



Useful Information

Greenhouse Gases (GHG) Analysis Emission Rate Lookup Table (ERLT)

This document provides information on the use and development of the ERLT for Greenhouse gases analyses.

Table of Contents

1.0 Background.....	3
2.0 Applying Running Exhaust Emissions Rates for GHG for Transportation Projects.....	3
2.1 Calculating free flow emissions	3
2.2 Calculating idling emissions.....	3
3.0 Glossary.....	3
4.0 Abbreviations and Acronyms	3
Appendix A: Pre-Analysis Consensus Plans for ERLT Development	4
TxDOT Austin District Area.....	5
TxDOT Corpus Christi District Area.....	12
Dallas-Fort Worth Metropolitan Area.....	19
TxDOT El Paso District Area.....	26
Houston Galveston Bay Metropolitan Area	33
TxDOT San Antonio District Area.....	40
TxDOT Waco District Area.....	47
Appendix B Document Revision History.....	54

1.0 Background

These tables provide emission rates for Greenhouse Gases (GHG). If a project level greenhouse gas emissions analysis will be performed, these rates can be used in the development of project level Greenhouse gases emissions.

2.0 Applying Running Exhaust Emissions Rates for GHG for Transportation Projects

2.1 Calculating free flow emissions

- The emission rates in the ERLT are in grams /mile;
- The formula for estimating emissions is:

Emissions (lbs/day)_{Speed, roadway type} = Emission Rate_{Speed, roadway type} (grams/mile)* Vehicle Miles of Travel (miles/day)*1 lb/453.59237 grams,

Where VMT on a specific Link at modeled speed = Volume * Link Length.

2.2 Calculating idling emissions

- The formula for estimating idling emissions is:

Emissions Rate (gram/hour) = Emission Rate (grams/mile)* 2.5 miles/hour.

3.0 Glossary

Emission Rate Lookup Tables – Tables of emission rates for various pollutants for varying speeds and years developed using the Environmental Protection Agency (EPA) MOVES2014 emissions model.

4.0 Abbreviations and Acronyms

CO ₂	Carbon Dioxide
EPA	Environmental Protection Agency
ERLT	Emission Rate Lookup Tables
GHG	Greenhouses gases
TxDOT	Texas Department of Transportation

Appendix A: Pre-Analysis Consensus Plans for ERLT Development

TxDOT Austin District Area

Project Description and Region

The 1990 Clean Air Act Amendment (CAAA) requires the United States Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards (NAAQS; 40 Code of Federal Regulations, Part 50) for pollutants considered harmful to public health and the environment, including six principal pollutants, which are called "criteria" pollutants. These are Ozone (O₃), Carbon Monoxide (CO), Particulate Matter (PM), Nitrogen Dioxide (NO₂), Sulfur Dioxide (SO₂), and Lead (PB). In addition to criteria air pollutants for which there are NAAQS, the EPA regulates air toxics which mostly originate from human-made sources, including on-road mobile sources, non-road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners), and stationary sources (e.g., factories, refineries).

Mobile source air toxics (MSAT) are compounds known, or suspected, to cause cancer or other serious health and environmental effects. The EPA has assessed this expansive list in their latest rule on the Control of Hazardous Air Pollutants from Mobile Sources (Federal Register, Vol. 72, No. 37, page 8430, February 26, 2007) and identified a group of 93 compounds emitted from mobile sources that are listed in their Integrated Risk Information System (IRIS) (<http://www.epa.gov/ncea/iris/index.html>). In addition, EPA identified seven compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers from their 1999 National Air Toxics Assessment (NATA) (<http://www.epa.gov/ttn/atw/nata1999/>). These are acrolein (ACROL), benzene (BENZ), 1,3-butadiene (BUTA), diesel particulate matter plus diesel exhaust organic gases (DPM), formaldehyde (FORM), naphthalene (NAP), and polycyclic organic matter (POM). While the Federal Highway Administration (FHWA) considers these the priority mobile source air toxics, the list is subject to change and may be adjusted in consideration of future EPA rules. The FHWA adopts the EPA priority list in their 2009 Interim Guidance.

With the release of EPA's latest on-road model Motor Vehicle Emission Simulator MOVES2014 (Version October 2014), a new set of emission rate look-up tables (ERLT) are developed for criteria pollutants and MSAT. The ERLT for MSAT for the TxDOT Austin District was developed using the following data assumptions, in accordance with the pre-analysis consensus plan. Two runs for TxDOT Austin District for each analysis year was performed, one for summer season and one for winter season. As the magnitude of emission factors depends on the seasonal inputs, for conservative estimation, the higher value of emission factors among the two seasonal runs are selected to develop the ERLT for MSAT and criteria pollutants. Winter season emission rates look-up table are used for estimation of carbon monoxide (CO) ERLT for CO analysis for the hour with the lowest temperature in the AM-Peak.

The ERLT are prepared for the analysis years and listed counties presented in Table 1 for TxDOT Austin District Area.

Table 1 Analysis Years and Counties TxDOT Austin District Area	
Requirement	Years
Base Year	2010, the first year of the mobility plan (as required).
Future Analysis Year	2015 through 2040 with 1 year increments.
Interpolation Years	N/A
Counties	Bastrop, Burnet, Caldwell, Hays, Travis, Williamson, Mason, Llano, Gillespie, Blanco and Lee.

Useful Information Regarding Greenhouse Gases Analysis ERLT

1. Activity Detail

The following are vehicle activity details that were applied in the post processing modeling process. Diurnal Distribution of Vehicle Activity was provided by Texas A&M Transportation Institute (TTI), and was applied to estimate MSAT and CO ERLT.

Table 2 Hourly Distribution Factors Analysis Year 2011 TxDOT Austin District Area		
Hours	Summer	Winter
12:00 a.m. – 12:59 a.m.	0.011752	0.010987
1:00 a.m. – 1:59 a.m.	0.007985	0.007781
2:00 a.m. – 2:59 a.m.	0.007443	0.007316
3:00 a.m. – 3:59 a.m.	0.006046	0.005971
4:00 a.m. – 4:59 a.m.	0.008254	0.008108
5:00 a.m. – 5:59 a.m.	0.021200	0.020646
6:00 a.m. – 6:59 a.m.	0.051097	0.050761
7:00 a.m. – 7:59 a.m.	0.064784	0.064309
8:00 a.m. – 8:59 a.m.	0.060195	0.059800
9:00 a.m. – 9:59 a.m.	0.055297	0.054543
10:00 a.m. – 10:59 a.m.	0.051948	0.052135
11:00 a.m. – 11:59 a.m.	0.055589	0.055865
12:00 p.m. – 12:59 p.m.	0.057944	0.058522
1:00 p.m. – 1:59 p.m.	0.058782	0.059973
2:00 p.m. – 2:59 p.m.	0.059842	0.062182
3:00 p.m. – 3:59 p.m.	0.063051	0.065895
4:00 p.m. – 4:59 p.m.	0.063413	0.065894
5:00 p.m. – 5:59 p.m.	0.062690	0.064393
6:00 p.m. – 6:59 p.m.	0.059810	0.060603
7:00 p.m. – 7:59 p.m.	0.049379	0.048754
8:00 p.m. – 8:59 p.m.	0.039679	0.037354
9:00 p.m. – 9:59 p.m.	0.035809	0.033464
10:00 p.m. – 10:59 p.m.	0.028266	0.026392
11:00 p.m. – 11:59 p.m.	0.019745	0.010987

Source: TTI

Useful Information Regarding Greenhouse Gases Analysis ERLT

2. Emissions Modeling Details (MOVES Emission Factor Model Information)

Detailed MOVES input parameter data and sources are outlined in the following sections for consultation partners review.

Table 3 Modeling Information TxDOT Austin District Area		
Description	Input Parameter Values	Comment
MOVES Model Version	MOVES2014	Latest MOVES2014 (revised October 2014) is the model to be utilized for this analysis.
MOVES Model County	Travis	Regional applicable inputs will be applied to the surrogate county to represent the TxDOT Austin District Area.
Time Periods	Hourly	
Functional Class	Off-Network, Urban Restricted, Rural Restricted, Urban Unrestricted and Rural Unrestricted	
Speed	2.5-75 mph at 5 mph increments	
Pollutant	Carbon monoxide (CO), Particulate Matter – 10 Micrometer or less (PM ₁₀), Particulate Matter – 2.5 Micrometer or less (PM _{2.5}), Sulfur Dioxide (SO ₂), Nitrogen Dioxide (NO ₂), Nitrogen Oxides (NO _x), Volatile Organic Compounds (VOC), Carbon Dioxide (CO ₂), Acrolein (ACROL), Benzene (BENZ), 1,3-butadiene (BUTA), Diesel Particulate Matter (DPM), Formaldehyde (FORM), Naphthalene (NAP), and Polycyclic Organic Matter (POM)	DPM is diesel emissions represented by PM ₁₀ total exhaust for diesel vehicles only (not gasoline vehicles). Although POM consists of 100s of compounds, which includes NAP, MOVES provides estimates for POM emissions using the most predominant POM pollutants, listed below, without NAP: Acenaphthene, Acenaphthylene, Anthracene, Benz(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Fluorene, Indeno(1,2,3,c,d)pyrene, Phenanthrene, and Pyrene.
VMT Mix	EPA's 23-vehicle class	Applied during post-processing of emission rates
Calendar Year	2010 and 2015 through 2040	Will also include the first (base) year of the mobility plan, as required
Evaluation Month	1 (Dec-Feb) 7 (June-Aug)	ERLT will represent annual average for all pollutants except CO. CO lookup table will represent winter season

Useful Information Regarding Greenhouse Gases Analysis ERLT

Table 4 MOVES2014 Input Parameters and Source TxDOT Austin District Area		
Input Parameter Name	Description	Source
Source Type Population	Input the number of vehicles in the geographic area which is to be modeled for each vehicle.	2010 and 2014 TXDMV registration data
Source Type Age Distribution	Input that provides the distribution of vehicle counts by age for each calendar year and vehicle type. TXDMV registration data is used to estimate the age distribution of vehicle types up to 30 years. The distribution of Age fractions should sum up to 1.0 for all vehicle types for each analysis year.	2010 and 2014 TXDMV registration data & MOVES default
Average Speed Distribution	Input average speed data specific to vehicle type, road type, and time of day/type of day into 16 speed bins. The sum of speed distribution to all speed bins for each road type, vehicle type, and time/day type would be 1.0.	MOVES Default
Road Type Distribution (VMT Fractions)	VMT by road type. VMT fraction is distributed between the road type and must sum to 1.0 for each source type.	MOVES Default
Fuel Supply	Existing fuels (gas & diesel) and associated market share for each fuel.	TTI Provided 2010 & 2014 Data (See table 4.a)
Fuel Formulation	Fuel properties in the MOVES database.	TTI Provided 2010 & 2014 Data (See Table 4.b)
Fuel usage Fraction	This specifies the fraction of E-85-capable vehicles using E-85 vs. conventional gasoline.	MOVES Default
Meteorology	Regional Specific data on temperature and humidity.	TTI Provided 2014 data (See Table 5)
I/M Coverage	Input I/M coverage record for each combination of pollutants, process, county, fuel type, regulatory class and model year are specified using this input.	See Table 6.
Alternative Vehicle Fuel Technology	Input fuel engine fractions (i.e. Gasoline vs. Diesel Engines types in the vehicle population) for all vehicle types.	2010 and 2014 TXDMV registration data & MOVES default

Useful Information Regarding Greenhouse Gases Analysis ERLT

Table 4.a MOVES2010b Fuel Supply TxDOT Austin District					
Fuel Region ID	Fuel Year ID	Month Group ID	Fuel Formulation ID	Market Share	Market Share CV
178010000	2010	1	8549	0.09	NULL
178010000	2010	1	8551	0.91	NULL
178010000	2010	1	31001	1	NULL
178010000	2010	7	8555	0.09	NULL
178010000	2010	7	8557	0.91	NULL
178010000	2010	7	31001	1	NULL
178010000	2014	1	13067	1	NULL
178010000	2014	1	30002	1	NULL
178010000	2014	7	10702	1	NULL
178010000	2014	7	30002	1	NULL

Source: TTI

Table 4.b MOVES2014 Fuel Properties TxDOT Austin District								
Fuel Year	2010					2014		
Fuel Type	Winter Gasoline	Summer Gasoline	Winter Gasohol (E10)	Summer Gasohol (E10)	Diesel	Winter Gasohol (E10)	Summer Gasohol (E10)	Diesel
fuelFormulationID	8549	8555	8551	8557	31001	13067	10702	30002
fuelSubtypeID	10	10	12	12	20	12	12	20
RVP	11.07	7.8	12.07	7.8	0	12.07	7.52	0
sulfurlevel	33.83	34.2	33.83	34.2	15	30	30.84	6.18
ETOHVolume	0	0	10	10	0	10	9.76	0
MTBEVolume	0	0	0	0	0	0	0	0
ETBEVolume	0	0	0	0	0	0	0	0
TAMEVolume	0	0	0	0	0	0	0	0
aromaticContent	22.94	25.25	19.29	23.23	0	19.29	22.65	0
olefinContent	12.54	12.98	10.46	12.52	0	10.46	11.75	0
benzeneContent	0.88	0.9	0.88	0.9	0	0.61	0.55	0
e200	49.42	43.79	54.3	45.64	0	54.3	49.82	0
e300	83.05	80.06	83.59	79.95	0	83.59	83.7	0
volToWtPercentOxy	0	0	0.3653	0.3653	0	0.3653	0.3653	0
BioDieselEsterVolume	NULL	NULL	NULL	NULL	0	NULL	NULL	NULL
CetaneIndex	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
PAHContent	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
T50	196.64	214.4	186.68	210.54	0	186.68	203.22	0
T90	329.38	340.54	326.93	341.04	0	326.93	322.54	0

^a For modeling analysis year 2017 and later years, gasoline sulfur level value of 10 will be used.

Source: TTI

**Useful Information Regarding
Greenhouse Gases Analysis ERLT**

Table 5 MOVES2014 Hourly Meteorological Data Analysis Year 2012 TxDOT Austin District Area				
Hours	Temperature (°F)		Relative Humidity (%)	
	Summer	Winter	Summer	Winter
12:00 a.m.	77.58	50.99	73.11	66.77
1:00 a.m.	76.82	50.45	74.47	69.25
2:00 a.m.	75.81	50.02	79.30	70.38
3:00 a.m.	75.24	49.60	81.44	70.90
4:00 a.m.	74.87	49.26	82.87	71.06
5:00 a.m.	74.53	48.86	83.50	71.30
6:00 a.m.	74.22	48.63	84.78	70.03
7:00 a.m.	74.71	48.27	83.60	71.13
8:00 a.m.	76.37	49.17	79.15	68.22
9:00 a.m.	78.37	51.21	72.54	63.64
10:00 a.m.	80.67	53.53	64.63	59.04
11:00 a.m.	82.75	55.68	58.58	55.52
12:00 p.m.	84.61	57.47	53.67	51.63
1:00 p.m.	86.08	58.74	50.34	49.13
2:00 p.m.	87.51	59.71	45.70	47.47
3:00 p.m.	88.41	60.31	43.66	46.43
4:00 p.m.	88.66	59.97	42.94	46.85
5:00 p.m.	88.39	58.53	43.99	49.91
6:00 p.m.	87.57	56.60	45.25	52.94
7:00 p.m.	85.98	54.64	48.44	58.13
8:00 p.m.	83.50	53.55	55.18	60.93
9:00 p.m.	81.71	52.68	60.29	62.78
10:00 p.m.	80.10	51.99	64.61	64.83
11:00 p.m.	78.69	51.38	69.11	66.81

Source: TTI

**Useful Information Regarding
Greenhouse Gases Analysis ERLT**

Table 6 MOVES2014 I/M Descriptive Inputs TxDOT Austin District Travis and Williamson County I/M data					
I/M Program ID	140	121	151	160	Identifies program number with MOVES Database.
Pollutant Process ID	101, 102, 201, 202, 301, 302,	101, 102, 201, 202, 301, 302,	112	112	
Source Use Type	21, 31, 32	21, 31, 32	21, 31, 32	21, 31, 32	
Begin Model Year	1996	X	X	1996	
End Model Year	y	1995	1995	y	
Inspection Frequency	1	1	1	1	Annual testing; program specifications
Test Standards ID	51	12	41	45	Identifies program number with MOVES Database.
Test Standards Description	Exhaust OBD Check	Two-mode, 2500 RPM/Idle Test	Evaporative Gas Cap Check	Evaporative Gas Cap and OBD Check	
I/M Compliance	93.12% for source type 21, 91.26% for source type 31 and 86.6% for source type 32				Expected compliance (%) - MOVES Default
<p>Begin Model Year and End Model year define the range of vehicle model years covered by I/M Program. Here Begin Model Year represented by "x" is calculated as YearID - 24 and End Model Year represented by "y" is calculated as YearID - 2.</p>					

TxDOT Corpus Christi District Area

Project Description and Region

The 1990 Clean Air Act Amendment (CAAA) requires the United States Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards (NAAQS; 40 Code of Federal Regulations, Part 50) for pollutants considered harmful to public health and the environment, including six principal pollutants, which are called "criteria" pollutants. These are Ozone (O₃), Carbon Monoxide (CO), Particulate Matter (PM), Nitrogen Dioxide (NO₂), Sulfur Dioxide (SO₂), and Lead (PB). In addition to criteria air pollutants for which there are NAAQS, the EPA regulates air toxics which mostly originate from human-made sources, including on-road mobile sources, non-road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners), and stationary sources (e.g., factories, refineries).

Mobile source air toxics (MSAT) are compounds known, or suspected, to cause cancer or other serious health and environmental effects. The EPA has assessed this expansive list in their latest rule on the Control of Hazardous Air Pollutants from Mobile Sources (Federal Register, Vol. 72, No. 37, page 8430, February 26, 2007) and identified a group of 93 compounds emitted from mobile sources that are listed in their Integrated Risk Information System (IRIS) (<http://www.epa.gov/ncea/iris/index.html>). In addition, EPA identified seven compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers from their 1999 National Air Toxics Assessment (NATA) (<http://www.epa.gov/ttn/atw/nata1999/>). These are *acrolein (ACROL)*, *benzene (BENZ)*, *1,3-butadiene (BUTA)*, *diesel particulate matter plus diesel exhaust organic gases (DPM)*, *formaldehyde (FORM)*, *naphthalene (NAP)*, and *polycyclic organic matter (POM)*. While the Federal Highway Administration (FHWA) considers these the priority mobile source air toxics, the list is subject to change and may be adjusted in consideration of future EPA rules. The FHWA adopts the EPA priority list in their *2009 Interim Guidance*.

With the release of EPA's latest on-road model Motor Vehicle Emission Simulator MOVES2014 (Version October 2014), a new set of emission rate look-up tables (ERLT) are developed for criteria pollutants and MSAT. The ERLT for MSAT for the TxDOT Corpus Christi District was developed using the following data assumptions, in accordance with the pre-analysis consensus plan. Two runs for TxDOT Corpus Christi District for each analysis year was performed, one for summer season and one for winter season. As the magnitude of emission factors depends on the seasonal inputs, for conservative estimation, the higher value of emission factors among the two seasonal runs are selected to develop the ERLT for MSAT and criteria pollutants. Winter season emission rates look-up table are used for estimation of carbon monoxide (CO) ERLT for CO analysis for the hour with the lowest temperature in the AM-Peak.

The ERLT are prepared for the analysis years and listed counties presented in **Table 1** for TxDOT Corpus Christi District Area.

Table 1 Analysis Years and Counties TxDOT Corpus Christi District Area	
Requirement	Years
Base Year	2006 (Current) and 2012 (future base year), the first year of the mobility plan.
Future Analysis Year	2015 through 2040 with 1 year increments.
Interpolation Years	N/A
Counties	Aransas, Bee, Goliad, Jim Wells, Karnes, Kleberg, Live Oak, Nueces, Refugio, and San Patricio.

Useful Information Regarding Greenhouse Gases Analysis ERLT

1. Activity Detail

The following are vehicle activity details that were applied in the post processing modeling process. Diurnal Distribution of Vehicle Activity was provided by Texas A&M Traffic Institute (TTI), and was applied to estimate MSAT and CO ERLT.

Table 2 Hourly Distribution Factors TxDOT Corpus Christi District Area		
Hours	Summer	Winter
12:00 a.m. – 12:59 a.m.	0.00811	0.00698
1:00 a.m. – 1:59 a.m.	0.00507	0.00453
2:00 a.m. – 2:59 a.m.	0.00450	0.00417
3:00 a.m. – 3:59 a.m.	0.00401	0.00377
4:00 a.m. – 4:59 a.m.	0.00755	0.00756
5:00 a.m. – 5:59 a.m.	0.01956	0.02019
6:00 a.m. – 6:59 a.m.	0.04299	0.04555
7:00 a.m. – 7:59 a.m.	0.06381	0.07046
8:00 a.m. – 8:59 a.m.	0.05728	0.06235
9:00 a.m. – 9:59 a.m.	0.05006	0.05233
10:00 a.m. – 10:59 a.m.	0.05110	0.05240
11:00 a.m. – 11:59 a.m.	0.05729	0.05686
12:00 p.m. – 12:59 p.m.	0.06051	0.06007
1:00 p.m. – 1:59 p.m.	0.06093	0.06050
2:00 p.m. – 2:59 p.m.	0.06196	0.06210
3:00 p.m. – 3:59 p.m.	0.06748	0.06860
4:00 p.m. – 4:59 p.m.	0.07521	0.07797
5:00 p.m. – 5:59 p.m.	0.08867	0.09208
6:00 p.m. – 6:59 p.m.	0.06347	0.06342
7:00 p.m. – 7:59 p.m.	0.04517	0.04102
8:00 p.m. – 8:59 p.m.	0.03627	0.03033
9:00 p.m. – 9:59 p.m.	0.03058	0.02535
10:00 p.m. – 10:59 p.m.	0.02323	0.01875
11:00 p.m. – 11:59 p.m.	0.01523	0.01269

Source: TTI

Useful Information Regarding Greenhouse Gases Analysis ERLT

2. Emissions Modeling Details (MOVES Emission Factor Model Information)

Detailed MOVES input parameter data and sources are outlined in the following sections for consultation partners review.

Table 3 Modeling Information TxDOT Corpus Christi District Area		
Description	Input Parameter Values	Comment
MOVES Model Version	MOVES2014	Latest MOVES2014 (revised October 2014) is the model to be utilized for this analysis.
MOVES Model County	Travis	Regional applicable inputs will be applied to the surrogate county to represent the TxDOT Corpus Christi District Area.
Time Periods	Hourly	
Functional Class	Off-Network, Urban Restricted, Rural Restricted, Urban Unrestricted and Rural Unrestricted	
Speed	1-75 mph at 5 mph increments	
Pollutant	Carbon monoxide (CO), Particulate Matter – 10 Micrometer or less (PM ₁₀), Particulate Matter – 2.5 Micrometer or less (PM _{2.5}), Sulfur Dioxide (SO ₂), Nitrogen Dioxide (NO ₂), Nitrogen Oxides (NO _x), Volatile Organic Compounds (VOC), Carbon Dioxide (CO ₂), Acrolein (ACROL), Benzene (BENZ), 1,3-butadiene (BUTA), Diesel Particulate Matter (DPM), Formaldehyde (FORM), Naphthalene (NAP), and Polycyclic Organic Matter (POM)	DPM is diesel emissions represented by PM ₁₀ total exhaust for diesel vehicles only (not gasoline vehicles). Although POM consists of 100s of compounds, which includes NAP, MOVES provides estimates for POM emissions using the most predominant POM pollutants, listed below, without NAP: Acenaphthene, Acenaphthylene, Anthracene, Benz(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Fluorene, Indeno(1,2,3,c,d)pyrene, Phenanthrene, and Pyrene.
VMT Mix	EPA's 23-vehicle class	Applied during post-processing of emission rates.
Calendar Year	2010 and 2015 through 2040	Will also include the first (base) year of the mobility plan, as required.
Evaluation Month	1 (Dec-Feb) 7 (June-Aug)	ERLT will represent annual average for all pollutants except CO. CO lookup table will represent winter season .

Useful Information Regarding Greenhouse Gases Analysis ERLT

Table 4 MOVES2014 Input Parameters and Source TxDOT Corpus Christi District Area		
Input Parameter Name	Description	Source
Source Type Population	Input the number of vehicles in the geographic area which is to be modeled for each vehicle.	2006, 2012 and 2014 TXDMV registration data
Source Type Age Distribution	Input that provides the distribution of vehicle counts by age for each calendar year and vehicle type. TXDMV registration data is used to estimate the age distribution of vehicle types up to 30 years. The distribution of Age fractions should sum up to 1.0 for all vehicle types for each analysis year.	2006, 2012 and 2014 TXDMV registration data & MOVES default
Average Speed Distribution	Input average speed data specific to vehicle type, road type, and time of day/type of day into 16 speed bins. The sum of speed distribution to all speed bins for each road type, vehicle type, and time/day type would be 1.0.	MOVES Default
Road Type Distribution (VMT Fractions)	VMT by road type. VMT fraction is distributed between the road type and must sum to 1.0 for each source type.	MOVES Default
Fuel Supply	Existing fuels (gas & diesel) and associated market share for each fuel.	TTI Provided 2006, 2012 and 2014 Data (See table 4.a)
Fuel Formulation	Fuel properties in the MOVES database.	TTI Provided 2006, 2012 and 2014 Data (See Table 4.b)
Fuel usage Fraction	This specifies the fraction of E-85-capable vehicles using E-85 vs. conventional gasoline.	MOVES Default
Meteorology	Regional Specific data on temperature and humidity.	TTI Provided 2014 data (See Table 5)
I/M Coverage	Input I/M coverage record for each combination of pollutants, process, county, fuel type, regulatory class and model year are specified using this input.	See Table 6.
Alternative Vehicle Fuel Technology	Input fuel engine fractions (i.e. Gasoline vs. Diesel Engines types in the vehicle population) for all vehicle types.	2006, 2012 and 2014 TXDMV registration data & MOVES default

Useful Information Regarding Greenhouse Gases Analysis ERLT

Table 4.a MOVES2010b Fuel Supply TxDOT Corpus Christi District Area					
Fuel Region ID	Fuel Year ID	Month Group ID	Fuel Formulation ID	Market Share	Market Share CV
178010000	2014	1	13067	1	NULL
178010000	2014	1	30002	1	NULL
178010000	2014	7	10702	1	NULL
178010000	2014	7	30002	1	NULL
178010000	2012	1	8809	1	NULL
178010000	2012	1	31001	1	NULL
178010000	2012	7	8815	1	NULL
178010000	2012	7	31001	1	NULL
178010000	2006	1	8033	1	NULL
178010000	2006	1	31001	1	NULL

Source: TTI

Table 4.b MOVES2014 Fuel Properties TxDOT Corpus Christi District Area									
Fuel Year	2006			2012			2014		
Fuel Type	Winter Gasoline	Summer Gasoline	Diesel	Winter Gasohol (E10)	Summer Gasohol (E10)	Diesel	Winter Gasohol (E10)	Summer Gasohol (E10)	Diesel
fuelFormulationID	8033	8039	31001	8809	8815	31001	13067	10702	30002
fuelSubtypeID	10	10	20	12	12	20	12	12	20
RVP	11.16	7.8	0	12.07	7.8	0	12.07	7.52	0
sulfurlevel	78.94	77.85	296.6	30	30	5.92	30	30.84	6.18
ETOHVolume	0	0	0	10	10	0	10	9.76	0
MTBEVolume	0	0	0	0	0	0	0	0	0
ETBEVolume	0	0	0	0	0	0	0	0	0
TAMEVolume	0	0	0	0	0	0	0	0	0
aromaticContent	25.35	25.9	0	19.29	23.23	0	19.29	22.65	0
olefinContent	12.88	12.83	0	10.46	12.52	0	10.46	11.75	0
benzeneContent	1.02	1.05	0	0.61	0.61	0	0.61	0.55	0
e200	48.76	45.73	0	54.3	45.64	0	54.3	49.82	0
e300	84.27	83.09	0	83.59	79.95	0	83.59	83.7	0
volToWtPercentOxy	0	0	0	0.3653	0.3653	0	0.3653	0.3653	0
BioDieselEsterVolume	NULL	NULL	0	NULL	NULL	0	NULL	NULL	NULL
CetaneIndex	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
PAHContent	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
T50	202.34	208.53	0	186.68	210.54	0	186.68	203.22	0

Useful Information Regarding Greenhouse Gases Analysis ERLT

Table 4.b MOVES2014 Fuel Properties TxDOT Corpus Christi District Area									
Fuel Year	2006			2012			2014		
Fuel Type	Winter Gasoline	Summer Gasoline	Diesel	Winter Gasohol (E10)	Summer Gasohol (E10)	Diesel	Winter Gasohol (E10)	Summer Gasohol (E10)	Diesel
T90	323.65	329	0	326.93	341.04	0	326.93	322.54	0

^a For modeling analysis year 2017 and later years, gasoline sulfur level value of 10 will be used.
Source: TTI

Table 5 MOVES2014 Hourly Meteorological Data TxDOT Corpus Christi District Area				
Hours	Temperature (°F)		Relative Humidity (%)	
	Summer	Winter	Summer	Winter
12:00 a.m.	81.60	56.20	80.84	79.53
1:00 a.m.	81.23	55.80	81.85	80.23
2:00 a.m.	80.79	55.41	83.02	80.84
3:00 a.m.	80.41	55.01	83.86	81.66
4:00 a.m.	80.05	54.66	84.66	82.06
5:00 a.m.	79.75	54.29	85.34	82.23
6:00 a.m.	79.46	54.00	85.77	82.36
7:00 a.m.	79.88	53.98	84.98	82.30
8:00 a.m.	81.93	55.07	79.11	80.49
9:00 a.m.	84.02	57.02	71.56	76.85
10:00 a.m.	86.11	59.14	64.46	71.86
11:00 a.m.	87.60	60.90	60.30	67.29
12:00 p.m.	88.61	61.99	58.01	64.26
1:00 p.m.	89.24	62.81	56.79	62.40
2:00 p.m.	89.50	63.27	56.11	61.81
3:00 p.m.	89.34	63.03	56.56	62.52
4:00 p.m.	88.72	62.00	58.01	64.81
5:00 p.m.	87.85	60.48	60.24	68.34
6:00 p.m.	86.68	58.96	63.25	72.04
7:00 p.m.	85.23	57.86	67.13	75.45
8:00 p.m.	83.57	57.32	72.97	77.19
9:00 p.m.	82.78	56.95	76.20	78.15
10:00 p.m.	82.35	56.74	77.97	78.56
11:00 p.m.	81.96	56.43	79.55	79.19

Source: TTI

**Table 6
MOVES2010b I/M Descriptive Inputs
Corpus Christi Area**

No inspection and maintenance (I/M) programs for Corpus Christi Area

Dallas-Fort Worth Metropolitan Area

Project Description and Region

The 1990 Clean Air Act Amendment (CAAA) requires the United States Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards (NAAQS; 40 Code of Federal Regulations, Part 50) for pollutants considered harmful to public health and the environment, including six principal pollutants, which are called "criteria" pollutants. These are Ozone (O₃), Carbon Monoxide (CO), Particulate Matter (PM), Nitrogen Dioxide (NO₂), Sulfur Dioxide (SO₂), and Lead (PB). In addition to criteria air pollutants for which there are NAAQS, the EPA regulates air toxics which mostly originate from human-made sources, including on-road mobile sources, non-road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners), and stationary sources (e.g., factories, refineries).

Mobile source air toxics (MSAT) are compounds known, or suspected, to cause cancer or other serious health and environmental effects. The EPA has assessed this expansive list in their latest rule on the Control of Hazardous Air Pollutants from Mobile Sources (Federal Register, Vol. 72, No. 37, page 8430, February 26, 2007) and identified a group of 93 compounds emitted from mobile sources that are listed in their Integrated Risk Information System (IRIS) (<http://www.epa.gov/ncea/iris/index.html>). In addition, EPA identified seven compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers from their 1999 National Air Toxics Assessment (NATA) (<http://www.epa.gov/ttn/atw/nata1999/>). These are *acrolein (ACROL)*, *benzene (BENZ)*, *1,3-butadiene (BUTA)*, *diesel particulate matter plus diesel exhaust organic gases (DPM)*, *formaldehyde (FORM)*, *naphthalene (NAP)*, and *polycyclic organic matter (POM)*. While the Federal Highway Administration (FHWA) considers these the priority mobile source air toxics, the list is subject to change and may be adjusted in consideration of future EPA rules. The FHWA adopts the EPA priority list in their *2009 Interim Guidance*.

With the release of EPA's latest on-road model Motor Vehicle Emission Simulator MOVES2014 (Version October 2014), a new set of emission rate look-up tables (ERLT) are developed for criteria pollutants and MSAT. The ERLT for MSAT for the Dallas-Fort Worth Metropolitan area was developed using the following data assumptions, in accordance with the pre-analysis consensus plan. Two runs for each analysis year was performed, one for summer season and one for winter season. As the magnitude of emission factors depends on the seasonal inputs, for conservative estimation, the higher value of emission factors among the two seasonal runs are selected to develop the ERLT for MSAT and criteria pollutants. Winter season emission rates look-up table are used for estimation of carbon monoxide (CO) ERLT for CO analysis for the hour with the lowest temperature in the AM-Peak.

The ERLT are prepared for the analysis years and listed counties presented in **Table 1** for Dallas - Fort Worth Metropolitan Area.

Table 1 Analysis Years and Counties Dallas-Fort Worth Metropolitan Area	
Requirement	Years
Base Year	2015.
Future Analysis Year	2015 through 2040 with 1 year increments.
Interpolation Years	N/A
Counties	Collin, Dallas, Denton, Ellis, Hood, Hunt, Johnson, Kaufman, Parker, Rockwall, Tarrant, and Wise.

Useful Information Regarding Greenhouse Gases Analysis ERLT

1. Activity Detail

The following are vehicle activity details that were applied in the post processing modeling process. Diurnal Distribution of Vehicle Activity was provided by Texas A&M Traffic Institute (TTI), and was applied to estimate MSAT and CO ERLT.

Table 2 Hourly Distribution Factors Analysis Year 2011 Dallas-Fort Worth Metropolitan Area		
Hours	Summer	Winter
12:00 a.m. – 12:59 a.m.	0.01048	0.00931
1:00 a.m. – 1:59 a.m.	0.00679	0.00614
2:00 a.m. – 2:59 a.m.	0.00629	0.00579
3:00 a.m. – 3:59 a.m.	0.00605	0.00559
4:00 a.m. – 4:59 a.m.	0.00990	0.00908
5:00 a.m. – 5:59 a.m.	0.02602	0.02394
6:00 a.m. – 6:59 a.m.	0.05379	0.05188
7:00 a.m. – 7:59 a.m.	0.06736	0.06878
8:00 a.m. – 8:59 a.m.	0.05942	0.06131
9:00 a.m. – 9:59 a.m.	0.05103	0.05111
10:00 a.m. – 10:59 a.m.	0.04932	0.04951
11:00 a.m. – 11:59 a.m.	0.05226	0.05282
12:00 p.m. – 12:59 p.m.	0.05492	0.05575
1:00 p.m. – 1:59 p.m.	0.05598	0.05732
2:00 p.m. – 2:59 p.m.	0.05878	0.06093
3:00 p.m. – 3:59 p.m.	0.06559	0.06847
4:00 p.m. – 4:59 p.m.	0.07235	0.07554
5:00 p.m. – 5:59 p.m.	0.07553	0.07818
6:00 p.m. – 6:59 p.m.	0.06124	0.06321
7:00 p.m. – 7:59 p.m.	0.04527	0.04442
8:00 p.m. – 8:59 p.m.	0.03587	0.03341
9:00 p.m. – 9:59 p.m.	0.03196	0.02893
10:00 p.m. – 10:59 p.m.	0.02580	0.02293
11:00 p.m. – 11:59 p.m.	0.01799	0.01568

Source: TTI

2. Emissions Modeling Details (MOVES Emission Factor Model Information)

Detailed MOVES input parameter data and sources are outlined in the following sections for consultation partners review.

Table 3 Modeling Information Dallas-Fort Worth Metropolitan Area		
Description	Input Parameter Values	Comment
MOVES Model Version	MOVES2014	Latest MOVES2014 (revised October 2014) is the model to be utilized for this analysis.
MOVES Model County	Travis	Regional applicable inputs will be applied to the surrogate county to represent the Dallas-Fort Worth Metropolitan Area.
Time Periods	Hourly	
Functional Class	Off-Network ,Urban Restricted, Rural Restricted, Urban Unrestricted and Rural Unrestricted	
Speed	1-75 mph at 5 mph increments	
Pollutant	Carbon monoxide (CO), Particulate Matter – 10 Micrometer or less (PM ₁₀), Particulate Matter – 2.5 Micrometer or less (PM _{2.5}), Sulfur Dioxide (SO ₂), Nitrogen Dioxide (NO ₂), Nitrogen Oxides (NO _x), Volatile Organic Compounds (VOC), Carbon Dioxide (CO ₂), Acrolein (ACROL), Benzene (BENZ), 1,3-butadiene (BUTA), Diesel Particulate Matter (DPM), Formaldehyde (FORM), Naphthalene (NAP), and Polycyclic Organic Matter (POM)	DPM is diesel emissions represented by PM ₁₀ total exhaust for diesel vehicles only (not gasoline vehicles). Although POM consists of 100s of compounds, which includes NAP, MOVES provides estimates for POM emissions using the most predominant POM pollutants, listed below, without NAP: Acenaphthene, Acenaphthylene, Anthracene, Benz(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Fluorene, Indeno(1,2,3,c,d)pyrene, Phenanthrene, and Pyrene.
VMT Mix	EPA's 23-vehicle class	Applied during post-processing of emission rates
Calendar Year	2015 through 2040	Will also include the first (base) year of the mobility plan, as required
Evaluation Month	1 (Dec-Feb) 7 (June-Aug)	ERLT will represent annual average for all pollutants except CO. CO lookup table will represent winter season

Table 4 MOVES2014 Input Parameters and Source Dallas-Fort Worth Metropolitan Area		
Input Parameter Name	Description	Source
Source Type Population	Input the number of vehicles in the geographic area which is to be modeled for each vehicle.	2014 TXDMV registration data
Source Type Age Distribution	Input that provides the distribution of vehicle counts by age for each calendar year and vehicle type. TXDMV registration data is used to estimate the age distribution of vehicle types up to 30 years. The distribution of Age fractions should sum up to 1.0 for all vehicle types for each analysis year.	2014 TXDMV registration data & MOVES default
Average Speed Distribution	Input average speed data specific to vehicle type, road type, and time of day/type of day into 16 speed bins. The sum of speed distribution to all speed bins for each road type, vehicle type, and time/day type would be 1.0.	MOVES Default
Road Type Distribution (VMT Fractions)	VMT by road type. VMT fraction is distributed between the road type and must sum to 1.0 for each source type.	MOVES Default
Fuel Supply	Existing fuels (gas & diesel) and associated market share for each fuel.	TTI Provided 2014 Data (See table 4.a)
Fuel Formulation	Fuel properties in the MOVES database.	TTI Provided 2014 Data (See Table 4.b)
Fuel usage Fraction	This specifies the fraction of E-85-capable vehicles using E-85 vs. conventional gasoline.	MOVES Default
Meteorology	Regional Specific data on temperature and humidity.	TTI Provided 2014 data (See Table 5)
I/M Coverage	Input I/M coverage record for each combination of pollutants, process, county, fuel type, regulatory class and model year are specified using this input.	See Table 6.
Alternative Vehicle Fuel Technology	Input fuel engine fractions (i.e. Gasoline vs. Diesel Engines types in the vehicle population) for all vehicle types.	2014 TXDMV registration data & MOVES default

Useful Information Regarding Greenhouse Gases Analysis ERLT

Table 4.a MOVES2010b Fuel Supply Dallas-Fort Worth Metropolitan Area					
Fuel Region ID	Fuel Year ID	Month Group ID	Fuel Formulation ID	Market Share	Market Share CV
1370011000	2014	1	10104	1	NULL
1370011000	2014	1	30002	1	NULL
1370011000	2014	7	10704	1	NULL
1370011000	2014	7	30002	1	NULL

Source: TTI

Table 4.b MOVES2014 Fuel Properties Dallas-Fort Worth Metropolitan Area			
Fuel Year	2014	2014	2014
Fuel Type	Winter Gasohol (E10)	Summer Gasohol (E10)	Diesel
Fuel Formulation ID	10104	10704	30002
Fuel Subtype ID	12	12	20
RVP	10.85	7.1	0
Sulfur Level	35.09	28.47	6.18
ETOH Volume	10.09	9.7	0
MTBE Volume	0	0	0
ETBE Volume	0	0	0
TAME Volume	0	0	0
Aromatic Content	13.86	14.42	0
Olefin Content	11.02	13.36	0
Benzene Content	0.47	0.44	0
e200	58.39	49	0
e300	86.61	84.3	0
Vol To Wt Percent Oxy	0.3653	0.3653	0
BioDiesel Ester Volume	NULL	NULL	NULL
Cetane Index	NULL	NULL	NULL
PAH Content	NULL	NULL	NULL
T50	155.64	203.6	0
T90	317.3	329.78	0

^a For modeling analysis year 2017 and later years, gasoline sulfur level value of 10 will be used.

Source: TTI

**Useful Information Regarding
Greenhouse Gases Analysis ERLT**

Table 5 MOVES2014 Hourly Meteorological Data Analysis Year 2012 Dallas-Fort Worth Metropolitan Area				
Hours	Temperature (°F)		Relative Humidity (%)	
	Summer	Winter	Summer	Winter
12:00 a.m.	79.03	47.33	68.91	68.50
1:00 a.m.	78.09	47.16	71.16	69.43
2:00 a.m.	77.25	46.75	73.10	70.44
3:00 a.m.	76.48	46.12	75.15	71.29
4:00 a.m.	75.70	45.73	77.07	72.28
5:00 a.m.	75.05	45.12	78.83	71.85
6:00 a.m.	74.38	44.86	80.32	72.13
7:00 a.m.	75.36	44.66	79.17	72.39
8:00 a.m.	77.72	45.82	73.79	69.86
9:00 a.m.	80.40	47.67	67.53	64.74
10:00 a.m.	82.78	49.89	61.95	59.99
11:00 a.m.	85.40	51.85	55.92	56.30
12:00 p.m.	87.31	53.69	51.86	53.34
1:00 p.m.	88.95	55.09	48.35	51.19
2:00 p.m.	90.01	56.07	46.08	49.53
3:00 p.m.	90.43	56.45	45.01	49.17
4:00 p.m.	90.62	55.94	44.37	49.73
5:00 p.m.	90.15	54.02	44.85	52.30
6:00 p.m.	89.21	52.53	46.32	56.81
7:00 p.m.	87.18	51.42	49.96	60.33
8:00 p.m.	85.49	50.43	52.89	61.59
9:00 p.m.	82.54	49.38	60.24	63.40
10:00 p.m.	81.24	48.60	63.40	65.35
11:00 p.m.	80.07	47.89	66.35	67.06

Source: TTI

**Useful Information Regarding
Greenhouse Gases Analysis ERLT**

**Table 6
MOVES2014 I/M Descriptive Inputs
Dallas-Fort Worth Metropolitan Area
Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, and Tarrant I/M data**

I/M Program ID	140	130	151	160	Identifies program number with MOVES Database.
Pollutant Process ID	101, 102, 201, 202, 301, 302,	101, 102, 201, 202, 301, 302,	112	112	
Source Use Type	21, 31, 32	21, 31, 32	21, 31, 32	21, 31, 32	
Begin Model Year	1996	X	X	1996	
End Model Year	y	1995	1995	y	
Inspection Frequency	1	1	1	1	Annual testing; program specifications
Test Standards ID	51	23	41	45	Identifies program number with MOVES Database.
Test Standards Description	Exhaust OBD Check	ASM 2525/5015 Phase-in Cut Points	Evaporative Gas Cap Check	Evaporative Gas Cap and OBD Check	
I/M Compliance	93.12% for source type 21, 91.26% for source type 31 and 86.6% for source type 32				Expected compliance (%) - MOVES Default

Begin Model Year and End Model year define the range of vehicle model years covered by I/M Program. Here Begin Model Year represented by "x" is calculated as YearID – 24 and End Model Year represented by "y" is calculated as YearID – 2.

TxDOT El Paso District Area

Project Description and Region

The 1990 Clean Air Act Amendment (CAAA) requires the United States Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards (NAAQS; 40 Code of Federal Regulations, Part 50) for pollutants considered harmful to public health and the environment, including six principal pollutants, which are called "criteria" pollutants. These are Ozone (O₃), Carbon Monoxide (CO), Particulate Matter (PM), Nitrogen Dioxides (NO₂), Sulfur Dioxide (SO₂), and Lead (PB). In addition to criteria air pollutants for which there are NAAQS, the EPA regulates air toxics which mostly originate from human-made sources, including on-road mobile sources, non-road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners), and stationary sources (e.g., factories, refineries).

Mobile source air toxics (MSAT) are compounds known, or suspected, to cause cancer or other serious health and environmental effects. The EPA has assessed this expansive list in their latest rule on the Control of Hazardous Air Pollutants from Mobile Sources (Federal Register, Vol. 72, No. 37, page 8430, February 26, 2007) and identified a group of 93 compounds emitted from mobile sources that are listed in their Integrated Risk Information System (IRIS) (<http://www.epa.gov/ncea/iris/index.html>). In addition, EPA identified seven compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers from their 1999 National Air Toxics Assessment (NATA) (<http://www.epa.gov/ttn/atw/nata1999/>). These are *acrolein (ACROL)*, *benzene (BENZ)*, *1,3-butadiene (BUTA)*, *diesel particulate matter plus diesel exhaust organic gases (DPM)*, *formaldehyde (FORM)*, *naphthalene (NAP)*, and *polycyclic organic matter (POM)*. While the Federal Highway Administration (FHWA) considers these the priority mobile source air toxics, the list is subject to change and may be adjusted in consideration of future EPA rules. The FHWA adopts the EPA priority list in their *2009 Interim Guidance*.

With the release of EPA's latest on-road model Motor Vehicle Emission Simulator MOVES2014 (Version October 2014), a new set of emission rate look-up tables (ERLT) are developed for criteria pollutants and MSAT. The ERLT for MSAT for the TxDOT El Paso District was developed using the following data assumptions, in accordance with the pre-analysis consensus plan. Two runs for TxDOT El Paso District for each analysis year was performed, one for summer season and one for winter season. As the magnitude of emission factors depends on the seasonal inputs, for conservative estimation, the higher value of emission factors among the two seasonal runs are selected to develop the ERLT for MSAT and criteria pollutants. Winter season emission rates look-up table are used for estimation of carbon monoxide (CO) ERLT for CO analysis for the hour with the lowest temperature in the AM-Peak.

The ERLT are prepared for the analysis years and listed counties presented in **Table 1** for TxDOT El Paso District Area.

Table 1 Analysis Years and Counties TxDOT El Paso District Area	
Requirement	Years
Base Year	2007(Current) and 2012 (future base year), the first year of the mobility plan.
Future Analysis Year	2015 through 2040 with 1 year increments.
Interpolation Years	N/A
Counties	El Paso, Hudspeth, Culberson, Jeff Davis, Presidio and Brewster.

1. Activity Detail

The following are vehicle activity details that were applied in the post processing modeling process. Diurnal Distribution of Vehicle Activity was provided by Texas A&M Transportation Institute (TTI), and was applied to estimate MSAT and CO ERLT.

Table 2 Hourly Distribution Factors TxDOT El Paso District Area		
Hours	Summer	Winter
12:00 a.m. – 12:59 a.m.	0.010707	0.010707
1:00 a.m. – 1:59 a.m.	0.007026	0.007026
2:00 a.m. – 2:59 a.m.	0.005971	0.005971
3:00 a.m. – 3:59 a.m.	0.005420	0.005420
4:00 a.m. – 4:59 a.m.	0.007670	0.007670
5:00 a.m. – 5:59 a.m.	0.018850	0.018850
6:00 a.m. – 6:59 a.m.	0.038834	0.038834
7:00 a.m. – 7:59 a.m.	0.065309	0.065309
8:00 a.m. – 8:59 a.m.	0.063975	0.063975
9:00 a.m. – 9:59 a.m.	0.054502	0.054502
10:00 a.m. – 10:59 a.m.	0.052003	0.052003
11:00 a.m. – 11:59 a.m.	0.055351	0.055351
12:00 p.m. – 12:59 p.m.	0.058348	0.058348
1:00 p.m. – 1:59 p.m.	0.059471	0.059471
2:00 p.m. – 2:59 p.m.	0.061601	0.061601
3:00 p.m. – 3:59 p.m.	0.067148	0.067148
4:00 p.m. – 4:59 p.m.	0.072022	0.072022
5:00 p.m. – 5:59 p.m.	0.074261	0.074261
6:00 p.m. – 6:59 p.m.	0.060427	0.060427
7:00 p.m. – 7:59 p.m.	0.045971	0.045971
8:00 p.m. – 8:59 p.m.	0.037325	0.037325
9:00 p.m. – 9:59 p.m.	0.032779	0.032779
10:00 p.m. – 10:59 p.m.	0.026339	0.026339
11:00 p.m. – 11:59 p.m.	0.018690	0.018690

Source: TTI

2. Emissions Modeling Details (MOVES Emission Factor Model Information)

Detailed MOVES input parameter data and sources are outlined in the following sections for consultation partners review.

Table 3 Modeling Information TxDOT El Paso District Area		
Description	Input Parameter Values	Comment
MOVES Model Version	MOVES2014	Latest MOVES2014 (revised October 2014) is the model to be utilized for this analysis.
MOVES Model County	Travis	Regional applicable inputs will be applied to the surrogate county to represent the TxDOT El Paso District Area.
Time Periods	Hourly	
Functional Class	Off-Network, Urban Restricted, Rural Restricted, Urban Unrestricted and Rural Unrestricted	
Speed	1-75 mph at 5 mph increments	
Pollutant	Carbon monoxide (CO), Particulate Matter – 10 Micrometer or less (PM ₁₀), Particulate Matter – 2.5 Micrometer or less (PM ₂₅), Sulfur Dioxide (SO ₂), Nitrogen Dioxide (NO ₂), Nitrogen Oxides (NO _x), Volatile Organic Compounds (VOC), Carbon Dioxide (CO ₂), Acrolein (ACROL), Benzene (BENZ), 1,3-butadiene (BUTA), Diesel Particulate Matter (DPM), Formaldehyde (FORM), Naphthalene (NAP), and Polycyclic Organic Matter (POM)	DPM is diesel emissions represented by PM ₁₀ total exhaust for diesel vehicles only (not gasoline vehicles). Although POM consists of 100s of compounds, which includes NAP, MOVES provides estimates for POM emissions using the most predominant POM pollutants, listed below, without NAP: Acenaphthene, Acenaphthylene, Anthracene, Benz(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Fluorene, Indeno(1,2,3,c,d)pyrene, Phenanthrene, and Pyrene.
VMT Mix	EPA's 23-vehicle class	Applied during post-processing of emission rates
Calendar Year	2010 and 2015 through 2040	Will also include the first (base) year of the mobility plan, as required
Evaluation Month	1 (Dec-Feb) 7 (June-Aug)	ERLT will represent annual average for all pollutants except CO. CO lookup table will represent winter season

Useful Information Regarding Greenhouse Gases Analysis ERLT

Table 4 MOVES2014 Input Parameters and Source TxDOT El Paso District Area		
Input Parameter Name	Description	Source
Source Type Population	Input the number of vehicles in the geographic area which is to be modeled for each vehicle.	2007, 2012 and 2014 TXDMV registration data
Source Type Age Distribution	Input that provides the distribution of vehicle counts by age for each calendar year and vehicle type. TXDMV registration data is used to estimate the age distribution of vehicle types up to 30 years. The distribution of Age fractions should sum up to 1.0 for all vehicle types for each analysis year.	2007, 2012 and 2014 TXDMV registration data & MOVES default
Average Speed Distribution	Input average speed data specific to vehicle type, road type, and time of day/type of day into 16 speed bins. The sum of speed distribution to all speed bins for each road type, vehicle type, and time/day type would be 1.0.	MOVES Default
Road Type Distribution (VMT Fractions)	VMT by road type. VMT fraction is distributed between the road type and must sum to 1.0 for each source type.	MOVES Default
Fuel Supply	Existing fuels (gas & diesel) and associated market share for each fuel.	TTI Provided 2007, 2012 and 2014 Data (See table 4.a)
Fuel Formulation	Fuel properties in the MOVES database.	TTI Provided 2007, 2012 and 2014 Data (See Table 4.b)
Fuel usage Fraction	This specifies the fraction of E-85-capable vehicles using E-85 vs. conventional gasoline.	MOVES Default
Meteorology	Regional Specific data on temperature and humidity.	TTI Provided 2014 data (See Table 5)
I/M Coverage	Input I/M coverage record for each combination of pollutants, process, county, fuel type, regulatory class and model year are specified using this input.	See Table 6.
Alternative Vehicle Fuel Technology	Input fuel engine fractions (i.e. Gasoline vs. Diesel Engines types in the vehicle population) for all vehicle types.	2007, 2012 and 2014 TXDMV registration data & MOVES default

Useful Information Regarding Greenhouse Gases Analysis ERLT

Table 4.a MOVES2010b Fuel Supply TxDOT El Paso District Area					
Fuel Region ID	Fuel Year ID	Month Group ID	Fuel Formulation ID	Market Share	Market Share CV
370010000	2014	1	13101	1	NULL
370010000	2014	1	30001	1	NULL
370010000	2014	7	10703	1	NULL
370010000	2014	7	30001	1	NULL
370010000	2012	1	8843	1	NULL
370010000	2012	1	31002	1	NULL
370010000	2012	7	8848	1	NULL
370010000	2012	7	31002	1	NULL
370010000	2007	1	10113	0.5	NULL
370010000	2007	1	10123	0.5	NULL
370010000	2007	1	30101	1	NULL
370010000	2007	7	10703	1	NULL
370010000	2007	7	30101	1	NULL

Source: TTI

Table 4.b MOVES2014 Fuel Properties TxDOT El Paso District Area										
Fuel Year	2007				2012			2014		
Fuel Type	Summer Gasoline	Winter Gasohol (E8)	Winter Gasohol (E8)	Diesel	Winter Gasohol (E10)	Summer Gasohol (E10)	Diesel	Summer Gasohol (E10)	Winter Gasohol (E10)	Diesel
Fuel Formulation ID	10703	10113	10123	30101	8843	8848	31002	10703	13101	30001
Fuel Subtype ID	10	13	13	20	12	12	20	12	12	20
RVP	6.67	12.6	11.97	0	11.61	7	0	6.83	11.61	0
Sulfur Level ^a	212.1	127.09	81.15	73.9	30	30	5.43	14.84	30	3.56
ETOH Volume	0	8.28	8.56	0	10	10	0	9.77	10	0
MTBE Volume	0.115	0	0	0	0	0	0	0	0	0
ETBE Volume	0	0	0	0	0	0	0	0	0	0
TAME Volume	0.001	0	0	0	0	0	0	0	0	0
Aromatic Content	33.47	25.5	24.35	0	22.05	25.67	0	25.79	22.05	0
Olefin Content	11.78	11.13	9.07	0	7.05	9.42	0	8.39	7.05	0
Benzene Content	1.75	1.87	1.65	0	0.63	0.63	0	0.4	0.63	0
e200	42.42	59.47	61.08	0	53.74	45.16	0	47.21	53.74	0
e300	83.77	88.64	89.31	0	87.4	83.72	0	87.77	87.4	0
Vol To Wt Percent Oxy	0.1792	0.3653	0.3653	0	0.3653	0.3653	0	0.3653	0.3653	0
BioDiesel	NULL	NULL	NULL	0	NULL	NULL	0	NULL	NULL	NULL

Useful Information Regarding Greenhouse Gases Analysis ERLT

**Table 4.b
MOVES2014 Fuel Properties
TxDOT El Paso District Area**

Fuel Year	2007				2012			2014		
Fuel Type	Summer Gasoline	Winter Gasohol (E8)	Winter Gasohol (E8)	Diesel	Winter Gasohol (E10)	Summer Gasohol (E10)	Diesel	Summer Gasohol (E10)	Winter Gasohol (E10)	Diesel
EsterVolume										
Cetane Index	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
PAH Content	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
T50	215.61	167.06	156.73	0	194.22	211.23	0	211.33	194.22	0
T90	321.08	304.4	301.9	0	310.28	324.92	0	306.75	310.28	0

⁴ For modeling analysis year 2017 and later years, gasoline sulfur level value of 10 will be used.

Source: TTI

**Table 5
MOVES2014 Hourly Meteorological Data
TxDOT El Paso District Area**

Hours	Temperature (°F)		Relative Humidity (%)	
	Summer	Winter	Summer	Winter
12:00 a.m.	81.79	49.27	37.25	37.74
1:00 a.m.	81.05	47.90	38.45	40.16
2:00 a.m.	78.79	47.15	41.82	41.71
3:00 a.m.	77.71	46.66	44.20	42.80
4:00 a.m.	77.07	45.42	45.48	45.24
5:00 a.m.	75.45	44.76	48.25	46.03
6:00 a.m.	74.26	44.69	49.49	46.61
7:00 a.m.	74.18	43.97	50.23	48.80
8:00 a.m.	76.31	44.48	48.13	46.89
9:00 a.m.	79.20	46.24	44.01	44.21
10:00 a.m.	80.69	51.06	41.51	36.43
11:00 a.m.	85.32	54.70	34.30	32.54
12:00 p.m.	87.80	55.84	30.79	30.85
1:00 p.m.	89.00	59.56	28.89	26.26
2:00 p.m.	91.75	60.89	25.11	24.51
3:00 p.m.	92.79	61.52	23.67	23.94
4:00 p.m.	93.05	62.13	23.18	22.86
5:00 p.m.	92.99	60.64	23.10	24.14
6:00 p.m.	92.41	58.97	23.38	25.10
7:00 p.m.	91.92	55.61	23.68	29.12
8:00 p.m.	89.12	53.90	26.43	30.99

Useful Information Regarding Greenhouse Gases Analysis ERLT

Table 5 MOVES2014 Hourly Meteorological Data TxDOT El Paso District Area				
Hours	Temperature (°F)		Relative Humidity (%)	
	Summer	Winter	Summer	Winter
9:00 p.m.	86.76	53.17	29.57	32.04
10:00 p.m.	85.64	51.26	31.35	35.16
11:00 p.m.	83.13	49.82	34.91	36.73

Source: TTI

Table 6 MOVES2014 I/M Descriptive Inputs TxDOT El Paso District Area El Paso I/M data					
I/M Program ID	140	121	151	160	Identifies program number with MOVES Database.
Pollutant Process ID	101, 102, 201, 202, 301, 302,	101, 102, 201, 202, 301, 302,	112	112	
Source Use Type	21, 31, 32	21, 31, 32	21, 31, 32	21, 31, 32	
Begin Model Year	1996	X	X	1996	
End Model Year	y	1995	1995	y	
Inspection Frequency	1	1	1	1	Annual testing; program specifications
Test Standards ID	51	12	41	45	Identifies program number with MOVES Database.
Test Standards Description	Exhaust OBD Check	Two-mode, 2500 RPM/Idle Test	Evaporative Gas Cap Check	Evaporative Gas Cap and OBD Check	
I/M Compliance	93.12% for source type 21, 91.26% for source type 31 and 86.6% for source type 32				Expected compliance (%) - MOVES Default
<p>Begin Model Year and End Model year define the range of vehicle model years covered by I/M Program. Here Begin Model Year represented by "x" is calculated as YearID – 24 and End Model Year represented by "y" is calculated as YearID – 2.</p>					

Houston Galveston Bay Metropolitan Area

Project Description and Region

The 1990 Clean Air Act Amendment (CAAA) requires the United States Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards (NAAQS; 40 Code of Federal Regulations, Part 50) for pollutants considered harmful to public health and the environment, including six principal pollutants, which are called "criteria" pollutants. These are Ozone (O₃), Carbon Monoxide (CO), Particulate Matter (PM), Nitrogen Dioxide (NO₂), Sulfur Dioxide (SO₂), and Lead (Pb). In addition to criteria air pollutants for which there are NAAQS, the EPA regulates air toxics which mostly originate from human-made sources, including on-road mobile sources, non-road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners), and stationary sources (e.g., factories, refineries).

Mobile source air toxics (MSAT) are compounds known, or suspected, to cause cancer or other serious health and environmental effects. The EPA has assessed this expansive list in their latest rule on the Control of Hazardous Air Pollutants from Mobile Sources (Federal Register, Vol. 72, No. 37, page 8430, February 26, 2007) and identified a group of 93 compounds emitted from mobile sources that are listed in their Integrated Risk Information System (IRIS) (<http://www.epa.gov/ncea/iris/index.html>). In addition, EPA identified seven compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers from their 1999 National Air Toxics Assessment (NATA) (<http://www.epa.gov/ttn/atw/nata1999/>). These are *acrolein (ACROL)*, *benzene (BENZ)*, *1,3-butadiene (BUTA)*, *diesel particulate matter plus diesel exhaust organic gases (DPM)*, *formaldehyde (FORM)*, *naphthalene (NAP)*, and *polycyclic organic matter (POM)*. While the Federal Highway Administration (FHWA) considers these the priority mobile source air toxics, the list is subject to change and may be adjusted in consideration of future EPA rules. The FHWA adopts the EPA priority list in their *2009 Interim Guidance*.

With the release of EPA's latest on-road model Motor Vehicle Emission Simulator MOVES2014 (Version October 2014), a new set of emission rate look-up tables (ERLT) are developed for criteria pollutants and MSAT. The ERLT for MSAT for the Houston Galveston Bay Metropolitan Area was developed using the following data assumptions, in accordance with the pre-analysis consensus plan. Two runs for each analysis year was performed, one for summer season and one for winter season. As the magnitude of emission factors depends on the seasonal inputs, for conservative estimation, the higher value of emission factors among the two seasonal runs are selected to develop the ERLT for MSAT and criteria pollutants. Winter season emission rates look-up table are used for estimation of carbon monoxide (CO) ERLT for CO analysis for the hour with the lowest temperature in the AM-Peak.

The ERLT are prepared for the analysis years and listed counties presented in **Table 1** for Houston Galveston Bay Metropolitan Area.

Table 1 Analysis Years and Counties Houston Galveston Bay Metropolitan Area	
Requirement	Years
Base Year	2015.
Future Analysis Year	2015 through 2040 with 1 year increments.
Interpolation Years	N/A
Counties	Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery and Waller.

Useful Information Regarding Greenhouse Gases Analysis ERLT

1. Activity Detail

The following are vehicle activity details that were applied in the post processing modeling process. Diurnal Distribution of Vehicle Activity was provided by Texas A&M Transportation Institute (TTI), and was applied to estimate MSAT and CO ERLT.

Hours	Summer	Winter
12:00 a.m. – 12:59 a.m.	0.00986	0.00902
1:00 a.m. – 1:59 a.m.	0.00696	0.00650
2:00 a.m. – 2:59 a.m.	0.00634	0.00602
3:00 a.m. – 3:59 a.m.	0.00662	0.00643
4:00 a.m. – 4:59 a.m.	0.01204	0.01174
5:00 a.m. – 5:59 a.m.	0.03089	0.03055
6:00 a.m. – 6:59 a.m.	0.05314	0.05262
7:00 a.m. – 7:59 a.m.	0.06325	0.06441
8:00 a.m. – 8:59 a.m.	0.05469	0.05591
9:00 a.m. – 9:59 a.m.	0.05074	0.05089
10:00 a.m. – 10:59 a.m.	0.05186	0.05217
11:00 a.m. – 11:59 a.m.	0.05545	0.05581
12:00 p.m. – 12:59 p.m.	0.05782	0.05844
1:00 p.m. – 1:59 p.m.	0.05887	0.05982
2:00 p.m. – 2:59 p.m.	0.06099	0.06217
3:00 p.m. – 3:59 p.m.	0.06646	0.06834
4:00 p.m. – 4:59 p.m.	0.07089	0.07295
5:00 p.m. – 5:59 p.m.	0.07284	0.07398
6:00 p.m. – 6:59 p.m.	0.05813	0.05927
7:00 p.m. – 7:59 p.m.	0.04489	0.04389
8:00 p.m. – 8:59 p.m.	0.03619	0.03375
9:00 p.m. – 9:59 p.m.	0.03094	0.02852
10:00 p.m. – 10:59 p.m.	0.02364	0.02169
11:00 p.m. – 11:59 p.m.	0.01651	0.01513

Source: TTI

2. Emissions Modeling Details (MOVES Emission Factor Model Information)

Detailed MOVES input parameter data and sources are outlined in the following sections for consultation partners review.

Table 3 Modeling Information Houston Galveston Bay Metropolitan Area		
Description	Input Parameter Values	Comment
MOVES Model Version	MOVES2014	Latest MOVES2014 (revised October 2014) is the model to be utilized for this analysis.
MOVES Model County	Travis	Regional applicable inputs will be applied to the surrogate county to represent the Houston Galveston Bay Metropolitan Area.
Time Periods	Hourly	
Functional Class	Off-network, Urban Restricted, Rural Restricted, Urban Unrestricted and Rural Unrestricted	
Speed	1-75 mph at 5 mph increments	
Pollutant	Carbon monoxide (CO), Particulate Matter – 10 Micrometer or less (PM ₁₀), Particulate Matter – 2.5 Micrometer or less (PM _{2.5}), Sulfur Dioxide (SO ₂), Nitrogen Dioxide (NO ₂), Nitrogen Oxides (NO _x), Volatile Organic Compounds (VOC), Carbon Dioxide (CO ₂), Acrolein (ACROL), Benzene (BENZ), 1,3-butadiene (BUTA), Diesel Particulate Matter (DPM), Formaldehyde (FORM), Naphthalene (NAP), and Polycyclic Organic Matter (POM)	DPM is diesel emissions represented by PM ₁₀ total exhaust for diesel vehicles only (not gasoline vehicles) . Although POM consists of 100s of compounds, which includes NAP, MOVES provides estimates for POM emissions using the most predominant POM pollutants, listed below, without NAP: Acenaphthene, Acenaphthylene, Anthracene, Benz(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Fluorene, Indeno(1,2,3,c,d)pyrene, Phenanthrene, and Pyrene.
VMT Mix	EPA's 23-vehicle class	Applied during post-processing of emission rates
Calendar Year	2015 through 2040	Will also include the first (base) year of the mobility plan, as required
Evaluation Month	1 (Dec-Feb) 7 (June-Aug)	ERLT will represent annual average for all pollutants except CO. CO lookup table will represent winter season

Useful Information Regarding Greenhouse Gases Analysis ERLT

Table 4 MOVES2014 Input Parameters and Source Houston Galveston Bay Metropolitan Area		
Input Parameter Name	Description	Source
Source Type Population	Input the number of vehicles in the geographic area which is to be modeled for each vehicle.	2014 TXDMV registration data
Source Type Age Distribution	Input that provides the distribution of vehicle counts by age for each calendar year and vehicle type. TXDMV registration data is used to estimate the age distribution of vehicle types up to 30 years. The distribution of Age fractions should sum up to 1.0 for all vehicle types for each analysis year.	2014 TXDMV registration data & MOVES default
Average Speed Distribution	Input average speed data specific to vehicle type, road type, and time of day/type of day into 16 speed bins. The sum of speed distribution to all speed bins for each road type, vehicle type, and time/day type would be 1.0.	MOVES Default
Road Type Distribution (VMT Fractions)	VMT by road type. VMT fraction is distributed between the road type and must sum to 1.0 for each source type.	MOVES Default
Fuel Supply	Existing fuels (gas & diesel) and associated market share for each fuel.	TTI Provided 2014 Data (See table 4.a)
Fuel Formulation	Fuel properties in the MOVES database.	TTI Provided 2014 Data (See Table 4.b)
Fuel usage Fraction	This specifies the fraction of E-85-capable vehicles using E-85 vs. conventional gasoline.	MOVES Default
Meteorology	Regional Specific data on temperature and humidity.	TTI Provided 2014 data (See Table 5)
I/M Coverage	Input I/M coverage record for each combination of pollutants, process, county, fuel type, regulatory class and model year are specified using this input.	See Table 6.
Alternative Vehicle Fuel Technology	Input fuel engine fractions (i.e. Gasoline vs. Diesel Engines types in the vehicle population) for all vehicle types.	2014 TXDMV registration data & MOVES default

Useful Information Regarding Greenhouse Gases Analysis ERLT

Table 4.a MOVES2010b Fuel Supply Houston Galveston Bay Metropolitan Area					
Fuel Region ID	Fuel Year ID	Month Group ID	Fuel Formulation ID	Market Share	Market Share CV
1370011000	2014	1	10104	1	NULL
1370011000	2014	1	30002	1	NULL
1370011000	2014	7	10704	1	NULL
1370011000	2014	7	30002	1	NULL

Source: TTI

Table 4.b MOVES2014 Fuel Properties Houston Galveston Bay Metropolitan Area			
Fuel Year	2014	2014	2014
Fuel Type	Winter Gasohol (E10)	Summer Gasohol (E10)	Diesel
fuelFormulationID	10104	10704	30002
fuelSubtypeID	12	12	20
RVP	10.85	7.1	0
sulfurLevel ^a	35.09	28.47	6.18
ETOHVolume	10.09	9.7	0
MTBEVolume	0	0	0
ETBEVolume	0	0	0
TAMEVolume	0	0	0
aromaticContent	13.86	14.42	0
olefinContent	11.02	13.36	0
benzeneContent	0.47	0.44	0
e200	58.39	49	0
e300	86.61	84.3	0
volToWtPercentOxy	0.3653	0.3653	0
BioDieselEsterVolume	NULL	NULL	NULL
CetaneIndex	NULL	NULL	NULL
PAHContent	NULL	NULL	NULL
T50	155.64	203.6	0
T90	317.3	329.78	0

^a For modeling analysis year 2017 and later years, gasoline sulfur level value of 10 will be used.

Source: TTI

**Useful Information Regarding
Greenhouse Gases Analysis ERLT**

Table 5 MOVES2014 Hourly Meteorological Data Houston Galveston Bay Metropolitan Area				
Hours	Temperature (°F)		Relative Humidity (%)	
	Summer	Winter	Summer	Winter
12:00 a.m.	79.76	52.40	82.64	79.53
1:00 a.m.	79.21	52.07	84.10	80.50
2:00 a.m.	78.74	51.78	85.50	81.05
3:00 a.m.	78.35	51.55	86.44	81.68
4:00 a.m.	77.99	51.32	87.41	81.85
5:00 a.m.	77.70	51.12	88.11	82.13
6:00 a.m.	77.54	50.95	88.49	82.59
7:00 a.m.	78.54	51.08	86.19	82.69
8:00 a.m.	81.05	52.60	78.99	79.20
9:00 a.m.	83.28	54.66	72.08	73.88
10:00 a.m.	85.28	56.51	65.29	68.47
11:00 a.m.	86.86	58.06	60.18	64.26
12:00 p.m.	87.95	59.21	56.99	61.63
1:00 p.m.	88.53	60.01	55.32	59.84
2:00 p.m.	88.35	60.44	55.52	58.91
3:00 p.m.	88.22	60.26	56.43	59.23
4:00 p.m.	87.99	59.53	57.63	60.92
5:00 p.m.	87.51	58.05	58.92	64.35
6:00 p.m.	86.61	56.51	61.13	68.31
7:00 p.m.	85.16	55.35	65.05	71.46
8:00 p.m.	83.24	54.48	70.94	73.66
9:00 p.m.	81.94	53.82	75.12	75.46
10:00 p.m.	81.08	53.27	78.16	77.00
11:00 p.m.	80.39	52.78	80.45	78.42

Source: TTI

**Useful Information Regarding
Greenhouse Gases Analysis ERLT**

Table 6 MOVES2014 I/M Descriptive Inputs Houston Galveston Bay Metropolitan Area Brazoria, Fort Bend, Galveston and Montgomery County I/M data					
I/M Program ID	140	130	151	160	Identifies program number with MOVES Database.
Pollutant Process ID	101, 102, 201, 202, 301, 302,	101, 102, 201, 202, 301, 302,	112	112	
Source Use Type	21, 31, 32	21, 31, 32	21, 31, 32	21, 31, 32	
Begin Model Year	1996	X	X	1996	
End Model Year	y	1995	1995	y	
Inspection Frequency	1	1	1	1	Annual testing; program specifications
Test Standards ID	51	23	41	45	Identifies program number with MOVES Database.
Test Standards Description	Exhaust OBD Check	ASM 2525/5015 Phase-in Cut Points	Evaporative Gas Cap Check	Evaporative Gas Cap and OBD Check	
I/M Compliance	93.12% for source type 21, 91.26% for source type 31 and 86.6% for source type 32				Expected compliance (%) - MOVES Default
Begin Model Year and End Model year define the range of vehicle model years covered by I/M Program. Here Begin Model Year represented by "x" is calculated as YearID – 24 and End Model Year represented by "y" is calculated as YearID – 2.					

TxDOT San Antonio District Area

Project Description and Region

The 1990 Clean Air Act Amendment (CAAA) requires the United States Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards (NAAQS; 40 Code of Federal Regulations, Part 50) for pollutants considered harmful to public health and the environment, including six principal pollutants, which are called "criteria" pollutants. These are Ozone (O₃), Carbon Monoxide (CO), Particulate Matter (PM), Nitrogen Dioxides (NO₂), Sulfur Dioxide (SO₂), and Lead (PB). In addition to criteria air pollutants for which there are NAAQS, the EPA regulates air toxics which mostly originate from human-made sources, including on-road mobile sources, non-road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners), and stationary sources (e.g., factories, refineries).

Mobile source air toxics (MSAT) are compounds known, or suspected, to cause cancer or other serious health and environmental effects. The EPA has assessed this expansive list in their latest rule on the Control of Hazardous Air Pollutants from Mobile Sources (Federal Register, Vol. 72, No. 37, page 8430, February 26, 2007) and identified a group of 93 compounds emitted from mobile sources that are listed in their Integrated Risk Information System (IRIS) (<http://www.epa.gov/ncea/iris/index.html>). In addition, EPA identified seven compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers from their 1999 National Air Toxics Assessment (NATA) (<http://www.epa.gov/ttn/atw/nata1999/>). These are *acrolein (ACROL)*, *benzene (BENZ)*, *1,3-butadiene (BUTA)*, *diesel particulate matter plus diesel exhaust organic gases (DPM)*, *formaldehyde (FORM)*, *naphthalene (NAP)*, and *polycyclic organic matter (POM)*. While the Federal Highway Administration (FHWA) considers these the priority mobile source air toxics, the list is subject to change and may be adjusted in consideration of future EPA rules. The FHWA adopts the EPA priority list in their *2009 Interim Guidance*.

With the release of EPA's latest on-road model Motor Vehicle Emission Simulator MOVES2014 (Version October 2014), a new set of emission rate look-up tables (ERLT) are developed for criteria pollutants and MSAT. The ERLT for MSAT for the TxDOT San Antonio District was developed using the following data assumptions, in accordance with the pre-analysis consensus plan. Two runs for TxDOT San Antonio District for each analysis year was performed, one for summer season and one for winter season. As the magnitude of emission factors depends on the seasonal inputs, for conservative estimation, the higher value of emission factors among the two seasonal runs are selected to develop the ERLT for MSAT and criteria pollutants. Winter season emission rates look-up table are used for estimation of carbon monoxide (CO) ERLT for CO analysis for the hour with the lowest temperature in the AM-Peak.

The ERLT are prepared for the analysis years and listed counties presented in **Table 1** for TxDOT San Antonio District Area.

Table 1 Analysis Years and Counties TxDOT San Antonio District Area	
Requirement	Years
Base Year	2010, the first year of the mobility plan (as required).
Future Analysis Year	2015 through 2040 with 1 year increments.
Interpolation Years	N/A
Counties	Atascosa, Bandera, Bexar, Comal, Frio, Guadalupe, Kendall, Kerr, McMullen, Medina, Uvalde and Wilson counties.

Useful Information Regarding Greenhouse Gases Analysis ERLT

1. Activity Detail

The following are vehicle activity details that were applied in the post processing modeling process. Diurnal Distribution of Vehicle Activity was provided by Texas A&M Transportation Institute (TTI), and was applied to estimate MSAT and CO ERLT.

Table 2 Hourly Distribution Factors Analysis Year 2011 TxDOT San Antonio District Area		
Hours	Summer	Winter
12:00 a.m. – 12:59 a.m.	0.009817	0.008826
1:00 a.m. – 1:59 a.m.	0.006493	0.006013
2:00 a.m. – 2:59 a.m.	0.005688	0.005385
3:00 a.m. – 3:59 a.m.	0.005443	0.005218
4:00 a.m. – 4:59 a.m.	0.008452	0.008155
5:00 a.m. – 5:59 a.m.	0.020000	0.019517
6:00 a.m. – 6:59 a.m.	0.050486	0.050686
7:00 a.m. – 7:59 a.m.	0.071262	0.072390
8:00 a.m. – 8:59 a.m.	0.059428	0.060392
9:00 a.m. – 9:59 a.m.	0.049299	0.048825
10:00 a.m. – 10:59 a.m.	0.048467	0.048157
11:00 a.m. – 11:59 a.m.	0.052209	0.052150
12:00 p.m. – 12:59 p.m.	0.054540	0.054831
1:00 p.m. – 1:59 p.m.	0.056197	0.056961
2:00 p.m. – 2:59 p.m.	0.059268	0.060970
3:00 p.m. – 3:59 p.m.	0.067715	0.070240
4:00 p.m. – 4:59 p.m.	0.077154	0.080107
5:00 p.m. – 5:59 p.m.	0.081120	0.082651
6:00 p.m. – 6:59 p.m.	0.061665	0.063741
7:00 p.m. – 7:59 p.m.	0.044313	0.043243
8:00 p.m. – 8:59 p.m.	0.035960	0.033102
9:00 p.m. – 9:59 p.m.	0.032213	0.029046
10:00 p.m. – 10:59 p.m.	0.025253	0.023282
11:00 p.m. – 11:59 p.m.	0.017558	0.016112

Source: TTI

Useful Information Regarding Greenhouse Gases Analysis ERLT

2. Emissions Modeling Details (MOVES Emission Factor Model Information)

Detailed MOVES input parameter data and sources are outlined in the following sections for consultation partners review.

Table 3 Modeling Information TxDOT San Antonio District Area		
Description	Input Parameter Values	Comment
MOVES Model Version	MOVES2014	Latest MOVES2014 (revised October 2014) is the model to be utilized for this analysis.
MOVES Model County	Travis	Regional applicable inputs will be applied to the surrogate county to represent the TxDOT San Antonio District Area.
Time Periods	Hourly	
Functional Class	Off-Network, Urban Restricted, Rural Restricted, Urban Unrestricted and Rural Unrestricted	
Speed	1-75 mph at 5 mph increments	
Pollutant	Carbon monoxide (CO), Particulate Matter – 10 Micrometer or less (PM ₁₀), Particulate Matter – 2.5 Micrometer or less (PM _{2.5}), Sulfur Dioxide (SO ₂), Nitrogen Dioxide (NO ₂), Nitrogen Oxides (NO _x), Volatile Organic Compounds (VOC), Carbon Dioxide (CO ₂), Acrolein (ACROL), Benzene (BENZ), 1,3-butadiene (BUTA), Diesel Particulate Matter (DPM), Formaldehyde (FORM), Naphthalene (NAP), and Polycyclic Organic Matter (POM)	DPM is diesel emissions represented by PM ₁₀ total exhaust for diesel vehicles only (not gasoline vehicles). Although POM consists of 100s of compounds, which includes NAP, MOVES provides estimates for POM emissions using the most predominant POM pollutants, listed below, without NAP: Acenaphthene, Acenaphthylene, Anthracene, Benz(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Fluorene, Indeno(1,2,3,c,d)pyrene, Phenanthrene, and Pyrene.
VMT Mix	EPA's 23-vehicle class	Applied during post-processing of emission rates
Calendar Year	2010 and 2015 through 2040	Will also include the first (base) year of the mobility plan, as required
Evaluation Month	1 (Dec-Feb) 7 (June-Aug)	ERLT will represent annual average for all pollutants except CO. CO lookup table will represent winter season

Useful Information Regarding Greenhouse Gases Analysis ERLT

Table 4 MOVES2014 Input Parameters and Source TxDOT San Antonio District Area		
Input Parameter Name	Description	Source
Source Type Population	Input the number of vehicles in the geographic area which is to be modeled for each vehicle.	2010 and 2014 TXDMV registration data
Source Type Age Distribution	Input that provides the distribution of vehicle counts by age for each calendar year and vehicle type. TXDMV registration data is used to estimate the age distribution of vehicle types up to 30 years. The distribution of Age fractions should sum up to 1.0 for all vehicle types for each analysis year.	2010 and 2014 TXDMV registration data & MOVES default
Average Speed Distribution	Input average speed data specific to vehicle type, road type, and time of day/type of day into 16 speed bins. The sum of speed distribution to all speed bins for each road type, vehicle type, and time/day type would be 1.0.	MOVES Default
Road Type Distribution (VMT Fractions)	VMT by road type. VMT fraction is distributed between the road type and must sum to 1.0 for each source type.	MOVES Default
Fuel Supply	Existing fuels (gas & diesel) and associated market share for each fuel.	TTI Provided 2010 & 2014 Data (See table 4.a)
Fuel Formulation	Fuel properties in the MOVES database.	TTI Provided 2010 & 2014 Data (See Table 4.b)
Fuel usage Fraction	This specifies the fraction of E-85-capable vehicles using E-85 vs. conventional gasoline.	MOVES Default
Meteorology	Regional Specific data on temperature and humidity.	TTI Provided 2014 data (See Table 5)
I/M Coverage	Input I/M coverage record for each combination of pollutants, process, county, fuel type, regulatory class and model year are specified using this input.	See Table 6.
Alternative Vehicle Fuel Technology	Input fuel engine fractions (i.e. Gasoline vs. Diesel Engines types in the vehicle population) for all vehicle types.	2010 and 2014 TXDMV registration data & MOVES default

Useful Information Regarding Greenhouse Gases Analysis ERLT

Table 4.a MOVES2010b Fuel Supply TxDOT San Antonio District					
Fuel Region ID	Fuel Year ID	Month Group ID	Fuel Formulation ID	Market Share	Market Share CV
178010000	2010	1	8549	0.09	NULL
178010000	2010	1	8551	0.91	NULL
178010000	2010	1	31001	1	NULL
178010000	2010	7	8555	0.09	NULL
178010000	2010	7	8557	0.91	NULL
178010000	2010	7	31001	1	NULL
178010000	2014	1	13067	1	NULL
178010000	2014	1	30002	1	NULL
178010000	2014	7	10702	1	NULL
178010000	2014	7	30002	1	NULL

Source: TTI

Table 4.b MOVES2014 Fuel Properties TxDOT San Antonio District								
Fuel Year	2010					2014		
Fuel Type	Winter Gasoline	Summer Gasoline	Winter Gasohol (E10)	Summer Gasohol (E10)	Diesel	Winter Gasohol (E10)	Summer Gasohol (E10)	Diesel
fuelFormulationID	8549	8555	8551	8557	31001	13067	10702	30002
fuelSubtypeID	10	10	12	12	20	12	12	20
RVP	11.07	7.8	12.07	7.8	0	12.07	7.52	0
sulfurLevel	33.83	34.2	33.83	34.2	15	30	30.84	6.18
ETOHVolume	0	0	10	10	0	10	9.76	0
MTBEVolume	0	0	0	0	0	0	0	0
ETBEVolume	0	0	0	0	0	0	0	0
TAMEVolume	0	0	0	0	0	0	0	0
aromaticContent	22.94	25.25	19.29	23.23	0	19.29	22.65	0
olefinContent	12.54	12.98	10.46	12.52	0	10.46	11.75	0
benzeneContent	0.88	0.9	0.88	0.9	0	0.61	0.55	0
e200	49.42	43.79	54.3	45.64	0	54.3	49.82	0
e300	83.05	80.06	83.59	79.95	0	83.59	83.7	0
volToWt PercentOxy	0	0	0.3653	0.3653	0	0.3653	0.3653	0
BioDieselEster Volume	NULL	NULL	NULL	NULL	0	NULL	NULL	NULL
CetaneIndex	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
PAHContent	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
T50	196.64	214.4	186.68	210.54	0	186.68	203.22	0

Useful Information Regarding Greenhouse Gases Analysis ERLT

Table 4.b MOVES2014 Fuel Properties TxDOT San Antonio District								
Fuel Year	2010					2014		
Fuel Type	Winter Gasoline	Summer Gasoline	Winter Gasohol (E10)	Summer Gasohol (E10)	Diesel	Winter Gasohol (E10)	Summer Gasohol (E10)	Diesel
T90	329.38	340.54	326.93	341.04	0	326.93	322.54	0

^a For modeling analysis year 2017 and later years, gasoline sulfur level value of 10 will be used.
Source: TTI

Table 5 MOVES2014 Hourly Meteorological Data Analysis Year 2012 TxDOT San Antonio District Area				
Hours	Temperature (°F)		Relative Humidity (%)	
	Summer	Winter	Summer	Winter
12:00 a.m.	79.23	50.32	75.10	74.01
1:00 a.m.	78.13	49.69	77.32	75.83
2:00 a.m.	77.19	49.25	80.64	77.05
3:00 a.m.	76.57	48.82	82.67	77.24
4:00 a.m.	76.07	48.46	84.08	77.71
5:00 a.m.	75.61	48.26	85.69	78.08
6:00 a.m.	75.31	47.99	86.44	77.97
7:00 a.m.	75.72	47.77	85.56	76.73
8:00 a.m.	77.61	49.20	79.97	73.06
9:00 a.m.	79.95	51.41	72.99	69.32
10:00 a.m.	82.48	53.79	65.93	63.48
11:00 a.m.	85.18	55.88	57.85	58.28
12:00 p.m.	87.46	57.73	52.05	55.13
1:00 p.m.	89.35	59.35	48.82	51.56
2:00 p.m.	91.18	60.64	43.81	49.48
3:00 p.m.	92.33	61.30	41.59	48.71
4:00 p.m.	92.94	61.27	41.08	49.06
5:00 p.m.	93.05	59.87	40.99	52.42
6:00 p.m.	92.13	57.60	42.98	56.55
7:00 p.m.	90.12	55.42	47.46	61.52
8:00 p.m.	87.05	53.94	55.30	65.05
9:00 p.m.	84.63	52.80	60.60	67.54
10:00 p.m.	82.72	51.74	64.75	71.03
11:00 p.m.	80.78	50.94	70.63	72.91

Source: TTI

**Table 6
MOVES2010b I/M Descriptive Inputs
TxDOT San Antonio District Area**

No inspection and maintenance (I/M) programs for San Antonio District Area

TxDOT Waco District Area

Project Description and Region

The 1990 Clean Air Act Amendment (CAAA) requires the United States Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards (NAAQS; 40 Code of Federal Regulations, Part 50) for pollutants considered harmful to public health and the environment, including six principal pollutants, which are called "criteria" pollutants. These are Ozone (O₃), Carbon Monoxide (CO), Particulate Matter (PM), Nitrogen Dioxides (NO₂), Sulfur Dioxide (SO₂), and Lead (PB). In addition to criteria air pollutants for which there are NAAQS, the EPA regulates air toxics which mostly originate from human-made sources, including on-road mobile sources, non-road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners), and stationary sources (e.g., factories, refineries).

Mobile source air toxics (MSAT) are compounds known, or suspected, to cause cancer or other serious health and environmental effects. The EPA has assessed this expansive list in their latest rule on the Control of Hazardous Air Pollutants from Mobile Sources (Federal Register, Vol. 72, No. 37, page 8430, February 26, 2007) and identified a group of 93 compounds emitted from mobile sources that are listed in their Integrated Risk Information System (IRIS) (<http://www.epa.gov/ncea/iris/index.html>). In addition, EPA identified seven compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers from their 1999 National Air Toxics Assessment (NATA) (<http://www.epa.gov/ttn/atw/nata1999/>). These are *acrolein (ACROL)*, *benzene (BENZ)*, *1,3-butadiene (BUTA)*, *diesel particulate matter plus diesel exhaust organic gases (DPM)*, *formaldehyde (FORM)*, *naphthalene (NAP)*, and *polycyclic organic matter (POM)*. While the Federal Highway Administration (FHWA) considers these the priority mobile source air toxics, the list is subject to change and may be adjusted in consideration of future EPA rules. The FHWA adopts the EPA priority list in their *2009 Interim Guidance*.

With the release of EPA's latest on-road model Motor Vehicle Emission Simulator MOVES2014 (Version October 2014), a new set of emission rate look-up tables (ERLT) are developed for criteria pollutants and MSAT. The ERLT for MSAT for the TxDOT Waco District was developed using the following data assumptions, in accordance with the pre-analysis consensus plan. Two runs for each analysis year was performed, one for summer season and one for winter season. As the magnitude of emission factors depends on the seasonal inputs, for conservative estimation, the higher value of emission factors among the two seasonal runs are selected to develop the ERLT for MSAT and criteria pollutants. Winter season emission rates look-up table are used for estimation of carbon monoxide (CO) ERLT for CO analysis.

The ERLT are prepared for the analysis years and listed counties presented in **Table 1** for TxDOT Waco District Area.

Table 1 Analysis Years and Counties TxDOT Waco District Area	
Requirement	Years
Base Year	2010, the first year of the mobility plan (as required).
Future Analysis Year	2015 through 2040 with 1 year increments.
Interpolation Years	N/A
Counties	Bell, Bosque, Coryell, Falls, Hamilton, Hill, Lime Stone and McLennan.

Useful Information Regarding Greenhouse Gases Analysis ERLT

1. Activity Detail

The following are vehicle activity details that were applied in the post processing modeling process. Diurnal Distribution of Vehicle Activity was provided by Texas A&M Transportation Institute (TTI), and was applied to estimate MSAT and CO ERLT.

Table 2		
Hourly Distribution Factors		
Analysis Year 2011		
TxDOT Waco District Area		
Hours	Summer	Winter
12:00 a.m. – 12:59 a.m.	0.015164	0.009215
1:00 a.m. – 1:59 a.m.	0.011838	0.006381
2:00 a.m. – 2:59 a.m.	0.010167	0.005528
3:00 a.m. – 3:59 a.m.	0.010060	0.005056
4:00 a.m. – 4:59 a.m.	0.012389	0.007128
5:00 a.m. – 5:59 a.m.	0.019335	0.016715
6:00 a.m. – 6:59 a.m.	0.033760	0.038479
7:00 a.m. – 7:59 a.m.	0.050734	0.069687
8:00 a.m. – 8:59 a.m.	0.047796	0.066258
9:00 a.m. – 9:59 a.m.	0.048629	0.053961
10:00 a.m. – 10:59 a.m.	0.053505	0.052616
11:00 a.m. – 11:59 a.m.	0.058486	0.056323
12:00 p.m. – 12:59 p.m.	0.061143	0.059208
1:00 p.m. – 1:59 p.m.	0.063443	0.060440
2:00 p.m. – 2:59 p.m.	0.066028	0.063216
3:00 p.m. – 3:59 p.m.	0.067970	0.071350
4:00 p.m. – 4:59 p.m.	0.069513	0.075251
5:00 p.m. – 5:59 p.m.	0.070445	0.075182
6:00 p.m. – 6:59 p.m.	0.056819	0.060374
7:00 p.m. – 7:59 p.m.	0.047822	0.044028
8:00 p.m. – 8:59 p.m.	0.041546	0.034323
9:00 p.m. – 9:59 p.m.	0.034853	0.029968
10:00 p.m. – 10:59 p.m.	0.027473	0.023193
11:00 p.m. – 11:59 p.m.	0.021082	0.016120

Source: TTI

Useful Information Regarding Greenhouse Gases Analysis ERLT

2. Emissions Modeling Details (MOVES Emission Factor Model Information)

Detailed MOVES input parameter data and sources are outlined in the following sections for consultation partners review.

Table 3 Modeling Information TxDOT Waco District Area		
Description	Input Parameter Values	Comment
MOVES Model Version	MOVES2014	Latest MOVES2014 (revised October 2014) is the model to be utilized for this analysis.
MOVES Model County	Travis	Regional applicable inputs will be applied to the surrogate county to represent the TxDOT Waco District Area.
Time Periods	Hourly	
Functional Class	Off-Network, Urban Restricted, Rural Restricted, Urban Unrestricted and Rural Unrestricted	
Speed	1-75 mph at 5 mph increments	
Pollutant	Carbon monoxide (CO), Particulate Matter – 10 Micrometer or less (PM ₁₀), Particulate Matter – 2.5 Micrometer or less (PM ₂₅), Sulfur Dioxide (SO ₂), Nitrogen Dioxide (NO ₂), Nitrogen Oxides (NO _x), Volatile Organic Compounds (VOC), Carbon Dioxide (CO ₂), Acrolein (ACROL), Benzene (BENZ), 1,3-butadiene (BUTA), Diesel Particulate Matter (DPM), Formaldehyde (FORM), Naphthalene (NAP), and Polycyclic Organic Matter (POM)	DPM is diesel emissions represented by PM ₁₀ total exhaust for diesel vehicles only (not gasoline vehicles). Although POM consists of 100s of compounds, which includes NAP, MOVES provides estimates for POM emissions using the most predominant POM pollutants, listed below, without NAP: Acenaphthene, Acenaphthylene, Anthracene, Benz(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Fluorene, Indeno(1,2,3,c,d)pyrene, Phenanthrene, and Pyrene.
VMT Mix	EPA's 23-vehicle class	Applied during post-processing of emission rates
Calendar Year	2010 and 2015 through 2040	Will also include the first (base) year of the mobility plan, as required
Evaluation Month	1 (Dec-Feb) 7 (June-Aug)	ERLT will represent annual average for all pollutants except CO. CO lookup table will represent winter season

Useful Information Regarding Greenhouse Gases Analysis ERLT

Table 4 MOVES2014 Input Parameters and Source TxDOT Waco District Area		
Input Parameter Name	Description	Source
Source Type Population	Input the number of vehicles in the geographic area which is to be modeled for each vehicle.	2010 and 2014 TXDMV registration data
Source Type Age Distribution	Input that provides the distribution of vehicle counts by age for each calendar year and vehicle type. TXDMV registration data is used to estimate the age distribution of vehicle types up to 30 years. The distribution of Age fractions should sum up to 1.0 for all vehicle types for each analysis year.	2010 and 2014 TXDMV registration data & MOVES default
Average Speed Distribution	Input average speed data specific to vehicle type, road type, and time of day/type of day into 16 speed bins. The sum of speed distribution to all speed bins for each road type, vehicle type, and time/day type would be 1.0.	MOVES Default
Road Type Distribution (VMT Fractions)	VMT by road type. VMT fraction is distributed between the road type and must sum to 1.0 for each source type.	MOVES Default
Fuel Supply	Existing fuels (gas & diesel) and associated market share for each fuel.	TTI Provided 2010 & 2014 Data (See table 4.a)
Fuel Formulation	Fuel properties in the MOVES database.	TTI Provided 2010 & 2014 Data (See Table 4.b)
Fuel usage Fraction	This specifies the fraction of E-85-capable vehicles using E-85 vs. conventional gasoline.	MOVES Default
Meteorology	Regional Specific data on temperature and humidity.	TTI Provided 2014 data (See Table 5)
I/M Coverage	Input I/M coverage record for each combination of pollutants, process, county, fuel type, regulatory class and model year are specified using this input.	See Table 6.
Alternative Vehicle Fuel Technology	Input fuel engine fractions (i.e. Gasoline vs. Diesel Engines types in the vehicle population) for all vehicle types.	2010 and 2014 TXDMV registration data & MOVES default

Useful Information Regarding Greenhouse Gases Analysis ERLT

Table 4.a MOVES2010b Fuel Supply TxDOT Waco District					
Fuel Region ID	Fuel Year ID	Month Group ID	Fuel Formulation ID	Market Share	Market Share CV
178010000	2010	1	8549	0.09	NULL
178010000	2010	1	8551	0.91	NULL
178010000	2010	1	31001	1	NULL
178010000	2010	7	8555	0.09	NULL
178010000	2010	7	8557	0.91	NULL
178010000	2010	7	31001	1	NULL
178010000	2014	1	13067	1	NULL
178010000	2014	1	30002	1	NULL
178010000	2014	7	10702	1	NULL
178010000	2014	7	30002	1	NULL

Source: TTI

Table 4.b MOVES2014 Fuel Properties TxDOT Waco District								
Fuel Year	2010					2014		
Fuel Type	Winter Gasoline	Summer Gasoline	Winter Gasohol (E10)	Summer Gasohol (E10)	Diesel	Winter Gasohol (E10)	Summer Gasohol (E10)	Diesel
Fuel Formulation ID	8549	8555	8551	8557	31001	13067	10702	30002
fuelSubtypeID	10	10	12	12	20	12	12	20
RVP	11.07	7.8	12.07	7.8	0	12.07	7.52	0
sulfurLevel	33.83	34.2	33.83	34.2	15	30	30.84	6.18
ETOHVolume	0	0	10	10	0	10	9.76	0
MTBEVolume	0	0	0	0	0	0	0	0
ETBEVolume	0	0	0	0	0	0	0	0
TAMEVolume	0	0	0	0	0	0	0	0
Aromatic Content	22.94	25.25	19.29	23.23	0	19.29	22.65	0
olefinContent	12.54	12.98	10.46	12.52	0	10.46	11.75	0
Benzene Content	0.88	0.9	0.88	0.9	0	0.61	0.55	0
e200	49.42	43.79	54.3	45.64	0	54.3	49.82	0
e300	83.05	80.06	83.59	79.95	0	83.59	83.7	0
volToWt PercentOxy	0	0	0.3653	0.3653	0	0.3653	0.3653	0
BioDieselEster Volume	NULL	NULL	NULL	NULL	0	NULL	NULL	NULL
CetaneIndex	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
PAH Content	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL

Useful Information Regarding Greenhouse Gases Analysis ERLT

Table 4.b MOVES2014 Fuel Properties TxDOT Waco District								
Fuel Year	2010					2014		
Fuel Type	Winter Gasoline	Summer Gasoline	Winter Gasohol (E10)	Summer Gasohol (E10)	Diesel	Winter Gasohol (E10)	Summer Gasohol (E10)	Diesel
T50	196.64	214.4	186.68	210.54	0	186.68	203.22	0
T90	329.38	340.54	326.93	341.04	0	326.93	322.54	0

^a For modeling analysis year 2017 and later years, gasoline sulfur level value of 10 will be used.

Source: TTI

Table 5 MOVES2014 Hourly Meteorological Data Analysis Year 2012 TxDOT Waco District Area				
Hours	Temperature (°F)		Relative Humidity (%)	
	Summer	Winter	Summer	Winter
12:00 a.m.	78.16	48.26	70.70	70.76
1:00 a.m.	77.63	47.42	72.06	71.98
2:00 a.m.	76.15	46.96	75.86	72.67
3:00 a.m.	75.30	46.36	77.90	73.45
4:00 a.m.	74.50	46.41	80.18	74.37
5:00 a.m.	73.92	45.71	81.96	73.98
6:00 a.m.	73.10	45.23	85.99	76.35
7:00 a.m.	73.73	44.72	85.66	76.90
8:00 a.m.	77.39	46.19	77.9	72.88
9:00 a.m.	80.75	48.71	70.15	67.67
10:00 a.m.	83.56	51.34	63.27	62.23
11:00 a.m.	86.17	53.71	57.79	58.14
12:00 p.m.	88.38	55.28	53.26	55.10
1:00 p.m.	89.65	57.09	50.84	52.61
2:00 p.m.	91.48	58.34	46.98	50.83
3:00 p.m.	92.17	58.71	45.52	50.23
4:00 p.m.	92.52	57.73	44.10	51.17
5:00 p.m.	92.20	55.19	44.03	55.41
6:00 p.m.	90.67	53.42	45.85	58.50
7:00 p.m.	88.69	50.65	48.86	63.59
8:00 p.m.	84.36	49.62	56.56	67.58
9:00 p.m.	81.78	49.06	62.03	69.02
10:00 p.m.	80.45	48.61	65.16	70.02
11:00 p.m.	79.39	48.62	67.53	69.93

Source: TTI

**Table 6
MOVES2010b I/M Descriptive Inputs
TxDOT Waco District Area**

No inspection and maintenance (I/M) programs for Waco District Area

Appendix B Document Revision History

The following table shows the revision history for this guidance document.

Revision History	
Effective Date Month, Year	Reason for and Description of Change
January 2017	Version 2 was released. Changed title from Useful Information Regarding CO ₂ Analysis ERLT to Useful Information Regarding Greenhouse Gases (GHG) Analysis ERLT
June 2016	Version 1 was released.