

Transportation Conformity Report



Transportation Air Quality Conformity Report for the Houston-Brazoria-Galveston Region

**for Amendments to the 2040 Regional Transportation Plan and
2015-2018 Transportation Improvement Program**

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Abstract

This conformity determination is being prepared to support amendments to the Houston-Galveston Area Council's (H-GAC) 2040 Regional Transportation Plan (RTP) and 2015-2018 Transportation Improvement Program (TIP). The proposed amendments include the advancement and addition of projects using reasonably available Proposition 1, Proposition 7 and federal funds. Federal approval of this conformity determination is needed to allow actions on environmental documents, permits and construction funding authorizations.

This conformity finding will be using the Motor Vehicle Emission Budgets (MVEBs) coming from the latest revisions to the *Houston-Galveston-Brazoria Attainment Demonstration and Reasonable Further Progress State Implementation Plan for the 1997 Eight-Hour Ozone Standard* (hereafter referred to as the "AD and RFP SIPs"), which are the "April 2013 HGB MVEB Update SIP Revision (Texas Commission on Environmental Quality (TCEQ) Project No. 2012-002-SIP-NR, adopted April 23, 2013)". These State Implementation Plan (SIP) revisions were done to replace the on-road mobile source emissions inventories for Nitrogen Oxides (NOx) and Volatile Organic Compounds (VOCs) based on EPA's MOBILE6 model with those based on EPA's MOVES model. The EPA found these MVEBs adequate on August 2, 2013 (effective date August 19, 2013).

The below table displays the results of the new conformity finding, which show that the emissions coming from the transportation plan conform to the emission budgets coming from the 8-hr Ozone SIP.

Year	NOx Emissions (t/d) ¹	NOx Budgets (t/d)	VOC Emissions (t/d)	VOC Budgets (t/d)	VMT ²
2015*	130.31	171.63	59.41	71.56	163,143,770
2017	92.29	130.00	47.19	59.76	169,737,122
2018**	86.68	103.34	45.91	50.13	173,394,870
2025	47.41	103.34	36.96	50.13	198,999,103
2035	31.40	103.34	20.27	50.13	237,585,074
2040	37.39	103.34	18.99	50.13	257,842,939

**2015 used the emission budget from the year 2014 RFP SIP for the 1997 8-hr ozone standard.*

***The emissions for year 2018 have been linearly interpolated using the data for the years 2017 and 2025 regional air quality analysis. The year 2018 was interpolated per United State Environmental Protection Agency (US EPA) 40 CFR 93.118(d)(2).*

¹t/d= tons/day

²VMT= vehicle miles traveled

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1. Introduction

This conformity determination is being prepared to support amendments to the 2040 RTP and 2015-2018 TIP. As stated in the conformity rule [<http://www.gpo.gov/fdsys/pkg/FR-2012-03-14/pdf/2012-6207.pdf>], all new regionally significant projects or all changes done to regionally significant projects must show that they conform to the emission budgets coming from the air quality State Implementation Plan.

The following is a summary of proposed revisions to regionally significant projects to be included in this conformity determination:

- New funding commitments from H-GAC's 2015 Call for Projects
 - IH 45 S Reconstruct and Widen from S of NASA 1 Bypass to 61st St
 - SH 36/SP 10 Widening from IH 69/US 59 to N of Brazos River, etc.
- New discretionary funding commitments from TxDOT/Transportation Commission
 - IH 10 W, Widening from FM 359 to Brazos River
- Additional schedule changes from project sponsors (Harris County Toll Road Authority (HCTRA), etc.)
 - BW 8 Widen from IH 10 to SH 225 (Ship Channel Bridge)
 - SH 99 Seg. B Direct Connector at SH 35, etc.

This list is not exhaustive of all projects that affect this conformity. A complete listing of projects subject to conformity is contained within Appendix 3.

The following is the timeline that represents the chronology of the main events representing this conformity:

- Tuesday, November 24, 2015 – Conformity conference call to begin the conformity process for amendment to the 2040 RTP and 2015-2018 TIP.
- Wednesday, March 16, 2016 – Start 30 day public comment period.
- Friday, March 18, 2016 - Transportation Policy Council (TPC) briefing to enter into public comment period for amendments to the 2040 RTP, 2015-2018 TIP and Conformity.
- Thursday, March 31, 2016 - Two Public Meetings at H-GAC (Noon and 6 pm).
- Friday, April 15, 2016 - End public comment period (30 Days).
- Friday, April 22, 2016 - Transportation Policy Council approval of amendments to 2040 RTP, 2015-2018 TIP and Conformity.

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2. Planning Detail

Current Metropolitan Transportation Plan

H-GAC's TPC approved the 2040 RTP and an accompanying transportation conformity determination on January 23, 2015.

The 2040 RTP covers a planning period of 2015 through 2040 and contains a list of projects fiscally constrained by estimates of reasonably available revenues. The complete 2040 RTP is available online at <http://www.h-gac.com/taq/plan/2040>.

On September 11, 2015, the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA) certified that the 2040 RTP met all the requirements for making a joint conformity determination for the Houston-Galveston-Brazoria (HGB) ozone nonattainment area.

Current Transportation Improvement Program

H-GAC's TPC approved the 2015-2018 TIP on May 23, 2014.

The current TIP covers a planning period of 2015 through 2018 and contains a list of projects fiscally constrained by funding commitments and estimates of reasonably available revenues. The original adopted TIP and subsequent amendments are available online at <http://h-gac.com/taq/tip>.

On December 2, 2014, the FHWA and the FTA issued a joint conformity finding for the 2015-2018 TIP as part of their approval of the statewide TIP.

Conformity Project Listing

A complete listing of projects, as proposed under this conformity determination, is provided under Appendix 3. This listing denotes projects which are regionally significant or otherwise subject to transportation conformity and those projects which are exempt of transportation conformity, exempt from regional emissions analysis, or have been determined to be not regionally significant.

Definition of Regionally Significant Projects:

Projects determined to be regionally significant, except as specifically exempted under 40 Code of Federal Regulations (CFR) § 93.126 and 40 CFR § 93.127, must come from a conforming RTP and TIP or be individually found to conform prior to the issuance of federal approvals and other actions. H-GAC has developed the following definition to classify projects as regionally significant for conformity purposes:

Regionally Significant Roadway Projects

Non-exempt projects on regionally significant roadways will be treated as regionally

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significant projects if they:

- a) Provide additional through traffic lanes greater than 1 mile in length;
- b) Construct a bypass to a principal arterial/interstate along on a new alignment;
- c) Add or extend freeway auxiliary/weaving lanes from one interchange to a point beyond the next interchange;
- d) Construct a new interchange that provides access from or allows movement between facilities that was not previously possible; and/or
- e) Remove an existing interchange and result in the elimination of access from or movement between facilities which previously existed;

Regionally significant roadways are limited to:

1. All freeways, tollways and other highways classified as principal arterial or higher; and
2. As identified in Figure 1, selected highways currently designated as minor arterials that serve significant interregional and intraregional travel, and connect rural population centers not already served by a principal arterial, or connect with intermodal transportation terminals not already served by a principal arterial.

Regionally Significant Transit Projects

Any transit facility within an exclusive right-of-way (“fixed guideway”) that offers an alternative to regional highway travel including light rail, commuter rail, bus rapid transit, and barrier separated High Occupancy Vehicles (HOV) lanes will be considered regionally significant.

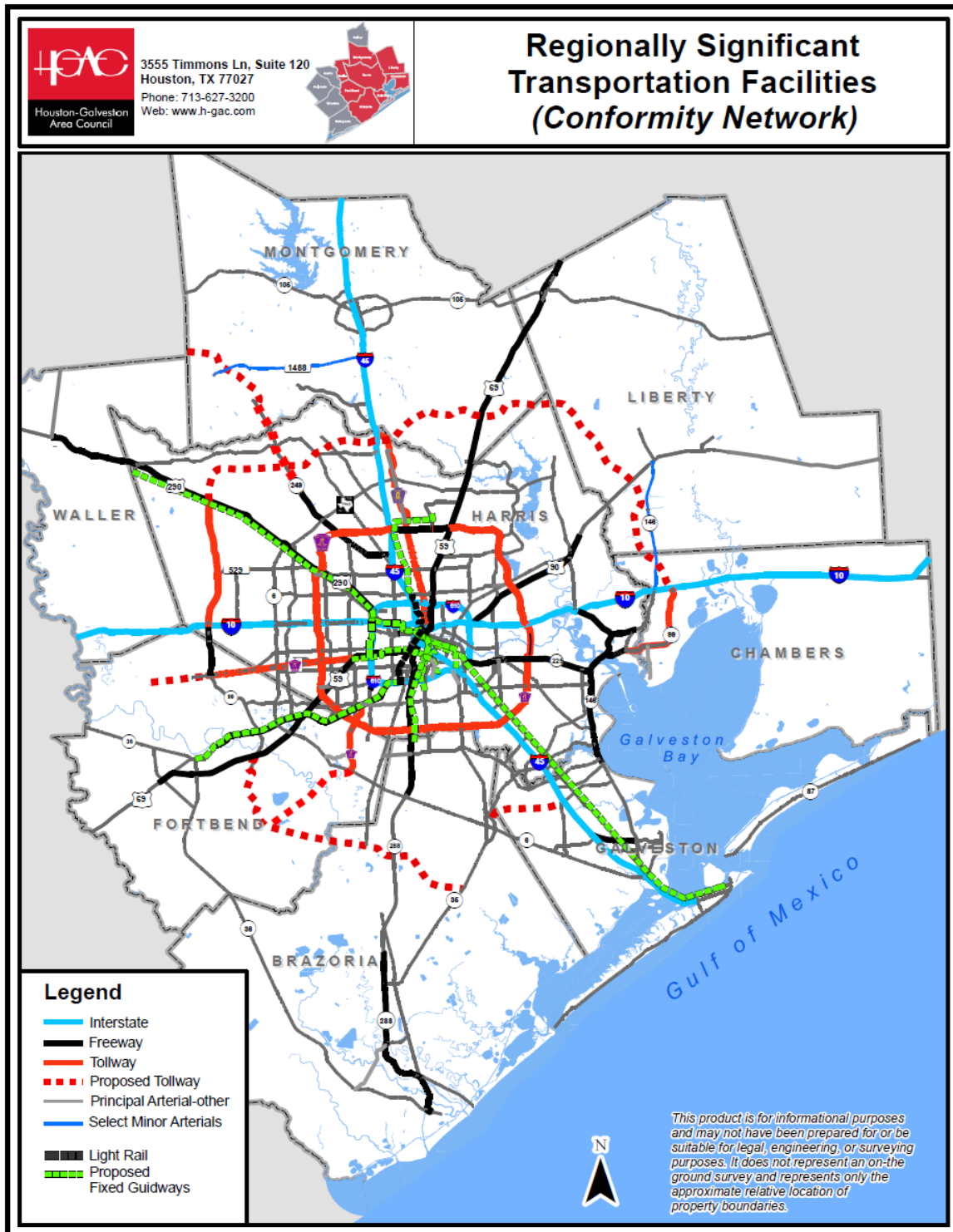
Other Projects

The regional significance of non-exempt projects¹ not addressed in the above statements will be decided on a case-by-case basis through the interagency consultation process. The consultation will occur before taking the plan to the Transportation Policy Council (TPC) (either plan or TIP revision), and prior to the environmental determination.

¹ Non-exempt projects include all projects that are not identified under 40 CFR § 93.126 and 40 CFR § 93.127 as exempt or exempt from regional emissions analysis.

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Figure 1: Regionally Significant Transportation Facilities (Conformity Network):



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Conformity Requirements

The Clean Air Act Amendments of 1990 (CAAA) require transportation plans, programs, and projects in nonattainment and maintenance areas, which are funded or approved by the FHWA or the FTA, to conform to the MVEBs established in the SIP. This ensures that transportation plans, programs, and projects do not produce new air quality violations, worsen existing violations, or delay timely attainment of the National Ambient Air Quality Standards (NAAQS). Conformity analysis requirements include:

- Use of the latest planning assumptions
- Analysis based on the latest emission estimation model available
- Interagency consultation, as well as a public involvement process, must be conducted during the analysis (found in Sections 6 and 7, respectively)
- Timely implementation of Transportation Control Measures (TCMs)
- An RTP and TIP that are consistent with the MVEBs established in the applicable SIP (if there is an adequate or approved SIP budget)
- Include all regionally significant projects expected in the nonattainment and maintenance area in the RTP and TIP

Regional Inventory

H-GAC conducts regional emission analyses of transportation plans to ensure that these activities are consistent with the air quality goals identified in the AD and RFP SIPs. This conformity analysis of the HGB nonattainment area accounts for emissions resulting from the nonattainment area's transportation plans, including all regionally significant projects and the effects of emission control programs.

This conformity finding will be using the Motor Vehicle Emission Budgets (MVEBs) coming from the latest revisions to the *Houston-Galveston-Brazoria Attainment Demonstration and Reasonable Further Progress State Implementation Plan for the 1997 Eight-Hour Ozone Standard* (hereafter referred to as the "AD and RFP SIPs"). The EPA found these MVEBs adequate on August 2, 2013 (effective by August 19, 2013).

Motor Vehicle Emission Budgets

The budgets established in the AD and RFP SIPs are as follows:

Table 1: AD Motor Vehicle Emission Budgets

Attainment Demonstration Budgets (t/d)		
Year	NOx	VOC
2018	103.34	50.13

Source: AD SIP, TCEQ, effective August 19, 2013

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Table 2: RFP Motor Vehicle Emission Budgets

Reasonable Further Progress Budgets (t/d)		
Year	NOx	VOC
2014	171.63	71.56
2017	130.00	59.76
2018	120.97	57.02

Source: RFP SIP, TCEQ, effective August 19, 2013

These MVEBs represent the maximum allowable amount of emissions that may be produced by on-road sources as a result of the implementation of the RTP and TIP. These budgets are developed based on the emission inventories and the analysis conducted for the development of the AD and RFP SIPs, and include emission reduction benefits from federal and state control programs.

Conformity Tests

As specified by the Code of Federal Regulations (40 CFR §93.109[c], as amended by 62 FR 43807, Aug. 15, 1997) all ozone nonattainment areas designated moderate and above must pass a motor vehicle emissions budget test if an approved SIP budget exists. The HGB area has been designated as “Marginal” for the 2008 eight-hour standard with an attainment date of July 20, 2015¹. Since the “Marginal” classification, the HGB region did not get MVEBs, and as a consequence, according with the conformity rule, must use previous ones established in the SIP for the *1997 Eight-Hour Ozone Standard*. As noted earlier, the budget test must be satisfied using the MVEBs established in the AD and RFP SIPs. Specifically, this test is satisfied when emissions of the ozone pollutant’s precursors (VOC and NOx) for each analysis year are less than or equal to the MVEBs established in the SIPs. For the test, the regional emission analysis should be performed for any years within the timeframe of the transportation plan, provided they are not more than ten years apart, any year that has an emission budget (2017, 2018), the attainment year (2015) and the plan horizon year (2040). To meet this analysis requirement, the years 2015, 2017, 2018, 2025, 2035 and 2040 were selected.

¹ Since June 3, 2016 the HGB region got a one-year extension to meet the 2008 eight-hour standard. The new deadline is July 20, 2016.

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Transportation Control Measures (TCMs)

A Transportation Control Measure (TCM) is a measure specifically committed to in a SIP for the purpose of reducing emissions from transportation sources. TCMs are further defined in 40 CFR §93.101, as amended by 62 FR 43780, 43803. The CAAA required that TCMs be included in SIPs for regions designated as serious and above ozone nonattainment areas. The TCMs committed to in the previous SIPs are listed in Appendix 12.

The transportation conformity rule includes specific criteria for determining if TCMs that are included in a SIP are being implemented in a timely manner. The intent of these provisions is to ensure that TCMs which are eligible for federal funding receive priority and that the SIP schedules and commitments are enforced. The TCM Appendix has emission estimates associated with each project. While emissions were calculated for each project, these credits were not applied in this conformity analysis.

Table 3 identifies the applicable SIP actions which committed Transportation Control Measures.

Table 3: Transportation Control Measures

Committed Transportation Control Measures
1. 2000 HGB RFP and AD SIP, Approved Nov. 2001 ID#2000-0826-SIP
2. 2004 HGB Mid Course Review SIP, Approved Dec. 2004 ID# 2004-42-NR
3. TCM Substitution for HGB 2006
4. 2010 HGB AD SIP for the 1997 8-hr Ozone Standard (2009-017-SIP-NR)

Source: TCEQ

Table 4 shows all the conformity analysis years and describes their corresponding requirements in the calculations.

Table 4: Conformity Analysis Years

Requirement	Years
Conformity Base Year	2012
Attainment Year**	2015
Motor Vehicle Emissions Budget Years	2014, 2017, 2018
First Analysis Year	2015

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Intermediate Analysis Years	2025, 2035
Last Year of Transportation Plan (MTP/RTP)	2040
Interpolation Years*	2018

* The year 2018 was interpolated per EPA 40 CFR 93.118(d)(2).

** Since June 3, 2016 the new attainment year is 2016. This conformity does not use this year because this action took place when the conformity analysis was already completed.

H-GAC tried to interpolate 2017 and 2018 using the regional air quality emissions results from 2015 and 2025. However, 2018 did not conform. Then, it was decided to calculate 2017 using the regional air quality emission results tool and then interpolate 2018 between 2017 and 2025.

3. Travel Demand Modeling

On October 23, 2015, the Transportation Policy Council (TPC) approved an initial ten-year list of projects from the 2015 Call for Projects. Accordingly, a significant update of the modeling network was required to capture the project. The major projects that are included in this conformity include:

- **IH 45 S** Reconstruct and Widen from S of NASA 1 Bypass to N of FM 519
- **SP 10** Widen to 4-lanes from IH 69/US 59 to SH 36
- **IH 10 W** Widen to 6-lanes from FM 359 to Brazos River
- **BW 8** Widen to 8-lanes from IH 10 to SH 225 (Ship Channel Bridge)
- **IH 45 S** Reconstruct and Widen from N of FM 519 to N of Causeway and from S of Causeway to 61st St
- **BU 90-U** Widen to 6-lanes from IH 610 to E of Mesa Rd
- **FM 521** Widen to 4-lanes from FM 2234 to SH 6
- **FM 1488** Widen to 4-lanes from Joseph Rd to W of FM 149
- **FM 1960** Widen to 6-lanes from E of Humble to W of San Jacinto River
- **FM 2100** Widen to 4-lanes from FM 1485 to FM 1960
- **SH 36** Widen to 4-lanes from IH 69/US 59 to N of Brazos River
- **SH 105** Widen to 4-lane divided from 10th St in Conroe to Liberty C/L
- **SH 146** Widen to 6-lanes with frontage roads from Fairmont Pkwy to Bluff Rd
- **SH 146** Widen to 6-lanes from FM 518 to FM 1764
- **SH 249** Construct 4-lane toll way from Harris C/L to S of FM 1774
- **US 90** Widen to 4-lanes from FM 563 to FM 160
- **Fort Bend Pkwy Toll Rd** Reconstruct with 4-lane toll way from W Belfort to US 90A
- **Gessner Rd** Widen to 6-lane divided from Richmond Rd. to Buffalo Bayou
- **Red Bluff Rd** Widen to 4-lane divided from Kirby Blvd to SH 146
- **Westpark Dr** Widen to 4-lane divided from Wilcrest to Dairy Ashford

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In addition to modeling network changes, the latest socio demographic data was used in this conformity. This forecast added roughly 500,000 people to the 2040 regional population forecast.

Socio Demographic

Demographic inputs to the 2012 Track-1 model update and validation were year 2012 household (HH) and employment by Traffic Analysis Zone (TAZ). Population and household inputs were developed using H-GAC's population synthesizer and, in the case of households, were controlled to 2010 Census data. Employment for the year 2012 was developed using business and employment data sets along with building data.

H-GAC's population synthesizer uses detailed information on a small sample of the region's population and then uses iterative proportional fitting (IPF) and various simulation techniques to develop the detailed cross-tabulation of households and distributions by household size, household income and workers for each TAZ. Household data creation took place in two phases: the first phase involved creation of population and households by household size while the second phase involved development of household income and worker status of the population.

In phase I, the margins of multi-way (age, sex, age of householder) contingency tables were filled with the block-level 2010 SF1 U.S. Census data and then the cell values of these tables were developed using IPF to match the margins. After all the tables were filled in with the values, the distributions of households and persons was created from the summary tables. The resulting households and persons are called the base year 2012 population. Next, a simulation is run to produce year 2012 population and household by evolving base year 2012 population. The simulation simulates immigration, emigration, natural birth and death, and marriage which all impact population and household mix.

In phase II, American Community Survey (ACS) data was used to "impute" worker status for individuals and income for households. Household income was imputed by constructing household income frequency distribution table contingent on age and race of the householder. Next, each householder from the disaggregate data developed in phase I was matched with the income data by county, age, and race. Then, a simulation technique was used to assign a specific income level to each householder. Worker status was imputed using 2006-2010 ACS Public Use Survey Microdata (PUMS). Individuals from phase I were matched to individuals in PUMS on up to 8 dimensions simultaneously. This method "finds" individuals in PUMS that are similar to phase I individuals in personal and household characteristic and then develops a frequency distribution to impute worker status using the same simulation method used to assign income.

For purposes of application in the 2012 Track-1 models, the households were assigned to one of five size groups (1- 5+ persons per household), one of three workers per household group (0-2+ workers per household group) and one of five household income groups. The five income groupings used in the 2012 Track-1 models are listed in Table 5

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Table 5: Year 2012 Household Income Groupings

Income Group	Range (2012 \$)
1	0 - 22,499
2	22,500 - 39,999
3	40,000 - 64,999
4	65,000 - 99,999
5	100,000+

Source: H-GAC 2012

Table 6 presents a summary of the year 2012 households summarized by each of the dimensions by which they are input into the travel model.

Table 6: 2012 Households By Size, Income & Workers Per Household Dimensions

HOUSEHOLD SIZE	# HHs	HOUSEHOLD INCOME	# HHs	WORKERS PER HH	# HHs
1	503,918	\$0 - \$22,499	414,345	0	546,039
2	618,724	\$22,500 - \$39,999	379,424	1	916,710
3	368,056	\$40,000 - \$64,999	454,437	2+	702,554
4	339,784	\$65,000 - \$99,999	395,368		
5+	334,821	\$100,000+	521,729		
Total	2,165,303	Total	2,165,303	Total	2,165,303

Source: H-GAC 2012

Table 7 summarizes households at the county-level for the years 2000 and 2012. Region wide households increased over 32 percent, from 1.64 million in 2000 to nearly 2.17 million in 2012. Relative household growth by county ranged from a low of 8.5 percent in Liberty County to a high of 86.6 percent in Fort Bend County. Not surprisingly, Harris County accounted for over half (55%) of the overall absolute growth in households. Table 8 summarizes the household population by county (which excludes group quarters such as prisons). The pattern of growth in household population largely tracks the growth in households, as would be expected.

Table 7: County Households for 2000 and 2012

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County	Year 2000	Year 2012	Change	% Change
Harris	1,205,516	1,495,610	290,094	24.1%
Brazoria	81,954	112,729	30,775	37.6%
Fort Bend	110,915	206,933	96,018	86.6%
Waller	10,557	14,079	3,522	33.4%
Montgomery	103,297	180,969	77,672	75.2%
Liberty	23,242	25,222	1,980	8.5%
Chambers	9,139	12,624	3,485	38.1%
Galveston	94,782	117,137	22,355	23.6%
Region Total	1,639,402	2,165,303	525,901	32.1%

Source: Trip Generation Data for 2000 and 2012 prepared by H-GAC

Table 8: County Household Population for 2000 and 2012

County	Year 2000	Year 2012	Change	% Change
Harris	3,358,444	4,200,326	841,882	25.1%
Brazoria	230,806	314,151	83,345	36.1%
Fort Bend	348,154	616,554	268,400	77.1%
Waller	29,454	39,561	10,107	34.3%
Montgomery	292,077	487,992	195,915	67.1%
Liberty	65,113	70,757	5,644	8.7%
Chambers	25,797	36,133	10,336	40.1%
Galveston	246,002	303,069	57,067	23.2%
Region Total	4,595,847	6,068,543	1,472,696	32.0%

Source: H-GAC 2012

TAZ employment for the year 2012 was developed from two primary datasets; the first comprised of buildings and the second comprised of businesses. The building data was obtained from county appraisal district data. The business data, which becomes the

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employment data, came from a variety of sources including the Texas Workforce Commission, InfoUSA, Texas Education Agency, Texas Department of State Health Services, the Houston Business Journal as well as various local government agencies. As the data is derived from multiple sources, it does include some self-employment and other unique employment types that are typically not included in common public employment data sources.

After data from the various data sources was standardized to company name and address, the businesses were geocoded to buildings from the county appraisal district data. Following geocoding, the employment was reviewed at the building level to identify issues with headquarters offices that result in overcrowding of the building. Building overcrowding is addressed through review of secondary data sources for location of branch office and/or adjustment of building employment to a typical value for the building type.

Following clean-up of the employment locations, the six-digit NAICS employment data was converted to the employment categories used by the Track-1 travel demand model at the parcel level. The last step in the process was to summarize the parcel level employment to TAZ.

Table 9 presents a summary of the year 2012 employment by the employment categories used in the 2012 Track-1 model.

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Table 9: Year 2012 County Employment by Employment Type

COUNTY	RETAIL	OFFICE	INDUSTRIAL	MEDICAL	EDUCATIONAL (K-12)	EDUCATIONAL (POST SECONDARY)	GOVERNMENT	TOTAL
Harris	628,131	920,339	364,219	250,551	68,819	15,756	80,863	2,328,678
Brazoria	34,597	19,455	14,549	8,792	4,093	760	4,933	87,179
Fort Bend	61,172	42,640	24,227	18,100	9,550	1,000	6,351	163,040
Waller	2,431	3,338	2,656	924	440	1	446	10,236
Montgomery	60,849	44,456	8,177	16,464	6,928	1,794	5,743	144,411
Liberty	4,409	3,430	1,119	2,123	1,501	4	1,728	14,314
Chambers	3,993	1,071	5,830	502	1,065	-	887	13,348
Galveston	40,156	22,012	8,671	11,415	4,230	527	7,063	94,074
Region Total	835,738	1,056,741	429,448	308,871	96,626	19,842	108,014	2,855,280

Source: H-GAC 2012

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A comparison of the year 2000 and year 2012 employment for the eight county region, as presented in Table 10, shows that employment increased comparably with population growth, 32.5% percent overall. Harris County gained over 550,000 jobs while Montgomery County employment grew more than 70.5% percent (over 59,000 jobs). In addition to the household, population and employment values themselves, the ratio of these variables to each other is frequently used to assess changes to a region's demographic characteristics over time.

Table 10: County Employment for Years 2000 and 2012

County	Year 2000	Year 2012	Change	% Change
Brazoria	75,556	87,179	11,623	15.4%
Chambers	7,759	13,348	5,589	72.0%
Fort Bend	96,316	163,129	66,813	69.4%
Galveston	86,469	98,798	12,329	14.3%
Harris	1,802,351	2,354,553	552,202	30.6%
Liberty	15,484	14,314	-1,170	-7.6%
Montgomery	84,719	144,411	59,692	70.5%
Waller	9,611	11,351	1,740	18.1%
Region Total	2,178,265	2,887,083	708,818	32.5%

Source: H-GAC, 2012

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Table 11 presents comparisons among these demographic comparison metrics between the year 2000 and the year 2012.

Table 11: Comparative Statistics – County Level — Years 2000 and 2012

County	Year	Person/HH	Pop/Emp	Emp/HH
Harris	2000	2.79	1.86	1.50
	2012	2.81	1.78	1.57
Brazoria	2000	2.82	3.05	0.92
	2012	2.79	3.60	0.77
Fort Bend	2000	3.14	3.61	0.87
	2012	2.98	3.78	0.79
Waller	2000	2.79	3.06	0.91
	2012	2.81	3.49	0.81
Montgomery	2000	2.83	3.45	0.82
	2012	2.70	3.38	0.8.
Liberty	2000	2.80	4.21	0.67
	2012	2.81	4.94	0.57
Chambers	2000	2.82	3.32	0.85
	2012	2.86	2.71	1.06
Galveston	2000	2.60	2.84	0.91
	2012	2.59	3.07	0.84
Region	2000	2.80	2.11	1.33
	2012	2.80	2.10	1.33

Source: H-GAC 2012

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The increase in persons per household in Harris County and thus, the region, reflects the component of population growth between the year 2000 and the year 2012. The regional population-to-employment and employment-to-household ratios are almost identical between the two years, but these ratios vary within a county. This reflects that overall both employment and population grows rapidly in similar rates region wide, but locally these two growth rates could be different.

**Table 12: Travel Demand Model
 (§93.122(b)(3))**

Model Factor	Detail and Methodology
Model Validation Year	2012
Software	Cube Voyager
Mode Split/Mode Choice	Updated and simplified model with help from Houston METRO
VMT adjustment - HPMS	H-GAC will adjust the forecasted VMT to TxDOT's HPMS for all roadway facilities. Please see below and Appendix 4
VMT adjustment -Seasonal Correction Factor	Please see Table 13
Time Periods Designation	Refer to Table 14
Counties Covered by Model	Harris, Galveston, Brazoria, Fort Bend, Montgomery, Liberty, Chambers and Waller.

Source: H-GAC 2012

2012 Highway Performance Monitoring System (HPMS) adjustment factor calculation: The factor used to reconcile model estimated regional VMT to HPMS estimated regional VMT is calculated by dividing the HPMS estimated average non- summer weekday VMT as follows:

HPMS Adjustment Factor

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

$$= (152,958,024) / (168,168,738)$$

$$= 0.90955$$

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Seasonal Corrections Factors

Seasonal correction factors are used to adjust the Travel Demand Model (TDM) and estimated intrazonal VMT to summer weekday VMT. The adjustment factors were developed using aggregated Automated Traffic Recorder (ATR) data for the years 2005-2014. These factors, provided in Table 13, were calculated by dividing the average day-of-week (weekday) count for the June – August episode by the Annual Non-Summer Weekday Traffic (ANSWT) count.

Two seasonal factors are needed because there are two different sources for data. The counties of Liberty and Chambers belong to the Beaumont TxDOT district while the counties of Harris, Brazoria, Fort Bend, Galveston, Montgomery and Waller belong to the Houston TxDOT district.

Table 13: Seasonal Correction Factors

	County Type	Factors (Midweek)
Seasonal Correction Factors	Harris, Brazoria, Fort. Bend, Galveston, Montgomery, Waller	0.99847
	Liberty, Chambers	1.03501

Source: Texas A & M Transportation Institute communication, November 13, 2015

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Table 14: Time Period Designations

Hours	Designations
12:00 a.m. – 12:59 a.m.	Overnight
1:00 a.m. – 1:59 a.m.	Overnight
2:00 a.m. – 2:59 a.m.	Overnight
3:00 a.m. – 3:59 a.m.	Overnight
4:00 a.m. – 4:59 a.m.	Overnight
5:00 a.m. – 5:59 a.m.	Overnight
6:00 a.m. – 6:59 a.m.	AM Peak
7:00 a.m. – 7:59 a.m.	AM Peak
8:00 a.m. – 8:59 a.m.	AM Peak
9:00 a.m. – 9:59 a.m.	Midday
10:00 a.m. – 10:59 a.m.	Midday
11:00 a.m. – 11:59 a.m.	Midday
12:00 p.m. – 12:59 p.m.	Midday
1:00 p.m. – 1:59 p.m.	Midday
2:00 p.m. – 2:59 p.m.	Midday
3:00 p.m. – 3:59 p.m.	PM Peak
4:00 p.m. – 4:59 p.m.	PM Peak
5:00 p.m. – 5:59 p.m.	PM Peak
6:00 p.m. – 6:59 p.m.	PM Peak
7:00 p.m. – 7:59 p.m.	Overnight
8:00 p.m. – 8:59 p.m.	Overnight

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9:00 p.m. – 9:59 p.m.	Overnight
10:00 p.m. – 10:59 p.m.	Overnight
11:00 p.m. – 11:59 p.m.	Overnight

Source: H-GAC Modeling, 2012

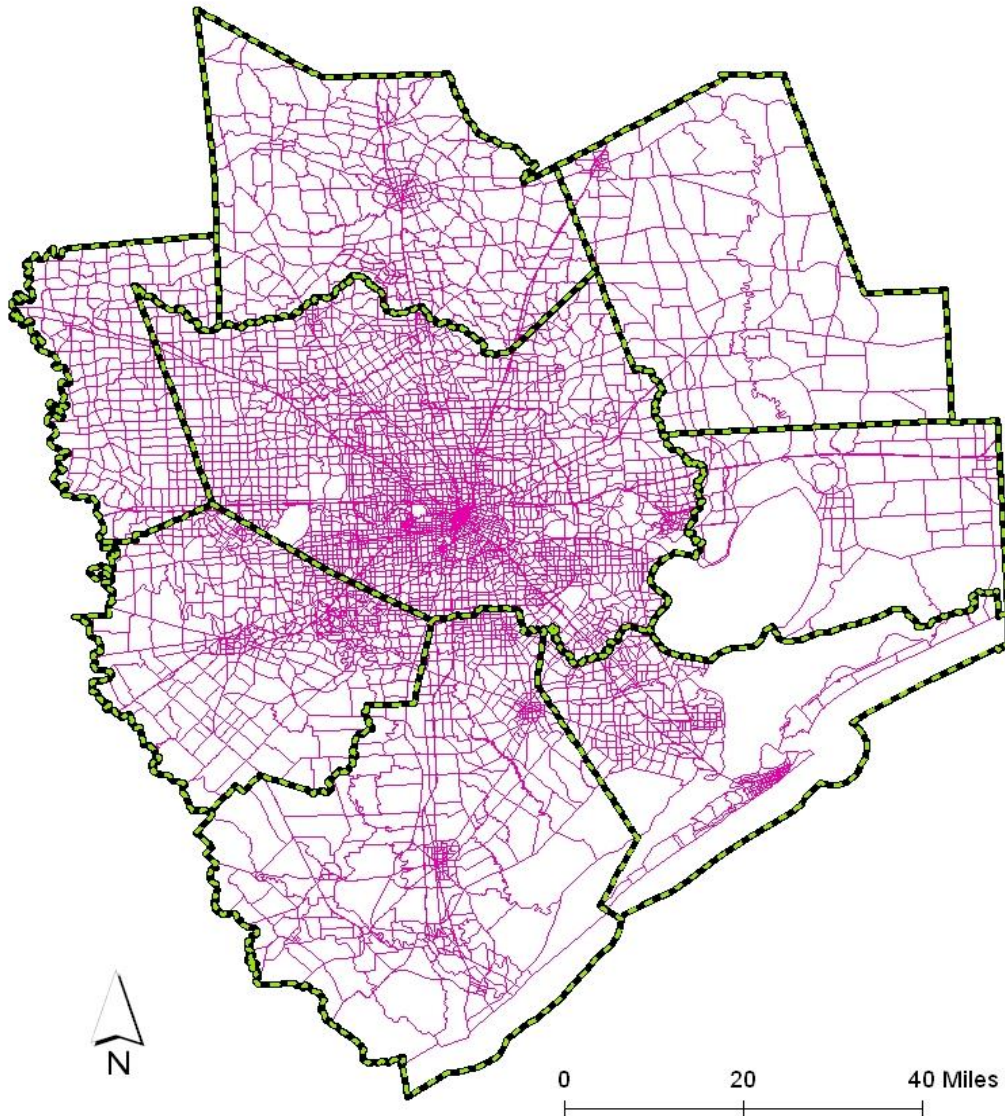
The 2012 Track-1 model is structured very much the same as the 2009 Track-1 model with one exception. Toll demand is now estimated in the Track-1 model in the traffic assignment component rather than in the mode choice component. The motivation for this change is twofold. First, the practice of estimating toll demand as part of the route choice component (i.e., traffic assignment) has become increasingly common. Second, a desire to create consistency among the Track-1 model and the new Activity Based Model (ABM).

Besides this one structural change to the regional travel model, many of the individual components of the Track-1 model set have been updated with new survey data. Also, some of the model component application procedures have been changed as part of this model update. Appendix 4 presents a brief summary of those aspects of the model components and procedures that have been changed.

The level of detail of the TAZ system of the Track-1 model was increased as part of the 2012 Track-1 model update. The 2012 Track-1 model makes use of 5,159 traffic analysis zones (TAZs) to represent the Houston-Galveston TMA. This includes 5,113 internal zones and 46 external stations. Figure 2 presents the TAZ structure used in the 2012 Track-1 travel model.

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Figure 2: H-GAC TAZ Structure



Source: H-GAC Modeling, 2012

Area Type

TAZ area type was updated to reflect the 2012 demographic density based on the updated 2012 TAZ demographics.

Trip Generation

Trip Rates

The trip production rates of the previous Track-1 model have been replaced with trip rates derived from the 2007-2009 regional household survey. The production rates have been enhanced to include a third dimension, workers per household, in addition to household size and household income. In this way, trip demand is sensitive to differences in the number of workers in a household, be that with respect to the base year 2012 or in application of the models to forecasted number of workers per household.

While the trip attraction rates are dimensioned as they were in the previous Track-1 model, updated rates were developed based on the 2010/2011 regional workplace survey.

Special Generators

Site trip control totals for Bush Intercontinental and Hobby airports were updated using data from the 2010/2011 regional special generator survey.

Non-resident trips

Estimates of trip ends for trips made by non-residents for the coastal portions of the region were updated based on year 2010 estimates of tract-level seasonal housing as well as hotel and seasonal housing vacancy rates.

Truck Trips

Truck trip demand for the 2012 Track-1 model was developed using H-GAC's Cube Cargo-based truck model. The procedures of this model segment truck demand into cargo truck and service truck demand and estimates of both internal and external truck movements in the H-GAC region. As opposed to estimating truck demand based on trip rates, H-GAC's truck model estimates demand for cargo-carrying trucks based on demand for and flow of commodities to, from and through the Houston region.

External travel

External travel demand, both local and through, was updated based on external volume and vehicle classification counts conducted by H-GAC in 2011. The new volume and classification counts were used to create external-local and through trip ends for auto travel and external-through trips for truck travel. External-local truck travel was estimated separately through the Cube Cargo-based truck demand modeling.

Trip Distribution

The source of Track-1 model off-peak highway travel time impedances used in the distribution of the non-work trip purposes was changed for the 2012 model update from average daily impedance to mid-day impedances. The mid-day impedances were based on assignment output volume-to-capacity ratios from a mid-day traffic assignment.

Friction factors for all internal trip purposes other than truck trips were re-calibrated as part of the 2012 Track-1 model update so that model-estimated average trip lengths by trip purpose were consistent with 2007-2009 regional household survey observed average trip length.

Mode Choice

The regional mode choice model was re-calibrated with year 2010 observed modal target values developed from the 2007-2009 regional household survey and a 2010 transit on-board survey. As previously mentioned, the one change in model structure involved the movement of the toll demand estimation procedures from the mode choice model to the assignment model. For this reason the toll sub-nests of the mode choice model were not included in the re-calibration.

Time-of-Day Models

A fifth time-of-day period was added to the time-of-day modeling procedures of the 2012 Track-1 model to acknowledge peak spreading that has occurred in the region, particularly the spreading of the PM peak period. This fifth period, referred to as the 'evening' period is designed to capture the PM peak period spill-over congestion while maintaining the length of the original PM peak period. As a result of the creation of the evening period, the length of the overnight period was reduced. However to be consistent with all previous Conformity analyses the five periods were collapsed to four (morning, midday, evening and overnight).

Using data from the 2007-2009 regional household travel survey, time-of-day factors for the five time-of-day periods were developed. As with the prior set of diurnal factors, the updated factors perform two functions. First, to factor the daily demand to the demand for the time period of interest, and second, impart the appropriate directionality of travel for the time period of interest.

Traffic Assignment

As previously mentioned, H-GAC changed the step in which the Track-1 model estimates toll demand. The Track-1 2012 model estimates toll demand via the traffic assignment component rather than the mode choice component. This was accomplished through a generalized-cost assignment (GC) for each of the five time-of-day periods. One of the primary motivations for choosing to move to a generalized-cost assignment is to allow for the use of the same assignment procedures for both the trip-based model and the H-GAC's

in-development ABM. The GC assignment method made use of values-of-time that are segmented by trip purpose, income and mode. In this way, toll demand was affected not only by time-of-day, but also by the purpose of the trip and whether the trip is a Single Occupancy Vehicle (SOV) trip or an HOV trip.

A second change to the traffic assignment procedures involved the replacement of a daily

assignment with the sum of time-of-day assignments. H-GAC's travel models have included time-of-day traffic assignment for many years. However, H-GAC also performed daily traffic assignments. As part of the 2012 Track-1 model update, H-GAC used summed time-of-day assignments to represent daily traffic assignment demand.

Feedback

The feedback procedures used in the Track-1 model were updated to evaluate mid-day along with AM peak period assignment and impedance statistics as part of the departure from the creation of daily impedances for trip distribution and the performance of daily traffic assignments. The 2012 Track-1 model update achieved the convergence criteria in three iterations.

Assignment Validation

The results of the time-of-day traffic assignments were summed to represent daily traffic volume on the modeling network. The resulting daily traffic volumes were then compared to the year 2012 daily traffic counts both on the basis of traffic volume and VMT.

Summary

The 2012 Track-1 model set is structured virtually the same as the 2009 Track-1 model set, except for movement of toll demand estimation from the mode choice to the traffic assignment procedure. The trip generation, trip distribution, and mode choice components were updated and calibrated to match a new set of survey data and external count data while the modified traffic assignment procedures were validated against counted daily traffic.

4. Regional Air Quality Transportation Emissions

Under contract through H-GAC, Eastern Research Group (ERG) developed a modeling framework for estimating regional on-road emission inventories for each hour of a day at link level. This framework has been named Spatial Emission Estimator (SEE) and employs MOVES2014a at both the project (link level) and county scale to cover all needed emission processes in accord with EPA modeling guidance.¹

As mentioned above the SEE tool employs MOVES at the project level to generate the on-road emission inventories at link level, this is another method than the one used to generate the motor vehicle emission budgets (MVEBs) coming from the SIP. The MVEBs were generated using the Texas A&M University Transportation Institute's tool that employs MOVES at the emission factor level to generate on-road emission inventories at link level. The SEE tool is explained below and in more detail in Appendix 8. For documentation on the Texas A&M University Transportation Institute's tool, please refer to <https://www.tceq.texas.gov/airquality/sip/criteria-pollutants/sip-ozone#EI%20SIP> and references therein. For benchmarks results comparing the SEE tool versus the Texas A&M University Transportation Institute's tool please refer to the end of Appendix 8.

As mentioned previously, the SEE framework uses MOVES2014a which is the latest EPA air quality emissions model and was released in November 2015. The most significant changes between MOVES2014a and MOVES2010b (the last model used in the previous conformity determination) are the inclusion of new effects of fuel properties such as gasoline sulfur and ethanol, new data on evaporative emissions from fuel leaks and from vehicles parked for multiple days, new analyses of particulate matter (PM) data related to PM speciation and temperature effects on running PM emissions, and new real world in-use emissions for heavy-duty vehicles using data from portable emission monitoring systems. Also, MOVES2014 includes three new emission control programs associated with regulations promulgated since the release of MOVES2010b:

- Tier 3 emission standards that phase in beginning in 2017 for cars, light-duty trucks, medium-duty passenger vehicles, and some heavy-duty trucks, and Tier 3 fuel standards that require lower sulfur gasoline beginning in 2017
- Heavy-duty engine and vehicle greenhouse gas (GHG) regulations that phase in during model years 2014-2018.
- The second phase of light-duty vehicle GHG regulations that phase in for model years 2017-2025 cars and light trucks.

For information about input parameters into MOVES, please refer to Appendix 7.

The Houston-Galveston-Brazoria modeling domain covers eight counties in Southeast Texas: Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery and Waller. This region

¹ U.S. EPA, *Using MOVES to Prepare Emission Inventories in State Implementation Plans and Transportation Conformity: Technical Guidance for MOVES2010, 2010a and 2010b*, Report No. EPA-420-B-012-028, 2012.

encompasses one of the nation’s largest ozone nonattainment areas outside of California, with a population of over 6 million people. H-GAC’s travel demand modeling characterizes this area with approximately 68,000 unique roadway links and 5,000 travel analysis zones (TAZs).

The SEE framework runs through a simple Graphical User Interface (GUI) that allows the user to employ the MOVES county data manager (CDM) to populate tables containing all the necessary local input data such as vehicle population, fuels, inspection/maintenance, meteorology and age distribution. The modeling suite makes use of a pre-processing utility that prepares raw travel demand model output for use in SEE, known as TRANSVMT. SEE uses the travel demand model output directly to provide major activity inputs to MOVES such as VMT, average speed and road type distribution.

Within SEE, on-network and off-network emissions are generated through a separate set of MOVES runs which share basic inputs for fuels, meteorology, age distribution, Inspection and Maintenance (I/M) and vehicle population. On-network emissions are generated using MOVES project scale runs combined with Pearl scripts that scale emissions to every link in the HGB region, for each hour of the day. These calculations make use of 24-hour average VMT mixes to calculate the emissions per link. The term VMT mix designates the vehicle types included in the analysis, and specifies the fraction of on-road fleet VMT attributable to each vehicle type by MOVES road type.

The VMT mixes were estimated based on Texas A&M Transportation Institute’s 24-hour average VMT mix method (Methodologies for Conversion of Data Sets for MOVES Model Compatibility., Texas A&M Transportation Institute’s August 2009) estimated for each TxDOT district associated with the eight-county HGB area (i.e., Houston and Beaumont districts). The 24-hour VMT mix was developed using vehicle classification counts (2001-2011), end-of-year registration data (2013), and MOVES defaults (where needed). Table 15 shows the VMT mix year and its correlation with the conformity analysis years.

Table 15: 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 2040

Source: Texas A&M Transportation Institute, February 5, 2016. This data is included in Appendix 9.

This calculation also accounts for on-network evaporative emissions (ie., running loss).

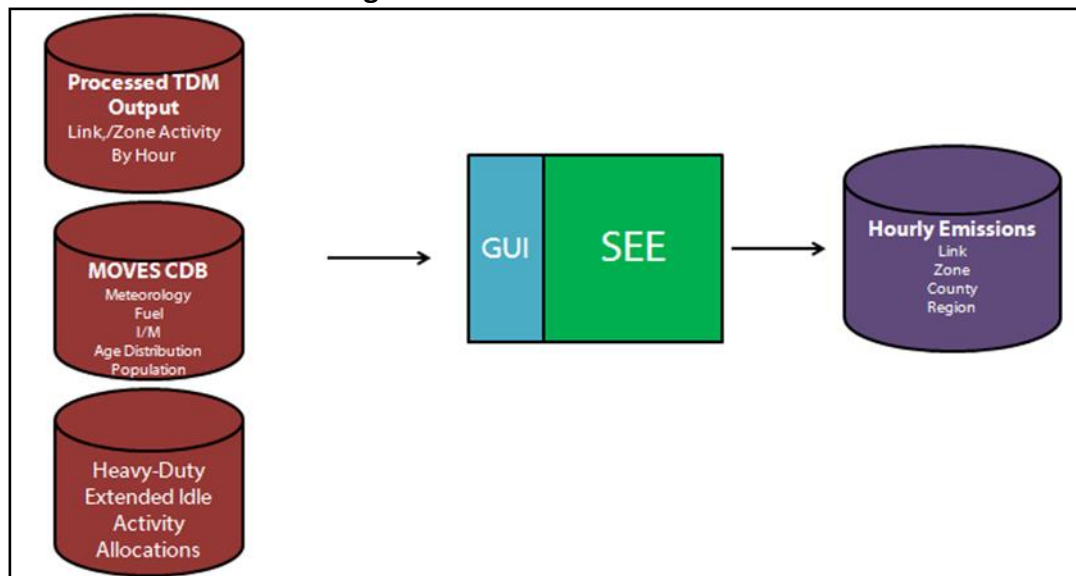
Off-network emissions include start (exhaust and crankcase), evaporative (permeation, vapor venting, liquid leaks and refueling) and extended idle emission processes. These calculations are done with a MOVES county scale run for a weekday, producing emission results per hour.

Allocation factors for start and evaporative emissions are calculated within SEE using Pearl scripts, based on travel demand model origin/destination by zone. Start allocations are based on number of trip origins by zone, and evaporative (park) allocations are based on number of trip ends by zone. These are estimated by the HGB travel model for four time periods – AM peak, Midday, PM peak and Overnight – all allocations are estimated for each time period and applied to the appropriate hourly MOVES results.

A SEE post-process script also implements the Texas Low Emission Diesel (TxLED) program NOx emission reductions for on-network and off-network calculations. The TxLED adjustments are described in Appendix 10. After this last step, SEE runs a script to aggregate on-network calculations with off-network calculations at the county level and outputs the VMT and emissions of selected pollutants per countyID.

Figure 3 shows an overall flow of SEE. The data canisters in red denote input data preparation before running SEE. Beginning with raw travel demand model output (traffic volume and average speed by link; trip origins and destination by TAZ), pre-processing for SEE includes running the updated TRANSVMT script to produce hourly link-level volume and speeds. SEE also requires data in MOVES input table format for non-travel related inputs. For allocation of extended idle emissions, a table of idle activity allocation factors by TAZ is also required.

Figure 3. Overview of SEE Flow



Source: ERG Report, October 1, 2014

Please refer to Appendix 8 for a more detailed explanation of the SEE framework in addition of sensitivity analysis done for 1 mile per hour versus 5 mile per hour speed bins. For information about input and output files for the SEE framework, please refer to Appendix 9.

The following table 16 shows the final air quality results for the conformity determination:

Table 16: Conformity Air Quality Emission Results

Year	NOx Emissions (t/d) ¹	NOx Budgets (t/d)	VOC Emissions (t/d)	VOC Budgets (t/d)	VMT ²
2015*	130.31	171.63	59.41	71.56	163,143,770
2017	92.29	130.00	47.19	59.76	169,737,122
2018**	86.68	103.34	45.91	50.13	173,394,870
2025	47.41	103.34	36.96	50.13	198,999,103
2035	31.40	103.34	20.27	50.13	237,585,074
2040	37.39	103.34	18.99	50.13	257,842,939

**2015 used the emission budget from the year 2014 RFP SIP for the 1997 8-hr ozone standard.*

***The emissions for year 2018 have been linearly interpolated using the data for the years 2017 and 2025 regional air quality analysis. The year 2018 was interpolated per EPA 40 CFR 93.118(d)(2).*

Conformity Interpolation for 2018:

The air quality emission results for the year 2018 were interpolated, as it is allowed in the conformity rule, using the results from 2017 and 2025. Following is the formula used and the calculation:

Formula for linear interpolation: $Y = Y_0 + (Y_1 - Y_0) * (X - X_0) / (X_1 - X_0)$

Where for NOx:

$Y_0 = 92.29$ tpd

$Y_1 = 47.41$ tpd

$X_0 = 2017$

$X_1 = 2025$

$X = 2018$

$NOx = 92.29 + (47.41 - 92.29) * (2018 - 2017) / (2025 - 2017)$

$NOx = 86.68$ tpd

Where for VOC:

$Y_0 = 47.19$ tpd

$Y_1 = 36.96$ tpd

$X_0 = 2017$

$X_1 = 2025$

$X = 2018$

$$VOC = 47.19 + (36.96 - 47.19) * (2018 - 2017)/(2025 - 2017)$$

VOC = 45.91 tpd

Where for VMT:

$Y_0 = 169,737,122$

$Y_1 = 198,999,103$

$X_0 = 2017$

$X_1 = 2025$

$X = 2018$

$$VMT = 169,737,122 + (198,999,103 - 169,737,122) * (2018 - 2017)/(2025 - 2017)$$

VMT = 173,394,870

The results of this conformity determination show that the amendments to the 2040 Regional Transportation Plan, and the 2015-2018 Transportation Improvement Program for the HGB Transportation Management Area meet the requirements of the SIPs for the Houston-Galveston ozone nonattainment area and are in accordance with the Clean Air Act (42 U.S.C. 7504, 7506 (c) and (d)), as amended on November 15, 1990, and the final conformity rule (40 CFR Parts 51 and 93).

5. Emissions Controls Used for Conformity Credit

This conformity did not use any credits from voluntary mobile emission reduction programs or Transportation Control Measures (TCMs) since they were not needed to show conformity to the emission budgets.

6. Interagency Consultation

Interagency review and comment on the conformity finding was conducted in accordance with the consultative process identified in the Conformity SIP. Local, state, and federal transportation and air quality agencies affected by this conformity analysis were consulted on the scope, methodologies and products of the conformity finding. A conformity steering committee (Conformity Consultation Committee (CCC)) composed of representatives of each of the following agencies was consulted regularly during the conformity process:

- Houston-Galveston Area Council (H-GAC)
- Metropolitan Transit Authority of Harris County (METRO)

- Texas Department of Transportation (TxDOT)
- Texas Commission on Environmental Quality (TCEQ)
- Texas Transportation Institute (TTI)
- Federal Highway Administration (FHWA)
- Federal Transit Administration (FTA)*
- U.S. Environmental Protection Agency (EPA)

The purpose of this group was to ensure that the modeling methodology utilized in this conformity analysis was consistent with the on-road modeling utilized in the SIP and that the most recent planning assumptions were used. A comprehensive list of the CCC meeting agenda and decisions can be found in Appendix 14.

**Note: FHWA acts as executive agent for the FTA*

7. Public Participation

Public participation is an important part of the conformity process. A 30-day public comment period is required by Federal regulation. All documentation for this conformity will be distributed to the consultation committee in the form of CDs and also posted on H-GAC's website http://www.h-gac.com/taq/airquality_model/conformity/2016.aspx

on March 16 2016. This website will be further utilized to post draft conformity material as it is developed by H-GAC and reviewed by the CCC.

The Public comment period begins on Wednesday, March 16, 2016 and ends on Friday, April 15, 2016 at 5:00pm. Two public meetings will be held on Thursday, March 31, 2016, from noon-1:00pm and again from 5:30-7:00pm, at H-GAC (3555 Timmons Lane, Houston, Texas). Comments received will be responded to in Appendix 15. The minutes from the public hearing can also be found in the same appendix.