,663	18,069,906	1.037120

[1] El Paso County.
[2] Applied to all analysis years and areas in the El Paso region TDM.

When the TDM analysis years are different from the inventory analysis years, intermediate year factors are developed using the bounding TDM data and applied to the nearest TDM analysis year network to estimate the inventory analysis year link VMT. Intermediate-year factors were needed for this analysis. The hourly average operational fleet speeds are estimated corresponding to the link VMT estimates using the speed model (i.e., Bureau of Public Roads [BPR] link speed model) within the El Paso travel model. Section 3.1 covers the detail calculations for the El Paso County.

2.2 Vehicle Population and Off-Network Vehicle Activity Factor Estimates

The non-roadway-based inventory estimates (e.g., from vehicle starts, parked vehicle evaporative processes, hotelling activity, and off-network idling) were calculated as the product of the amount of the associated activity factor and the mass per unit of the activity factor. To estimate the ONI, SHP, and vehicle Start activity, vehicle population estimates were needed. ONI activity for each hour of the day was estimated from the source hours operating (SHO) and total source hours idling (SHI) that occurred on and off the network. Hotelling activity factor estimates (composed largely of the emissions-producing SHEI and diesel APU hours) were based on county-specific actual estimates.[7]

[7] Base estimates of hotelling hours used in this analysis are 2017 winter weekday estimates, developed by TTI during the truck idling study that produced county 24-hour hotelling estimate totals for all Texas counties, sponsored by TCEQ in 2017.

2.2.1 Vehicle Type Populations

TTI based the vehicle population estimates on vehicle registration data, vehicle SUT/FT population factors developed from the VMT mix, and, additionally, for future years, VMT growth estimates. For a historical year, the vehicle population estimates are based solely on the historical analysis year or the closest year to the historical analysis year TxDOT (or TxDMV) county registration data, if available , and regional, all roads-weekday VMT mix-based vehicle type population factors for the analysis year. For future years, vehicle type populations were estimated as a function of base (e.g., latest available) registrations, grown to a future value (growth as a function of base and future VMT), and all roads-weekday VMT mix-based vehicle type population factors for the analysis year. This same procedure may be used to back-cast vehicle populations for earlier years for which vehicle registrations are unavailable.

2.2.2 Off-Network Idling (ONI) Hours

ONI (introduced by the EPA with MOVES3) is not related to combination truck hotelling activity. This is an idling activity that occurs while a vehicle is idling in a parking lot, drive-through, or driveway while waiting to pick up passengers, or loading/unloading cargo. ONI applies to all MOVES source types. Emissions are calculated by multiplying the emission rates (exhaust running emissions for MOVES roadType ID "1" (off-network links), and MOVES avgspeedbinID "0") with the corresponding hours of ONI.

TTI estimates ONI hours of activity consistent with the MOVES methodology. This is accomplished in general using a formula that calculates ONI as a function of MOVES default relationships on total idling and total operating hours derived from telematics data in combination with local roadway network activity estimates (VMT and speeds) and MOVES default road idling fractions (proportions of idling while operating on roads).

2.2.3 SHP

The SHP was estimated as a function of total source hours (hours a vehicle exists) minus its hours operating on roads (source hours operating [SHO]) and minus its ONI hours. For a historical year, the vehicle type SHP estimates are based on VMT mix, link VMT and speeds, and vehicle population estimates. The VMT mix is applied to the link VMT to produce vehicle-type-specific VMT estimates. Link VMT is divided by the associated speed to produce Link based SHO estimates, which are aggregated by vehicle type and subtracted from associated source hours resulting in SHP estimates. For a future year, 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 vehicle population estimates. This was performed by hour.

2.2.4 Starts

Engine starts were based on MOVES output starts per vehicle and local vehicle population estimates. The MOVES default starts per day per vehicle, starts hour fractions, and the average of June through August starts-month-adjust inputs to MOVES were used to calculate the seasonally adjusted starts per day per vehicle, in combination with local vehicle age distributions, to produce the MOVES "starts per vehicle" output for estimating vehicle starts. MOVES weekday starts per vehicle were used. The starts were calculated as the product of starts/vehicles from MOVES and the county vehicle type population estimates. This was performed by hour.

2.2.5 SHEI and APU Hours

The SHEI and APU hours components of hotelling hours were then estimated for each hour using the hourly hotelling hours estimates, combination long-haul truck travel fractions (calculated from local age distributions and moves default relative mileage accumulation rates), and hotelling activity distributions for each model year (Table 7).

Table 7. Hotelling Activity Distributions by Model Year and OpMode Fraction.

fuelType	Begin Model Year	End Model Year	200 Extend Idling	201 Diesel Aux	203 Battery AC	204 APU Off
Diesel	1960	2009	0.8	0	0	0.2
	2010	2020	0.73	0.07	0	0.2
	2021	2023	0.48	0.24	0.08	0.2
	2024	2026	0.4	0.32	0.08	0.2
	2027	2060	0.36	0.32	0.12	0.2
Electricity	1960	2060	0	0	0.8	0.2

The SHEI and APU hours activity distribution fractions were each first multiplied by the travel distribution (model year operating mode activity fraction multiplied by the associated model year travel fraction).

The product of the SHEI fractions and travel fractions were then summed to produce the total SHEI fraction, and the same process was performed for APU hours to produce the total APU hours fraction. (The sum of the SHEI and APU hours fractions subtracted from

1.0 results in the remaining fraction of hotelling hours, consisting of the electric power or no power in use modes.)

The total SHEI and APU hours fractions were then each multiplied by the hotelling hours for each hour of the day to produce the SHEI and APU hours estimates for each hour.

2.3 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 time of day, by day type, and by MOVES road type.

TTI developed and improved the VMT mix procedure to produce the four-period, time-of-day estimates[8] of vehicle type VMT allocations by MOVES road type and by day type, for use with the El Paso District. The main data sources used include recent, 2013 to 2022 TxDOT vehicle classification counts, year-end 2021 TxDOT/Texas Department of Motor Vehicles (TxDMV) registration data, Freight Analysis Framework data, Vehicle Inventory and Use Survey data, and MOVES default data.

2.4 MOVES-Based Emissions Rates

TTI produced the emission rates look-up table inputs to the TTI's inventory calculation utility in three basic steps. The first step was to set up and execute the MOVES emissions rate mode runs. The next step was to perform the initial post-processing, which calculates rates in the form needed that are not directly available from MOVES and combines all the needed rates in tables for the emissions calculations. The third step is to apply emission rate adjustments to an emission rate database table if necessary (which does not apply to this analysis).

Local input parameters were developed and used to produce rates reflective of the local scenario conditions (e.g., weather, fleet characteristics, and fuel properties). MOVES county scale, rates mode modeling scenarios produced rates for the MOVES weekday day type by pollutant, process, speed (for roadway-based processes), hour, road type, and average SUT/fuel type (shown in Table 8). Two rate post-processing steps were performed to produce the final rates in the form needed. The next step produced the mass-per-SHP off-network evaporative rates not available from MOVES.

[8] TTI (July 2024). Subtask 5.3 Maintain, Update and Enhance Traffic Activity Estimation and Forecasting Methods. TxDOT-TTI Interagency Contract 27476.

Table 8. MOVES SUT/Fuel Types (Vehicle Types).

SUT ID	SUT Description	SUT/FT Abbreviation
11	Motorcycle	MC_Gas
21	Passenger Car	PC_Gas, PC_Diesel, PC_Electricity
31	Passenger Truck	PT_Gas, PT_Diesel, PT_Electricity
32	Light Commercial Truck	LCT_Gas, LCT_Diesel, LCT_Electricity
41	Other Buses	OBus_Gas, OBus_Diesel, OBus_Electricity
42	Transit Bus	TBus_Gas, TBus_Diesel, TBus_Electricity
43	School Bus	SBus_Gas, SBus_Diesel, SBus_Electricity
51	Refuse Truck	RT_Gas, RT_Diesel, RT_Electricity
52	Single Unit Short-Haul Truck	SUShT_Gas, SUShT_Diesel, SUSht_Electricity
53	Single Unit Long-Haul Truck	SULhT_Gas, SULhT_Diesel, SULhT_Electricity
54	Motor Home	MH_Gas, MH_Diesel, MH_Electricity
61	Combination Short-Haul Truck	CShT_Gas, CShT_Diesel, CShT_Electricity
62	Combination Long-Haul Truck	CLhT_Diesel, CLhT_Electricity

County-level, MOVES weekday hourly emissions factors were developed for three RFP control scenarios: 1) pre-1990 controls except FMVCP are current as of each year, and 2) control strategy (or "current controls"). For the estimation of emissions reductions by individual control measure an additional set of MOVES runs was performed for El Paso County, for which control measures were incrementally added to the pre-1990 scenario (CS1) starting with current fuels (CS2), then the I/M program (CSC). Actual, local, activity estimates for El Paso were then externally combined with the associated emission rates in the inventory calculations process, as needed to produce the inventories for each particular RFP scenario and for the individual control measure emissions reductions estimation procedure.

2.5 Inventory Calculations

Summer weekday analysis year inventories for each RFP control scenario and each "incremental control" scenario were calculated for El Paso County. The major inputs were:

- TxDOT district-level, weekday, time-of-day, VMT mix by MOVES road type;
- county, hourly on-road fleet link VMT, and speed estimates for each analysis year summer weekday;

- county, hourly, and off-network activity factor estimates by vehicle type for each activity scenario of ONI hours, SHP, starts, SHEI, and APU hours; and
- county-level look-up tables of hourly MOVES seasonal weekday rates by road type, speed bin, vehicle type (SUT/fuel type), and 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 types. Emission rates for each link's average speed were interpolated (see procedure in Appendix A) from the appropriate set of look-up table rates and corresponding index speeds (i.e., the average bin speeds of 2.5, 5.0, 10.0, 15.0, … 75.0 mph) bounding the link's average speed. For link speeds below or above the minimum and maximum average bin speeds of 2.5 and 75 mph, the rates for those bounding speeds were used. The estimated vehicle type and MOVES road type link-speed-specific rates for each process were then multiplied by the associated VMT to produce the link-based emissions estimates. This process was performed for each hour, for each El Paso County RFP inventory scenario and individual control measure scenario.

For the off-network calculations, which are county level, the vehicle type, and county-level rates were multiplied by the associated county total activity factor estimate (starts, ONI hours, SHP, SHEI, APU hours), as determined by the pollutant process. This process was performed for each hour, for each El Paso County RFP inventory scenario and individual control measure scenario.

The on-road mobile inventory utilities produce two types of tab-delimited summary output files and optionally a set of 24 link-emissions files (not included in this analysis). The standard on-road tab-delimited output file includes hourly and 24-hour activity and emissions results summarized by vehicle type and road type. The extensible markup language (XML) format output feature produces 24-hour activity and emissions data in a form (aggregated and coded) consistent with the EPA's latest 2020 National Emissions Inventory (NEI) inventory, as needed for uploading specified inventory data to TCEQ's Texas Air Emissions Repository (TexAER).

Appendix B contains more information on the output definitions and specifications, including the inventory data formatted for compatibility with TexAER.

2.6 Individual Control Strategy Emissions Reductions Estimation

Additional emissions modeling for attainment and contingency years were performed to estimate emissions reductions by individual control strategy for El Paso County using the following procedure.

To estimate emissions reductions from individual control measures, an additional set of MOVES runs were performed. For El Paso County additional scenarios were set up by adding sequentially to the pre-1990 control scenario (except FMVCP are current as of each year): current fuel standards and I/M programs. The rates from these runs were used for estimating the individual control program emissions reductions for 2023 and 2024.

From the El Paso County-based individual control reduction estimates, the total reductions (i.e., pre-1990 scenario, except FMVCP are current as of each year, emissions minus control strategy scenario emissions) were calculated for each control. These estimated incremental reduction fractions were used to break out individual control measure reduction estimates for El Paso County. The individual controls modeling sequence is as follows:

1. Produce current control strategy EIs (i.e., with both pre-1990 and post-1990 controls) for all analysis years (base year 2017, attainment year 2023, and attainment contingency year 2024).
2. Produce pre-1990 controls except for current FMVCP EIs (i.e., pre-1990 fuels, no I/M program, but with full FMVCP) for the analysis years 2023 and 2024.
3. Produce incremental CS EIs for the analysis years 2023 and 2024 for quantifying emissions reductions:
   a. post-1990 fuels added into Step 2 EIs;
   b. I/M program added into Step 3a EIs.
4. Calculate total post-1990 reductions (except FMVCP) as Step 2 minus Step 1 EIs.
5. Calculate individual control emissions reductions for:
   a. Post-1990 fuels as Step 2 EIs minus Step 3a EIs;
   b. I/M program as Step 3a EIs minus Step 3b EIs.

The RFP inventory analysis requires sets of emissions factors for the three main RFP control scenarios:

- "CS1" = Pre-1990 control scenario Except Full FMVCP;
- "CS2" = CS1 + current state and federal fuels; and
- "CSC" = CS2 +I/M programs (i.e., full control strategy scenario).

3 ESTIMATION OF ACTIVITY AND VEHICLE MIX

To estimate El Paso County on-road emissions inventory, both on-network and off-network activity are required. The detailed, hourly, link-based emissions process requires VMT estimates by hour and direction for each link in the TDMs. To estimate the off-network (or parked vehicle) emissions using the mass per activity factor emissions rates, county-level estimates of the ONI hours, SHP, starts, SHEI, and APU hours are required by the hour and vehicle type for each activity scenario (SHEI and APU hours are for diesel combination long-haul trucks only). This section provides the TTI's process used for the development of on-network and off-network activity, data sources, and adjustment factors used for the El Paso County ozone non-attainment area analysis.

3.1 Vehicle Miles of Travel

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 activity scenario (i.e., 2017, 2023, and 2024 summer weekday). The emissions inventory utilities (see Appendix A), the latest available data sets from the El Paso County 2017, 2022, and 2032 TDMs, and post-processing factors developed from several other data sources, were used to produce this hourly VMT by direction.

A summary of the VHT and VMT for each scenario and analysis year is shown in Table 9. More detailed breakdowns of the hourly and 24-hour VMT and VHT by road type were provided electronically to TCEQ (see Appendix B for electronic data descriptions).

Table 9. Summary of El Paso County 24-hour VHT and VMT for each scenario and analysis year

Scenario	Year	VHT	VMT
CS1	2023	502,978	19,453,166
	2024	509,510	19,631,066
CS2	2023	502,978	19,453,166
	2024	509,510	19,631,066
CSC	2017	439,586	17,243,814
	2023	502,978	19,453,166
	2024	509,510	19,631,066

3.1.1 Data Sources

The latest available link trips data, and zonal radii data sets extracted from the El Paso County 2017, 2022, and 2032 TDMs were used to estimate the directional link VMT and speeds by the hour. Since intrazonal VMT is not accounted for in the TDMs, the intrazonal VMT was estimated using the TDM's trip matrix and zonal radii data sets. El Paso MPO provided the TDM data sets, validated in 2017 (February 2024).

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 Federal Highway Administration (FHWA) designed to estimate VMT. The county total HPMS 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 continuously. These vehicle counts are available by season, month, and day types, 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 (2013 through 2022) 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 El Paso TxDOT District were used with El Paso County. This data source was also used to produce the time-of-day (hourly) allocation factors, in which the data from the ATR stations within El Paso County were combined.

3.1.2 VMT Adjustments

For each activity scenario, the TDM VMT was adjusted for HPMS consistency and seasonality (i.e., summer weekday). For the 2017 activity scenario, which by definition is a historical year (i.e., HPMS VMT data exists for this year), county-level VMT control totals were used to develop VMT adjustment factors. For the remaining activity scenario years (2023 and 2024), which are considered future years (i.e., HPMS VMT data did not exist for these years[9]), a regional HPMS factor and seasonal weekday factors were used. Since a current 2023 and 2024 TDM did not exist, TTI also produced intermediate-year growth factors using the bounding TDMs (i.e., 2022 and 2032) and applied these factors to designated (2023, 2024) TDM VMT. Hourly travel factors were also applied to distribute this adjusted VMT over each hour of the day.

3.1.2.1 Historical Year Activity Scenarios – VMT Control Totals and VMT Adjustments

To estimate the HPMS-consistent summer weekday VMT for the 2017 historical year scenarios, county-level 2017 summer weekday VMT control totals were used to develop county-level VMT adjustment factors. The VMT control totals are comprised of two key components: the analysis year county-level HPMS AADT VMT and the AADT-to-summer weekday adjustment factors.

The AADT-to-summer weekday adjustment factor was developed for El Paso County using aggregated ATR data for the years 2013 through 2022. This factor was calculated by dividing the average day-of-week count for June through August by the AADT traffic count. Table 10 shows the El Paso District AADT-to-summer weekday factor used in developing the VMT control totals.

Table 10. AADT-to-Summer Weekday Factor for Control Total Development.

TxDOT District	Adjustment Factor[1]
El Paso	1.003041

[1] Converts AADT to average summer weekday (June through August, Monday through Friday).

The VMT control total for El Paso County was then produced by multiplying the 2017 analysis year HPMS AADT VMT for the county by the summer weekday adjustment factor. To develop the county-level VMT adjustment factor, the county's 2017 summer weekday control total was divided by the total VMT (TDM assignment VMT plus intrazonal VMT estimate) from the 2017 analysis year TDM. 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 analysis year link-level HPMS consistent, 2017

[9] TxDOT typically update their official roadway inventory annual report in October of the following year. I.e., the 2022 report was released on October 17, 2023, and the 2021 report was release on October 26, 2022.

summer weekday VMT estimates. This same adjustment was applied to the intrazonal VMT.

3.1.2.2 Future Year Activity Scenarios – HPMS Adjustment Factor

For the future year activity scenarios, an HPMS adjustment factor was used to adjust the total VMT (TDM assignment VMT plus intrazonal VMT estimate) from each TDM for HPMS consistency. The HPMS factor used in this analysis (1.03712) was based on El Paso's 2017 TDM validation.

3.1.2.3 Future Year Activity Scenarios – Seasonal Adjustment Factors

For the future year activity scenarios, seasonal adjustment factors were used to adjust the TDM and estimated intrazonal VMT to summer weekday VMT. The seasonal adjustment factor was developed for the El Paso TDM area using aggregated ATR data for the years 2013 through 2022. These factors were calculated by dividing the average day-of-week (weekday) count for June through August by the ANSWT traffic count. Table 11 shows the seasonal adjustment factor for the El Paso TDM area.

Table 11. ANSWT-to-Summer Weekday Factor for Future Year Activity Scenarios.

TDM Area	Adjustment Factor[1]
El Paso TDM Area	0.964928

[1] Converts ANSWT to average summer weekday (June through August, Monday through Friday).

3.1.2.4 Future Year Activity Scenarios – Intermediate Year Adjustment Factors

TDMs do not exist for the 2023 and 2024 future analysis year scenarios. Thus, intermediate-year adjustment factors were used to estimate future analysis year VMT from an existing TDM. These adjustment factors were developed using the bounding year TDMs (i.e., 2022 and 2032) and applied to 2023 and 2024. The intermediate-year adjustment factors were based on the annually compounded growth rates between bounding year TDMs, as shown in Table 12.

Table 12. Annually Compounded Growth Rates (Intermediate Year Adjustment Factors).

VMT and Growth Rate[1]	2022 TDM VMT[1]	2032 TDM VMT[1]	Growth Rate
El Paso County	19,266,401	21,104,170	1.00915

[1] VMT is unadjusted TDM VMT plus intrazonal VMT.

3.1.3 Future Year Activity Scenarios – VMT Summary

For each future year activity scenario (i.e., 2023 and 2024 summer weekday), the final HPMS-consistent, 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, intermediate year adjustment factor seasonal adjustment factor, and the link's respective length based on the 2022 TDM 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). This set of adjustment factors (as well as the hourly factors mentioned previously) was also applied to the estimated intrazonal VMT. Table 13 shows the TDM and summer weekday VMT summaries.

Table 13. 2017, 2023, and 2024 VMT Summary.

County	2017		2023		2024	
	TDM[1]	Weekday	TDM[1]	Weekday	TDM[1]	Weekday
El Paso	17,191,534	17,243,814	NA2	19,453,166	NA[2]	19,631,066

[1] Includes intrazonal VMT.
[2] Future years 2023 and 2024 TDMs do not exist; the weekday data were interpolated from existing TDMs – 2022 and 2032.

3.1.4 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 (2010 through 2019) aggregated ATR station data for the El Paso 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 activity scenario year. These factors were also multiplied by the estimated intrazonal VMT to produce the final hourly-adjusted VMT. Table 14 shows the summer weekday time period hourly travel factors.

Table 14. El Paso Summer Weekday Time Period Hourly Travel Factors.

Assignment	Hour	Base factor	Time Period Factor[1]
AM Peak	7:00 a.m. to 8:00 a.m.	0.062075	0.345821727
	8:00 a.m. to 9:00 a.m.	0.062271	0.346913649
	9:00 a.m. to 10:00 a.m.	0.055154	0.307264624

Assignment	Hour	Base factor	Time Period Factor[1]
Mid-Day	10:00 a.m. to 11:00 a.m.	0.053072	0.184062399
	11:00 a.m. to 12:00 p.m.	0.055241	0.191584847
	12:00 p.m. to 1:00 p.m.	0.058238	0.201978934
	1:00 p.m. to 2:00 p.m.	0.05963	0.206806619
	2:00 p.m. to 3:00 p.m.	0.062156	0.215567201
PM Peak	3:00 p.m. to 4:00 p.m.	0.066427	0.245422369
	4:00 p.m. to 5:00 p.m.	0.070583	0.2607772
	5:00 p.m. to 6:00 p.m.	0.071855	0.265476753
	6:00 p.m. to 7:00 p.m.	0.061799	0.228323678
Overnight	7:00 p.m. to 8:00 p.m.	0.048569	0.185733024
	8:00 p.m. to 9:00 p.m.	0.039539	0.151201343
	9:00 p.m. to 10:00 p.m.	0.032687	0.124998566
	10:00 p.m. to 11:00 p.m.	0.025816	0.098723131
	11:00 p.m. to 12:00 a.m.	0.018366	0.070233538
	12:00 a.m. to 1:00 a.m.	0.010727	0.041021189
	1:00 a.m. to 2:00 a.m.	0.007135	0.027284999
	2:00 a.m. to 3:00 a.m.	0.005837	0.022321309
	3:00 a.m. to 4:00 a.m.	0.005877	0.022474273
	4:00 a.m. to 5:00 a.m.	0.008603	0.032898787
	5:00 a.m. to 6:00 a.m.	0.020052	0.076680982
	6:00 a.m. to 7:00 a.m.	0.038291	0.146428858

[1] Used in the VMT calculation process.

3.1.5 Estimation of Link Speeds

To estimate link operational (congested) speeds, the speed model built in the El Paso TDM is used. The BPR speed model is formulated as a polynomial function with respect to the ratio of traffic volume to capacity. The BPR speed model was used to estimate the hourly, directional, congested speed for each link, except for the TDM centroid connectors and added intrazonal links. The speeds of centroid connectors are the model free-flow speed (FFS). The speeds of intrazonal links are calculated as the average speeds of all centroid connectors in the same TAZ. The congested speed was calculated using the following formula:

$$Congested\ Speed = \frac{LEN}{(FFT * \left(1 + \alpha \times \left(\frac{V}{C}\right)^{\beta}\right))/60}$$

Where

LEN is the length of the link,

FFT is the directional link free-flow travel time (in minutes),

V is the directional link traffic flow,

C is the directional link capacity,

α and β are model parameters.

To calculate the hourly, directional, congested speed:

i. The link length and directional link free-flow speeds in the El Paso travel model were directly used as the FFS,

ii. the directional hourly link flow *V* was estimated by distributing the Time-Of-Day (TOD) link flow among each hour in the TOD using corresponding normalized hourly factors for the TOD,(see Table 14),

iii. the directional hourly link capacity *C* was estimated by evenly distributing the TOD capacity among each hour within the TOD, and

iv. the model parameters α and β associated with each link in the El Paso travel model were directly used.

3.1.6 Estimation of link-level VMT

The directional hourly link-level VMT is calculated as follows.

$$VMT_h = V_h * LEN$$

Where V_h is the hourly directional link flow (after applying VMT adjustment factors),

LEN is the length of the link.

3.2 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 ONI hour, mass per SHP, mass per start, and mass per SHEI), county-level estimates of the ONI hours, SHP, starts, SHEI, and APU hours are required by the hour and vehicle type for each activity scenario (SHEI 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 ONI hours, SHP, starts, SHEI, and APU hours off-network activity factors are included as Appendix E. Hourly ONI hours, SHP, starts, SHEI, and APU hours activity estimates are included with the detailed inventory data provided (see inventory data file descriptions in Appendix B).

The county-level vehicle population estimates were developed using the VehPopulationBuild utility. The county-level ONI hours, SHP, starts, SHEI, and APU hours of off-network activity were developed using the OffNetActCalc utility. Appendix A contains a description of the utilities.

3.2.1 Estimation of Vehicle Population

Vehicle population estimates are needed to estimate the SHP and starts off-network activity factors. The vehicle population estimates (included as Appendix E) were produced for El Paso County for each activity scenario year. The vehicle population estimates are a function of vehicle registration data (TxDMV registration data sets), population scaling factors (where applicable), and vehicle type VMT mix.

For estimating vehicle populations, a historical activity scenario year is defined as any year where actual TxDMV registration data and HPMS VMT data (used in developing population scaling factors) exist. Therefore, the 2017 activity scenario year was considered a historical year and the vehicle population estimates were based on the 2018 TxDMV registration data and scaling factor estimated between 2017 and 2018 HPMS VMT. Since the HPMS VMT data were not available for 2023 and 2024, these analyses were considered future activity scenario years. For the future activity scenario years, the vehicle population estimates were based on the most recent year (2021) TxDMV registration data set and the activity scenario 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 Chapter 3.3.

3.2.1.1 Historical Years Vehicle Population Estimates

The county-level vehicle population estimates for the base year (2017) were calculated using the inventory year, county-level, registration data (end-year 2021 TxDMV vehicle registrations county totals) with VMT-based backscaling and the assigned aggregate VMT mix (see Table 17 and Appendix D). These historical year county-level vehicle population scaling factors were calculated as the ratio of the county-level summer weekday VMT for the activity scenario year (2017) to the county-level summer weekday VMT for the year of the most recent (2021) TxDMV registration data (i.e., vehicle population decreases/increases linearly with VMT). Historical years' VMT mix was applied to make sure the SUT-FT-based vehicle population was calculated properly. 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 registration 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 the county, the inventory year vehicle registrations were aggregated into five categories. Table 15 shows these five categories.

Table 15. Registration Data Categories.

Registration Data Category	Vehicle Registration Aggregation
1	Motorcycles
2	Passenger Cars (PC)
3	Trucks <= 8.5 K gross vehicle weight rating (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 fraction for each vehicle type by the summed total of the VMT mix fractions in their 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 16 shows the vehicle registration aggregations and their associated MOVES SUT/fuel types (vehicle types).

Table 16. 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; PC_Electricity
Trucks <= 8.5 K GVWR (pounds)	PT_Gas; PT_Diesel; PT_Electricity LCT_Gas; LCT_Diesel; LCT_ Electricity
Trucks > 8.5 and <= 19.5 K GVWR	RT_Gas; RT_Diesel; RT_ Electricity SUShT_Gas; SUShT_Diesel; SUShT_ Electricity MH_Gas; MH_Diesel; MH_ Electricity Obus_Gas; Obus_Diesel; Obus_ Electricity TBus_Gas; TBus_Diesel; TBus_ Electricity SBus_Gas; SBus_Diesel; SBus_ Electricity
Trucks > 19.5 K GVWR	CShT_Gas; CShT_Diesel; CShT_ Electricity
NA[1]	SULhT_Gas; SULhT_Diesel; SULhT_ Electricity CLhT_Gas; CLhT_Diesel; CShT_ Electricity

[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 end-year TxDMV county registrations data extracts were used (i.e., the three data sets 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 aggregated registrations of 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]).

3.2.1.2Future Years Vehicle Population Estimates

The process for estimating the county-level population estimates for the future years is very similar to the historical vehicle population. The most recent (2021) county-level TxDMV registration data sets for which HPMS data exists were used. The county-level base 2021 vehicle total population estimates were calculated using the 2021 registration data sets. Future year county-level vehicle population scaling factors were used to scale the county-level base 2021 vehicle population estimates to the activity scenario year. These future year county-level vehicle population scaling factors were calculated as the ratio of the county-level summer weekday VMT for the activity scenario year to the county-level summer weekday VMT for the year of the most recent (2021) TxDMV registration data (i.e., vehicle population increases linearly with VMT). With the assigned aggregate VMT mix for future years and the 2021 registration data sets, the future year source type and fuel type-based vehicle populations were calculated.

3.2.2 Estimation of ONI Hours

One of the activity measures needed to estimate the off-network emissions is the new activity type introduced by MOVES3 and inherited in MOVES4, off-network idling. ONI hours are not related to combination truck hours of hotelling activity. ONI is an idling activity that occurs while a vehicle is idling in a parking lot, drive-through, or driveway while waiting to pick up passengers, or loading/unloading cargo. ONI applies to all MOVES source types. Emissions are calculated by multiplying the emission rates (exhaust running emissions for MOVES roadType ID "1", or "off-network") with the corresponding hours of ONI.

TTI estimates ONI hours activity factors (or source hours idling [SHI] off-network) following the MOVES methodology, by employing key MOVES defaults derived from telematics data, in combination with local network link-level activity estimates. This is accomplished using the formula that calculates ONI[10] as a function of the:

- Total idle fraction (TIF) (MOVES default derived from telematics data), or total idling hours on and off-network divided by total SHO (on network plus ONI hours): *TIF = (SHInetwork + ONI) / (SHOnetwork+ ONI)*,
- SHOnetwork (from local link VMT and speeds), and
- SHI on the network (SHInetwork). SHInetwork is calculated using the MOVES default road idle fractions (RIF) applied to local SHOnetwork (VMT/speed) at the link level.

The equation for calculating ONI Hours is:

$$ONI = (SHOnetwork \times TIF - SHInetwork) / (1 - TIF).$$

3.2.3 Estimation of SHP

Another activity measure needed to estimate the off-network emissions using the mass per activity emissions rates is county-level estimates of SHP by hour and vehicle type for each activity scenario. For each hour, the county-level vehicle type total SHP was

[10] Population and Activity of Onroad Vehicles in MOVES4 (pdf) (August 2023, EPA-420-R-23-005)

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 were 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). The ONI hours estimated in the previous step are then subtracted from the total SHP to produce the adjusted SHP (for vehicle emission calculations with their engine off) used in the analysis. Appendix E includes the 24-hour summaries of the county-level weekday estimates of the adjusted SHP by vehicle type for each activity scenario (hourly summaries were provided electronically to TCEQ; see Appendix B for electronic data descriptions).

3.2.3.1 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 activity scenario was set equal to the vehicle type vehicle population for the activity scenario year.

3.2.3.2 Vehicle Type SHO

To calculate 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 17 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.

3.2.4 Estimation of Starts

Another activity measure needed to estimate the off-network emissions using the mass per activity emissions rates is county-level estimates of starts by hour and vehicle type for each activity scenario. For each activity scenario, the vehicle type hourly default starts per vehicle was multiplied by the activity scenario county-level vehicle type population to estimate the county-level vehicle type starts by the hour.

The engine starts were estimated using county-level vehicle type populations and data from MOVES representing the average number of vehicle starts per vehicle type per hour. The starts per vehicle are calculated using the applicable MOVES algorithm with data on the age distribution and fuel fractions of the local fleet. Local age distributions and fuel fractions inputs to MOVES are combined with MOVES default parameters (startsageadjustment, startsmonthadjust [three-month seasonal average (June, July, and August) for summer weekday scenario], and startspervehicle) to produce 24-hour starts per vehicle output representative of each seasonal period. The MOVES output provides the scenario-specific starts per vehicle defined by the study scope. For each hour of the day, the starts per vehicle data calculated by the MOVES algorithm are multiplied by the local vehicle type population estimates to produce the total number of starts by vehicle type per hour.

Appendix E includes the 24-hour summaries of the county-level vehicle type starts for the activity scenario (hourly summaries were provided electronically to TCEQ; see Appendix B for electronic data descriptions).

3.2.5 Estimation of SHEI 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 heavy-duty diesel truck (SUT 62, fuel type 2 [CLhT_Diesel]) emissions-producing hotelling activity factors (i.e., truck main engine idling and diesel APU use). During hotelling, the truck's main engine is assumed to be in idling mode or its diesel auxiliary power unit is in use, or it is using electric power or no power. For each activity scenario, hotelling hours were first estimated, followed by an estimation of the SHEI and diesel APU hours components of hotelling hours. With the introduction of electric vehicles modeling capability in MOVES4,. the hotelling hours for heavy-duty diesel and electric trucks (SUT 62, fuel type 9 [CLhT_Electricity]) were also calculated. The discussion and associated emission calculation procedures are only applicable to CLhT_Diesel vehicles.

The hotelling activity estimates were based on information from a TCEQ extended idling study, which produced 2017 winter weekday extended idling estimates for each Texas county. Hotelling scaling factors (by activity scenario) were applied to the base 2017 winter weekday hotelling values from the study to estimate the 24-hour hotelling. Hotelling hourly factors were then applied to allocate the 24-hour hotelling to each hour of the day. To ensure valid hourly hotelling values were used in the emissions estimation, the hourly hotelling hours were compared to the CLhT_Diesel and CLhT_Electricity hourly SHP (i.e., hourly hotelling values cannot exceed the hourly SHP values). SHEI and APU hours factors were then applied to the hotelling hours to produce the hourly SHEI and APU hours of activity. This procedure was performed for each activity scenario. Appendix E includes the 24-hour summaries of the county-level estimates of hotelling hours, SHEI, and APU hours for each activity scenario (hourly summaries were provided electronically to TCEQ; see Appendix B for electronic data descriptions).

3.2.5.1Hotelling Scaling Factors

To estimate the county-level 24-hour hotelling by activity scenario, county-level hotelling scaling factors were developed for each activity scenario. These scaling factors were produced using the county-level 2017 winter weekday link-level VMT and speeds, the TxDOT district-level base weekday vehicle type VMT mix (by MOVES road type), the county-level activity scenario link-level VMT and speeds, and the TxDOT district-level activity scenario vehicle type VMT mix (by MOVES road type). The 2017 winter weekday link-level VMT and speeds were developed similarly to the 2017 summer weekday link-level VMT and speed data except using a 2017 winter 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 17 and Appendix C). For the base weekday vehicle type VMT mix, the 2015 weekday vehicle type VMT mix was used and for the future year analyses the 2025 VMT mix was used.

For each link in the 2017 winter weekday link-level VMT and speeds, the link VMT was allocated to CLhT_Diesel and CLhT_Electricity using the base weekday vehicle type VMT mix. This VMT allocation was performed for each link and hour in the 2017 winter weekday link-level VMT and speeds, with the individual link VMT aggregated by hour to produce the CLhT_Diesel and CLhT_Electricity hourly and 24-hour 2017 winter weekday VMT. Using a similar allocation process, the activity scenario CLhT_Diesel hourly and 24-hour VMT were calculated using the activity scenario link-level VMT and speeds and the inventory vehicle type VMT mix. The county-level 24-hour hotelling scaling factors by activity scenario were calculated by dividing the activity scenario CLhT_Diesel and CLhT_Electricity 24-hour VMT by the CLhT_Diesel 24-hour 2017 winter weekday VMT.

3.2.5.2Hotelling Hourly Factors

Hotelling hourly factors for each activity scenario were used to allocate county-level, 24-hour, hotelling hours to each hour of the day. These hotelling hourly factors were calculated as the inverse of the activity scenario hourly VHT fractions. The hourly VHT fractions were first calculated using the hourly VHT from the SHP estimation process (VHT = SHO). The inverses of these hourly VHT fractions were calculated and then normalized across all hours to produce the county-level, hotelling hours hourly distribution. This procedure was performed for each activity scenario.

3.2.5.3Hotelling by Hour Estimation

The initial activity scenario hotelling by the hour was calculated by multiplying the 24-hour 2017 winter weekday hotelling hours by the activity scenario hotelling scaling factor and by the activity scenario hotelling hourly factors. A comparison was then made between hourly hotelling and hourly SHP for the scenario. For each hour where the activity scenario's initial hotelling hours were greater than the SHP, the final hotelling hours estimate was set equal to the SHP, otherwise, the initial hotelling hours estimate was set as the final value. All calculations (scaling factors, hotelling hourly factors, and hotelling by hour) were performed for El Paso County for each activity scenario.

3.2.5.4SHEI and APU Hours Estimation

The hourly, county-level, hotelling estimates for each activity scenario were then factored to produce the SHEI and APU hours activity components using aggregate extended idle mode and aggregate APU mode fractions. For each hour, the activity scenario hotelling hours were multiplied by the SHEI fraction to calculate the hourly SHEI and by the APU fraction to calculate the hourly APU hours.

The aggregate SHEI 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 distributions are shown previously in Table 7. 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 SHEI and APU fractions. (The sum of the resulting SHEI and APU fractions, when subtracted from 1.0, leaves the portion of hotelling hours in which trucks were using electric power or using no power.)

3.3 Development of Vehicle Type VMT Mix

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.

Since proportions of travel by vehicle type can significantly vary by TOD, affecting emissions totals, the TTI VMT mix procedure develops 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, and Weekday (average Monday through Friday) VMT mix (for gasoline-, diesel-, and electric-powered vehicles) is estimated by the four MOVES road type categories using the methodology characterizing VMT by vehicle type for a region (or district).[11] To accommodate MOVES4 changes, the procedure has been updated to manage MOVES4 requirements. The procedural approach is to modify certain vehicle categories and fuel combinations to allow the immediate use of MOVES4. Figure 1 shows the simplified process flow chart of the SUT VMT mix procedure prior to the subdivision of the estimated SUT proportions by fuel type.

[11] TTI (2024). *Fiscal Year (FY) 2024 MOVES4 Source Use Type and Fuel Type Vehicle Miles Traveled (VMT) Distribution Update for Conformity Analysis. TxDOT-TTI Interagency Contract 27476.*

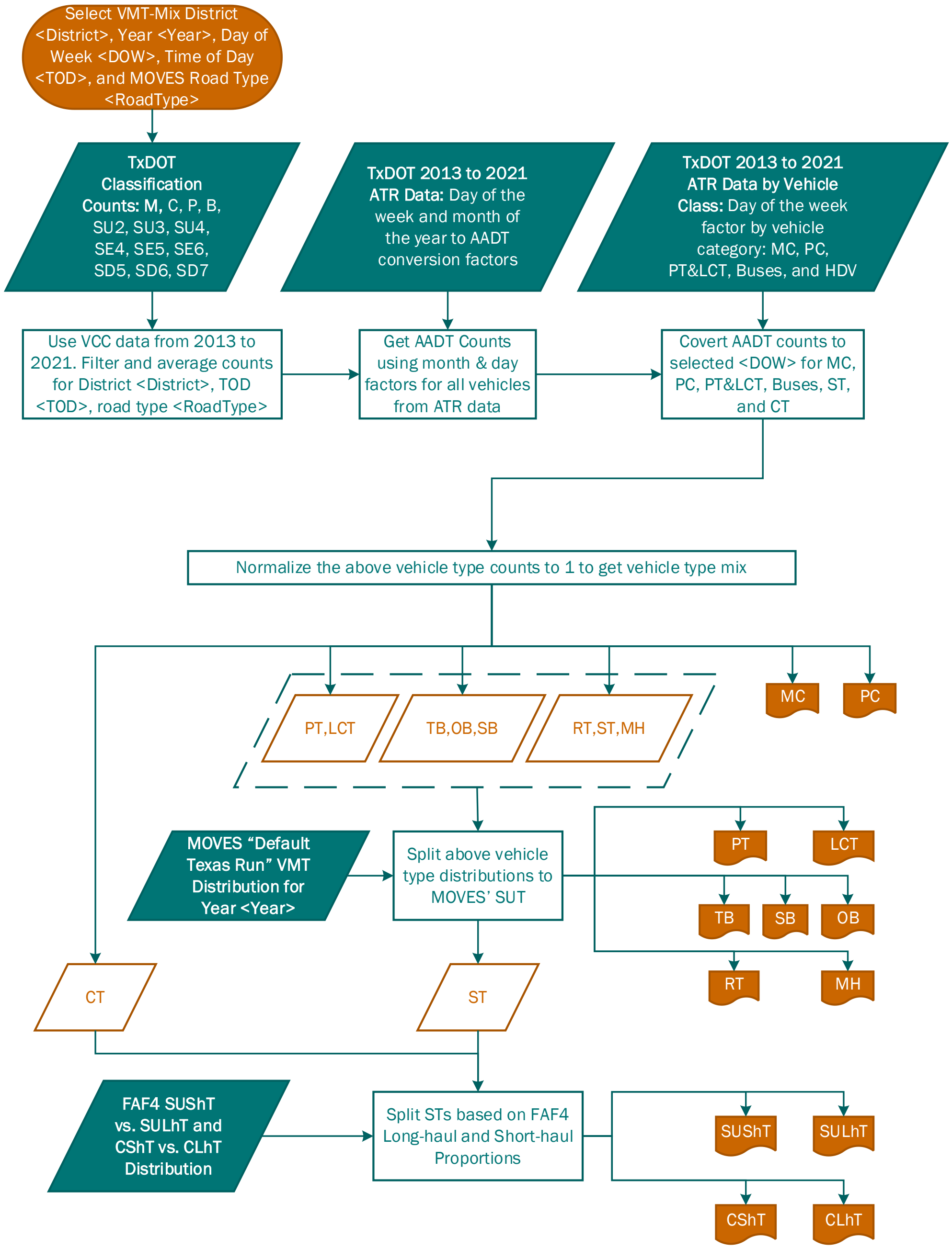

Figure 1. Simplified Overview of the VMT Mix Process Prior to Subdivision by Fuel Type.

The modified procedure characterizes VMT by vehicle type for a region or district as described below:

1. Develop county-level customized Alternate Vehicle Fuel and Technology (AVFT) table using TxDMV Registration Data and dfwcleancities online database[12] for MOVES4.
2. Conduct MOVES county-level inventory runs using customized AVFT and default values. Aggregate the VMT by SUT and fuel type at the district level.
3. TxDOT Classification Counts – Data files of standard TxDOT classification data assembled and used for determining the in-use road fleet mix.
4. TxDOT ATR Data – Data files of TxDOT ATR data assembled and used to allocate VMT by season and day of the week.
5. Day of Week (DOW) Factors by Urban Area/TxDOT District – Seasonal day-of-week factors from TxDOT ATR data used to allocate VMT by season and day-of-week by urban area/TxDOT district.
6. Convert TxDOT Classification Counts into MOVES SUT:

- Split vehicle classes 1 (motorcycles [M]) and 2 (passenger vehicles [C]) count into motorcycle and passenger cars directly based on their vehicle classification counts.
- Split vehicle class 3 (two-axle, four-tire single-unit trucks [P]) counts into passenger trucks and light commercial trucks using district-level VMT distribution by the corresponding SUTs.
- Split vehicle class 4 (buses [B]) counts into other buses, transit buses, and school buses using MOVES4 district-level VMT by the corresponding SUTs.
- Split vehicle classes 5 (six-tire, two-axle single-unit vehicles [SU2]), 6 (three-axle single-unit vehicles [SU3]), and 7 (four or more axle single-unit vehicles [SU4]) into single-unit trucks, single-unit trucks, mobile homes, and refuse trucks using MOVES4 district-level VMT by the corresponding SUTs.
- Split vehicle classes 8 (three or four-axle single-trailer vehicles [SE4]), 9 (five- axle single-trailer vehicles [SE5]), 10 (six or more axle single-trailer vehicles [SE6]), 11 (five or less axle multi-trailer vehicles [SD5]), 12 (six axle multi-trailer vehicles [SD6]), and 13 (seven or more axle multi-trailer vehicles [SD7]) into combination short-haul trucks and combination long-haul trucks and split single-unit trucks

[12] Dfwcleancities online database: https://www.dfwcleancities.org/.

into single-unit short-haul trucks and single-unit long-haul trucks using assignment results from registration data.

7. Estimate fractions of fuel types for each MOVES SUT using its district-level VMT by fuel types and apply the fuel type fractions to each SUT.
    - To account for the Texas-specific EV population, the 2021 vehicle registration data was utilized to develop an EV adjustment factor at the county-level by comparing the actual EV count to the MOVES4 default. This adjustment factor was applied to the market share of electric passenger cars, passenger trucks, and light commercial trucks of all model years in the *samplevehiclepopulation* table. Then, the market share of all other fuel types but gasoline, diesel, and electric in the *samplevehiclepopulation* table was set to zero.
8. Produce VMT mix – Output file of MOVES SUTs and fuel types by region, analysis year, day type, and time period.

TxDOT district-level Weekday (as well as Friday, Saturday, and Sunday) VMT mix by MOVES road-type category is produced based on recent multi-year vehicle classification counts and appropriate end-of-year TxDOT vehicle registration 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) are also produced. To ensure general applicability and consistency across all study areas, all VMT mixes are developed in five-year increments beginning with the year 2005 and applied to the analysis years based on Table 17.

Table 17. 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

4 ESTIMATION OF EMISSIONS RATES

TTI developed the emissions rates needed for the on-road mobile source emissions inventories according to TTI's detailed MOVES rates-per-activity, county-level, link-based method. On-road mobile emission rates data from the EPA's latest emissions factor model, MOVES4 (version 4.0.1; database = movesdb20240104), were used in TTI's rates post-processing utilities to produce rates in the form needed as input for the external inventory calculation procedure.

El Paso County emission rates were developed as required for an average summer weekday for the RFP SIP emissions inventory. A conversion was performed of MOVES mass/vehicle rates for parked vehicle evaporative emission rates to mass/SHP, as needed for the activity-based emissions estimation methodology. Emission rates were produced by hour, year, vehicle type (source type and fuel type), MOVES road type (and speed), pollutant, and emission process. Emission rates are for gasoline, diesel, and electricity-powered vehicles (with alternative vehicles currently assumed negligible).

The emissions rates were developed based on the latest TTI emission inventory development methods and procedures but updated to accommodate MOVES4. The EPA's current *Technical Guidance*[13] applicable to MOVES4 inventory development was used. The TTI MOVES4 data post-processing utilities used to produce the databases of rates look-up tables are consistent in concept with the prior MOVES2014-based TTI utilities, as described, along with other TTI emissions inventory utilities, in Appendix A.

The following sections describe the emission rates development process, inputs, data sources, and post-processing performed in the development of MOVES emission rates.

4.1 PROCESS OVERVIEW

The general process involves setting up and executing MOVES emissions rates mode runs to produce the emissions and activity data needed for the development of on-road mobile source, county-level emissions rates, for an average summer weekday. For the initial post-processing step following the MOVES emission rates mode run, TTI uses an on-road rates look-up table post-processor utility to convert the mass/vehicle evaporative rates to mass/SHP and to compile all the needed rates into look-up tables.

[13] EPA. 2023. *MOVES4 Technical Guidance: Using MOVES to Prepare Emission Inventories for State Implementation Plans and Transportation Conformity*, EPA-420-B-23-011, Office of Transportation and Air Quality. August 2023.

Using this process, on-road rates look-up tables are produced from each set of MOVES runs, in the form needed for input to the external inventory calculations utility.

For the external inventory calculations, the method requires that all rates be in terms of mass per unit of activity, as opposed to particular off-network rates of mass per vehicle, which is the only output option available for off-network "parked vehicle" evaporative emissions output by MOVES. Table 18 summarizes the form of rates produced for the external inventory calculations. The MOVES input files (MOVES run specification input files [RunSpec or MRS] and county database input files [CDBs]) are provided as a part of the electronic data submittal (Appendix B).

Table 18. Emissions Rates by MOVES Emissions Process and Activity Factor.

Process (Process ID)	Activity Factor[1]	Emissions Rates[2]
Running Exhaust (1)	VMT	mass/mile (mass/mi)
Crankcase Running Exhaust (15)	VMT	mass/mi
Brake Wear (9)	VMT	mass/mi
Tire Wear (10)	VMT	mass/mi
Start Exhaust (2)	starts	mass/start
Crankcase Start Exhaust (16)	starts	mass/start
Extended Idle Exhaust (90)	SHEI	mass/hour
Crankcase Extended Idle Exhaust (17)	SHEI	mass/hour
Auxiliary Power Exhaust (91)	APU Hours	mass/hour
Running exhaust (1) – Road Type 1 Off-network	ONI Hours	mass/hour
Evaporative Permeation (11) Evaporative Fuel Vapor Venting (12) Evaporative Fuel Leaks (13)	VMT, SHP	mass/mi, mass/hour

[1] VMT, ONI hours, SHP, vehicle starts, and hotelling activity (SHEI and APU hours) are the basic activity factors. SHEI and APU hours are for combination long-haul trucks only.
[2] All mass per activity rates shown are available in MOVES rate mode table output, except for mass/SHP, which is produced using the TTI emissions inventory utilities.

The RFP inventory analysis required sets of emissions factors for the three main RFP control scenarios: pre-1990 controls (except for current FMVCP EIs), incremental control strategy, and full control strategy. The current methodology is mostly consistent with TTI's fiscal year 2020 RFP EIs methodology[14], except individual control reductions for post-1990 FMVCP were not estimated. This change is needed because the EPA removed the MOVES4 model's capability to switch off the post-1990 FMVCP effects. Since MOVES4 is only capable of modeling full FVMCP effects for each RFP analysis year,

[14] As documented in *Houston-Galveston-Brazoria (HGB) 2015-Eight-Hour Ozone Reasonable Further Progress (RFP) On-Road Mobile Emissions Inventories* (TTI, June 2021).

MOVES4 cannot be used to accurately estimate emissions reductions solely attributable to post-1990 FMVCP.

To estimate emissions reductions from individual control measures, an additional set of MOVES runs was performed:

- "CS1" = Pre-1990 control scenario except for current FMVCP;
- "CS2" = CS1 + current fuels; and
- "CSC" = CS2 +I/M programs (i.e., full control strategy scenario).

The main purpose of this overall discussion is three-fold. First, the MOVES-based emissions rate look-up table development process is explained. Second, specifics are provided on emission rate modeling for the two main RFP control scenarios - Pre-1990 controls (CS1) and control strategy (CSC)—the first and last bullets of the previously listed control scenarios. TTI produced all emissions rates consistent with the methods and procedures presented for these two main RFP control scenarios. Third and last, the control scenario rates development for the estimation of individual control measure impacts (i.e., CS1 and CS2) is detailed.

The MOVES model is equipped with default modeling values for the range of conditions that affect emissions factors. MOVES defaults may be replaced by alternate input data sets that better reflect local scenario conditions, where available and consistent with the methodology. Local data were developed to reflect county weather conditions, regional seasonal (summer) fuel properties, and county vehicle age distributions.

For the activity input data to MOVES, the MOVES defaults are generally used, which is basic to the emissions rates method (i.e., inventory scenario emission rates produced via post-processing were externally multiplied by the actual local VMT and off-network activity estimates, detailed in previous sections, to calculate emissions external to MOVES). Where local data is required, MOVES default data are replaced with local data using the MRS and MOVES CDBs. The MRS files, CDBs, and MOVES default database provide the input data tailored for each local scenario model run.

For each analysis year MOVES run, there was a corresponding RunSpec, one input CDB, and one MOVES output database.

MOVES set-ups and runs were executed and the results were post-processed to produce county-level, summer weekday, activity-based emission rates of the desired pollutants and processes. The emission rates were estimated by speed (for miles-based rates), process, hour, MOVES road type (road type 1 for off-network), SUT, and fuel type. The following sections describe the emission rates estimation process used for setting up the MOVES RunSpec files and CDBs, executing MOVES emissions rate mode runs, and post-processing.

4.2 Summary of Control Programs Modeled by RFP Control Scenario

Table 19 shows the control measures modeled in each of the RFP control scenarios, pre-1990 controls (CS0), and control strategy (CSC).

Table 19. Control Measure Modeling by RFP Control Scenario.

Individual Control Measures[1]	Method	RFP Control Scenario		
		Pre-1990 Controls (CS1)	Incremental Control Strategy (CS2)	Control Strategy (CSC)
Pre-1990 CAA FMVCP	MOVES inputs	√	√	√
1992 Federal Controls on Gasoline Volatility	MOVES inputs	√		
Current Federal and State Fuels Standards	MOVES inputs		√	√
Post-1990 CAA FMVCP Tier 1 National Low Emission Vehicle Program Tier 2 Tier 3 Heavy-Duty 2004 Diesel 2005 Gasoline 2007 Gasoline and Diesel Highway Motorcycle 2006 Light- and Medium-Duty 2010 Cold Weather Light- and Heavy-Duty Greenhouse Gas (GHG) Heavy-Duty Phase 2 GHG Safer Affordable Fuel-Efficient (SAFE) Vehicles 2023 Heavy-Duty Engine and Vehicle Standards (HD2027) Revised 2023 and later model year light-duty vehicle GHG standards (LDGHG2023)	MOVES inputs	√	√	√
I/M Program	MOVES inputs			√

[1] For the pre-1990 scenario, MOVES diesel and gasoline property inputs reflected pre-1990 diesel sulfur and pre-1992 conventional gasoline with the 1992 summer Reid vapor pressure [RVP] limit promulgated prior to the enactment of the 1990 CAAA. For the control strategy scenario, MOVES gasoline and diesel inputs reflected Ultra Low Sulfur Diesel, CG for 2017 consistent with the actual, summer 2017 El Paso survey data, and for 2023 the same as 2017 CG inputs except with sulfur set to the Tier 3 sulfur (10 ppm) standard; Post-1990 FMVCP altogether, per MOVES limitation.

4.3 MOVES Run Specification Input Files

The MRS is a file (in XML format) that 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 and scenario using the MOVES graphical user interface (GUI), then converted the MRS to a template, and used it as a base from which to build all the needed MRS files.

Table 20 describes the MRS selections used to produce MOVES output needed for post-processing the emissions rates for the two main RFP control scenarios, with further details on the selections provided after the table.

Table 20. RFP Control Scenario MRS Selections by MOVES GUI Panel.

<table>
<tr><th>Navigation Panel</th><th>Detail Panel</th><th colspan="6">Selection</th></tr>
<tr><td>Scale[1]</td><td>Model; Domain/Scale;
Calculation Type</td><td colspan="6">On-Road; County;
Emissions Rates</td></tr>
<tr><td>Time Spans[1]</td><td>Time Aggregation Level;
Years – Months – Days – Hours</td><td colspan="6">Hour;
<YEAR>[1] - July – Weekday - All</td></tr>
<tr><td>Geographic Bounds[1]</td><td>Region;</td><td colspan="6">Zone and Link;
<COUNTY>;[1]
<COUNTY INPUT DATABASE (CDB) NAME>[1]</td></tr>
<tr><td rowspan="14">On-Road Vehicles[2]</td><td rowspan="14">SUT/Fuel Combinations
(1- gasoline, 2- diesel, 3- CNG,
5- E85, 9- electricity)</td><td>SUT</td><td>1</td><td>2</td><td>3</td><td>5</td><td>9</td></tr>
<tr><td>Motorcycle</td><td>X</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Passenger Car</td><td>X</td><td>X</td><td>-</td><td>-</td><td>X</td></tr>
<tr><td>Passenger Truck</td><td>X</td><td>X</td><td>-</td><td>-</td><td>X</td></tr>
<tr><td>Light Commercial Truck</td><td>X</td><td>X</td><td>-</td><td>-</td><td>X</td></tr>
<tr><td>Other Buses</td><td>X</td><td>X</td><td>X</td><td>-</td><td>X</td></tr>
<tr><td>Transit Bus</td><td>X</td><td>X</td><td>X</td><td>-</td><td>X</td></tr>
<tr><td>School Bus</td><td>X</td><td>X</td><td>X</td><td>-</td><td>X</td></tr>
<tr><td>Refuse Truck</td><td>X</td><td>X</td><td>X</td><td>-</td><td>X</td></tr>
<tr><td>Single Unit Short-Haul Truck</td><td>X</td><td>X</td><td>X</td><td>-</td><td>X</td></tr>
<tr><td>Single Unit Long-Haul Truck</td><td>X</td><td>X</td><td>X</td><td>-</td><td>X</td></tr>
<tr><td>Motor Home</td><td>X</td><td>X</td><td>X</td><td>-</td><td>X</td></tr>
<tr><td>Combination Short-Haul Truck</td><td>X</td><td>X</td><td>X</td><td>-</td><td>X</td></tr>
<tr><td>Combination Long-Haul Truck</td><td>-</td><td>X</td><td>-</td><td>-</td><td>X</td></tr>
<tr><td>Road Type</td><td>Selected Road Types</td><td colspan="6">Off-Network –
Rural Restricted Access – Rural Unrestricted Access –
Urban Restricted Access – Urban Unrestricted Access</td></tr>
</table>

Navigation Panel	Detail Panel	Selection
Pollutants[3] and Processes	VOC; CO; NO_X; Atmospheric CO_2; SO_2; NH_3; $PM_{2.5}$: Total Exhaust, Brakewear, and Tirewear; PM_{10}: Total Exhaust, Brakewear, and Tirewear	Dependent on pollutants: Running Exhaust, Start Exhaust, Extended Idle Exhaust, Auxiliary Power Exhaust, Crankcase Running Exhaust, Crankcase Start Exhaust, Crankcase Extended Idle Exhaust, Evap Permeation, Evap Fuel Vapor Venting, Evap Fuel Leaks; Brakewear, Tirewear
General Output	Output Database; Units; Activity	***<MOVES OUTPUT DATABASE NAME>***;[1] Grams, KiloJoules, Miles; Hotelling Hours, Population, Starts (not adjustable, pre-selected)
Output Emissions Detail	Always; For All Vehicles/Equipment; On Road	Time: Hour – Location: Link – Pollutant; Fuel Type, Emission Process; Road Type, Source Use Type
Advanced Features	Aggregation and Data Handling	Only the "clear BaseRateOutput after rate calculations" box was checked

[1] County FIPS code, year, season/daytype, and control scenario labels were included in the MRS file and output database names. The same is true for the CDBs, except for season/day type labels.
[2] Although MOVES requires all fuel types to be included in MRSs, only gasoline, diesel, and electricity were modeled.
[3] Pre-requisite pollutants that were needed to model the reported pollutants are not shown.

4.3.1 Scale

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 link-based inventory estimation process.

4.3.2 Time Spans

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 (2017, 2023, or 2024) was selected, and one "Months" (July) and one "Days" (Weekdays) selection was made. Table 21 shows the season used for emissions rate development.

Table 21. Seasonal Analysis Period.

Season	MOVES monthID	Months	Label[1]
Summer	7	June through August	S

[1] Label used in filenames

4.3.3 Geographic Bounds

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, 24 hourly periods, and 16 (speed bin) average speeds were modeled per run.

4.3.4 On-Road Vehicles 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 gasoline, diesel, and electricity SUTs designated as "on-road vehicle equipment" selections in Table 20. These SUT/fuel type combinations were chosen in all the MOVES RunSpecs. All other SUT/fuel type combinations available in MOVES were also selected as required by MOVES, but only gasoline, diesel, and electricity were modeled. Fuel type output was controlled through adjustments to the MOVES default fuel engine fractions, via the MOVES avft table (discussed later). All five MOVES road-type categories were selected.

4.3.5 Pollutants and Processes

In addition to the required pollutants within the scope of the inventory, MOVES requires that additional pollutants be selected for "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 total gaseous hydrocarbons (for VOC); total energy consumption (TEC) (for CO_2 and SO_2); and Composite – NonECPM, Elemental Carbon, H_2O (aerosol), and sulfate for Primary Exhaust $PM_{2.5}$ - Total. All of the associated on-road processes available by the selected pollutants were included; the two refueling emissions processes were excluded (in Texas refueling emissions are in the area source category).

4.3.6 Output Features

The output units were grams, kilojoules, and miles. The activity categories were pre-set by MOVES rates mode (and not adjustable) for inclusion in the output database. The selected output detail level was by hour, link (in MOVES rates mode "link" is the combination of county, road type, and speed bin), pollutant, process, road type, SUT, and fuel type.

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

- Thirteen source types (i.e., vehicle types);
- Five fuel types;
- Five road types (four actual MOVES road categories and "off-network");
- Each of the 24 hours in a day;
- Sixteen-speed bins (only included in miles-based rate tables);
- One hundred thirteen pollutants; and
- Fourteen on-road processes.

The vehicle fleet was modeled as powered only by the predominant on-road fuels of gasoline, diesel, and electricity (alternate fuels were considered *de minimis*). The five road type categories in MOVES are Off-Network (not a road type, this category is for parked vehicle activity), Rural Restricted Access, Rural Unrestricted Access, Urban Restricted Access, and Urban Unrestricted Access. 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.

Appendix B lists the electronic data files provided in support of this analysis, which includes the MRSs used.

4.4 MOVES County Input Databases

TTI developed procedures to accommodate building and checking CDBs for 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 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 were provided directly in the CDB builder MySQL script. Any default data used was selected from the

MOVES default database, MOVESDB20240104. After running the scripts to produce the CDBs, the CDBs were checked to verify all CDB tables were built and populated as intended.

Table 22 provides an outline and brief description of the CDBs, followed by a discussion of the development of the local data and the defaults contained therein. Unless otherwise stated, the CDB table data applies to all counties, years, and RFP scenarios.

Table 22. CDB Input Tables.

Table	Data Source	Notes
auditlog	Local Input	Table required for MOVES to determine if the imcoverage table is needed
avft	Local Input	Estimated SUT fuel fractions using TxDMV vehicle registration data and MOVES defaults, where needed. Local data sets used were consistent with sourcetypeagedistribution tables. The avft estimate is also consistent with the analysis VMT mix (i.e., gasoline, diesel, and electricity).
county	Local Input	Identifies county with local altitude and barometric pressure (BP). Used 2017 annual average BP based on El Paso County weather station data provided by TCEQ (from the 2017 periodic emissions inventory).
fuelformulation	Local Input	• Conventional gasoline (CG) formulations based on TCEQ's summer 2023 (latest available) fuel survey samples from El Paso County. ○ The CG properties are actual 2023 averages (fuel grade averages weighted by relative sales volumes). ○ The 2024 CG properties are the latest available actual 2023 averages except with RVP, average sulfur level, and average benzene content set to the "expected" values (MOVES3 defaults, consistent with the pertinent regulatory standards). • The 2023 diesel sulfur level is the statewide average from TCEQ's 2023 survey. • 2024 diesel sulfur was set to the current expected future year value (MOVES3 default - 6 ppm), which is conservative and consistent with the statewide diesel sulfur average from TCEQ's latest (2023) survey. • The latest available (2021) DOE state-level transportation sector BD consumption estimates are applied for all future analysis years. Fuel subtype IDs 12 and 21 are 10% ethanol-blend gasoline and biodiesel, respectively.
fuelsupply	Local Input	For each analysis year and season, the local fuel supply will consist of one conventional gasoline formulation and one biodiesel formulation. (Although only the predominant fuels gasoline and diesel were modeled, the other MOVES fuel type formulations were also input as required to run the MOVES model.)
fuelusagefraction	Local Input	Flex-fuel vehicle fuel type usage, set for Texas modeling assumptions, i.e., flex-fuel vehicles operate totally on gasoline.

Table	Data Source	Notes
imcoverage	Local Input	Empty for all scenarios aside from CSC.
sourcetypeagedistribution	Local Input	Distribution by 31 age categories for each source type, based on the latest available county vehicle registrations (TxDOT district level for county group CDBs), and MOVES defaults where needed (i.e., for buses, refuse trucks, motor homes)
zonemonthhour	Local Input	Summer hourly temperature and relative humidity for the county. 2017 averages: June-July-August from TCEQ's El Paso County 2017 periodic emissions inventory.
avgspeeddistribution	MOVES Default	Used MOVES default average speed distributions.
dayvmtfraction	MOVES Default	Used MOVES default day VMT fractions.
hotellingactivitydistribution	MOVES Default	Used the MOVES default activity distributions.
hourvmtfraction	MOVES Default	Used MOVES default hour VMT fractions.
hpmsvtypeyear	MOVES Default	Used MOVES default national annual VMT by HPMS vehicle type.
monthvmtfraction	MOVES Default	Used MOVES default seasonal average VMT fractions.
roadtypedistribution	MOVES Default	Used MOVES default road type VMT fractions.
sourcetypeyear	MOVES Default	Used MOVES default national SUT populations.
startsageadjustment	MOVES Default	Distribution by 31 age categories for each source type, based on the latest available county vehicle registrations (TxDOT district level for county group CDBs), and MOVES defaults where needed (i.e., for buses, refuse trucks, motor homes)
startshourfraction	MOVES Default	Used MOVES default starts hour fractions.
startsmonthadjust	MOVES Default	Used MOVES default seasonal average starts month adjustment fractions. For the summer season, use the average value from June, July, and August.
startsopmodedistribution	MOVES Default	Used MOVES default starts operating mode fractions.
startsperdaypervehicle	MOVES Default	Used MOVES default starts per day per vehicle.
state	MOVES Default	Identifies the state (Texas) for the analysis.
totalidlefraction	MOVES Default	Used MOVES default seasonal average total idle fractions.
year	MOVES Default	Designates analysis year as a base year (base year means that local activity inputs will be supplied rather than forecast by the model).
zone	MOVES Default	Start, hotelling, and SHP zone allocation factors. County = zone and all factors were set to 1.0 (required for county scale analyses).
zoneroadtype	MOVES Default	SHO zone/roadtype allocation factors. County = zone and all factors were set to 1.0 (required for county scale analyses).
hotellingagefraction	Empty Table	An empty table in MOVES default format was created in the database to avoid MOVES run errors.
idledayadjust	Empty Table	An empty table in MOVES default format was created in the database to avoid MOVES run errors.
idlemonthadjust	Empty Table	An empty table in MOVES default format was created in the database to avoid MOVES run errors.
idlemodelyeargrouping	Empty Table	An empty table in MOVES default format was created in the database to avoid MOVES run errors.
onroadretrofit	Empty Table	An empty table in MOVES default format was created in the database to avoid MOVES run errors.
starts	Empty Table	An empty table in MOVES default format was created in the database to avoid MOVES run errors.
starts per day	Empty Table	An empty table in MOVES default format was created in the database to avoid MOVES run errors.

Table	Data Source	Notes
hpmsvtypeday	Empty Table	An empty table in MOVES default format was created in the database to avoid MOVES run errors.
sourcetypedayvmt	Empty Table	An empty table in MOVES default format was created in the database to avoid MOVES run errors.
sourcetypeyearvmt	Empty Table	An empty table in MOVES default format was created in the database to avoid MOVES run errors.

4.4.1 Year, State, and County Inputs

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 certain 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. Countytypeid was set to 1 indicating El Paso County is an MSA county, and MSA was set to "El Paso; TX". Whether a county is in an MSA affects the off-network idling emission rates, which vary in MOVES between MSA and non-MSA counties.

4.4.2 Activity and Vehicle Population Inputs

The following activity and vehicle population input parameters under the methodology mostly use the MOVES defaults. The data tables are: hourvmtfraction, dayvmtfraction, monthvmtfraction, hpmsvtypeyear, roadtypedistribution, avgspeeddistribution, sourcetypeyear, startsperdaypervehicle, startshourfraction, startsmonthadjust, startsageadjustment, startssopmodedistribution, totalidelfraction, and hotellingactivitydistribution. Data for all these tables were selected and inserted from the MOVES default database. In the case of the startsmonthadjust and totalidlefraction, which vary by month, the MOVES default data were averaged for each three-month seasonal period (same for MOVES default monthvmtfraction, for consistency).

The zone and zoneroadtype tables contain zonal sub-allocation activity factors. For county scale analyses, the county is equal to the zone; therefore these allocation factors were set to 1.0. The MOVES default value was used for the fuelusagefraction except that the usage for fuel type 5 was set to zero.

4.4.3 Age Distributions and Fuel Engine Fractions Inputs

The locality-specific inputs of vehicle age and fuel type fractions by model year, under the SIP county-level inventory procedures, consist of county-level age distributions and statewide gasoline, diesel, E-85, and electricity fractions (fuel engine fractions in MOVES). 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 age distributions, and the avft table for fuel engine fractions. MySQL scripts were used to populate the CDB input tables.

The age distributions and fuel engine fractions were based on TxDMV year-end 2021 county registration data and MOVES model defaults, where needed. (Typically latest available mid-year age distributions would be used, however, no recent mid-year registration data were available.) The local registration data currently available provides no light-duty fuel-type information and provides gasoline and non-gasoline (assumed diesel) registrations for heavy-duty categories. The fuel engine fractions were developed consistent with the local registration data, as well as the VMT mix estimate (i.e., the local fuel engine fractions estimates reflect no compressed natural gas vehicles and no E85 fuel usage, in effect, gasoline, diesel, and electricity use only). MOVES default flex fuel fractions were included in the AVFT table giving the potential for E85 use, however, E85 use was set to zero via the fuelusagefraction table. Appendix F includes the age distributions and fuel engine fractions summaries.

Table 23 summarizes the data sources and aggregation levels used to estimate the local sourcetypeagedistribution and avft inputs to MOVES.

Table 23. Age Distributions and Fuel/Engine Fractions - Data Sources and Aggregations.

SUT Name	SUT ID	TxDMV Category[1] Aggregations for Age Distributions and Fuel/Engine Fractions	Geographic Aggregation for Age Distributions	Geographic Aggregation for Fuel/Engine Fractions[2]
Motorcycle	11	Motorcycles	County	NA – 100% gasoline, no Fuel/Engine Fractions
Passenger Car	21	Passenger Cars	County	District[2]
Passenger Truck	31	Total Trucks<=8500	County	District[2]
Light Commercial Truck	32	Total Trucks<=8500	County	District[2]
Single-Unit Short-Haul Truck	52	>8500+ >10000+ >14000+>16000	County	Texas Statewide
Single-Unit Long-Haul Truck	53	>8500+ >10000+ >14000+>16000	Texas Statewide	Texas Statewide
Refuse Truck	51	MOVES default (for MOVES yearID consistent with the analysis year)		
Motor Home	54			
Other Buses	41			
Transit Bus[2]	42			
School Bus	43			
Combination Short-Haul Truck	61	>19500+ >26000+ >33000+ >60000	County	Texas Statewide
Combination Long-Haul Truck	62	>19500+ >26000+ >33000+ >60000	Texas Statewide	Texas Statewide

[1] TxDMV year-end 2021(latest available, used for all years) county vehicle registration data were used for developing local inputs (weights are GVWR in units of pounds). The MOVES model default age distributions were from the MOVESDB20240104 database.
[2] MOVES fuel engine fraction defaults (for gasoline, diesel, E85 capability) were used for light-duty SUTs (with E85 use set to zero in the fuelusagefraction table). MOVES default fuel engine fractions were taken from the MOVESDB20240104 sample vehicle population table. District-level local EV-adjusted MOVES4 default is applied.

4.4.4 Local Meteorological (County and Zonemonthhour Table) Inputs

Meteorological data was used to develop the "county" (barometric pressure and altitude) and "zonemonthhour" (temperature and relative humidity) table inputs. These inputs were developed as seasonal hourly temperature and relative humidity, and 24-hour barometric pressure averages, using the hourly data from multiple weather stations within Bexar County (originally developed and applied in the TCEQ's 2017 Air Emissions

Reporting Requirements [AERR] inventory analysis). The altitude was set to low. Table 24 provides tabulated input values temperatures and relative humidity used as input into MOVES. The barometric pressure input for El Paso County is 26.169 inches of mercury.

Table 24. Meteorological Inputs.

Hour	Temperature (Degrees Fahrenheit)	Relative Humidity (Percent)
1	79.77	42.73
2	78.51	45.05
3	77.31	47.11
4	76.27	49.05
5	75.38	50.63
6	74.47	52.45
7	73.96	53.51
8	75.19	51.26
9	77.54	46.95
10	80.13	42.42
11	82.81	37.98
12	85.38	33.88
13	87.54	30.66
14	89.27	28.03
15	90.68	25.90
16	91.85	24.01
17	92.09	24.18
18	91.62	24.77
19	90.74	25.75
20	89.02	28.24
21	86.68	32.05
22	84.78	34.61
23	82.97	37.00
24	81.28	40.04

Source: Average hourly from weather stations within El Paso County—June through August 2017 and December, January, and February 2017 (provided by TCEQ). Temperature units are degrees Fahrenheit and relative humidity is percent.

4.4.5 Fuels Inputs

4.4.5.1Overview and Assumptions

TTI uses various data sources to produce the best available Texas summer fuel formulation inputs to MOVES. Four MOVES fuels input tables must be consistent between the fuel types in the scope of the inventory analysis. These are:

- AVFT (source type population fuel type distributions by model year).
- fuelformulation (fuel properties for each fuel sub type supplied in the study area).
- fuelsupply (market shares of each fuel sub-type formulation).
- fuelusagefraction (flex fuel vehicle fuel type usage).

The fuel types in the scope of the inventory analysis for Texas FY2023 are gasoline, diesel, and electricity with other alternative fuels assumed to have insignificant impact. Thus the AVFT model year fuel fractions are normalized for only gasoline, diesel, electricity, and flex-fuel vehicles (i.e., vehicles with the capability to be powered by gasoline or E85 [gasoline with about a 15% by volume ethanol content]). Since the analysis scope is gasoline, diesel, and electricity, flex fuel vehicle fuel usage is set to 100% gasoline (via the fuelusagefraction table). With the gasoline, diesel, and electricity scope set by the AVFT and fuelusagefraction tables, the fuelformulation and fuelsupply table's gasoline and diesel fuel properties and market shares must be specified.

4.4.5.2Texas fuel type details

The Texas MOVES4 fuels inputs consist of gasohol (gasoline blended with roughly 10% ethanol - for conventional [CG] and reformulated [RFG] - fuelsubtypeID 12) and biodiesel (BD) (ultra-low sulfur diesel [USLD] - in Texas blended with roughly 5% biodiesel - fuelsubtypeid 21). Except for electricity, the other alternative fuels available in MOVES4 are treated as negligible and are excluded from the analysis (via the use of the MOVES avft and fuelusagefraction tables fuelfraction inputs). Since MOVES4 requires all (5) available fuel types to be included in the fuelformulation and fuelsupply inputs for error-free runs, the MOVES4 default fuelformulations for CNG (fuelsubtypeid 30), E85 (ethanol - blended with roughly 15% gasoline - fuelsubtypeid 51), and electricity (fuelsubtypeid 90) with 1.0 market share in the fuel supply are included in the CDBs. (TTI inserted these alternative fuel formulations and supplies, and the updated avft fuel fractions [i.e., gasoline, diesel, electricity, and flex-fuel types only], and set flex-fuel vehicles to 100 percent gasoline use in the fuelusagefraction table, via CDB builder scripts.)

4.4.5.3Data Sources

The local data include historical and current, latest available retail outlet seasonal fuel surveys of gasoline and diesel fuel, and annual, estimated state-level fuels sales statistics including summaries from which to estimate biodiesel volumes relative to petroleum diesel sales volumes and gasoline sales estimates by the three grades (regular, midgrade, premium). Survey data consists of TCEQ statewide summer gasoline and diesel retail outlet sampling surveys. The TCEQ survey data applicable to FY2024 TCEQ inventories includes the 2017, 2020, and 2023 summer season statewide surveys. TTI uses the TCEQ E10 conventional gasoline data processed by MOVES fuel regions for non-RFG regions and produces statewide diesel sample averages (sulfur content) assumed for all counties, supplemented with biodiesel volume content estimates based on the DOE Energy Information Administration's (EIA) diesel sales statistics (historical and latest available).

4.4.5.4General Procedure

The goal is to use the best available local fuel survey data by season and year, supplemented as needed by defaults and other data (e.g., U.S. Department of Energy [DOE] annual fuel sales statistics). For future years where no survey data is yet available, the latest available local fuel properties are used, where particular regulated properties are replaced with expected future year values (e.g., regulatory standards or limits, typically reflected in the MOVES analysis year and season default values).

The fuel formulation development procedures by MOVES fuel regions are documented in the latest TTI emissions inventory development reports sponsored by TCEQ. In general, the sample data are aggregated and averaged by fuel grade within each MOVES fuel region (e.g., consistent with Texas fuel regulation jurisdictions and distribution networks), then weighted into gasoline composite averages using relative sales volumes by grade.

The application of summer fuel formulations is for the June through August season, referenced in MOVES by month ID 7 (for July).

During the local, summer season, fuel inputs to MOVES were supplied in the CDB fuelsupply and fuelformulation tables. The fuel supply for each El Paso County, year, and RFP scenario consisted of one gasoline, one diesel, and one electricity formulation, to be modeled in the inventories, plus one each of the other de minimus MOVES alternative fuel types required to run MOVES but excluded from the inventory via the AVFT. Each fuel formulation market share in the fuel supply was therefore set to 1.0. These fuel types are consistent with the local SUT/fuel type VMT mix and AVFT estimates. TTI prepared both RFP pre-1990 and control strategy scenario inputs.

TTI developed the control strategy that fuels inputs based on local, retail outlet survey data, and where appropriate, expected future year values.

For the pre-1990 controls scenario, TTI used an appropriate MOVES default gasoline formulation. The pre-1990 controls diesel formulation used was developed by TTI for previous analyses based on the National Institute for Petroleum and Energy Research (NIPER)-developed information on pre-regulation diesel sulfur content.

The MOVES fuelformulation table fields and units include:

- RVP (pounds per square inch [psi]);
- sulfurLevel (parts per million [ppm]);
- ETOHVolume (volume percent);
- MTBEVolume (volume percent);
- ETBEVolume (volume percent);
- 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);
- BioDieselEsterVolume (volume percent);
- T50 (degrees Fahrenheit at 50 percent vapor); and
- T90 (degrees Fahrenheit at 90 percent vapor).

Although not listed previously, the fields CetaneIndex, and PAHContent are also included in the fuelformulation table but are not currently enabled for use in MOVES.

4.4.5.5 Fuel Formulations.

Table 25 summarizes the gasoline and diesel fuel property inputs.

Table 25. Summer Gasoline and Diesel Fuel Formulation Table Inputs to MOVES.

Fuel Formulation Field	Units	Pre-1990 Control Fuels[1]		El Paso County Conventional Gas (CG)[2]			Diesel[3]		
		Gasoline	Diesel	2017	2023	2024	2017	2023	2024
fuelFormulationID	-	10001	32500	17703	2373	2473	30176	30236	30600
fuelSubtypeID	-	10	20	12	12	12	21	21	21
RVP	psi	7.80	0	6.94	7.11	7	0	0	0
sulfurLevel	ppm	429.96	2,500.0	19.56	9.39	7.15	6.37	5.91	6
ETOHVolume	vol.%	0	0	9.6	9.89	9.89	0	0	0
MTBEVolume	vol.%	0	0	0	0	0	0	0	0
ETBEVolume	vol.%	0	0	0	0	0	0	0	0
TAMEVolume	vol.%	0	0	0	0	0	0	0	0
aromaticContent	vol.%	26.40	0	26.67	27.1	27.1	0	0	0
olefinContent	vol.%	11.90	0	5.5	5.62	5.62	0	0	0
benzeneContent	vol.%	1.64	0	1.13	1.07	0.689	0	0	0
e200	vap.%	50	0	48.74	45.96	45.96	0	0	0
e300	vap.%	83	0	87.84	85.8	85.8	0	0	0
VolToWtPercentOxy	-	0	0	0.3653	0.3653	0.3653	0	0	0
BioDieseEsterVolume	vol.%	\N	0	\N	\N	\N	4.68	3.13	3.13
CetaneIndex	-	\N	\N	\N	\N	\N	\N	\N	\N
PAHContent	vol.%	\N	\N	\N	\N	\N	\N	\N	\N
T50	deg. F	199.82	0	206.12	207.76	207.76	0	0	0
T90	deg. F	329.41	0	306.72	315.98	315.98	0	0	0

[1] For pre-1990 control fuels, fuel formulation ID 10001 and 32500 are consistent with TCEQ's most recent RFP emissions analysis (for HGB, TTI 2019). The 7.8 psi RVP limit formulation (not available in MOVES4) is from MOVES2014b. The diesel formulation is based on NIPER U.S. refiner survey summaries which placed average sulfur content for the typical No. 2 diesel, within the post-1979/pre-1993 regulation period, in the 2500-3000 ppm range. Fuel subtype IDs 10 and 20 are non-oxygenated CG and conventional diesel, respectively.

[2] The CG E10 estimates for 2017 and later are based on the TCEQ's summer 2017 and 2020 (latest available) fuel surveys, using MOVES4 defaults for future year expected values (for RVP, sulfur level, and benzene content).

[3] The diesel sulfur level for 2017 is the statewide average of TCEQ's 2017 survey samples. Diesel sulfur for future years is set to the MOVES4 default expected value for future years, which fits well with the actual, relatively stable, statewide averages observed in the last four TCEQ fuel surveys (2011, 2014, 2017, 2020). The biodiesel ester volume percent estimates are based on EIA transportation sector biodiesel and diesel consumption estimates for Texas, by year, using the latest available data (2019) for future years. Fuel subtype ID 21 is biodiesel (BD), in Texas, ULSD is currently estimated with a blend of about 5% by volume biodiesel ester.

The actual fuel formation and fuelsupply input database tables used are included in the electronic data submittal as described in Appendix B.

4.4.6 Local I/M Inputs

For this study, the analysis year 2017 used the 2017 I/M coverage compliance factor, whereas analysis years 2023 and 2024 used the 2021 I/M coverage compliance factor.

This information was received from TCEQ. Table 26 summarizes the I/M program for the El Paso County. I/M inputs are only used in the Full control scenarios (CSC) for each of the analysis years.

Table 26 Local I/M inputs for El Paso County

yearID	sourceTypeID	IMProgramID	begModelYearID	endModelYearID	testStandardsID	compliance factor
2017	21	121	1993	1995	12	95.20
2017	21	140	1996	2015	51	95.20
2017	31	121	1993	1995	12	92.56
2017	31	140	1996	2015	51	92.56
2017	32	121	1993	1995	12	73.27
2017	32	140	1996	2015	51	73.27
2023	21	140	1999	2021	51	94.00
2023	31	140	1999	2021	51	91.39
2023	32	140	1999	2021	51	72.35
2024	21	140	2000	2022	51	94.00
2024	31	140	2000	2022	51	91.39
2024	32	140	2000	2022	51	72.35

4.4.7 Hotelling Activity Distribution Inputs

The updated hotellingactivitydistribution table inputs were previously shown in Table 7. (These are consistent with MOVES4 defaults.)

4.5 Checks and Runs

After completing the input data preparation, the CDBs were checked to verify that all 41 tables were in the appropriate CDBs and that the tables were populated with data as intended. The MOVES RunSpecs were executed in batches using the MOVES commandline tool. After completion, TTI verified that the MOVES runs were error-free (i.e., checked all run log text files for errors and warnings).

4.6 Emissions Rates for Estimation of Individual Control Reductions

In a manner consistent with the development of the CSC scenario emissions rates, TTI produced emissions rates for the CS1 and CS2 incremental control scenarios needed for estimating the individual control measure emissions reductions.

Table 27 summarizes the run sequence. Note that existing MOVES and MOVES post-processor utility runs from the CS1, CS2, and CSC scenarios were used to produce the required 3 scenarios of emissions estimates. Existing runs and new runs are summarized together for the overall emissions rates development process, which includes the development of MOVES setups (MRSs, CDBs), and post-processing set-ups. (Utility runs to calculate the emissions estimates are discussed in the next section).

Table 27. El Paso County Emissions Factor Modeling Control Scenarios and Sequence.

Scenario Label	Controls Increment	MOVES CDB	MRS	MOVES Runs	Post-process Rates[2]
CS1	Pre-1990 Controls Except Full FMVCP (base)	All pre-1990 controls except FMVCP are current as of each year	CS1 labels		√ CS1_calc (no TxLED)
CS2	CS1 + current fuels	Same as CS1 except pre-1990 fuels are replaced with current fuels	CS2 labels		√ CSC_calc (no TxLED)
CSC	CS2 +I/M	Same as CS2 CDB with I/M inputs	CSC labels		√ CS1_calc (no TxLED)

[1] For El Paso county, there are no TxLED factors.

[2] MOVES output will be post-processed for all scenarios to produce SHP-based emission rates as a conversion of the MOVES vehicle-based off-network evaporative rates and to format the rates for input to the TTI EI utilities.

As shown in Table 27, CS1, CS2, and CSC will require the full process stream of MOVES set-ups and runs, plus post-processing to format and convert the rates to TTI EI utility input specifications (without TxLED adjustments applied which are not applicable in El Paso County). This series of emission factor modeling set-ups was executed for RFP analysis years 2023 and 2024. For the 2017 base year, only the CSC rates were needed input for the base year EI.

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

5 EMISSIONS CALCULATIONS

Using TTI's emissions inventory utilities and the previously detailed inventory activity and emissions rate inputs, TTI calculated the hourly on-road mobile emissions inventory estimates for each applicable El Paso County RFP scenario.

Under the TDM link-based inventory methodology, the on-road emissions calculation process falls into two vehicle activity categories: VMT-based emissions calculations and off-network emissions calculations. The VMT-based emissions calculations use the TDM link-based VMT and speeds to estimate emissions at the TDM roadway network link level. The off-network emissions calculations use off-network activity factors (ONI hours, SHP, starts, SHEI, and APU hours) to estimate emissions at the county level.

The emissions inventory utilities produced a standard tab-delimited emissions inventory summary.

5.1 HOURLY LINK-BASED EMISSIONS CALCULATIONS

The hourly link-based emissions by county for each inventory scenario were calculated using the emissions inventory utilities and the following major inputs.

- Time period TxDOT district-level SUT/fuel type VMT mix – by MOVES roadway type;
- Time period designation – the four VMT mix time periods (periods (Morning Peak, Mid-Day, Evening Peak, Overnight) to hour-of-day associations;
- Roadway-based activity – link (and intrazonal link)-specific, hourly, directional, operational VMT and speed estimates as developed by the 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;
- TDM road type designations – TDM road type and area type codes to MOVES road type codes (and to VMT mix road type, and rates road type codes) (see Table 28);
- Off-network activity factors – county, hourly ONI hours, SHP, starts, SHEI, and APU hours by vehicle type;
- Pollutant/process/units list – for emissions to be calculated and written to output in tab-delimited emissions summary files;

- Roadway-based emissions factors – MOVES-based, county level by pollutant, process, hour, average speed, MOVES road type, SUT, and fuel type;
- Off-network (parked vehicle) emissions factors – MOVES-based, county level by pollutant, process, hour, SUT, and fuel type, associated with MOVES road type ID 1;
- SCCs – mapping for MOVES source type, fuel type, road type, and process codes to output SCCs; and
- MOVES pollutant codes to NEI pollutant codes – for SCC output.

The VMT-based emissions were calculated for each hour using the time-period TxDOT-level SUT/fuel type VMT mix, the link VMT and speeds estimates, the MOVES-based "on-network" emissions factors, and the link road type/area type-to-MOVES road type designations. For each link, the link was assigned a MOVES road type based on the link's road type and area type (see Table 28). The link VMT was distributed to each SUT/fuel type using the VMT mix from the appropriate time period based on the link's designated MOVES road type. The time period VMT mixes were applied by the hour as follows: morning peak – 7 a.m. to 10 a.m.; mid-day – 10 a.m. to 3 p.m.; evening peak – 3 p.m. to 7 p.m.; and overnight – 7 p.m. to 7 a.m.

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

Table 28. El Paso 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 at the county-level by multiplying the hourly MOVES-based SUT/fuel type off-network emissions factors by the appropriate county-level hourly SUT/fuel type off-network activity, which was determined by the pollutant process and associated emissions rate table.

5.2 Off-Network Emission Calculations

The off-network emissions were calculated at the county-level by multiplying the hourly MOVES-based SUT/fuel type off-network emissions factors by the appropriate county-level hourly SUT/fuel type off-network activity factor, which was determined by the pollutant process (and road type ID 1 for ONI) and associated emission rates table. The off-network emissions calculations used off-network activity (ONI hours, SHP, starts, SHEI, and APU hours) to estimate emissions at the county level.

5.3 Emissions Output

The emissions inventory utilities produced the hourly link-based emissions output data sets consisting of two output files per run. These output files are:

- A tab-delimited summary output file consisting of one header section followed by hourly and 24-hour total data blocks of on-road activity and emissions (in units of pounds). Hourly and 24-hour total summaries are by road type and vehicle type of VMT, VHT, speed (VMT/VHT), pollutant totals, and pollutant process totals (with the "off-network" category listed as the last road type preceding the TOTALS row in each data block), and with starts, SHP, SHEI, and APU activity rows last in the activity data block for each time period; and
- A tab-delimited summary SCC output file that contains the 24-hour totals of VMT and emissions (in units of pounds) using inventory data aggregations, SCCs, and pollutant codes consistent with the EPA's 2020 NEI.

The pollutants included are:

- VOC, CO, NO_X, NH_3, SO_2, CO_2, PM_{10} Total Exhaust, PM_{10} Brakewear, PM_{10} Tirewear, $PM_{2.5}$ Total Exhaust, $PM_{2.5}$ Brakewear, $PM_{2.5}$ Tirewear
- See Appendix A for further details on the emissions inventory utilities.

5.4 XML-Formatted 24-Hour Summaries for TexAER

TTI post-processed the 24-hour summer weekday 2017, 2023, and 2024 RFP control strategy scenario SCC-labeled inventory output, using the TTI's emissions inventory utilities, in the NEI Emission Inventory System (EIS) CERS XML format for inclusion in TCEQ's TexAER database.

The tab-delimited SCC-based inventory data files output by the emissions utility were produced for direct input to the XML format utility using inventory data aggregation and coding (SCCs and pollutant codes) consistent with EPA's latest 2020 NEI, as required for compatibility with TexAER. The current NEI SCC codes are aggregations of the more detailed MOVES SCC codes, providing the total emissions for each valid NEI pollutant by source type and fuel type (e.g., for on-road, by pollutant, the total of all roadway-based and off-network processes, excluding refueling).

The on-road emissions inventory XML summaries include VOC, CO, NO_X, SO_2, NH_3, CO_2, $PM_{2.5}$, and PM_{10} (PMs are aggregate of exhaust, tirewear, and brakewear). Each run produced the XML file and one tab-delimited SCC-labeled inventory summary per county included in the run, in this case, El Paso County. Further details may be found in Appendix B.

6 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 the American Society for Quality, American National Standard ASQ/ANSI: E4:2014: *Quality Management Systems for Environmental Information and Technology Programs – Requirements with Guidance for Use,* February 2014, and the TCEQ Quality Management Plan.

The Quality Assurance Project Plans (QAPP) category and project type most closely matching the intended use of this analysis are QAPP Category II (for important, highly visible Agency projects involving areas such as supporting the development of environmental regulations or standards) and Modeling for NAAQS Compliance. Internal review and quality control measures consistent with the QA category and project type-specific requirements provided in Guidance for Quality Assurance Project Plans for Modeling, EPA QA/G-5M,[15] along with appropriate audits or assessments of data and reporting of findings, were employed. These include but are not limited to the elements outlined, per EPA Requirements for Quality Assurance Project Plans (EPA QA/R-5),[16] in the following description.

6.1 PROJECT MANAGEMENT

The definition and background of the problem addressed by this project, the project/task description, and the 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.

The objective was to produce the emissions inventory product of the quality suited to its purpose as specified (i.e., inventories needed to support RFP analyses), in accordance with the appropriate guidance and methods documents as referenced, as detailed in the Grant Activity Description (GAD), 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 as specified, including:

[15] PDF available at: https://www.epa.gov/sites/production/files/2015-06/documents/g5m-final.pdf.
[16] PDF available at: https://www.epa.gov/sites/production/files/2016-06/documents/r5-final_0.pdf.

- The product met the purpose of the emissions analysis (i.e., for use in support of RFP SIP analyses);
- The full extent of the modeling domain (i.e., analysis years, geographic coverage, seasonal periods, alternate scenarios, days, sources, pollutants) was included;
- Agreed methods, models, tools, and data were used (i.e., as listed in the GAD);
- The required output data sets were produced in the appropriate formats in accordance with the GAD;
- Any deficiencies found during development and end-product quality checks (as discussed in QAPP Part D) were corrected; and
- Aggregate emissions estimate results were comparable with available, similarly produced emissions estimates.

6.2 Measurement and Data 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 the development of emissions rate model inputs and adjustment factors and for the 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 GAD.

All data used either as direct input or to produce inputs (e.g., to the MOVES model or TTI's emissions inventory development utilities used) 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 discussed in Section D) were corrected, and the QA procedure was repeated until satisfied. No significant problems were found.

6.3 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 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 were copied (via an external hard drive) to the cluster's Master computer and executed. Upon execution, completion, and error checking, the MOVES output databases were (for cluster runs first copied to an individual workstation) archived and processed further in preparation for input to the emissions calculations utility.

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 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 B) was produced along with data description (on CD-ROM, DVDs, or external hard drive, depending on needed storage space) and delivered to TCEQ.

6.4 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 that input data preparation, and model or utility execution instructions (e.g., run specifications, scripts, JCFs, command files) were prepared according to the plan.
- Checked that correct output data were produced (including 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 (the process was performed until the QA check was satisfied).

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

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

6.5 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 the 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.

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

TTI verified that the overall scope of the emissions analysis has been met as prescribed in the GAD, to include:

- Purpose of the emissions analysis (i.e., needed for RFP SIP analysis);
- Extent of the modeling domain (e.g., analysis years, geographic coverage, seasonal periods, alternate scenarios, days, sources, pollutants);
- Methods, models, and data used (e.g., default versus local input data sources); and
- Procedures and tools were 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, job control files [JCFs], command files), and output, as appropriate to the component.

- Input data preparation checks:
    - Verified the basis of input data sets: Actual historical or latest available data, validated model, expected values or regulated limits, regulatory program design, model defaults, surrogates, professional judgment; checked 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 – when spot-checking a series of results, including extremes and intermediate values).
    - Completeness: Verified that input data sets were within the required dimensions, and all required fields were populated and properly coded or labeled.
    - Format: Verified that formats were within required specifications (e.g., field positions, data types and formats, and file formats) if any.
    - Reasonability checks: (discussed in the next section).
    - Ensured that any inputs provided from external sources were quality-assured, as listed previously.
- Checked the model or utility execution instructions:

  - Verified that the correct number of utility or model run specifications were prepared for each application (e.g., by year, county, season, and day type).
  - Verified that each utility or model run script included the correct modeling specifications for the application per applicable user guide (e.g., commands, input values, input and output file paths, and output options).

- 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 for warnings and errors (e.g., utility listing files or model execution logs that contain error and warning records).
  - 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, the 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, compared and noted whether directional differences were as expected (e.g., activity distributions between weekends/weekdays, vehicle mix, or average speeds between road types or time periods).

- 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). Compare the results to results from previous emissions analyses where available.

- Calculated county, and 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. Any issues found needing resolution were corrected, and appropriate QA checks were performed until satisfied, ensuring the project results met TCEQ requirements, i.e., as outlined in the GAD and QAPP.

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APPENDIX A:
EMISSIONS ESTIMATION UTILITIES FOR MOVES-BASED EMISSIONS INVENTORIES (ELECTRONIC ONLY)

APPENDIX B:
EL PASO COUNTY RFP ON-ROAD INVENTORIES ELECTRONIC DATA SUBMITTAL (ELECTRONIC ONLY)

APPENDIX C:
TXDOT DISTRICT VMT MIX BY TIME OF DAY

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
2035	2033 through 2037

MOVES Road Type Codes

Roadway Type	Roadway Code
Rural Restricted	RT2
Rural Unrestricted	RT3
Urban Restricted	RT4
Urban Unrestricted	RT5

2015 Weekday VMT Mix – El Paso TxDOT District (2017 Activity Scenario)

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
11_G	0.00000	0.00165	0.00178	0.00168	0.00105	0.00193	0.00218	0.00174	0.00099	0.00220	0.00269	0.00210	0.00034	0.00193	0.00239	0.00223
21_D	0.00307	0.00449	0.00502	0.00474	0.00273	0.00415	0.00493	0.00462	0.00315	0.00453	0.00525	0.00504	0.00306	0.00443	0.00520	0.00507
21_E	0.00013	0.00023	0.00034	0.00031	0.00012	0.00021	0.00033	0.00031	0.00014	0.00023	0.00035	0.00034	0.00013	0.00023	0.00035	0.00034
21_G	0.41156	0.60169	0.67288	0.63473	0.36567	0.55631	0.66019	0.61841	0.42255	0.60702	0.70319	0.67519	0.41016	0.59388	0.69718	0.67928
31_D	0.00745	0.00742	0.00678	0.00737	0.00710	0.00761	0.00648	0.00732	0.00779	0.00786	0.00642	0.00720	0.00571	0.00618	0.00554	0.00598
31_E	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
31_G	0.23318	0.23216	0.21199	0.23064	0.22196	0.23804	0.20276	0.22892	0.24376	0.24593	0.20080	0.22530	0.17847	0.19325	0.17341	0.18692
32_D	0.00144	0.00134	0.00176	0.00170	0.00137	0.00138	0.00168	0.00169	0.00151	0.00142	0.00167	0.00166	0.00110	0.00112	0.00144	0.00138
32_E	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
32_G	0.01900	0.01769	0.02319	0.02246	0.01808	0.01814	0.02218	0.02230	0.01986	0.01874	0.02197	0.02194	0.01454	0.01473	0.01897	0.01821
41_D	0.00066	0.00165	0.00177	0.00141	0.00052	0.00113	0.00125	0.00108	0.00137	0.00095	0.00097	0.00097	0.00177	0.00089	0.00082	0.00080
41_E	0.00000	0.00001	0.00001	0.00001	0.00000	0.00000	0.00000	0.00000	0.00001	0.00000	0.00000	0.00000	0.00001	0.00000	0.00000	0.00000
41_G	0.00012	0.00031	0.00033	0.00026	0.00010	0.00021	0.00024	0.00020	0.00026	0.00018	0.00018	0.00018	0.00033	0.00017	0.00015	0.00015
42_D	0.00023	0.00058	0.00076	0.00050	0.00018	0.00040	0.00054	0.00039	0.00047	0.00033	0.00042	0.00035	0.00061	0.00031	0.00036	0.00029
42_E	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
42_G	0.00006	0.00014	0.00018	0.00012	0.00004	0.00010	0.00013	0.00009	0.00011	0.00008	0.00010	0.00008	0.00015	0.00008	0.00009	0.00007
43_D	0.00041	0.00119	0.00098	0.00080	0.00032	0.00082	0.00070	0.00062	0.00085	0.00068	0.00054	0.00055	0.00109	0.00064	0.00046	0.00046
43_G	0.00002	0.00005	0.00004	0.00004	0.00001	0.00004	0.00003	0.00003	0.00004	0.00003	0.00002	0.00003	0.00005	0.00003	0.00002	0.00002
51_D	0.00070	0.00047	0.00043	0.00053	0.00077	0.00061	0.00054	0.00056	0.00056	0.00039	0.00029	0.00029	0.00042	0.00032	0.00027	0.00027
51_G	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
52_D	0.01563	0.02243	0.01847	0.02768	0.01723	0.02957	0.02303	0.02882	0.01248	0.01871	0.01233	0.01515	0.00928	0.01517	0.01170	0.01420
52_E	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
52_G	0.00542	0.00779	0.00641	0.00961	0.00598	0.01026	0.00799	0.01000	0.00433	0.00649	0.00428	0.00526	0.00322	0.00527	0.00406	0.00493
53_D	0.02149	0.00313	0.00334	0.00102	0.02369	0.00413	0.00416	0.00106	0.01716	0.00261	0.00223	0.00056	0.01276	0.00212	0.00211	0.00052
53_E	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

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
53_G	0.00736	0.00107	0.00114	0.00035	0.00811	0.00141	0.00142	0.00036	0.00587	0.00089	0.00076	0.00019	0.00437	0.00073	0.00072	0.00018
54_D	0.00112	0.00072	0.00055	0.00079	0.00123	0.00095	0.00068	0.00082	0.00089	0.00060	0.00036	0.00043	0.00066	0.00049	0.00035	0.00041
54_G	0.00215	0.00138	0.00105	0.00152	0.00237	0.00182	0.00131	0.00159	0.00172	0.00115	0.00070	0.00083	0.00128	0.00094	0.00066	0.00078
61_D	0.02089	0.04363	0.01499	0.03875	0.02497	0.05702	0.02104	0.05176	0.01975	0.03728	0.01267	0.02725	0.02724	0.07420	0.02710	0.05810
61_G	0.00000	0.00000	0.00000	0.00000	0.00000	0.00001	0.00000	0.00001	0.00000	0.00000	0.00000	0.00000	0.00000	0.00001	0.00000	0.00001
62_D	0.24789	0.04874	0.02578	0.01294	0.29636	0.06371	0.03619	0.01729	0.23436	0.04165	0.02179	0.00910	0.32325	0.08289	0.04663	0.01940

2025 Weekday VMT Mix – El Paso TxDOT District (2023 and 2024 Activity Scenarios)

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
11_G	0.00000	0.00165	0.00178	0.00168	0.00105	0.00193	0.00218	0.00174	0.00099	0.00220	0.00269	0.00210	0.00034	0.00193	0.00239	0.00223
21_G	0.40977	0.59818	0.66714	0.62934	0.36408	0.55306	0.65455	0.61316	0.42072	0.60347	0.69719	0.66946	0.40838	0.59041	0.69123	0.67352
21_D	0.00174	0.00255	0.00285	0.00269	0.00155	0.00236	0.00280	0.00262	0.00179	0.00257	0.00298	0.00286	0.00174	0.00252	0.00295	0.00288
21_E	0.00325	0.00569	0.00825	0.00775	0.00289	0.00526	0.00810	0.00755	0.00334	0.00574	0.00862	0.00825	0.00324	0.00561	0.00855	0.00830
31_G	0.23311	0.23191	0.21138	0.23001	0.22189	0.23778	0.20218	0.22830	0.24369	0.24567	0.20022	0.22468	0.17842	0.19304	0.17292	0.18641
31_D	0.00633	0.00630	0.00575	0.00625	0.00603	0.00646	0.00550	0.00620	0.00662	0.00668	0.00544	0.00611	0.00485	0.00525	0.00470	0.00507
31_E	0.00102	0.00121	0.00143	0.00155	0.00097	0.00124	0.00137	0.00154	0.00106	0.00128	0.00136	0.00152	0.00078	0.00101	0.00117	0.00126
32_G	0.01927	0.01794	0.02347	0.02273	0.01834	0.01839	0.02245	0.02256	0.02014	0.01900	0.02223	0.02221	0.01475	0.01493	0.01920	0.01842
32_D	0.00125	0.00117	0.00153	0.00148	0.00119	0.00120	0.00146	0.00147	0.00131	0.00124	0.00145	0.00145	0.00096	0.00097	0.00125	0.00120
32_E	0.00009	0.00010	0.00016	0.00016	0.00008	0.00010	0.00016	0.00016	0.00009	0.00010	0.00015	0.00015	0.00007	0.00008	0.00013	0.00013
41_G	0.00022	0.00055	0.00059	0.00047	0.00017	0.00038	0.00042	0.00036	0.00045	0.00032	0.00032	0.00032	0.00058	0.00030	0.00027	0.00026
41_D	0.00061	0.00152	0.00163	0.00129	0.00048	0.00104	0.00115	0.00099	0.00126	0.00088	0.00089	0.00089	0.00162	0.00082	0.00076	0.00073
41_E	0.00001	0.00003	0.00003	0.00002	0.00001	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00003	0.00001	0.00001	0.00001
42_G	0.00007	0.00018	0.00024	0.00016	0.00006	0.00012	0.00017	0.00012	0.00015	0.00010	0.00013	0.00011	0.00019	0.00010	0.00011	0.00009
42_D	0.00018	0.00046	0.00060	0.00040	0.00014	0.00031	0.00043	0.00031	0.00037	0.00026	0.00033	0.00027	0.00048	0.00025	0.00028	0.00023
42_E	0.00000	0.00001	0.00001	0.00001	0.00000	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00000

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
43_G	0.00004	0.00011	0.00009	0.00007	0.00003	0.00008	0.00007	0.00006	0.00008	0.00006	0.00005	0.00005	0.00010	0.00006	0.00004	0.00004
43_D	0.00037	0.00107	0.00089	0.00072	0.00029	0.00074	0.00063	0.00056	0.00077	0.00062	0.00049	0.00050	0.00099	0.00058	0.00041	0.00041
43_E	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
51_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
51_D	0.00048	0.00032	0.00030	0.00037	0.00053	0.00042	0.00037	0.00038	0.00039	0.00027	0.00020	0.00020	0.00029	0.00022	0.00019	0.00019
51_E	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
52_G	0.00631	0.00904	0.00745	0.01116	0.00695	0.01192	0.00928	0.01162	0.00504	0.00754	0.00497	0.00611	0.00374	0.00612	0.00471	0.00572
52_D	0.01494	0.02143	0.01764	0.02644	0.01647	0.02825	0.02199	0.02752	0.01193	0.01787	0.01177	0.01447	0.00887	0.01449	0.01117	0.01356
52_E	0.00007	0.00010	0.00008	0.00012	0.00008	0.00013	0.00010	0.00013	0.00005	0.00008	0.00005	0.00007	0.00004	0.00007	0.00005	0.00006
53_G	0.00882	0.00128	0.00137	0.00042	0.00972	0.00169	0.00171	0.00043	0.00704	0.00107	0.00091	0.00023	0.00524	0.00087	0.00087	0.00021
53_D	0.02028	0.00295	0.00315	0.00096	0.02236	0.00390	0.00392	0.00100	0.01619	0.00246	0.00210	0.00053	0.01204	0.00200	0.00199	0.00049
53_E	0.00010	0.00001	0.00002	0.00000	0.00011	0.00002	0.00002	0.00000	0.00008	0.00001	0.00001	0.00000	0.00006	0.00001	0.00001	0.00000
54_G	0.00184	0.00118	0.00090	0.00130	0.00203	0.00156	0.00112	0.00136	0.00147	0.00099	0.00060	0.00071	0.00109	0.00080	0.00057	0.00067
54_D	0.00104	0.00067	0.00051	0.00074	0.00115	0.00088	0.00063	0.00077	0.00083	0.00056	0.00034	0.00040	0.00062	0.00045	0.00032	0.00038
54_E	0.00001	0.00000	0.00000	0.00000	0.00001	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
61_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
61_D	0.02087	0.04359	0.01497	0.03870	0.02495	0.05696	0.02101	0.05171	0.01973	0.03724	0.01265	0.02722	0.02721	0.07412	0.02707	0.05804
61_E	0.00002	0.00005	0.00002	0.00005	0.00003	0.00007	0.00002	0.00006	0.00002	0.00004	0.00002	0.00003	0.00003	0.00009	0.00003	0.00007
62_D	0.24770	0.04871	0.02576	0.01293	0.29613	0.06366	0.03616	0.01727	0.23417	0.04161	0.02178	0.00909	0.32300	0.08283	0.04659	0.01939
62_E	0.00019	0.00004	0.00002	0.00001	0.00023	0.00005	0.00003	0.00001	0.00018	0.00003	0.00002	0.00001	0.00025	0.00006	0.00004	0.00002

APPENDIX D: TXDOT DISTRICT AGGREGATE WEEKDAY VMT MIX

Aggregate Weekday VMT Mix – El Paso TxDOT District

SUT/FT	2015[1]	2025[2]
11_G	0.001760	0.001760
21_G	0.593332	0.589024
21_D	0.004430	0.002513
21_E	0.000264	0.006488
31_G	0.214554	0.214164
31_D	0.006859	0.005820
31_E	0.000002	0.001252
32_G	0.019669	0.019920
32_D	0.001491	0.001297
32_E	0.000000	0.000121
41_G	0.000213	0.000375
41_D	0.001132	0.001040
41_E	0.000004	0.000019
42_G	0.000102	0.000132
42_D	0.000423	0.000334
42_E	0.000002	0.000007
43_G	0.000031	0.000065
43_D	0.000692	0.000625
43_E	0.000000	0.000002
51_G	0.000009	0.000001
51_D	0.000457	0.000316
51_E	0.000000	0.000001
52_G	0.006376	0.007408
52_D	0.018374	0.017549
52_E	0.000001	0.000081
53_G	0.002015	0.002415
53_D	0.005885	0.005553
53_E	0.000000	0.000027
54_G	0.001303	0.001115
54_D	0.000677	0.000629
54_E	0.000000	0.000003
61_G	0.000004	0.000000
61_D	0.033160	0.033124
61_E	0.000000	0.000039
62_D	0.086781	0.086713
62_E	0.000000	0.000068

[1] 2017 activity scenario.
[2] 2023 and 2024 activity scenarios

APPENDIX E: VEHICLE POPULATION ESTIMATES AND 24-HOUR SHP, STARTS, SHEI AND APU SUMMARIES

Vehicle Population for El Paso County by Analysis Year.

SUT/FT	2017	2023	2024
11_G	9,470	10,684	10,781
21_G	435,108	487,036	491,490
21_D	3,248	2,079	2,098
21_E	203	5,634	5,685
31_G	119,627	134,653	135,884
31_D	3,824	3,660	3,693
31_E	1	840	847
32_G	11,534	13,174	13,294
32_D	874	857	865
32_E	0	85	86
41_G	71	141	142
41_D	376	390	394
41_E	1	7	7
42_G	34	50	51
42_D	142	127	128
42_E	1	3	3
43_G	10	23	24
43_D	222	227	229
43_E	0	1	1
51_G	3	0	0
51_D	151	118	119
51_E	0	0	0
52_G	2,279	2,992	3,020
52_D	6,566	7,089	7,153
52_E	0	33	33
53_G	471	638	644
53_D	1,376	1,467	1,480
53_E	0	7	7
54_G	417	403	407
54_D	217	227	230
54_E	0	1	1
61_G	1	0	0
61_D	12,673	14,281	14,412
61_E	0	17	17
62_D	24,224	27,306	27,555
62_E	0	21	22

24-Hour Weekday ONI Hour Summaries for El Paso County by Analysis Year.

SUT/FT	2017	2023	2024
11_G	0.00	0.00	0.00
21_G	71,141.60	80,302.55	81,187.17
21_D	531.10	342.92	346.70
21_E	34.43	966.59	977.26
31_G	24,040.64	27,154.88	27,452.05
31_D	768.55	738.02	746.10
31_E	0.19	176.91	178.85
32_G	2,397.89	2,754.82	2,785.51
32_D	181.77	179.30	181.29
32_E	0.04	18.45	18.65
41_G	51.57	103.96	105.21
41_D	274.41	288.27	291.72
41_E	1.03	5.17	5.24
42_G	17.75	26.32	26.65
42_D	73.41	66.37	67.19
42_E	0.34	1.43	1.45
43_G	2.95	6.86	6.94
43_D	64.90	66.50	67.26
43_E	0.00	0.26	0.26
51_G	2.76	0.31	0.31
51_D	148.13	116.09	117.50
51_E	0.00	0.42	0.43
52_G	1,380.25	1,826.58	1,847.31
52_D	3,977.34	4,326.97	4,376.08
52_E	0.15	19.93	20.15
53_G	208.81	270.42	273.98
53_D	609.99	621.85	630.02
53_E	0.02	3.01	3.05
54_G	0.00	0.00	0.00
54_D	0.00	0.00	0.00
54_E	0.00	0.00	0.00
61_G	0.66	0.05	0.05
61_D	5,851.57	6,628.56	6,697.87
61_E	0.00	7.88	7.96
62_G	0.00	0.00	0.00
62_D	2,222.50	2,335.94	2,365.71
62_E	0.00	1.83	1.85

24-Hour Weekday Adjusted SHP Summaries for El Paso County by Analysis Year.

SUT/FT	2017	2023	2024
11_G	226,429.46	255,421.01	257,753.13
21_G	10,089,794.85	11,288,073.82	11,389,908.73
21_D	75,324.96	48,183.55	48,618.23
21_E	4,697.93	130,391.12	131,566.58
31_G	2,751,701.03	3,095,744.05	3,123,584.19
31_D	87,968.47	84,136.21	84,892.85
31_E	20.80	19,267.12	19,440.20
32_G	265,033.63	302,529.98	305,247.09
32_D	20,090.93	19,690.31	19,867.15
32_E	4.50	1,949.74	1,967.24
41_G	1,549.07	3,083.11	3,110.16
41_D	8,242.18	8,548.94	8,623.93
41_E	30.93	153.45	154.80
42_G	760.43	1,111.65	1,121.40
42_D	3,145.66	2,803.12	2,827.71
42_E	14.60	60.53	61.06
43_G	226.79	524.84	529.49
43_D	4,987.98	5,087.31	5,132.37
43_E	0.00	19.72	19.90
51_G	61.17	6.82	6.88
51_D	3,280.59	2,562.52	2,584.99
51_E	0.00	9.35	9.43
52_G	50,231.40	65,893.64	66,476.19
52_D	144,747.00	156,094.54	157,474.53
52_E	5.29	718.79	725.15
53_G	10,670.99	14,484.72	14,613.44
53_D	31,173.80	33,308.03	33,604.03
53_E	1.20	161.24	162.67
54_G	9,479.42	9,163.36	9,245.14
54_D	4,928.97	5,170.05	5,216.19
54_E	0.00	27.81	28.06
61_G	32.03	2.41	2.44
61_D	283,653.32	319,351.34	322,217.48
61_E	0.00	379.42	382.82
62_G	0.00	0.00	0.00
62_D	563,107.38	635,543.87	641,285.20
62_E	0.00	497.77	502.27

24-Hour Weekday Starts Summaries for El Paso County by Analysis Year.

SUT/FT	2017	2023	2024
11_G	1,643.85	1,854.46	1,871.42
21_G	1,755,181.76	1,964,626.93	1,981,985.82
21_D	13,897.28	7,649.83	7,447.12
21_E	972.45	27,323.71	27,442.75
31_G	510,537.48	574,673.09	579,576.16
31_D	15,781.56	14,822.86	15,106.57
31_E	5.38	5,033.67	5,049.79
32_G	52,350.70	59,779.83	60,262.73
32_D	3,793.47	3,693.46	3,763.85
32_E	1.15	539.78	542.13
41_G	557.12	1,073.39	1,079.55
41_D	2,554.01	2,648.71	2,673.38
41_E	12.10	57.02	56.58
42_G	280.35	404.37	408.22
42_D	1,094.93	978.74	987.51
42_E	5.82	23.04	23.00
43_G	40.89	115.71	116.66
43_D	973.36	979.79	987.85
43_E	0.00	4.86	4.93
51_G	2.41	0.19	0.16
51_D	287.46	222.77	225.03
51_E	0.00	1.27	1.29
52_G	50,947.04	71,112.56	71,763.35
52_D	140,566.02	143,117.30	144,058.72
52_E	6.98	914.07	1,003.57
53_G	716.68	995.50	1,002.73
53_D	1,941.65	1,996.73	2,014.16
53_E	0.09	12.47	13.52
54_G	211.56	208.52	210.44
54_D	117.75	118.97	120.04
54_E	0.00	0.00	0.76
61_G	2.84	0.09	0.09
61_D	84,068.44	93,247.09	93,851.97
61_E	0.00	172.02	170.93
62_G	0.00	0.00	0.00
62_D	13,505.88	15,224.32	15,362.77
62_E	0.00	0.00	18.20

Analysis Year Weekday Hotelling Hours Summaries by Operating Mode for El Paso County.

Year	SHEI[1]	APU Hours[1]	Plug-in Hours	Engine Off Hours
2017	13,468.38	859.49	0.00	3,581.97
2023	12,709.69	2,021.05	11.86	4,200.35
2024	12,253.45	2,475.80	11.97	4,373.40

[1]The hotelling hours used for emission estimations are the SHEI + APU Hours for diesel combination long-haul trucks. The plugin hours and engine off hours do not produce on-road emissions.

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

El Paso County 2017 Age Distribution Inputs to MOVES.

Age	MC	PC	PT	LCT	OBus	Tbus	Sbus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.04585	0.05419	0.04954	0.04954	0.06090	0.08942	0.05630	0.04098	0.07288	0.10895	0.03513	0.07342	0.06883
1	0.05100	0.06608	0.04857	0.04857	0.06447	0.09396	0.04914	0.04517	0.08347	0.10365	0.03992	0.05613	0.05954
2	0.04614	0.06951	0.04963	0.04963	0.05705	0.07899	0.04717	0.03679	0.08326	0.11127	0.03568	0.04171	0.04790
3	0.06450	0.07128	0.04752	0.04752	0.04989	0.08108	0.04350	0.03260	0.07247	0.08576	0.03132	0.07290	0.06068
4	0.06246	0.07691	0.04424	0.04424	0.05377	0.07341	0.03985	0.03404	0.07963	0.10245	0.02664	0.07125	0.07197
5	0.06140	0.06684	0.04718	0.04718	0.04043	0.07118	0.04416	0.03279	0.05139	0.05603	0.02016	0.05908	0.05726
6	0.05712	0.06155	0.03329	0.03329	0.04207	0.06577	0.04993	0.02552	0.03706	0.05081	0.01864	0.06100	0.05812
7	0.04799	0.05119	0.03050	0.03050	0.04214	0.07717	0.04856	0.02023	0.05845	0.07144	0.01791	0.06595	0.06003
8	0.03089	0.03935	0.03101	0.03101	0.04756	0.07996	0.06303	0.03452	0.04620	0.04883	0.01746	0.03476	0.03087
9	0.02837	0.03990	0.03010	0.03010	0.04701	0.06355	0.06605	0.02859	0.02689	0.01704	0.02678	0.02624	0.02000
10	0.05683	0.03238	0.02479	0.02479	0.05158	0.05038	0.06026	0.08767	0.02274	0.01619	0.04285	0.03597	0.02743
11	0.05392	0.04899	0.04718	0.04718	0.05094	0.04854	0.03605	0.07094	0.06634	0.04138	0.04552	0.02389	0.02481
12	0.06732	0.04962	0.04930	0.04930	0.03298	0.02844	0.03265	0.05730	0.03063	0.02706	0.04665	0.06230	0.07872
13	0.05188	0.04322	0.04543	0.04543	0.02584	0.01937	0.03595	0.04543	0.04693	0.03020	0.05228	0.04579	0.05090
14	0.04614	0.03966	0.04444	0.04444	0.03888	0.02112	0.02568	0.04811	0.03571	0.02570	0.04700	0.03936	0.04309
15	0.03361	0.03363	0.04791	0.04791	0.03864	0.02575	0.03105	0.04250	0.02969	0.01923	0.04196	0.01912	0.02442
16	0.04323	0.03019	0.04151	0.04151	0.03930	0.01242	0.03345	0.04329	0.02627	0.01579	0.03719	0.02198	0.02162
17	0.02905	0.02519	0.04134	0.04134	0.04245	0.00806	0.03014	0.05142	0.01941	0.01349	0.04261	0.01547	0.01686
18	0.02380	0.01945	0.03876	0.03876	0.03759	0.00282	0.02764	0.04022	0.01775	0.01353	0.04992	0.02268	0.02355
19	0.01515	0.01762	0.03283	0.03283	0.03086	0.00262	0.02335	0.02469	0.02045	0.00983	0.03891	0.03667	0.03223
20	0.01671	0.01278	0.02543	0.02543	0.01843	0.00237	0.02154	0.01889	0.01609	0.00937	0.03405	0.02815	0.02437
21	0.01020	0.00991	0.02065	0.02065	0.01662	0.00155	0.01801	0.02010	0.00716	0.00451	0.03088	0.01720	0.01839
22	0.00729	0.00746	0.02068	0.02068	0.01181	0.00075	0.01905	0.02350	0.01225	0.00468	0.02821	0.01338	0.01267
23	0.00680	0.00507	0.01361	0.01361	0.00910	0.00067	0.01066	0.01357	0.00561	0.00232	0.02728	0.00947	0.01238
24	0.00418	0.00476	0.01413	0.01413	0.00789	0.00024	0.01185	0.01149	0.00654	0.00239	0.02323	0.00895	0.01177
25	0.00408	0.00348	0.01331	0.01331	0.00451	0.00013	0.01027	0.00970	0.00415	0.00141	0.01922	0.00686	0.00808

Age	MC	PC	PT	LCT	OBus	Tbus	Sbus	RT	SUShT	SULhT	MH	CShT	CLhT
26	0.00282	0.00267	0.00883	0.00883	0.00420	0.00009	0.01293	0.01134	0.00249	0.00107	0.01613	0.00565	0.00627
27	0.00223	0.00209	0.00731	0.00731	0.00359	0.00006	0.01094	0.00855	0.00249	0.00071	0.01453	0.00443	0.00387
28	0.00165	0.00182	0.00514	0.00514	0.00291	0.00004	0.00904	0.00632	0.00197	0.00073	0.01297	0.00348	0.00364
29	0.00243	0.00151	0.00465	0.00465	0.00237	0.00002	0.00741	0.00582	0.00218	0.00065	0.01253	0.00339	0.00349
30	0.02497	0.01171	0.04120	0.04120	0.02423	0.00008	0.02441	0.02795	0.01142	0.00353	0.06647	0.01338	0.01626

El Paso County 2023 Age Distribution Inputs to MOVES.

Age	MC	PC	PT	LCT	OBus	Tbus	Sbus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.06111	0.05553	0.05319	0.05319	0.05243	0.05243	0.05243	0.05237	0.05885	0.07853	0.05237	0.05056	0.04177
1	0.05038	0.05615	0.04531	0.04531	0.05105	0.05102	0.05115	0.05064	0.08011	0.08600	0.05110	0.06957	0.06651
2	0.05078	0.05959	0.05493	0.05493	0.06339	0.06115	0.05418	0.04688	0.08783	0.11842	0.03591	0.07128	0.07153
3	0.04899	0.06448	0.04452	0.04452	0.06222	0.06149	0.06395	0.04362	0.07024	0.08521	0.03356	0.05947	0.05841
4	0.04789	0.06958	0.04723	0.04723	0.05381	0.09188	0.05498	0.05453	0.07141	0.09197	0.04159	0.04811	0.04915
5	0.05733	0.06861	0.04507	0.04507	0.04932	0.08203	0.05444	0.04850	0.06172	0.07137	0.04469	0.09162	0.07115
6	0.05356	0.07280	0.04153	0.04153	0.05609	0.08331	0.05427	0.04367	0.06836	0.08260	0.03398	0.08843	0.07447
7	0.05316	0.06290	0.04429	0.04429	0.05812	0.08368	0.04641	0.04790	0.04548	0.04459	0.03847	0.06348	0.05385
8	0.04929	0.05794	0.03138	0.03138	0.04963	0.06492	0.04292	0.03755	0.03364	0.04011	0.03374	0.04707	0.05171
9	0.04402	0.04770	0.02869	0.02869	0.04163	0.06087	0.03794	0.03106	0.05356	0.05666	0.02873	0.04366	0.04856
10	0.02802	0.03634	0.02931	0.02931	0.04258	0.04853	0.03304	0.03124	0.03956	0.03882	0.02413	0.02368	0.02471
11	0.02425	0.03615	0.02804	0.02804	0.03074	0.04264	0.03508	0.02873	0.02117	0.01360	0.01791	0.02272	0.01660
12	0.05256	0.02841	0.02278	0.02278	0.03108	0.03709	0.03860	0.02153	0.01696	0.01280	0.01629	0.02792	0.02300
13	0.04720	0.04160	0.04276	0.04276	0.02987	0.03932	0.03604	0.01686	0.05365	0.03234	0.01557	0.01856	0.02076
14	0.05704	0.04141	0.04497	0.04497	0.03298	0.03874	0.04568	0.02763	0.02700	0.02169	0.01490	0.04737	0.06251
15	0.04680	0.03360	0.04104	0.04104	0.03146	0.02822	0.04625	0.02212	0.03858	0.02402	0.02257	0.03252	0.04043
16	0.03935	0.03058	0.03904	0.03904	0.03310	0.02010	0.04039	0.06459	0.02934	0.02034	0.03540	0.02962	0.03469
17	0.02822	0.02534	0.04206	0.04206	0.03174	0.01814	0.02349	0.05023	0.02297	0.01550	0.03696	0.01440	0.01945
18	0.03438	0.02221	0.03624	0.03624	0.01969	0.00951	0.02040	0.04007	0.01884	0.01265	0.03769	0.01485	0.01746
19	0.02365	0.01772	0.03454	0.03454	0.01508	0.00614	0.02192	0.03042	0.01615	0.01071	0.04144	0.01077	0.01334
20	0.01948	0.01372	0.03228	0.03228	0.02168	0.00600	0.01498	0.03088	0.01480	0.01076	0.03658	0.01552	0.01845
21	0.01332	0.01206	0.02759	0.02759	0.02064	0.00651	0.01733	0.02592	0.01498	0.00762	0.03204	0.02703	0.02590
22	0.01312	0.00869	0.02148	0.02148	0.02022	0.00284	0.01801	0.02543	0.01274	0.00733	0.02802	0.01908	0.01938
23	0.00974	0.00689	0.01678	0.01678	0.02090	0.00163	0.01549	0.02862	0.00556	0.00338	0.03145	0.01314	0.01455
24	0.00556	0.00504	0.01727	0.01727	0.01794	0.00053	0.01379	0.02142	0.00879	0.00347	0.03620	0.00913	0.01020
25	0.00606	0.00363	0.01098	0.01098	0.01421	0.00044	0.01125	0.01307	0.00413	0.00174	0.02822	0.00676	0.00988

Age	MC	PC	PT	LCT	OBus	Tbus	Sbus	RT	SUShT	SULhT	MH	CShT	CLhT
26	0.00417	0.00335	0.01173	0.01173	0.00828	0.00037	0.01010	0.00952	0.00431	0.00178	0.02419	0.00683	0.00909
27	0.00348	0.00234	0.01098	0.01098	0.00723	0.00022	0.00820	0.00967	0.00314	0.00102	0.02155	0.00520	0.00641
28	0.00239	0.00192	0.00734	0.00734	0.00496	0.00010	0.00836	0.01124	0.00260	0.00081	0.01968	0.00535	0.00508
29	0.00179	0.00146	0.00567	0.00567	0.00373	0.00008	0.00456	0.00616	0.00197	0.00053	0.01863	0.00297	0.00303
30	0.02295	0.01228	0.04100	0.04100	0.02423	0.00009	0.02441	0.02795	0.01157	0.00365	0.06647	0.01336	0.01802

El Paso County 2024 Age Distribution Inputs to MOVES

Age	MC	PC	PT	LCT	OBus	Tbus	Sbus	RT	SUShT	SULhT	MH	CShT	CLhT
0	0.06111	0.05553	0.05319	0.05319	0.05226	0.05226	0.05226	0.05278	0.05885	0.07853	0.05278	0.05056	0.04177
1	0.05038	0.05615	0.04531	0.04531	0.05128	0.05124	0.05132	0.05111	0.08011	0.08600	0.05163	0.06957	0.06651
2	0.05078	0.05959	0.05493	0.05493	0.04993	0.04987	0.05007	0.04942	0.08783	0.11842	0.05038	0.07128	0.07153
3	0.04899	0.06448	0.04452	0.04452	0.06201	0.05977	0.05303	0.04575	0.07024	0.08521	0.03540	0.05947	0.05841
4	0.04789	0.06958	0.04723	0.04723	0.06086	0.06010	0.06260	0.04257	0.07141	0.09197	0.03309	0.04811	0.04915
5	0.05733	0.06861	0.04507	0.04507	0.05222	0.08878	0.05341	0.05290	0.06172	0.07137	0.04081	0.09162	0.07115
6	0.05356	0.07280	0.04153	0.04153	0.04749	0.07836	0.05247	0.04678	0.06836	0.08260	0.04363	0.08843	0.07447
7	0.05316	0.06290	0.04429	0.04429	0.05400	0.07958	0.05231	0.04212	0.04548	0.04459	0.03318	0.06348	0.05385
8	0.04929	0.05794	0.03138	0.03138	0.05552	0.07902	0.04438	0.04593	0.03364	0.04011	0.03738	0.04707	0.05171
9	0.04402	0.04770	0.02869	0.02869	0.04740	0.06130	0.04104	0.03601	0.05356	0.05666	0.03278	0.04366	0.04856
10	0.02802	0.03634	0.02931	0.02931	0.03976	0.05748	0.03628	0.02979	0.03956	0.03882	0.02792	0.02368	0.02471
11	0.02425	0.03615	0.02804	0.02804	0.04034	0.04529	0.03134	0.02978	0.02117	0.01360	0.02333	0.02272	0.01660
12	0.05256	0.02841	0.02278	0.02278	0.02912	0.03979	0.03328	0.02739	0.01696	0.01280	0.01732	0.02792	0.02300
13	0.04720	0.04160	0.04276	0.04276	0.02921	0.03421	0.03632	0.02041	0.05365	0.03234	0.01567	0.01856	0.02076
14	0.05704	0.04141	0.04497	0.04497	0.02808	0.03626	0.03392	0.01598	0.02700	0.02169	0.01498	0.04737	0.06251
15	0.04680	0.03360	0.04104	0.04104	0.03100	0.03573	0.04299	0.02618	0.03858	0.02402	0.01434	0.03252	0.04043
16	0.03935	0.03058	0.03904	0.03904	0.02933	0.02571	0.04318	0.02084	0.02934	0.02034	0.02160	0.02962	0.03469
17	0.02822	0.02534	0.04206	0.04206	0.03085	0.01831	0.03771	0.06084	0.02297	0.01550	0.03389	0.01440	0.01945
18	0.03438	0.02221	0.03624	0.03624	0.02934	0.01633	0.02175	0.04703	0.01884	0.01265	0.03521	0.01485	0.01746
19	0.02365	0.01772	0.03454	0.03454	0.01820	0.00856	0.01889	0.03752	0.01615	0.01071	0.03591	0.01077	0.01334
20	0.01948	0.01372	0.03228	0.03228	0.01383	0.00546	0.02013	0.02831	0.01480	0.01076	0.03928	0.01552	0.01845
21	0.01332	0.01206	0.02759	0.02759	0.01988	0.00533	0.01376	0.02874	0.01498	0.00762	0.03468	0.02703	0.02590
22	0.01312	0.00869	0.02148	0.02148	0.01893	0.00579	0.01592	0.02412	0.01274	0.00733	0.03037	0.01908	0.01938
23	0.00974	0.00689	0.01678	0.01678	0.01839	0.00249	0.01640	0.02353	0.00556	0.00338	0.02643	0.01314	0.01455
24	0.00556	0.00504	0.01727	0.01727	0.01901	0.00143	0.01411	0.02648	0.00879	0.00347	0.02966	0.00913	0.01020
25	0.00606	0.00363	0.01098	0.01098	0.01631	0.00046	0.01256	0.01982	0.00413	0.00174	0.03414	0.00676	0.00988

Age	MC	PC	PT	LCT	OBus	Tbus	Sbus	RT	SUShT	SULhT	MH	CShT	CLhT
26	0.00417	0.00335	0.01173	0.01173	0.01281	0.00038	0.01016	0.01202	0.00431	0.00178	0.02648	0.00683	0.00909
27	0.00348	0.00234	0.01098	0.01098	0.00747	0.00032	0.00913	0.00875	0.00314	0.00102	0.02270	0.00520	0.00641
28	0.00239	0.00192	0.00734	0.00734	0.00652	0.00019	0.00740	0.00889	0.00260	0.00081	0.02022	0.00535	0.00508
29	0.00179	0.00146	0.00567	0.00567	0.00443	0.00008	0.00749	0.01027	0.00197	0.00053	0.01837	0.00297	0.00303
30	0.02295	0.01228	0.04100	0.04100	0.02423	0.00014	0.02441	0.02795	0.01157	0.00365	0.06647	0.01336	0.01802

Texas Statewide 2017 Fuel Engine Fractions Summary

SUT_FT	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003
11_G	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
21_G	0.9861	0.9906	0.9813	0.9815	0.9804	0.9851	0.9864	0.9892	0.9920	0.9990	0.9994	0.9929	0.9949	0.9966	0.9958
21_D	0.0009	0.0009	0.0102	0.0133	0.0135	0.0126	0.0117	0.0106	0.0078	0.0007	0.0005	0.0069	0.0049	0.0034	0.0042
21_E	0.0129	0.0085	0.0084	0.0051	0.0061	0.0023	0.0019	0.0002	0.0002	0.0003	0.0002	0.0001	0.0002	0.0000	0.0001
31_G	0.9734	0.9680	0.9679	0.9770	0.9798	0.9735	0.9766	0.9867	0.9828	0.9700	0.9721	0.9560	0.9641	0.9594	0.9614
31_D	0.0249	0.0300	0.0320	0.0229	0.0201	0.0264	0.0234	0.0133	0.0172	0.0300	0.0279	0.0440	0.0359	0.0406	0.0386
31_E	0.0017	0.0020	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
32_G	0.9413	0.9332	0.9266	0.9483	0.9688	0.9437	0.9398	0.9652	0.9535	0.9198	0.9321	0.9002	0.9148	0.9073	0.9159
32_D	0.0567	0.0649	0.0733	0.0516	0.0312	0.0562	0.0601	0.0348	0.0465	0.0802	0.0679	0.0998	0.0852	0.0927	0.0841
32_E	0.0020	0.0019	0.0000	0.0002	0.0000	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
41_G	0.4037	0.2821	0.2479	0.2455	0.2390	0.2520	0.2552	0.1808	0.1266	0.1669	0.1323	0.1773	0.1725	0.1688	0.1525
41_D	0.5751	0.7097	0.7319	0.7421	0.7610	0.7480	0.7448	0.8192	0.8734	0.8331	0.8677	0.8227	0.8275	0.8308	0.8474
41_E	0.0213	0.0082	0.0201	0.0124	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0004	0.0002
42_G	0.4037	0.2821	0.2479	0.2455	0.2390	0.2520	0.2552	0.1808	0.1266	0.1669	0.1323	0.1773	0.1725	0.1688	0.1525
42_D	0.5751	0.7097	0.7319	0.7421	0.7610	0.7480	0.7448	0.8192	0.8734	0.8331	0.8677	0.8227	0.8275	0.8308	0.8474
42_E	0.0213	0.0082	0.0201	0.0124	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0004	0.0002
43_G	0.0802	0.0605	0.0311	0.0331	0.0555	0.0640	0.0468	0.0492	0.0275	0.0130	0.0078	0.0101	0.0066	0.0038	0.0055
43_D	0.9195	0.9393	0.9689	0.9669	0.9445	0.9360	0.9532	0.9508	0.9725	0.9870	0.9922	0.9899	0.9934	0.9962	0.9945
43_E	0.0004	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
51_G	0.0008	0.0016	0.0000	0.0000	0.0066	0.0000	0.0000	0.0000	0.0046	0.0020	0.0035	0.0009	0.0007	0.0000	0.0004
51_D	0.9979	0.9984	1.0000	1.0000	0.9934	1.0000	1.0000	1.0000	0.9954	0.9980	0.9965	0.9991	0.9993	1.0000	0.9996
51_E	0.0012	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
52_G	0.4990	0.4898	0.4428	0.4001	0.4214	0.2754	0.2837	0.3322	0.3834	0.3310	0.2717	0.2733	0.2492	0.2572	0.2512
52_D	0.5007	0.5101	0.5571	0.5999	0.5786	0.7246	0.7162	0.6675	0.6166	0.6690	0.7283	0.7267	0.7508	0.7428	0.7488
52_E	0.0003	0.0001	0.0000	0.0001	0.0000	0.0000	0.0001	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
53_G	0.4990	0.4898	0.4428	0.4001	0.4214	0.2754	0.2837	0.3322	0.3834	0.3310	0.2717	0.2733	0.2492	0.2572	0.2512
53_D	0.5007	0.5101	0.5571	0.5999	0.5786	0.7246	0.7162	0.6675	0.6166	0.6690	0.7283	0.7267	0.7508	0.7428	0.7488
53_E	0.0003	0.0001	0.0000	0.0001	0.0000	0.0000	0.0001	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
54_G	0.6646	0.6613	0.6701	0.6802	0.7076	0.7251	0.7013	0.0059	0.5339	0.3804	0.4420	0.5778	0.3493	0.6016	0.5619

SUT_FT	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003
54_D	0.3354	0.3387	0.3299	0.3198	0.2924	0.2749	0.2987	0.9941	0.4661	0.6196	0.5580	0.4222	0.6507	0.3984	0.4381
54_E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
61_G	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0543	0.0649	0.0607	0.0769	0.0859
61_D	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9457	0.9351	0.9393	0.9231	0.9141
61_E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
62_G	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
62_D	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
62_E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Texas Statewide 2017 Fuel Engine Fractions Summary - Continue

SUT_FT	2002	2001	2000	1999	1998	1997	1996	1995	1994	1993	1992	1991	1990	1989	1988	1987
11_G	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
21_G	0.9932	0.9962	0.9966	0.9981	0.9978	0.9991	0.9988	0.9991	0.9998	0.9993	0.9988	0.9972	0.9989	0.9991	0.9997	0.9872
21_D	0.0046	0.0034	0.0031	0.0019	0.0022	0.0009	0.0012	0.0009	0.0002	0.0007	0.0012	0.0028	0.0011	0.0009	0.0003	0.0128
21_E	0.0021	0.0004	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
31_G	0.9653	0.9590	0.9702	0.9607	0.9872	0.9555	0.9575	0.9609	0.9662	0.9575	0.9619	0.9660	0.9692	0.9741	0.9804	0.9767
31_D	0.0347	0.0410	0.0297	0.0392	0.0128	0.0445	0.0425	0.0391	0.0338	0.0425	0.0381	0.0340	0.0308	0.0259	0.0196	0.0233
31_E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
32_G	0.9150	0.9116	0.9225	0.9012	0.9547	0.8987	0.9070	0.9083	0.9212	0.9055	0.9222	0.9187	0.9259	0.9376	0.9369	0.9350
32_D	0.0848	0.0882	0.0773	0.0986	0.0449	0.1012	0.0930	0.0917	0.0788	0.0944	0.0778	0.0813	0.0741	0.0624	0.0631	0.0650
32_E	0.0002	0.0002	0.0002	0.0002	0.0004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
41_G	0.1322	0.1068	0.0740	0.0017	0.0014	0.0012	0.0108	0.0346	0.0138	0.0133	0.1335	0.0039	0.0014	0.0000	0.0009	0.0000
41_D	0.8535	0.8913	0.9260	0.9983	0.9986	0.9988	0.9892	0.9654	0.9862	0.9867	0.8665	0.9961	0.9986	1.0000	0.9991	1.0000
41_E	0.0143	0.0020	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
42_G	0.1322	0.1068	0.0740	0.0017	0.0014	0.0012	0.0108	0.0346	0.0138	0.0133	0.1335	0.0039	0.0014	0.0000	0.0009	0.0000
42_D	0.8535	0.8913	0.9260	0.9983	0.9986	0.9988	0.9892	0.9654	0.9862	0.9867	0.8665	0.9961	0.9986	1.0000	0.9991	1.0000
42_E	0.0143	0.0020	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
43_G	0.0260	0.0117	0.0257	0.0100	0.0100	0.0100	0.0415	0.1143	0.1475	0.1205	0.0100	0.0895	0.1240	0.2290	0.2498	0.2655
43_D	0.9740	0.9883	0.9743	0.9900	0.9900	0.9900	0.9585	0.8857	0.8525	0.8795	0.9900	0.9105	0.8760	0.7710	0.7502	0.7345
43_E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

SUT_FT	2002	2001	2000	1999	1998	1997	1996	1995	1994	1993	1992	1991	1990	1989	1988	1987
51_G	0.0000	0.0000	0.0000	0.1688	0.4036	0.0193	0.0253	0.0235	0.1050	0.0315	0.2103	0.1012	0.2040	0.0294	0.1139	0.1141
51_D	1.0000	1.0000	1.0000	0.8312	0.5964	0.9807	0.9747	0.9765	0.8950	0.9685	0.7897	0.8988	0.7960	0.9706	0.8861	0.8859
51_E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
52_G	0.2749	0.3024	0.3629	0.3252	0.4135	0.4154	0.3828	0.6233	0.5018	0.4900	0.4938	0.5069	0.5453	0.7823	0.7823	0.7823
52_D	0.7251	0.6976	0.6371	0.6748	0.5865	0.5846	0.6172	0.3767	0.4982	0.5100	0.5062	0.4931	0.4547	0.2177	0.2177	0.2177
52_E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
53_G	0.2749	0.3024	0.3629	0.3252	0.4135	0.4154	0.3828	0.6233	0.5018	0.4900	0.4938	0.5069	0.5453	0.7823	0.7823	0.7823
53_D	0.7251	0.6976	0.6371	0.6748	0.5865	0.5846	0.6172	0.3767	0.4982	0.5100	0.5062	0.4931	0.4547	0.2177	0.2177	0.2177
53_E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
54_G	0.6028	0.5459	0.6539	0.7975	0.6494	0.8361	0.8008	0.8510	0.8084	0.7276	0.7869	0.8497	0.9199	0.9513	0.9806	0.9918
54_D	0.3972	0.4541	0.3461	0.2025	0.3506	0.1639	0.1992	0.1490	0.1916	0.2724	0.2131	0.1503	0.0801	0.0487	0.0194	0.0082
54_E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
61_G	0.0932	0.0957	0.1104	0.1105	0.1092	0.1217	0.1185	0.2083	0.1003	0.1042	0.1162	0.1415	0.1370	0.2556	0.2556	0.2556
61_D	0.9068	0.9043	0.8896	0.8895	0.8908	0.8783	0.8815	0.7917	0.8997	0.8958	0.8838	0.8585	0.8630	0.7444	0.7444	0.7444
61_E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
62_G	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
62_D	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
62_E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Texas Statewide 2023 Fuel Engine Fractions Summary

SUT_FT	2023	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009
11_G	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
21_G	0.8977	0.8669	0.9199	0.9619	0.9678	0.9626	0.9861	0.9906	0.9813	0.9815	0.9804	0.9851	0.9864	0.9892	0.9920
21_D	0.0001	0.0001	0.0001	0.0001	0.0001	0.0009	0.0009	0.0009	0.0102	0.0133	0.0135	0.0126	0.0117	0.0106	0.0078
21_E	0.1022	0.1330	0.0800	0.0380	0.0321	0.0365	0.0129	0.0085	0.0084	0.0051	0.0061	0.0023	0.0019	0.0002	0.0002
31_G	0.9211	0.9416	0.9713	0.9766	0.9765	0.9731	0.9734	0.9680	0.9679	0.9770	0.9798	0.9735	0.9766	0.9867	0.9828
31_D	0.0243	0.0244	0.0247	0.0224	0.0208	0.0248	0.0249	0.0300	0.0320	0.0229	0.0201	0.0264	0.0234	0.0133	0.0172
31_E	0.0546	0.0340	0.0040	0.0010	0.0027	0.0021	0.0017	0.0020	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000
32_G	0.8852	0.9055	0.9347	0.9437	0.9473	0.9429	0.9413	0.9332	0.9266	0.9483	0.9688	0.9437	0.9398	0.9652	0.9535
32_D	0.0602	0.0605	0.0613	0.0553	0.0512	0.0545	0.0567	0.0649	0.0733	0.0516	0.0312	0.0562	0.0601	0.0348	0.0465
32_E	0.0546	0.0340	0.0040	0.0010	0.0015	0.0026	0.0020	0.0019	0.0000	0.0002	0.0000	0.0001	0.0001	0.0000	0.0000
41_G	0.3176	0.3129	0.3097	0.3014	0.2820	0.2312	0.4037	0.2821	0.2479	0.2455	0.2390	0.2520	0.2552	0.1808	0.1266
41_D	0.6688	0.6717	0.6749	0.6832	0.7034	0.7173	0.5751	0.7097	0.7319	0.7421	0.7610	0.7480	0.7448	0.8192	0.8734
41_E	0.0135	0.0154	0.0155	0.0154	0.0146	0.0515	0.0213	0.0082	0.0201	0.0124	0.0000	0.0000	0.0000	0.0000	0.0000
42_G	0.3176	0.3129	0.3097	0.3014	0.2820	0.2312	0.4037	0.2821	0.2479	0.2455	0.2390	0.2520	0.2552	0.1808	0.1266
42_D	0.6688	0.6717	0.6749	0.6832	0.7034	0.7173	0.5751	0.7097	0.7319	0.7421	0.7610	0.7480	0.7448	0.8192	0.8734
42_E	0.0135	0.0154	0.0155	0.0154	0.0146	0.0515	0.0213	0.0082	0.0201	0.0124	0.0000	0.0000	0.0000	0.0000	0.0000
43_G	0.1502	0.1503	0.1502	0.1494	0.1451	0.0885	0.0802	0.0605	0.0311	0.0331	0.0555	0.0640	0.0468	0.0492	0.0275
43_D	0.8467	0.8462	0.8460	0.8468	0.8513	0.9101	0.9195	0.9393	0.9689	0.9669	0.9445	0.9360	0.9532	0.9508	0.9725
43_E	0.0031	0.0035	0.0038	0.0038	0.0035	0.0014	0.0004	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
51_G	0.0008	0.0007	0.0007	0.0007	0.0007	0.0008	0.0008	0.0016	0.0000	0.0000	0.0066	0.0000	0.0000	0.0000	0.0046
51_D	0.9979	0.9977	0.9977	0.9977	0.9979	0.9988	0.9979	0.9984	1.0000	1.0000	0.9934	1.0000	1.0000	1.0000	0.9954
51_E	0.0014	0.0015	0.0016	0.0015	0.0014	0.0004	0.0012	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
52_G	0.5185	0.5185	0.5185	0.5185	0.5185	0.4741	0.4990	0.4898	0.4428	0.4001	0.4214	0.2754	0.2837	0.3322	0.3834
52_D	0.4812	0.4812	0.4812	0.4812	0.4812	0.5255	0.5007	0.5101	0.5571	0.5999	0.5786	0.7246	0.7162	0.6675	0.6166
52_E	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0001	0.0000	0.0001	0.0000	0.0000	0.0001	0.0003	0.0000
53_G	0.5185	0.5185	0.5185	0.5185	0.5185	0.4741	0.4990	0.4898	0.4428	0.4001	0.4214	0.2754	0.2837	0.3322	0.3834
53_D	0.4812	0.4812	0.4812	0.4812	0.4812	0.5255	0.5007	0.5101	0.5571	0.5999	0.5786	0.7246	0.7162	0.6675	0.6166
53_E	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0001	0.0000	0.0001	0.0000	0.0000	0.0001	0.0003	0.0000
54_G	0.6671	0.6673	0.6617	0.6563	0.6476	0.6641	0.6646	0.6613	0.6701	0.6802	0.7076	0.7251	0.7013	0.0059	0.5339

SUT_FT	2023	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009
54_D	0.3329	0.3327	0.3383	0.3437	0.3524	0.3359	0.3354	0.3387	0.3299	0.3198	0.2924	0.2749	0.2987	0.9941	0.4661
54_E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
61_G	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
61_D	0.9995	0.9995	0.9995	0.9995	0.9995	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
61_E	0.0005	0.0005	0.0005	0.0005	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
62_G	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
62_D	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
62_E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Texas Statewide 2023 Fuel Engine Fractions Summary - Continue

SUT_FT	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995	1994	1993
11_G	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
21_G	0.9990	0.9994	0.9929	0.9949	0.9966	0.9958	0.9932	0.9962	0.9966	0.9981	0.9978	0.9991	0.9988	0.9991	0.9998	0.9993
21_D	0.0007	0.0005	0.0069	0.0049	0.0034	0.0042	0.0046	0.0034	0.0031	0.0019	0.0022	0.0009	0.0012	0.0009	0.0002	0.0007
21_E	0.0003	0.0002	0.0001	0.0002	0.0000	0.0001	0.0021	0.0004	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
31_G	0.9700	0.9721	0.9560	0.9641	0.9594	0.9614	0.9653	0.9590	0.9702	0.9607	0.9872	0.9555	0.9575	0.9609	0.9662	0.9575
31_D	0.0300	0.0279	0.0440	0.0359	0.0406	0.0386	0.0347	0.0410	0.0297	0.0392	0.0128	0.0445	0.0425	0.0391	0.0338	0.0425
31_E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
32_G	0.9198	0.9321	0.9002	0.9148	0.9073	0.9159	0.9150	0.9116	0.9225	0.9012	0.9547	0.8987	0.9070	0.9083	0.9212	0.9055
32_D	0.0802	0.0679	0.0998	0.0852	0.0927	0.0841	0.0848	0.0882	0.0773	0.0986	0.0449	0.1012	0.0930	0.0917	0.0788	0.0944
32_E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0002	0.0002	0.0002	0.0004	0.0000	0.0000	0.0000	0.0000	0.0000
41_G	0.1669	0.1323	0.1773	0.1725	0.1688	0.1525	0.1322	0.1068	0.0740	0.0017	0.0014	0.0012	0.0108	0.0346	0.0138	0.0133
41_D	0.8331	0.8677	0.8227	0.8275	0.8308	0.8474	0.8535	0.8913	0.9260	0.9983	0.9986	0.9988	0.9892	0.9654	0.9862	0.9867
41_E	0.0000	0.0000	0.0000	0.0000	0.0004	0.0002	0.0143	0.0020	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
42_G	0.1669	0.1323	0.1773	0.1725	0.1688	0.1525	0.1322	0.1068	0.0740	0.0017	0.0014	0.0012	0.0108	0.0346	0.0138	0.0133
42_D	0.8331	0.8677	0.8227	0.8275	0.8308	0.8474	0.8535	0.8913	0.9260	0.9983	0.9986	0.9988	0.9892	0.9654	0.9862	0.9867
42_E	0.0000	0.0000	0.0000	0.0000	0.0004	0.0002	0.0143	0.0020	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
43_G	0.0130	0.0078	0.0101	0.0066	0.0038	0.0055	0.0260	0.0117	0.0257	0.0100	0.0100	0.0100	0.0415	0.1143	0.1475	0.1205
43_D	0.9870	0.9922	0.9899	0.9934	0.9962	0.9945	0.9740	0.9883	0.9743	0.9900	0.9900	0.9900	0.9585	0.8857	0.8525	0.8795
43_E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

SUT_FT	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995	1994	1993
51_G	0.0020	0.0035	0.0009	0.0007	0.0000	0.0004	0.0000	0.0000	0.0000	0.1688	0.4036	0.0193	0.0253	0.0235	0.1050	0.0315
51_D	0.9980	0.9965	0.9991	0.9993	1.0000	0.9996	1.0000	1.0000	1.0000	0.8312	0.5964	0.9807	0.9747	0.9765	0.8950	0.9685
51_E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
52_G	0.3310	0.2717	0.2733	0.2492	0.2572	0.2512	0.2749	0.3024	0.3629	0.3252	0.4135	0.4154	0.3828	0.6233	0.5018	0.4900
52_D	0.6690	0.7283	0.7267	0.7508	0.7428	0.7488	0.7251	0.6976	0.6371	0.6748	0.5865	0.5846	0.6172	0.3767	0.4982	0.5100
52_E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
53_G	0.3310	0.2717	0.2733	0.2492	0.2572	0.2512	0.2749	0.3024	0.3629	0.3252	0.4135	0.4154	0.3828	0.6233	0.5018	0.4900
53_D	0.6690	0.7283	0.7267	0.7508	0.7428	0.7488	0.7251	0.6976	0.6371	0.6748	0.5865	0.5846	0.6172	0.3767	0.4982	0.5100
53_E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
54_G	0.3804	0.4420	0.5778	0.3493	0.6016	0.5619	0.6028	0.5459	0.6539	0.7975	0.6494	0.8361	0.8008	0.8510	0.8084	0.7276
54_D	0.6196	0.5580	0.4222	0.6507	0.3984	0.4381	0.3972	0.4541	0.3461	0.2025	0.3506	0.1639	0.1992	0.1490	0.1916	0.2724
54_E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
61_G	0.0000	0.0543	0.0649	0.0607	0.0769	0.0859	0.0932	0.0957	0.1104	0.1105	0.1092	0.1217	0.1185	0.2083	0.1003	0.1042
61_D	1.0000	0.9457	0.9351	0.9393	0.9231	0.9141	0.9068	0.9043	0.8896	0.8895	0.8908	0.8783	0.8815	0.7917	0.8997	0.8958
61_E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
62_G	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
62_D	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
62_E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Texas Statewide 2024 Fuel Engine Fractions Summary

SUT_FT	2024	2023	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010
11_G	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
21_G	0.8559	0.8977	0.8669	0.9199	0.9619	0.9678	0.9626	0.9861	0.9906	0.9813	0.9815	0.9804	0.9851	0.9864	0.9892
21_D	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0009	0.0009	0.0009	0.0102	0.0133	0.0135	0.0126	0.0117	0.0106
21_E	0.1440	0.1022	0.1330	0.0800	0.0380	0.0321	0.0365	0.0129	0.0085	0.0084	0.0051	0.0061	0.0023	0.0019	0.0002
31_G	0.9162	0.9211	0.9416	0.9713	0.9766	0.9765	0.9731	0.9734	0.9680	0.9679	0.9770	0.9798	0.9735	0.9766	0.9867
31_D	0.0243	0.0243	0.0244	0.0247	0.0224	0.0208	0.0248	0.0249	0.0300	0.0320	0.0229	0.0201	0.0264	0.0234	0.0133
31_E	0.0595	0.0546	0.0340	0.0040	0.0010	0.0027	0.0021	0.0017	0.0020	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000
32_G	0.8798	0.8852	0.9055	0.9347	0.9437	0.9473	0.9429	0.9413	0.9332	0.9266	0.9483	0.9688	0.9437	0.9398	0.9652
32_D	0.0602	0.0602	0.0605	0.0613	0.0553	0.0512	0.0545	0.0567	0.0649	0.0733	0.0516	0.0312	0.0562	0.0601	0.0348
32_E	0.0600	0.0546	0.0340	0.0040	0.0010	0.0015	0.0026	0.0020	0.0019	0.0000	0.0002	0.0000	0.0001	0.0001	0.0000
41_G	0.3275	0.3176	0.3129	0.3097	0.3014	0.2820	0.2312	0.4037	0.2821	0.2479	0.2455	0.2390	0.2520	0.2552	0.1808
41_D	0.6637	0.6688	0.6717	0.6749	0.6832	0.7034	0.7173	0.5751	0.7097	0.7319	0.7421	0.7610	0.7480	0.7448	0.8192
41_E	0.0088	0.0135	0.0154	0.0155	0.0154	0.0146	0.0515	0.0213	0.0082	0.0201	0.0124	0.0000	0.0000	0.0000	0.0000
42_G	0.3275	0.3176	0.3129	0.3097	0.3014	0.2820	0.2312	0.4037	0.2821	0.2479	0.2455	0.2390	0.2520	0.2552	0.1808
42_D	0.6637	0.6688	0.6717	0.6749	0.6832	0.7034	0.7173	0.5751	0.7097	0.7319	0.7421	0.7610	0.7480	0.7448	0.8192
42_E	0.0088	0.0135	0.0154	0.0155	0.0154	0.0146	0.0515	0.0213	0.0082	0.0201	0.0124	0.0000	0.0000	0.0000	0.0000
43_G	0.1512	0.1502	0.1503	0.1502	0.1494	0.1451	0.0885	0.0802	0.0605	0.0311	0.0331	0.0555	0.0640	0.0468	0.0492
43_D	0.8407	0.8467	0.8462	0.8460	0.8468	0.8513	0.9101	0.9195	0.9393	0.9689	0.9669	0.9445	0.9360	0.9532	0.9508
43_E	0.0081	0.0031	0.0035	0.0038	0.0038	0.0035	0.0014	0.0004	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
51_G	0.0008	0.0008	0.0007	0.0007	0.0007	0.0007	0.0008	0.0008	0.0016	0.0000	0.0000	0.0066	0.0000	0.0000	0.0000
51_D	0.9903	0.9979	0.9977	0.9977	0.9977	0.9979	0.9988	0.9979	0.9984	1.0000	1.0000	0.9934	1.0000	1.0000	1.0000
51_E	0.0090	0.0014	0.0015	0.0016	0.0015	0.0014	0.0004	0.0012	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
52_G	0.5156	0.5185	0.5185	0.5185	0.5185	0.5185	0.4741	0.4990	0.4898	0.4428	0.4001	0.4214	0.2754	0.2837	0.3322
52_D	0.4785	0.4812	0.4812	0.4812	0.4812	0.4812	0.5255	0.5007	0.5101	0.5571	0.5999	0.5786	0.7246	0.7162	0.6675
52_E	0.0058	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0001	0.0000	0.0001	0.0000	0.0000	0.0001	0.0003
53_G	0.5156	0.5185	0.5185	0.5185	0.5185	0.5185	0.4741	0.4990	0.4898	0.4428	0.4001	0.4214	0.2754	0.2837	0.3322
53_D	0.4785	0.4812	0.4812	0.4812	0.4812	0.4812	0.5255	0.5007	0.5101	0.5571	0.5999	0.5786	0.7246	0.7162	0.6675
53_E	0.0058	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0001	0.0000	0.0001	0.0000	0.0000	0.0001	0.0003
54_G	0.6642	0.6671	0.6673	0.6617	0.6563	0.6476	0.6641	0.6646	0.6613	0.6701	0.6802	0.7076	0.7251	0.7013	0.0059

SUT_FT	2024	2023	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010
54_D	0.3293	0.3329	0.3327	0.3383	0.3437	0.3524	0.3359	0.3354	0.3387	0.3299	0.3198	0.2924	0.2749	0.2987	0.9941
54_E	0.0064	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
61_G	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
61_D	0.9976	0.9995	0.9995	0.9995	0.9995	0.9995	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
61_E	0.0024	0.0005	0.0005	0.0005	0.0005	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
62_G	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
62_D	0.9976	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
62_E	0.0024	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Texas Statewide 2024 Fuel Engine Fractions Summary - Continue

SUT_FT	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995	1994
11_G	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
21_G	0.9920	0.9990	0.9994	0.9929	0.9949	0.9966	0.9958	0.9932	0.9962	0.9966	0.9981	0.9978	0.9991	0.9988	0.9991	0.9998
21_D	0.0078	0.0007	0.0005	0.0069	0.0049	0.0034	0.0042	0.0046	0.0034	0.0031	0.0019	0.0022	0.0009	0.0012	0.0009	0.0002
21_E	0.0002	0.0003	0.0002	0.0001	0.0002	0.0000	0.0001	0.0021	0.0004	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
31_G	0.9828	0.9700	0.9721	0.9560	0.9641	0.9594	0.9614	0.9653	0.9590	0.9702	0.9607	0.9872	0.9555	0.9575	0.9609	0.9662
31_D	0.0172	0.0300	0.0279	0.0440	0.0359	0.0406	0.0386	0.0347	0.0410	0.0297	0.0392	0.0128	0.0445	0.0425	0.0391	0.0338
31_E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
32_G	0.9535	0.9198	0.9321	0.9002	0.9148	0.9073	0.9159	0.9150	0.9116	0.9225	0.9012	0.9547	0.8987	0.9070	0.9083	0.9212
32_D	0.0465	0.0802	0.0679	0.0998	0.0852	0.0927	0.0841	0.0848	0.0882	0.0773	0.0986	0.0449	0.1012	0.0930	0.0917	0.0788
32_E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0002	0.0002	0.0002	0.0004	0.0000	0.0000	0.0000	0.0000
41_G	0.1266	0.1669	0.1323	0.1773	0.1725	0.1688	0.1525	0.1322	0.1068	0.0740	0.0017	0.0014	0.0012	0.0108	0.0346	0.0138
41_D	0.8734	0.8331	0.8677	0.8227	0.8275	0.8308	0.8474	0.8535	0.8913	0.9260	0.9983	0.9986	0.9988	0.9892	0.9654	0.9862
41_E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0004	0.0002	0.0143	0.0020	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
42_G	0.1266	0.1669	0.1323	0.1773	0.1725	0.1688	0.1525	0.1322	0.1068	0.0740	0.0017	0.0014	0.0012	0.0108	0.0346	0.0138
42_D	0.8734	0.8331	0.8677	0.8227	0.8275	0.8308	0.8474	0.8535	0.8913	0.9260	0.9983	0.9986	0.9988	0.9892	0.9654	0.9862
42_E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0004	0.0002	0.0143	0.0020	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
43_G	0.0275	0.0130	0.0078	0.0101	0.0066	0.0038	0.0055	0.0260	0.0117	0.0257	0.0100	0.0100	0.0100	0.0415	0.1143	0.1475
43_D	0.9725	0.9870	0.9922	0.9899	0.9934	0.9962	0.9945	0.9740	0.9883	0.9743	0.9900	0.9900	0.9900	0.9585	0.8857	0.8525
43_E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

SUT_FT	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995	1994
51_G	0.0046	0.0020	0.0035	0.0009	0.0007	0.0000	0.0004	0.0000	0.0000	0.0000	0.1688	0.4036	0.0193	0.0253	0.0235	0.1050
51_D	0.9954	0.9980	0.9965	0.9991	0.9993	1.0000	0.9996	1.0000	1.0000	1.0000	0.8312	0.5964	0.9807	0.9747	0.9765	0.8950
51_E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
52_G	0.3834	0.3310	0.2717	0.2733	0.2492	0.2572	0.2512	0.2749	0.3024	0.3629	0.3252	0.4135	0.4154	0.3828	0.6233	0.5018
52_D	0.6166	0.6690	0.7283	0.7267	0.7508	0.7428	0.7488	0.7251	0.6976	0.6371	0.6748	0.5865	0.5846	0.6172	0.3767	0.4982
52_E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
53_G	0.3834	0.3310	0.2717	0.2733	0.2492	0.2572	0.2512	0.2749	0.3024	0.3629	0.3252	0.4135	0.4154	0.3828	0.6233	0.5018
53_D	0.6166	0.6690	0.7283	0.7267	0.7508	0.7428	0.7488	0.7251	0.6976	0.6371	0.6748	0.5865	0.5846	0.6172	0.3767	0.4982
53_E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
54_G	0.5339	0.3804	0.4420	0.5778	0.3493	0.6016	0.5619	0.6028	0.5459	0.6539	0.7975	0.6494	0.8361	0.8008	0.8510	0.8084
54_D	0.4661	0.6196	0.5580	0.4222	0.6507	0.3984	0.4381	0.3972	0.4541	0.3461	0.2025	0.3506	0.1639	0.1992	0.1490	0.1916
54_E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
61_G	0.0000	0.0000	0.0543	0.0649	0.0607	0.0769	0.0859	0.0932	0.0957	0.1104	0.1105	0.1092	0.1217	0.1185	0.2083	0.1003
61_D	1.0000	1.0000	0.9457	0.9351	0.9393	0.9231	0.9141	0.9068	0.9043	0.8896	0.8895	0.8908	0.8783	0.8815	0.7917	0.8997
61_E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
62_G	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
62_D	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
62_E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000