

Fort Bend County Toll Road Authority Systemwide Comprehensive Level Traffic & Toll Revenue Study



Fort Bend County Toll Road Authority

October 2015

Prepared by

**CDM
Smith**



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October 12, 2015

Richard W. Stolleis, P.E.
Fort Bend County Engineering Department
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Re: FBCTRA Systemwide Comprehensive Level Traffic and Toll Revenue Study

Dear Mr. Stolleis:

CDM Smith is pleased to submit the Fort Bend County Toll Road Authority (FBCTRA) Systemwide Comprehensive Traffic and Toll Revenue (T&R) Study report. The report summarizes the results of the study, which include T&R estimates for a forty-year period. The purpose of this study was to conduct a Comprehensive T&R evaluation for FBCTRA system. The FBCTRA System facilities for which T&R estimates are included in this report are the Westpark Tollway including extension and the Fort Bend Parkway.

Our project team, including Michael Copeland, Yagnesh Jarmarwala, Amit Thomas, Mark Middleton, Scott Allaire, Sandeep Aysola, Elizabeth Marie Regan, CDS Market Research and others, gratefully acknowledge the assistance and cooperation received from FBCTRA, H-GAC, Fort Bend County as well as the authority's consultant team contacted during the course of the study. CDM Smith sincerely appreciates the opportunity to have participated in this important project.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Kamran A. Khan", with a long horizontal line underneath.

Kamran A. Khan
Senior Vice President
CDM Smith Inc.



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Disclaimer

CDM Smith used currently-accepted professional practices and procedures in the development of these traffic and revenue estimates. However, as with any forecast, it should be understood that differences between forecasted and actual results may occur, as caused by events and circumstances beyond the control of the forecasters. In formulating the estimates, CDM Smith reasonably relied upon the accuracy and completeness of information provided (both written and oral) by Fort Bend County Toll Road Authority (FBCTRA). CDM Smith also relied upon the reasonable assurances of independent parties and is not aware of any material facts that would make such information misleading.

CDM Smith made qualitative judgments related to several key variables in the development and analysis of the traffic and revenue estimates that must be considered as a whole; therefore, selecting portions of any individual result without consideration of the intent of the whole may create a misleading or incomplete view of the results and the underlying methodologies used to obtain the results. CDM Smith gives no opinion as to the value or merit of partial information extracted from this report.

All estimates and projections reported herein are based on CDM Smith's experience and judgment and on a review of information obtained from multiple agencies, including FBCTRA. These estimates and projections may not be indicative of actual or future values, and are therefore subject to substantial uncertainty. Future developments cannot be predicted with certainty, and may affect the estimates or projections expressed in this report, such that CDM Smith does not specifically guarantee or warrant any estimate or projection contained within this report.

While CDM Smith believes that the projections or other forward-looking statements contained within the report are based on reasonable assumptions as of the date of the report, such forward-looking statements involve risks and uncertainties that may cause actual results to differ materially from the results predicted. Therefore, following the date of this report, CDM Smith will take no responsibility or assume any obligation to advise of changes that may affect its assumptions contained within the report, as they pertain to socioeconomic and demographic forecasts, proposed residential or commercial land use development projects and/or potential improvements to the regional transportation network.

CDM Smith is not, and has not been, a municipal advisor as defined in Federal law (the Dodd Frank Bill) to FBCTRA and does not owe a fiduciary duty pursuant to Section 15B of the Exchange Act to FBCTRA with respect to the information and material contained in this report. CDM Smith is not recommending and has not recommended any action to FBCTRA. FBCTRA should discuss the information and material contained in this report with any and all internal and external advisors that it deems appropriate before acting on this information.

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Executive Summary

CDM Smith was retained by the Fort Bend County Toll Road Authority (FBCTRA) to conduct a Comprehensive (Level 3) Systemwide traffic and toll revenue study of two facilities, Westpark Tollway and Fort Bend Parkway Toll Road, in Fort Bend County, Texas. As part of this study, CDM Smith updated the January 2014 Level 2 Study traffic and revenue (T&R) estimates for Fort Bend Parkway Toll Road and Westpark Tollway including the proposed Westpark Tollway Extension. This study utilized the most recent traffic and revenue data from the two existing facilities and the available regional travel demand models to reflect the most recent regional transportation plans and socioeconomic datasets developed for the Houston region. The construction of the extension of Westpark Tollway further west of the Grand Parkway (SH 99) in Fort Bend County will support the growth in the study corridors and improve mobility in the greater Houston region. This report provides long-term (40-year) traffic and revenue estimates of the two FBCTRA facilities and will be useful to support the proposed financing of the Westpark Tollway Extension.

Objective and Project Need

The objective of this study was to develop the baseline Level 3 long-range revenue forecasts through 2054 for Fort Bend Parkway Toll Road and Westpark Tollway including the Westpark Tollway Extension. The location of the two facilities is shown in **Figure ES-1**. The forecasts reflect the latest socio-economic growth assumptions, updated assumptions on future highway improvements for the Houston region including planned highway, arterial and toll road improvements. It also includes assumptions regarding future toll rates and other key variables.

One of the most rapidly growing counties in the Houston area has been Fort Bend County, with an average population growth of approximately four to six percent per year over the past three decades. The population of the county has grown more than tenfold from about 53,000 residents in 1970 to over 585,000 residents in 2010. This growth has resulted in increasing traffic volumes on roadways in the region and the need for additional capacity and improvement projects outside the City of Houston.

The Houston region has become a toll road success story. The two major regional toll authorities, Harris County Toll Road Authority (HCTRA) and FBCTRA have successfully used toll road financing to support the construction of new roadway capacity. The Fort Bend Grand Parkway Toll Road Authority (FBGPTRA) operates the Grand Parkway (SH-99) from US-59 to FM 1093/Westpark as a toll road with a series of tolled overpasses. Additionally, the Grand Parkway Transportation Corporation (GPTC) authorized by TxDOT manages all the Grand Parkway segments except Segment A, Segment B, Segment C, and portion of Segment D in Fort Bend County. Grand Parkway Segment D is currently open to traffic and part of Segment C in Fort Bend County is scheduled to be let in late 2015.

Both of the proposed FBCTRA toll facilities connect to existing toll facilities. Fort Bend Parkway in Fort Bend County connects to the HCTRA portion in the north at Beltway 8. The Westpark Tollway in Fort Bend County connects with the HCTRA portion of Westpark Tollway which extends further east to US 59 and Post Oak Boulevard. The Westpark Tollway also connects to the Grand Parkway facility, which is a toll facility operated by TxDOT.

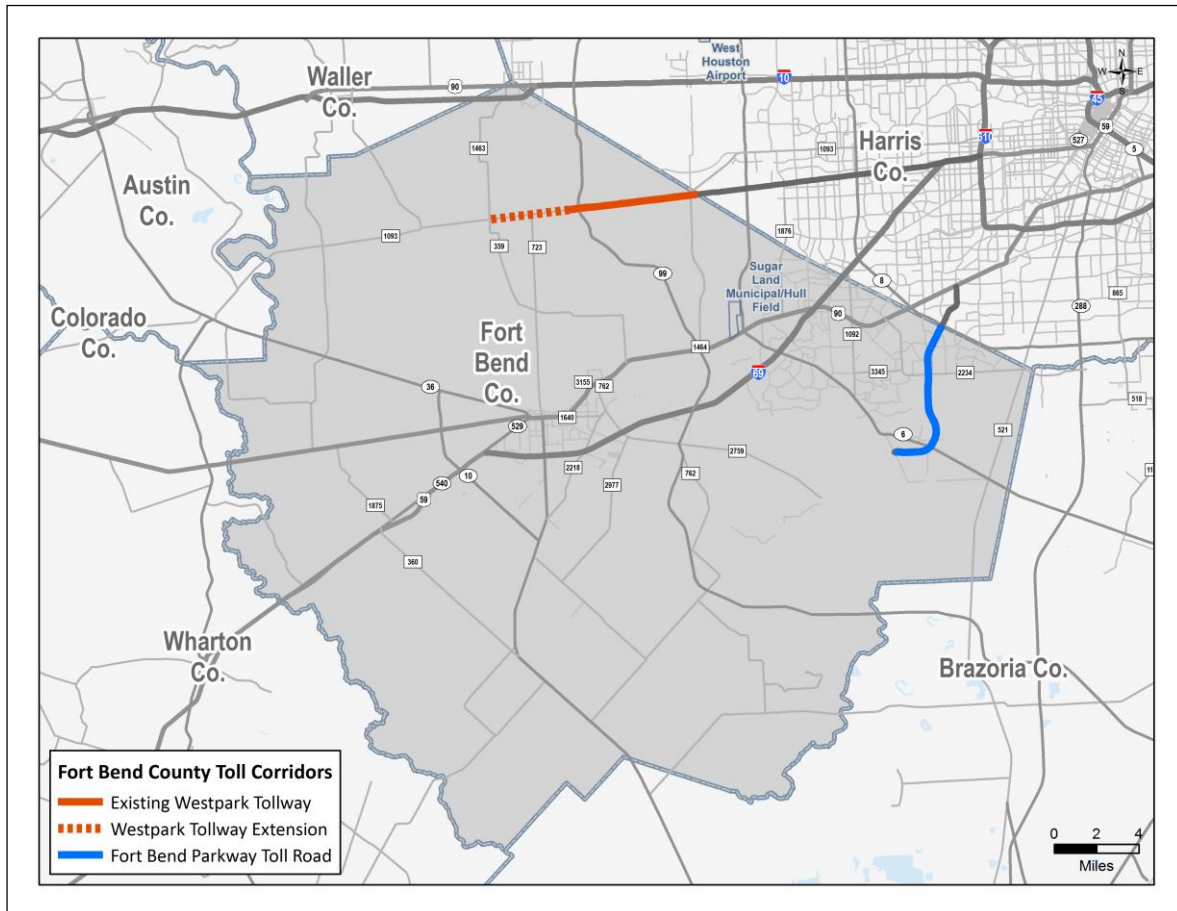


Figure ES-1: Regional Location Map

Modeling Methodology

The latest Houston-Galveston Area Council (H-GAC) travel demand model was used for this study. The regional travel demand model was validated to 2012 conditions using the Citilabs Cube platform. This model uses a detailed zonal structure with the 5,113 internal traffic analysis zones (TAZ) and 46 external stations used to represent the Houston-Galveston Transportation Management Area (TMA). The TAZ structure in this latest model incorporates a more detailed zone structure that reflects the increased development in the suburban portion and redevelopment in the urban portions of the region.

For the purposes of the study, the H-GAC model was converted to CDM Smith's standard toll diversion modeling framework. The model was then fine-tuned for base year conditions through an application of appropriate calibration measures which were then applied to the future year model datasets. Future year traffic assignments were conducted and several sensitivity scenarios were undertaken as part of the study. For each scenario, the future year network and trip tables were developed from the calibrated toll diversion model to produce the estimated traffic demand for future years. Toll transactions at each of the tolling locations were then extracted from the calibrated model and annual estimates for interim and horizon years, 2017, 2020, 2025, 2030 and 2040 were developed. Transactions and revenue for the interim years between these model years and forecast years beyond 2040 were interpolated and extrapolated, respectively. Toll revenue estimates were then calculated at each of the toll gantries by applying the appropriate toll rates.

The 2015 model network was used as the base year for model validation purposes. The modeled traffic volumes were compared to the traffic counts and actual toll transactions for various roadways to ensure that the screenline modeled volumes match reasonably well with the traffic counts. Output travel time and speeds from the travel demand model were also compared to observed travel time information.

Toll Sensitivity Analysis

Toll sensitivity analysis involves testing a series of toll rates to determine how price affects traffic demand on the toll facility taking into account future characteristics of the transportation network and future willingness-to-pay tolls.

In general, a toll sensitivity curve suggests that when toll rates increase, a portion of travelers will divert from the toll facility in favor of other routes and thus decreasing the captured toll transactions. The initial increases from a low toll rate level typically result in increased toll revenues until an optimal point where the maximum revenue is generated. Increases beyond this optimal toll rate level yields diminished revenues as the magnitude of diverted traffic exceeds the net return generated by the toll rate increase.

CDM Smith evaluated traffic and revenue potential under a range of alternative toll rates. **Figures ES-2** and **ES-3** illustrate the toll sensitivity curves for the FBCTRA facilities for average weekday revenue before applying ramp-up for the Fort Bend Parkway and Westpark Tollway corridors respectively for 2017. The average toll rate shown reflects the average toll rate of all the tolling locations for that facility. Several average toll rates that were higher and lower than the assumed programmed toll rate were analyzed. The toll sensitivity analysis results indicate that the projected toll rates of the both Fort Bend Parkway Toll Road and Westpark Tollway are below the estimated theoretical revenue maximization points. This demonstrates that overall for the both facilities, there is potential for revenue enhancement through toll increases above current toll rate levels and the assumed escalated rates used for forecasting purposes, if warranted.

Estimated Toll Revenue

Based on the traffic forecast at each toll plaza location, annual forecasts for the FBCTRA System were prepared from 2015 through 2054, including Fort Bend Parkway Toll Road, Westpark Tollway and the Westpark Extension. In each case, forecasts for each of the facilities are based on modeled traffic estimates at each toll collection location, through the year 2040. These modeled estimates were refined using post-model adjustments, reflecting validation factors used to match observed 2015 traffic data at each toll gantry location.

As shown in **Table ES-1**, the estimated annual revenue on Fort Bend Parkway is expected to increase from \$13 million in 2020 to \$24.8 million by 2030 and to \$39 million by 2040. The annual revenue for Westpark Tollway is expected to increase from \$17.3 million in 2020 to \$26.5 million by 2030, reaching \$41 million by 2040. Total revenue on the entire FBCTRA System, is expected to increase from about \$36 million in 2020 to \$95.3 million by 2040. Driven by nominal traffic growth and continued assumed inflationary adjustments in toll rates, revenue on the FBCTRA System is expected to reach \$154.2 million by 2054.

Table ES-2 shows the projected annual transaction and revenue growth rates on the FBCTRA System including Fort Bend Parkway, Westpark Tollway and Westpark Extension.

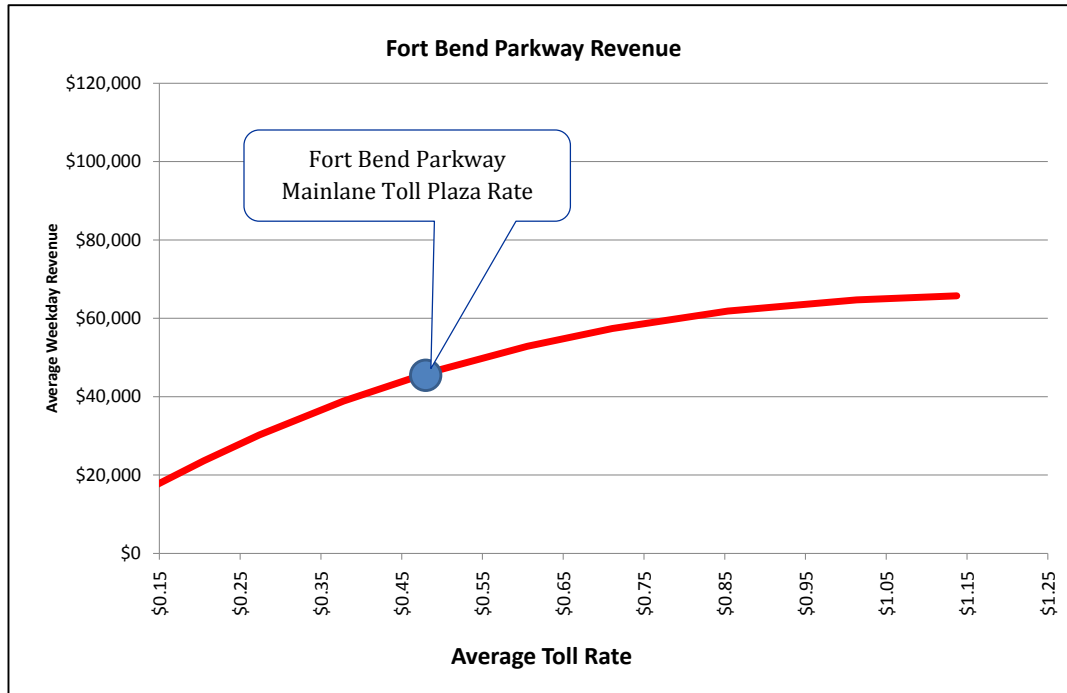


Figure ES-2. 2017 Toll Sensitivity Curve for Fort Bend Parkway

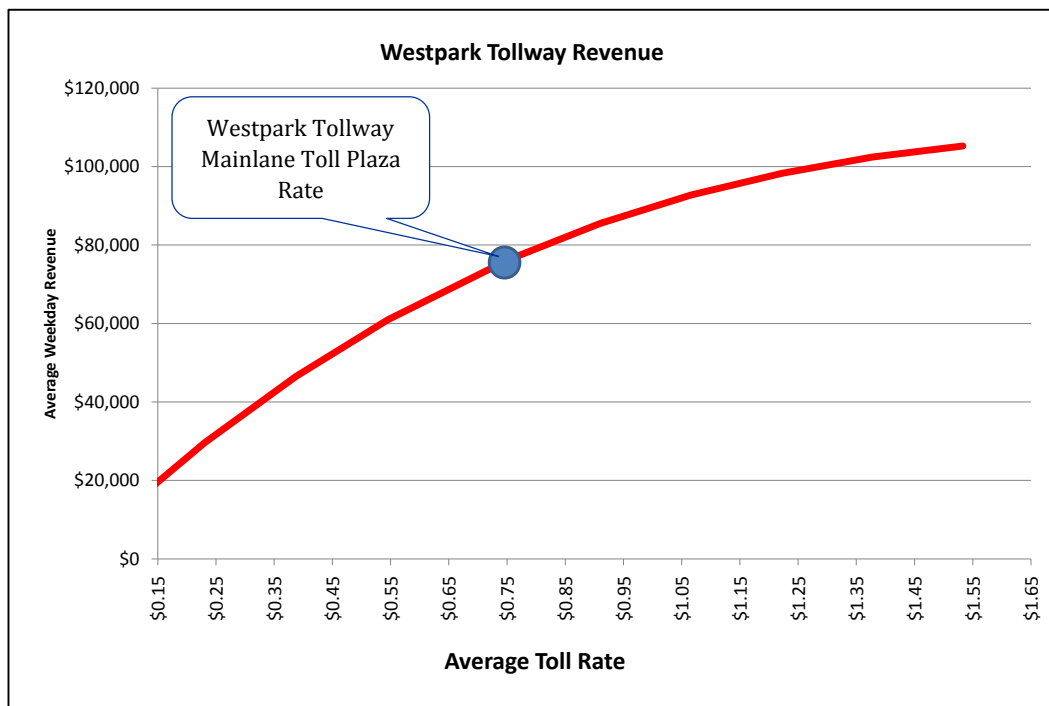


Figure ES-3. 2017 Toll Sensitivity Curve for Westpark Tollway (including Westpark Extension)

Annual transaction and revenue growth rates for the FBCTRA from 2020 through 2030 are about 3.3 percent and 5.4 percent respectively. Annual transaction and revenue growth rates from 2030 through 2040 are estimated to be 2.3 percent and 4.6 percent respectively. The total annual revenue forecasts are displayed graphically in **Figure ES-4**.

Table ES-1. FBCTRA System Estimated Annual Toll Revenue

Year	Annual Transactions (Thousands)					Annual Revenue ⁽⁵⁾ (Thousands)					
	Fort Bend Parkway	Westpark Tollway	Westpark Extension	Westpark Tollway and Extension Total	FBCTRA System	Fort Bend Parkway	Westpark Tollway	Westpark Extension	Westpark Tollway and Extension Total	FBCTRA System	
2015	(1)	25,346	22,293	0	22,293	47,639	\$9,759	\$13,006	\$0	\$13,006	\$22,765
2016		26,472	23,022	0	23,022	49,494	\$10,233	\$13,959	\$0	\$13,959	\$24,192
2017	(2)	27,648	23,968	3,161	27,129	54,777	\$10,729	\$15,105	\$2,336	\$17,441	\$28,170
2018		28,890	25,040	4,584	29,624	58,514	\$11,647	\$15,799	\$3,457	\$19,256	\$30,903
2019		30,187	26,159	5,681	31,840	62,027	\$12,643	\$16,524	\$4,371	\$20,895	\$33,538
2020	(3)	29,830	27,329	7,367	34,696	64,526	\$12,972	\$17,282	\$5,785	\$23,067	\$36,039
2021		31,178	28,464	7,772	36,236	67,414	\$13,946	\$18,506	\$6,174	\$24,680	\$38,626
2022		32,586	29,647	8,200	37,847	70,433	\$14,993	\$19,817	\$6,589	\$26,406	\$41,399
2023		34,058	30,879	8,650	39,529	73,587	\$16,118	\$21,219	\$7,032	\$28,251	\$44,369
2024		35,597	32,162	9,126	41,288	76,885	\$17,327	\$22,722	\$7,506	\$30,228	\$47,555
2025		36,864	30,593	9,157	39,750	76,614	\$18,421	\$22,222	\$7,617	\$29,839	\$48,260
2026		38,304	31,265	9,398	40,663	78,967	\$19,543	\$23,015	\$7,983	\$30,998	\$50,541
2027		39,800	31,951	9,645	41,596	81,396	\$20,732	\$23,836	\$8,366	\$32,202	\$52,934
2028		41,354	32,653	9,898	42,551	83,905	\$21,994	\$24,687	\$8,767	\$33,454	\$55,448
2029		42,969	33,369	10,158	43,527	86,496	\$23,331	\$25,568	\$9,189	\$34,757	\$58,088
2030		44,647	34,102	10,425	44,527	89,174	\$24,750	\$26,480	\$9,630	\$36,110	\$60,860
2031		45,822	34,838	10,680	45,518	91,340	\$25,994	\$27,687	\$10,145	\$37,832	\$63,826
2032		47,028	35,589	10,941	46,530	93,558	\$27,301	\$28,949	\$10,687	\$39,636	\$66,937
2033		48,266	36,357	11,208	47,565	95,831	\$28,673	\$30,270	\$11,258	\$41,528	\$70,201
2034		49,536	37,142	11,482	48,624	98,160	\$30,114	\$31,650	\$11,860	\$43,510	\$73,624
2035	(4)	50,096	37,943	11,762	49,705	99,801	\$31,211	\$33,093	\$12,493	\$45,586	\$76,797
2036		51,268	38,762	12,050	50,812	102,080	\$32,640	\$34,536	\$13,016	\$47,552	\$80,192
2037		52,468	39,599	12,345	51,944	104,412	\$34,134	\$36,040	\$13,562	\$49,602	\$83,736
2038		53,696	40,454	12,648	53,102	106,798	\$35,696	\$37,611	\$14,129	\$51,740	\$87,436
2039		54,953	41,327	12,958	54,285	109,238	\$37,330	\$39,250	\$14,721	\$53,971	\$91,301
2040		56,239	42,219	13,275	55,494	111,733	\$39,037	\$40,960	\$15,337	\$56,297	\$95,334
2041		57,364	43,063	13,541	56,604	113,968	\$40,614	\$42,615	\$15,956	\$58,571	\$99,185
2042		58,511	43,925	13,811	57,736	116,247	\$42,255	\$44,337	\$16,601	\$60,938	\$103,193
2043		59,681	44,803	14,088	58,891	118,572	\$43,962	\$46,128	\$17,272	\$63,400	\$107,362
2044		60,875	45,699	14,369	60,068	120,943	\$45,738	\$47,992	\$17,970	\$65,962	\$111,700
2045		61,788	46,385	14,585	60,970	122,758	\$47,353	\$49,686	\$18,603	\$68,289	\$115,642
2046		62,715	47,080	14,804	61,884	124,599	\$49,024	\$51,440	\$19,261	\$70,701	\$119,725
2047		63,656	47,787	15,026	62,813	126,469	\$50,755	\$53,256	\$19,940	\$73,196	\$123,951
2048		64,610	48,503	15,251	63,754	128,364	\$52,546	\$55,136	\$20,644	\$75,780	\$128,326
2049		65,580	49,231	15,480	64,711	130,291	\$54,401	\$57,082	\$21,373	\$78,455	\$132,856
2050		66,235	49,723	15,635	65,358	131,593	\$56,044	\$58,806	\$22,018	\$80,824	\$136,868
2051		66,898	50,221	15,791	66,012	132,910	\$57,737	\$60,582	\$22,683	\$83,265	\$141,002
2052		67,567	50,723	15,949	66,672	134,239	\$59,480	\$62,411	\$23,368	\$85,779	\$145,259
2053		68,242	51,230	16,108	67,338	135,580	\$61,276	\$64,296	\$24,074	\$88,370	\$149,646
2054		<u>68,925</u>	<u>51,742</u>	<u>16,269</u>	<u>68,011</u>	<u>136,936</u>	<u>\$63,127</u>	<u>\$66,238</u>	<u>\$24,801</u>	<u>\$91,039</u>	<u>\$154,166</u>
Total		1,947,749	1,517,241	443,278	1,960,519	3,908,268	\$1,305,580	\$1,419,798	\$506,574	\$1,926,372	\$3,231,952

Notes:

Source: CDM Smith Estimates, September 9, 2015

- (1) Transactions and Revenue for all years for Fort Bend Parkway Toll Road represent the tolling configuration changed from mainlines and ramp gantries to all mainline gantries,
- (2) Opening date of Westpark Extension from SH 99 to west of FM 723.
- (3) Assumed Opening date of SH 288 Managed Lanes.
- (4) Assumed Opening date of SH 288 Toll Lanes south of SH 6.
- (5) Annual Revenue is in nominal dollars (after leakage)

Table ES-2. FBCTRA System Transactions and Revenue Annual Growth

Period	FBCTRA Transactions Growth Rate	FBCTRA Revenue Growth Rate
2015-2020	6.3%	9.6%
2020-2030	3.3%	5.4%
2030-2040	2.3%	4.6%
2040-2050	1.6%	3.7%

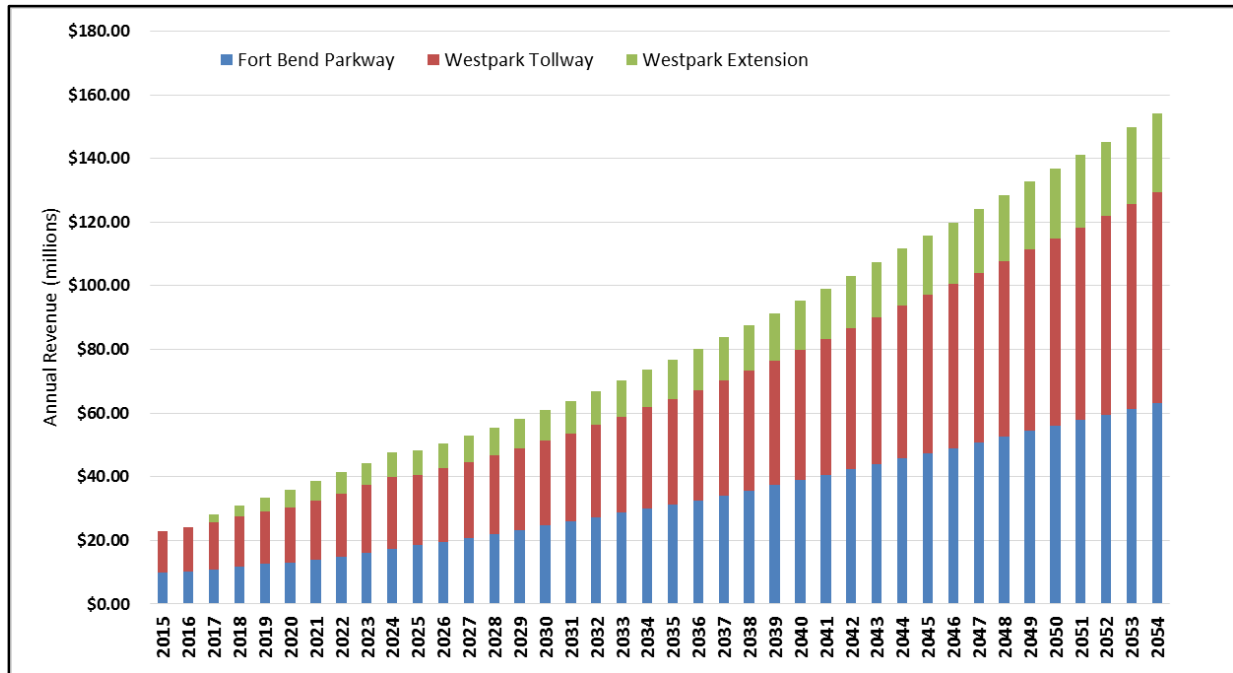


Figure ES-4. FBCTRA System Estimated Annual Revenue by Facility

Chapter 1

Introduction

CDM Smith was retained by the Fort Bend County Toll Road Authority (FBCTRA) to conduct a Comprehensive (Level 3) Systemwide traffic and toll revenue study of two facilities, Westpark Tollway and Fort Bend Parkway Toll Road, in Fort Bend County, Texas. As part of this study, CDM Smith updated the January 2014 Level 2 Study traffic and revenue (T&R) estimates for Fort Bend Parkway Toll Road and Westpark Tollway including the proposed Westpark Tollway Extension. This study utilized the most recent traffic and revenue data from the two existing facilities and the available regional travel demand models to reflect the most recent regional transportation plans and socioeconomic datasets developed for the Houston region. The construction of the extension of Westpark Tollway further west of the Grand Parkway (SH 99) in Fort Bend County will support the growth in the study corridors and improve mobility in the greater Houston region. This report provides long-term (40-year) traffic and revenue estimates of the two FBCTRA facilities and will be useful to support the proposed financing of the Westpark Tollway Extension.

Objective and Scope of Study

The objective of this study was to develop the baseline Level 3 long-range revenue forecasts through 2064 for Fort Bend Parkway Toll Road and Westpark Tollway including the Westpark Tollway Extension. The forecasts reflect the latest socio-economic growth assumptions, updated assumptions on future highway improvements for the Houston region including planned highway, arterial and toll road improvements. It also includes assumptions regarding future toll rates and other key variables.

This chapter provides background information regarding the Fort Bend County Toll Road Authority System (FBCTRA System) facilities and other major roadways in the study corridor. This chapter describes the following two facilities under the FBCTRA System for which CDM Smith has developed updated long-term forecasts:

- The Fort Bend Parkway Toll Road
- The Westpark Tollway (including the Westpark extension)

Project Description

The eight-county region surrounding Houston has historically seen significant population growth over several decades. The region added almost one million people between 1970 and 1980. Although the rate of growth reduced in the early 1980s, the greater Houston region emerged as a much more diverse economy after the restructuring that occurred in the mid-1980s. Strong growth resumed in the 1990s and through the early 2000s. According to the US Census, more than 4 million people lived in Harris County in 2010, and over 5.9 million in the larger Houston-The Woodlands-Sugar Land metro area.

Background and Project Need

One of the most rapidly growing counties in the Houston area has been Fort Bend County, with an average population growth of approximately four to six percent per year over the past three decades.

The population of the county has grown more than tenfold from about 53,000 residents in 1970 to over 585,000 residents in 2010.

This growth has resulted in increasing traffic volumes on roadways in the region and the need for additional capacity and highway improvement projects particularly outside the City of Houston. Some of these projects have been identified for implementation by Texas Department of Transportation (TxDOT), including a possible extension of the IH 10 Katy Tollway Managed Lanes to the west, an extension of the existing SH 249 Freeway in the northwestern part of the region, a new toll facility along the SH 35 corridor between Hobby Airport and Alvin and future managed toll lanes along IH 45 between downtown Houston and Montgomery County. According to Forbes, the Port of Houston ranks first in the United States in international waterborne tonnage and second in the US for domestic total cargo tonnage.

The Houston region has become a toll road success story. The two major regional toll authorities, Harris County Toll Road Authority (HCTRA) and FBCTRA have successfully used toll road financing to support the construction of new roadway capacity. The Fort Bend Grand Parkway Toll Road Authority (FBGPTRA) operates the Grand Parkway (SH-99) from US-59 to FM 1093/Westpark as a toll road with a series of tolled overpasses. Additionally, the Grand Parkway Transportation Corporation (GPTC) authorized by TxDOT manages all the Grand Parkway segments except Segment A, Segment B, Segment C, and portion of Segment D in Fort Bend County. Grand Parkway Segment D is currently open to traffic and part of Segment C in Fort Bend County is scheduled to be let in late 2015.

A review of the historical performance of Houston toll facilities illustrates the widespread acceptance of toll roads by the local population, and high ownership of toll transponders. Almost all of the facilities experienced a doubling of full first-year traffic within the first ten years. This significant growth of toll-paying traffic was driven by the socio-economic growth in the region. The Katy Tollway managed lanes are a part of the upgraded Katy Freeway system that has provided significant additional tolled and toll-free capacity to the Katy corridor, resulting in tremendous growth in development over the past four years. The demand for the managed lanes, particularly outside Beltway 8, has exceeded expectations and the region now has five operating tolled managed lanes. The map in **Figure 1-1** depicts the various existing and proposed toll and managed lane facilities in the region.

FBCTRA built and financed the Fort Bend Parkway and the Westpark Tollway. A regional location map is provided in **Figure 1-2** showing the two facilities that are a part of this Level 3 study. Fort Bend Parkway is a north-south roadway that connects communities including Dewalt, Trammels, Sienna Plantation and Arcola in the south with Missouri City, Almeda, the City of Houston and other locations in Harris County. The existing portion of the FBCTRA Westpark Tollway runs east-west between the Grand Parkway (SH 99) and Fort Bend/Harris County Line. The Westpark Extension will extend west from Grand Parkway (SH 99) to just west of FM 723.

Both of the FBCTRA toll facilities connect to existing toll facilities. Fort Bend Parkway in Fort Bend County connects to the HCTRA portion in the north at Beltway 8. The Westpark Tollway in Fort Bend County connects with the HCTRA portion of Westpark Tollway which extends further east to US 59 and Post Oak Boulevard. The Westpark Tollway also connects to the Grand Parkway facility, which is a toll facility operated by FBGPTRA.

Segment D of the Grand Parkway (SH 99) from US 59 to FM 1093/Westpark is also a toll facility within Fort Bend County. However, the Grand Parkway (Segment D) is not included in our analysis. TxDOT operates the adjoining segment of Grand Parkway from FM 1093/Westpark north to US 290. The

segment between FM 1093/Westpark and IH 10 is not tolled except the mainlanes crossing over FM 1093. However, the segment between IH 10 and US 290 is a tolled facility.

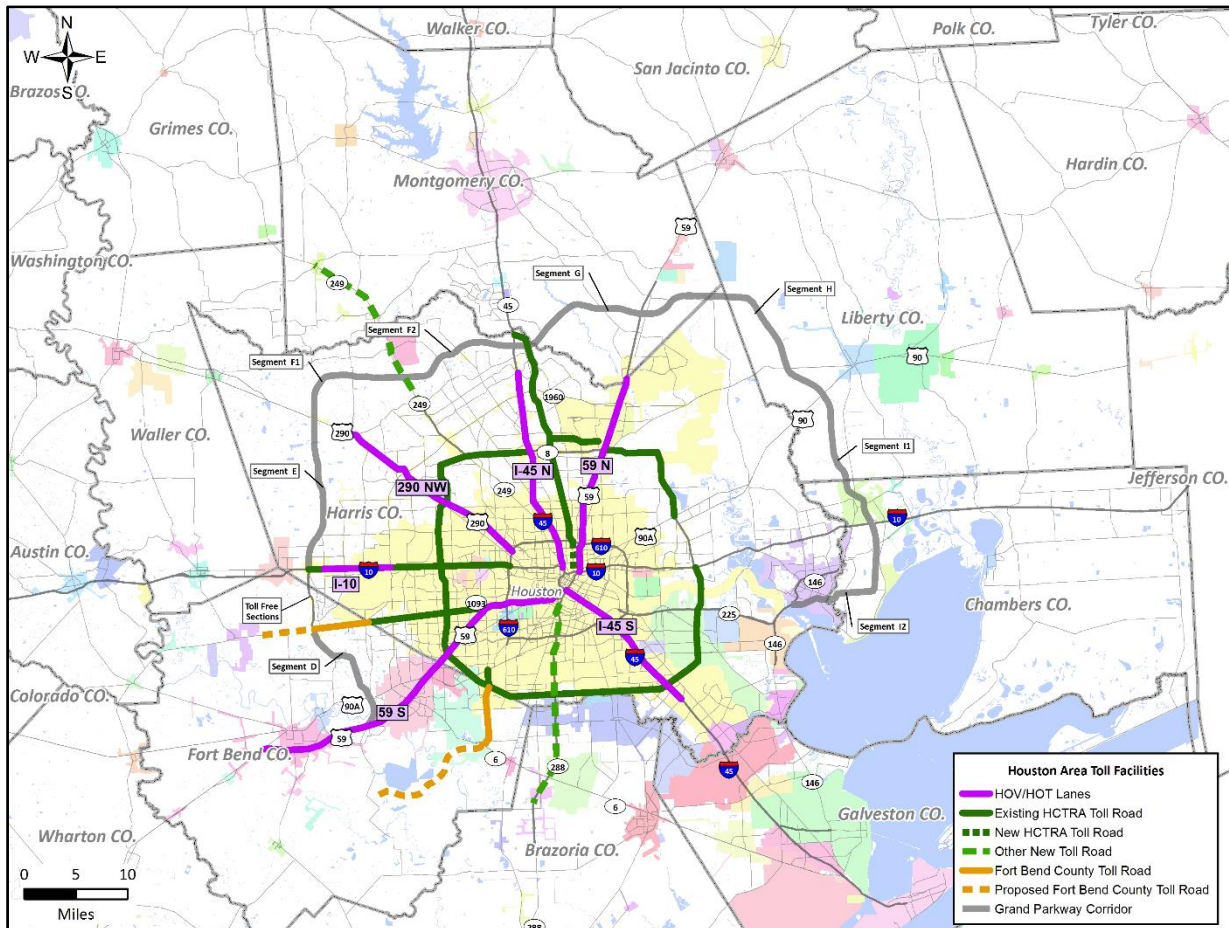


Figure 1-1. Houston Area Toll Facilities – Existing and Proposed

FBCTRA System Facilities

This section provides a detailed overview of each of the FBCTRA System facilities. The FBCTRA System facilities currently in operation are the Fort Bend Parkway Toll Road and the Westpark Tollway. Both facilities are shown on the map in **Figure 1-2**. Additionally, the Westpark Tollway Extension (which is assumed to be open to traffic by 2017) includes main lanes that extend from west of the Grand Parkway (SH 99) to west of FM 723, from where traffic will exit to the frontage road system and connect with the existing FM 1093.

Fort Bend Parkway Toll Road

The Fort Bend Parkway Toll Road connects Sienna Parkway on its south end to US 90A or South Main at its north end. FBCTRA operates the 6.2 mile section of toll road in Fort Bend County from Sam Houston Tollway/Beltway 8 to Sienna Parkway. Original construction was completed in August 2004. HCTRA operates the section of the toll road in Harris County from Beltway 8 to US 90A. No future extensions beyond the existing terminus of Fort Bend Parkway Toll Road at Sienna Parkway are assumed in this study.

The Fort Bend Parkway is a north-south four lane facility, with interchanges at SH 6, Lake Olympia Parkway, FM 2234/McHard Road, Fondren Road, Sam Houston Tollway/Beltway 8 and US 90A. There are four mainlane toll gantries on the Fort Bend Parkway Toll Road near Sienna Parkway, Lake Olympia Parkway, McHard Road and Fondren Road.

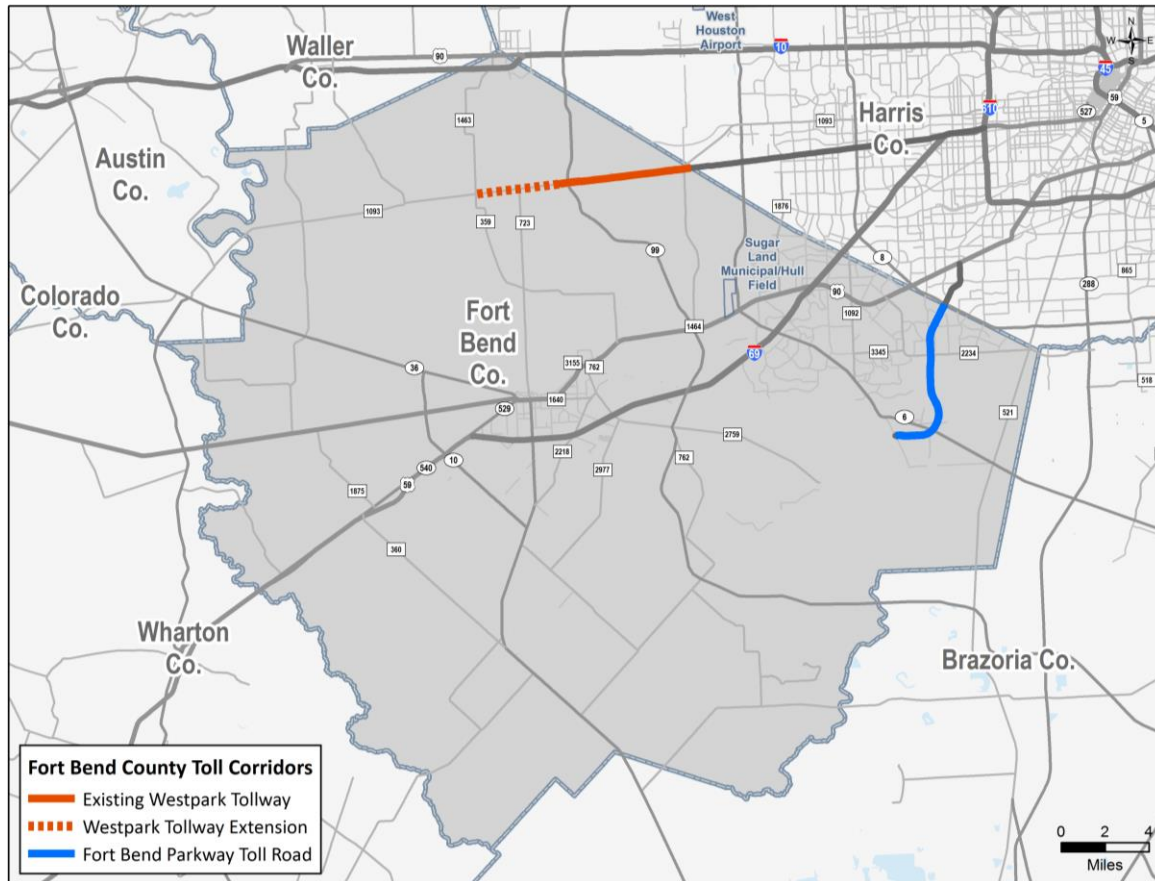


Figure 1-2: Regional Location Map

Westpark Tollway

The Westpark Tollway is an east-west corridor that connects SH 99, the Grand Parkway, to IH 610 in Houston. FBCTRA operates approximately six miles of the toll road located in Fort Bend County, which begins at the Harris County line just east of FM 1464. Original construction of the Westpark Tollway was completed in August 2005. HCTRA operates the portion of the toll road in Harris County. TxDOT operates and maintains the eastbound and westbound service roads on either side of the mainlane toll lanes.

The Westpark Tollway provides access from Fort Bend County to SH 6, the Sam Houston Tollway/Beltway 8, US 59 and the Galleria area in Houston. Westpark Tollway is a four lanes toll facility and the frontage road was widened to four lanes by TxDOT. There are two mainlane toll gantries operated by FBCTRA located on the Westpark Tollway near Peek Road and Westmoor Drive.

West of Grand Parkway, the Westpark Tollway connects directly to FM 1093. There is an existing direct connector between Grand Parkway and Westpark. For all model future year runs beyond 2018, two

the exit to Peek Road in the westbound direction. The Westmoor gantry is located between the Grand Mission Boulevard entrance ramp and the exit ramp to Barker Cypress Road (FM 1464) in the eastbound direction. In the westbound direction the Westmoor gantry is located between the entrance ramp from Barker Cypress Road (FM 1464) and the exit ramp to Grand Mission Boulevard.

Westpark Tollway Extension Tolling Configuration

The tolling configuration of the Westpark Tollway Extension is shown in **Figure 1-5**. In addition to the Peek and Westmoor gantries, there is one additional tolling location west of the Grand Parkway.

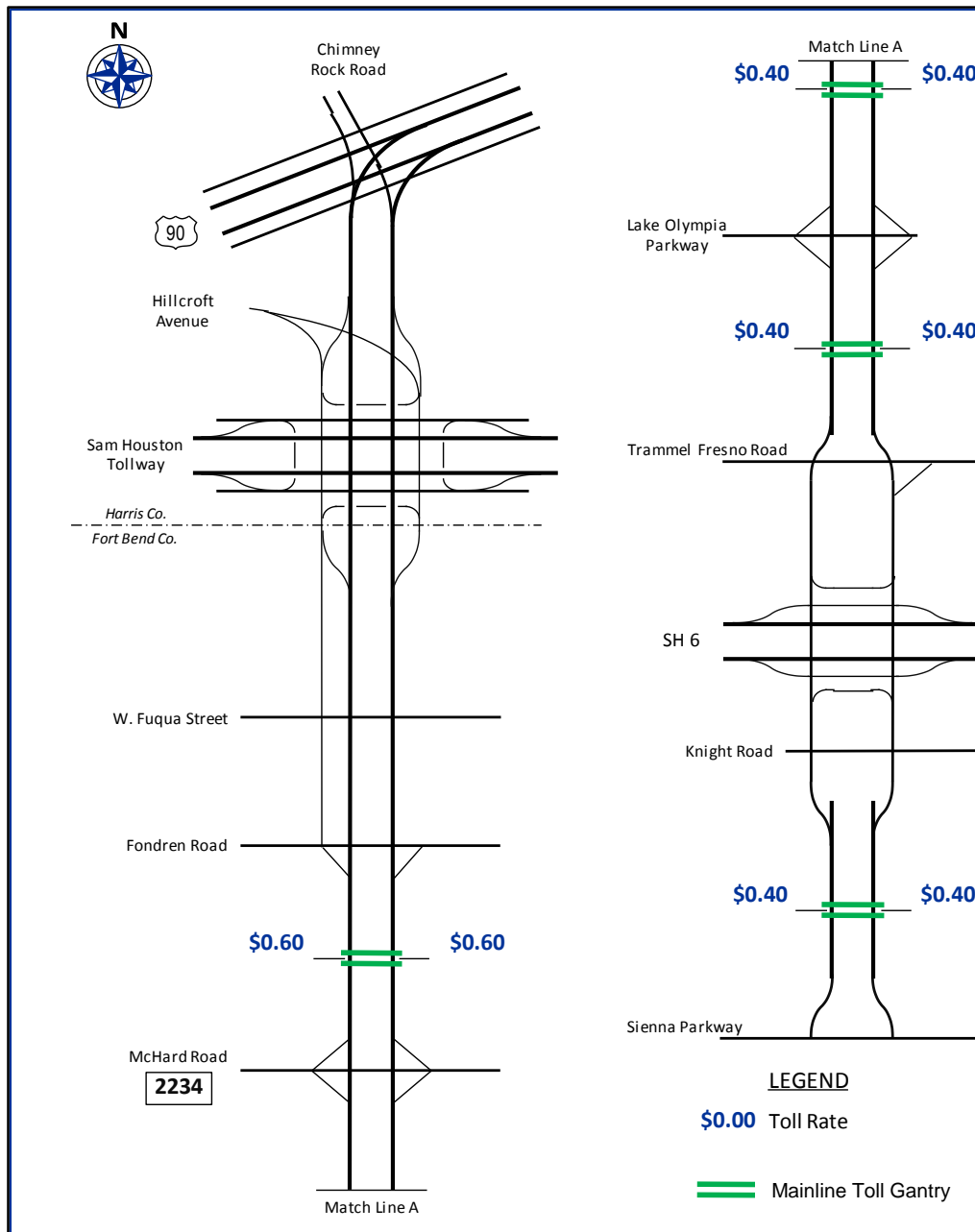


Figure 1-4. Fort Bend Parkway Toll Road Toll Collection System

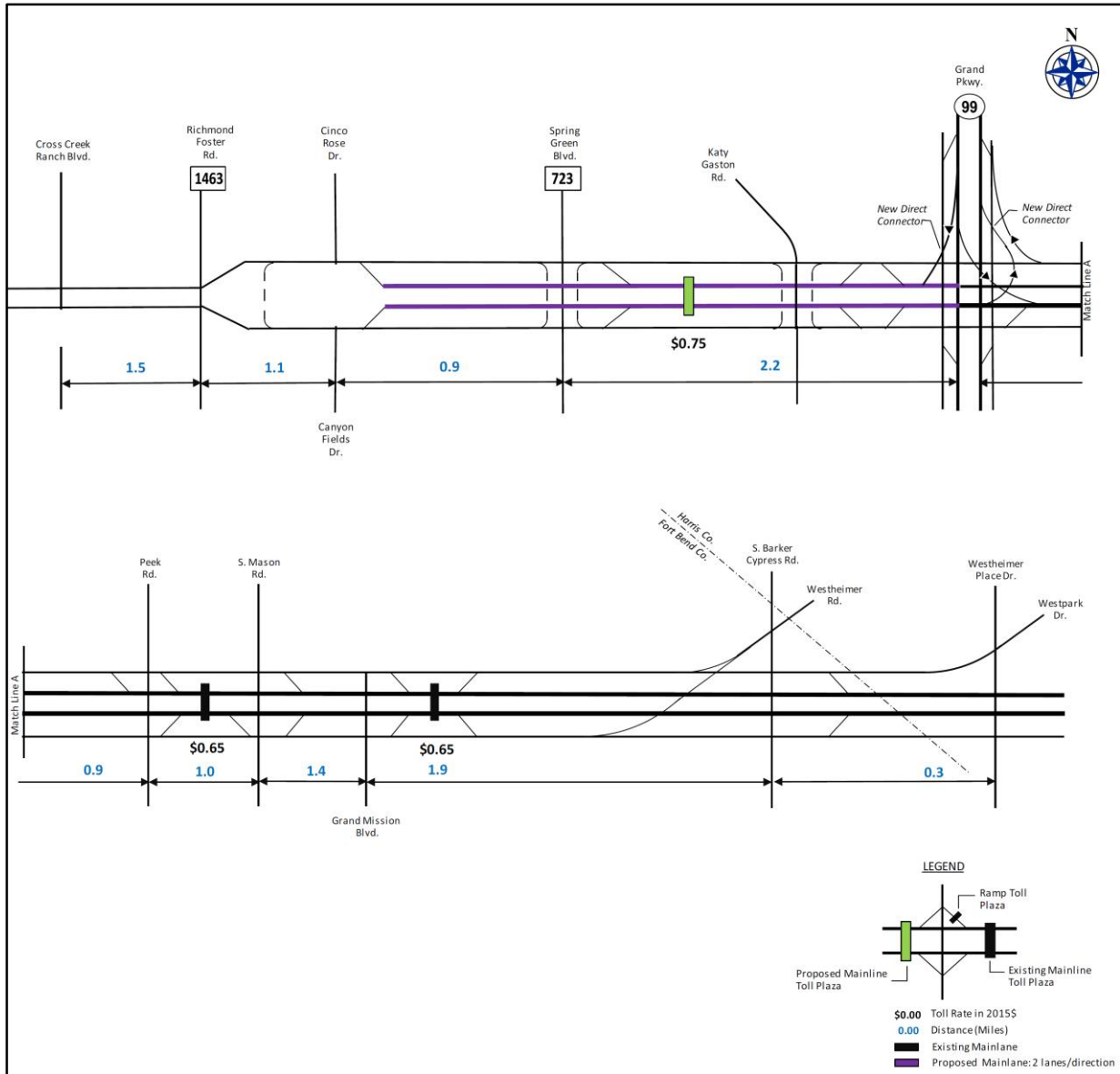


Figure 1-5. Westpark Tollway and Westpark Tollway Extension

Organization of Report

The subsequent chapters present the toll traffic and analysis methodology, assumptions, inputs and results of the Level 3 T&R study. The remaining portions of this report are organized into the following chapters:

Chapter 2: Existing Traffic Conditions

Chapter 2 describes the existing and historical traffic and operating conditions for the FBCTRA system. In addition to utilizing existing and historical transactions and revenue data for Westpark Tollway and Fort Bend Parkway Toll Road provided by FBCTRA, CDM Smith collected additional field data. An extensive data collection program consisting of several 48-hour traffic counts was collected at multiple locations, primarily on screenline location and roadways within and adjacent to the FBCTRA facilities.

In addition to traffic counts, speed and delay studies, market research on willingness-to-pay and local values-of-time (VOT) were estimated.

Chapter 3: Economic Growth

Chapter 3 presents the economic growth of the Fort Bend Parkway Toll Road and Westpark Tollway corridors. An updated independent socio-economic review was conducted by an independent economist, CDS Market Research. CDS reviewed each zone in the model area and developed forecasts of future population, employment and households in these subzones that would have a significant impact on traffic on the proposed extensions. Details of the analysis conducted by CDS are included as Appendix A of this report.

Chapter 4: Roadway Network Improvements

Chapter 4 illustrates the major roadway network improvements that were assumed for different future years as part of the Houston-Galveston Area Council (H-GAC) model. The H-GAC Transportation Improvement Plan (TIP) and Regional Transportation Plan (2040) reviewed and updated as needed and the proposed projects were coded into the model.

Chapter 5: Traffic and Revenue Analysis

Chapter 5 presents the results of the model developed and detailed traffic and revenue analysis, including the baseline traffic and toll revenue estimates for the two facilities. A review of the value of time results from stated preference surveys that were part of recent traffic and revenue studies in the Houston metropolitan area was conducted to use in this analysis. This chapter also includes the assumptions upon which the traffic and revenue estimates are based. Calibration of base year model volumes to match existing conditions was completed using the regional travel demand model, and the resulting model was used to generate the traffic and revenue forecasts.

Chapter 6: Sensitivity Tests

Chapter 6 includes sensitivity tests that identify the impacts of changes in select key variables on the traffic and revenue forecasts.

Chapter 2

Existing Traffic Trends

This chapter provides background information regarding the existing traffic characteristics of Fort Bend County Toll Road Authority System (FBCTRA System) facilities and other major roadways in the study corridor. The information in this section provides an overview of the toll collection system and the historical traffic and revenue trends on the FBCTRA System. This section also describes the additional data that was collected, which includes traffic counts at specific locations around the FBCTRA System corridors and speed and delay studies on the system corridors and other roadways in Fort Bend County. These traffic counts and observed speed and delay data are used in the calibration process for the travel demand model, as described in **Chapter 5**.

This chapter is organized into the following sections:

- Toll Collection System and Rates
- Annual Transaction and Toll Revenue Trends
- Traffic Count Program
- Travel Time Characteristics

Toll Collection System and Rates

The following section provides a brief description of the FBCTRA System electronic tolling system and a summary of the existing toll collection configuration and toll rates. A comparison of the system per mile toll rates with other similar toll facilities throughout the United States is also included.

Electronic Tolling System

The FBCTRA System was the first toll agency in the United States to eliminate cash from all lanes and move to all electronic toll collection. A valid electronic toll tag issued by one of the following toll agencies in Texas is required to drive on any of the FBCTRA System roadways:

- TxTag issued by the Texas Department of Transportation
- EZ TAG issued by the Harris County Toll Road Authority
- TollTag issued by the North Texas Tollway Authority.

A vehicle operating on the FBCTRA System without a tag can call customer support to make a one-time pre-payment, but all future travel will require a valid tag. Future travel on any FBCTRA roadway without a tag will be a violation and can result in additional fines and fees.

Fort Bend Parkway Toll Road

The Fort Bend Parkway Toll Road collection system is presented in **Figure 2-1**. As indicated in Chapter 1, the Fort Bend Parkway Toll Road has four mainlane toll gantries - the Sienna Parkway Toll Gantry, the Lake Olympia Toll Gantry, the McHard Toll Gantry and the Fondren Toll Gantry.

Two axle vehicles are charged \$0.40 at the Sienna Parkway, Lake Olympia and McHard Toll Gantries. At the Fondren Toll Gantry, two axle vehicles are charged \$0.60.

Westpark Tollway

The Westpark Tollway collection system is presented in **Figure 2-2**. As indicated in Chapter 1, there are two mainlane toll gantries on the Westpark Tollway - the Peek Toll Gantry and the Westmoor Gantry. Two axle vehicles are charged \$0.65 at both the Peek and Westmoor Gantries.

Table 2-1 provides a summary of the toll rates at various tolling locations on Fort Bend Parkway Toll Road and Westpark Tollway.

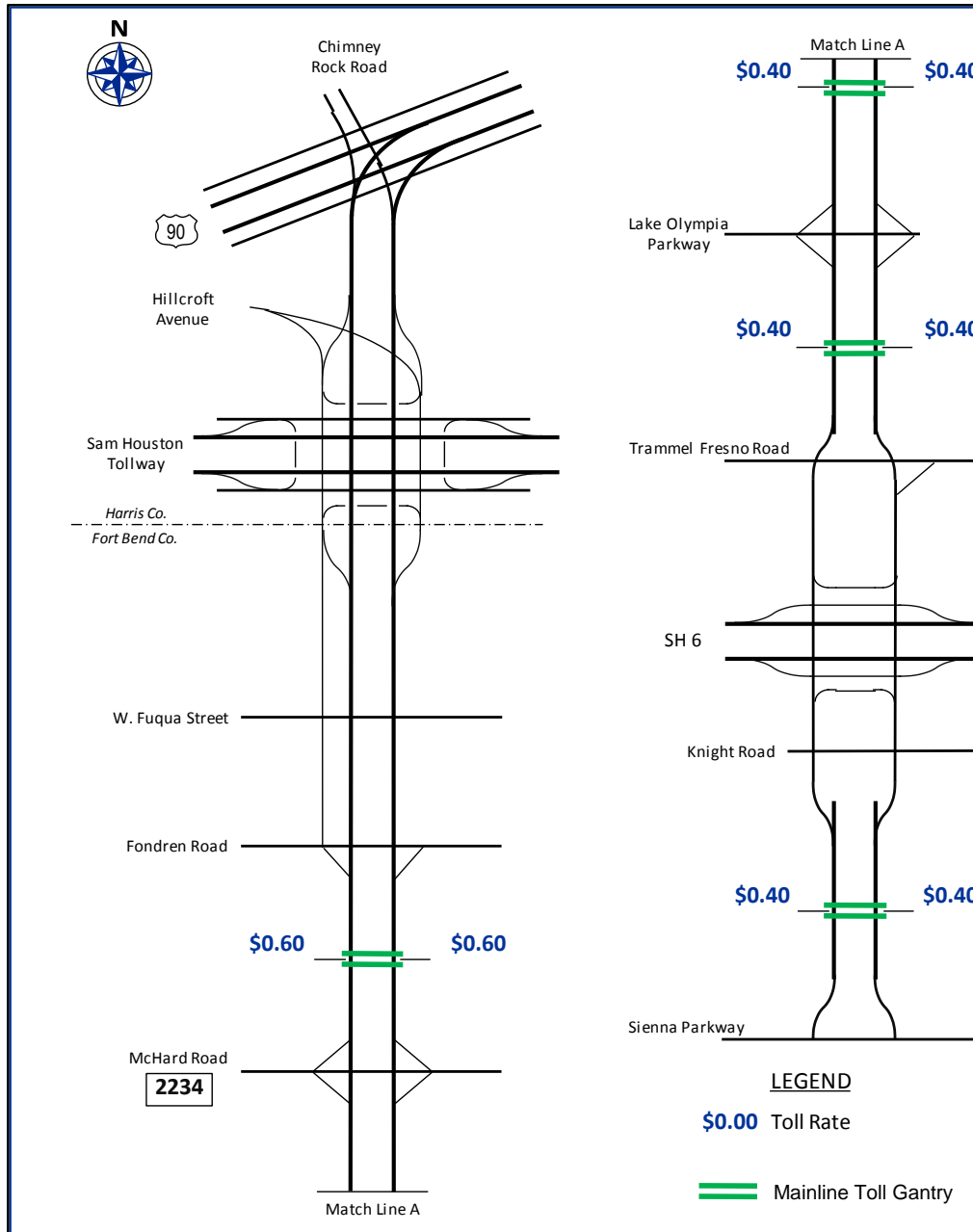


Figure 2-1. Current Passenger Car Toll Rates for Fort Bend Parkway Toll Road

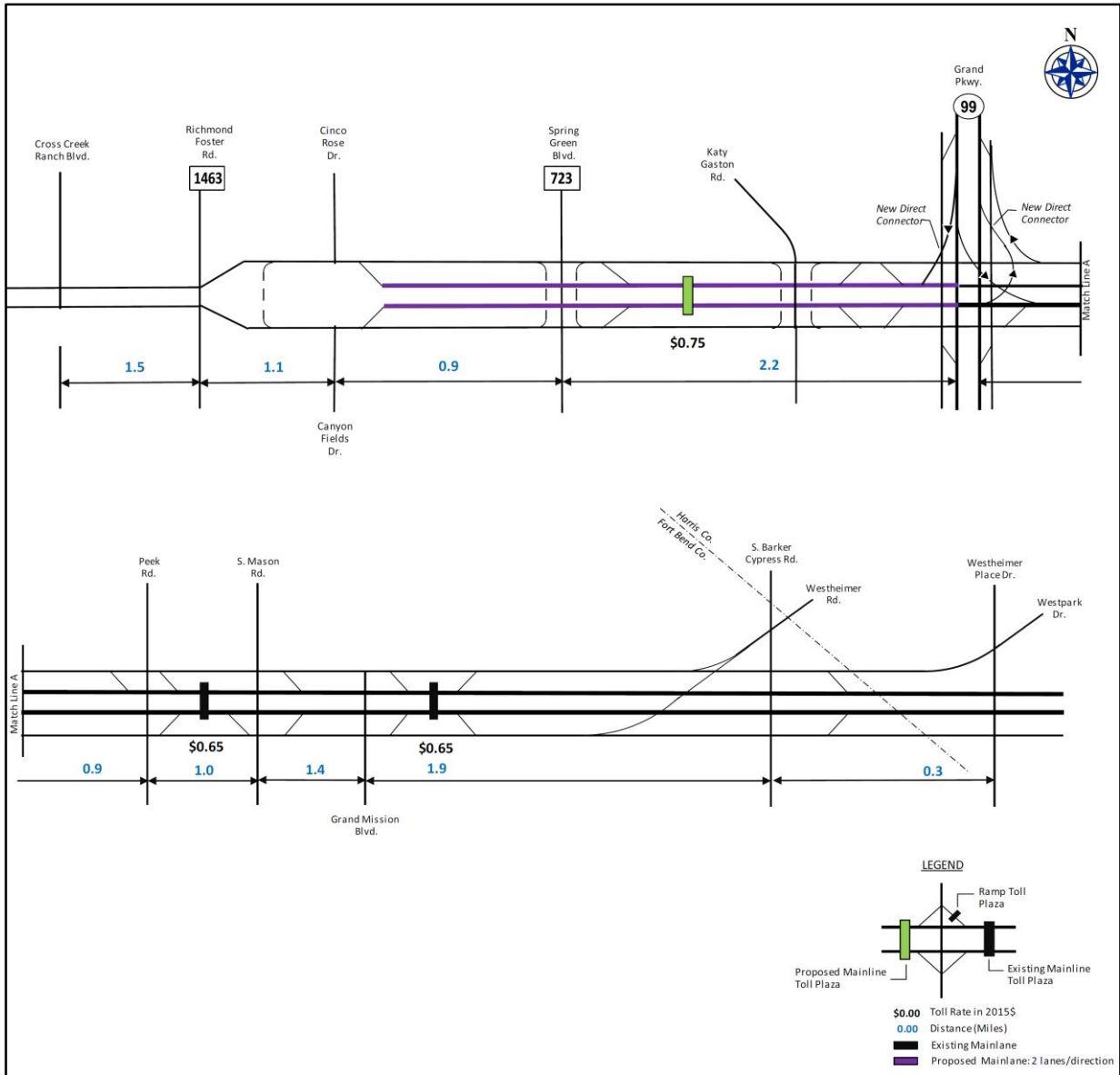


Figure 2-2. Current Passenger Car Toll Rates for Westpark Tollway

Table 2-1. Existing FBCTRA System Toll Rates for Two-Axle Vehicles

Fort Bend Parkway	Valid Tag	Non-Tag/Invalid
Fondren	\$0.60	\$0.75
McHard	\$0.40	\$0.55
Lake Olympia	\$0.40	\$0.55
Sienna Parkway	\$0.40	\$0.55
Westpark Tollway	Valid Tag	Non-Tag/Invalid
Westmoor	\$0.65	\$0.80
Peek	\$0.65	\$0.80

Source: Fort Bend County Toll Road Authority
 Toll Rates Effective 5/13/2015

Comparison of Per-Mile Toll Rates

The average per-mile toll rates for passenger cars on the FBCTRA System are compared with other representative urban toll facilities throughout the United States in **Figure 2-3**. In general, toll rates on the FBCTRA System fall within the range of rates on other urban toll facilities. Currently, the estimated average per-mile toll rate for two-axle vehicles is close to 22-24.0 cents per mile on the Fort Bend Parkway Toll Road and the Westpark Tollway.

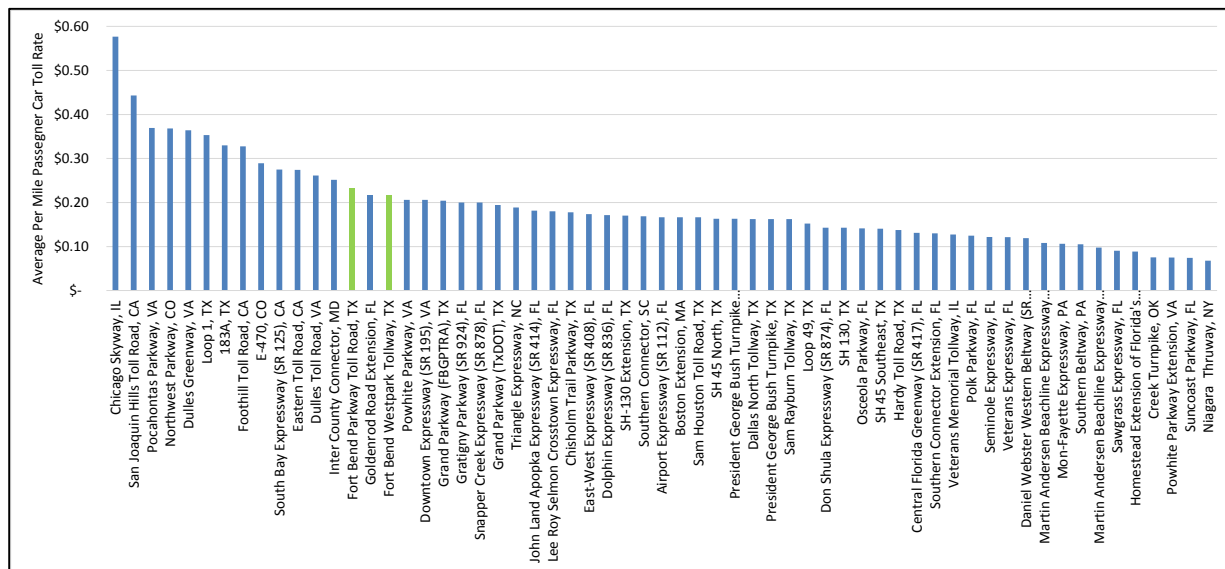


Figure 2-3. Toll Rate Per Mile Comparison (2015\$)

Annual Transaction and Toll Revenue Trends

CDM Smith evaluated transaction and toll trends on the FBCTRA System from 2010 through 2014. This evaluation was used to provide a general understanding of the current, as well as historical, transaction and toll revenue performance of the FBCTRA System facilities. The analysis provided useful insight into the effect that roadway improvements and recent economic changes may have had on system transactions and toll revenue trends.

Trends in Average Daily Transactions and Toll Revenue

Trends in annual average daily transactions and toll revenue from 2010 to 2014 for the FBCTRA System facilities are presented in **Table 2-2** and **Table 2-3** and are based on unaudited transaction and revenue data from FBCTRA.

In 2014, average annual daily transactions averaged approximately 23,700 on the Fort Bend Parkway Toll Road, and approximately 57,000 on the Westpark Tollway. Since 2010, both toll facilities have consistently seen positive growth in transactions. The year-over-year revenue growth on both Fort Bend Parkway and the Westpark Tollway has been increasing at a slightly faster pace than transaction growth. The Fort Bend Parkway toll configuration was modified in early 2015. As a result of the new configuration, the average annual daily transactions for the year 2015 and beyond are not comparable with those prior to the year 2015.

Table 2-2. FBCTRA System Average Annual Daily Transactions (thousands)

Year	Fort Bend Parkway	Westpark Tollway	Total
2010	20.7	43.0	63.7
2011	20.8	45.7	66.5
Change	0.5%	6.3%	4.4%
2012	21.7	48.6	70.3
Change	4.3%	6.3%	5.7%
2013	22.3	52.5	74.8
Change	2.8%	8.0%	6.4%
2014	23.7	57.0	80.7
Change	6.3%	8.6%	7.9%

Table 2-3. FBCTRA System Average Annual Daily Revenue in nominal dollars (thousands)

Year	Fort Bend Parkway	Westpark Tollway	Total
2010	\$21.8	\$25.9	\$47.7
2011	\$22.3	\$27.7	\$49.9
Change	2.1%	6.6%	4.6%
2012	\$24.4	\$30.7	\$55.1
Change	9.6%	10.9%	10.3%
2013	\$25.5	\$34.3	\$59.9
Change	4.7%	12.0%	8.8%
2014	\$27.4	\$37.3	\$64.8
Change	7.4%	8.7%	8.2%

Trends in Monthly Transactions and Toll Revenue

Tables 2-4 through **Table 2-7** show the monthly transactions and potential revenue for each facility from January 2010 through December 2014. As can be seen, the FBCTRA System has seen overall positive growth since 2010, and the toll revenues have seen even higher growth.

Table 2-4. Monthly Transaction Trends - Fort Bend Parkway Toll Road (millions)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2010	0.61	0.60	0.67	0.65	0.65	0.62	0.60	0.63	0.63	0.66	0.61	0.61	7.55
2011	0.61	0.57	0.67	0.64	0.66	0.63	0.60	0.67	0.65	0.67	0.59	0.64	7.60
Change	-0.9%	-4.9%	-0.9%	-1.5%	1.7%	2.6%	0.4%	5.4%	3.7%	1.5%	-4.1%	4.6%	0.7%
2012	0.63	0.61	0.77	0.60	0.78	0.54	0.57	0.80	0.63	0.71	0.65	0.64	7.94
Change	3.5%	7.6%	15.8%	-7.6%	18.1%	-14.8%	-4.8%	20.3%	-3.1%	6.5%	11.2%	-0.1%	4.5%
2013	0.62	0.68	0.69	0.70	0.72	0.64	0.65	0.69	0.68	0.74	0.67	0.68	8.15
Change	-1.4%	11.1%	-11.1%	18.0%	-7.9%	19.1%	13.0%	-14.3%	7.2%	4.1%	3.1%	5.7%	2.7%
2014	0.66	0.67	0.73	0.73	0.75	0.71	0.71	0.72	0.73	0.79	0.70	0.74	8.64
Change	6.5%	-1.5%	5.6%	4.5%	4.6%	10.7%	9.2%	5.3%	7.6%	6.6%	3.3%	9.7%	6.0%

Table 2-5. Monthly Revenue Trends - Fort Bend Parkway Toll Road (millions)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2010	\$0.64	\$0.62	\$0.72	\$0.69	\$0.68	\$0.65	\$0.64	\$0.67	\$0.67	\$0.69	\$0.65	\$0.65	\$7.96
2011	\$0.64	\$0.60	\$0.70	\$0.68	\$0.70	\$0.67	\$0.64	\$0.70	\$0.69	\$0.72	\$0.69	\$0.70	\$8.12
Change	-0.3%	-3.8%	-1.7%	-1.5%	2.0%	2.6%	0.0%	5.2%	3.8%	3.2%	7.2%	8.5%	2.1%
2012	\$0.73	\$0.72	\$0.77	\$0.75	\$0.79	\$0.72	\$0.69	\$0.76	\$0.73	\$0.79	\$0.75	\$0.73	\$8.93
Change	14.0%	19.9%	9.1%	10.6%	13.3%	7.9%	9.1%	8.4%	5.8%	10.8%	7.6%	3.7%	9.9%
2013	\$0.71	\$0.77	\$0.78	\$0.80	\$0.82	\$0.73	\$0.75	\$0.79	\$0.78	\$0.85	\$0.77	\$0.77	\$9.33
Change	-2.0%	8.1%	2.1%	6.4%	4.4%	1.6%	7.8%	3.1%	6.3%	6.9%	2.9%	5.9%	4.5%
2014	\$0.77	\$0.77	\$0.84	\$0.83	\$0.86	\$0.82	\$0.82	\$0.83	\$0.85	\$0.92	\$0.81	\$0.88	\$10.01
Change	8.8%	-0.7%	6.8%	3.7%	4.9%	11.3%	9.5%	6.1%	9.6%	8.7%	5.7%	14.7%	7.4%

Table 2-6. Monthly Transaction Trends - Westpark Tollway (millions)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2010	1.23	1.21	1.40	1.33	1.33	1.30	1.28	1.34	1.32	1.36	1.29	1.32	15.70
2011	1.30	1.19	1.43	1.37	1.40	1.38	1.38	1.48	1.41	1.49	1.44	1.43	16.70
Change	5.7%	-1.4%	2.7%	3.3%	5.2%	5.5%	7.8%	10.0%	7.1%	9.6%	11.5%	8.7%	6.4%
2012	1.40	1.39	1.50	1.45	1.54	1.46	1.43	1.57	1.43	1.63	1.50	1.47	17.77
Change	7.5%	17.0%	4.9%	5.4%	9.9%	5.9%	3.6%	6.5%	1.4%	9.7%	4.2%	2.5%	6.4%
2013	1.44	1.56	1.61	1.61	1.67	1.51	1.59	1.65	1.57	1.74	1.60	1.61	19.16
Change	3.1%	12.1%	6.9%	11.0%	8.1%	3.7%	11.3%	4.8%	9.6%	6.5%	7.0%	10.0%	7.8%
2014	1.62	1.59	1.79	1.77	1.79	1.69	1.73	1.75	1.73	1.88	1.68	1.79	20.80
Change	12.2%	2.3%	11.2%	9.8%	7.2%	11.5%	8.3%	6.5%	10.7%	8.0%	4.7%	10.8%	8.6%

Table 2-7. Monthly Revenue Trends - Westpark Tollway (millions)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2010	\$0.73	\$0.72	\$0.84	\$0.80	\$0.81	\$0.78	\$0.77	\$0.81	\$0.80	\$0.82	\$0.78	\$0.80	\$9.47
2011	\$0.78	\$0.72	\$0.87	\$0.83	\$0.85	\$0.83	\$0.84	\$0.89	\$0.85	\$0.90	\$0.87	\$0.86	\$10.09
Change	7.1%	0.0%	2.7%	3.3%	5.3%	6.2%	8.0%	9.9%	7.1%	9.5%	11.4%	8.7%	6.6%
2012	\$0.87	\$0.87	\$0.94	\$0.90	\$0.96	\$0.91	\$0.90	\$0.98	\$0.90	\$1.04	\$0.98	\$0.96	\$11.22
Change	11.5%	21.0%	8.8%	8.9%	13.5%	9.8%	7.3%	9.8%	5.8%	15.1%	13.0%	11.0%	11.2%
2013	\$0.94	\$1.02	\$1.05	\$1.05	\$1.09	\$0.99	\$1.04	\$1.08	\$1.02	\$1.14	\$1.05	\$1.06	\$12.53
Change	7.6%	17.4%	11.6%	16.4%	13.4%	8.3%	16.3%	10.0%	13.5%	9.9%	6.8%	10.1%	11.7%
2014	\$1.06	\$1.04	\$1.17	\$1.18	\$1.17	\$1.10	\$1.13	\$1.15	\$1.14	\$1.23	\$1.10	\$1.17	\$13.63
Change	12.4%	2.3%	11.3%	11.6%	7.0%	11.4%	8.3%	6.5%	10.8%	8.2%	4.8%	10.8%	8.7%

Average monthly transaction variations on the FBCTRA System facilities for 2014 are presented in **Table 2-8** as an index of the average monthly transactions. As **Table 2-8** indicates, the monthly variations are similar for both facilities. The peak travel month appears to be October for both FBCTRA System toll roads, while January and February were the months with the least traffic for both facilities.

Table 2-8. FBCTRA System Monthly Transaction Index for 2014

Month	Fort Bend Parkway	Westpark Tollway
January	92	93
February	93	92
March	101	103
April	102	102
May	105	103
June	99	97
July	98	100
August	100	101
September	102	100
October	110	108
November	97	97
December	103	103
Average	100	100

Traffic Count Program

CDM Smith embarked on a comprehensive traffic count program in the FBCTRA System area to assist with the base year calibration of the Houston-Galveston Area Council (H-GAC) travel demand model. This included counts along both the Fort Bend Parkway Toll Road and the Westpark Tollway corridors. The traffic count program included a series of screenlines. The locations of the traffic count screenlines are shown in **Figure 2-4** – the screenlines related to the Westpark Tollway corridor are indicated by the red lines on the map, and the screenlines for the Fort Bend Parkway Toll Road corridor are shown in blue. Traffic counts from the transactions data were obtained from FBCTRA for all of the existing mainline toll gantries. In addition, traffic counts were collected at the ramps in both toll corridors and at a few strategic locations along the corridors including service roads and mainlanes.

To collect the traffic counts, CDM Smith engaged the services of CJ Hensch & Associates, Inc. and GRAM Traffic. All the counts on the toll roads and on screenlines were conducted for a continuous 48-hour period on interior weekdays only (Tuesday, Wednesday and Thursday). By combining the toll gantry transaction data and counts on toll road mainlines and ramps, CDM Smith estimated an average weekday traffic profile for the both the Fort Bend Parkway Toll Road and the Westpark Tollway. The average weekday profile also reflected AM, PM, midday and overnight traffic volumes. The data from the traffic count program were then used to calibrate the travel demand model.

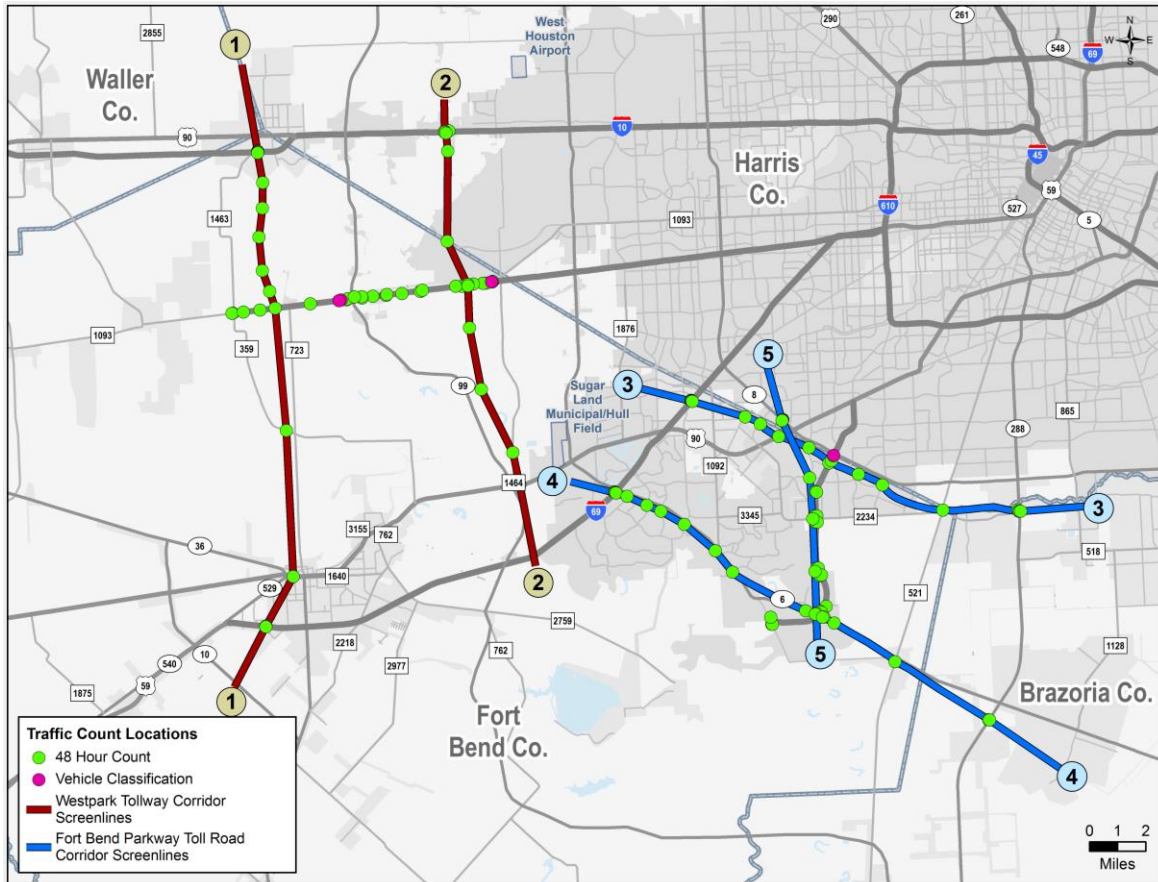


Figure 2-4. Traffic Count and Screenline Count Locations

Screenline 1 is a north-south screenline, and it crosses the western end of the proposed Westpark Tollway corridor, FM 1093, to the west of FM 793. Screenline 2 is also a north-south screenline that crosses the Westpark Tollway at the Westmoor Gantry. Screenline 3 crosses the Fort Bend Parkway Toll Road just to the southwest of the Fort Bend and Harris county line. Screenline 4 also crosses the Fort Bend Parkway Toll Road and lies just to the west of SH 6. Screenline 5 lies to the west of the Fort Bend Parkway Toll Road. A summary of the screenline traffic volumes is presented in **Table 2-9**.

Table 2-9. Screenline Traffic Profile Summary

Screenline	Total Screenline Volume							
	AM Peak		PM Peak		Off Peak		Daily Total	
	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB
1	20,217	19,415	30,587	31,482	58,297	58,546	109,101	109,442
2	59,517	25,744	49,446	78,625	118,646	110,818	227,608	215,187
3	81,878	41,201	76,750	95,937	166,702	143,903	325,330	281,040
4	55,046	29,380	60,231	65,764	124,358	110,504	236,444	202,911
5	29,688	32,232	46,559	43,766	70,723	66,381	146,969	142,378

Figures 2-5 through 2-9 show the profile for both travel directions on the Fort Bend Parkway Toll Road and the Westpark Tollway respectively for four time periods (these periods correspond with the time periods in the H-GAC regional travel demand model). The AM peak period is from 6:00 AM to 9:00 AM (3 hours), the mid-day period is from 9:00 AM to 3:00 PM (6 hours), the PM peak period is from 3:00 PM to 7:00 PM (4 hours), and the remaining hours constitute the overnight period from 7:00 PM to 6:00 AM (11 hours).

Fort Bend Parkway Toll Road

The northbound traffic on the Fort Bend Parkway Toll Road peaks in the AM peak period and reflects the movement of traffic from the residential suburbs in Fort Bend County to the employment centers in Houston and Harris County. During the AM peak period, the highest volume of traffic occurs at the Fondren Gantry. During the other time periods, the highest volume is seen just to the north of SH 6.

In the southbound direction the Fort Bend Parkway Toll Road peaks in the PM peak period, which is expected given the high AM peak volumes in the northbound direction. The highest level of traffic in the southbound direction occurs at the McHard Toll Gantry throughout the day.

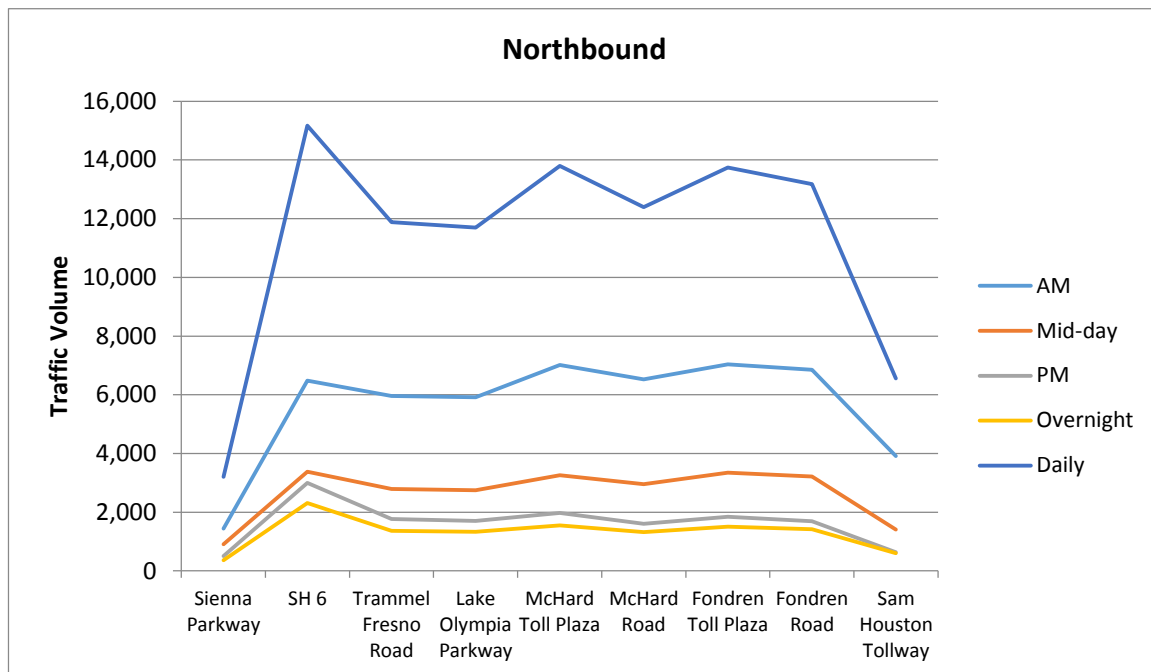


Figure 2-5. Fort Bend Parkway Toll Road Northbound Traffic Volume Profile

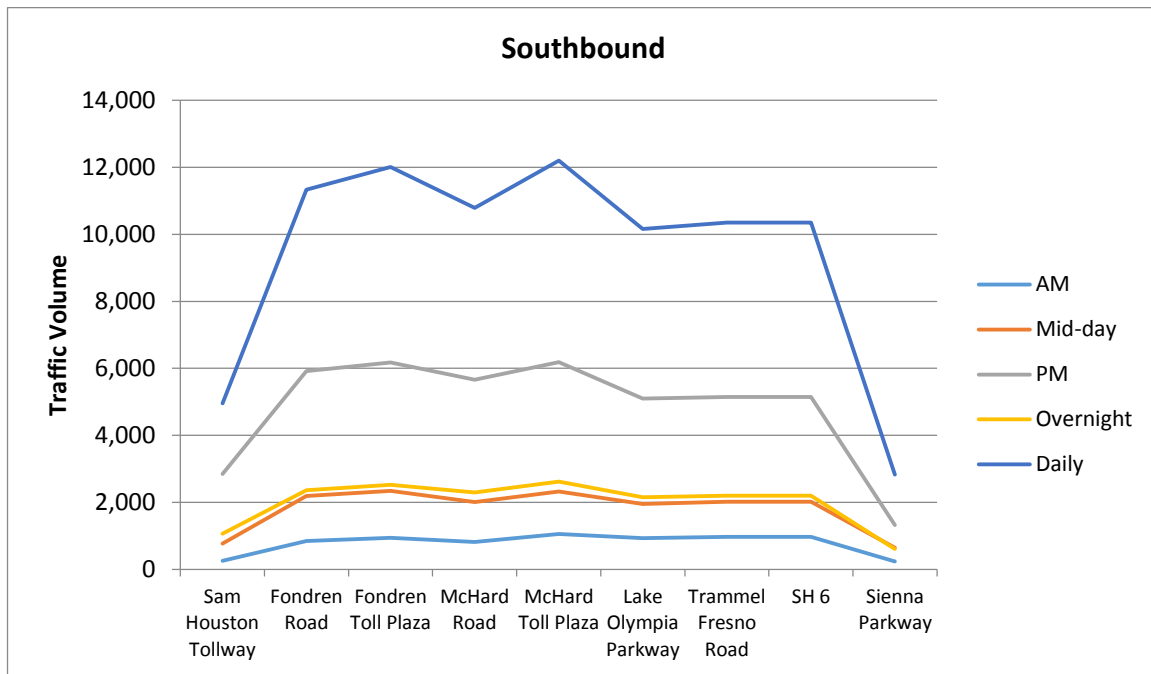


Figure 2-6. Fort Bend Parkway Toll Road Southbound Traffic Volume Profile

Westpark Tollway

The eastbound traffic on the Westpark Tollway peaks in the AM peak period, which reflects the movement of traffic from residential areas of Fort Bend County into the employment centers in Harris County. During the AM peak, the highest volume of traffic occurs at the Westmoor Gantry. During the other time periods the highest volume is seen just to the west of the Grand Parkway.

In the westbound direction the Westpark Tollway peaks in the PM peak period, which is expected given the high AM peak volumes in the eastbound direction. During the PM peak the highest volume of traffic also occurs at the Westmoor Gantry. The highest level of traffic in the westbound direction for the other time periods occurs to the west of the Grand Parkway.

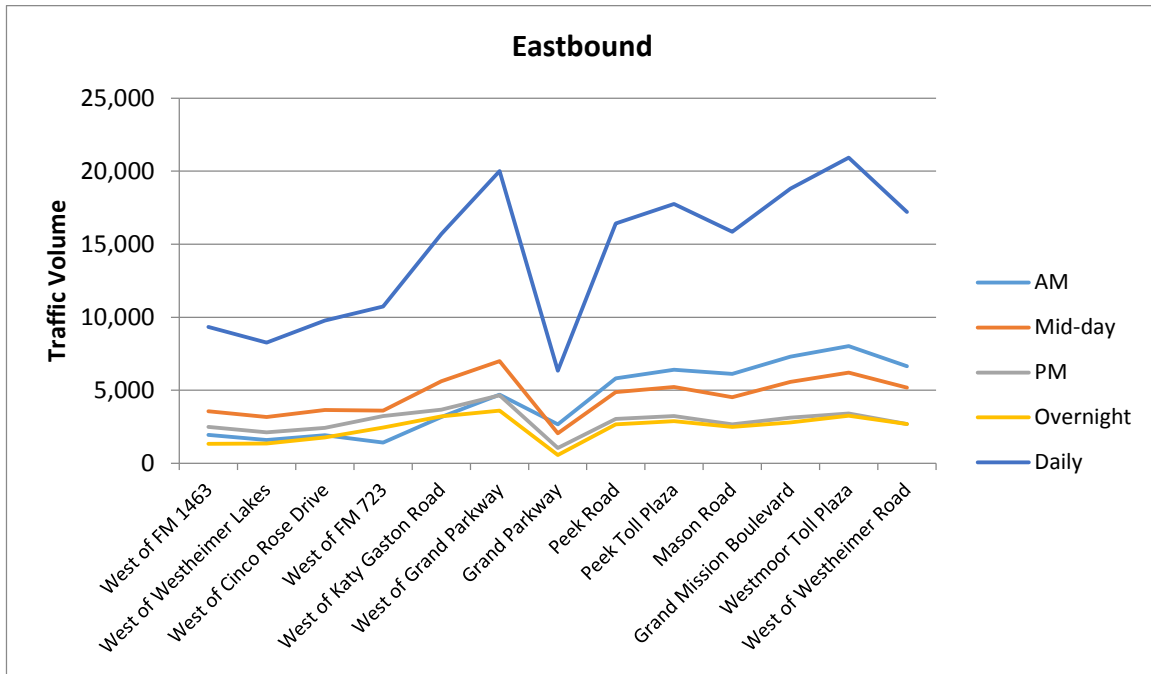


Figure 2-7. Westpark Tollway Eastbound Traffic Volume Profile

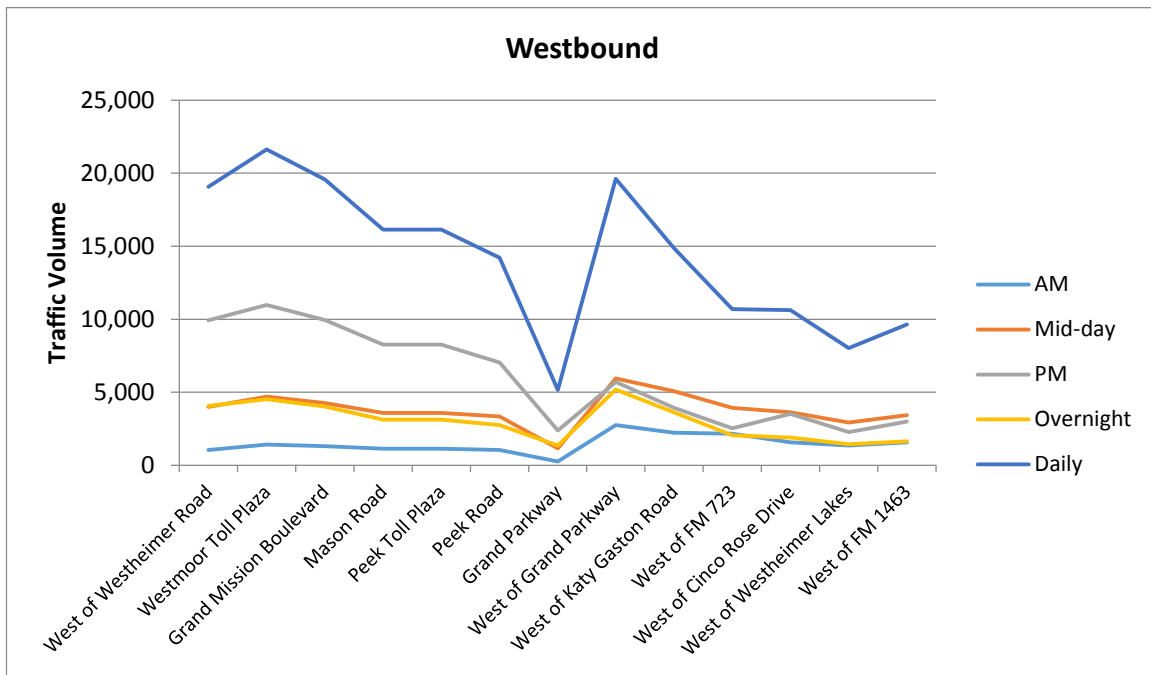


Figure 2-8. Westpark Tollway Westbound Traffic Volume Profile

Average Weekday Transactions by Location

Figures 2-9 and 2-10 show the average weekday transactions in 2014 (from January through December) at each of the toll gantries on the Fort Bend Parkway Toll Road and the Westpark Tollway. The highest number of transactions on the Fort Bend Parkway Toll Road occurred at the Fondren Gantry, and the highest number on Westpark Tollway occurred at the Westmoor Gantry.

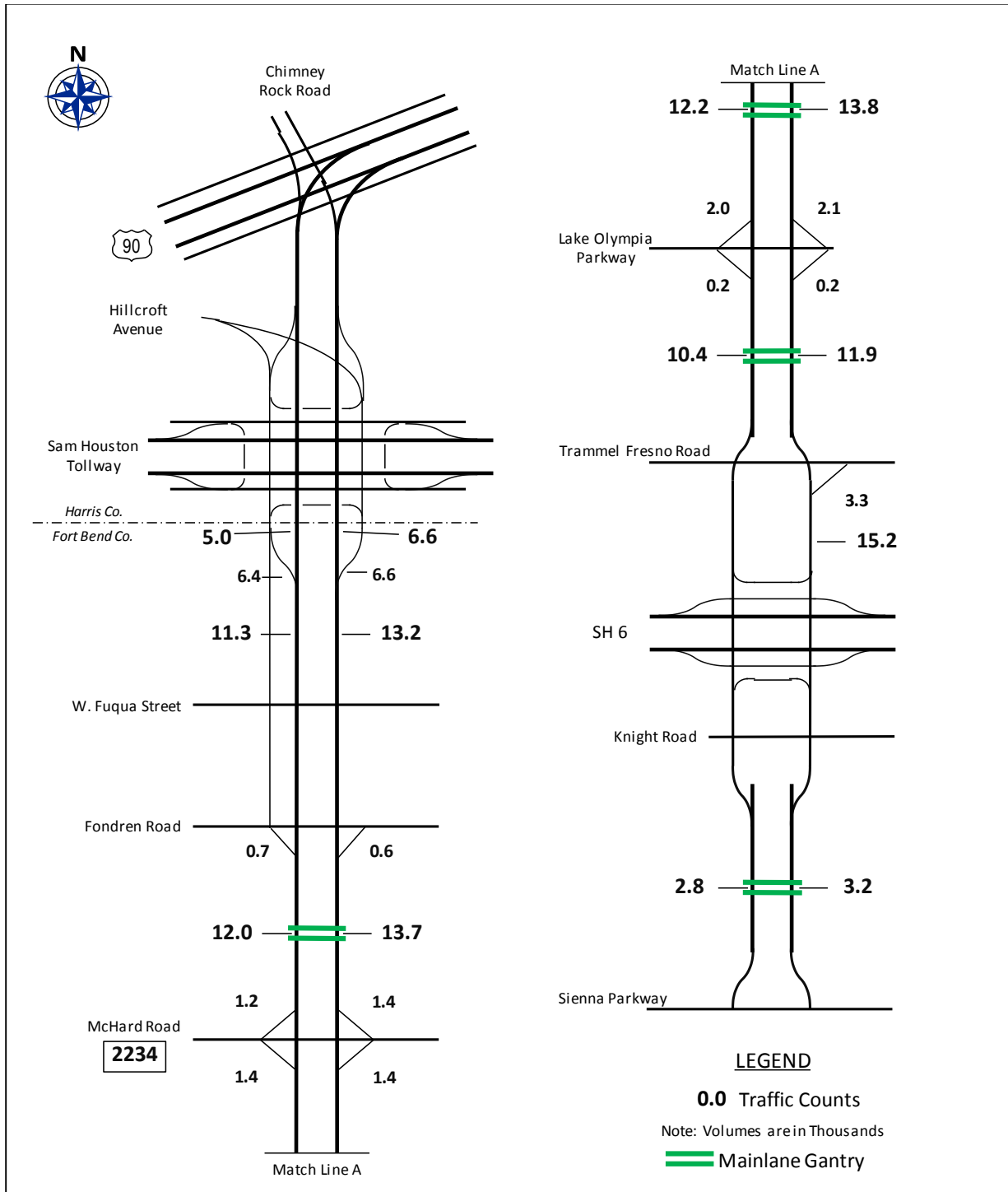


Figure 2-9. Fort Bend Parkway Toll Road 2014 Average Weekday Transactions by Location

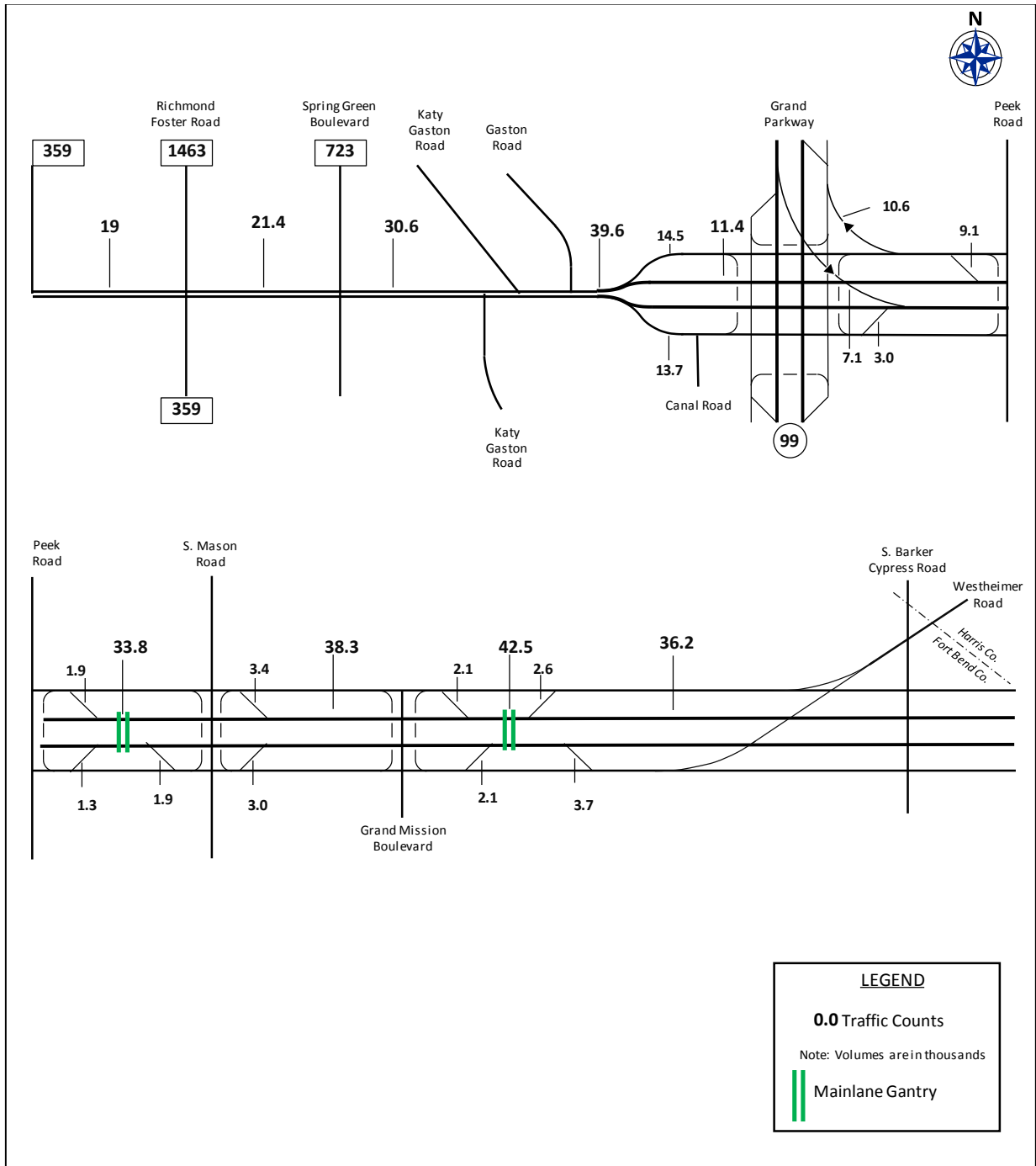


Figure 2-10. Westpark Tollway 2014 Average Weekday Transactions by Location

Travel Time Characteristics

The evaluation of a toll facility’s future traffic and revenue requires knowledge of the current travel time characteristics of the major roadways in the project area. For the current study, travel time data was collected by two methods. The primary source was historical travel data obtained from INRIX, Inc., a traffic data company based in Washington State that maintains an archive of travel speed data for thousands of roadways across the United States accumulated from GPS-enabled devices along the

highway network. INRIX is a Data as a Service (DaaS) company that monitors traffic flow along approximately 260,000 miles of major freeways, highways, urban and rural arterials, and side streets in the United States. This data provides historical as well as real-time traffic data seven days a week, 24 hours a day in as little as 5 minute increments for all metro areas with a population of more than one million. They were engaged to provide a series of travel speed data for several roadways within the study area.

INRIX obtains its data via crowd sourcing and collects travel speed information from various probes; including anonymous cell phones/smartphones and vehicles equipped with global positioning system (GPS) devices (trucks, delivery vans, transit vehicles, etc.). The collected data is then processed in real-time to create traffic speed information along most of the major roadways. The real-time travel speed data is normalized to account for parameters that affect traffic flow conditions, such as weather forecasts, school schedules, special events, accidents, seasonal variation, and road construction.

INRIX data for several limited access roadways and arterials in the two study corridors was purchased, and average weekday travel time data was summarized.

For routes within the proposed study area currently not captured by INRIX, the data was supplemented using GPS-based route reconnaissance for a few selected routes. The time and location of each vehicle on the study routes was gathered using a GPS device at regular intervals, and the operating speeds were then calculated. This information was used to calibrate the output speeds from the travel demand model to the existing conditions on those highway facilities.

In addition to FBCTRA's toll facilities, travel time analysis was also derived from INRIX data on several local arterials that compete directly with the FBCTRA System facilities. The summarized travel time data provided an indication of the fluctuation in operating speed throughout the area and the relationship between demand and congestion levels. The GPS-based data was collected the week of May 18, 2015.

Table 2-10 lists the travel time routes for which data was collected in the study corridor. The results from the travel time runs derived from INRIX data are presented graphically in **Figures 2-11** through **2-13** for the major freeways and toll roads in the study area for the AM, mid-day and PM periods. Similarly, **Figures 2-14, 2-15** and **2-16** illustrate the actual travel speeds from INRIX data for various arterials in the corridor for the AM, mid-day and PM periods.

The typical peak period speeds in each direction on other facilities (for which INRIX did not have travel time data) for the AM peak and PM peak periods were collected using GPS-based speed delay runs. The results from the AM and PM period travel time data estimated from GPS data are presented graphically in **Figures 2-17** and **2-18**.

Table 2-10. FBCTRA System Travel Speed Routes

Corridor/Roadway	From	To
Fort Bend Parkway Toll Road	Alt US 90	SH 6
FM 1093/Westpark Tollway	FM 359	Beltway 8
IH 10	FM 1463	Beltway 8
IH 69	FM 762	Beltway 8
SH 288	Beltway 8	SH 6
Alternate US 90	Beltway 8	FM 762
SH 99 Grand Parkway	IH 10	IH 69
SH 6	IH 10	SH 288
FM 359 north of FM 1093	IH 10	FM 1093
Cinco Ranch Boulevard	FM 1463	Peek Road
Westheimer Road	Westpark Tollway	Beltway 8
Peek Road	Grand Parkway	FM 1093
FM 1464	SH 99	FM 1093
Grand Mission/Harlem Road	Alt US 90	FM 1093
FM 723	Alt US 90	FM 1093
Kingsland Blvd	Grand Parkway	IH 10
Beltway 8/Sam Houston Tollway	IH 10	SH 288
FM 521	Beltway 8	SH 6

For both the toll roads in Fort Bend County, the observed speeds appear to be close to free flow speeds with little to no delay at any time through the day. On the Westpark Tollway, there is some delay to the east of the Sam Houston Tollway in Harris County in the eastbound direction in the AM peak and somewhat less severe in the westbound direction during PM peak.

In general, on the competing routes in both corridors slower speeds are observed in AM peak heading towards Harris County and in the PM peak heading back in the westbound or southbound directions away from Harris County.

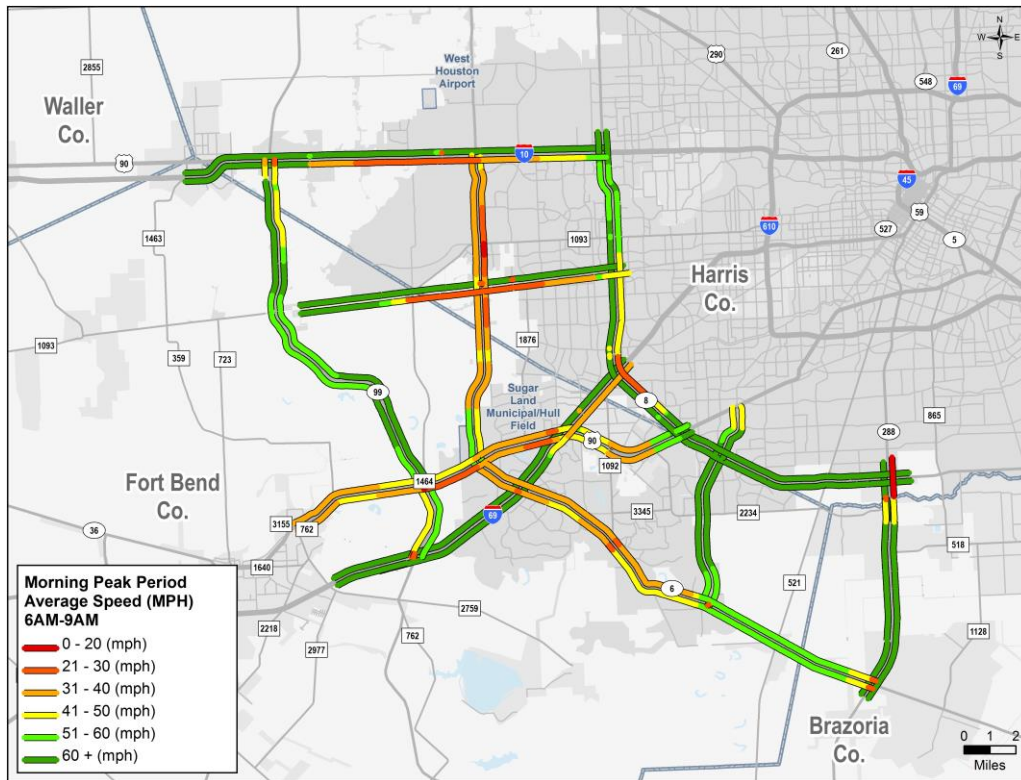


Figure 2-11. Travel Time Results from INRIX for Freeways and Toll Roads: AM Peak

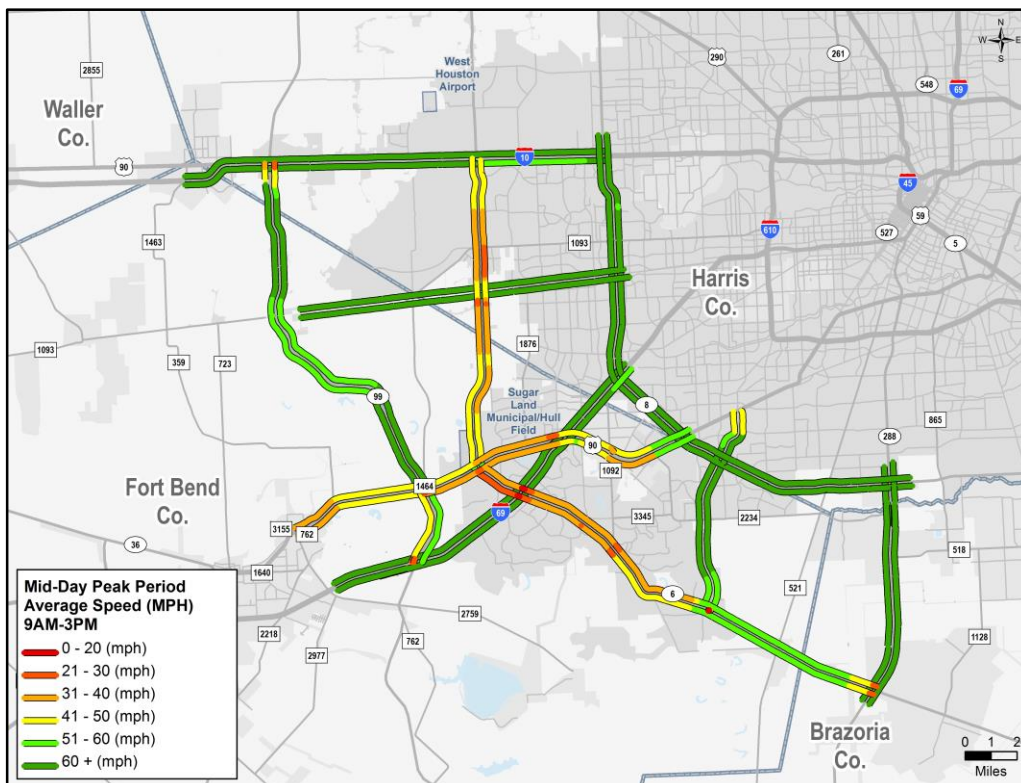


Figure 2-12. Travel Time Results from INRIX for Freeways and Toll Roads: Mid-Day Period

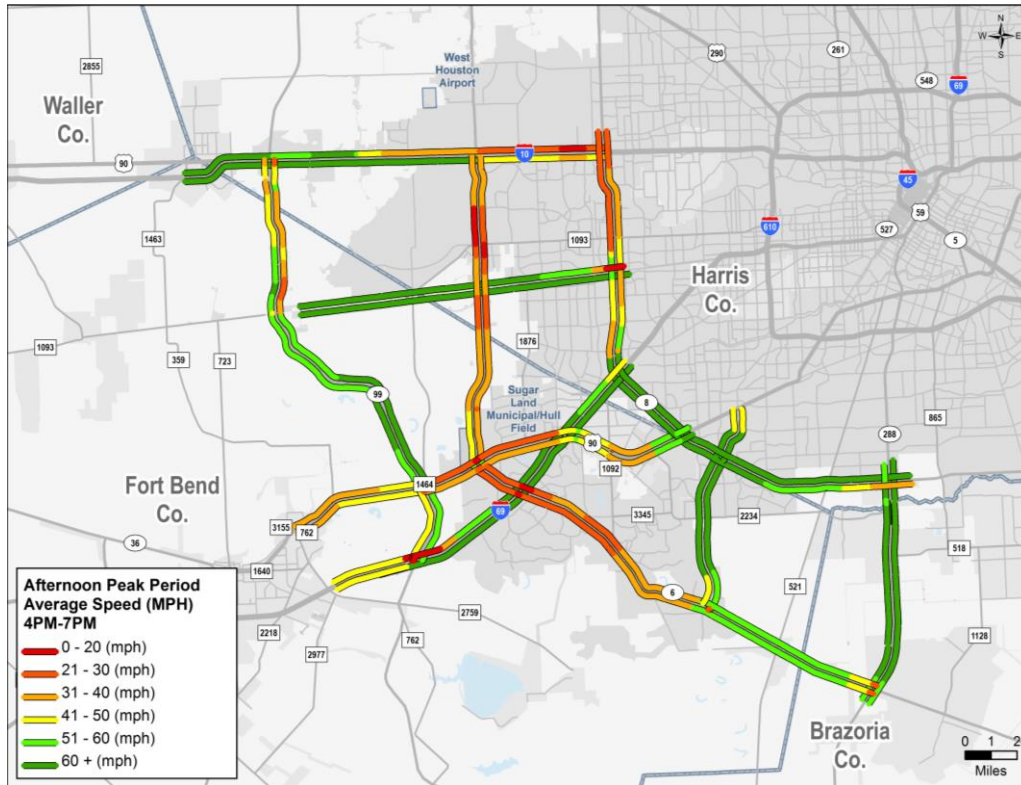


Figure 2-13. Travel Time Results from INRIX for Freeways and Toll Roads: PM Peak

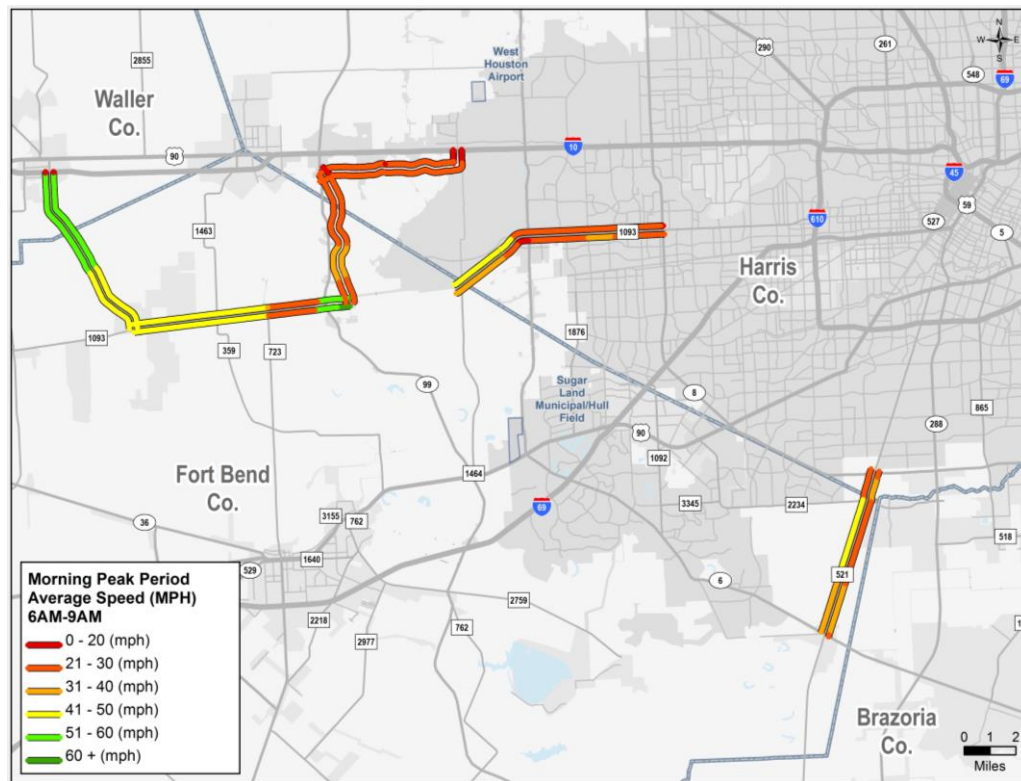


Figure 2-14. Travel Time Results from INRIX for Arterials: AM Peak

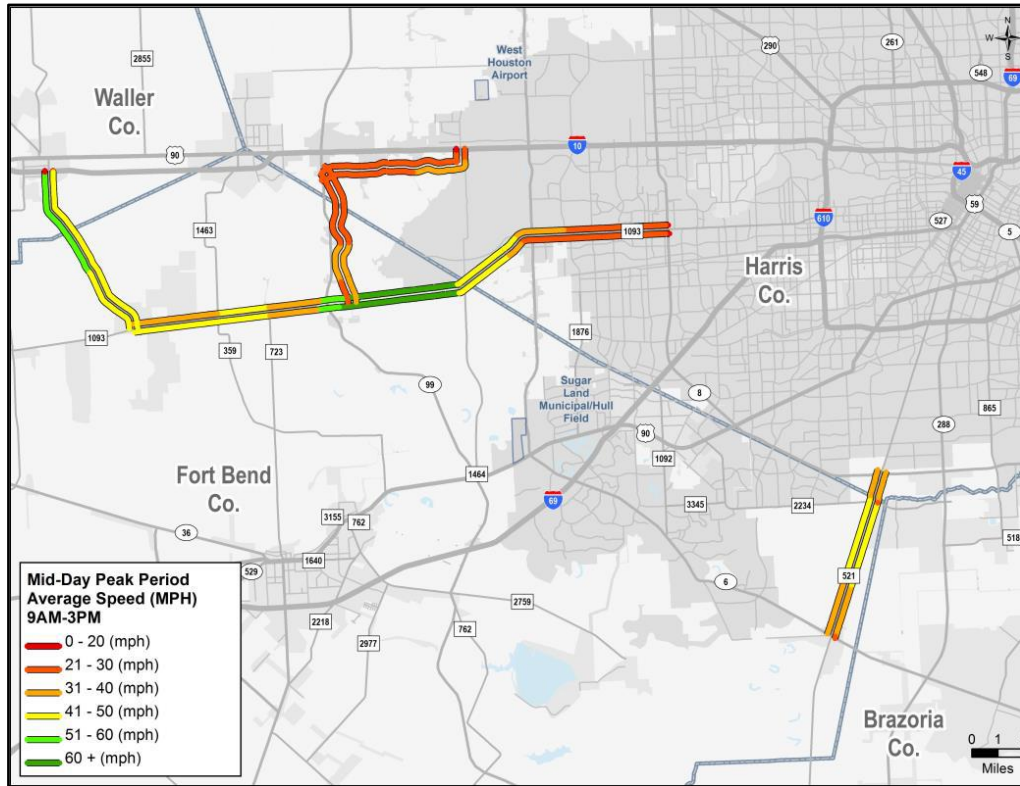


Figure 2-15. Travel Time Results from INRIX for Arterials: Mid-Day Period

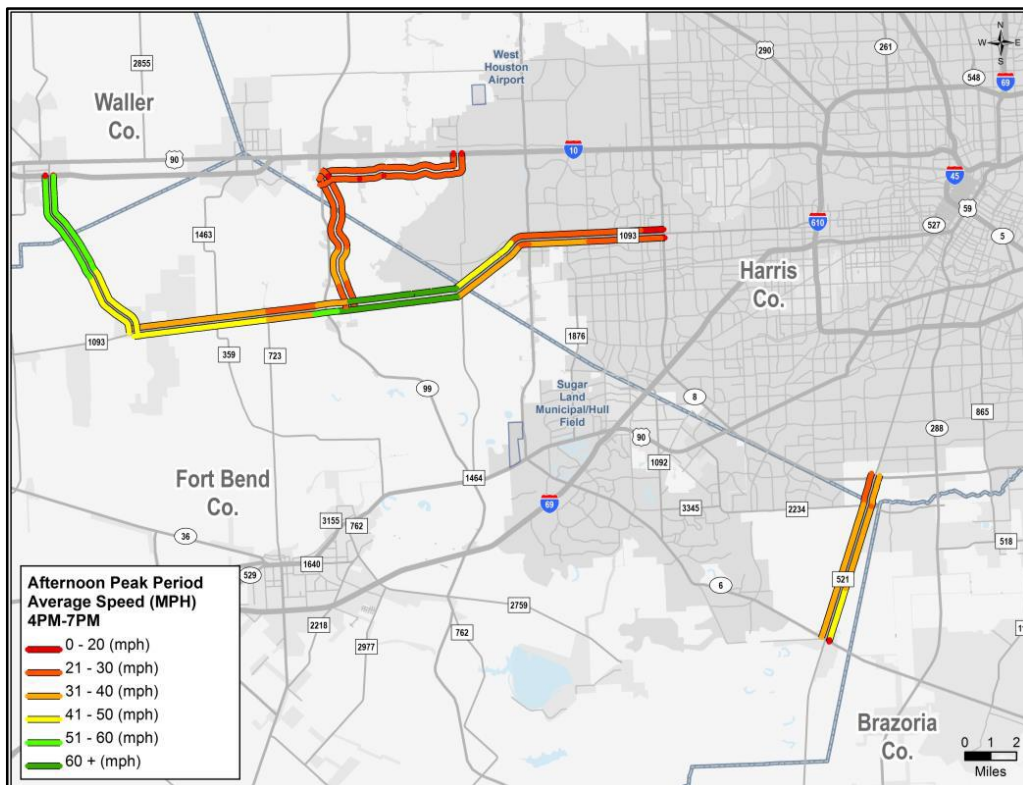


Figure 2-16. Travel Time Results from INRIX for Arterials: PM Peak Hour

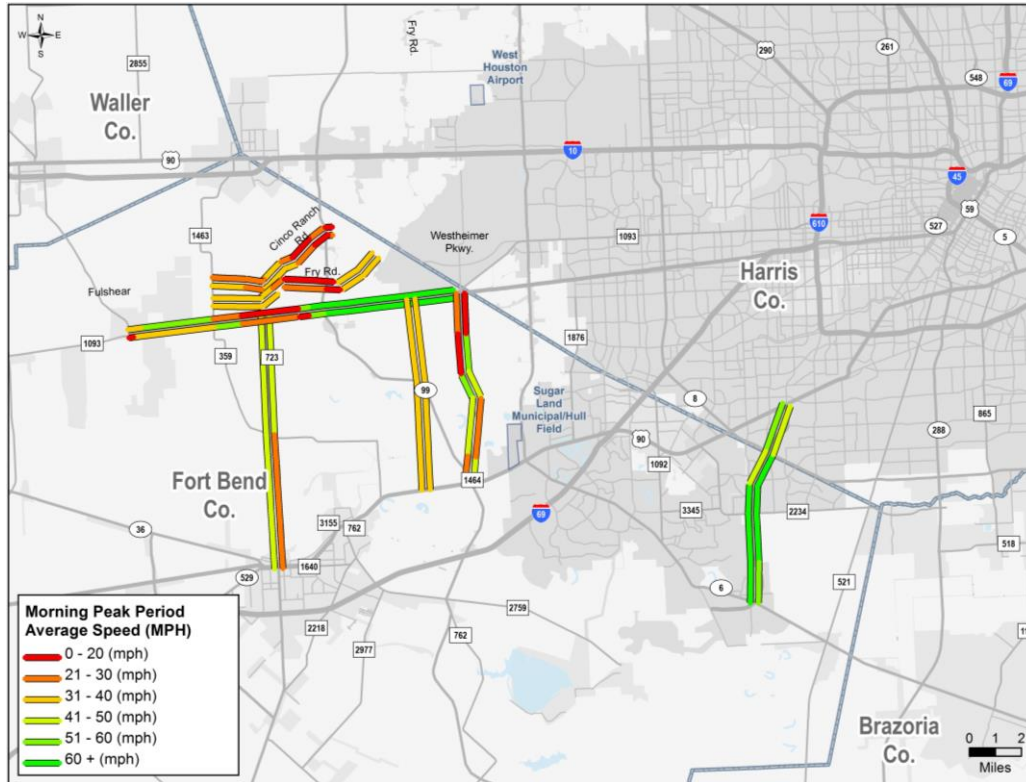


Figure 2-17. Travel Time Results from GPS units: AM Peak Hour

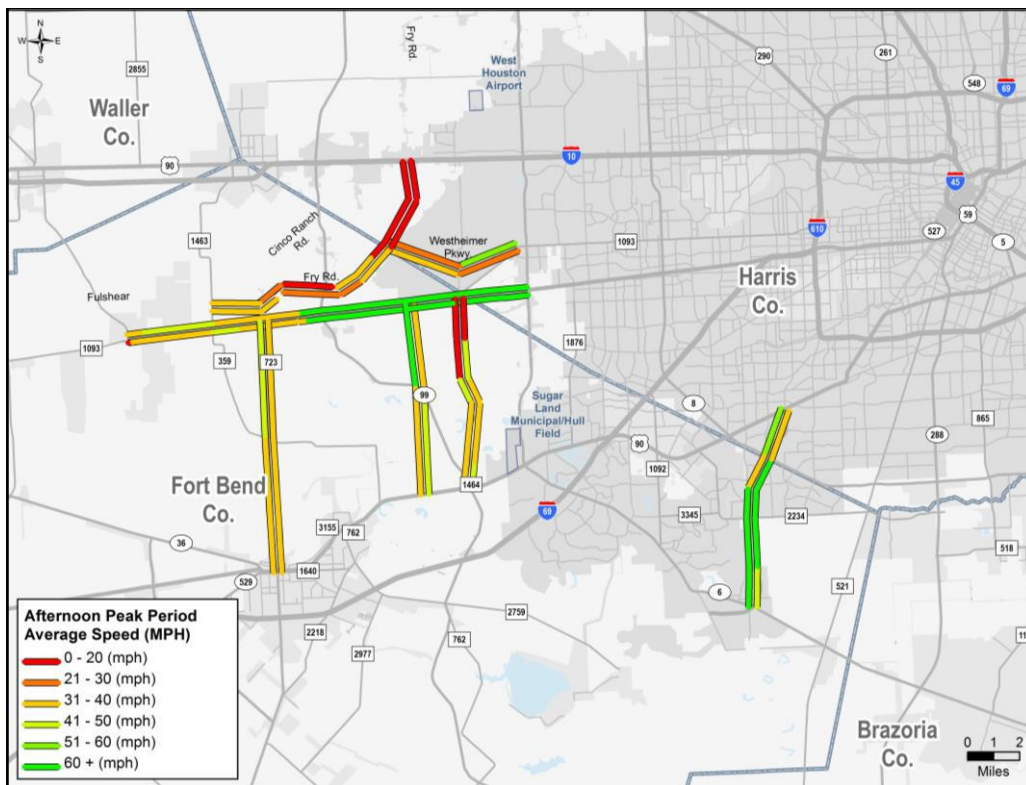


Figure 2-18. Travel Time Results from GPS units: PM Peak Hour

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Chapter 3

Regional Demographic and Economic Trends

The distribution and growth of population, households, and employment have a significant impact on the initial and continued feasibility of a toll facility. The forecasts of these indicators are a key input for the trip generation step in building travel demand model trip tables. These trip tables are the foundation of the travel demand model in key forecasting years and correspondingly affect the future traffic and revenue estimates. It is therefore critical to carefully review these underlying demographic assumptions. Houston-Galveston Area Council (H-GAC) develops the official demographic forecasts for the greater Houston metropolitan area.

This chapter is organized into the following sections:

- H-GAC Demographic Forecasting Process
- Historical and Future Regional Growth
- Socioeconomic Indicators
- Evaluation of H-GAC Forecasts
- Summary of Independent Socioeconomic Review

H-GAC Demographic Forecasting Process

The H-GAC demographic forecasting process involved two major phases. In Phase I, the county-level control totals for population and employment were developed. In Phase II, growth was allocated to specific areas within each county.

The development of the county control totals (Phase I) was a multi-step process. H-GAC first developed forecasts of the total population in the region using a national population projection from the U.S. Census Bureau and applied to it the projection of the region's share in the total U.S. population. In the next step, it allocated the regional population forecast to the counties using the shares from the population growth scenarios developed by the Office of the State Demographer. Then it developed the forecast for the number of households from the ethnic and age compositions of the forecasted county populations and demographic statistical relationships obtained from the Census data. The regional employment forecast was driven by the available future population in the working age group. The regional employment forecast was allocated to the counties using projected shares of the regional employment.

In Phase II, H-GAC used a land use forecasting and simulation model to allocate projected growth. The model analyzed land use dynamics, and determined statistical relationships between different types of land uses and various factors such as proximity to population and employment, land values and accessibility over the transportation network. Based on the information, the model made predictions about the likelihood of land use change in each grid cell. The model simulated the real estate development market by selecting certain locations and "building" new housing units and job slots (non-residential square footage) in them. Then, the model simulated the housing and employment markets by placing new households and jobs (defined by the county control totals from Phase I) into available housing and job locations.

The official regional socioeconomic forecasts used in the regional travel demand model were prepared using the process defined in preceding two paragraphs. The 2040 Regional Growth Forecasts presented estimates for population, households, and employment in the eight-county area encompassing Houston area, namely Harris, Fort Bend, Waller, Montgomery, Liberty, Chambers, Galveston, and Brazoria counties. Additionally, as part of this study, an independent firm, Community Development Strategies (CDS) Market Research was retained to conduct an independent analysis of the validity of the socioeconomic data that was used in conjunction with the H-GAC Regional Planning Model to forecast future travel demand in the Houston-Galveston area. In particular, the independent economist focused on the area of influence of the FBCTRA facilities. A separate report was prepared by CDS and is included as **Appendix A** of this report. The population and employment forecast totals are presented in **Table 3-1**.

Table 3-1. Population and Employment Forecast Totals

	2010	2020	2030	2040
TSDC Population Scenario 0.0	5,891,999	6,404,173	6,804,024	6,959,460
TSDC Population Scenario 0.5	5,891,999	6,865,178	7,886,965	8,405,044
TSDC Population Scenario 1.0	5,891,999	7,376,672	9,232,149	10,296,493
HGAC Population Forecast	5,809,869	7,222,074	8,633,186	10,018,940
HGAC Employment Forecast	2,742,616	3,393,918	3,925,289	4,458,904

Source: Texas State Data Center, 2014 Population Projection, HGAC 2040 Regional Growth Projection 2015 Q1

The following section of the chapter provides a summary of the historical and future demographic and economic growth from various sources. This includes summaries of the CDS findings and the adjusted socio-economic forecast used for the base case traffic and revenue estimates.

Historical and Future Regional Growth

A review of historical trends of the region's economic indicators was performed to assess growth patterns in the Houston-Galveston area. This sub-section summarizes the past socio-economic trends in the region for variables like population and employment.

The eight counties served by H-GAC include Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller. **Figure 3-1** illustrates the geographical location of these counties which are included in the H-GAC travel demand model area. The analysis of the future demographic growth from a regional perspective is based on information pertaining to population, employment, and income for these eight counties.

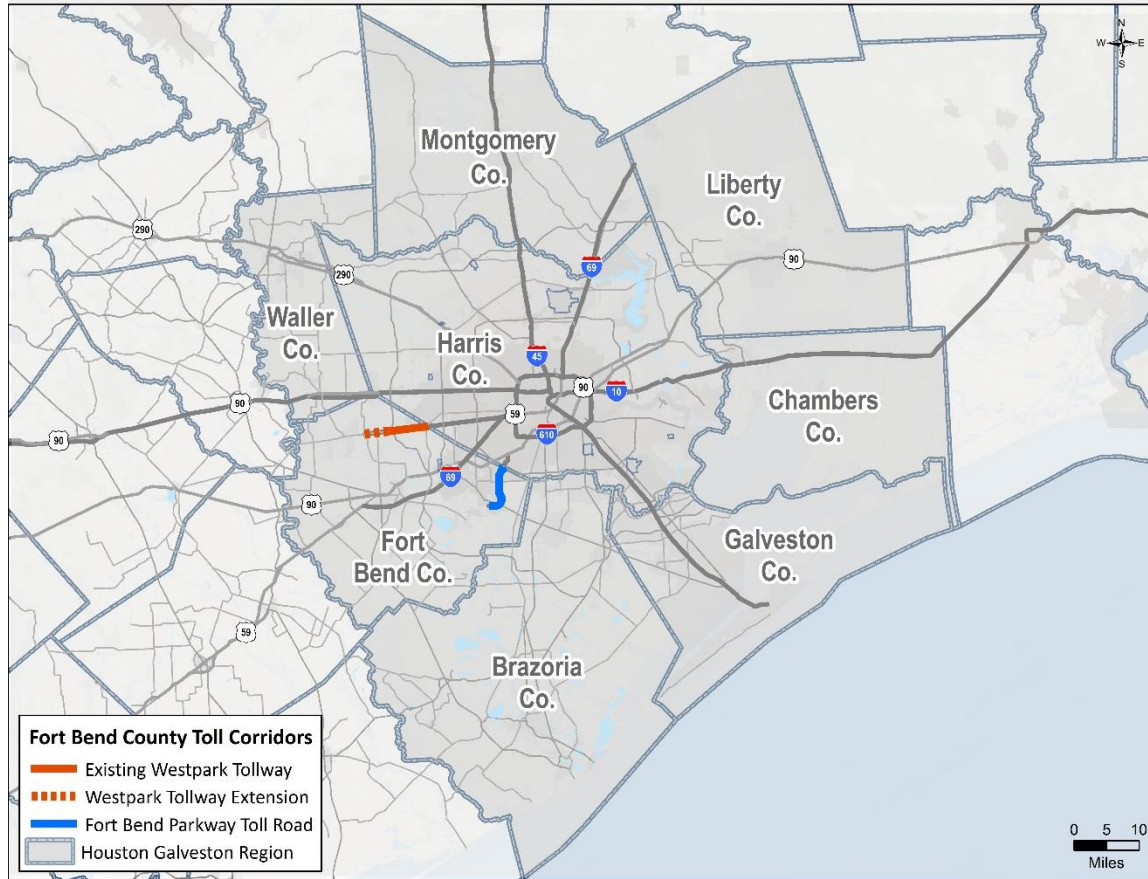


Figure 3-1. H-GAC Planning Area

Historical Regional Population Trends

Table 3-2 shows the historical population totals and trends for Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller counties in the Houston-Galveston region. It also includes the totals for the eight-county area, the state of Texas and the United States. The total population has increased by an average annual growth rate of 2.5 percent from 1970 to 2010 for the eight-county region, adding approximately 3.71 million new residents to the area.

The eight-county region added almost one million people between 1970 and 1980. The rate of growth was substantially reduced by major economic recession and restructuring which occurred in the mid-1980s as a result of falling oil prices and an over-dependency on the petroleum industry within the Houston economy. Subsequent to that economic downturn, the greater Houston region emerged as a much more diverse economy and strong growth resumed in the 1990s and the first ten years of the new century.

The most populous county is Harris County. In the 40 years between 1970 and 2010, Harris County added over 2.4 million additional residents, an overall rate of growth of 2.2 percent per year. According to Census 2010, more than four million people lived in Harris County, out of 5.9 million in the total eight-county region.

The most rapidly growing counties are Fort Bend and Montgomery, averaging about six percent per year in growth from 1970 to 2010. Both of these counties had populations in the range of 50,000

residents in 1970; today Fort Bend County has more than eleven times that amount while Montgomery County has over 455,000 residents. Fort Bend County has had consistent long-term growth, even during the 1980's (after the fall of the oil market, which had a devastating impact on the Houston area's economy). In the past decade Fort Bend County had the highest rate of population growth of 5.1 percent per annum.

Population growth is one of the principal measures of the economic vitality of any area because increasing population is generally the result of more jobs, a high level of immigration and a stable or expanding economy.

From 1970 to 2010, population in the eight-county region has grown from 2.2 million to 5.9 million. This corresponds to an annual compound growth rate of 2.5 percent per year. Population growth is made up of three primary components – natural increase (births minus deaths); domestic migration (from within the U.S.); and international migration (from outside the U.S.). The net in-migration, which is calculated based on the persons “moving in” versus those “moving out”, has accounted for almost 50 percent of the growth in Houston Metropolitan Statistical Area (MSA) population over the 2000-2011 period (according to U.S. Census Bureau). International migration comprised of 29.1 percent of the total net change while domestic migration made up a share of 21.7 percent of the net change in population in the region.

Future Regional Population Growth

Also included in **Table 3-2** are the revised population forecasts provided by CDS based on the H-GAC 2040 Regional Growth Forecast. Population in the eight-county region is expected to increase from 5.9 million in 2010 to 9.7 million by 2040, corresponding to an annual average growth rate of 1.7 percent. This annual growth rate for the eight-county region is anticipated to be higher than the annual growth rate for both the state and the nation, which are expected to be 1.3 percent and 0.7 percent, respectively. The forecasted growth rate of 1.7 percent for the eight-county region is expected to be lower than the historical 1980-2010 growth rate of 2.1 percent.

Harris County's population is expected to grow by an annual rate of 1.0 percent between 2010 and 2040, from 4.1 million in 2010 to 5.5 million in 2040. The additional 1.4 million residents expected in Harris County represent the highest number of residents for any county in the eight-county area during the period. It is expected to be followed by Fort Bend County with a 700,000 increase in resident population.

The year 2040 population distributions for each of the counties in the eight-county area are also presented in **Table 3-2**. As in 2010, Harris County will continue to be the largest population center in the eight-county area. However, the share of the Harris County population of the total population is expected to decrease to 56.5 percent in 2040 from 72.8 percent in 2010. The population growth in Fort Bend and Montgomery counties absorbs a major share of the population distribution change.

Table 3-2. Countywide Population Trends and Projections

County	US Census Bureau				CDS FBCTRA Demographic Forecast (June 2015)
	Year 1980	Year 1990	Year 2000	Year 2010	Year 2040
Brazoria	169,587	191,707	241,767	313,166	682,679
Chambers	18,538	20,088	26,031	35,096	86,709
Fort Bend	130,846	225,421	354,452	585,375	1,330,687
Galveston	195,940	217,399	250,158	291,309	574,510
Harris	2,409,547	2,818,199	3,400,578	4,092,459	5,501,038
Liberty	47,088	52,726	70,154	75,643	223,924
Montgomery	128,487	182,201	293,768	455,746	1,130,470
Waller	19,798	23,390	32,663	43,205	198,942
Eight-County Area	3,119,831	3,731,131	4,669,571	5,891,999	9,728,959
State of Texas	14,229,191	16,986,510	20,851,820	25,145,561	36,550,595
United States	226,545,805	248,709,873	281,421,906	308,745,538	380,219,000
County	Annual Growth (1980-2010)		Percent Population Distribution By County		Share of New Growth (2010-2040)
	1980-2010	2010-2040	2010	2040	
Brazoria	2.1%	2.6%	5.2%	7.0%	9.6%
Chambers	2.2%	3.1%	0.6%	0.9%	1.3%
Fort Bend	5.1%	2.8%	7.6%	13.7%	19.4%
Galveston	1.3%	2.3%	5.4%	5.9%	7.4%
Harris	1.8%	1.0%	72.8%	56.5%	36.7%
Liberty	1.6%	3.7%	1.5%	2.3%	3.9%
Montgomery	4.3%	3.1%	6.3%	11.6%	17.6%
Waller	2.6%	5.2%	0.7%	2.0%	4.1%
Eight-County Area	2.1%	1.7%	100.0%	100.0%	100.0%
State of Texas	1.9%	1.3%	N/A	N/A	N/A
United States	1.0%	0.7%	N/A	N/A	N/A

Source: US Census Bureau, Texas State Data Center, U.S. Census 2014 National Population Projections, CDS population forecast

Historical Regional Employment Trends

Employment statistics are used as relative indicators of trip attractions to an area. Intense employment growth in an area indicates the potential for an increase in the demand for transportation infrastructure. Historical employment trends by county in the H-GAC area are shown in **Table 3-3**. Between 1990 and 2010, employment in the eight-county area increased at an annual rate of 1.7 percent, which was higher than the employment growth rate in the nation but lower than the state's.

Considering the entire Houston Metropolitan Area, there has been an increase in employment of almost a quarter of a million jobs between 2000 and 2010. This represents an annual growth rate of 1.1 percent for the ten year period. The greatest increases occurred in the far southwest (Fort Bend County) and far northwest (Montgomery County), with ten-year growth rates of about 46 percent and 60 percent respectively. The counties of Fort Bend and Montgomery maintained higher annual growth rates of 5.1

percent and 5.7 percent, respectively, compared to the other six counties. Employment distributions by county are also shown in **Table 3-3**. Harris County incorporates the bulk of the employment centers in the eight-county area, encompassing 80.5 percent of the region's total employment in 2010. **Figure 3-2** shows historical unemployment rates for Houston and the US. As can be seen, Houston has been performing better than the rest of the nation in terms of unemployment rates since 2007.

Future Regional Employment Trends

Table 3-3 also shows the CDS revised employment forecast for the year 2010 and 2040. Harris County will continue to be the major employment center in the region and is expected to add an additional 820,000 jobs between 2010 and 2040. Harris County employment is expected to increase from 2.0 million in 2010 to 2.8 million in 2040 at an annual growth rate of 1.1 percent. Harris County is expected to house 47.9 percent of the total additional jobs in the eight-county area by 2040.

Between 2010 and 2040, 1.7 million additional jobs are expected to be added in the eight-county area, at an annual average growth rate of 1.7 percent. **Table 3-3** also presents year 2040 employment distributions for the eight-county area. The major employment concentrations are expected to continue to be located in Harris County. However, Montgomery and Fort Bend Counties will approximately double their share in the employment distribution.

Table 3-3. Countywide Employment Trends and Projections

County	Historical Employment		CDS FBCTRA Forecast (June 2015)		
	Year 1990	Year 2000	Year 2010	Year 2040	
Brazoria	70,950	77,472	87,610	166,077	
Chambers	6,048	8,288	9,639	32,821	
Fort Bend	50,546	99,768	135,987	450,286	
Galveston	80,224	94,138	96,169	170,714	
Harris	1,539,045	1,855,051	2,027,193	2,847,443	
Liberty	14,251	17,901	16,492	62,106	
Montgomery	43,268	89,634	129,959	445,342	
Waller	7,612	9,851	13,854	54,544	
Eight-County Area	1,811,944	2,252,103	2,516,903	4,229,333	
County	Annual Growth (1980-2010)		Employment Distribution		Percentage of New Employment (2010-2040)
	1990-2010	2010-2040	2010	2040	
Brazoria	1.1%	2.2%	3.5%	3.9%	4.6%
Chambers	2.4%	4.2%	0.4%	0.8%	1.4%
Fort Bend	5.1%	4.1%	5.4%	10.6%	18.4%
Galveston	0.9%	1.9%	3.8%	4.0%	4.4%
Harris	1.4%	1.1%	80.5%	67.3%	47.9%
Liberty	0.7%	4.5%	0.7%	1.5%	2.7%
Montgomery	5.7%	4.2%	5.2%	10.5%	18.4%
Waller	3.0%	4.7%	0.6%	1.3%	2.4%
Eight-County Area	1.7%	1.7%	100.0%	100.0%	100.0%

Source: U.S. Census Bureau, Texas State Data Center, CDS employment forecasts, University of Houston – Institute for Regional Forecasting

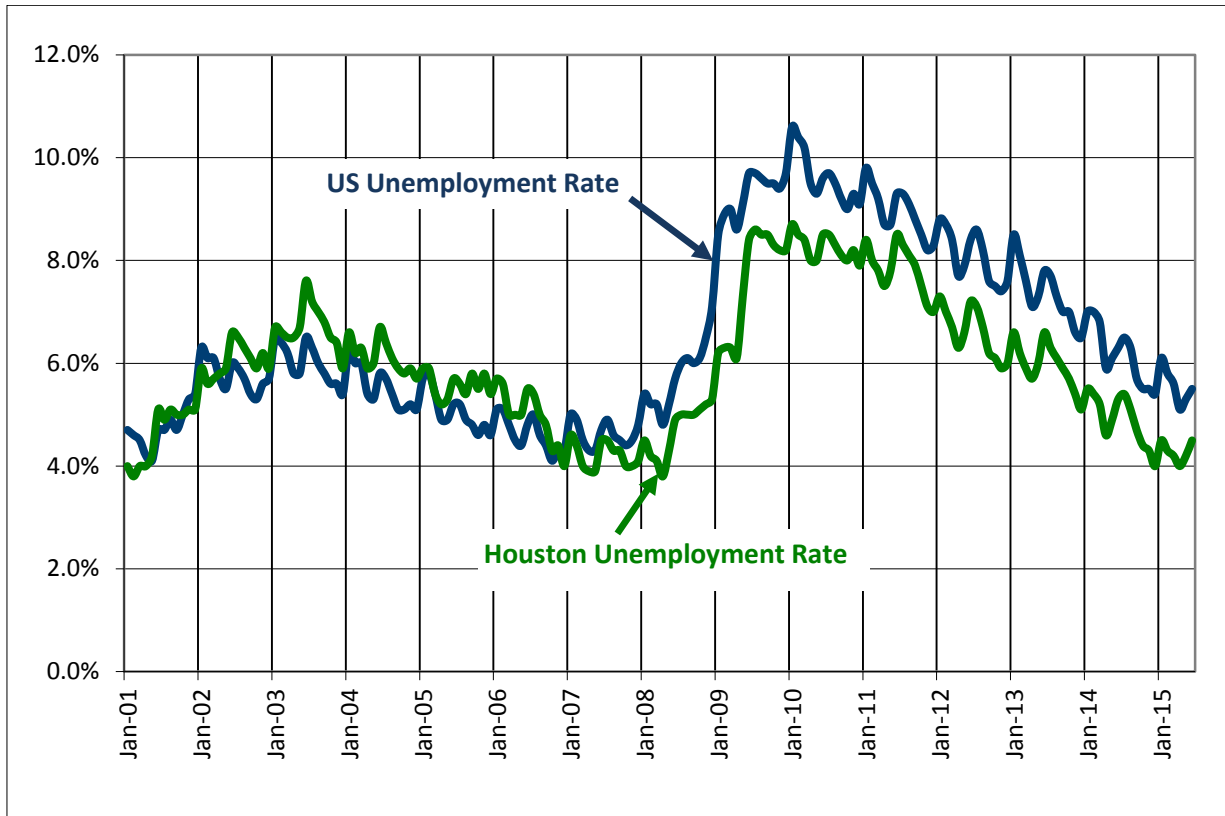


Figure 3-2. Historical Unemployment Rates

Source: Texas Workforce Commission, Accessed August, 2015

The Houston area enjoyed a boom in the 1970s during the country's energy shortages. When the oil market fell in the early 1980s, it had a devastating impact on the Houston Area economy. From 1982 to 1987, almost 222,000 jobs were lost. Over 80 percent of those lost jobs were in oil and gas related industries. Since 1986, Houston diversified its economy and thereby lessened dependence on the energy industry. In 2011, the upstream energy sector accounted for approximately a third of the Houston Area employment base and the downstream refining and chemicals sector accounted for approximately 15 percent of the total employment base.

Figure 3-3 shows the decline in employment that began in 1982 and continued through 1987. Jobs increased significantly from 1988 through 1990 and then growth flattened out for the next four years. There was another period of sharp increase from 1993 to 1999. Following a year of no growth, 2000 and 2001 showed another sharp increase that was again followed by another "flat" period from 2002 to 2004 and steady growth through 2008. Houston was affected by the recent national recession with job losses beginning in January 2009. Recent data show Houston's recovery began in early 2010 and the region has added 487,100 jobs from January 2010 to March 2015. In the most recent 12 months from March 2014 to March 2015, the Houston region added 82,500 jobs as the fastest growing urban region in the nation.

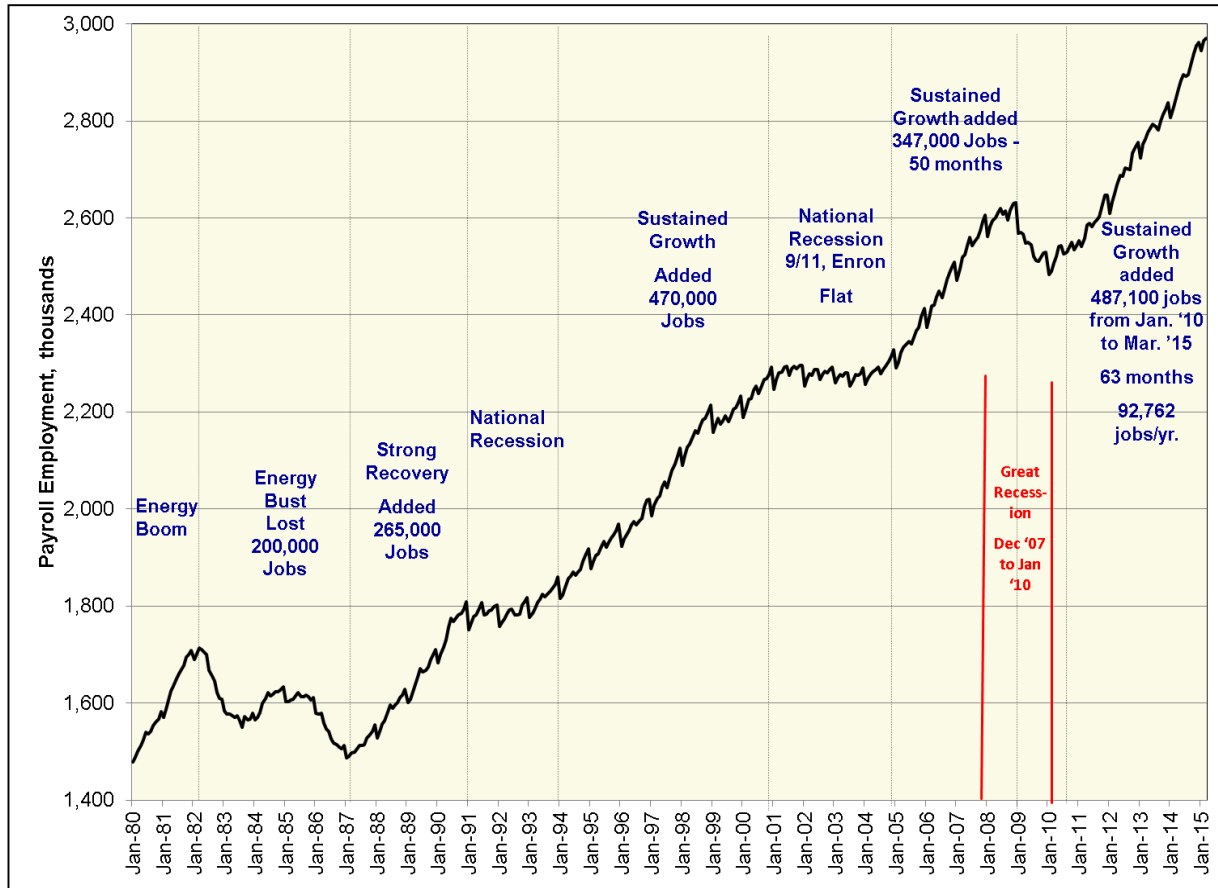


Figure 3-3. Houston Metropolitan Statistical Area Historical Employment Trends from CDS report

Source: Texas Workforce Commission, Feb 2015

Regional Median Household Income Trends

Travel demand, and specifically demand for toll roads, is sensitive to the amount of disposable income available within a household. A reliable indicator of a household's propensity for trip-making, and specifically a motorist's willingness to pay a toll, is median household income. Generally, households with higher incomes have a propensity to make more automobile trips than those with lower incomes due to their greater levels of disposable income. Value of time, a key factor in motorists' willingness to pay tolls, also tends to be higher in households with higher incomes.

A comparison of median household income for the eight-county area is provided in **Table 3-4**. The most recent median household income data estimated by the U.S. Census Bureau for 2013 are provided for the eight-county area, the state, and the nation. The median household income data presented in **Table 3-4** indicates that when reported in real 2013 dollars, income in the region, the state and the nation grew between 1989 and 1999, but had declined somewhat in some counties by 2013. The 2013 median household income in Harris County was higher than those of the state and nation. Excluding Liberty and Waller counties, the surrounding counties have median incomes much higher than the state and nation. Fort Bend county median household income in 2013 dollars is \$87,901 which is the highest in the region and in the state of Texas.

Table 3-4. Median Household Income (in Real 2013 Dollars)

County	Year 1989 ¹	Year 1999 ¹	Year 2013 Estimate ²	Average Annual Growth Rate		
				(1989-1999)	(1989-2013)	(1999-2013)
Brazoria	\$62,431	\$67,373	\$66,337	0.8%	0.3%	-0.1%
Chambers	\$57,448	\$66,559	\$74,915	1.5%	1.1%	0.8%
Fort Bend	\$77,651	\$89,423	\$87,901	1.4%	0.5%	-0.1%
Galveston	\$53,448	\$59,039	\$60,210	1.0%	0.5%	0.1%
Harris	\$56,176	\$59,312	\$52,533	0.5%	-0.3%	-0.9%
Liberty	\$41,061	\$52,954	\$46,176	2.6%	0.5%	-1.0%
Montgomery	\$58,505	\$71,050	\$69,317	2.0%	0.7%	-0.2%
Waller	\$40,511	\$52,322	\$49,326	2.6%	0.8%	-0.4%
State of Texas	\$49,004	\$55,565	\$51,714	1.3%	0.2%	-0.5%
United States	\$54,518	\$58,509	\$52,250	0.7%	-0.2%	-0.8%

¹ Adjusted to 2013 dollars using the Consumer Price Index (CPI).
² Estimate calculated by U.S. Census Bureau, 2013 Poverty and Median Household Income Estimates
Sources: U.S. Census Bureau, Small Area Income and Poverty Estimates (SAIPE) Program

Socioeconomic Indicators

Major Employment Establishments

An analysis of major employers in Houston area suggests that major employers are from the biomedical/biochemical, financial services, chemical, and energy sectors. Over thirty establishments employ more than 5,000 employees. Many of these employment establishments are medical institutions including Memorial Hermann Healthcare System, The University of Texas M.D. Anderson Cancer Center, The Methodist Hospital, The University of Texas Medical Branch at Galveston, and Baylor College of Medicine. Other major companies include Continental Airlines, ExxonMobil, Shell Oil Company, Kroger, National Oilwell Varco, HP, ARAMARK Corp., and Chevron.

Fort Bend County maintains a comprehensive list of major employment establishments in the county. Over thirteen establishments in Fort Bend County employ more than 500 employees. The major employers include Fort Bend ISD, Lamar CISD, Fluor Corporation, Fort Bend County, Schlumberger Technology Corp., Richmond State School, Methodist Sugar Land Hospital, and Texas Instruments. **Figure 3-4** graphically presents major employers in the Fort Bend County.

Consumer Price Index

The consumer price index for all urban consumers (CPI-U) is the most widely used measure of inflation and serves as an economic indicator. The CPI-U determines the aggregate price level of a specific market basket of goods and services that are consumed by typical urban households. This is done by calculating the average going price of each item in the market basket. Food, clothing, housing, transportation (including tolls) and entertainment are all included in the basket. Income taxes and investment items such as stocks and bonds are not included. The Bureau of Labor and Statistics of the U.S. Department of Labor calculates the CPI-U every month.

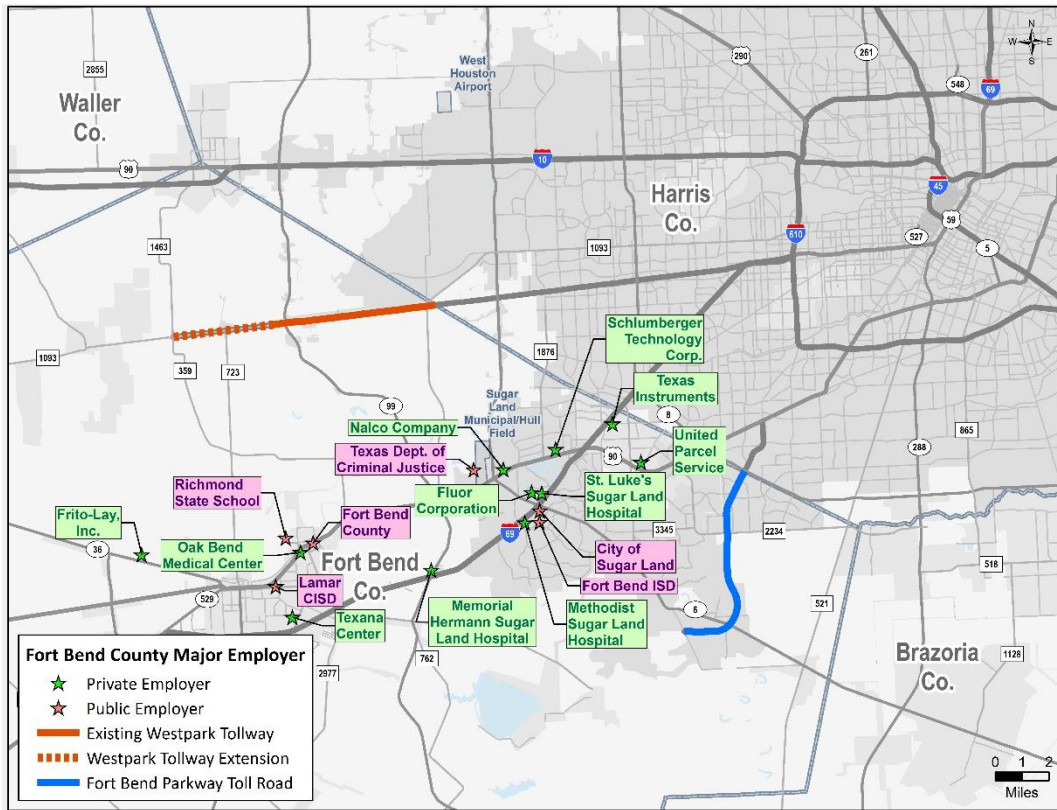


Figure 3-4. Major Employers in Fort Bend County

Table 3-5 gives the historical trends for CPI-U from 1967-2014 for the Houston region, the Southern Region of the US (Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, Washington D.C., and West Virginia) and the entire United States. As indicated in **Table 3-5**, the CPI-U in Houston has continually increased at a similar rate to the CPI-U for both the Southern Region and the United States over the 10 year period from 2004 and 2014. This indicates that the inflation rate in Houston is consistent with the rate of inflation seen nationwide.

The average CPI-U in the Houston-Galveston-Brazoria MSA for 2014 represents an average annual growth rate in CPI of 2.5 percent per year since 1984. In Houston, the CPI-U has grown at an average annual rate of 2.5 percent per year since 1984, which is a similar rate of growth experienced by the Southern Region and the nation during that time. Between 2004 and 2014, CPI-U grew at an average annual rate of 2.3 percent for Houston, at an annual rate of 2.4 percent for the Southern Region and at an average annual rate of 2.2 percent for the United States. It should also be noted that the CPI-U sharply increased between 2007 and 2008 and decreased between 2008 and 2009.

Table 3-5. Consumer Price Index for All Urban Consumers

Year	Houston-Galveston-Brazoria	Growth	Southern Region	Growth	United States	Growth
1967	31.2	-----	32.6	-----	33.4	-----
1968	32.5	4.2%	34.0	4.3%	34.8	4.2%
1969	34.6	6.5%	36.0	5.9%	36.7	5.5%
1970	36.4	5.2%	37.9	5.3%	38.8	5.7%
1971	37.7	3.6%	39.5	4.2%	40.5	4.4%
1972	39.0	3.4%	40.7	3.0%	41.8	3.2%
1973	41.2	5.6%	43.3	6.4%	44.4	6.2%
1974	46.1	11.9%	48.6	12.2%	49.3	11.0%
1975	51.4	11.5%	53.3	9.7%	53.8	9.1%
1976	55.3	7.6%	56.3	5.6%	56.9	5.8%
1977	59.3	7.2%	60.0	6.6%	60.6	6.5%
1978	64.9	9.4%	65.0	8.3%	65.2	7.6%
1979	73.5	13.3%	72.4	11.4%	72.6	11.3%
1980	82.7	12.5%	81.9	13.1%	82.4	13.5%
1981	91.0	10.0%	90.7	10.7%	90.9	10.3%
1982	97.3	6.9%	96.5	6.4%	96.5	6.2%
1983	100.0	2.8%	99.7	3.3%	99.6	3.2%
1984	102.7	2.7%	103.8	4.1%	103.9	4.3%
1985	104.9	2.1%	107.1	3.2%	107.6	3.6%
1986	103.9	-1.0%	108.9	1.7%	109.6	1.9%
1987	106.5	2.5%	112.4	3.2%	113.6	3.6%
1988	109.5	2.8%	116.4	3.6%	118.3	4.1%
1989	114.1	4.2%	121.5	4.4%	124.0	4.8%
1990	120.6	5.7%	127.9	5.3%	130.7	5.4%
1991	125.1	3.7%	132.9	3.9%	136.2	4.2%
1992	129.1	3.2%	136.5	2.7%	140.3	3.0%
1993	133.4	3.3%	140.8	3.2%	144.5	3.0%
1994	137.9	3.4%	144.7	2.8%	148.2	2.6%
1995	139.8	1.4%	149.0	3.0%	152.4	2.8%
1996	142.7	2.1%	153.6	3.1%	156.9	3.0%
1997	145.4	1.9%	156.9	2.1%	160.5	2.3%
1998	146.8	1.0%	158.9	1.3%	163.0	1.6%
1999	148.7	1.3%	162.0	2.0%	166.6	2.2%
2000	154.2	3.7%	167.2	3.2%	172.2	3.4%
2001	158.8	3.0%	171.1	2.3%	177.1	2.8%
2002	159.2	0.3%	173.3	1.3%	179.9	1.6%
2003	163.7	2.8%	177.3	2.3%	184.0	2.3%
2004	169.5	3.5%	181.8	2.5%	188.9	2.7%
2005	175.6	3.6%	188.3	3.6%	195.3	3.4%
2006	180.6	2.8%	194.7	3.4%	201.6	3.2%
2007	183.8	1.8%	200.4	2.9%	207.3	2.8%
2008	190.0	3.3%	208.7	4.2%	215.3	3.8%
2009	190.5	0.3%	207.8	-0.4%	214.5	-0.4%
2010	194.2	1.9%	211.3	1.7%	218.1	1.6%
2011	200.5	3.3%	218.6	3.4%	224.9	3.2%
2012	204.2	1.9%	223.2	2.1%	229.6	2.1%
2013	207.6	1.6%	226.7	1.6%	233.0	1.5%
2014	213.4	2.8%	230.6	1.7%	234.8	0.8%
Compounded Annual Growth Rate	(1984-2014)	2.5%	(1984-2014)	2.7%	(1984-2014)	2.8%
	(2004-2014)	2.3%	(2004-2014)	2.4%	(2004-2014)	2.2%

Source: Bureau of Labor Statistics (BLS)

Trends in Building Permits

The housing industry accounts for a large percentage of investment spending. Building permit issuances are leading economic indicators as they help predict where the economy is headed in the near future. Sustained declines in building permits slow the economy and can be indicative of a potential recession. Likewise, increases in this leading indicator can potentially indicate or trigger economic growth.

The trends in single family residential building permits for the Houston-The Woodlands-Sugar Land region are presented in **Figure 3-5**. Single family building permits continued to grow from year to year until 2007. However, due to the recession, the number of building permits issued since 2008 dropped significantly. The single family residential permits resumed its growth trends since 2011.

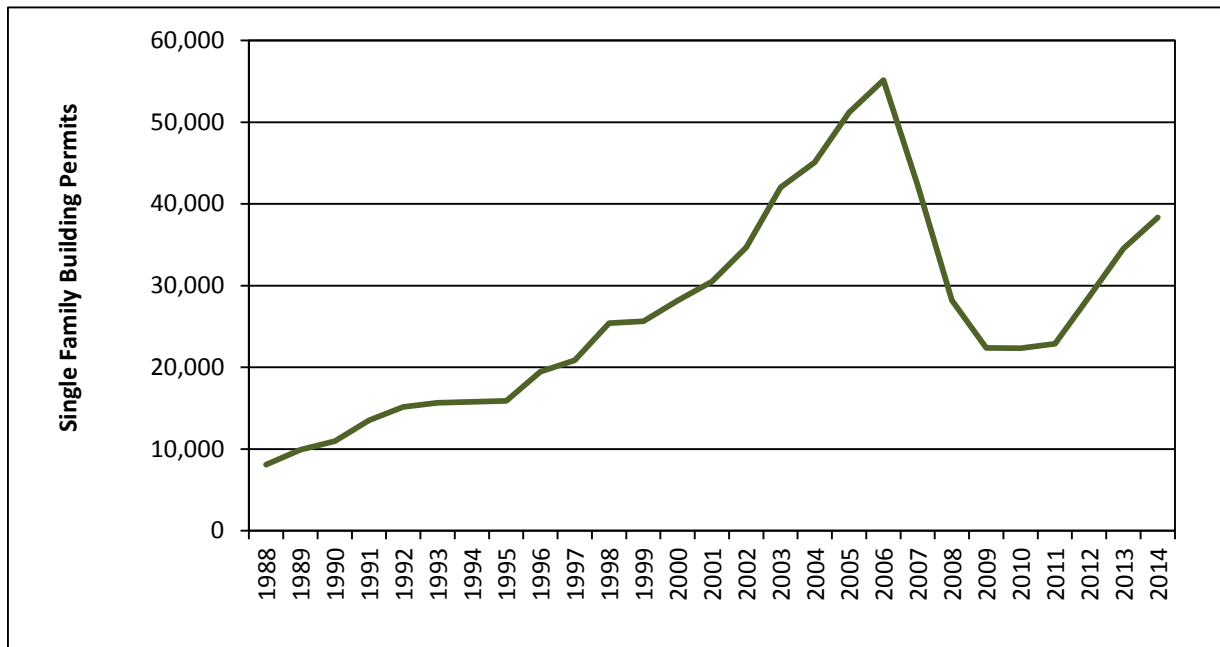


Figure 3-5. Trends in Single Family Building Permits in Houston-The Woodlands-Sugar Land, TX

Regional Home Sales

Trends in home sale prices and the number of sales can serve as a good indicator of the state of a local economy. Growth in the median sale price of area homes are presented for the Fort Bend County multiple listing service (MLS), Houston MLS, and the State of Texas in **Figure 3-6**. The median price of homes sold has been steadily increasing in the eight-county area and throughout the state since 1993. There were some minor decreases in 2008 and 2009 due to the recession, but prices have been steadily increasing since that time.

Figure 3-7 shows the total number of homes sold in the Houston MLS annually since 1993. Home sales began dropping significantly in 2006 and reached a ten-year low in 2010. However, by 2014 home sales had moved above pre-recession levels.

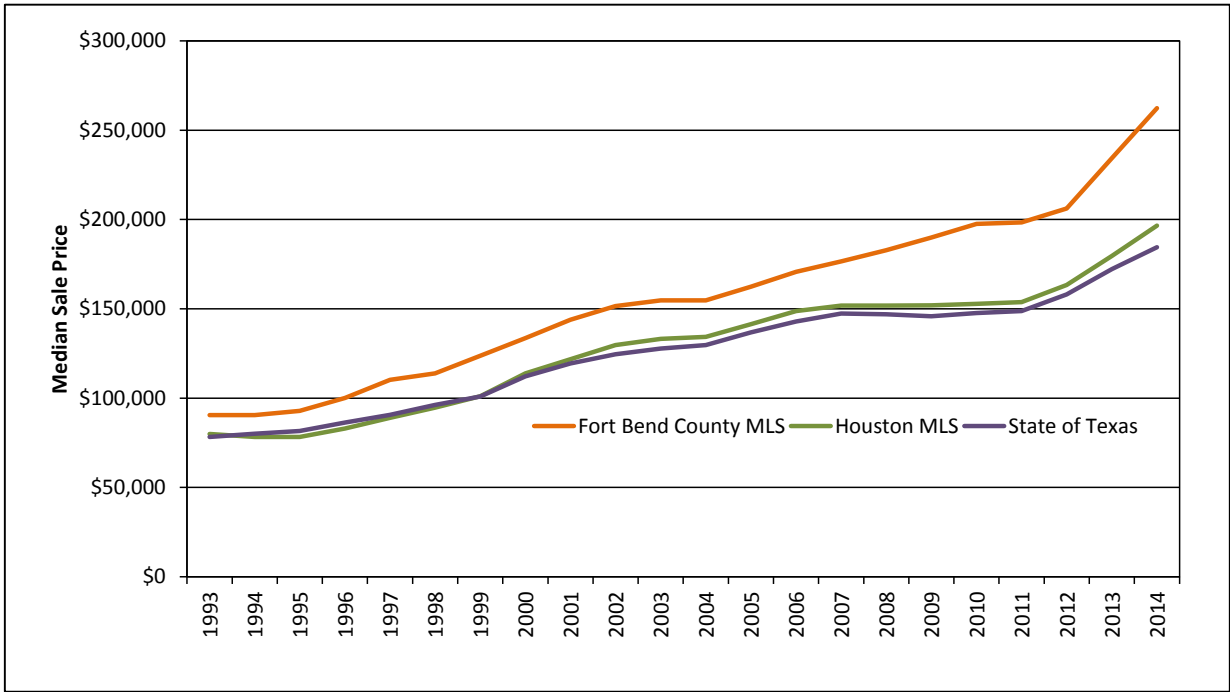


Figure 3-6. Median Home Sale Prices

Source: Texas A&M Real Estate Center

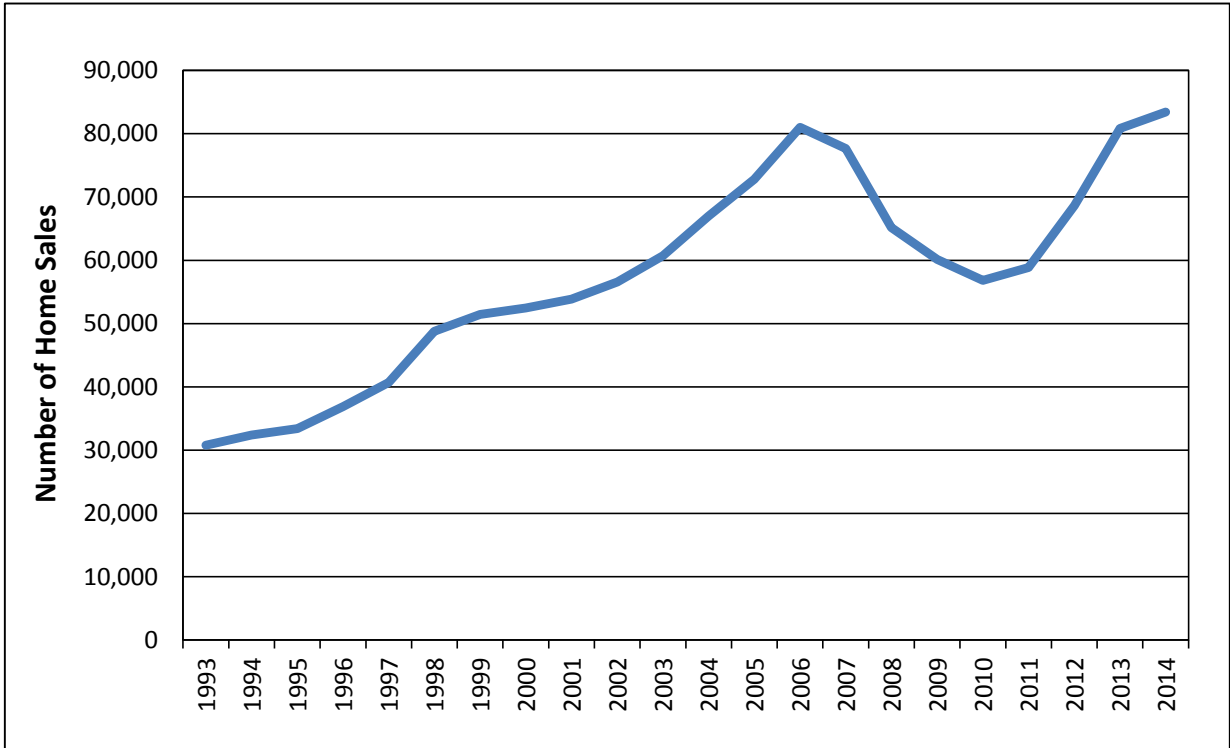


Figure 3-7. Houston MLS Home Sales

Source: Texas A&M Real Estate Center

Gasoline Prices

Figure 3-8 shows the average weekly gasoline price in Texas since 2012. Gasoline prices in Texas fell slightly during the latter part of 2013 and dropped below \$3.00 per gallon for the first time since early 2011. The prices since October 2014 have remained under \$2.75 per gallon.

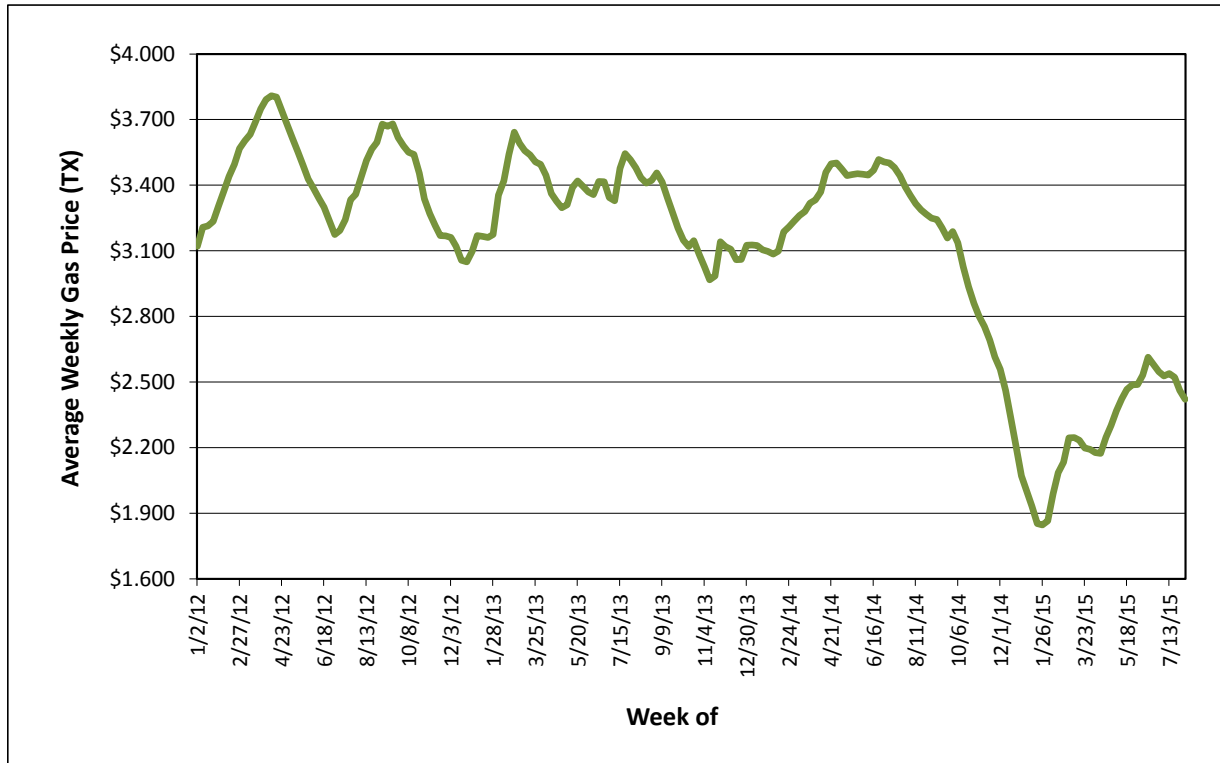


Figure 3-8. Average Weekly Gasoline Prices in Texas

Source: US Energy Information Administration

Independent Economic Review

CDM Smith engaged CDS, as an independent consultant, to review recent economic indicators for the Houston-Galveston area to better understand how trends in Houston's market compare to national trends. CDS conducted a study that analyzed the validity of regional socio-economic data and also focused on evaluating the socioeconomic trends within Fort Bend County to better reflect the existing socio-economic profile and forecasts based on recent known developments in the vicinity of the FBCTRA facilities. A summary of this analysis is presented in this section. CDS's full report on local economic indicators is included as Appendix A of this report.

Factors Affecting Future Regional Economic Growth

According to the Greater Houston Partnership, three factors have governed the state of Houston's economy for the past 10 years:

- The health of the national economy
- The value of the U.S. dollar against foreign currencies
- Energy prices

Higher oil and gas prices stimulate demand for oil field equipment and services, which is a strong sector within the Houston economy. Spot market closing prices for West Texas Intermediate (WTI) began the 2000's decade in the \$20-\$30 per barrel range and remained there until 2004 when they began a steady climb, with a brief downward fall in 2006, to a peak of over \$140 per barrel during the first half of 2008. The worldwide recession, accompanied by a fall-off in demand, resulted in a decrease in WTI crude oil prices (blue line in **Figure 3-9**) to less than \$40/Bbl. By 2011, WTI price rebounded to more than \$100/Bbl and fluctuated within a range of \$85 to \$110 until June of 2014 when it declined from a high of \$106 to \$46 in January of 2015. Oil prices have rebounded slightly in the following three months of 2015, reaching \$54 by April 2015. Concurrently, Henry Hub spot natural gas (red line in **Figure 3-9**) remained under \$10/mm Btu before falling to a low of \$2/mm BTU and then rebounding to \$6 in late 2009. Spot natural gas prices again fell to \$2.00 in the spring of 2012 but reached \$6.24 by February of 2014. Since that peak, natural gas prices have dropped to \$2.60 as of April of 2015.

According to CDS, currently only one of the three factors that affect the Houston economy, National Economic Growth, presents slightly positive signs for Houston's economy. Most analysts are now expecting Houston's economic growth be less robust and significant until energy prices rebound back to 2007 levels.

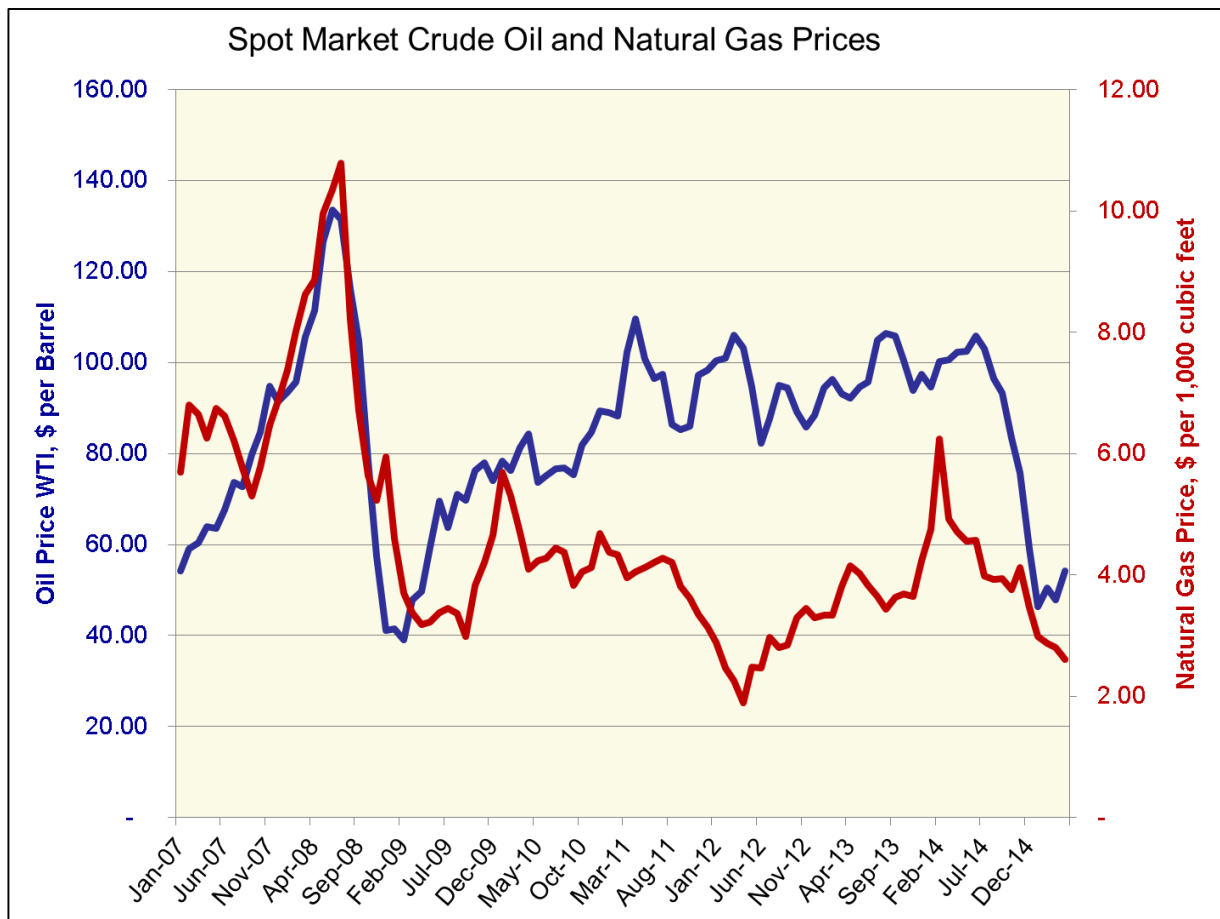


Figure 3-9. Energy Price Trends from CDS report

Source: U.S. Energy Information Administration, January 2015.

Economic Geography

The City of Houston has never had zoning but development is governed by codes that address how property can be subdivided. The region's Central Business District presently accounts for approximately six percent of the regional employment. Loosely-defined "edge cities" comprise a large portion of the region's employment base. These are usually made up of clusters of office, medical office, hotel, and supportive retail land uses. Many of these clusters contain high-rise, high density buildings. Examples of major regional employers and activity centers include the Uptown/Galleria, the Texas Medical Center in the urban core, or the Energy Corridor, Greenway Plaza, Sugar Land, Westchase, Greenspoint and The Woodlands in the suburbs. The region's heavy industries are clustered around the Houston Ship Channel and Galveston Bay area. Additionally, a significant number of jobs are spread among Houston's suburbs in numerous office parks, retail centers, and light industrial facilities. Emerging clusters include Springwoods Village, Generation Park, and Cedar Crossing. The area's large employment centers are largely dependent upon access from the highway system. The de-centralized locations of these centers do not lend themselves to the use of mass transit.

Evaluation of H-GAC Forecasts

CDS Market Research was contracted by CDM Smith to review and develop estimates of population and employment near the FBCTRA facilities through 2040. This effort by CDS built upon the economic and demographic forecasts for other projects in the Houston region. This study by CDS provided an update of 2013 forecasts (developed for the 2013 Level 2 FBCTRA T&R Study) to account for changing conditions and recently "announced" and "under construction" residential and commercial development. Also included were updates undertaken between 2011 to 2014 for TxDOT and the Harris County Toll Road Authority (HCTRA).

CDS considered multiple independent forecasts to determine and develop their most likely case scenarios. Along with H-GAC's regional forecast, this report considered seven independent forecasts of population and three independent forecasts of employment from reputable organizations.

The H-GAC's regional forecasts, from which their small area forecasts are derived, tended to fall within the median of the independent forecasts. CDS concluded that the H-GAC 2040 regional forecasts at the eight-county regional level were reasonable and consistent with other credible forecasts. However, CDS suggested that the small area and county-level forecasts by H-GAC's 2040 forecast were divergent with recent growth trends. Therefore, CDS adjusted the forecasts to reflect their estimated changes in the demographic forecasts.

CDS vs. H-GAC Forecasts

Table 3-6 and **Table 3-7** compare population and employment forecasts of CDS versus H-GAC 2015 Quarter 1. At the eight-county region level, the CDS population forecast is approximately 2.5 percent lower than the H-GAC forecast in 2015. The CDS forecast is lower than the H-GAC forecast by 1.4 percent in 2020 and by 2.9 percent in 2040. While CDS's Harris County population forecast is very close to the H-GAC forecast, their Fort Bend County population forecast is greater by 13.6 percent in 2040.

The average annual growth of population from 1980 to 2010 was 1.3 percent in Fort Bend County. CDS estimates the population growth from 2010 to 2040 to be 2.3 percent per year.

At the eight-county region level, the CDS employment forecast is about 4.1 percent lower than the H-GAC forecast in 2015, by 6 percent in 2020 and by 5.1 percent in 2040. Harris County employment forecast by CDS is lower than the H-GAC forecast by about 17.2 percent in 2040. However, CDS's forecast for Fort Bend County is greater by about 49.1 percent in 2040.

The average annual growth of employment from 1990 to 2010 was 5.1 percent in Fort Bend County and CDS estimates the growth from 2010 to 2040 to be 4.1 percent per year.

Growth in population, as predicted by CDS, for 2010 to 2020, 2020 to 2030, and 2030 to 2040, is shown on **Figure 3-10** to **Figure 3-12**. **Figure 3-13** to **Figure 3-15** show the employment growth for 2010 to 2020, 2020 to 2030, and 2030 to 2040. Additional details regarding the reasons for the changes made by CDS to the H-GAC forecasts is included in the CDS report included as **Appendix A**.

Table 3-6. Comparison of County-Level Population Forecasts by H-GAC and CDS

County	2015			2020		
	H-GAC (000's)	CDS Revised (000's)	Change (%)	H-GAC (000's)	CDS Revised (000's)	Change (%)
Brazoria County	346.2	341.9	-1.2	387.9	408.9	5.4
Chambers County	38.4	39.6	3.1	42.3	47.4	12.2
Fort Bend County	705.9	700.0	-0.8	824.9	845.9	2.5
Galveston County	338.0	315.7	-6.6	375.8	369.1	-1.8
Harris County	4,422.1	4,299.1	-2.8	4,809.6	4,636.9	-3.6
Liberty County	74.0	76.9	4.0	76.8	94.7	23.3
Montgomery County	553.4	537.2	-2.9	661.5	652.4	-1.4
Waller County	40.1	47.5	18.4	43.3	68.1	57.4
Total	6,518.1	6,358.1	-2.5	7,222.1	7,123.5	-1.4
County	2030			2040		
	H-GAC (000's)	CDS Revised (000's)	Change (%)	H-GAC (000's)	CDS Revised (000's)	Change (%)
Brazoria County	555.4	552.3	-0.5	759.2	682.7	-10.1
Chambers County	51.1	65.3	27.7	59.3	86.7	46.2
Fort Bend County	1,020.4	1,108.5	8.6	1,171.2	1,330.7	13.6
Galveston County	498.3	480.7	-3.5	599.4	574.5	-4.1
Harris County	5,390.0	5,175.8	-4.0	5,866.4	5,501.0	-6.2
Liberty County	109.1	150.1	37.5	179.9	223.9	24.5
Montgomery County	944.3	901.4	-4.5	1,280.8	1,130.5	-11.7
Waller County	64.6	124.9	93.4	102.8	198.9	93.4
Total	8,633.2	8,559.1	-0.9	10,018.9	9,729.0	-2.9

Table 3-7. Comparison of County-Level Employment Forecasts by H-GAC and CDS

County	2015			2020		
	H-GAC (000's)	CDS Revised (000's)	Change (%)	H-GAC (000's)	CDS Revised (000's)	Change (%)
Brazoria County	91.9	104.8	14.0	96.3	113.8	18.1
Chambers County	14.1	13.1	-6.7	15.3	15.4	1.0
Fort Bend County	189.9	187.2	-1.4	228.1	224.5	-1.6
Galveston County	102.7	112.0	9.0	114.0	120.9	6.1
Harris County	2,517.6	2,345.2	-6.8	2,710.9	2,449.7	-9.6
Liberty County	14.4	19.7	36.6	14.6	22.8	56.5
Montgomery County	165.1	181.5	9.9	197.9	221.8	12.1
Waller County	12.6	17.2	37.1	16.9	20.9	23.3
Total	3,108.3	2,980.7	-4.1	3,393.9	3,189.7	-6.0
County	2030			2040		
	H-GAC (000's)	CDS Revised (000's)	Change (%)	H-GAC (000's)	CDS Revised (000's)	Change (%)
Brazoria County	128.8	140.5	9.1	172.0	166.1	-3.4
Chambers County	17.3	23.2	33.7	19.3	32.8	70.2
Fort Bend County	271.5	346.0	27.4	301.9	450.3	49.1
Galveston County	132.7	147.9	11.5	194.0	170.7	-12.0
Harris County	3,115.1	2,688.3	-13.7	3,437.0	2,847.4	-17.2
Liberty County	17.5	39.3	124.3	32.8	62.1	89.4
Montgomery County	223.9	338.7	51.3	280.3	445.3	58.9
Waller County	18.4	37.5	103.2	21.6	54.5	152.1
Total	3,925.3	3,761.3	-4.2	4,458.9	4,229.3	-5.1

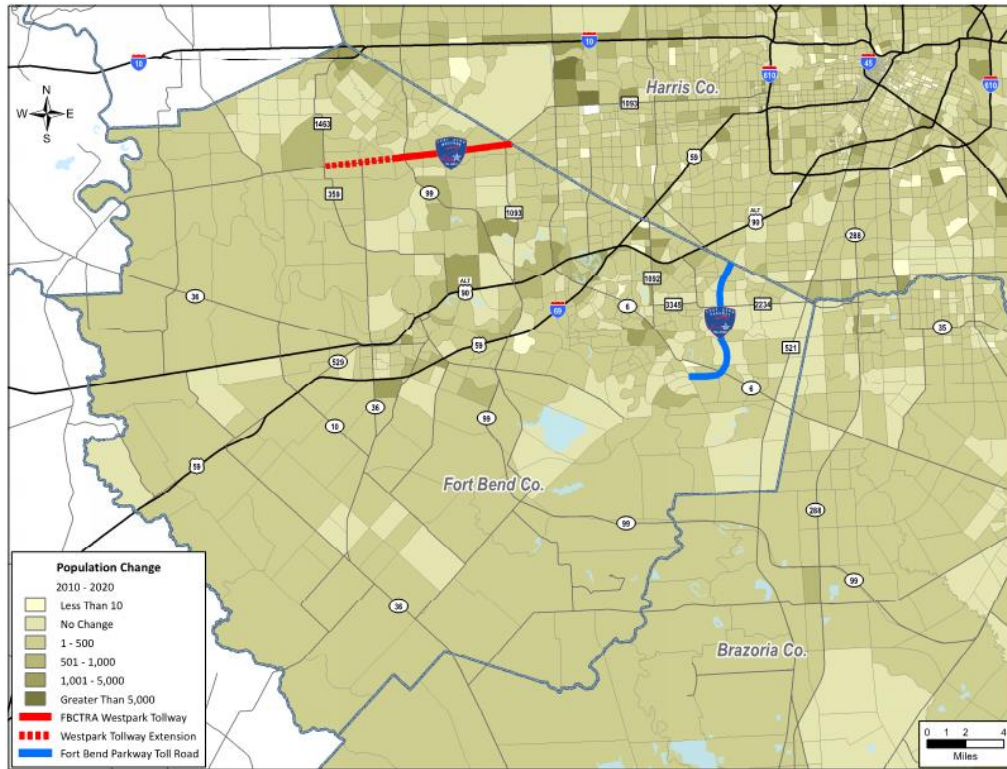


Figure 3-10. CDS Forecasted Population Growth 2010-2020

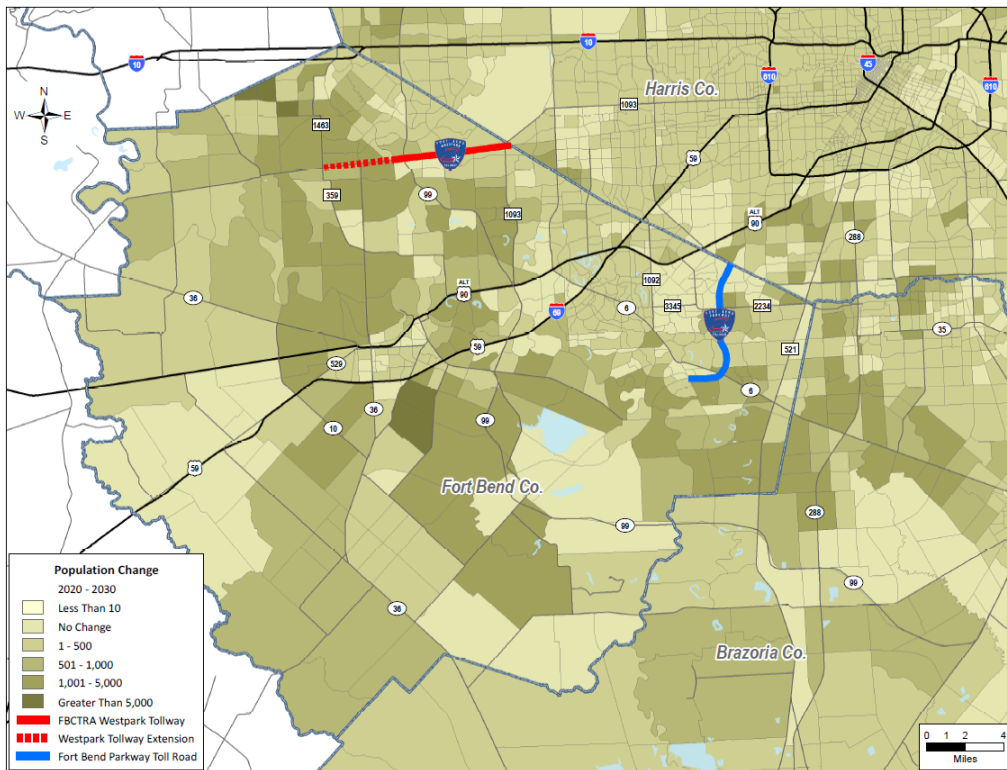


Figure 3-11. CDS Forecasted Population Growth 2020-2030

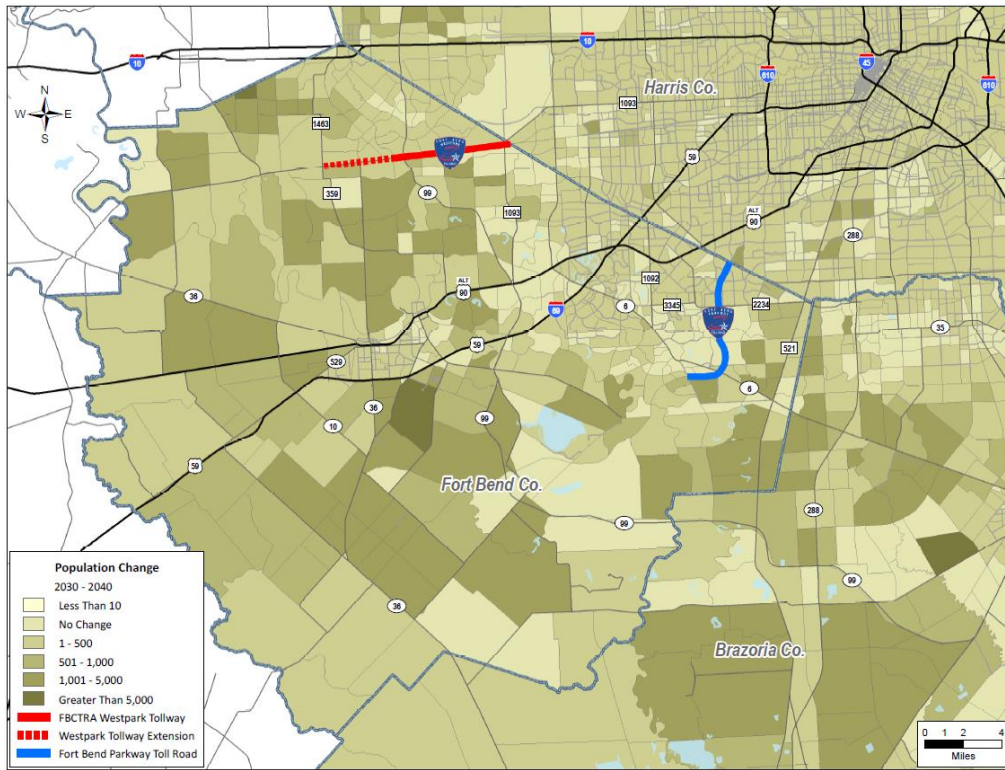


Figure 3-12. CDS Forecasted Population Growth 2030-2040

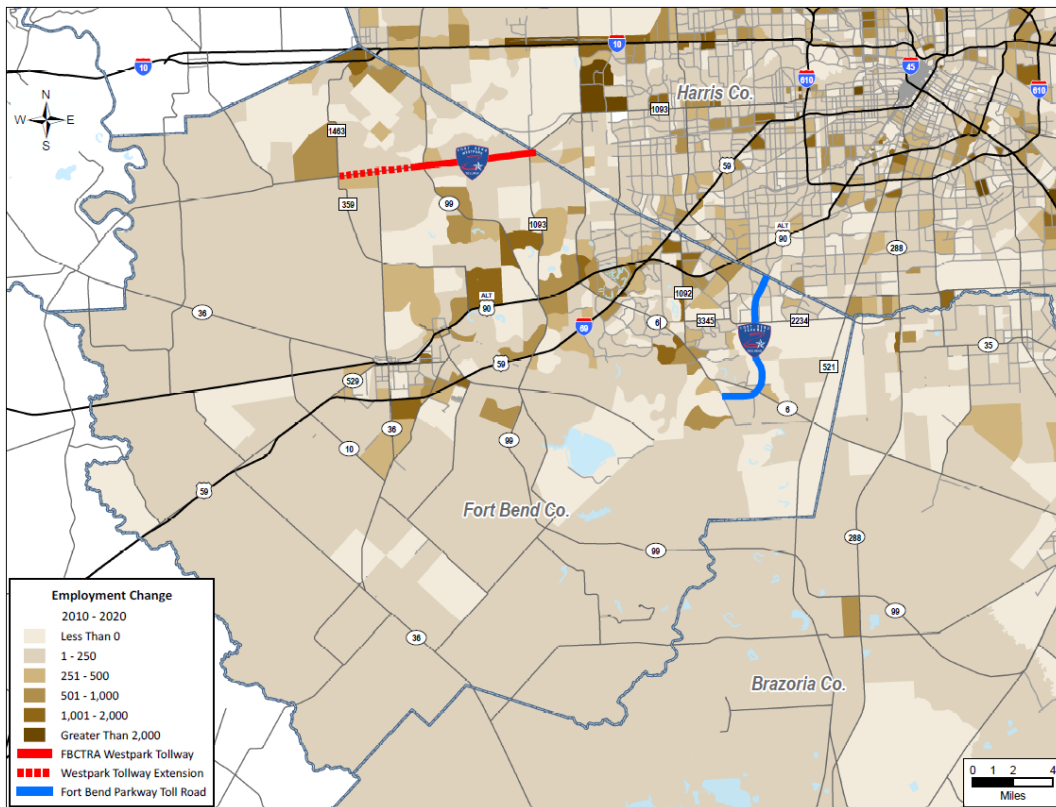


Figure 3-13. CDS Forecasted Employment Growth 2010-2020

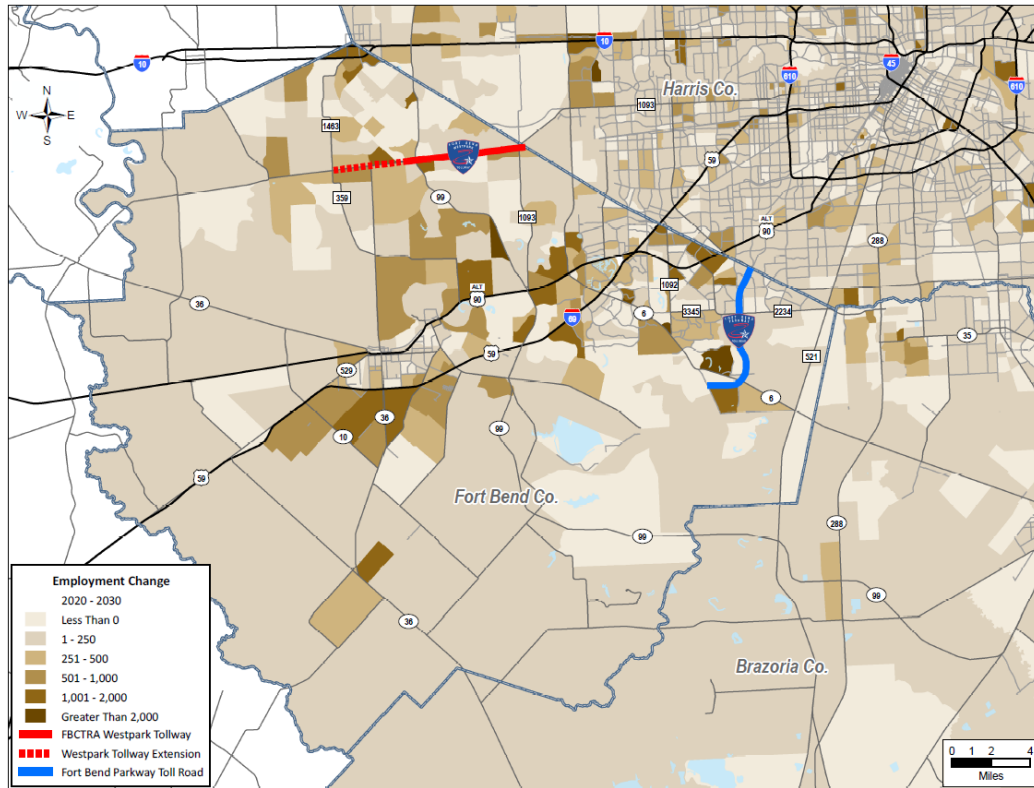


Figure 3-14. CDS Forecasted Employment Growth 2020-2030

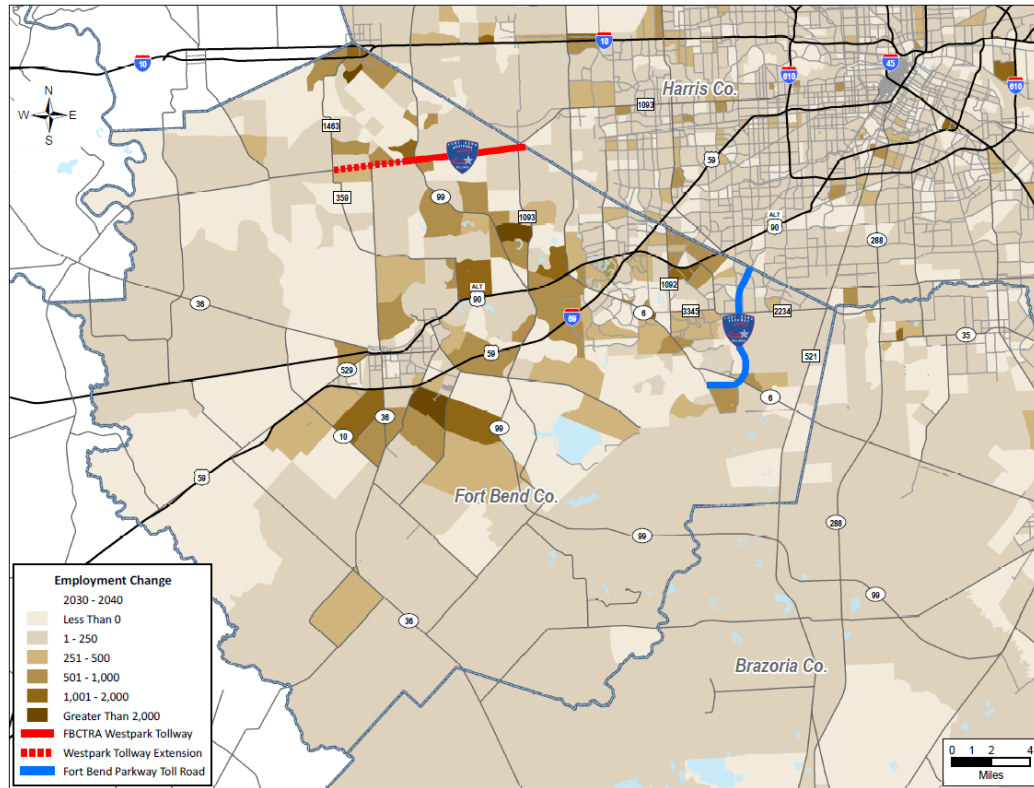


Figure 3-15. CDS Forecasted Employment Growth 2030-2040

Summary of Independent Socioeconomic Review

The region, and Montgomery and Fort Bend Counties in particular, has sustained very high growth rates in population, employment and other key demographic and economic variables over the past 40 years.

Relatively high levels of growth are expected to continue, and the H-GAC 2040 Regional Growth Forecast release 2015 Quarter 1 estimates the region will grow from below six million in 2010 to ten million by 2040. This is consistent with a number of key forecasting sources that were reviewed. CDS has reviewed this forecast and found it to be reasonable at the regional level. However, CDS suggested that the small area and county-level forecasts by H-GAC's 2040 Forecast are divergent with recent growth trends. Therefore, CDS utilized the regional forecasts from the University of Houston Institute for Regional Forecasting (UH-IRF) and adjusted them to reflect the 2010 Census as well as current conditions for developing the demographic forecasts used in this study.

For small area growth, CDS predicted a higher share of the growth in Fort Bend County than the latest H-GAC forecasts. Given the historical growth trends and the growth projected by several sources for the Houston area in general and along the FBCTRA facilities, CDS opined that the socioeconomic forecasts developed by it were reasonable for the development of the T&R forecasts for this project.

CDM Smith used the CDS forecasts as an input for base case scenario T&R estimates presented later in **Chapter 5**.

Chapter 4

Future Roadway Network Improvements

This chapter provides an overview of the major future transportation improvements in the Houston metropolitan area in the vicinity of the FBCTRA System facilities. The information described in this chapter is based on the improvement projects identified by the Houston-Galveston Area Council (H-GAC), the local metropolitan planning organization (MPO) for the Houston region. The improvement projects described in this chapter are drawn from the Regional Transportation Plan (RTP) 2040 for the eight-county H-GAC travel demand model area. This includes existing and committed projects that are included as part of the short-term Transportation Improvement Program (TIP) and the long-range Regional Transportation Plan (RTP) 2040.

The RTP 2040 serves as a guide for the Houston region's planned investment in the transportation infrastructure and services over the next twenty-five years. The RTP is financially constrained and was formally approved by H-GAC's Transportation Policy Council (TPC) the MPO policy body for the Houston metropolitan area in January 2015. The recommendations detailed in the RTP 2040 for the improvements to the transportation system in the Houston-Galveston area amounts to \$75 billion (in 2015 dollars) in investments. Of that amount, \$26 billion (in 2015 dollars) is designated for major investment corridors.

The following chapter, **Chapter 5**, provides an overview of how the various data collected and revised socio-economic growth forecasts for the corridor were used in conjunction with the various roadway network improvements presented in this chapter to develop traffic and revenue estimates for the Fort Bend Parkway Toll Road and the Westpark Tollway corridors.

Chapter 4 is organized into the following sections:

- 2040 RTP System Overview
- Transportation Improvement Program
- Regional Transportation Plan 2040

2040 RTP System Overview

Existing Regional Roadway System

The current transportation system in the H-GAC travel demand model area includes more than 25,000 miles of total roadway, with more than 170 million miles traveled daily in 2015. The majority of the major roadway system is arterial streets. Freeways, including interstates and other limited-access roads, make up around ten percent of the roadway system and local roads and collectors comprise almost a quarter of the system.

According to H-GAC, approximately 180 miles of tollways are located in the Houston-Galveston-Brazoria region. The 2040 RTP recommends extension of some of the most traveled roads – Sam Houston Tollway, Westpark Tollway, Fort Bend Parkway Toll Road and Hardy Toll Road. The RTP also recommends the completion or construction of new toll corridors including US 290 (partial

toll/managed lanes), Hempstead Toll Road, SH 249 Toll Road, remaining portions of SH 99 (the Grand Parkway) and SH 288 managed lanes.

Regional Transit System

The regional transit system is comprised of seven public transportation providers which cover seven counties. The various available transit modes are local bus routes, park and ride/commuter service, demand response, and light rail.

In addition to the regional roadway and transit systems, the region currently has about 300 miles of bikeways.

Regional Freight System

The regional freight system includes more than 1,000 miles of freight-carrying railroad track that move goods and services, 21,500 miles of pipeline that support the petrochemical industry and 26 airports that serve air cargo.

Transportation Improvement Program

The Transportation Improvement Program (TIP) is a fiscally constrained financial plan of transportation projects approved to receive federal funding. It stages the RTP projects in a short-term window over the next four years for construction. Projects selected for the TIP are priorities for the region in all surface transportation areas including transit, roadway and highways, bicycle and pedestrian, preventative maintenance, rehabilitation and transportation operations. The TIP is updated every two years, and the current TIP (2015-2018) includes approximately \$9 billion in expenditures in eight counties.

H-GAC's Transportation Policy Council (TPC) oversees the development of, and adopts, the TIP. Following adoption, the TPC monitors implementation of the TIP and approves significant changes to projects contained in the TIP. New projects are added to the TIP on a periodic basis and a Call for Projects is conducted approximately every two years.

Regional Transportation Plan 2040

The 2040 Regional Transportation Plan (RTP) identifies the H-GAC region's transportation needs, goals, and policies over the next 25 years. According to the H-GAC RTP 2040 document, the plan sets the framework for a balanced and forward-thinking system with the identification of major investment strategies supporting traditional modes, such as roadway improvements, and alternative modes, such as mass transit, bicycle and pedestrian facilities.

The RTP 2040 identifies transportation facilities and services needed to support the Houston area's anticipated growth using the available resources.

Future Freeway, Tollway and Arterial System

Figure 4-1 provides an illustration of the funded roadway improvement projects included in the constrained 2040 RTP, focusing on freeways, tollways, HOV/managed lanes, frontage roads and other regionally significant arterials.

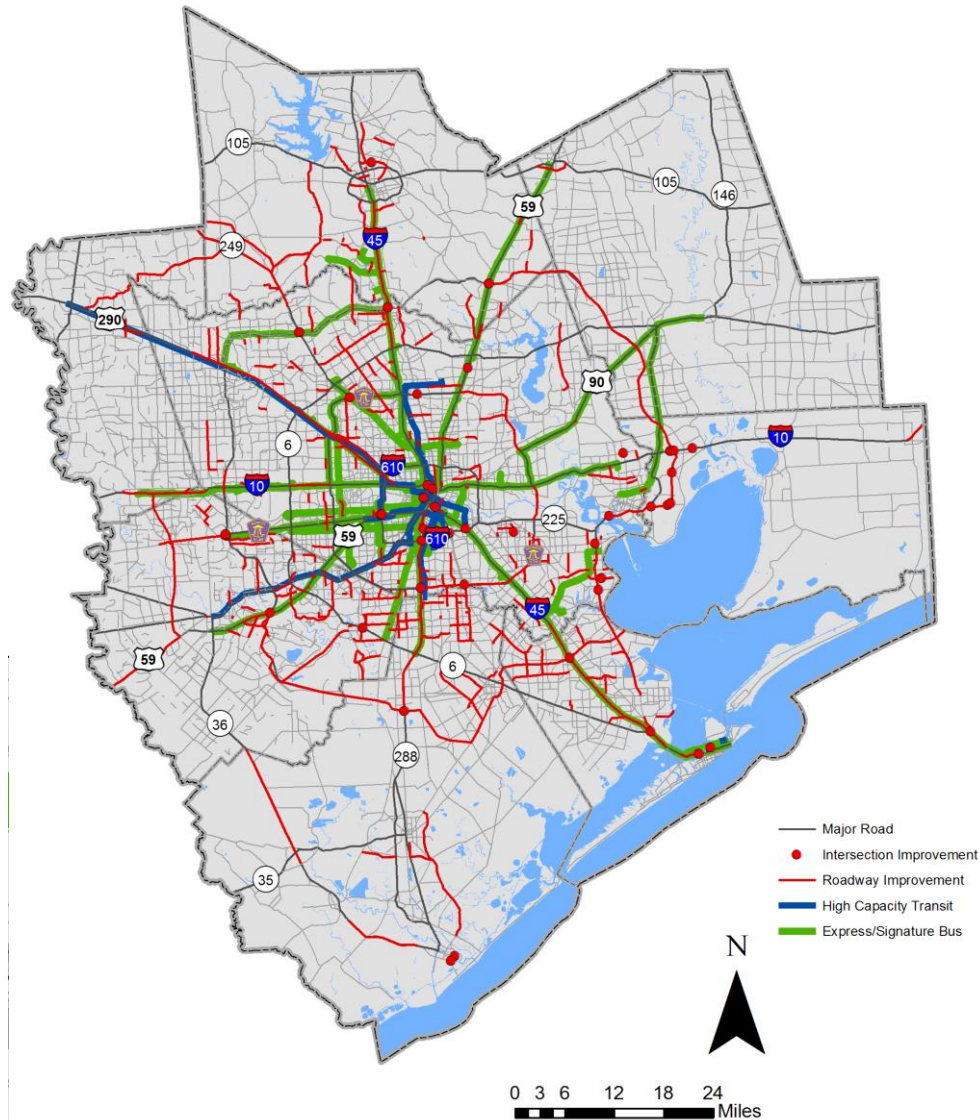


Figure 4-1. Constrained 2040 RTP Projects

Source: H-GAC RTP 2040

The identification of these facilities in the study area is very important to this study because additional freeway and arterial improvements could materially impact the FBCTRA System traffic and toll revenue. Facilities that provide improved accessibility to FBCTRA System facilities could provide positive impacts to the FBCTRA System while competing non-tolled and tolled alternative routes could dampen its traffic and revenue potential.

Additional toll roads and managed lane projects programmed for the region during the next 25 years are shown in **Figure 4-2**. Near the FBCTRA facilities, these planned toll roads include roadways such as Grand Parkway and SH 288 and associated extensions.

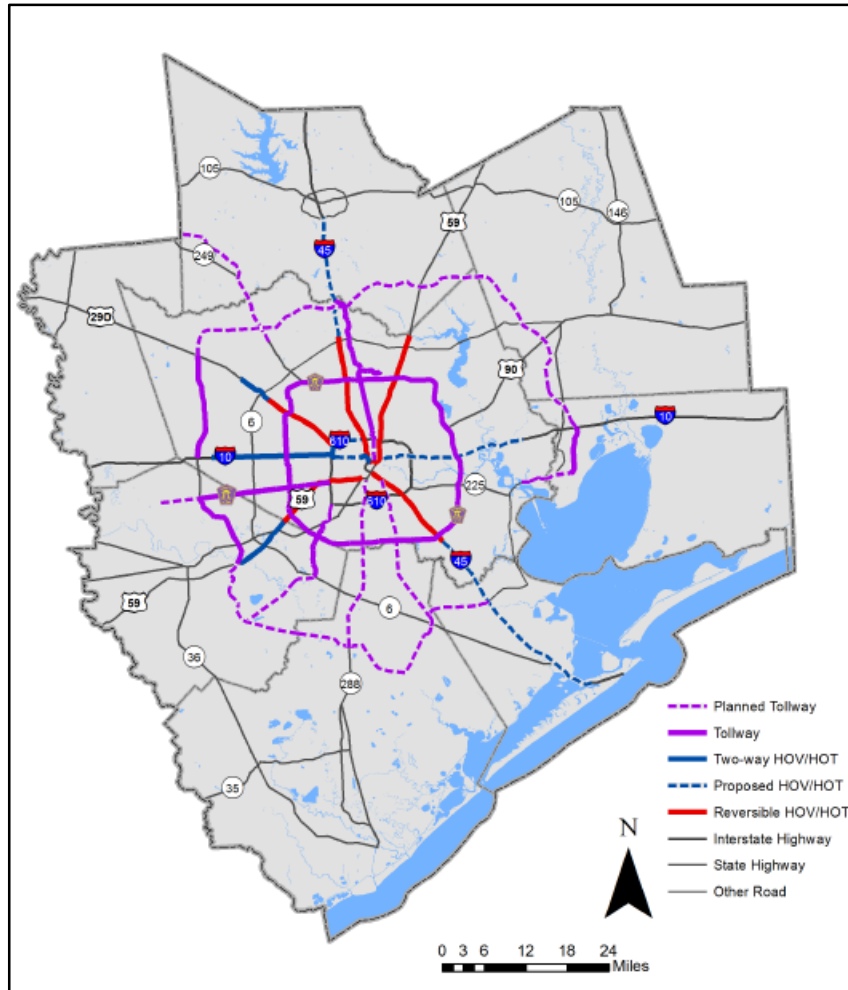


Figure 4-2. Toll Roads and Managed Lane Projects in the H-GAC Model Area

Future Transit System

Local fixed route and demand responsive transit services will continue to comprise the largest number of transit trips—a service frequently used by older segments of the regional population.

The light rail system currently consists of one 13-mile line through the historic core of Houston. Two additional light rail lines, adding ten miles to the system, opened in May 2015.

Figure 4-3 illustrates the future transit system showing various new services that are shown in H-GAC’s 2040 RTP.

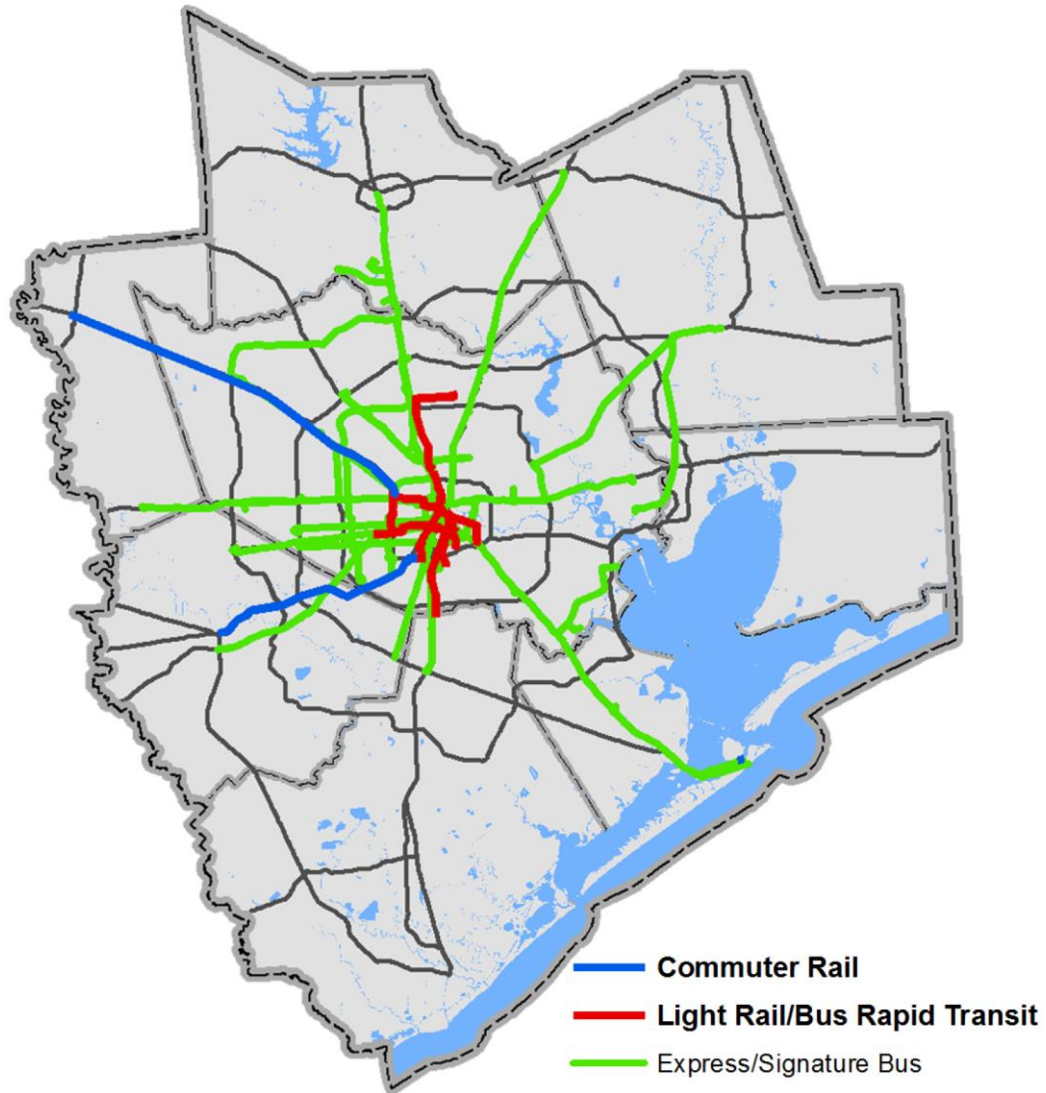


Figure 4-3. Future Regional Transit System

Source: H-GAC RTP 2040

Future Roadway Improvements in the Fort Bend County Study Area

Figure 4-4 provides an overview of major roadway improvement projects that were included in the future travel demand models within the two project study areas in Fort Bend County.

The model year for which the specific improvement was included is also shown in **Figure 4-4**.

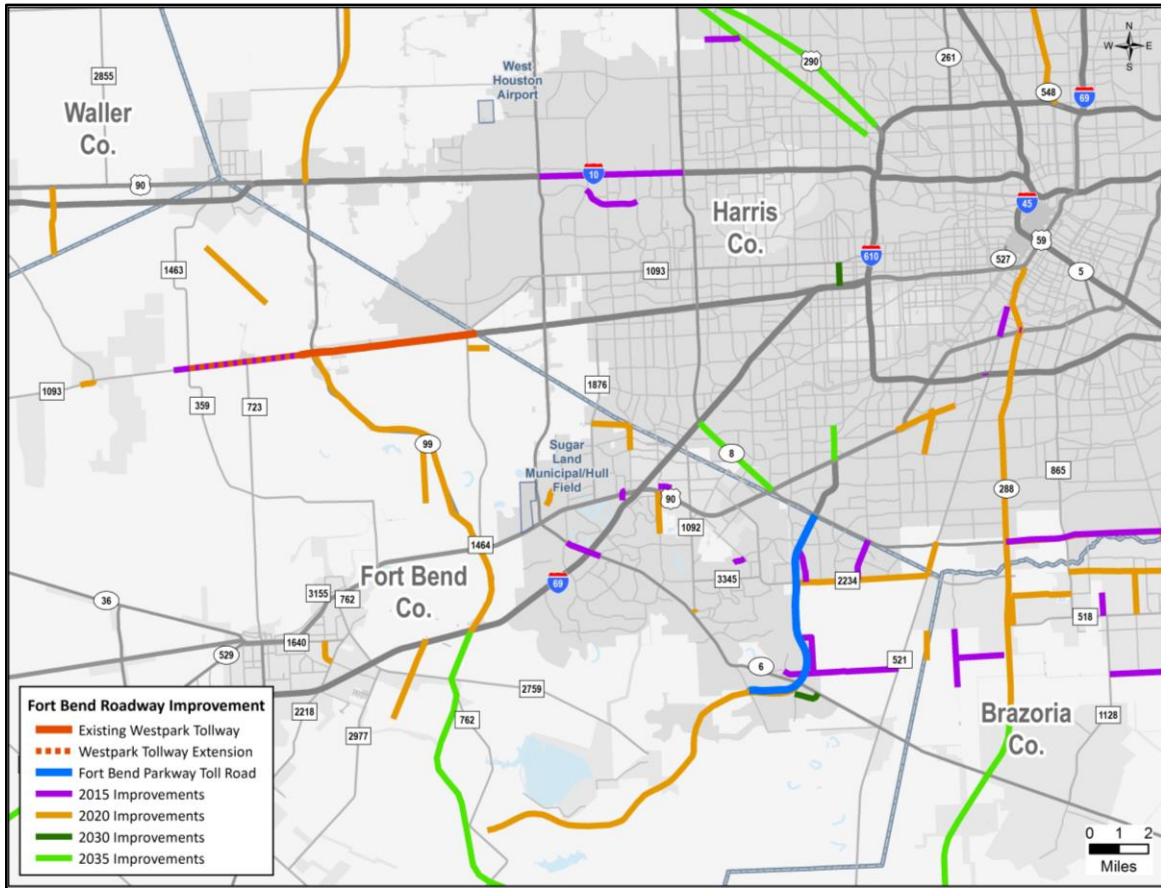


Figure 4-4. Major Roadway Improvement Projects

The following chapter, Chapter 5, provides an overview of the traffic and toll revenue potential of the two FBCTRA facilities comprising the FBCTRA System. It includes an overview of the travel demand models including model calibration, how various socioeconomic inputs and future network projects affect the traffic projections and revenue estimates from the two facilities.

Chapter 5

Estimated Traffic and Revenue

This chapter presents the traffic and revenue (T&R) estimates for the Fort Bend County Toll Road Authority System (FBCTRA System) from 2015 through 2054. The FBCTRA System facilities for which future year traffic and revenue estimates were developed are the Fort Bend Parkway Toll Road, the existing Westpark Tollway and the Westpark Extension.

The long-term T&R forecasts are based on modeling methodologies and background assumptions that are described in this chapter. In addition, this section presents the toll sensitivity analyses that were performed to estimate the revenue maximization toll rates. Chapter 5 also provides estimated average weekday traffic for model years, and the resulting estimates of annual transactions and toll revenue through 2054.

The following chapter presents the results of various sensitivity tests to assess impacts on the T&R of key input variables.

Chapter 5 is organized into the following sub-sections:

- Modeling Methodology
- Base Year Model Validation
- Traffic and Toll Revenue Assumptions
- Toll Sensitivity Analysis
- Estimated Average Weekday Traffic
- Travel Time Savings
- Corridor Share Analysis
- Annual Transactions and Toll Revenue

Modeling Methodology

This section describes the travel demand model validation process, including database modifications and updates to the CUBE network and socio-economic characteristics in the Houston-Galveston area.

Figure 5-1 illustrates the travel demand process used by CDM Smith for developing the traffic and toll revenue forecasts for the FBCTRA System.

The H-GAC Regional Travel Demand Model

The H-GAC Travel Demand Model is cooperatively developed and maintained by the H-GAC, the Texas Department of Transportation (TxDOT) and the Metropolitan Transit Authority of Harris County (METRO). The H-GAC regional travel demand model was used by CDM Smith as the foundation for developing a toll diversion model used as part of this study.

The eight-county Houston-Galveston-Brazoria Consolidated Metropolitan Statistical Area (CMSA) has been federally designated as the Transportation Management Area (TMA) for the Houston-Galveston region. The eight counties that are included in this geography are Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery and Waller counties. Land use and demographic forecasts for the TMA are developed by H-GAC.

The latest Houston-Galveston Area Council (H-GAC) travel demand model was used for this study. The regional travel demand model was validated by H-GAC to 2012 conditions using the Citilabs Cube platform. This model uses a detailed zonal structure with the 5,113 internal traffic analysis zones (TAZ) and 46 external stations used to represent the Houston-Galveston TMA. The TAZ structure in this latest model incorporates a more detailed zone structure that reflects the increased development in the suburban portion and redevelopment in the urban portions of the H-GAC region.

For the purposes of the study, the H-GAC model was converted to CDM Smith's standard toll diversion modeling framework. The model was then fine-tuned for base year conditions through an application of appropriate calibration measures which were then applied to the future year networks and trip table model datasets.

Future year traffic assignments were conducted for the base case scenario and then several sensitivity scenarios were undertaken as part of the study. For each scenario, the future year network and trip tables were developed from the calibrated toll diversion model to produce the estimated traffic demand for future years. Toll transactions at each of the tolling locations were then extracted from the calibrated model and annual estimates for interim and horizon years, 2017, 2020, 2025, 2030 and 2040 were developed. Transactions and revenue for the interim years between these model years and forecast years beyond 2040 were interpolated and extrapolated, respectively. Toll revenue estimates were then calculated at each of the tolling zone locations by applying the appropriate toll rates.

The following sections describe the regional travel demand model refinement process in further detail including the highway network development, the trip table development, and the toll diversion methodology adopted for this study. There is also an overview of key input parameters influencing the traffic and toll revenue forecasting process.

Socioeconomic Data Update

As indicated in Chapter 3, the official socioeconomic and demographic information at the TAZ level were revised as part of this study. An independent economist (CDS Market Research) led this effort to conduct a detailed review of the official HGAC forecasts and provide an alternate set of socioeconomic and demographic forecasts at the TAZ level. CDM Smith reviewed these alternate sets of forecasts for consistency and quality. The review included comparisons to the official H-GAC 2015 Q1 Regional Growth Forecasts (RGF) and other prior CDM Smith led studies in the region and growth rates were compared for reasonableness. These socioeconomic data inputs were used in the trip table development process.

Trip Table Development

The revised CDS socioeconomic and demographic forecasts were provided to H-GAC staff who ran the regional travel demand model to develop the trip tables for the years 2015, 2020, 2030 and 2040. These trip tables were stratified by vehicle types and purpose and were provided for the following time periods: AM peak, PM peak, mid-day and overnight. CDM Smith reviewed the trip tables to ensure that the growth in trips was consistent with the socioeconomic and demographic growth.

Highway Network Updates

CDM Smith conducted a thorough review of the highway model networks as part of the forecasting for the FBCTRA System. These networks were provided by H-GAC and compared against the latest transportation improvements recommended in 2040 Regional Transportation Plan (RTP) and the 2015-2018 Transportation Improvement Program (TIP). A detailed overview of the various roadway

improvement projects including those included in H-GAC's 2040 RTP and 2015-2018 TIP is included in Chapter 4.

The networks were also reviewed to incorporate all existing HCTRA and TxDOT toll facilities and numerous other planned facilities in the HGAC TMA. Existing toll facilities were coded to reflect all existing ramp and mainlane tolls. The network attributes were reviewed for consistency and fine-tuned based on the travel time characteristics and traffic counts collected within the study corridors as described in Chapter 2.

The refined networks were then used to run travel demand models, the outputs of which were used to develop the FBCTRA System traffic and toll revenue estimates.

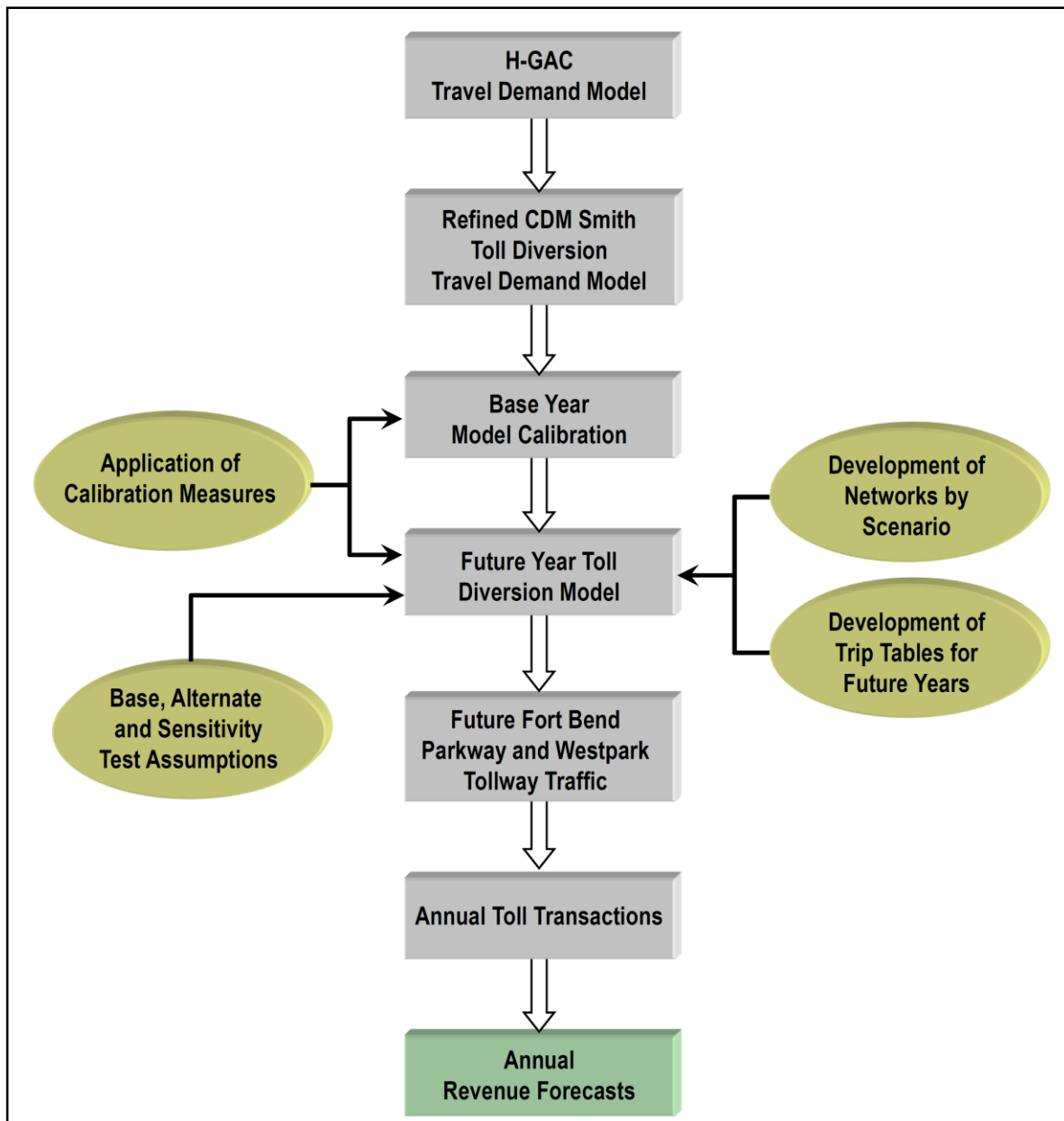


Figure 5-1. FBCTRA System - Travel Demand Modeling Process

Base Year Model Calibration

The 2015 model network was used as the base year for model validation purposes. The model calibration process involved comparing the 2015 traffic assignment output volumes based on the revised demographics to adjusted traffic counts obtained for this study and toll transactions at all existing Fort Bend toll gantries. Output travel time and speeds from the travel demand model were also compared to observed travel time information. This process was performed for each of the time periods modeled (AM, PM, mid-day and overnight).

CDM Smith used traffic counts collected in 2015 and toll transaction data to validate the model and adjust the network characteristics where needed. A total of five screenlines were developed along the Fort Bend and Westpark corridors to analyze the total corridor traffic distribution and to ensure that the base model outputs reflected current traffic characteristics within those corridors. Screenlines 1 and 2 were selected to analyze traffic on the Westpark Tollway corridor. Screenlines 3, 4 and 5 were selected to capture traffic along the Fort Bend Parkway Toll Road corridor. The locations of these five screenlines are shown in **Figure 5-2**.

The travel time and speed data collected were used to adjust the free-flow speeds along Fort Bend Parkway Toll Road and Westpark Tollway System facilities as well as on competing and complementary roadways. These adjustments accounted for any delays on the major roadways that are typically not captured or reflected as part of a regional validation process of travel time attributes. Some typical factors that can influence traffic flow in the corridor are intersection design constraints, traffic signal and stop sign impedances, narrow median design, and multiple entry point characteristics.

Table 5-1 shows a comparison of the daily model output volumes from the base year model and the processed daily traffic count volumes for each location on the five screenlines. The model inputs were adjusted so that output daily volumes matched closer to the traffic count volumes. These adjustments are carried forward in all model years accounting for the differences in the base year model forecast and the observed traffic counts.

Figure 5-3 shows a comparison of the modeled traffic volumes to the traffic count locations for various roadways. As the figure indicates, the modeled volumes match reasonably well with the traffic counts.

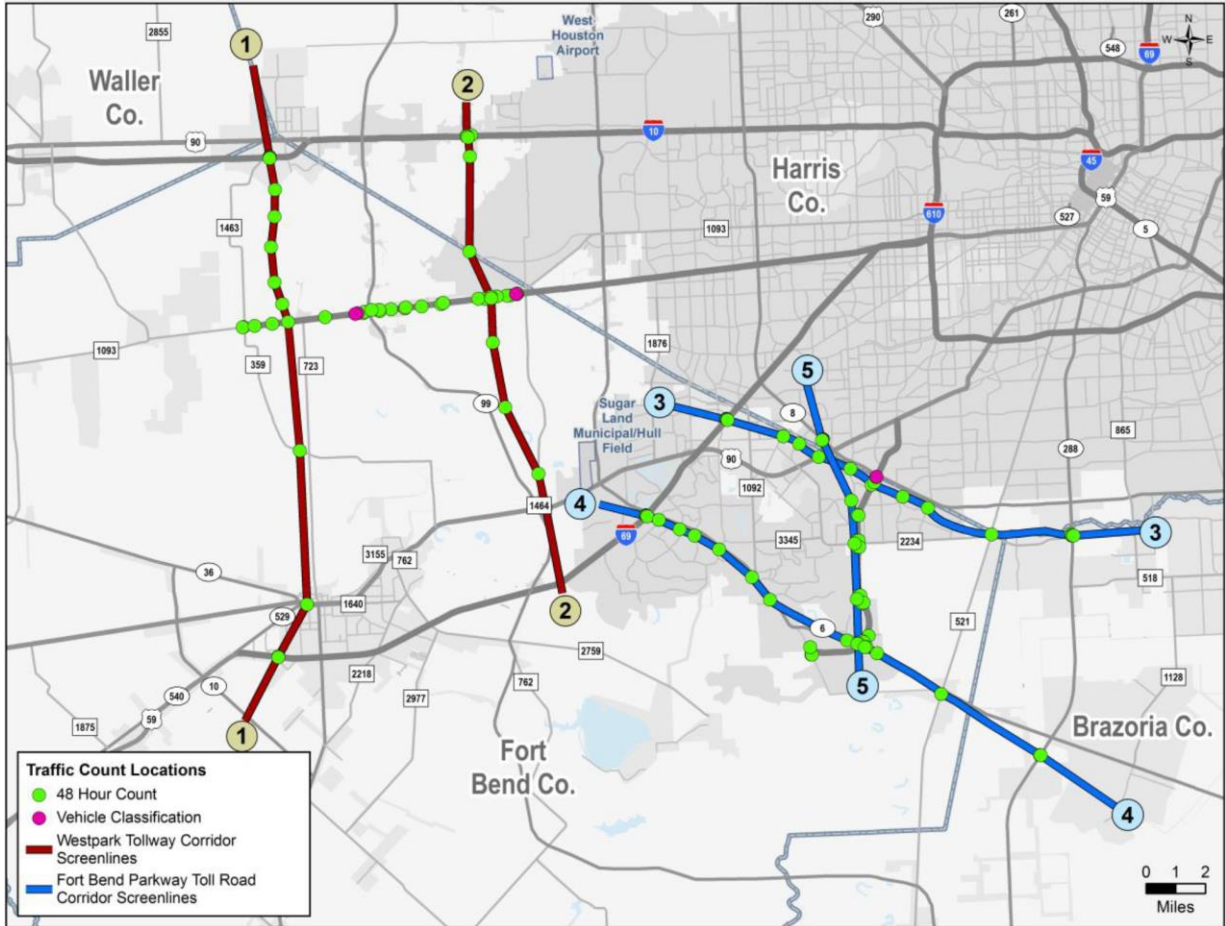


Figure 5-2. Screenline Locations for Fort Bend Parkway Toll Road and Westpark Tollway Corridors

Table 5-1. Calibration Summary: Comparison of Daily Model Traffic Volumes and Traffic Counts

Screenline No.	Daily Traffic Counts	Daily Model Volumes	Percent Difference
1	218,543	214,788	-1.7%
2	447,073	488,317	9.2%
3	606,370	593,002	-2.2%
4	445,286	350,366	-21.3%
5	289,347	239,321	-17.3%

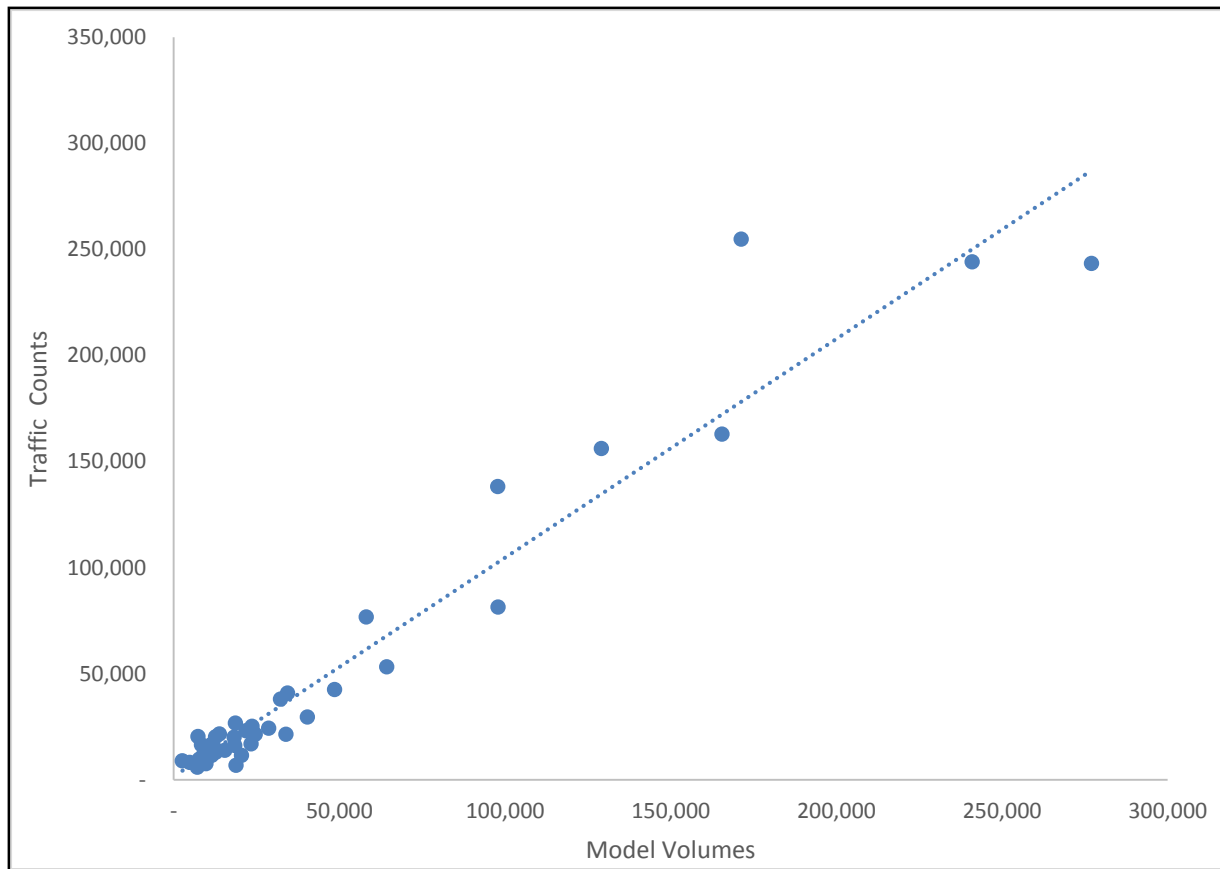


Figure 5-3. Comparison of Daily Model Volumes to Traffic Counts

Future Trip Table Adjustments

The travel demand model used for the revenue estimation process is based on the forecasts of socioeconomic variables such as population, households, and employment. These socioeconomic forecasts are used to generate vehicular trips that, in turn, are assigned on the transportation network. CDM Smith employed CDS to review and adjust the H-GAC population and employment estimates in the FBCTRA corridor at five-year intervals beginning in 2010. These forecasts and other base year trip table validation adjustments were applied to obtain adjusted future year trip tables.

Toll Diversion Methodology

A toll diversion model was used to estimate the market share of toll and non-toll facilities based on factors such as value-of-time, operating cost, toll cost, and congestion. A CDM Smith-developed algorithm was used to determine the minimum time path between each zone pair. The minimum time path for each O-D pair may or may not include the use of toll facilities.

For the trips that may potentially use toll facilities, travel time and distance of the toll facility routing was compared with that of the best alternative route not involving a toll payment. A share of the total traffic moving between each pair of zones is then assigned to the toll facility routing, while the remaining portion is assigned to the best toll-free alternative route. The model's estimate of the toll facility's market share is a function of time savings, distance relationships, toll rate, and estimates of perceived value-of-time and vehicle operating costs by the motorists. As the cost of the toll facility route increases compared to the toll-free route, the share of traffic using the toll road would likewise decrease.

Values of Time and Vehicle Operating Costs

Motorists' willingness-to-pay tolls is influenced by a combination of their perceived value-of-time (VOT) and their expected travel time savings. Values-of-time for drivers in the Houston area near the project study area were estimated using the results of stated-preference (SP) surveys conducted in the area.

Table 5-2 summarizes the multinomial values-of-time as derived from the SP surveys. For passenger cars and commercial vehicles, a mean regional VOT of approximately \$12.18 per hour (\$0.20/minute) and \$10.38 per hour (\$0.17/minute) respectively in 2015 dollars was estimated for peak and off-peak travel respectively.

As a further refinement, CDM Smith developed values-of-time for each traffic analysis zone (TAZ) for use in the model traffic assignment. In the base year, these were developed using TAZ income distributions from Census data. The VOT for future years was estimated by inflating to the respective year using an annual average growth rate of 2.0 percent from 2015.

Table 5-2. Average Values of Time (\$/min)

County	2015 VOT Peak	2015 VOT Off-Peak
Harris	\$0.19	\$0.16
Fort Bend	\$0.27	\$0.23
Brazoria	\$0.21	\$0.18
8-County Average	\$0.20	\$0.17

The vehicle operating cost used in the analysis was calculated by taking into account the average per-mile costs of gasoline and oil, and to a lesser extent, maintenance, and wear and tear of tires for vehicles in the area. For this study, it was assumed that fuel efficiency of vehicles would improve in future years. Future gasoline prices are assumed to increase to \$3.00 (in 2015 dollars) by year 2020. The resulting vehicle operating costs for passenger cars and trucks adopted for this study are shown in **Table 5-3**.

Table 5-3. Vehicle Operating Costs (\$/mile)

Year	Passenger Cars	Commercial Vehicles
2015	\$0.17	\$0.88
2020	\$0.18	\$0.97
2030	\$0.20	\$1.05
2040	\$0.24	\$1.24

Traffic and Toll Revenue Estimation Assumptions

The transaction and toll revenue estimates for FBCTRA System facilities are predicated on the following assumptions, which are consistent with observed trends and are considered reasonable for this study:

Toll Rate Assumptions

The toll rate policy adopted in April, 2015 established the toll rates on the FBCTRA facilities and the associated toll rate escalation for future years.

Toll rates for Fort Bend Parkway and Westpark Tollway were computed using the following parameters as per toll rate policy:

- Toll rates (in 2015 dollars) will be as shown in **Figures 5-4** and **5-5** for Fort Bend Parkway Toll Road and Westpark Tollway respectively.

- Toll rate escalation is as follows per the toll rate policy:
 - 2.0 percent per year with tolls adjusted annually, or
 - The annual change in the Consumer Price Index All Urban Consumers (CPI-U) for the Houston-Brazoria-Galveston region as published by the Bureau of Labor Statistics (BLS)

For purposes of this study, a two percent annual toll rate increase was assumed.

- Toll rates will be rounded to the nearest nickel.
- All users of the FBCTRA facilities are expected to pay tolls at the designated toll gantries through the use of an electronic toll tag issued by one of the toll agencies in Texas. The electronic toll tags that are accepted include TxTag, EZ-Tag and TollTag.
- Commercial vehicles pay tolls using the (N-1) formula, where N is the number of axles for a vehicle. For example, a four axle truck will pay a toll rate that is three times that of the associated passenger car toll rate at that gantry.

Toll rates for the existing and future HCTRA and TxDOT systems were also reviewed including known assumptions regarding existing and future toll rate and the toll escalation policies of the respective toll agencies.

Truck Traffic Shares/Truck Toll Assumptions

Truck traffic (vehicles with greater than two axles) shares are applied on a gantry-by-gantry basis and estimated based on actual transactions data provided by FBCTRA.

AVI Transaction Shares

AVI transaction shares are applied at each toll gantry based on the actual AVI transactions data provided by FBCTRA.

Annual Revenue Days

“Annual revenue days” is a parameter used in revenue estimation to convert the forecasted weekday transactions and revenue to annual transactions and revenue. Observed ratios of the weekend-to-weekday traffic on FBCTRA System facilities were used to estimate the annual revenue days. Annual revenue days of 290 were applied to average weekday traffic volumes to estimate annual transactions and revenue.

Traffic Growth Assumptions Beyond 2040

Between 2015 and 2040, traffic is estimated to increase at a steady growth rate which diminishes over time. Annual traffic growth rates from 2040 onwards are shown in **Table 5-4**.

Table 5-4. Annual Traffic Growth Rate Assumptions (2040 Onwards)

Year	Annual Growth Rate (%)
2041-2045	2.0
2046-2050	1.5
2051-2054	1.0

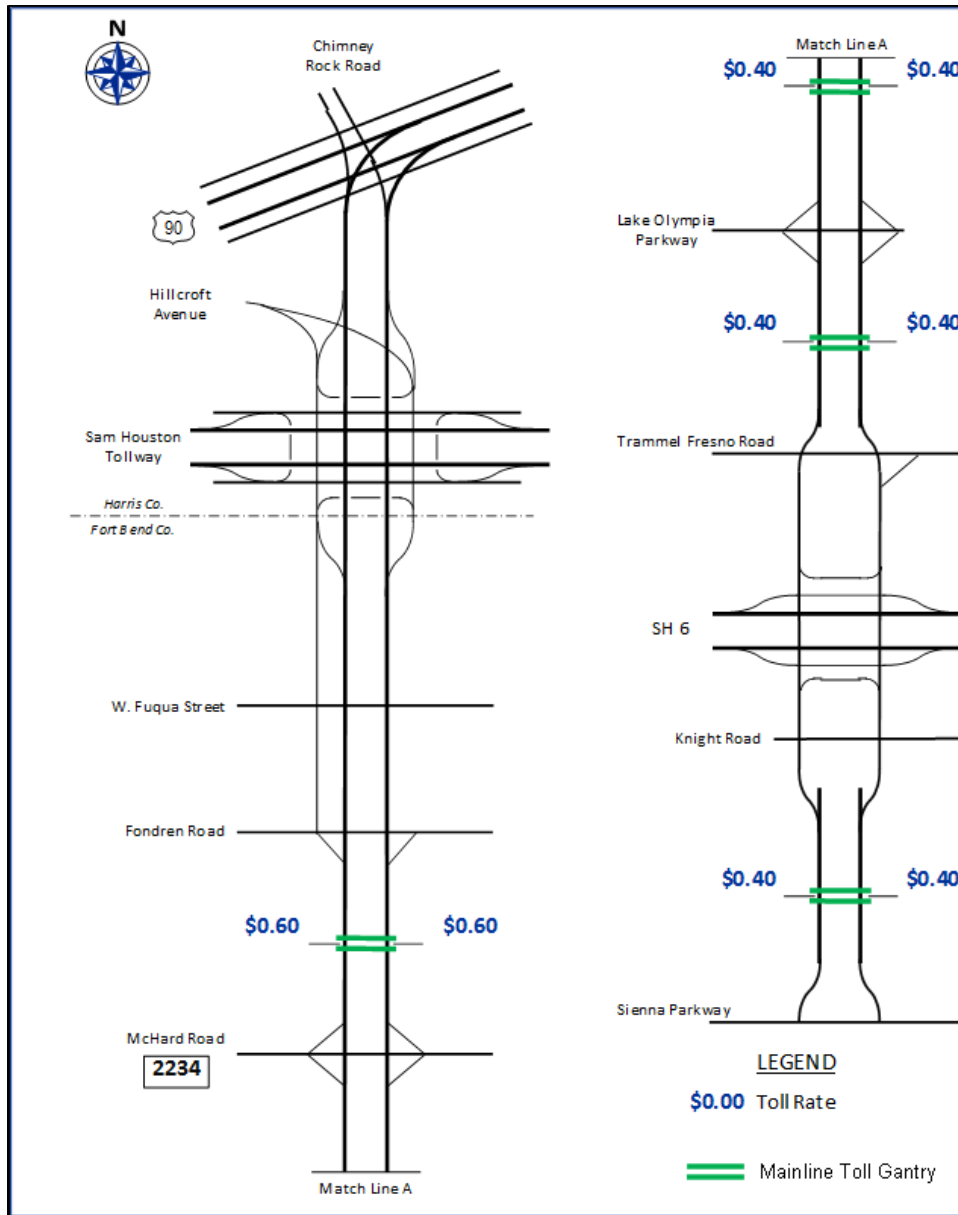


Figure 5-4. Toll Rates for Fort Bend Parkway (in 2015 dollars)

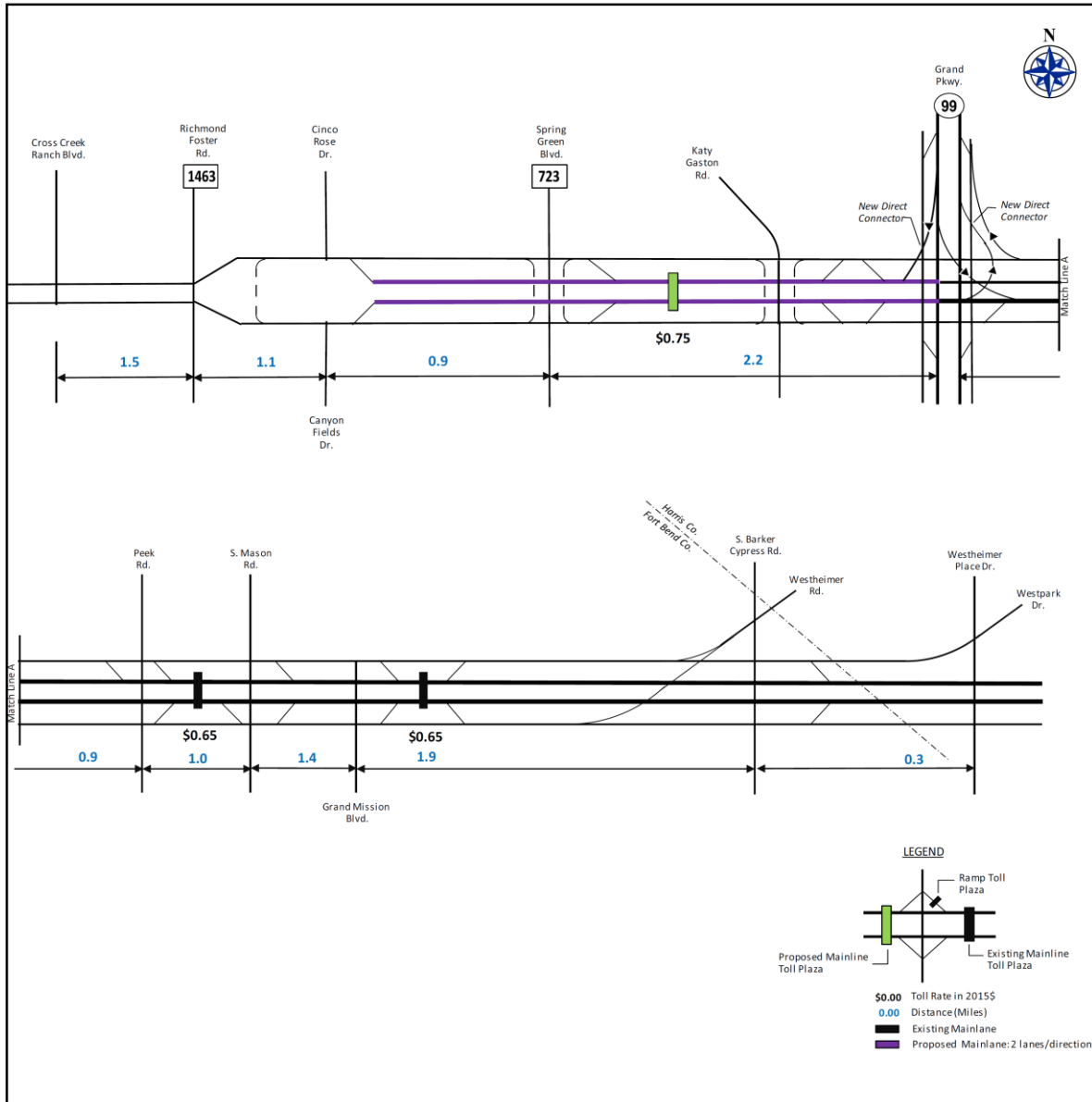


Figure 5-5. Toll Rates for Westpark Tollway and Westpark Extension (in 2015 dollars)

Revenue Leakage

Revenue leakage will occur due to unreadable plates or uncollectable automatic vehicle identification (AVI) transactions or any transactions that cannot be processed and payment collected.

Revenue leakage of 12 percent was assumed in this study. The leakage percentage reflects at-lane violations which includes non-revenue vehicles, veteran’s discounts and any other uncollectible revenue. Revenue estimates have not been adjusted to reflect any estimates of leakage due to additional revenue recovery through violation enforcement, non-tag toll administrative fees, fines and other administrative fees that might be recovered over time. However, it is understood that FBCTRA issues toll violation notices for violations and is able to recover a portion of the revenue related to vehicles that get initially recorded at the toll lane as a violation.

Ramp-up

The traffic levels for the first few years of a new tolled facility or new toll extension will typically have a “ramp-up” period because the traffic will not be at full potential because of unfamiliarity by travelers. This ramp-up period is assumed to last for three years from the opening date.

The ramp-up factor for Westpark Extension is assumed to be 65 percent in year one, 85 percent in year two, 95 percent in year three and 100 percent beyond year four.

A brief summary of all the various assumptions is presented in **Table 5-5**.

Table 5-5. Summary of Assumptions

Traffic and Revenue Assumptions			
1.0 General:			
1.1	Contact Person: Michael Copeland, CDM Smith		
1.2	Type of T&R Study: Comprehensive T&R Study		
1.3	T&R estimation for FBCTRA System which includes Westpark Tollway, Westpark extension and Fort Bend Parkway		
2.0 Annual T&R estimates from 2015 to 2054 for each calendar year.			
3.0 Configuration/Capacity Assumptions:			
3.1	Westpark Tollway including Westpark extension		
	- All electronic toll collection system.		
	- Current Westpark Tollway is a 4-lane limited access facility extending from I-610 to west of SH 99.		
	- Proposed Westpark Extension is assumed to be a 4-lane limited access facility extending from west of SH 99 to west of FM 723.		
	- Non-tolled frontage road extends from west of SH 99 to FM 1463.		
	- Opening year assumed to be 2017.		
	Please refer to the line diagrams for Westpark Tollway for detailed configuration.		
3.2	Fort Bend Parkway		
	- All electronic toll collection system.		
	- 4-lane limited access facility extending from Alt US 90 to the Sienna Parkway.		
	- Other extensions will not be assumed as part of this study. It should be noted that RTP 2040 includes the extension to SH 99.		
	- 4 mainlane toll plazas at Sienna Parkway, Lake Olympia, McHard and Fondren. All previous ramp tolling locations were removed.		
	Please refer to the line diagrams for Fort Bend Parkway for the new detailed configuration.		
4.0 Demographics and Background Transportation Network Assumptions:			
4.1	HGAC Trip tables are updated to reflect independent economic review by Community Development Strategies (CDS) in 2015. In addition, validation adjustments will be done, as needed.		
4.2	Background networks for travel demand modeling are based on H-GAC 2040 Regional Transportation Plan and H-GAC 2015-2018 Transportation Improvement Program.		
5.0 Toll Rate Assumptions			
	Tolls will be adjusted annually as per the April 2015 Toll Rate Order. As per the Toll Rate Order toll rates will be escalated at the greater of:		
	(a) 2 percent, or (b) the annual change in CPI All Urban consumers Houston-Galveston-Brazoria as published by the BLS for the month of August, and rounded to the nearest nickel.		
6.0 Vehicle Operating costs			
	Year	Passenger Cars	Commercial Vehicles
	2015	0.17	0.88
	2020	0.18	0.97
	2030	0.20	1.05
	2040	0.24	1.24
	Fuel efficiency of vehicles assumed to improve in future years.		
	Future gas prices assumed at a rate of \$3.00 per gallon in real terms from year 2020.		
	Commercial vehicle operating cost is assumed to be 5.26 times the passenger car vehicle operating costs.		
7.0 Toll Rate Escalation			
	Tolls assumed to be inflated by 2.0 percent from 2015 to 2054.		
8.0 Annual average transactions growth rate beyond 2040 is assumed as follows:			
	Between 2040 - 2045: 2.0 percent per year		
	Between 2045 - 2050: 1.5 percent per year		
	Between 2050 - 2054: 1.0 percent per year		
9.0 Annualization factor is assumed as 290 days			
10.0 Toll Violation (Leakage) Percentage			
	AVI	Leakage will account for about 12 percent of transactions.	
11.0 Ramp-up			
	Ramp up assumed to be:		
	65% in year 1		
	85% in year 2		
	95% in year 3		
	100% in year 4 and beyond		

Toll Sensitivity Analysis

Toll sensitivity analysis involves testing a series of toll rates to determine how price affects traffic demand on the toll facility taking into account future characteristics of the transportation network and future willingness-to-pay tolls.

In general, a toll sensitivity curve suggests that when toll rates increase, a portion of travelers will divert from the toll facility in favor of other routes and thus decreasing the captured toll transactions. The initial increases from a low toll rate level typically result in increased toll revenues until an optimal point where the maximum revenue is generated. Increases beyond this optimal toll rate level yields diminished toll revenues as the magnitude of diverted traffic exceeds the net return generated by the toll rate increase.

CDM Smith evaluated traffic and revenue potential under a range of alternative toll rates for future years 2017 and 2040. **Figures 5-6** and **5-7** illustrate the toll sensitivity curves for the FBCTRA facilities for average weekday transactions and revenue before applying ramp-up for the Fort Bend Parkway and Westpark Tollway corridors respectively for 2017. The average toll rate shown reflects the average toll rate of all the tolling locations for that facility. Several average toll rates that were higher and lower than the assumed programmed toll rate were analyzed.

Figures 5-6 and **5-7** also illustrate the programmed toll rates for each facility. The toll sensitivity analysis results indicate that the projected toll rates of the both Fort Bend Parkway Toll Road and Westpark Tollway are below the estimated theoretical revenue maximization points. This demonstrates that overall for the both facilities, there is potential for revenue enhancement through toll increases above current toll rate levels and the assumed escalated rates used for forecasting purposes, if warranted.

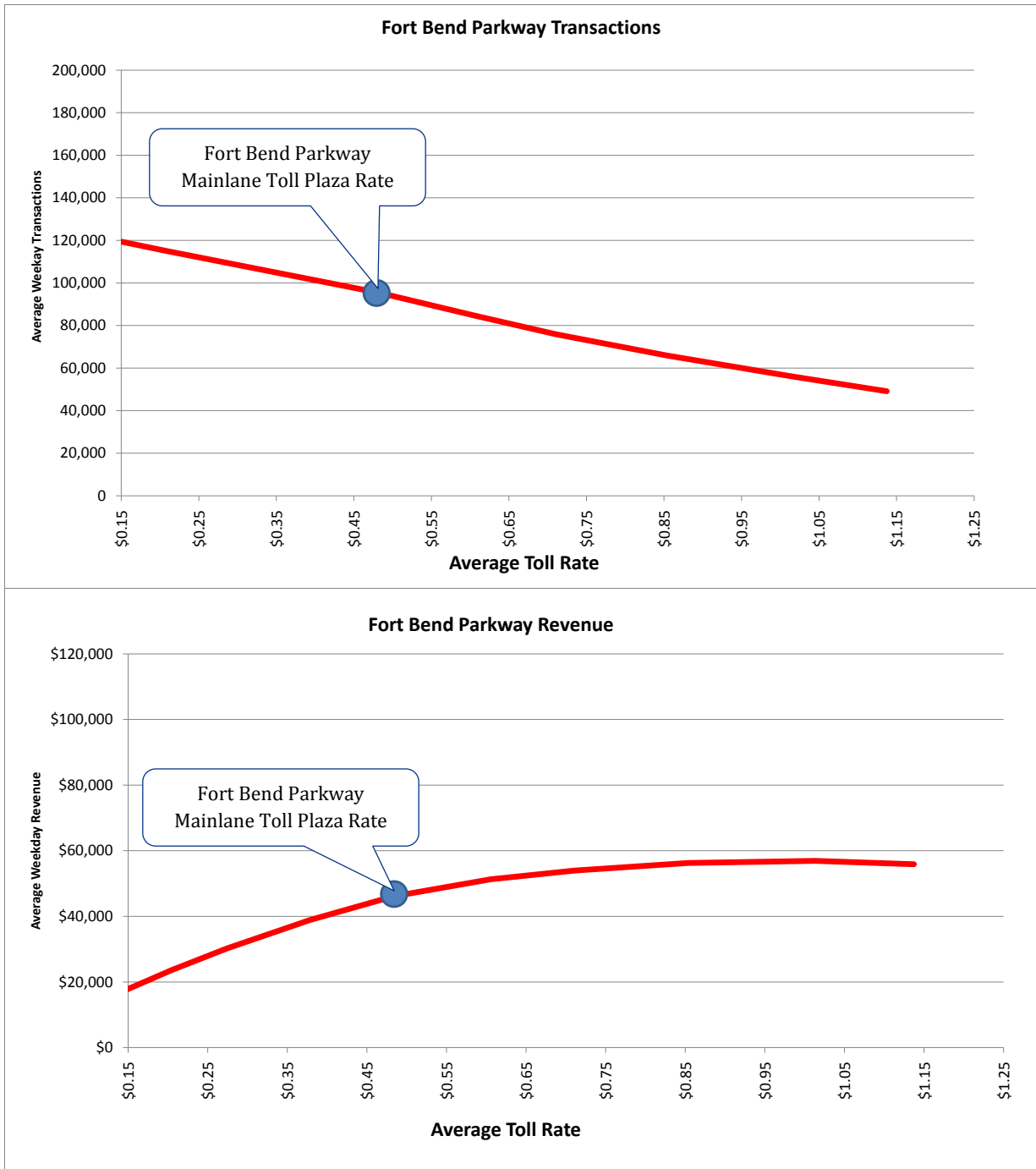


Figure 5-6. 2017 Toll Sensitivity Curves for Fort Bend Parkway

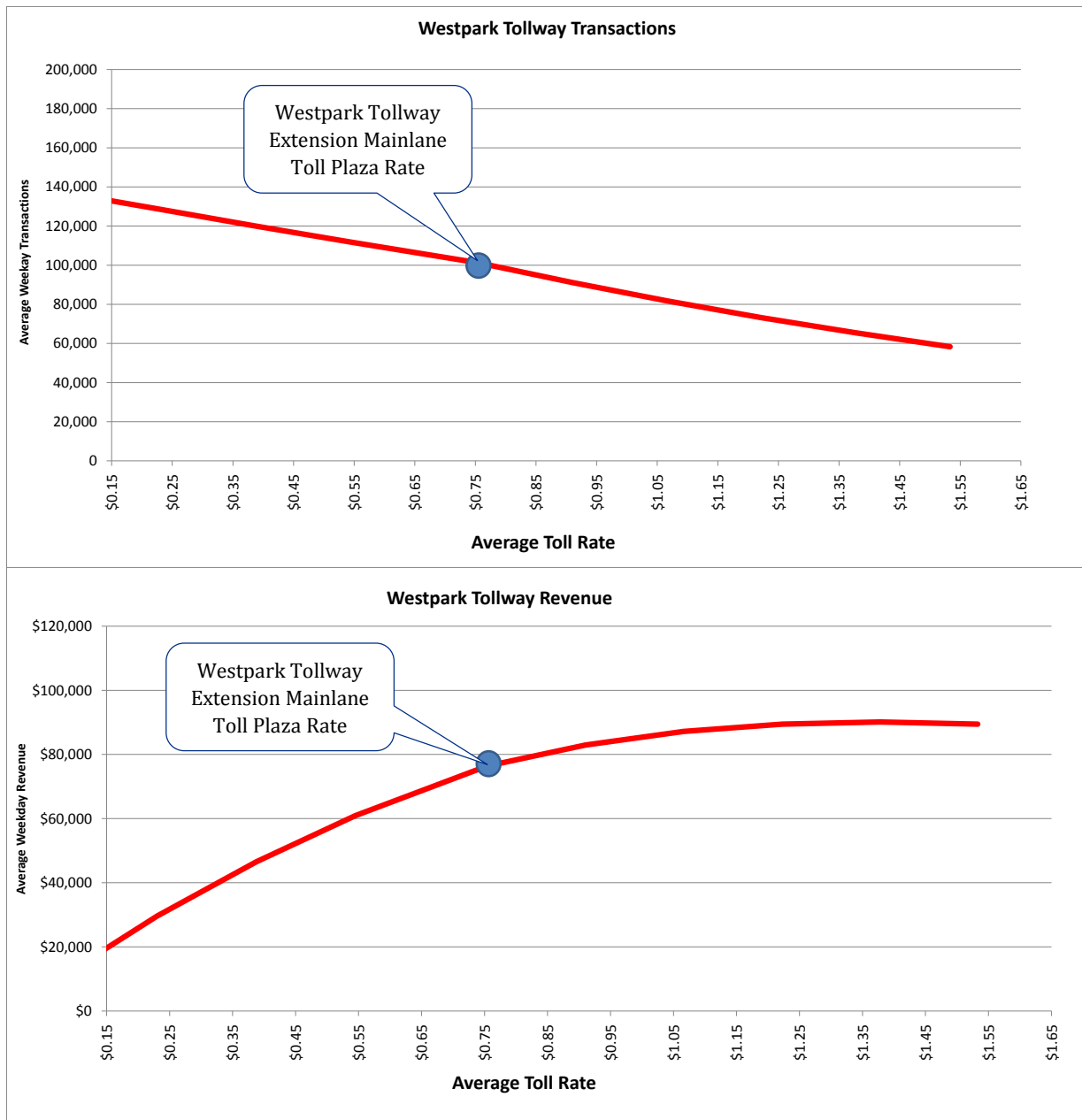


Figure 5-7. 2017 Toll Sensitivity Curves for Westpark Tollway (including Westpark Extension)

Estimated Average Weekday Traffic

An equilibrium diversion technique was used to carry out traffic assignment runs for the four periods, AM peak, PM peak, mid-day and over-night. Traffic volumes were estimated by using the revised demographics trip tables, which were adjusted based on the base year model validation process.

All other years were interpolated or extrapolated between or beyond the modeled years to obtain the yearly traffic and revenue estimates.

The traffic assignment results at each of the analysis years were reviewed for reasonableness and post-model adjustments were made as necessary. This included adjustments to reflect model validation results along the two FBCTRA facilities. Traffic on Westpark Tollway is highly directional and will likely continue to be so in the short term to medium term. Capacity constraints of the existing segments of Westpark Tollway were considered when developing long term projections. It is commonly observed that as a facility matures, peak period travel spreads to shoulder periods of the peak hour as well as the other non-peak time of the day. Also as suburban growth continues westward it is likely to impact the highly directional characteristic of the facility increasing its ability to carry more traffic on a daily basis.

Tables 5-6 and **5-7** show the estimated weekday traffic and revenue volumes for the toll gantries on Fort Bend Parkway, Westpark Tollway and the Westpark Extension for 2020 (before ramp-up) and 2040 respectively.

Figures 5-8 through **5-11** illustrate the estimated 2020 and 2040 average weekday volumes (minor differences due to rounding) at mainlines and ramp locations along Fort Bend Parkway and Westpark Tollway (including the Westpark extension).

Table 5-6. Estimated Average Weekday Traffic and Revenue at FBCTRA gantries in 2020

Fort Bend Parkway	Passenger Cars			Commercial Vehicles			Total Vehicles		
	Transactions	Toll	Revenue	Transactions	Toll	Revenue	Transactions	Toll	Revenue
Fondren Rd Mainline	32,100	\$ 0.65	\$ 20,900	700	\$ 1.75	\$ 1,200	32,800	\$ 0.67	\$ 22,100
McHard Rd Mainline	33,100	\$ 0.45	\$ 14,900	700	\$ 1.20	\$ 800	33,800	\$ 0.46	\$ 15,700
Lake Olympia Parkway Mainline	26,400	\$ 0.45	\$ 11,900	700	\$ 1.20	\$ 800	27,100	\$ 0.47	\$ 12,700
Mainlane east of Sienna Pkwy	8,700	\$ 0.45	\$ 3,900	500	\$ 1.20	\$ 600	9,200	\$ 0.49	\$ 4,500
Total	100,300	\$ 0.51	\$ 51,600	2,600	\$ 1.31	\$ 3,400	102,900	\$ 0.53	\$ 55,000

Westpark Tollway	Passenger Cars			Commercial Vehicles			Total Vehicles		
	Transactions	Toll	Revenue	Transactions	Toll	Revenue	Transactions	Toll	Revenue
Peek Road Mainlane	41,800	\$ 0.70	\$ 29,300	1,400	\$ 1.90	\$ 2,700	43,200	\$ 0.74	\$ 32,000
Westmoor Mainline	49,700	\$ 0.70	\$ 34,800	1,400	\$ 1.90	\$ 2,700	51,100	\$ 0.73	\$ 37,500
Westpark Extension	24,700	\$ 0.85	\$ 21,000	700	\$ 2.30	\$ 1,600	25,400	\$ 0.89	\$ 22,600
Existing Westpark Tollway	91,500	\$ 0.70	\$ 64,100	2,800	\$ 1.93	\$ 5,400	94,300	\$ 0.74	\$ 69,500
Westpark Extension	24,700	\$ 0.85	\$ 21,000	700	\$ 2.29	\$ 1,600	25,400	\$ 0.89	\$ 22,600
Total	116,200	\$ 0.73	\$ 85,100	3,500	\$ 2.00	\$ 7,000	119,700	\$ 0.77	\$ 92,100

Table 5-7. Estimated Average Weekday Traffic and Revenue at FBCTRA gantries in 2040

Fort Bend Parkway	Passenger Cars			Commercial Vehicles			Total Vehicles		
	Transactions	Toll	Revenue	Transactions	Toll	Revenue	Transactions	Toll	Revenue
Fondren Rd Mainline	58,000	\$1.00	\$ 58,000	1,300	\$2.70	\$ 3,500	59,300	\$1.04	\$ 61,500
McHard Rd Mainline	64,400	\$0.65	\$ 41,900	1,400	\$1.75	\$ 2,500	65,800	\$0.67	\$ 44,400
Lake Olympia Parkway Mainline	49,800	\$0.65	\$ 32,400	1,200	\$1.75	\$ 2,100	51,000	\$0.68	\$ 34,500
Mainlane east of Sienna Pkwy	16,800	\$0.65	\$ 10,900	900	\$1.75	\$ 1,600	17,700	\$0.71	\$ 12,500
TOTAL	189,000	\$0.76	\$ 143,200	4,800	\$2.02	\$ 9,700	193,800	\$0.79	\$ 152,900

Westpark Tollway	Passenger Cars			Commercial Vehicles			Total Vehicles		
	Transactions	Toll	Revenue	Transactions	Toll	Revenue	Transactions	Toll	Revenue
Peek Road Mainlane	68,200	\$1.05	\$ 71,600	2,200	\$2.85	\$ 6,300	70,400	\$1.11	\$ 77,900
Westmoor Mainline	73,100	\$1.05	\$ 76,800	2,000	\$2.85	\$ 5,700	75,100	\$1.10	\$ 82,500
Westpark Extension	44,400	\$1.25	\$ 55,500	1,300	\$3.40	\$ 4,400	45,700	\$1.31	\$ 59,900
Existing Westpark Tollway	141,300	\$1.05	\$ 148,400	4,200	\$2.86	\$ 12,000	145,500	\$1.10	\$ 160,400
Westpark Extension	44,400	\$1.25	\$ 55,500	1,300	\$3.38	\$ 4,400	45,700	\$1.31	\$ 59,900
TOTAL	185,700	\$1.10	\$ 203,900	5,500	\$2.98	\$ 16,400	191,200	\$1.15	\$ 220,300

Corridor Share Analysis

The model traffic assignment results were reviewed for reasonableness using a screenline corridor share analysis. As part of this screenline review, special attention was paid to the overall level of growth in traffic throughout the projection period, and the relative share of total screenline demand expected to be captured by Fort Bend Parkway and Westpark Tollway.

Figure 5-12 shows the screenlines evaluated as part of the corridor share analysis for Westpark Tollway and Fort Bend Parkway Toll Road. Screenlines 1 and 2 are useful to analyze the share of traffic on Westpark Tollway, while Screenlines 3 and 4 can be used to estimate the corridor share for Fort Bend Parkway.

Table 5-8 summarizes the results of the corridor share analysis at screenlines 1, 2, 3 and 4 for years 2020 and 2040. As expected, the relative share of the screenline traffic carried by the various mainlane sections of Fort Bend Parkway and Westpark Tollway increases from future year 2020 to future year 2040 due to increased corridor growth as well as congestion along the competing arterial and freeway roadways. The share of the screenline traffic carried by the Westpark Tollway corridor for both 2020 and 2040 is higher compared to the Fort Bend Parkway corridor.

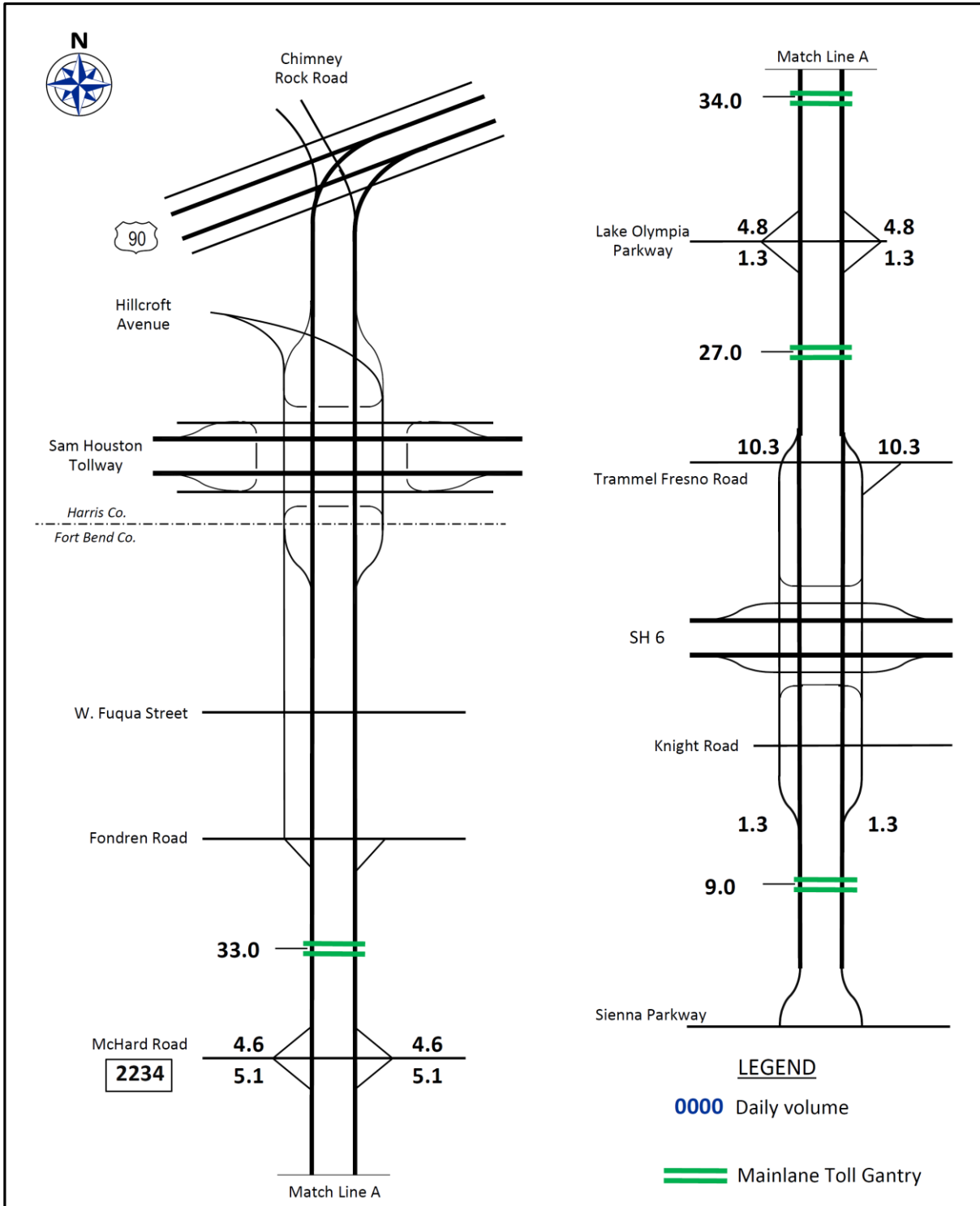


Figure 5-8. Balanced Average Weekday Traffic (thousands) for Fort Bend Parkway - 2020

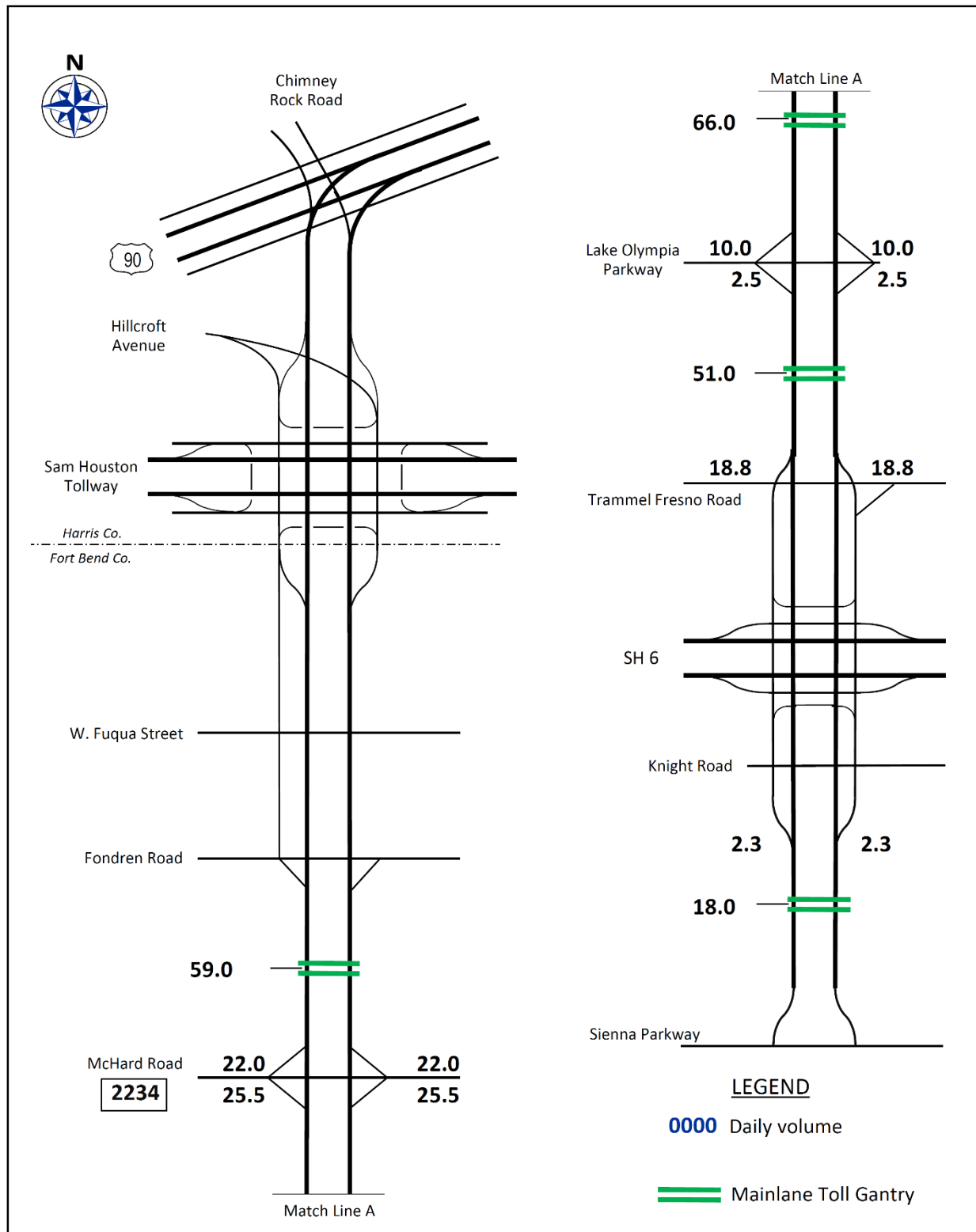


Figure 5-9. Balanced Average Weekday Traffic (thousands) for Fort Bend Parkway - 2040

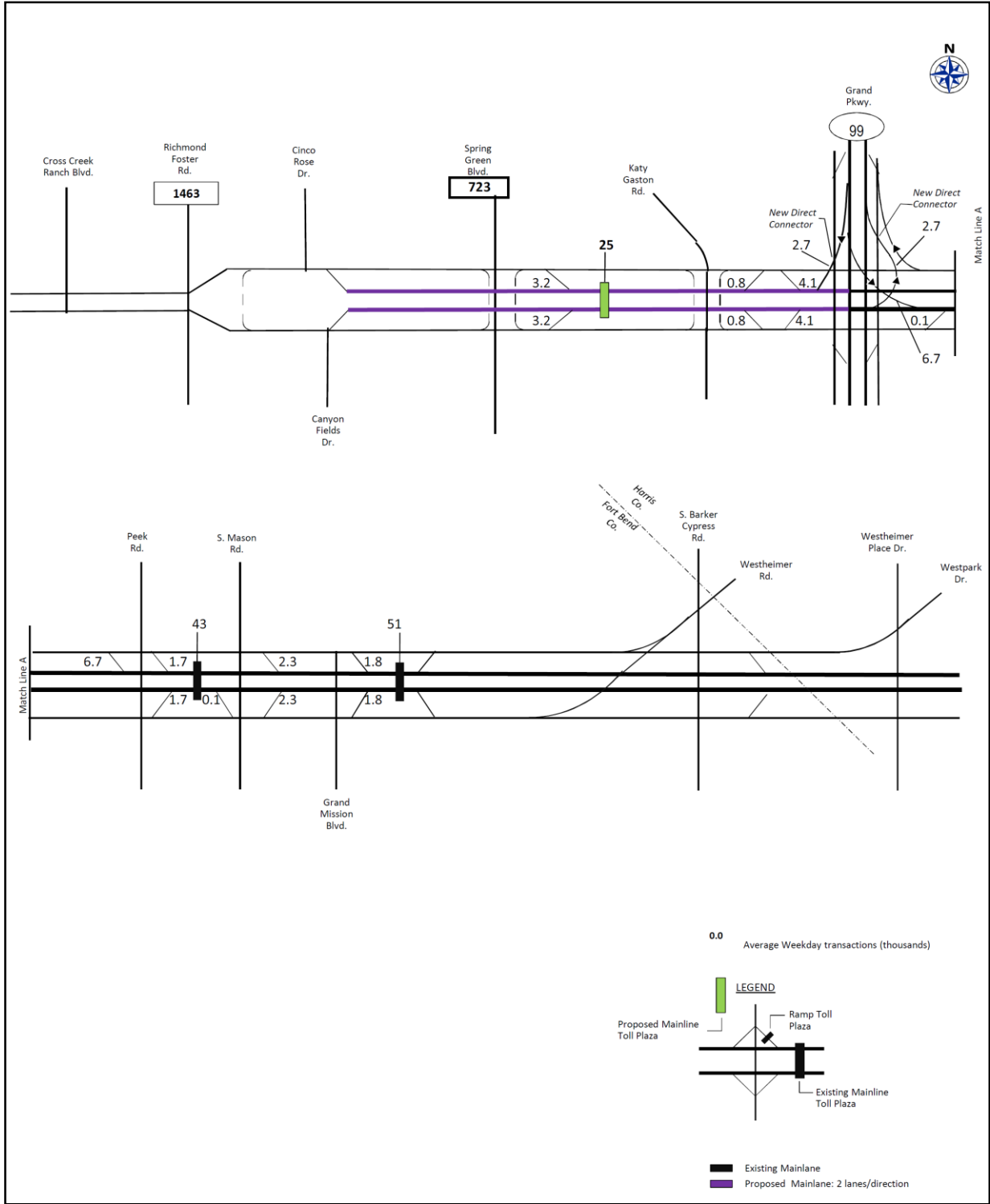


Figure 5-10. Balanced Average Weekday Traffic (thousands) for Westpark Tollway – 2020

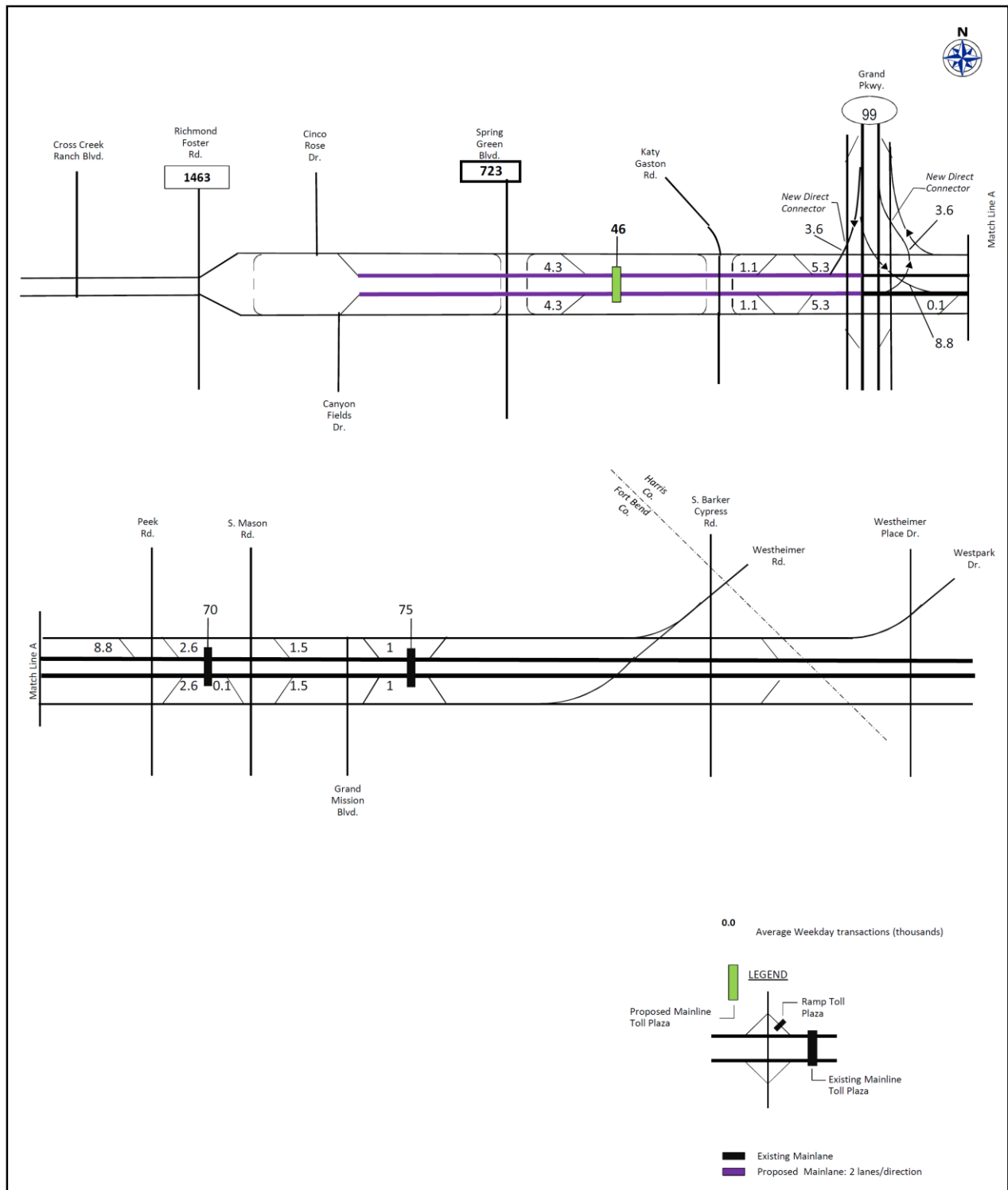


Figure 5-11. Balanced Average Weekday Traffic (thousands) for Westpark Tollway - 2040

Table 5-8. Corridor Share Analysis Results –Screenlines 1, 2, 3 and 4

Screen Line 1 Road Name	Year					
	2015		2020		2040	
	Volume	Market Share	Volume	Market Share	Volume	Market Share
I-10	81,300	37.2%	89,000	32.4%	132,200	29.8%
Katy Flewellen Rd	16,600	7.6%	20,200	7.3%	30,900	7.0%
Gaston Rd	8,900	4.1%	9,100	3.3%	14,400	3.2%
Roesner Rd	8,100	3.7%	13,100	4.8%	17,800	4.0%
Cinco Ranch Blvd	11,500	5.3%	16,800	6.1%	27,200	6.1%
Fry Rd	9,600	4.4%	16,400	6.0%	30,700	6.9%
Westpark Mainlanes	---	---	18,600	6.8%	37,400	8.4%
Westpark Frontage Road	21,400	9.8%	14,100	5.1%	17,700	4.0%
FM 359	7,700	3.5%	10,800	3.9%	18,300	4.1%
US 90 Alt	15,400	7.0%	21,900	8.0%	44,800	10.1%
US 59	38,000	17.4%	45,000	16.4%	71,700	16.2%
Total Screen Line	218,500	100.0%	275,000	100.0%	443,100	100.0%
Screen Line 2 Road Name	Year					
	2015		2020		2040	
	Volume	Market Share	Volume	Market Share	Volume	Market Share
I-10	243,400	54.4%	263,200	52.1%	346,600	51.8%
Kingsland Blvd	16,300	3.6%	16,300	3.2%	21,400	3.2%
Westhemier Pkwy	23,000	5.1%	25,000	5.0%	27,900	4.2%
Alief Clodine Rd	29,600	6.6%	34,200	6.8%	28,200	4.2%
Westpark Toll Plaza	42,400	9.5%	51,000	10.1%	75,000	11.2%
Beechnut Rd	7,500	1.7%	16,100	3.2%	30,800	4.6%
Airport Blvd	6,700	1.5%	9,000	1.8%	16,600	2.5%
FM 1464	16,900	3.8%	22,100	4.4%	35,900	5.4%
US 90 Alt	61,300	13.7%	67,800	13.4%	87,100	13.0%
Total Screen Line	447,100	100.0%	504,700	100.0%	669,500	100.0%
Screen Line 3 Road Name	Year					
	2015		2020		2040	
	Volume	Market Share	Volume	Market Share	Volume	Market Share
US 59	244,100	40.3%	268,700	38.1%	339,500	35.6%
Stafford Rd	12,400	2.0%	13,600	1.9%	20,400	2.1%
Gessner	21,500	3.5%	22,600	3.2%	30,700	3.2%
Alt 90	78,100	12.9%	87,600	12.4%	117,200	12.3%
Fondren Rd	24,200	4.0%	26,600	3.8%	37,800	4.0%
Fort Bend Parkway Mainlanes	24,500	4.0%	28,000	4.0%	47,400	5.0%
Fuqua Dr	9,900	1.6%	12,800	1.8%	17,700	1.9%
Post Oak Rd	25,100	4.1%	31,000	4.4%	31,200	3.3%
Alameda Rd	26,600	4.4%	30,100	4.3%	37,700	4.0%
SH 288	140,000	23.1%	185,000	26.2%	274,600	28.8%
Total Screen Line	606,400	100.0%	706,000	100.0%	954,200	100.0%
Screen Line 4 Road Name	Year					
	2015		2020		2040	
	Volume	Market Share	Volume	Market Share	Volume	Market Share
US 59	254,800	57.2%	289,300	54.9%	402,900	54.1%
Lexington Blvd	20,000	4.5%	22,100	4.2%	30,200	4.1%
Williams Trace Blvd	13,900	3.1%	13,800	2.6%	16,900	2.3%
Settlers Way Blvd	13,200	3.0%	14,700	2.8%	18,000	2.4%
Austin Pkwy	20,200	4.5%	24,200	4.6%	45,700	6.1%
Murphy Rd	20,300	4.6%	23,000	4.4%	35,900	4.8%
Lake Olympia Pkwy	6,900	1.5%	7,900	1.5%	11,900	1.6%
Sienna Pkwy	22,200	5.0%	25,600	4.9%	32,300	4.3%
Sienna Pkwy Toll Plaza	5,900	1.3%	9,000	1.7%	18,000	2.4%
FM 521	14,700	3.3%	22,600	4.3%	40,000	5.4%
SH 288	53,200	11.9%	75,000	14.2%	92,900	12.5%
Total Screen Line	445,300	100.0%	527,200	100.0%	744,700	100.0%

Travel Time Savings

An important part of the decision to use a toll facility is the potential time savings that is offered to the traveler. This section illustrates the travel time savings associated with using the FBCTRA facilities rather than alternative routes in the study area for the year 2040.

Two origin-destination (O-D) pairs were evaluated, one each for Fort Bend Parkway and Westpark. For each O-D pair, the tolled route was compared to one alternate route for the morning peak and evening peak as illustrated in **Figures 5-13** and **5-14**.

As shown in **Figure 5-13**, Fort Bend Parkway offers time savings of up to 22 minutes over the alternate route in the morning peak period and a time savings of 18 minutes in the evening peak period. Comparatively, as shown in **Figure 5-14**, Westpark Tollway shows smaller time savings, with the maximum time savings of 16 minutes, which occurs during the morning peak period.

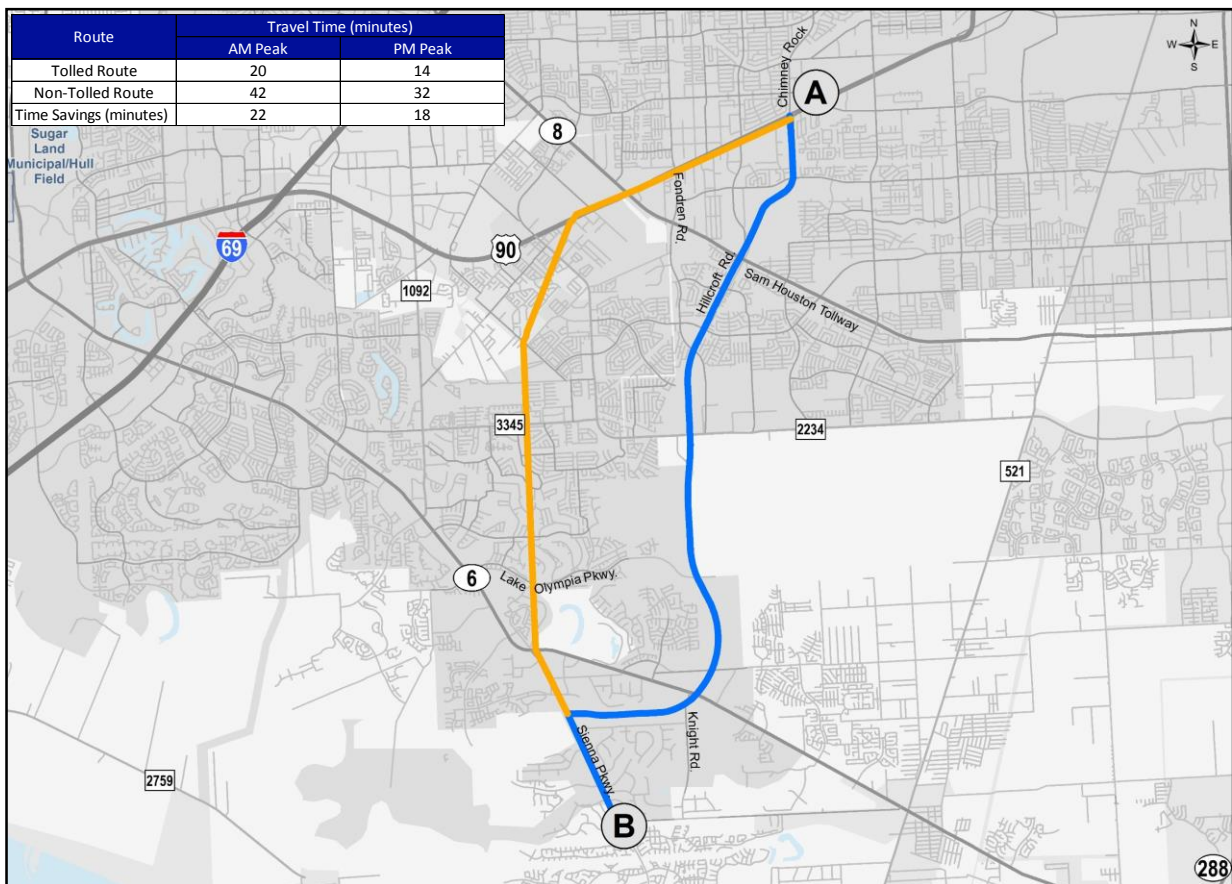


Figure 5-13. Estimated Travel Time Savings for Fort Bend Parkway Corridor

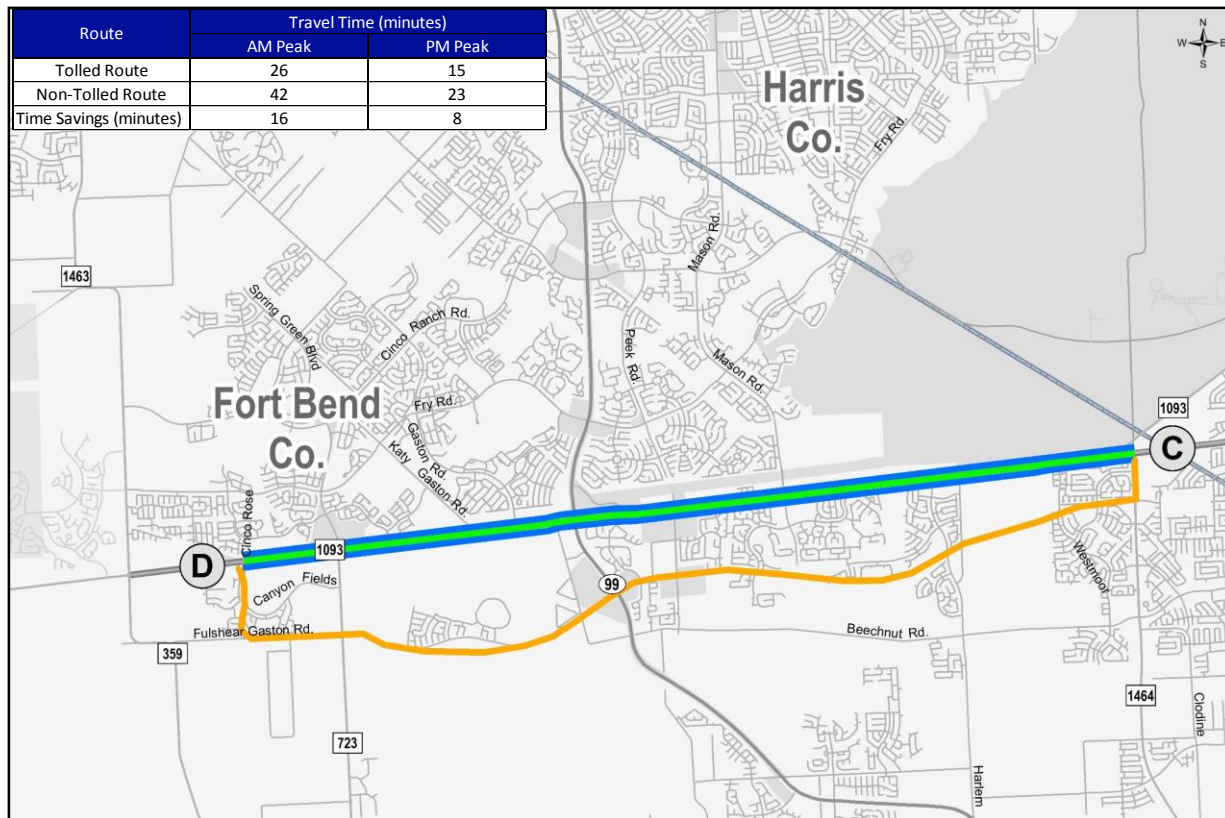


Figure 5-14. Estimated Travel Time Savings for Westpark Corridor

Estimated Annual FBCTRA System Toll Revenue

Based on the traffic forecast at each toll plaza location, annual forecasts for the FBCTRA System were prepared from 2015 through 2054, including Fort Bend Parkway Toll Road, Westpark Tollway and the Westpark Extension. In each case, forecasts for each of the facilities are based on modeled traffic estimates at each toll collection location, through the year 2040. These modeled estimates were refined using post-model adjustments, reflecting validation factors used to match observed 2015 traffic data at each toll gantry location. Estimates beyond year 2040 are based on nominal assumptions regarding future traffic growth as shown previously in **Table 5-4**, with assumed toll rate increases as noted previously.

As shown in **Table 5-9**, the estimated annual revenue on Fort Bend Parkway is expected to increase from \$13 million in 2020 to \$24.8 million by 2030 and to \$39 million by 2040. The annual revenue for Westpark Tollway is expected to increase from \$17.3 million in 2020 to \$26.5 million by 2030, reaching \$41 million by 2040.

Total revenue on the entire FBCTRA System, is expected to increase from about \$36 million in 2020 to \$95.3 million by 2040. Driven by nominal traffic growth and continued assumed inflationary adjustments in toll rates, revenue on the FBCTRA System is expected to reach \$154.2 million by 2054.

Table 5-10 shows the projected annual transaction and revenue growth rates on the FBCTRA System including Fort Bend Parkway, Westpark Tollway and Westpark Extension. Annual transaction and revenue growth rates for the FBCTRA from 2020 through 2030 are about 3.3 percent and 5.4 percent respectively. During this period, the growth in transactions is driven by the growth in the demographics

along the FBCTRA System corridors. Revenue growth includes traffic growth and toll rate increases due to inflation.

Annual transaction and revenue growth rates from 2030 through 2040 are estimated to be 2.4 percent and 4.6 percent respectively.

Table 5-9. FBCTRA System Estimated Annual Toll Revenue

Year	Annual Transactions (Thousands)					Annual Revenue ⁽⁵⁾ (Thousands)					
	Fort Bend Parkway	Westpark Tollway	Westpark Extension	Westpark Tollway and Extension Total	FBCTRA System	Fort Bend Parkway	Westpark Tollway	Westpark Extension	Westpark Tollway and Extension Total	FBCTRA System	
2015	(1)	25,346	22,293	0	22,293	47,639	\$9,759	\$13,006	\$0	\$13,006	\$22,765
2016		26,472	23,022	0	23,022	49,494	\$10,233	\$13,959	\$0	\$13,959	\$24,192
2017	(2)	27,648	23,968	3,161	27,129	54,777	\$10,729	\$15,105	\$2,336	\$17,441	\$28,170
2018		28,890	25,040	4,584	29,624	58,514	\$11,647	\$15,799	\$3,457	\$19,256	\$30,903
2019		30,187	26,159	5,681	31,840	62,027	\$12,643	\$16,524	\$4,371	\$20,895	\$33,538
2020	(3)	29,830	27,329	7,367	34,696	64,526	\$12,972	\$17,282	\$5,785	\$23,067	\$36,039
2021		31,178	28,464	7,772	36,236	67,414	\$13,946	\$18,506	\$6,174	\$24,680	\$38,626
2022		32,586	29,647	8,200	37,847	70,433	\$14,993	\$19,817	\$6,589	\$26,406	\$41,399
2023		34,058	30,879	8,650	39,529	73,587	\$16,118	\$21,219	\$7,032	\$28,251	\$44,369
2024		35,597	32,162	9,126	41,288	76,885	\$17,327	\$22,722	\$7,506	\$30,228	\$47,555
2025		36,864	30,593	9,157	39,750	76,614	\$18,421	\$22,222	\$7,617	\$29,839	\$48,260
2026		38,304	31,265	9,398	40,663	78,967	\$19,543	\$23,015	\$7,983	\$30,998	\$50,541
2027		39,800	31,951	9,645	41,596	81,396	\$20,732	\$23,836	\$8,366	\$32,202	\$52,934
2028		41,354	32,653	9,898	42,551	83,905	\$21,994	\$24,687	\$8,767	\$33,454	\$55,448
2029		42,969	33,369	10,158	43,527	86,496	\$23,331	\$25,568	\$9,189	\$34,757	\$58,088
2030		44,647	34,102	10,425	44,527	89,174	\$24,750	\$26,480	\$9,630	\$36,110	\$60,860
2031		45,822	34,838	10,680	45,518	91,340	\$25,994	\$27,687	\$10,145	\$37,832	\$63,826
2032		47,028	35,589	10,941	46,530	93,558	\$27,301	\$28,949	\$10,687	\$39,636	\$66,937
2033		48,266	36,357	11,208	47,565	95,831	\$28,673	\$30,270	\$11,258	\$41,528	\$70,201
2034		49,536	37,142	11,482	48,624	98,160	\$30,114	\$31,650	\$11,860	\$43,510	\$73,624
2035	(4)	50,096	37,943	11,762	49,705	99,801	\$31,211	\$33,093	\$12,493	\$45,586	\$76,797
2036		51,268	38,762	12,050	50,812	102,080	\$32,640	\$34,536	\$13,016	\$47,552	\$80,192
2037		52,468	39,599	12,345	51,944	104,412	\$34,134	\$36,040	\$13,562	\$49,602	\$83,736
2038		53,696	40,454	12,648	53,102	106,798	\$35,696	\$37,611	\$14,129	\$51,740	\$87,436
2039		54,953	41,327	12,958	54,285	109,238	\$37,330	\$39,250	\$14,721	\$53,971	\$91,301
2040		56,239	42,219	13,275	55,494	111,733	\$39,037	\$40,960	\$15,337	\$56,297	\$95,334
2041		57,364	43,063	13,541	56,604	113,968	\$40,614	\$42,615	\$15,956	\$58,571	\$99,185
2042		58,511	43,925	13,811	57,736	116,247	\$42,255	\$44,337	\$16,601	\$60,938	\$103,193
2043		59,681	44,803	14,088	58,891	118,572	\$43,962	\$46,128	\$17,272	\$63,400	\$107,362
2044		60,875	45,699	14,369	60,068	120,943	\$45,738	\$47,992	\$17,970	\$65,962	\$111,700
2045		61,788	46,385	14,585	60,970	122,758	\$47,353	\$49,686	\$18,603	\$68,289	\$115,642
2046		62,715	47,080	14,804	61,884	124,599	\$49,024	\$51,440	\$19,261	\$70,701	\$119,725
2047		63,656	47,787	15,026	62,813	126,469	\$50,755	\$53,256	\$19,940	\$73,196	\$123,951
2048		64,610	48,503	15,251	63,754	128,364	\$52,546	\$55,136	\$20,644	\$75,780	\$128,326
2049		65,580	49,231	15,480	64,711	130,291	\$54,401	\$57,082	\$21,373	\$78,455	\$132,856
2050		66,235	49,723	15,635	65,358	131,593	\$56,044	\$58,806	\$22,018	\$80,824	\$136,868
2051		66,898	50,221	15,791	66,012	132,910	\$57,737	\$60,582	\$22,683	\$83,265	\$141,002
2052		67,567	50,723	15,949	66,672	134,239	\$59,480	\$62,411	\$23,368	\$85,779	\$145,259
2053		68,242	51,230	16,108	67,338	135,580	\$61,276	\$64,296	\$24,074	\$88,370	\$149,646
2054		68,925	51,742	16,269	68,011	136,936	\$63,127	\$66,238	\$24,801	\$91,039	\$154,166
Total		1,947,749	1,517,241	443,278	1,960,519	3,908,268	\$1,305,580	\$1,419,798	\$506,574	\$1,926,372	\$3,231,952

Notes:

Source: CDM Smith Estimates, September 9, 2015

- (1) Transactions and Revenue for all years for Fort Bend Parkway Toll Road represent the tolling configuration changed from mainlines and ramp gantries to all mainline gantries,
- (2) Opening date of Westpark Extension from SH 99 to west of FM 723.
- (3) Assumed Opening date of SH 288 Managed Lanes.
- (4) Assumed Opening date of SH 288 Toll Lanes south of SH 6.
- (5) Annual Revenue is in nominal dollars (after leakage)

Table 5-10. FBCTRA System Transactions and Revenue Annual Growth

Period	FBCTRA Transactions Growth Rate	FBCTRA Revenue Growth Rate
2015-2020	6.3%	9.6%
2020-2030	3.3%	5.4%
2030-2040	2.3%	4.6%
2040-2050	1.6%	3.7%

Figure 5-15 graphically displays the annual revenue forecasts shown previously in **Table 5-9** by facility.

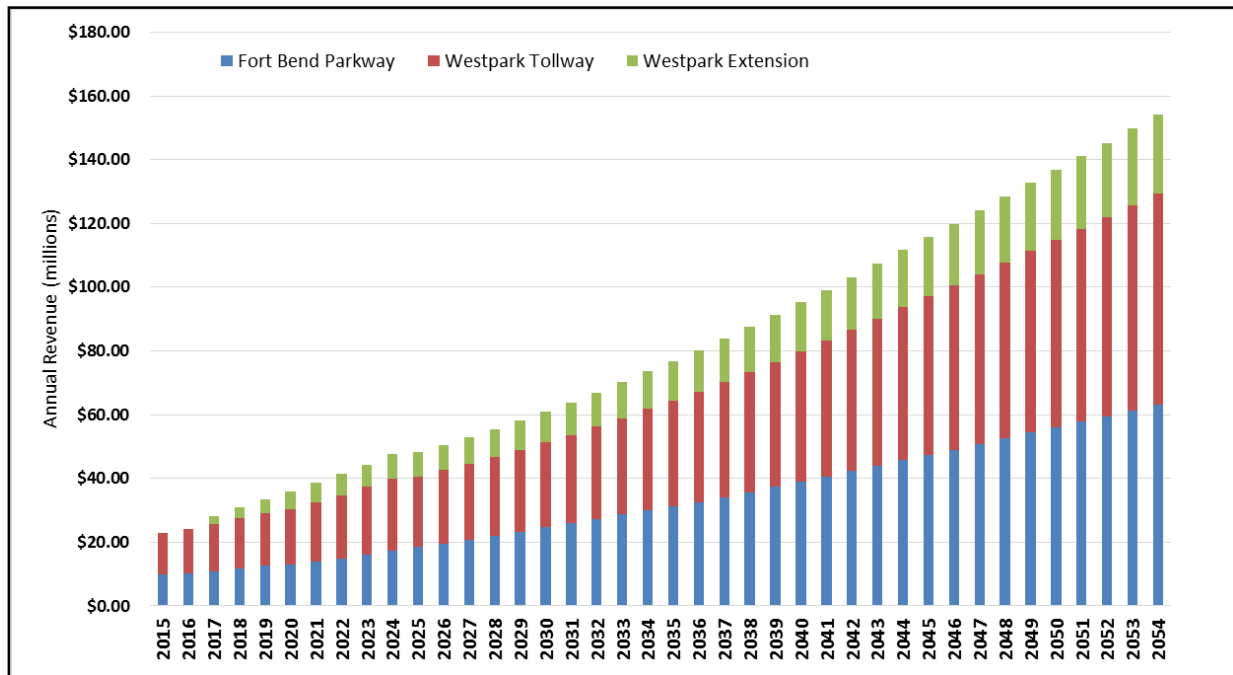


Figure 5-15. FBCTRA System Estimated Annual Revenue by Facility

Chapter 6

Sensitivity Tests

This chapter presents a series of sensitivity tests that were performed to provide a measure of the sensitivity of transactions and toll revenue to changes in some key assumptions of this study.

Chapter 5 provided estimates of traffic and toll revenue for the Fort Bend County Toll Road Authority System (FBCTRA System) from 2015 through 2054 based on several background assumptions that are documented in that chapter. Chapter 6, presents the results of various sensitivity tests to assess impacts of changes to some of those key input variables to the transactions and revenue on the FBCTRA facilities.

Chapter 6 is organized into the following sections:

- Sensitivity Tests
- Sensitivity Test Results for Fort Bend Parkway
- Sensitivity Test Results for Westpark Tollway
- Sensitivity Test Impacts on the FBCTRA System
- Early Opening of SH 288 Managed Lanes
- Sensitivity impacts of toll rates on Westpark plazas

Sensitivity Tests

The sensitivity tests were conducted for future years 2020 and 2040 and included adjustments to key variables such as value of time (VOT), trip growth, truck percentages and revenue days. A list of the various sensitivity tests performed is shown below:

- Lower VOT – Assumes a reduced willingness to pay tolls in 2020 and 2040
- Higher VOT – Assumes more willingness to pay tolls in 2020 and 2040
- Low Trip Table Growth – Assumes a 50 percent reduction in the growth of the baseline trip table in 2020 and 2040. While this may be an unlikely scenario, this sensitivity test was analyzed to determine the effect of very low economic growth in the Houston metropolitan area.
- Increase in Truck Percentage – Assumes a 50 percent increase in the truck share of transactions
- Increase in Revenue Days – Assumes an increase from 290 to 300 revenue days
- Early Opening of SH 288 Managed Lanes – Assumes that the priced lanes on SH 288 will open by 2017

Sensitivity Test Results for Fort Bend Parkway

The results of the sensitivity tests for 2020 and 2040 for Fort Bend Parkway are presented in **Table 6-1**. Each analysis shown includes a change to only one parameter to estimate the impact of that specific change on annual transactions and revenue.

As indicated in Table 6-1, increasing the VOT by 10 percent results in a 4.7 percent and 2.8 percent increase in annual revenue by 2020 and 2040 respectively. Conversely, decreasing the VOT by 20 percent results in an 11 percent and 8.3 percent decrease in revenue by 2020 and 2040 respectively.

Future economic growth is an important variable in determining future T&R estimates and can be sensitive to future variations. If a decrease in growth of 50 percent is assumed, the annual revenue on Fort Bend Parkway would decrease by roughly 13.2 percent in 2020 and 36.4 percent in 2040 compared to the baseline revenue.

Also shown in **Table 6-1** are the effects of assumed increases/decreases in truck percentage, the impact of an increase in revenue days to 300 days and reduced speed on Fort Bend Parkway by 10 miles per hour. The reduced speed sensitivity test showed that the Fort Bend Parkway transactions and revenue reduced by 14 percent in year 2020 and 9 percent in year 2040 compared to the base case forecast.

Table 6-1: Sensitivity Test Results for 2020 and 2040 (in thousands) – Fort Bend Parkway

Scenario	2020 (Transactions)	2040 (Transactions)	2020 (Revenue)	2040 (Revenue)
Base Case Forecast	29,830	56,239	\$14,741	\$44,359
10 Percent Higher VOT	31,208	57,759	15,434	45,589
Difference vs. Base	1,378	1,520	693	1,230
% Impact vs. Base	+4.6%	+2.7%	+4.7%	+2.8%
20 Percent Lower VOT	26,599	51,653	13,118	40,656
Difference vs. Base	-3,231	-4,586	-1,623	-3,703
% Impact vs. Base	-10.8%	-8.2%	-11.0%	-8.3%
Low Trip Table Growth (50% reduction in the growth of the baseline trip tables)	25,833	35,670	12,791	28,210
Difference vs. Base	-3,997	-20,569	-1,950	-16,149
% Impact vs. Base	-13.4%	-36.6%	-13.2%	-36.4%
Increase in Truck Percentage	29,830	56,239	15,046	45,287
Difference vs. Base	---	---	305	928
% Impact vs. Base	---	---	+2.1%	+2.1%
Decrease in Truck Percentage	29,830	56,239	14,445	43,457
Difference vs. Base	---	---	-296	-902
% Impact vs. Base	---	---	-2.0%	-2.0%
Increase in Revenue Days from 290 to 300	30,859	58,178	15,249	45,889
Difference vs. Base	1,029	1,939	508	1,530
% Impact vs. Base	+3.4%	+3.4%	+3.4%	+3.4%
Reduce Speeds by 10 mph	25,544	51,231	12,632	40,428
Difference vs. Base	-4,286	-5,008	-2,109	-3,931
% Impact vs. Base	-14.4%	-8.9%	-14.3%	-8.9%

Sensitivity Test Results for Westpark Tollway

The results of the sensitivity tests for Westpark Tollway and Westpark Extension are presented in **Table 6-2**. As indicated in **Table 6-2**, increasing the VOT by 10 percent compared to the baseline increased revenue by 5.4 percent in 2020 and 4.3 percent in 2040. Decreasing the VOT by 20 percent compared to the baseline decreased revenue by 12.4 percent and 9.6 percent in 2020 and 2040 respectively. Assuming a decrease in the growth of trips by 50 percent, annual revenue would decrease roughly 16.3 percent in 2020 and 28.5 percent in 2040 as compared with baseline forecasts. **Table 6-2** also illustrates the impact of changes in truck shares, revenue days and reduced speed on Fort Bend Parkway by 10 miles per hour. The reduced speed sensitivity test showed that the Westpark tollway transactions and revenue reduced by 7 percent in the year 2020 and 6 percent in year 2040 compared to the base case forecast.

Table 6-2: Sensitivity Test Results for 2020 and 2040 (in thousands) – Westpark Tollway and Westpark Extension

Scenario	2020 (Transactions)	2040 (Transactions)	2020 (Revenue)	2040 (Revenue)
Base Case Forecast	34,696	55,494	\$26,213	\$63,974
10 Percent Higher VOT	36,559	57,890	27,616	66,717
Difference vs. Base	1,863	2,396	1,403	2,743
% Impact vs. Base	+5.4%	+4.3%	+5.4%	+4.3%
20 Percent Lower VOT	30,390	50,175	22,963	57,825
Difference vs. Base	-4,306	-5,319	-3,250	-6,149
% Impact vs. Base	-12.4%	-9.6%	-12.4%	-9.6%
Low Trip Table Growth (50% reduction in the growth of the baseline trip tables)	29,116	39,883	21,941	45,727
Difference vs. Base	-5,580	-15,611	-4,272	-18,247
% Impact vs. Base	-16.1%	-28.1%	-16.3%	-28.5%
Increase in Truck Percentage	34,696	55,494	26,863	65,569
Difference vs. Base	---	---	650	1,595
% Impact vs. Base	---	---	+2.5%	+2.5%
Decrease in Truck Percentage	34,696	55,494	25,582	62,426
Difference vs. Base	---	---	-631	-1,548
% Impact vs. Base	---	---	-2.4%	-2.4%
Increase in Revenue Days from 290 to 300	35,892	57,408	27,117	66,180
Difference vs. Base	1,196	1,914	904	2,206
% Impact vs. Base	+3.4%	+3.4%	+3.4%	+3.4%
Reduce Speeds by 10 mph	32,196	52,289	24,323	60,284
Difference vs. Base	-2,500	-3,205	-1,890	-3,690
% Impact vs. Base	-7.2%	-5.8%	-7.2%	-5.8%

Sensitivity Test Impacts on the FBCTRA System

Table 6-3 combines the results of **Table 6-1** and **Table 6-2** for the whole FBCTRA system including Fort Bend Parkway, Westpark Tollway and Westpark Extension.

As shown in **Table 6-3**, an increase in the value of time assumed results in a FBCTRA systemwide toll revenue impact of 5.0 percent and 3.7 percent in 2020 and 2040 respectively. A reduction in the value of time assumed results in a FBCTRA systemwide toll revenue reduction of about 12.0 percent and 9.0 percent in 2020 and 2040 respectively. The sensitivity tests for the reduced trip table scenario revealed an estimated reduction of 15 percent and 31.8 percent on systemwide toll revenues in 2020 and 2040 respectively. The reduced speed sensitivity test showed transactions and revenue reduction by 10 percent and 7 percent in years 2020 and 2040 respectively.

Table 6-3: Sensitivity Test Impacts on FBCTRA System for 2020 and 2040 (in thousands)

Scenario	2020 (Transactions)	2040 (Transactions)	2020 (Revenue)	2040 (Revenue)
Base Case Forecast	64,526	111,733	\$40,954	\$108,333
10 Percent Higher VOT	67,767	115,649	43,050	112,306
Difference vs. Base	3,241	3,916	2,096	3,973
% Impact vs. Base	+5.0%	+3.5%	+5.1%	+3.7%
20 Percent Lower VOT	56,989	101,828	36,081	98,481
Difference vs. Base	-7,537	-9,905	-4,873	-9,852
% Impact vs. Base	-11.7%	-8.9%	-11.9%	-9.1%
Low Trip Table Growth (50% reduction in the growth of the baseline triptables)	54,949	75,553	34,732	73,937
Difference vs. Base	-9,577	-36,180	-6,222	-34,396
% Impact vs. Base	-14.8%	-32.4%	-15.2%	-31.8%
Increase in Truck Percentage	64,526	111,733	41,909	110,856
Difference vs. Base	---	---	955	2,523
% Impact vs. Base	---	---	+2.3%	+2.3%
Decrease in Truck Percentage	64,526	111,733	40,027	105,883
Difference vs. Base	---	---	-927	-2,450
% Impact vs. Base	---	---	-2.3%	-2.3%
Increase in Revenue Days from 290 to 300	66,751	115,586	42,366	112,069
Difference vs. Base	2,225	3,853	1,412	3,736
% Impact vs. Base	+3.4%	+3.4%	+3.4%	+3.4%
Reduce Speeds by 10 mph	57,740	103,520	36,955	100,712
Difference vs. Base	-6,786	-8,213	-3,999	-7,621
% Impact vs. Base	-10.5%	-7.4%	-9.8%	-7.0%

Early Opening of SH 288 Managed Lanes

In the T&R analysis, it was assumed that the SH 288 Managed Lanes will open in year 2020. The sensitivity test was conducted to determine impact on T&R assuming an early opening of SH 288 Managed Lanes. The assumption of early opening of the managed lanes on SH 288 results in a decrease in projected annual transactions on Fort Bend Parkway, resulting in an overall estimated reduction of projected annual revenue of approximately 6 percent in 2017 compared to the baseline revenue on Fort Bend Parkway. For FBCTRA system, the early opening of SH 288 managed lanes would reduce 2017 annual toll revenues by 2.4 percent.

Sensitivity Impacts of Toll Rates on Westpark Plazas

CDM Smith applied initial tolls on Westpark extension based on per mile rate. The new mainlane plaza at Westpark extension has a toll rate of 75 cents in 2015 dollars while the existing main lane plazas have a 65 cent toll rate. However, it is possible that the initial toll rate on the Westpark Extension would be set equal to the mainlane plazas along Westpark Tollway. Two sensitivity tests were evaluated, the first sensitivity test assumes 65 cents (2015\$) on all main lane plazas along Westpark Tollway and the second sensitivity test assumes 70 cents (2015\$) on all main lane plazas along Westpark Tollway.

Table 6-4 shows the sensitivity impacts on Westpark Tollway due to applying the same toll rates on all main lane plazas along Westpark Tollway. For the first sensitivity test, the Westpark transactions in 2020 increase by 1.8 percent and revenue decreases by 2.6 percent. In 2040, the Westpark transactions increase by 1.4 percent and revenue decreases by 3.0 percent. For the second sensitivity test, the Westpark transactions in 2020 decrease by 0.8 percent and revenue increases by 1.8 percent. In 2040, the Westpark transactions decrease by 1.1 percent and revenue increases by 3.6 percent

Table 6-4 Sensitivity Impacts of Applying Same Tolls on all Westpark Plazas for the year 2020 and 2040 (in thousands) – Westpark Tollway

Scenario	Transactions		Revenue	
	2020	2040	2020	2040
Base Case Forecast	34,696	55,494	\$26,213	\$63,974
All Westpark toll plazas toll rate at \$0.65 (2015\$)	35,312	56,292	25,519	62,063
Difference vs. Base	616	798	-694	-1,911
% Impact vs. Base	+1.8%	+1.4%	-2.6%	-3.0%
All Westpark toll plazas toll rate at \$0.70(2015\$)	34,430	54,900	26,672	66,258
Difference vs. Base	-266	-594	459	2,284
% Impact vs. Base	-0.8%	-1.1%	+1.8%	+3.6%

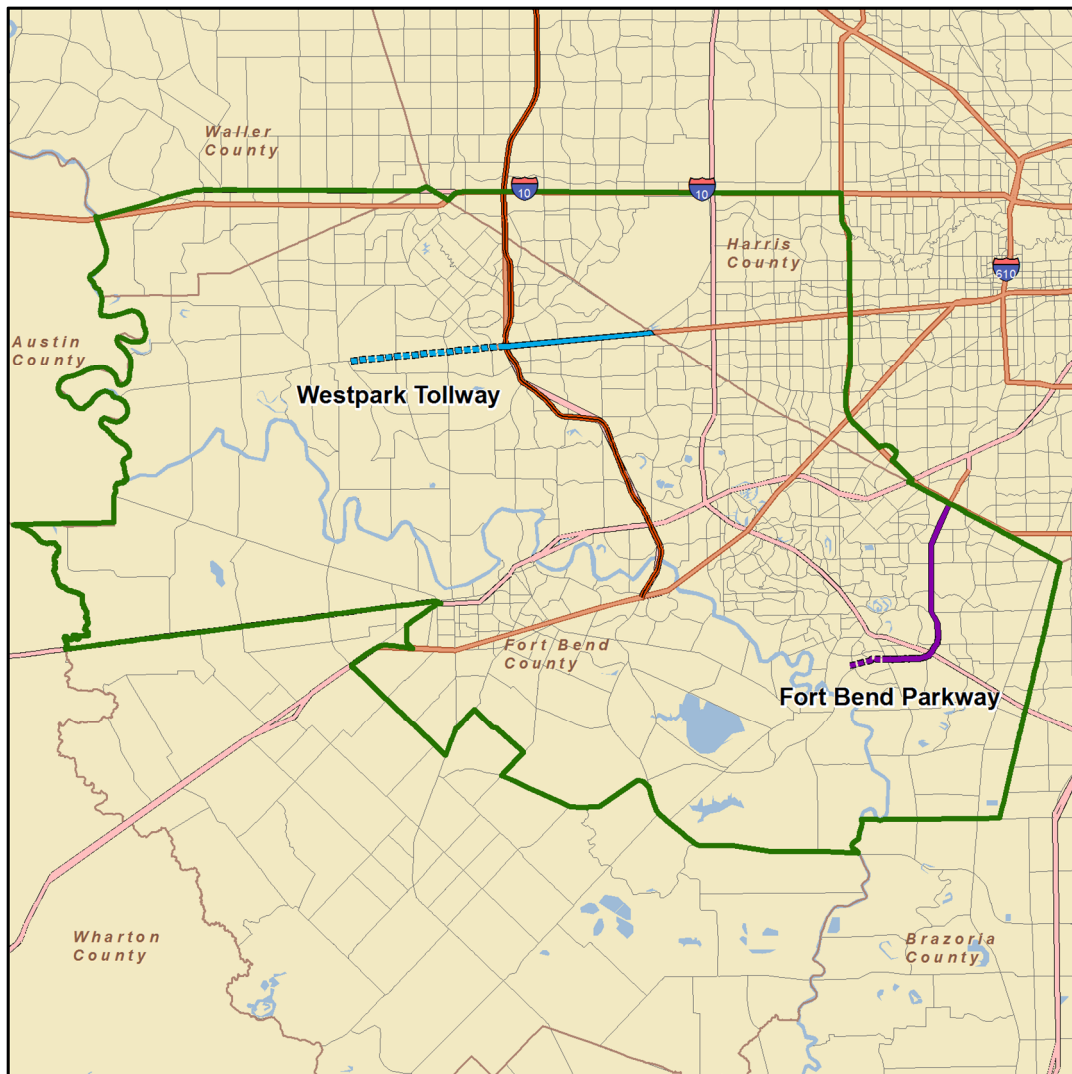
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Appendices

Appendix A Fort Bend County Toll Road Economic and Demographic Forecast Update,
prepared by CDS

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Fort Bend County Toll Road Economic and Demographic Forecast Update



Prepared for

CDM Smith

8140 Walnut Hill Lane, Suite 1000

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Prepared by:



September 2015

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Introduction and Objectives

The following work is in support of the Traffic and Revenue Study for two Fort Bend County Toll Road Authority (FBCTRA) projects, the extensions of the Westpark Toll Road and Fort Bend Parkway.

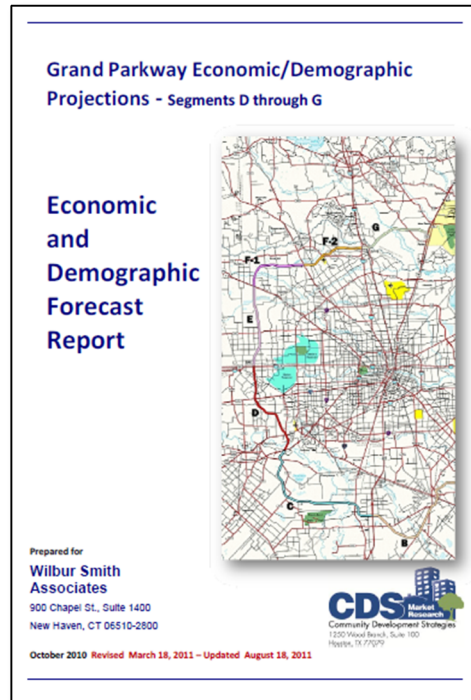
In order to estimate the potential traffic and subsequent revenue on the toll lanes, CDM Smith contracted with CDS Market Research to provide small area forecasts of population and jobs in five year increments between the years of 2010 and 2040.

CDS’s current forecast, as presented in this report, traces its original basis back to a forecast provided to CDM Smith as part of an economic and demographic project for the tolled sections of Grand Parkway Segments D-G in 2011. CDS further refined that analysis and forecast in a 2012 report focused on the same two toll road extensions examined in this forecast.

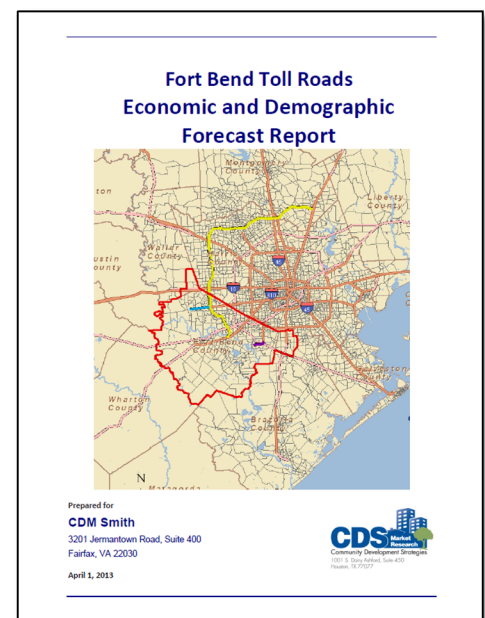
This report provides an update of those initial 2012 forecasts to account for changing conditions and recent “announced” and “under construction” residential and commercial development. In a departure from previous forecasting projects performed by CDS, it also uses current-year county-level estimates rather than forecasts for 2015’s figures and incorporates H-GAC’s new Traffic Analysis Zone structure. Information and material from other updates to the original 2011 report, completed from 2011 to 2015 for TxDOT, the Harris County Toll Road Authority (HCTRA), and the Fort Bend County Toll Road Authority is also included.

Original Forecast Reports

2011 Grand Parkway Forecast Report



2012 FBCTRA Forecast Report



Houston Metropolitan Trends

In this report, the overall historical growth of the Houston metropolitan region will be presented and analyzed. In addition, various projections of regional growth were investigated and compared. These forecasts, which have a basis in the population and household counts of the 2010 Census, form the starting point for the small area projections that are the end result of this analysis.

Overview of Houston Regional Growth Trends

The Houston Area Economy

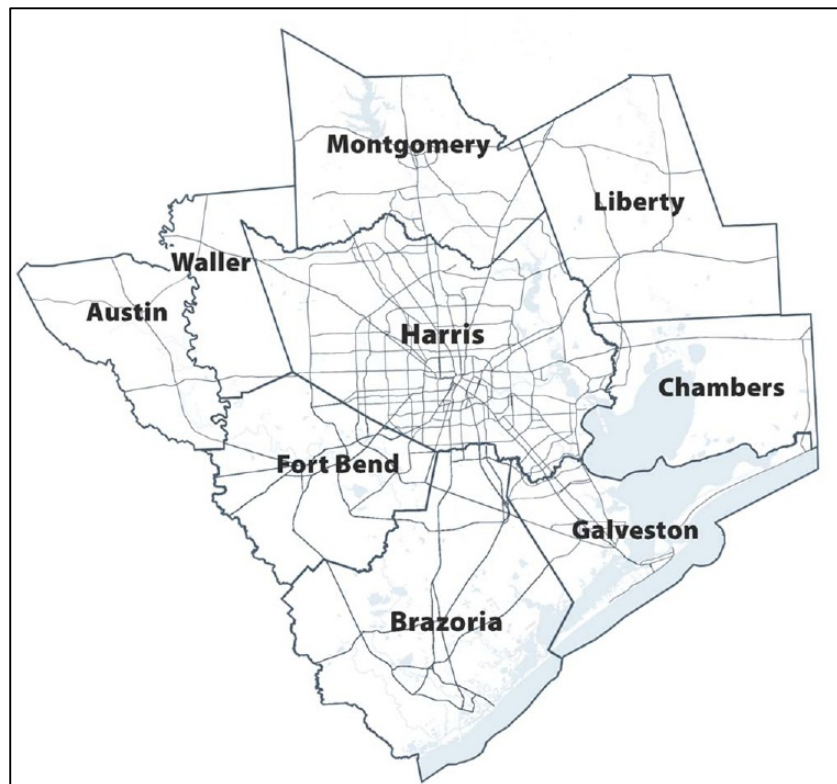
Over the years, Houston’s economy has evolved from a manufacturing economy to a services based economy. Service-providing organizations including Government now account for 80% of Houston MSA jobs and represented 81% of net job growth over the 15 years leading up to 2014. More and more, Houston is evolving to an economy based on engineering, computer, legal, accounting and administrative services. Houston’s diversification and growth in the services sector is reflected in the charts depicting industry shares of new jobs and employment by industry.

In the twelve months from March 2014 to March 2015, the Houston economy has been

adversely affected by lower oil and gas prices but the jobs data still demonstrates substantial growth in the energy-related cluster of sectors (“mining” professional services and “manufacturing”).

The chart on the following page illustrates the Industry shares of job growth over the 12 months from March 2014 to March 2015.

Houston-The Woodlands-Sugar Land Metropolitan Statistical Area (MSA)*



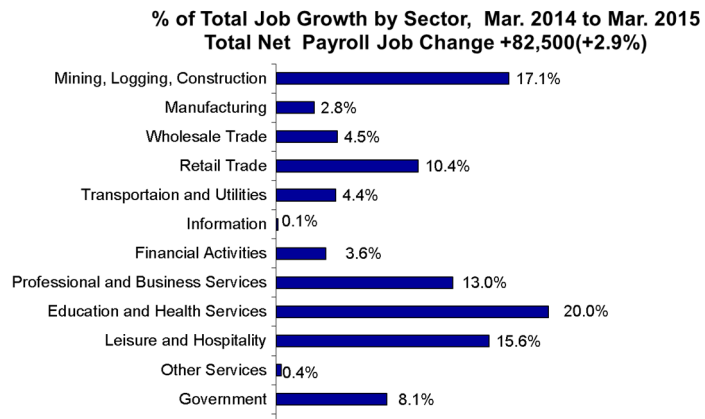
* San Jacinto County was removed from the MSA in a 2013 change to the MSA definition. It is included in this report for comparison with previous data sets.

Houston’s economic breadth is further substantiated by the number of large employers in the Houston area. According to the Greater Houston Partnership, as of 2014, there are 116 companies in Houston with 1,000 employees or more. A total of 21 Fortune 500 companies call Houston home.

In order to grow, Houston’s employers rely on a substantial local college and university system. There are 17 community college campuses and 16 university campuses within the Houston MSA. Rice University has gained significant national attention with its recent discoveries in the field of nanotechnology.

The chart on the following page, depicting Houston MSA job growth, demonstrates that the Houston economy was flat during national recessions in the early 90s and early 00s (following the 9/11 attacks) but very robust during the intervening and subsequent years up to 2008. Houston was affected by the recent national recession with job losses beginning in January 2009. Recent data show Houston’s recovery began in early 2010 and the region has added 487,100 jobs from Jan 2010 to March 2015. In the most recent 12 months from March 2014 to March 2015, the Houston region added 82,500 jobs – the fastest growing urban region in the U.S.

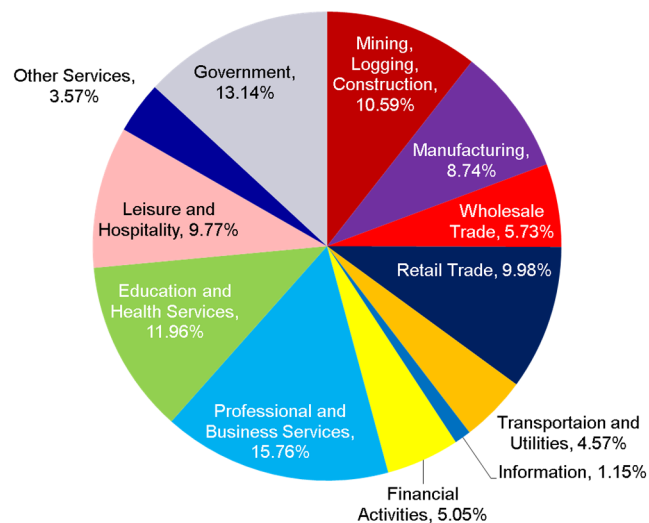
Industry Shares of Job Change



Source: Texas Workforce Commission, From Greater Houston Partnership, June 2015

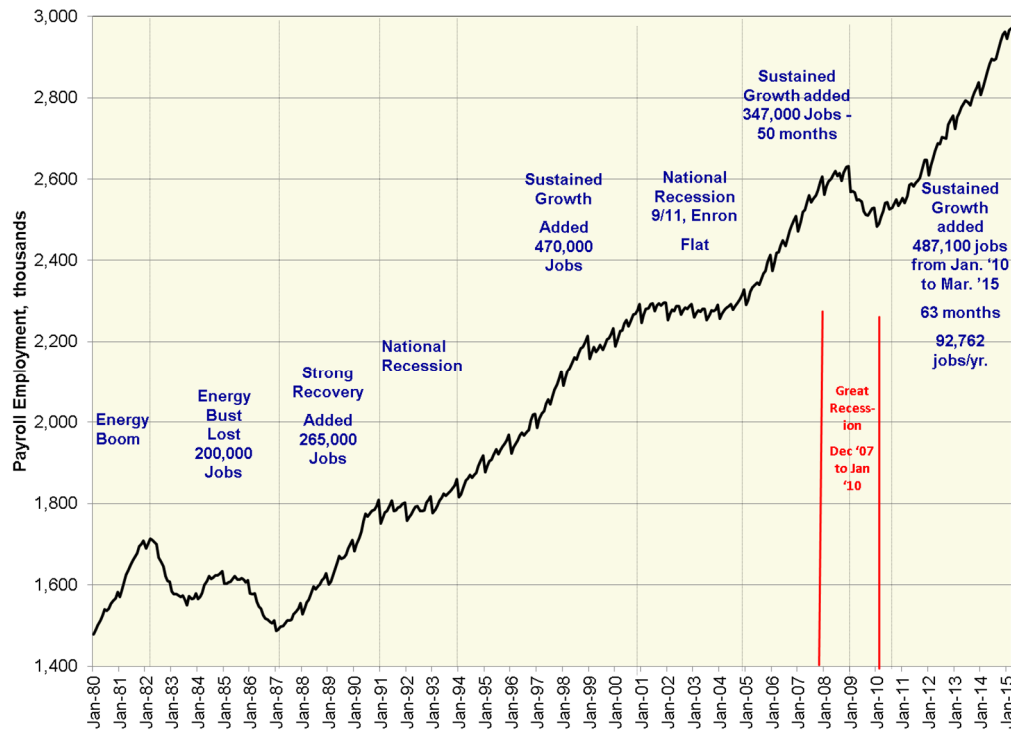
Employment by Industry

Percentage of Total Jobs by Sector March 2015



Source: Texas Workforce Commission, From Greater Houston Partnership, Feb 2015

Houston MSA Long-Term Employment Growth Trends



Source: Texas Workforce Commission, Feb 2015

Real GDP by metropolitan area is an inflation-adjusted measure of each area's gross product that is based on national prices for the goods and services produced within the metropolitan area. This is an excellent measure of comparative levels of real regional economic activity because, for instance, a cup of coffee served at a restaurant is counted at the same dollar amount (a national average) regardless of whether it is served in high-cost New York City or low-cost Houston, Texas.

Houston is outperforming every other city in the United States by a significant margin in terms of its growth rate. Its performance is especially remarkable because it is a large city; only Houston and Dallas rank in the top ten metropolitan areas for regional GDP and are also in the top ten for the rate of growth. Houston is also in the top echelon of cities ranked by GDP per capita and is the fastest-growing city in that category. Whereas Dallas or Austin are experiencing rapid GDP growth mostly as a function of population growth, Houston's growth is driven by both population and productivity gains.

GDP Ranked by Metropolitan Area

Rank	Metropolitan Area	2013 Per Capita GPD (\$)	Rank	Metropolitan Area	2010 Per Capita GPD (\$)	2013 Per Capita GPD (\$)	Percent Change
1	New York-Newark-Jersey City, NY-NJ-PA	1,377,989	1	Houston-The Woodlands-Sugar Land, TX	379,595	456,177	20.17%
2	Los Angeles-Long Beach-Anaheim, CA	775,967	2	San Jose-Sunnyvale-Santa Clara, CA	165,435	192,184	16.17%
3	Chicago-Naperville-Elgin, IL-IN-WI	550,793	3	Austin-Round Rock, TX	86,546	98,126	13.38%
4	Houston-The Woodlands-Sugar Land, TX	456,177	4	Portland-Vancouver-Hillsboro, OR-WA	140,717	159,266	13.18%
5	Washington-Arlington-Alexandria, DC-VA-MD-WV	437,085	5	Charlotte-Concord-Gastonia, NC-SC	115,229	130,318	13.09%
6	Dallas-Fort Worth-Arlington, TX	413,627	6	Oklahoma City, OK	57,856	65,246	12.77%
7	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	358,091	7	Nashville-Davidson-Murfreesboro-Franklin, TN	84,572	95,124	12.48%
8	San Francisco-Oakland-Hayward, CA	356,081	8	Dallas-Fort Worth-Arlington, TX	368,015	413,627	12.39%
9	Boston-Cambridge-Newton, MA-NH	349,652	9	Salt Lake City, UT	63,090	70,719	12.09%
10	Atlanta-Sandy Springs-Roswell, GA	288,175	10	San Antonio-New Braunfels, TX	80,101	89,463	11.69%

Sources: U.S. Bureau of Economic Analysis

GDP Per Capita Ranked by Metropolitan Area

Rank	Metropolitan Area	2013 Per Capita GPD (\$)	Rank	Metropolitan Area	2010 Per Capita GPD (\$)	2013 Per Capita GPD (\$)	Percent Change
1	San Jose-Sunnyvale-Santa Clara, CA	100,115	1	Houston-The Woodlands-Sugar Land, TX	63,816	72,258	13.23%
2	San Francisco-Oakland-Hayward, CA	78,844	2	San Jose-Sunnyvale-Santa Clara, CA	89,806	100,115	11.48%
3	Seattle-Tacoma-Bellevue, WA	74,701	3	Portland-Vancouver-Hillsboro, OR-WA	63,025	68,810	9.18%
4	Boston-Cambridge-Newton, MA-NH	74,643	4	Columbus, OH	50,370	54,493	8.19%
5	Washington-Arlington-Alexandria, DC-VA-MD-WV	73,461	5	Grand Rapids-Wyoming, MI	41,248	44,482	7.84%
6	Houston-The Woodlands-Sugar Land, TX	72,258	6	Charlotte-Concord-Gastonia, NC-SC	51,819	55,802	7.69%
7	New York-Newark-Jersey City, NY-NJ-PA	69,074	7	Oklahoma City, OK	45,993	49,441	7.50%
8	Portland-Vancouver-Hillsboro, OR-WA	68,810	8	Salt Lake City, UT	57,790	62,008	7.30%
9	Hartford-West Hartford-East Hartford, CT	66,870	9	Nashville-Davidson-Murfreesboro-Franklin, TN	50,464	54,112	7.23%
10	Salt Lake City, UT	62,008	10	Detroit-Warren-Dearborn, MI	46,314	49,653	7.21%

Sources: U.S. Bureau of Economic Analysis

Factors Affecting Future Regional Economic Growth

According to the Federal Reserve Bank and the Greater Houston Partnership, three factors have governed the state of Houston’s economy for the past ten years:

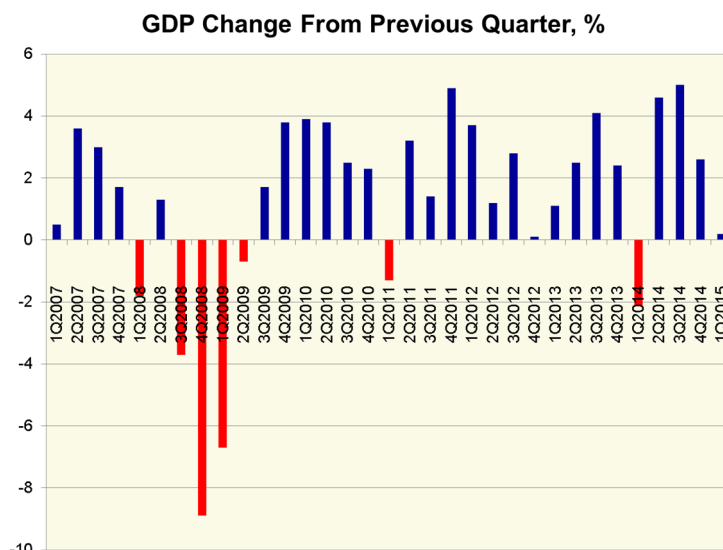
- the health of the national economy;
- the value of the U.S. dollar against foreign currencies; and
- the prices of oil and gas.

All of the drivers of the economy entered a period of decline starting in mid-2008, real GDP began to drop, the value of the dollar began to rise and in oil prices began a sharp decline. These factors began to have an effect on the Houston economy. However, since that recession, the factors contributing to Houston’s growth have been positive. In late 2014 oil and gas prices plummeted and the U.S. dollar strengthened, creating headwinds for Houston’s economy.

The National Economy—According to the Bureau of Economic Analysis, U.S. real gross domestic product (GDP) peaked at \$13.36 trillion in the fourth quarter of 2007 and then declined by \$555.0 billion by mid-2009. GDP has subsequently increased in 20 of the past 22 quarters culminating in an estimate of \$17.710 trillion in the fourth quarter of 2014. First quarter 2015 reflects a 0.2% increase.

The U.S. Dollar – The U.S. Dollar is at a relatively high level today as compared to the long-term historical trend of the Dollar Index of the Federal Reserve Bank. It is, however, substantially lower than the peak level of 129 set in late 2001. As of April of 2015 the index was 115 (14 points below the 2001 peak.) A weak dollar stimulates Houston’s manufacturing/export sectors; however a strong dollar has the negative effect of reducing Houston’s exports.

U.S GDP Trends



Source: Bureau of Economic Analysis, January 2015.

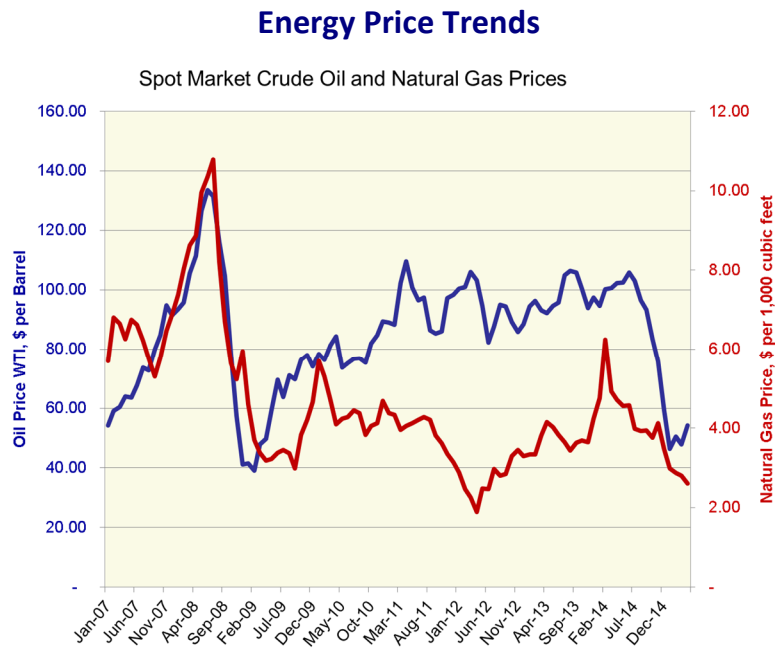
Major Foreign Currencies vs. the Dollar

Dollar Index U.S. Federal Reserve Bank



Source: U.S. Federal Reserve Bank, January 2015.

Energy Prices – Higher oil and gas prices stimulate demand for oil field equipment and services which is a strong sector within the Houston economy. Prices for West Texas Intermediate (WTI) crude began the decade in the \$20-\$30/Bbl range and remained there until 2004 when they began a steady climb to a peak of nearly \$140/Bbl. during the first half of 2008. The worldwide recession, accompanied by a fall-off in demand, resulted in a decrease in WTI crude oil prices (**blue line in the graph to the right**) to less than \$40/Bbl. By 2011, WTI price rebounded to more than \$100/Bbl and fluctuated within a range of \$85 to \$110



Source: U.S. Energy Information Administration, January 2015.

until June of 2014 when it declined from a high of \$106 to \$46 in January of 2015. Oil prices have rebounded slightly in the following three months of 2015, reaching \$54.20 by April 2015. Concurrently, Henry Hub spot natural gas (**red line in the graph**) remained under \$10/mm Btu before falling to a low of \$2/mm BTU and then rebounding to \$6 in late 2009. Spot natural gas prices again fell to \$2 in the spring of 2012 but reached \$6.24 by February of 2014. Since that peak, natural gas prices have dropped to \$2.60 as of April of 2015.

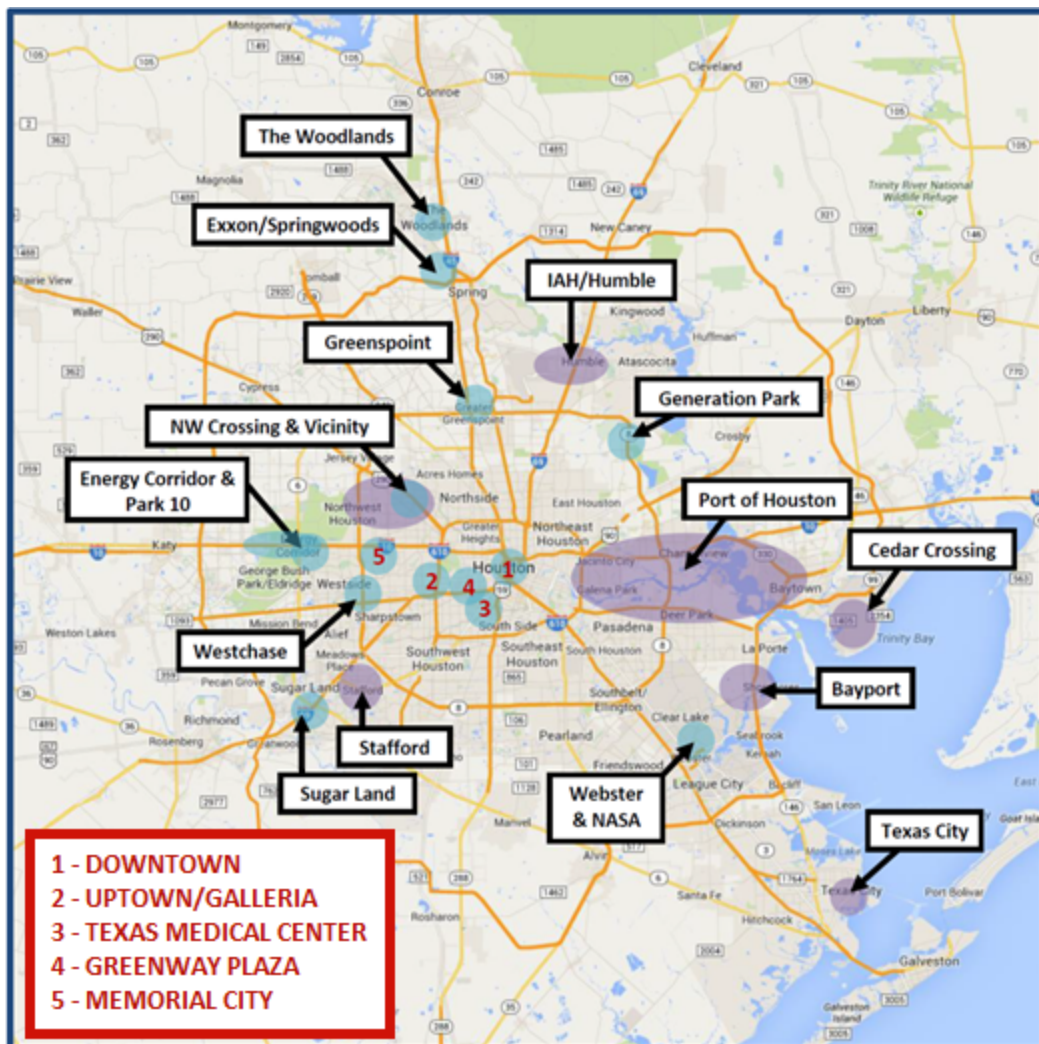
At the current time, only one of the three factors that affect the Houston economy, **National Economic Growth**, presents slightly positive signs for the Houston economy. Most analysts now expect Houston’s economy to be less robust until energy prices rebound to 2007 levels

Economic Geography

The Houston MSA has historically developed in a low-density suburban form, uninhibited by natural geographic boundaries or excessive political regulation. The region’s central business district presently accounts for only about six percent of regional employment. Other loosely-defined ‘edge cities’ comprise a large portion of the region’s employment base. These typically are made up of a loose cluster of office, medical office, hotel, and supportive retail land uses. Examples within the Houston area include the Uptown/Galleria area and Texas Medical Center in the urban core, or the Energy Corridor and The Woodlands in the suburbs. The region’s heavy industries are heavily clustered around the Houston Ship Channel and the Galveston Bay area. Additionally, a significant number of jobs are spread among Houston’s suburbs in numerous office parks, retail centers, and light industrial facilities. Emerging clusters include Springwoods Village, Generation Park, and Cedar Crossing.

The accompanying map illustrates the locations of the principal activity centers (in blue) and industrial districts (in purple) in the Houston MSA. Note that all future sections of the Grand Parkway are indicated on the map.

Major Regional Employment & Activity Centers

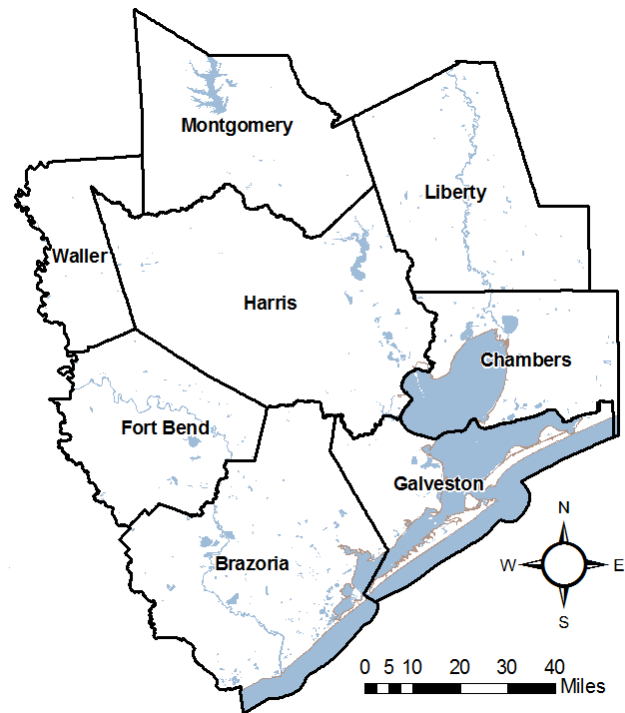


The H-GAC Transportation Planning Region

As described in the previous sections, the Houston-The Woodlands-Sugar Land Metropolitan Statistical Area (MSA) as of 2013 includes 9 counties. The MSA had previously included 10 counties, with San Jacinto County subtracted from the 2013 definition. For transportation planning purposes, the Houston-Galveston Area Council (H-GAC) as the Metropolitan Planning Organization (MPO) currently uses an 8-county region, as the Transportation Management Area (TMA) shown in the map to the right, which until 2004 was defined as the Houston-Galveston- Brazoria Combined Metropolitan Statistical Area (CMSA). Included in that geography are the following counties: Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery and Waller. The only currently-defined MSA county that is not a part of the H-GAC management area is Austin County.

For the remainder of this report, the 8-county region will be the focus of the analysis.

H-GAC Transportation Management Area



Houston Area Growth Patterns

The Houston region has a history of growth in all areas of the community. Since 1980, the growth has been biased to the southwest, west and northwestern areas of the region.

Population

Historic Growth and Projections

Population growth is one of the principal measures of the economic vitality of any area because increasing population is generally the result of more jobs, a high level of immigration and a stable or expanding economy. The table entitled Population Growth Trends and Projections summarizes historical Census population counts for 1980, 1990, 2000, and 2010.

The Houston MSA has undergone tremendous growth in recent decades – from 3.1 million in 1980 to 4.7 million in 2000. In 2010, total population reached 5.89 million.

As the table on the right demonstrates, population has grown rapidly in the counties that comprise the 8-county region. The 2010 Census revealed that the population of the region was 5,891,999.

Fort Bend County was the fastest growing county by percentage from 2000 to 2010 adding 324,000 persons (91.5%). Montgomery County grew by 162,000 persons (55.1%) in that 10-year period. Harris County grew the most in number of net new residents adding 691,000 (20.3%).

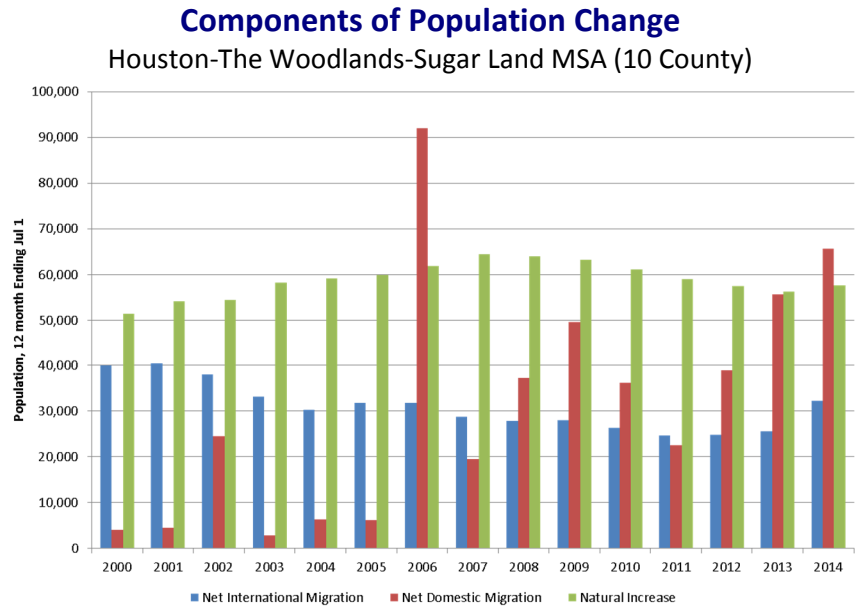
Population Growth Trends
Counties 1960 – 2010 (in thousands of persons)

County	Historical Census Population, 1,000s					Census
	1960	1970	1980	1990	2000	2010
Brazoria	76	108	170	192	242	313
Chambers	10	12	19	20	26	40
Fort Bend	41	52	131	225	354	678
Galveston	140	170	196	217	250	291
Harris	1,243	1,742	2,410	2,818	3,401	4,092
Liberty	32	33	47	53	70	76
Montgomery	27	49	129	182	294	456
Waller	12	14	20	23	33	36
8-Co. Total	1,581	2,180	3,122	3,730	4,670	5,892
Grimes	13	12	14	19	24	27

Source: U.S. Bureau of the Census

Population Growth Accounted for by In-Migration

Components of change in the population published by the U.S. Bureau of the Census are presented in the chart below. Net in-migration, which is calculated based on the number of persons moving in versus the number moving out, has accounted for almost 50% of the growth in MSA population over the 2000-2011 period. International migration comprised 29.1% of the total net change while domestic migration made up a slightly smaller share of 21.7% of the net change in population in the region. Natural increase accounted for just over one-half of the increase.



Source: U.S. Bureau of the Census, 2013

Components of Population Change by County

Cumulative April 1 2010 to July 1 2014

County	Total Population Change	Natural Increase	International Migration	Domestic Migration
Brazoria	24,997	10,825	2,544	11,303
Chambers	3,049	891	126	1,987
Fort Bend	100,448	23,657	16,646	58,395
Galveston	22,894	6,719	2,873	13,009
Harris	348,359	187,642	100,542	63,037
Liberty	2,474	1,380	238	856
Montgomery	63,183	14,317	6,384	40,967
Waller	3,583	1,278	210	2,044
8-county Region	568,987	246,709	129,563	191,598
Grimes	604	162	82	333

Source: U.S. Bureau of the Census, May 2015

The most recent data on the components of population change is shown in the table below right. From 2010 to 2014, natural increase in the 8-county region accounts for 43.5% of the net population change while international and domestic migration accounted for 22.8% and 33.7%, respectively.

Harris County received 77.6% of the international migrants accounting for the 28.8% of the total County’s change. Galveston, Grimes, Montgomery and Fort Bend counties received the largest share of their net growth from domestic migration.

Regional Population and Employment Projections

A key element of this report is to evaluate population and employment forecasts for the overall 8-county region. Small area forecasts are most often performed using allocations of regional “control total” values to the small geographies.

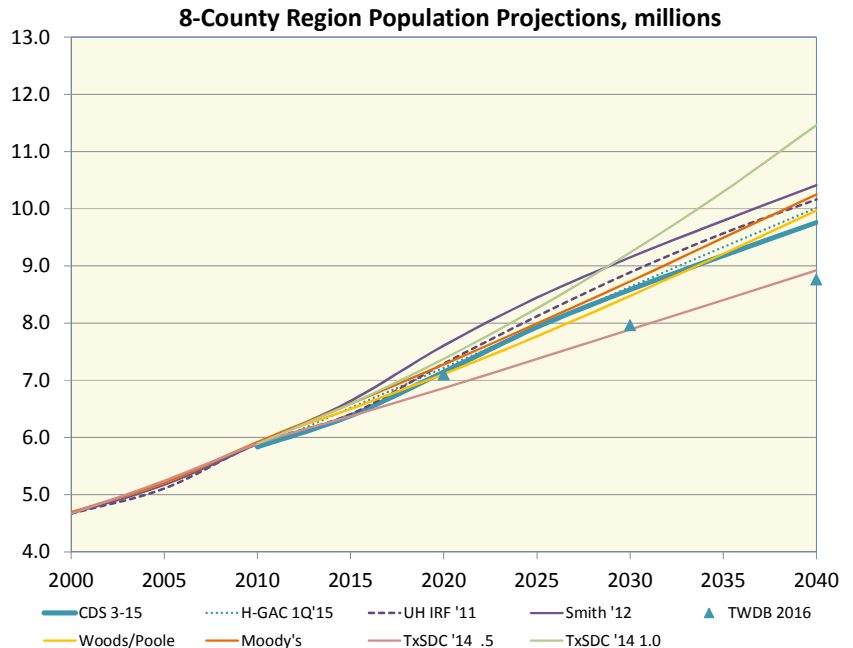
In this section, we will investigate alternative forecasts of Houston area population and employment.

Population Projections

The chart on the right illustrates eight forecasts of population growth in the Houston region. The sources are:

- The CDS 2015 forecasts using the University of Houston Institute for Regional Forecasting (UH-IRF) model updated for recent employment trends.
- The most recent Houston-Galveston Area Council (H-GAC), 2040 Regional Growth Forecast for the 1st Quarter pf 2015 (H-GAC 1Q '15);
- The latest regional forecasts from the University of Houston – Institute for Regional Forecasting (UH-IRF '11);
- The most recent forecasts from Dr. Barton Smith using the UH-IRF model he developed. (Smith '12)
- The Texas Water Development Board (TWDB) 2016 State Water Plan Projections Data (TWDB 2016);
- Woods & Poole Economics, Inc., County Forecasts to 2040, 2015 (Woods/Poole);
- Moody’s Economy.com Projections 2015 (Moody’s); and
- The Texas State Data Center (TxSDC '14), 2014 Population Projections, two migration scenarios. Scenario 1.0 based on 100% of the 2000-2010 migration rates (TxSDC '14 1.0) and Scenario .5 based on migration at 50% of the 2000-2010 rates (TxSDC '14 0.5).

Population Projection Comparisons



All of the forecasts present the expectation of substantial future growth in the Houston region. From a 2010 population of 5.89 million, the region is expected to grow to between 8.7 and 11.5 million residents by 2040. That range of annual growth is 97,666 to 188,490 new residents annually. As discussed previously, this region added an average of 118,000 new residents annually between 2000 and 2010.

An important issue to note is that the CDS '15 population includes only the population in households, excluding persons living in group quarters such as dormitories and jails.

To additionally illustrate the information shown in the chart on the previous page, the following table summarizes the data for 5-year increments.

Various Population Projections

8-County Houston Region

	Year	CDS '15	H-GAC 1Q '15	Barton Smith '12	TWDB	Woods & Poole	Moody's	TxSDC 1.0
Population by Year	2000	4,669,589	4,669,589	4,669,589	4,591,812	4,693,671	4,693,548	4,669,589
	2005			5,175,064	5,202,623	5,207,398	5,207,035	5,175,064
	2010	5,837,975	5,809,869	5,814,383	5,813,433	5,920,246	5,920,385	5,891,999
	2015	6,381,891	6,518,074	6,552,928		6,503,555	6,589,202	6,589,809
	2020	7,147,718	7,222,074	7,504,591	7,102,261	7,110,775	7,278,379	7,376,672
	2025	7,929,375	7,925,285	8,326,692		7,769,738	7,994,382	8,258,811
	2030	8,585,516	8,633,186	9,016,482	7,964,492	8,475,948	8,729,635	9,232,149
	2035	9,181,012	9,331,321	9,642,309		9,211,606	9,492,060	10,296,493
	2040	9,759,720	10,018,940	10,250,381	8,764,753	9,968,088	10,249,120	11,459,984
Annual Average Growth by Period	'00-'10	116,839	114,028	114,479	122,162	122,658	122,684	122,241
	'10-'20	130,974	141,221	169,021	128,883	119,053	135,799	148,467
	'20-'30	143,780	141,111	151,189	86,223	136,517	145,126	185,548
	'30-'40	117,420	138,575	123,390	80,026	149,214	151,949	222,784
	'10-'40	130,725	140,302	147,867	98,377	134,928	144,291	185,600

A review of these forecasts suggests that they can be grouped. The Texas Water Development Board growth scenario represents the low side of potential growth. The CDS and Woods & Poole forecasts are similar and represent the mid-range of the projections. The H-GAC forecast sits just above that mid-range. The Barton Smith 2012 and Moody's forecasts both grow to a population of 10.25 million residents by 2040.

The TxSDC's most recent 1.0 projections are by far the highest, topping 11.45 million residents in 2040. The TxSDC's various scenarios are demographic projections assuming varying levels of foreign immigration to Texas and do not account for specific economic trends or known developments.

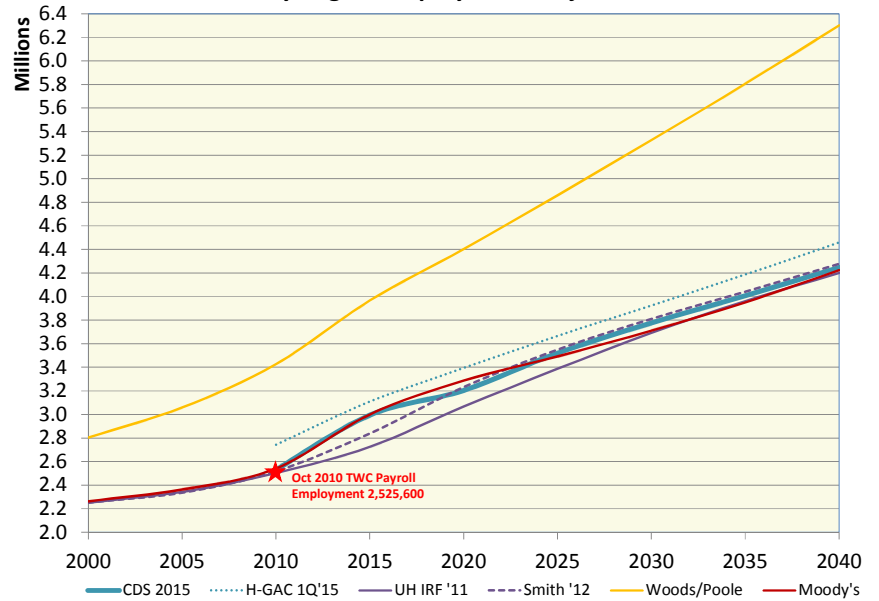
Employment Projections

The chart on the right illustrates five forecasts of employment growth in the Houston region. The sources are:

- The CDS 2015 forecasts using the University of Houston Institute for Regional Forecasting (UH-IRF) model updated to recent employment trends.
- The Houston-Galveston Area Council (H-GAC), 2040 Regional Growth Forecast 1st Quarter 2015;
- Two forecasts from Dr. Barton Smith, UH-IRF '11 and an update Smith '12;
- Woods & Poole Economics, Inc., County Forecasts to 2040, 2015; and
- Moody's Economy.com Projections 2015 (Moody's).

Job Projection Comparisons

8-County Region Employment Projections



The Texas State Data Center and the Texas Water Development Board do not forecast employment.

One major aberration in these projections is that Woods & Poole uses a measure of “total jobs” which adds self-employed persons and part-time jobs to the payroll job counts used by the other forecasts and are therefore not comparable to the others.

Consistent with the population data, all of the employment forecasts present the expectation of future growth in the Houston region.

As discussed previously, Woods & Poole uses a measure of “total jobs” rather than the “payroll job” count used by the other forecasts and therefore is not included in the following analysis.

Another anomaly is that the H-GAC forecast starts at a 2010 job base that is higher than most of the current estimates

Various Job Projections

8-County Houston Region

	Year	CDS '15	H-GAC 1Q '15	Barton Smith '12	Moody's	Woods & Poole
Jobs by Year	2000	2,252,103	2,252,103	2,252,103	2,263,045	2,804,020
	2005			2,343,072	2,362,961	3,059,401
	2010	2,529,876	2,742,616	2,516,653	2,541,894	3,426,993
	2015	2,994,160	3,108,285	2,838,786	3,000,248	3,967,130
	2020	3,203,751	3,393,918	3,230,522	3,286,364	4,403,127
	2025	3,520,282	3,666,405	3,550,217	3,492,518	4,860,329
	2030	3,777,323	3,925,289	3,809,538	3,710,551	5,328,288
	2035	4,007,178	4,187,474	4,041,283	3,950,812	5,805,515
	2040	4,247,608	4,458,904	4,276,011	4,223,996	6,301,224
Annual Average Growth by Period	'00-'10	27,777	49,051	26,455	27,885	62,297
	'10-'20	67,388	65,130	71,387	74,447	97,613
	'20-'30	57,357	53,137	57,902	42,419	92,516
	'30-'40	47,029	53,362	46,647	51,344	97,294
	'10-'40	57,258	57,210	58,645	56,070	95,808

of other sources listed in the table to the right by more than 230,000 jobs. This is likely the likely result of adding self-employed and part-time workers to the job base in some counties. The net result is that their average annual job growth is 48,832. By comparison, from December 1986 to December 2008 (before the recession hit Houston) the average annual job growth was 51,000 jobs.

From a current employment of 2.5 million, the region is expected to grow to between 4.22 and 4.46 million jobs by 2040. That narrow range of annual employment growth is 57,210 to 58,645 new jobs annually.

County Forecast Comparisons

On the following pages, the same sets of forecasts at the county level are presented and discussed. Note that, because of the wide variation in the population and jobs in the eight counties of the region, the scales on the following graphs are all different making visual comparisons of growth rates difficult.

County Population Comparisons

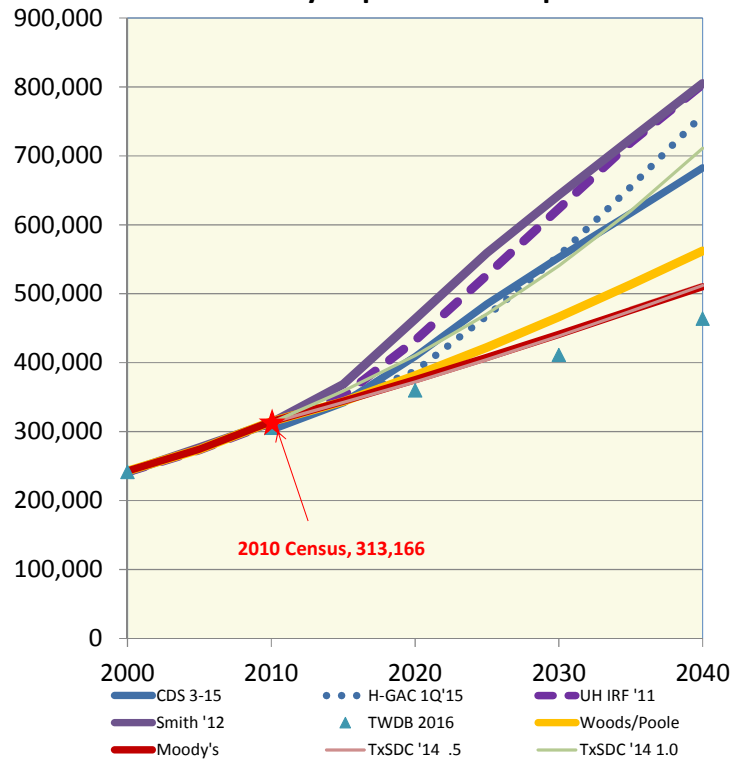
Brazoria County:

All forecasts present substantial growth for Brazoria County. The Smith '12 and UH-IRF '11 are highest, followed by the H-GAC 1Q'15 and the TxSDC 1.0. The CDS '15 forecast is in the middle followed by Woods & Poole and Moody's. The TWBD forecast is the lowest.

Brazoria County is poised to capture substantial growth in the north as the next southerly expansion of the Houston urban region.

County Population Forecast Comparisons – Brazoria and Chambers Counties

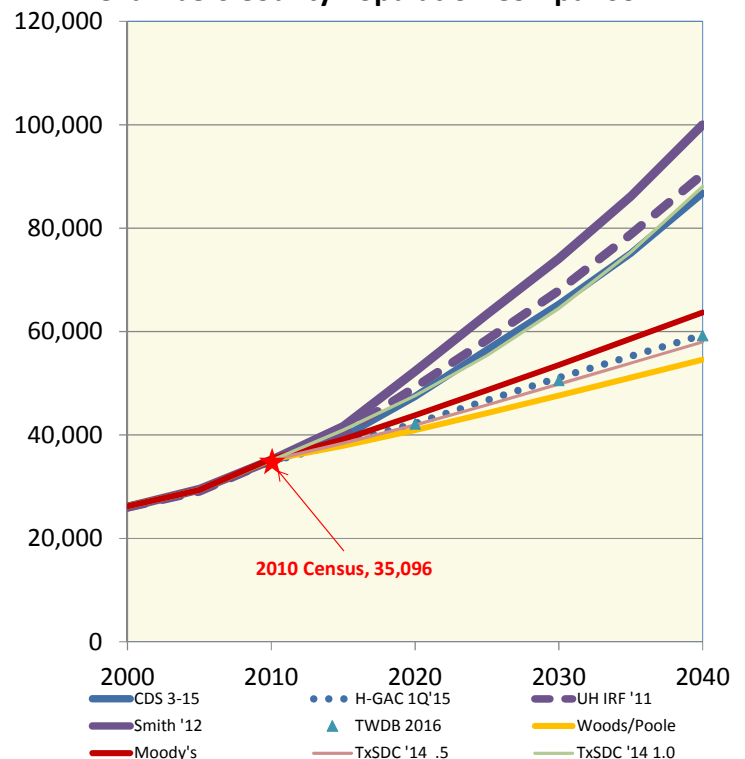
Brazoria County Population Comparison



Chambers County:

The forecast comparison represents a wide range of growth estimates for Chambers County. The Smith '12 and UH-IRF '11 are highest, followed by the CDS '15 and the TxSDC 1.0. Moody's, H-GAC 1Q'15, TWDB, TxSDC and Woods & Poole form up a low-range set of forecasts.

Chambers County Population Comparison

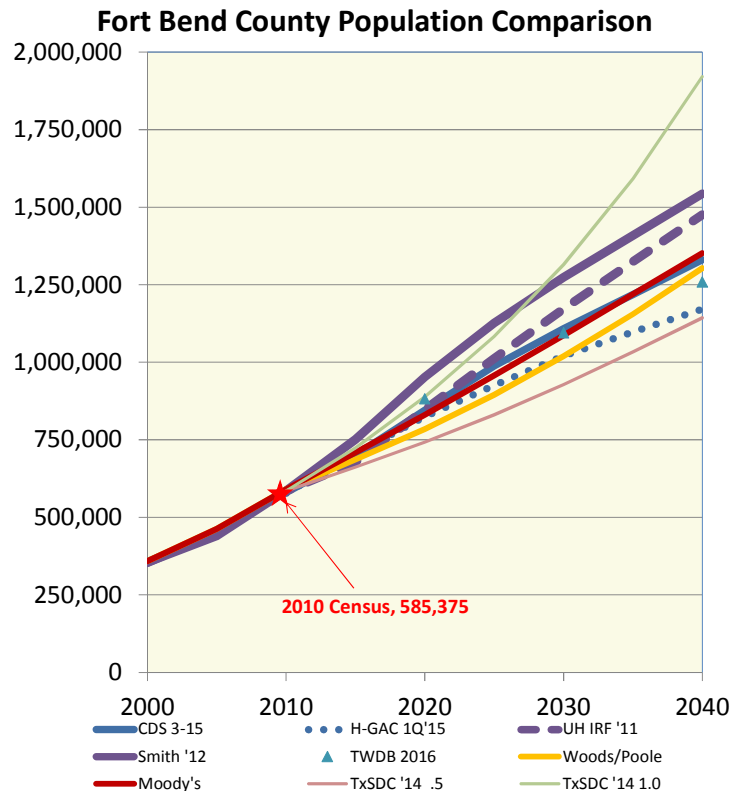


County Population Forecast Comparisons – Fort Bend and Galveston Counties

Fort Bend County:

All forecasts present substantial growth for Fort Bend County. The TxSDC 1.0 forecast is the highest, predicting 1.9 million residents by 2040. Smith '12 and UH-IRF '11 are next highest, followed by the TWDB, CDS '15 and the Woods & Poole. The H-GAC 1Q'15 is in the bottom group of the forecast along with the TxSDC .5 forecast.

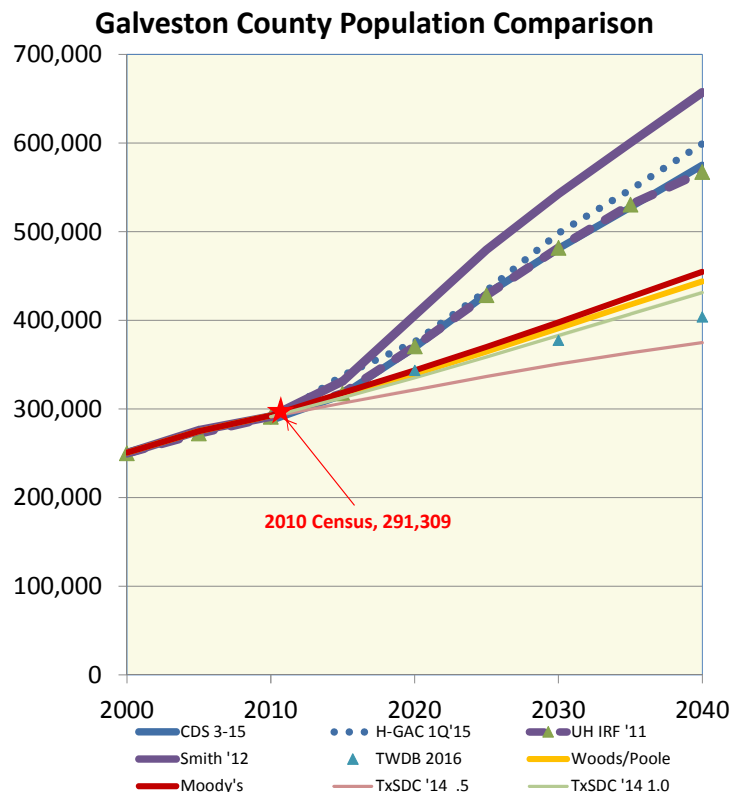
Fort Bend has been one of the fastest growing counties in the nation. The mid-range of forecasts has Fort Bend reaching a population of 1.3 million by 2040.



Galveston County:

The forecast comparison for Galveston County represents a wide range of growth estimates. The Smith '12 is the highest, followed by the TxSDC 1'0, the H-GAC 1Q '15, and the CDS '15. The low range of forecasts include Moody's, Woods & Poole, the TxSDC 1.0 and TWDB. The TxSDC .5 is the lowest – predicting very little growth for Galveston County.

The wide range of forecasts are due to the fact that the southern portion of Galveston County was hit hard by Hurricane Ike in 2008 and has struggled to regain its population growth. The bullish forecasts are all locally generated and likely expect future growth in the County.

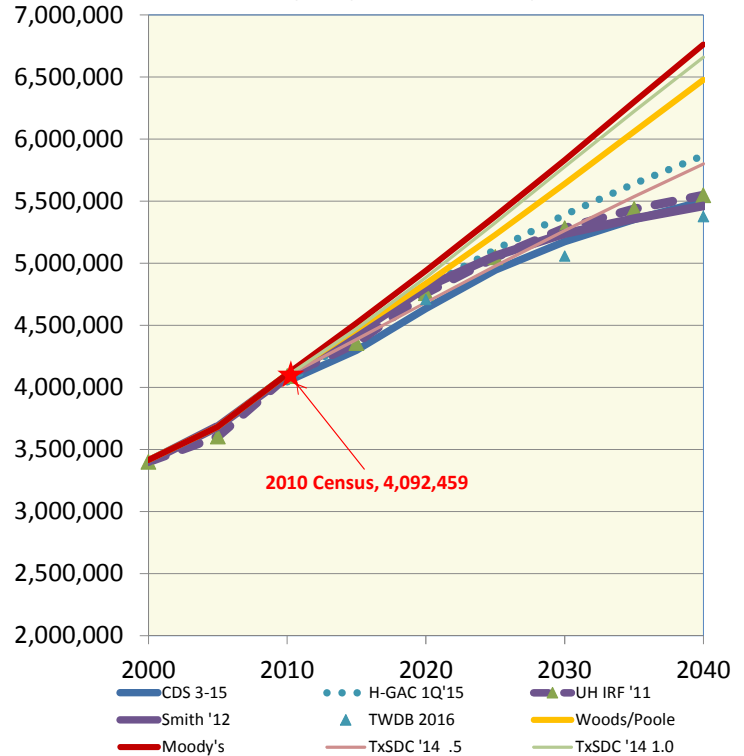


Harris County:

All forecasts present substantial growth for Harris County. The Moody's, TxSDC 1.0, and Woods & Poole forecasts represent the highest, predicting around 6.5 million residents by 2040. The remainder of the forecasts predicts a slowdown in population growth as the County reaches near full development. The H-GAC 1Q '15 is the highest of the low range group. Smith '12, UH-IRF '11 and TxSDC .5 and CDS '15 are tightly grouped as the low-range forecasts with 2040 population reaching 5.5 million residents. The TWDB predicts the lowest growth.

County Population Forecast Comparisons – Harris and Liberty Counties

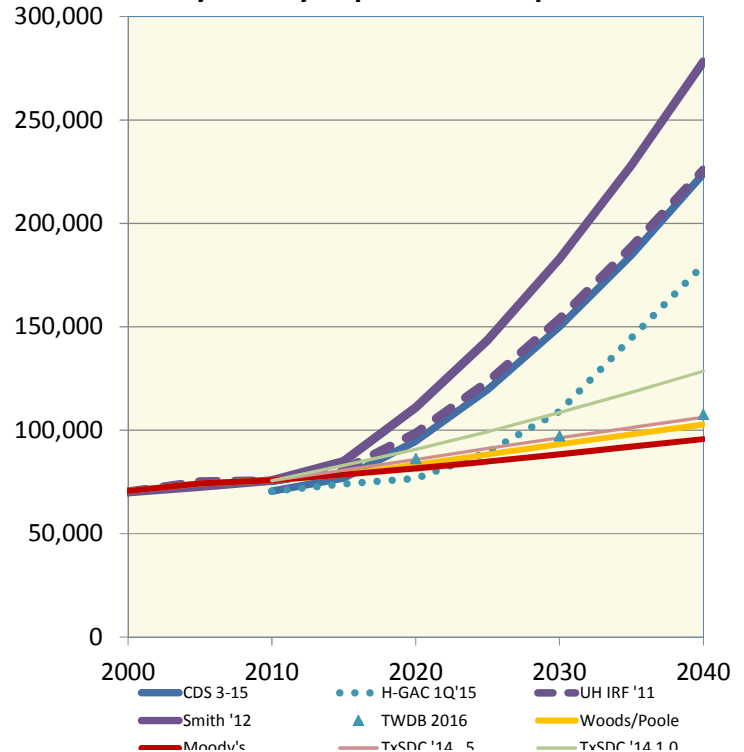
Harris County Population Comparison



Liberty County:

The forecast comparison for Liberty County represents a wide range of growth estimates. The Smith '12 is the highest predicting a 2040 population for Liberty County of 275,000. That bullish forecast is followed by the UH-IRF and the CDS '15 which all use the same model. The TxSDC 1'0 is at the top of the low-range group. The H-GAC 1Q '15 predicts very little population growth in Liberty County until 2030.

Liberty County Population Comparison

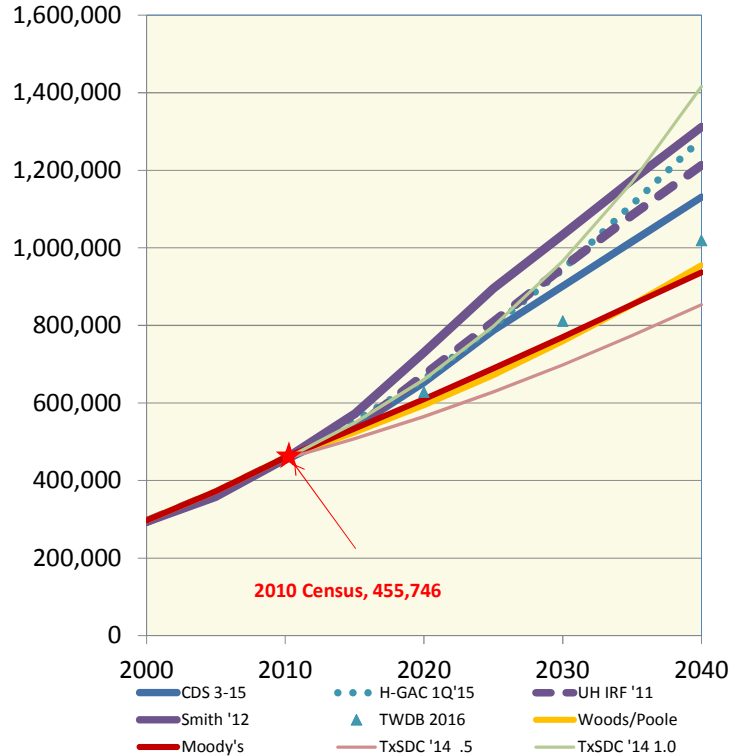


County Population Forecast Comparisons – Montgomery and Waller Counties

Montgomery County:

All forecasts present substantial growth for Montgomery County – historically one of the nation’s fastest growing counties. The TxSDC 1.0 forecast is the highest, predicting 1.4 million residents by 2040. Smith ’12, H-GAC 1Q ’15, and UH-IRF ’11 are next highest, followed by the CDS ’15. The TWDB forecast represents the mid-range. Woods & Poole and Moody’s forecasts are almost identical. The TxSDC .5 forecast represents the lowest growth in population – reaching only 810,000 residents by 2040.

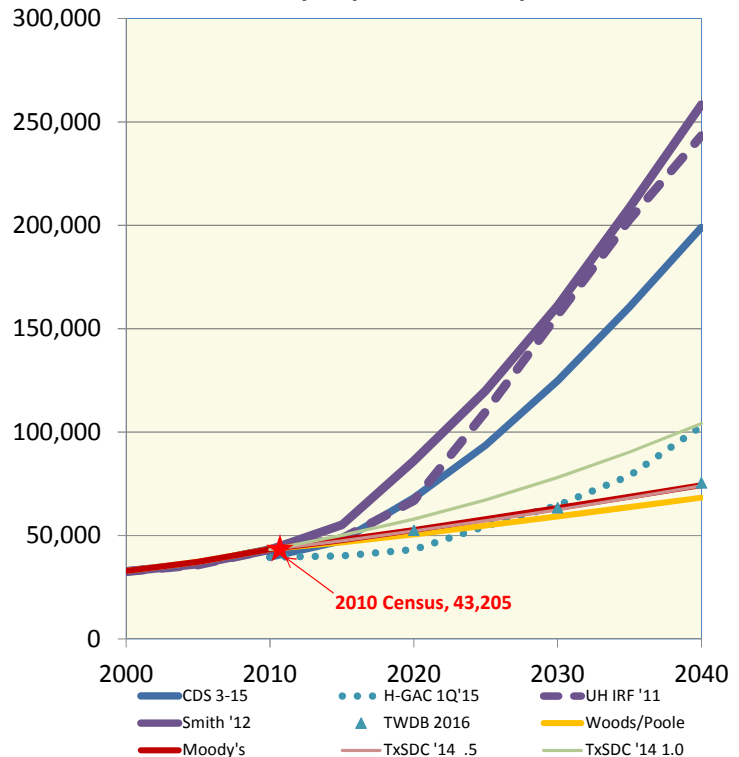
Montgomery County Population Comparison



Waller County:

As with most of the more rural counties of the region, Waller County forecasts demonstrate a wide range of future population growth expectations. The Smith ’12 and UH-IFR are the highest forecasts, followed by the CDS ’15 – all using the same regional growth model. The TxSDC 1’0 is the highest of the low range forecasts. The H-GAC 1Q ’15, Moody’s, Woods & Poole, and TxSDC .5 and the TWDB forecasts predict only moderate growth in Waller County.

Waller County Population Comparison



County Employment Comparisons

Because the Woods & Poole forecasts are based on total employment rather than payroll employment in the counties, those forecasts will not be included in the narratives below.

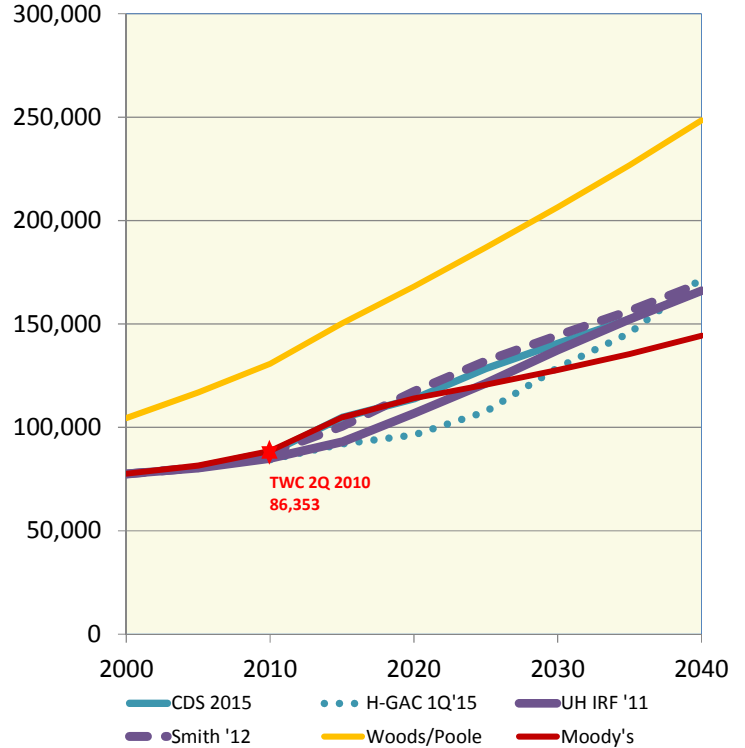
Brazoria County:

All forecasts present significant job growth for Brazoria County. All predict 2040 employment in the County of between 140,000 and 165,000 jobs.

The Smith '12, UH-IRF '11 and CDS '15 are highest, followed by the Moody's forecast. The H-GAC 1Q '15 begins as the lowest, but picks up substantial job growth after 2025 to match most of the other forecasts.

County Jobs Forecast Comparisons – Brazoria and Chambers Counties

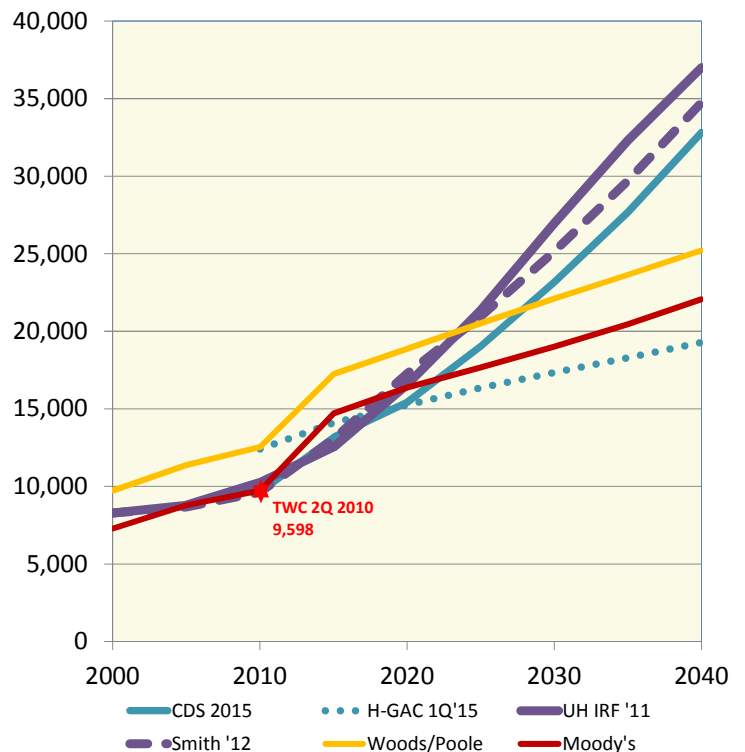
Brazoria County Jobs Comparison



Chambers County:

The jobs forecast comparison for Chambers County again represents a very wide range of growth estimates. The three forecasts using the UH-IRF model represent the highest growth band, predicting between 33,000 and 37,000 jobs by 2040. The Moody's forecast predicts only 22,000 jobs by 2040. The H-GAC 1Q'15 forecasts is by far the lowest – predicting very little job growth in Chambers County.

Chambers County Jobs Comparison

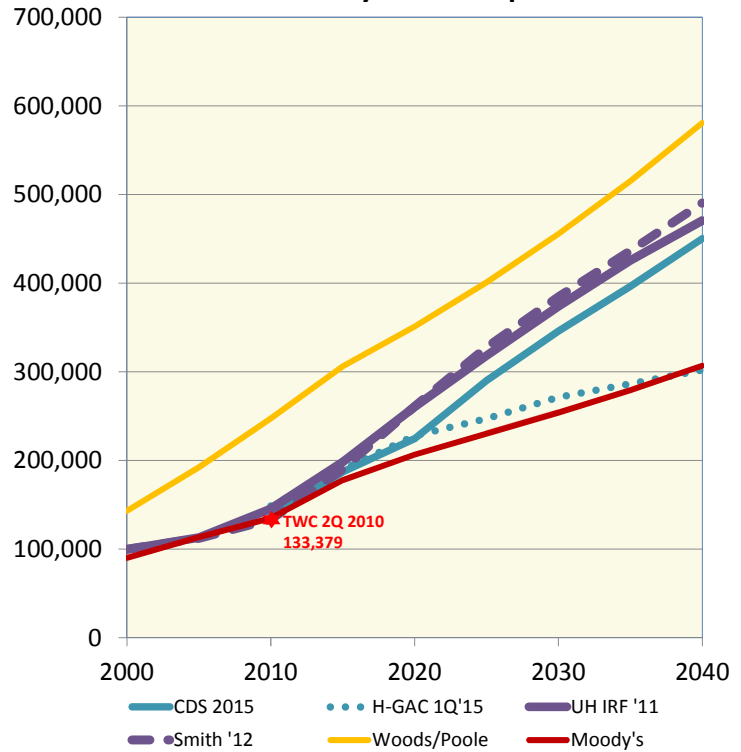


County Jobs Forecast Comparisons – Fort Bend and Galveston Counties

Fort Bend County:

The employment forecasts for Fort Bend County form two distinct growth forecasts. The top band includes the three UH-IRF based model results and present substantial job growth for Fort Bend County reaching approximately 450,000 jobs by 2040. The H-GAC 1Q'15 and Moody's job forecasts are almost identical with jobs reaching 300,000 by 2040.

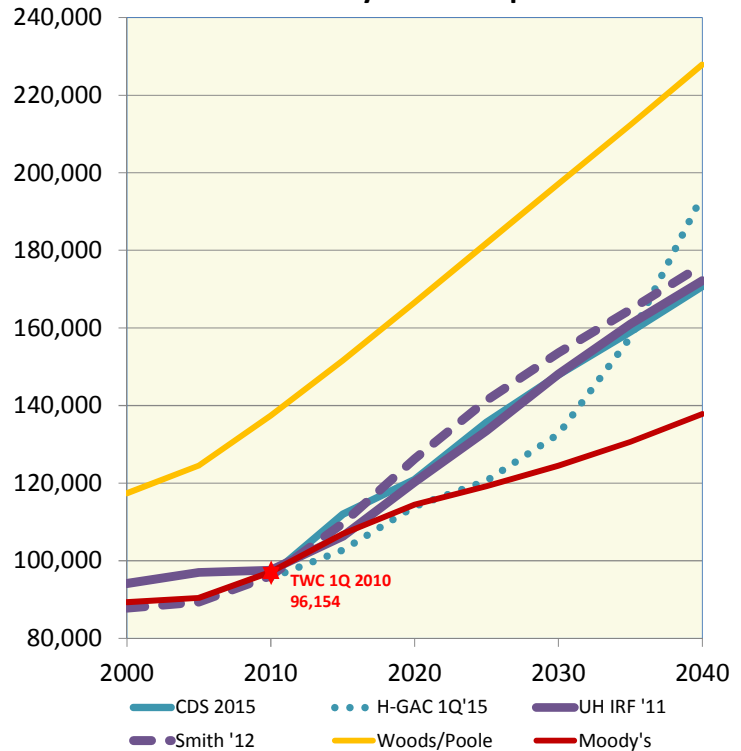
Fort Bend County Jobs Comparison



Galveston County:

Four of the five jobs forecasts for Galveston County reach 170,000 jobs by 2040. However, the H-GAC 1Q '15 forecast predicts fairly slow growth until 2030 and then a dramatic growth spurt. Moody's forecast is the lowest with 2040 jobs of 139,000.

Galveston County Jobs Comparison

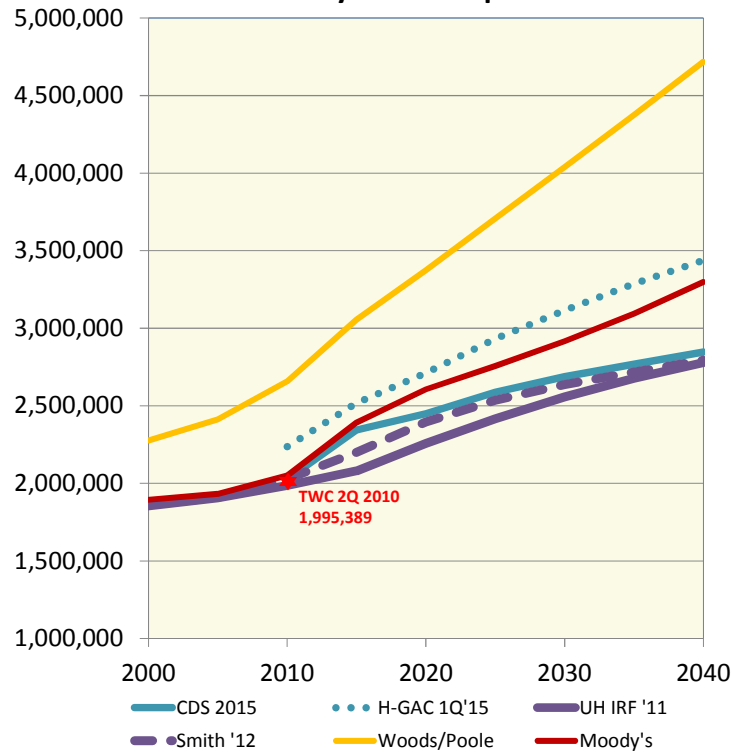


County Jobs Forecast Comparisons – Harris and Liberty Counties

Harris County:

The job growth forecasts for Harris County are in two groups. The high growth band represented by the H-GAC 1Q '15 and Moody's forecasts, have employment in Harris County reaching 3.25 million by 2040. Note that the H-GAC employment estimate for 2010 exceeds the others by a substantial margin. The three UH-IRF model-based forecasts also predict substantial growth at a slightly slower rate – reaching 2.75 million jobs by 2040.

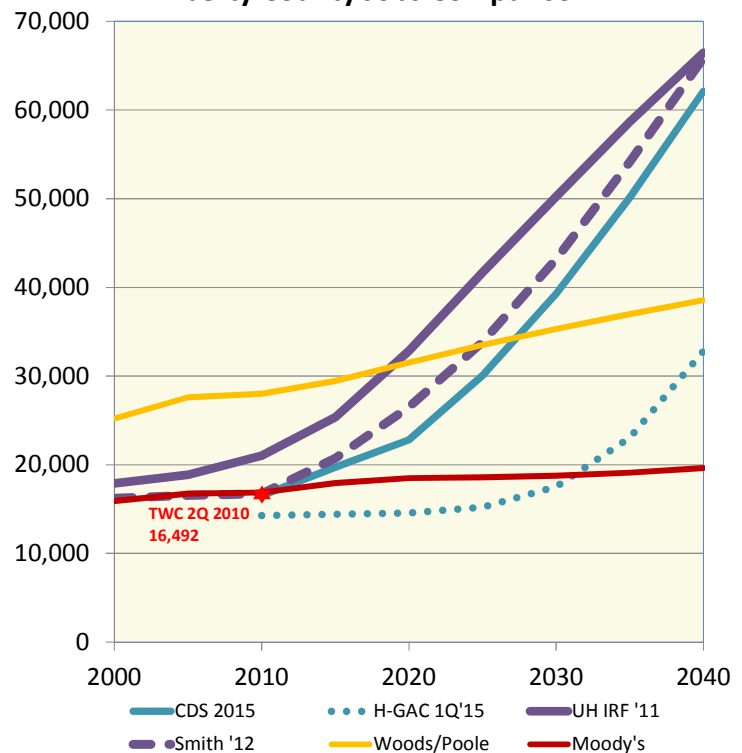
Harris County Jobs Comparison



Liberty County:

As with the population forecast, the job forecast comparison for Liberty County represents a wide range of growth estimates. The three forecasts based on the UH-IRF model predict substantial job growth in Liberty County, reaching more than 60,000 jobs by 2040. The H-GAC 1Q '15 predicts practically no job growth in the County until 2030, while the Moody's forecast demonstrates very little job expansion in the County throughout the forecast period.

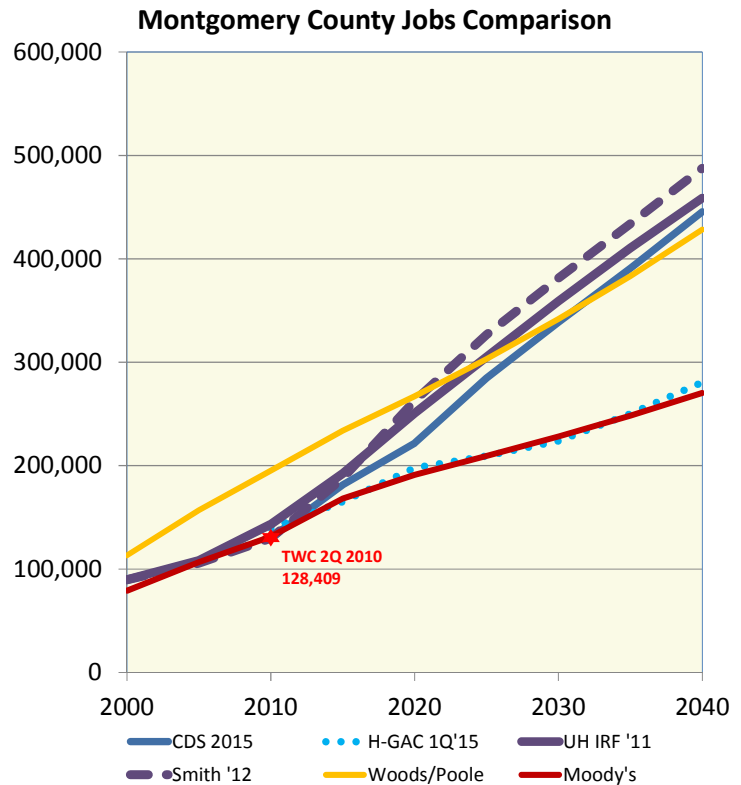
Liberty County Jobs Comparison



County Jobs Forecast Comparisons – Montgomery and Waller Counties

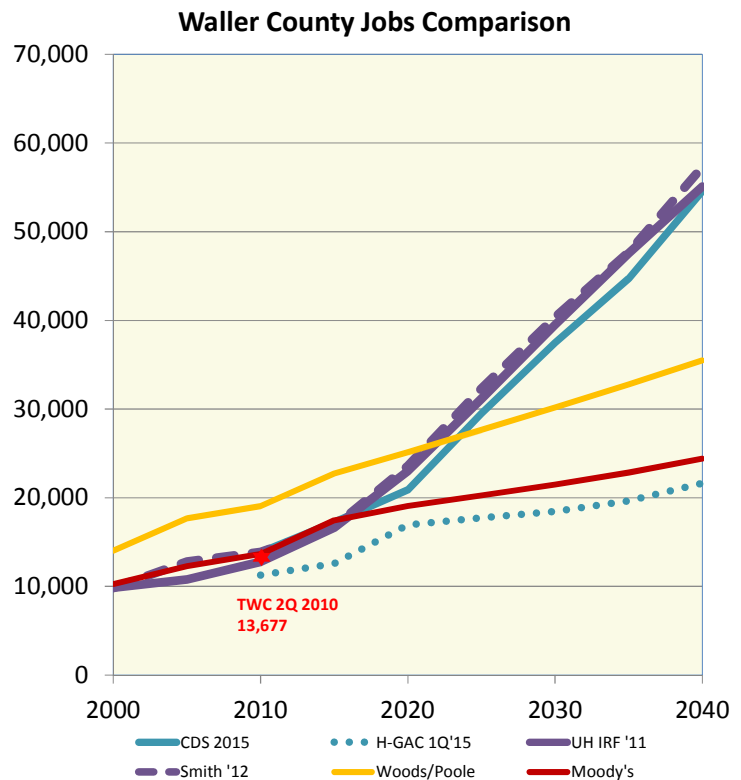
Montgomery County:

Most forecasts present substantial job growth for Montgomery County. The three UH-IRF forecasts represent the high growth band. They all predict more than 400,000 jobs in the County by 2040. The low growth band including the, H-GAC 1Q '15, and Moody's forecast result in only 250,000 jobs in Montgomery County by 2040.



Waller County:

Similar to the population forecasts, the Waller County employment forecasts demonstrate a wide range of future job growth expectations. The three UH-IRF-based models represent the high range of job growth with substantial expansion after 2020. The Moody's and H-GAC forecasts predict very little job growth in Waller County.



Selection of Appropriate Regional and County-level Forecasts

Long-term economic forecasts are most often a reasonable extension of historical trends into the future. There is no assurance that those trends will be sustained. Future growth is likely to deviate, higher or lower than history would suggest. The historical employment growth of the Houston region presented on page 4 of this report confirms that growth is not likely to follow a straight line or smooth curve into the future. All economies go through periods of growth and recession. For the reasons presented in this report, the Houston region is resilient and oriented to support future growth.

The key factor in evaluating forecasts is: ***Are they reasonable given all we know today?*** The best test is to consider multiple independent forecasts and consider which are most likely. Along with H-GAC's regional forecast, this report considered many forecasts of population from respected organizations and three separate forecasts of employment.

The H-GAC's regional forecasts, from which their small area forecasts are derived, tended to be in the middle of the independent forecasts considered in this project. It is the conclusion of this project team that the H-GAC 2040 forecasts at the "8-county regional level" were reasonable and consistent with other credible forecasts.

However, the small area and county-level forecast being produced in the H-GAC's 1Q 2015 forecast are somewhat discordant with recent growth trends. Recent versions of the H-GAC forecast have improved and have resolved many of the discrepancies uncovered in the previous analysis. H-GAC plans on updating their forecasts every quarter, and this improvement is likely to continue.

The Woods & Poole 2015 Forecasts were reasonable for population but their employment forecasts considered self-employed and part-time workers – a determination not shared by the other forecasting groups. The Woods & Poole job forecasts are so much higher than previous forecasting used by the H-GAC travel demand model that their use as control totals would require adjustment in the modeling regimen. The Moody's forecasts while reasonable, were determined to be simple extensions of previous trends and don't capture the dynamics of the likely future spatial growth in the Houston region.

After considering the various forecasts, it was decided to continue to use the Regional Forecasts produced from the University of Houston – Institute for Regional Forecasting (UH-IRF) model, updated by Dr. Barton Smith in 2012 and further updated for recent job growth by CDS Market Research (CDS '15), for future projections. The regional and county forecasts of the "CDS '15" will form the most appropriate basis for this revised set of small area forecasts for the Fort Bend Toll Road Traffic and Revenue Study. These forecasts were altered from their original state to move from forecasting housing units and total population to households and household population, as other sources (notably H-GAC) have done. Following are the key points that led to this conclusion:

- The adopted baseline forecast for county totals is the model created and updated by Dr. Barton Smith, formerly of the University of Houston Institute for Regional Forecasting (IRF) and now working as an independent consultant. The original model was not developed for UofH, but for consulting work for TXDOT and Harris County Toll Road Authority and it has been used as the primary macro tool for at least a half dozen toll road studies. Dr. Smith updated the model in 2012, retaining the underlying model structure of the previous region model. CDS Market Research updated the model to capture the remarkable increase in job growth in the region from 2010 to 2014.

- When compared to H-GAC's forecast and others gathered by CDS, the "CDS '15" forecast model is notable for the extent of anticipated decentralization of both jobs and population. This pattern is consistent with what has happened in almost every major urban area in America, including both the older cities in the northeast and the newer ones in the south and west. This results in totals for those two variables in outlying counties which are well above H-GAC's and others' projections, while Harris County ends up with lower totals. An important reason is that the model is sensitive to two significant factors: the presence of vacant developable land (and conversely the lack of it in existing built-up areas) and the qualitative factors and market forces which tend to favor outlying locations for many types of new development.
- The "CDS '15" model, and its predecessors based on the model developed by Dr. Barton Smith for the UH-IRF, also allows counties to capture accelerating or decelerating (non-linear) shares of growth over time – signifying "tipping points" and changes in market momentum that are similar to patterns that typically play out in the marketplace. This is done through second-degree polynomial formulas incorporated into a shift-share model.
- Dr. Smith had previously adjusted the estimated coefficients further as he became aware of additional information that was particularly relevant such as the expansion of the toll road system in the region and the limited expansion of roadways in the urban core.
- While it is an alteration, the CDS '15 adjustment of the "Smith '12" forecast to consider households and household population instead of housing units and total population does not change the underlying methodology or conclusions of Dr. Smith's forecast. The method behind the alterations is quite simple. Housing units were converted to households by assuming a continuation of recent historical trends in housing occupancy, while total population was converted to household population by through the assumption that recent trends in share of population outside of households (group quarters) would continue. These alterations change the forecast totals very slightly, and do not affect the growth rates or shares in any significant way.
- The CDS '15 forecasts present a revised set of regional and county forecasts based on current conditions. However, an extended run of low oil prices and slowdown of the oil and gas industry is not out of the realm of possibility, and could make even the modified scenario that were used for the current forecast somewhat optimistic. While the CDS'15 forecast assumes a moderate downturn in regional economic growth terms of sharpness and duration, sharper and longer downturns are certainly possible.

Adjusting the Regional and County Forecasts to Recent Trends

The most significant change in the Houston area growth trends over the past four years has been the increased rate of job growth and resulting population growth as a result of the expansion of the upstream energy and related sectors. This section describes the process involved in adjusting the current estimates of population, households and employment and adjusting the forecasts in light of the likely effect of low oil prices on the local economy over an extended time period.

2015 Employment Adjustment

In adjusting the regional economic forecasts to the new information on growth from 2010 to 2014, the first step was to estimate the 2015 regional total employment. Compounding the issue of regional analysis is the varying definitions of the Houston region. The CDS model, using Barton Smith’s UH-IRF forecasts was for an eight-county PMSA. This 8-county region is consistent with the Transportation Planning Region used by the regional MPO and TxDOT. CDS subsequently added Grimes County for use in the SH249 Toll Road Traffic and Revenue study. The official U.S. Census definition of the Houston Sugar Land Baytown MSA includes ten counties. Further complicating things, the most recent (February 2013) metropolitan area definition, called the Houston-The Woodlands-Sugar Land, TX MSA includes the nine counties of Austin, Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller. The Texas Workforce Commission uses the ten-county (Houston Sugar Land Baytown MSA) definition in their employment reporting. The comparison is shown in the table on the right.

Houston Sugar Land Baytown MSA Counties	CDS/UH-IRF Houston Region Counties
Austin	
Brazoria	Brazoria
Chambers	Chambers
Fort Bend	Fort Bend
Galveston	Galveston
	Grimes
Harris	Harris
Liberty	Liberty
Montgomery	Montgomery
San Jacinto	
Waller	Waller

The process used to determine a new 2015 employment forecast for the CDS model is as follows:

1. Determine the most recent employment estimates for the 10-county MSA from the Texas Workforce Commission (TWC). According to the TWC, the region contained 2,955,900 jobs as of November 2014.
2. Estimate the MSA employment for December 2014. According to the Greater Houston’s Partnership analysis included in the 2015 Houston Employment Forecast, published on December 11, 2014, the estimated December 2014 regional employment would be 2,961,600.
3. Adjust the TWC June 2014 employment estimates by county proportionally to match the end-year 2014 MSA total employment (the adjustment factor was 1.02672).
4. To estimate the likely employment growth to mid-year 2015, three 2015 annual job growth estimates (shown in the table on the right) were averaged. Using one-half of the average of the three projections, we

2015 MSA Projections

Source	Job Growth	Period
Greater Houston Partnership	62,900	2015
UH IRF - if oil prices recover	76,000	per year for 3 years
UH IRF - if oil prices do not recover	50,000	per year for 3 years

added 31,500 jobs to the year-end estimate which resulted in a 2015 MSA jobs estimate of 2,993,100.

5. Next, the 2015 MSA estimate was adjusted to eliminate Austin and San Jacinto Counties and add Grimes County to reach the CDS model’s 9-county region 2015 jobs estimate of 2,994,260. The table below illustrates the revised 2015 county and regional employment forecast base.
6. Using 2010 as the base, we estimate that the region will have added approximately 92,500 jobs per year from 2010 to 2015 as compared with the previous model assumption of 54,600.

Adjusted 2015 Regional Employment Base

County	Barton Smith 2012		Adjustment
	2010	2015	For 2015
Brazoria	87,619	100,404	104,760
Chambers	9,637	13,062	13,150
Fort Bend	135,985	192,183	187,180
Galveston	96,165	109,600	111,970
Grimes	13,246	14,100	14,100
Harris	2,026,916	2,198,611	2,344,680
Liberty	16,492	20,509	19,710
Montgomery	129,965	187,665	181,490
Waller	13,851	16,755	17,220
Total	2,531,886	2,854,904	2,994,260

2015 Population and Household Adjustment

To adjust the population and household estimates for 2015 in the CDS model, the most recent data from the U.S. Bureau of the Census was utilized. In this case, the county population estimates for 2013 were available so no adjustments to the 10-county region were required. The steps were as follows:

1. The county estimates for 2010 to 2013 from the Census were used to determine the average growth rate of county population for those three years.
2. A population estimate by county for 2015 was computed by using the 2013 population, adding another year at the same rate to estimate 2014 and then using a somewhat arbitrary, slower rate of growth for 2015 (1/3 of the 2010 to 2013 average) to estimate the total population for 2015.
3. Since the CDS model uses “population in households” rather than “total population,” the 2015 total population estimates were reduced by subtracting the previously estimated “persons in group quarters” the resulting estimates are compared with the previous

Adjusted 2015 Regional Population Base

County	Original Pop in HHs		NEW Pop in HHs	
	2010	2015	New Estimate 2015	Diff New-Old
Brazoria	302,607	356,145	324,838	-31,307
Chambers	34,867	41,367	37,226	-4,142
Fort Bend	579,439	743,475	672,361	-71,114
Galveston	287,012	326,495	308,179	-18,316
Grimes	23,592	24,947	23,789	-1,158
Harris	4,047,935	4,388,085	4,389,826	1,741
Liberty	70,499	79,223	71,605	-7,618
Montgomery	452,522	567,743	512,801	-54,942
Waller	39,502	50,396	41,267	-9,128
Total	5,837,975	6,577,875	6,381,891	-195,984

estimates in the table on the right.

It is curious that the population estimates for 2015 are lower in almost all counties than the forecasts used in the previous model. That slower population growth result suggests a changing dynamic of labor force participation in the Houston region. That is, there are more workers per population than in the past. Since unemployment rates have decreased, this result seems reasonable.

4. The CDS model also forecasts households for use in the travel demand modeling, so the next step involved determining a new estimate of the number of households by county for 2015. The American Community Survey (ACS) data of the U.S. Census was accessed to obtain the most recent household size data for the nine counties. In the case of the large counties, data on household size was available for 2013. In the case of the more rural counties such as Chambers, Grimes, Liberty, and Waller, the data was available for the 3-year 2010-2013 ACS.
5. The ACS 2015 household population was then divided by the ACS average county household size to estimate 2015 households, as seen in the table to the right.

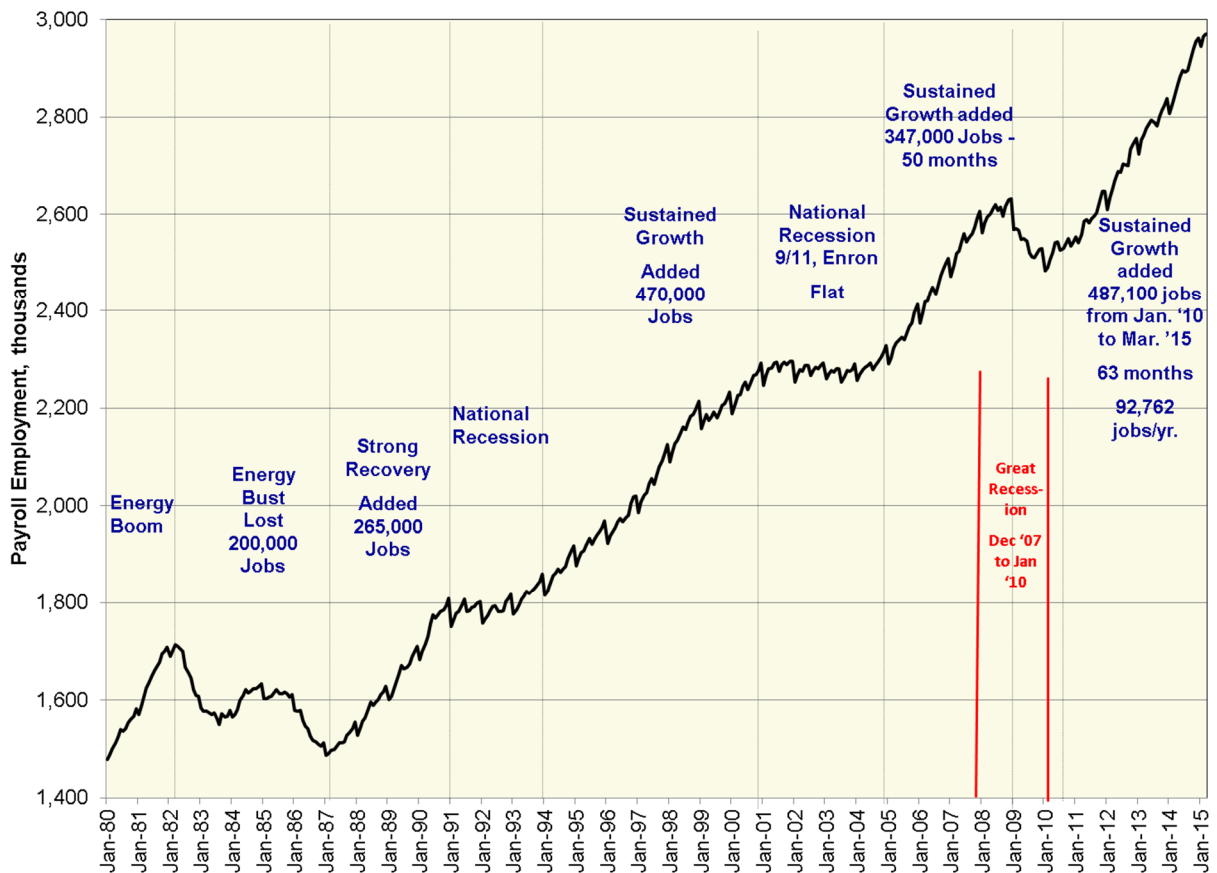
Adjusted 2015 Regional Households Base

County	Original Households		New Households	
	2010	2015	New Estimate 2015	Diff New-Old
Brazoria	106,589	124,346	113,415	-10,931
Chambers	11,952	14,050	12,643	-1,407
Fort Bend	187,384	241,537	218,433	-23,103
Galveston	108,969	121,512	114,695	-6,817
Grimes	8,902	9,413	8,977	-437
Harris	1,435,155	1,578,478	1,579,105	626
Liberty	25,073	28,092	25,391	-2,701
Montgomery	162,530	205,564	185,671	-19,893
Waller	14,040	17,942	14,692	-3,250
Total	2,060,594	2,340,934	2,273,022	-67,912

Future Conditions in the Houston Economy

The historical employment growth of the Houston region, shown in the chart below, illustrates both the occasional volatility of Houston’s employment and the ultimate growth trend that the area has seen during the last 3 decades. All economies go through periods of growth and recession and Houston is no different. Historical data would indicate, as has been said, that the Houston regional economy is resilient and oriented to support future growth.

Houston MSA Long-Term Employment Growth Trends



In the first economic forecasting project for CDM Smith – *Grand Parkway Economic/Demographic Projections - Segments D through G*— completed in the spring of 2011, CDS considered seven independent forecasts of population from respected organizations and three independent forecasts of employment. After the review, it was determined that “Regional and County-level forecasts” of the University of Houston – Institute for Regional Forecasting should form the appropriate basis for the small area forecasts for the Grand Parkway Investment Grade Traffic and Revenue Study.”

In 2012, Dr. Barton Smith updated the forecasts to account for recent changes including the 2010 Census. All subsequent forecasts prepared for toll road traffic and revenue studies are based on these forecasts. Unfortunately, Dr. Smith has retired from the University of Houston and is no longer

affiliated with the Institute for Regional Forecasting IUH-IRF. Also unfortunately, the UH-IRF, under the new leadership of Dr. Bill Gilmer, has decided to discontinue the long-term regional forecasts prepared historically by Dr. Smith – focusing instead on current and short-range regional economic analyses. The adjustment of the regional forecast is now left to CDS Market Research based on the original model which Dr. Smith used in the UH-IRF forecasts.

Analysis of Regional Employment Growth and Oil Prices

As discussed in the previous section on employment growth, and illustrated in the chart on the previous page, the Houston region has recently experienced dramatic job growth – due in large part to the expansion of the upstream energy jobs. According to the Texas Workforce Commission’s current job estimates, over the past 6 years, the 10- county MSA added almost 477,400 jobs, more than 95,000 jobs per year. In the nine-county region of the CDS forecast, the average annual job growth from 2010 to 2015 is estimated at approximately 92,500 jobs.

Note that the long-term job growth trend, evidenced in the chart on the previous page, from 1980 through 2014, is an average addition of 43,600 payroll jobs annually.

In the 5-year period from 1982 to 1987, when the Houston region suffered severe economic distress as a result of falling oil prices, the region lost almost 200,000 jobs. During that period, crude oil prices fell from about \$35 per barrel to approximately \$17 per barrel. In inflation adjusted 2014\$ that would equate to a drop of \$93 per barrel to \$37 per barrel. In the following four years, 1987 to 1991, the region added 265,000 new jobs. In that period, oil prices remained low – at \$17 to \$20 per barrel (\$37 to \$41 in 2014\$).

From July 2014 to January 2015, the price of crude oil declined from \$105 per barrel to \$48 per barrel.

It is clear that the lower crude oil prices will remain low over the near future and will certainly have somewhat of a negative effect on the growth of jobs and population in the Houston region.

The U.S. Energy Information Agency (EIA) in the January 2015, **Short-Term Energy Outlook**, predicted that the price of a barrel of WTI crude oil would average \$54.58 in 2015 and \$71.00 in 2016. The actual future prices of oil and the affect that oil prices will have on the Houston economy is not clear to all analysts. Examples are below. Links to the sources of these quotes can be found in Appendix B.

Boyd Nash-Stacey, an economist at BBVA Compass Bank prediction with regards to the diversification of Houston economy compared to 1980’s - Houston Chronicle, November 19, 2014

While it is obvious that a decline in oil prices will negatively impact Houston’s economy, our estimates suggests a moderate-to- mild impact. In fact, in the more severe demand-side scenario, growth is pulled 2.3 (percent points) below our baseline. In spite of losing nearly 34.9K in the mining sector jobs, home prices also remain largely unaffected by the direct impact from the mining sector.

This could be explained from the fact that large O&G companies can offset losses from drilling and exploration activities with refining, since oil prices act as a boost to this

sector. In addition, as a share of employment, the mining sector only accounts for 3.5% of all employees and in fact is only 2.0 % of the total population.

Dr. Bill Gilmer's (Institute for Regional Forecasting at the University of Houston) view on oil prices and Houston Economy - Houston Chronicle, November 25, 2014

Nearly half of Houston jobs are tied to the energy sector in some way, said Robert Gilmer, who heads the Institute for Regional Forecasting at the University of Houston. If oil prices recover slightly, as predicted, the best Houstonians should hope for is an economic plateau over the next three years. The Houston area will likely add only 76,000 jobs a year on average, compared with the 120,000 jobs it added this year, he said.

If oil stays around \$75 a barrel or drops further, U.S. producers will be forced to cut back dramatically on drilling. Analysts at Baird Equity Research Group estimated that if prices remain at current levels, North America could see a 10 percent cut in spending by oil and gas companies and a 25 percent reduction in the number of operating rigs.

Under that scenario, Gilmer said during a recent presentation, Houston would average only 50,000 new jobs a year, much slower than the rest of the nation.

"Crude in the \$80-\$90 a barrel range means modest cutbacks," Gilmer summed up. "At \$70-\$74 a barrel oil ... the Houston oil sector will be off, and that is the risk."

If the energy sector lays-off just 1 percent of its workforce, that's 17,000 lost Houston jobs, he added. The sector has already seen some layoffs. Houston oil driller Hercules Offshore plans to lay-off 324 rig workers, and Shell's Houston-based exploration and production unit for the Americas plans to cut 400 positions.

This pullback in oil and natural gas spending will test claims that Houston's economy has diversified.

Gilmer said cheap oil and natural gas prices mean cheaper inputs for the refineries and petrochemical plants along the Houston Ship Channel. He said the industrial boom on Houston's east side will likely continue for the next few years, keeping construction workers busy.

The Greater Houston Partnership's 2015 Houston Employment Forecast included these comments about the effects of lower oil prices - December 11, 2014

No one knows how far oil prices will fall in the coming months. Most oil companies would be grateful if prices remained that high. In early December, crude futures on the New York Mercantile Exchange traded between \$65 and \$68 per barrel through the end

of '15. Recent media reports suggested the Saudis would be content with Brent at \$60 per barrel.

One thing is certain—the industry will drill fewer wells next year. Moody's Investor Services expects independents to cut their exploration budgets by 20 percent. An analysis by Tudor, Pickering, Holt & Co. suggests exploration budgets could fall 30 percent or more in '15. Both Tudor Pickering and Simmons & Co. anticipate the rig count to fall by 500 units by the end of '15, which suggests a dramatic cut in the number of wells drilled. Every basin will see a significant drop in activity, even the Eagle Ford, Permian and Bakken.

For the past four years, conventional wisdom held that the breakeven point for drilling a well in the Eagle Ford is \$70 a barrel and between \$50 and \$80 in the Permian. The EIA estimates the breakeven for the Bakken much lower at \$42. Those floors will be tested in the coming months.

As exploration firms pull back and the rig count falls, they will gain leverage to negotiate cheaper rates which will lower break-even points. Land acquisition, a significant upfront cost, will slow. Firms will work prospects already in their portfolios, focusing on wells that turn a profit at lower prices. Companies will utilize technologies to increase production from existing wells and test whether wells can be spaced closer without sacrificing overall production. The industry will adapt, and consequently production growth will not slow as quickly as OPEC hopes. The U.S. now produces 9.1 million barrels per day; EIA forecasts production will average 9.5 million in '15. If Libya returns to Gaddafi-era production levels or sanctions are lifted against Iran, the glut and subsequent low oil prices may linger.

A shakeout in the industry will undoubtedly occur. That change began with the pending Halliburton-Baker Hughes merger. Expect more mergers in the future.

Balance sheets will be as important as the economics of drilling individual wells. Companies burdened with debt will fold, providing others with opportunities to acquire assets at bargain prices. Service firms with offices in remote locations will consolidate, most likely into Houston. That was the pattern in the '80s and it should repeat itself in the '10s. Mega projects in their early stages will come under closer scrutiny. Those well underway will continue. In a year or two, perhaps more, the industry will emerge leaner and more efficient, and production growth will resume.

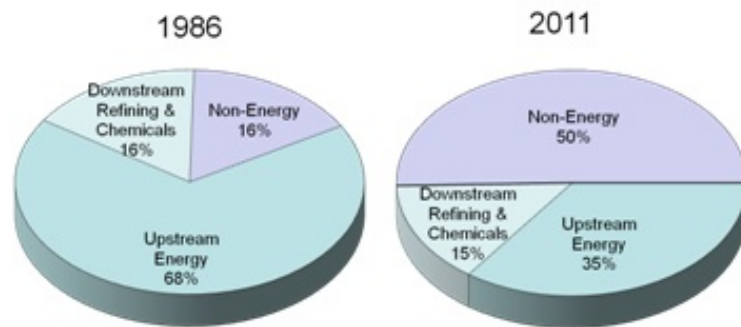
Expert estimates of Houston region job growth for 2015-18 suggest a tapering of recent trends but do not predict the job losses of the energy recession of the early 1980's. As discussed previously, the Greater Houston Partnership predicts that the region will add 62,900 jobs in 2015. The UH-IRF predicts job growth of 76,000 per year for the next 3 years if oil prices recover and they predict jobs growth of 50,000 per year for the next 3 years assuming that oil prices do not recover.

Recall that Houston's growth resumed strongly at the end of the 1980s, despite oil prices not having recovered significantly at that point from the mid-1980s crash. In the late 1990s after the Asian financial crisis, when oil prices also slumped, Houston's growth also continued, but at a slower pace.

Two elements of the Houston economy that must not be overlooked are:

1. The Houston economy is much less dependent on upstream and downstream energy sectors than it was in 1986, when an estimated 84% of the Houston economic base was dependent on those two sectors. By 2011, the last year that the UH-IRF made the analysis shown at the right, non-energy sectors accounted for 50% of the economic base.

Houston's Economic Diversification



Source: University of Houston, Institute for Regional Forecasting (2011 was the last year of this data)

2. The downstream sector of Houston's economy stands to benefit from lower crude prices. Recent refining and petrochemical plant expansions along the Houston Ship Channel and in the Baytown area expected to remain quite viable in spite of depressed crude oil prices and will produce a significant number of new jobs in the region.

Forecast Shares – From Two Forecasts

The tables below illustrate the shift-share results for both population and employment in the forecast issued for this project. The percentages in the table represent the county shares of the regional growth in each time period. Historical data is included and the bold type is the forecast shares.

Shares of Historical and Future Growth by County – CDS Forecast

County Share of Regional Population Change

Period	Brazoria	Chambers	Ft. Bend	Galveston	Harris	Liberty	Montgomery	Waller
1970 to 1980	6.54%	0.68%	8.39%	2.77%	71.24%	1.50%	8.30%	2.11%
1980 to 1990	3.61%	0.25%	15.42%	3.54%	66.70%	0.92%	8.97%	0.59%
1990 to 1995	5.06%	0.46%	13.35%	2.48%	63.33%	1.72%	12.72%	0.88%
1995 to 2000	5.46%	0.73%	13.93%	3.94%	61.49%	1.92%	11.52%	1.04%
2000 to 2005	6.94%	0.66%	17.00%	5.08%	56.24%	0.52%	12.83%	0.70%
2005 to 2010	5.06%	0.78%	20.22%	2.16%	56.85%	0.40%	13.55%	0.97%
2010 to 2015	7.25%	0.88%	22.21%	5.35%	46.06%	1.18%	15.60%	1.48%
2015 to 2020	8.76%	1.02%	19.07%	6.99%	44.08%	2.32%	15.06%	2.70%
2020 to 2025	9.75%	1.15%	18.16%	7.70%	39.51%	3.19%	17.25%	3.27%
2025 to 2030	10.31%	1.36%	18.45%	7.86%	35.13%	4.66%	17.46%	4.77%
2030 to 2035	10.84%	1.65%	18.47%	7.83%	30.11%	5.80%	19.31%	5.99%
2035 to 2040	11.38%	2.01%	19.48%	8.21%	25.65%	6.81%	19.80%	6.66%

County Share of Regional Employment Change

Period	Brazoria	Chambers	Ft. Bend	Galveston	Harris	Liberty	Montgomery	Waller
1970 to 1980	4.80%	0.56%	3.28%	1.95%	85.84%	0.83%	2.39%	0.35%
1980 to 1990	1.48%	-0.73%	6.64%	3.79%	79.12%	0.20%	8.62%	0.87%
1990 to 1995	1.38%	0.79%	10.27%	3.25%	72.74%	0.63%	10.24%	0.69%
1995 to 2000	1.51%	0.41%	11.49%	1.22%	73.90%	0.38%	10.63%	0.45%
2000 to 2005	3.70%	0.47%	14.90%	1.86%	56.16%	0.39%	19.00%	3.52%
2005 to 2010	3.95%	0.53%	11.74%	3.74%	65.87%	0.09%	13.50%	0.58%
2010 to 2015	3.70%	0.76%	11.04%	3.41%	68.55%	0.69%	11.12%	0.73%
2015 to 2020	4.30%	1.08%	17.87%	4.29%	49.99%	1.47%	19.26%	1.75%
2020 to 2025	4.63%	1.15%	20.80%	4.69%	43.77%	2.31%	19.93%	2.73%
2025 to 2030	4.76%	1.62%	21.79%	4.76%	39.23%	3.60%	21.12%	3.12%
2030 to 2035	5.20%	1.97%	22.05%	4.83%	35.26%	4.75%	22.78%	3.17%
2035 to 2040	5.71%	2.15%	22.52%	4.90%	32.83%	5.00%	22.79%	4.11%

By comparison, the following tables illustrate the similar growth shares by county in the H-GAC 1Q 2015 forecast.

Shares of Historical and Future Growth by County – H-GAC 1Q 2015 Forecast

County Share of Regional Population Change

Period	Brazoria	Chambers	Ft. Bend	Galveston	Harris	Liberty	Montgomery	Waller
2010 to 2015	6.15%	0.51%	18.03%	7.21%	53.28%	0.49%	14.25%	0.09%
2015 to 2020	5.92%	0.54%	16.91%	5.38%	55.04%	0.40%	15.35%	0.45%
2020 to 2025	11.32%	0.63%	14.29%	8.18%	42.65%	1.80%	19.53%	1.59%
2025 to 2030	12.41%	0.62%	13.42%	9.18%	39.62%	2.78%	20.54%	1.42%
2030 to 2035	14.33%	0.59%	11.02%	7.06%	35.80%	5.10%	24.05%	2.05%
2035 to 2040	15.10%	0.59%	10.73%	7.53%	32.94%	5.11%	24.52%	3.49%

County Share of Regional Employment Change

Period	Brazoria	Chambers	Ft. Bend	Galveston	Harris	Liberty	Montgomery	Waller
2010 to 2015	2.05%	0.46%	11.33%	1.97%	76.86%	0.04%	6.93%	0.35%
2015 to 2020	1.54%	0.41%	13.38%	3.95%	67.69%	0.05%	11.47%	1.53%
2020 to 2025	4.17%	0.40%	6.97%	2.41%	81.34%	0.24%	4.18%	0.29%
2025 to 2030	8.16%	0.38%	9.45%	4.69%	70.51%	0.89%	5.64%	0.28%
2030 to 2035	6.42%	0.36%	5.73%	9.51%	65.46%	2.10%	9.96%	0.45%
2035 to 2040	9.70%	0.37%	5.66%	13.40%	55.35%	3.60%	11.19%	0.74%

The tables below illustrate the forecast shift-share results for both population and employment in the Houston MSA for the CDS Forecast. The percentages in the table represent the county shares of the total 8-county region in each time period. Historical data is included and the bold type is the forecast shares.

County Shares of Historical and Future Population and Employment – CDS Forecast

County Share of Regional Population

Year	Brazoria	Chambers	Ft. Bend	Galveston	Harris	Liberty	Montgomery	Waller
1970	4.97%	0.56%	2.40%	7.78%	79.86%	1.51%	2.27%	0.65%
1980	5.44%	0.59%	4.20%	6.28%	77.27%	1.51%	4.08%	0.63%
1990	5.14%	0.54%	6.04%	5.83%	75.53%	1.41%	4.88%	0.63%
1995	5.13%	0.53%	6.57%	5.59%	74.65%	1.44%	5.45%	0.65%
2000	5.18%	0.56%	7.59%	5.36%	72.82%	1.50%	6.29%	0.70%
2005	5.35%	0.57%	8.51%	5.33%	71.20%	1.41%	6.93%	0.70%
2010	5.20%	0.60%	9.97%	4.94%	69.62%	1.21%	7.78%	0.68%
2015	5.38%	0.62%	11.01%	4.97%	67.61%	1.21%	8.45%	0.75%
2020	5.74%	0.67%	11.88%	5.19%	65.08%	1.33%	9.16%	0.96%
2025	6.14%	0.71%	12.50%	5.44%	62.56%	1.51%	9.96%	1.19%
2030	6.46%	0.76%	12.95%	5.62%	60.46%	1.75%	10.53%	1.46%
2035	6.74%	0.82%	13.31%	5.76%	58.49%	2.02%	11.10%	1.75%
2040	7.02%	0.89%	13.68%	5.91%	56.54%	2.30%	11.62%	2.04%

County Share of Regional Employment

Year	Brazoria	Chambers	Ft. Bend	Galveston	Harris	Liberty	Montgomery	Waller
1970	3.75%	0.39%	1.57%	6.52%	85.49%	0.88%	1.04%	0.38%
1980	4.21%	0.46%	2.32%	4.50%	85.64%	0.86%	1.63%	0.37%
1990	3.92%	0.33%	2.79%	4.43%	84.94%	0.79%	2.39%	0.42%
1995	3.77%	0.36%	3.22%	4.36%	84.24%	0.78%	2.84%	0.44%
2000	3.44%	0.37%	4.43%	3.90%	82.72%	0.72%	3.98%	0.44%
2005	3.45%	0.37%	4.81%	3.83%	81.77%	0.71%	4.52%	0.55%
2010	3.49%	0.38%	5.30%	3.82%	80.63%	0.66%	5.16%	0.55%
2015	3.52%	0.44%	6.28%	3.76%	78.68%	0.66%	6.09%	0.58%
2020	3.57%	0.48%	7.04%	3.79%	76.80%	0.71%	6.95%	0.65%
2025	3.66%	0.54%	8.28%	3.87%	73.82%	0.86%	8.12%	0.84%
2030	3.74%	0.62%	9.20%	3.93%	71.47%	1.04%	9.01%	1.00%
2035	3.82%	0.69%	9.94%	3.98%	69.39%	1.26%	9.80%	1.12%
2040	3.93%	0.78%	10.65%	4.04%	67.32%	1.47%	10.53%	1.29%

By comparison, the following tables illustrate the similar growth shares by county in the H-GAC 1Q 2015 forecast.

County Shares of Historical and Future Population and Employment – H-GAC 1Q 2015 Forecast

County Share of Regional Population

Year	Brazoria	Chambers	Ft. Bend	Galveston	Harris	Liberty	Montgomery	Waller
2010	5.21%	0.60%	9.95%	4.94%	69.62%	1.21%	7.79%	0.68%
2015	5.31%	0.59%	10.83%	5.19%	67.84%	1.13%	8.49%	0.62%
2020	5.37%	0.59%	11.42%	5.20%	66.60%	1.06%	9.16%	0.60%
2025	5.90%	0.59%	11.68%	5.47%	64.47%	1.13%	10.08%	0.69%
2030	6.43%	0.59%	11.82%	5.77%	62.43%	1.26%	10.94%	0.75%
2035	7.02%	0.59%	11.76%	5.87%	60.44%	1.55%	11.92%	0.85%
2040	7.58%	0.59%	11.69%	5.98%	58.55%	1.80%	12.78%	1.03%

County Share of Regional Employment

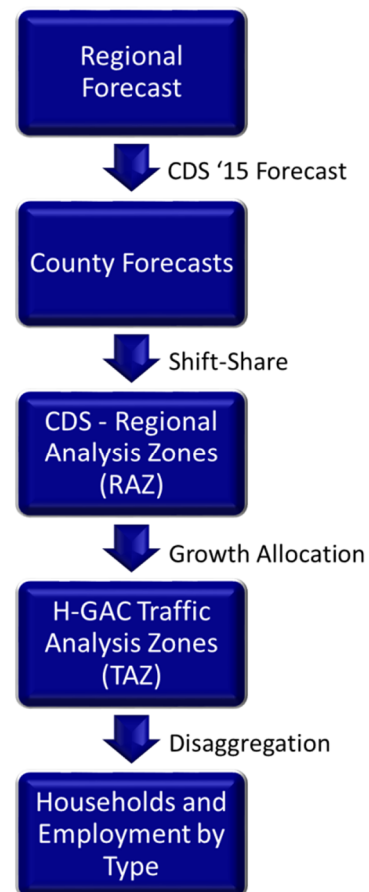
Year	Brazoria	Chambers	Ft. Bend	Galveston	Harris	Liberty	Montgomery	Waller
2010	3.08%	0.45%	5.41%	3.48%	81.55%	0.52%	5.10%	0.41%
2015	2.96%	0.45%	6.11%	3.30%	81.00%	0.46%	5.31%	0.40%
2020	2.84%	0.45%	6.72%	3.36%	79.88%	0.43%	5.83%	0.50%
2025	2.94%	0.45%	6.74%	3.29%	79.98%	0.41%	5.71%	0.48%
2030	3.28%	0.44%	6.92%	3.38%	79.36%	0.45%	5.70%	0.47%
2035	3.48%	0.44%	6.84%	3.76%	78.49%	0.55%	5.97%	0.47%
2040	3.86%	0.43%	6.77%	4.35%	77.08%	0.74%	6.29%	0.49%

A comparison of the various county-level forecasts for population and jobs that were considered by CDS, including the selected base forecast (the adjusted IRF), is given on the following pages.

Small Area Forecast Method Overview

The previously mentioned Houston Galveston Area Council (H-GAC) forecast is available at smaller geographic areas in addition to its county and region-wide levels. CDS was tasked with providing an independent forecast using H-GAC’s geographic forecasting structure and providing values for the same forecasting data variables. This meant that CDS would need to create datasets for all of H-GAC’s Traffic Analysis Zones (TAZs) that include values for all output variables required by the agency’s newest traffic model. In general, the methodology to create these independent forecast datasets included the following steps.

1. Begin with the CDS ’15 forecast at the regional and county levels.
2. Investigate historical growth trends from:
 - the decennial US Census and other Census Bureau sources such as the American Community Survey (ACS) and Longitudinal Employer-Household Dynamics (LEHD).
 - PCensus for ArcView, a program that distributes and displays Nielsen/Claritas demographic data which included 1990, 2000, and 2010 Census data, estimates for 2005 and 2014 as well as projections to 2019 at the census block level
 - historical employment information from the Texas Workforce Commission (TWC)/Bureau of Labor Statistics (BLS)
 - previous the H-GAC forecasting efforts
3. Investigate the opinions and forecasts of area governmental agencies, private organizations, and area experts.
4. Evaluate the potential growth inducing effects of the two FBTRA projects and other major infrastructure improvements, including the Grand Parkway.
5. Account for near-term residential and commercial developments that have been recently announced or begun.
6. Implement a “shift-share” forecasting methodology at the Regional Analysis Zone (RAZ) level. CDS created new RAZs for this project, as H-GAC no longer uses these geographies. This takes into account:
 - the historical trends
 - the known historical growth areas for housing and jobs
 - announced major developments
 - the land available for new development
 - likely areas in the community for new development based on locally influenced qualitative factors
7. Disaggregate the RAZ forecast into the smaller Traffic Analysis Zones (TAZ).
8. Disaggregate the TAZ forecast for households and employment by H-GAC’s data categories.



Forecasting Population and Jobs – County Control Totals

County Level and Region Growth Projections

	Year	8-County CMSA	Brazoria	Cham- bers	Ft. Bend	Galveston	Harris	Liberty	Mont- gomery	Waller
POPULATION										
Popu- lation by Year	1970	2,181,316	108,312	12,187	52,314	169,812	1,741,913	33,014	49,479	14,285
	1980	3,118,480	169,587	18,538	130,962	195,738	2,409,547	47,088	127,222	19,798
	1990	3,731,131	191,707	20,088	225,421	217,399	2,818,199	52,726	182,201	23,390
	1995	4,021,841	206,421	21,416	264,235	224,620	3,002,304	57,713	219,190	25,941
	2000	4,669,589	241,767	26,031	354,452	250,158	3,400,578	70,154	293,786	32,663
	2005	5,109,124	273,338	29,122	451,391	272,316	3,604,232	75,104	367,857	35,764
	2010	5,814,383	302,607	34,867	579,439	287,012	4,047,935	70,499	452,522	39,502
	2015	6,357,303	341,964	39,646	700,025	316,037	4,297,986	76,913	537,223	47,510
	2020	7,122,108	408,949	47,425	845,895	369,468	4,635,121	94,689	652,419	68,143
	2025	7,902,562	485,061	56,413	987,645	429,595	4,943,509	119,602	787,057	93,680
	2030	8,557,433	552,577	65,300	1,108,498	481,040	5,173,582	150,113	901,428	124,894
	2035	9,151,620	616,963	75,111	1,218,223	527,549	5,352,493	184,601	1,016,169	160,510
2040	9,728,922	682,680	86,710	1,330,687	574,958	5,500,554	223,929	1,130,472	198,933	
Annual Average Pop. Growth by Period	'00-'10	114,479	6,084	884	22,499	3,685	64,736	35	15,874	684
	'10-'20	130,773	10,634	1,256	26,646	8,246	58,719	2,419	19,990	2,864
	'20-'30	143,532	14,363	1,787	26,260	11,157	53,846	5,542	24,901	5,675
	'30-'40	117,149	13,010	2,141	22,219	9,392	32,697	7,382	22,904	7,404
	'10-'40	130,485	12,669	1,728	25,042	9,598	48,421	5,114	22,598	5,314
JOBS										
Jobs by Year	1970	904,142	33,873	3,509	14,159	58,934	772,907	7,919	9,403	3,438
	1980	1,616,123	68,052	7,482	37,545	72,799	1,384,104	13,854	26,388	5,899
	1990	1,811,944	70,950	6,048	50,546	80,224	1,539,045	14,251	43,268	7,612
	1995	1,922,608	72,482	6,921	61,908	83,826	1,619,544	14,951	54,602	8,373
	2000	2,252,103	77,472	8,288	99,768	94,138	1,855,051	17,901	89,634	9,851
	2005	2,343,072	80,250	8,787	112,936	96,956	1,906,019	18,862	108,484	10,778
	2010	2,516,630	87,619	9,637	135,985	96,165	2,026,916	16,492	129,965	13,851
	2015	2,980,160	104,760	13,150	187,180	111,970	2,344,680	19,710	181,490	17,220
	2020	3,189,243	113,741	15,409	224,534	120,947	2,449,192	22,789	221,760	20,872
	2025	3,504,786	128,346	19,029	290,176	135,743	2,587,309	30,064	284,636	29,483
	2030	3,760,787	140,527	23,169	345,962	147,918	2,687,748	39,290	338,696	37,477
	2035	3,989,554	152,419	27,681	396,396	158,967	2,768,407	50,149	390,819	44,718
2040	4,228,812	166,074	32,819	450,272	170,701	2,846,949	62,109	445,347	54,541	
Annual Average Jobs Growth by Period	'00-'10	26,453	1,015	135	3,622	203	17,187	-141	4,033	400
	'10-'20	67,261	2,612	577	8,855	2,478	42,228	630	9,179	702
	'20-'30	57,154	2,679	776	12,143	2,697	23,856	1,650	11,694	1,661
	'30-'40	46,802	2,555	965	10,431	2,278	15,920	2,282	10,665	1,706
	'10-'40	57,073	2,615	773	10,476	2,485	27,334	1,521	10,513	1,356

Note: These control totals represent the starting point of the forecast, and will differ slightly from RAZ and TAZ level forecasts summed to the county level due to rounding that occurs when producing the smaller area forecasts.

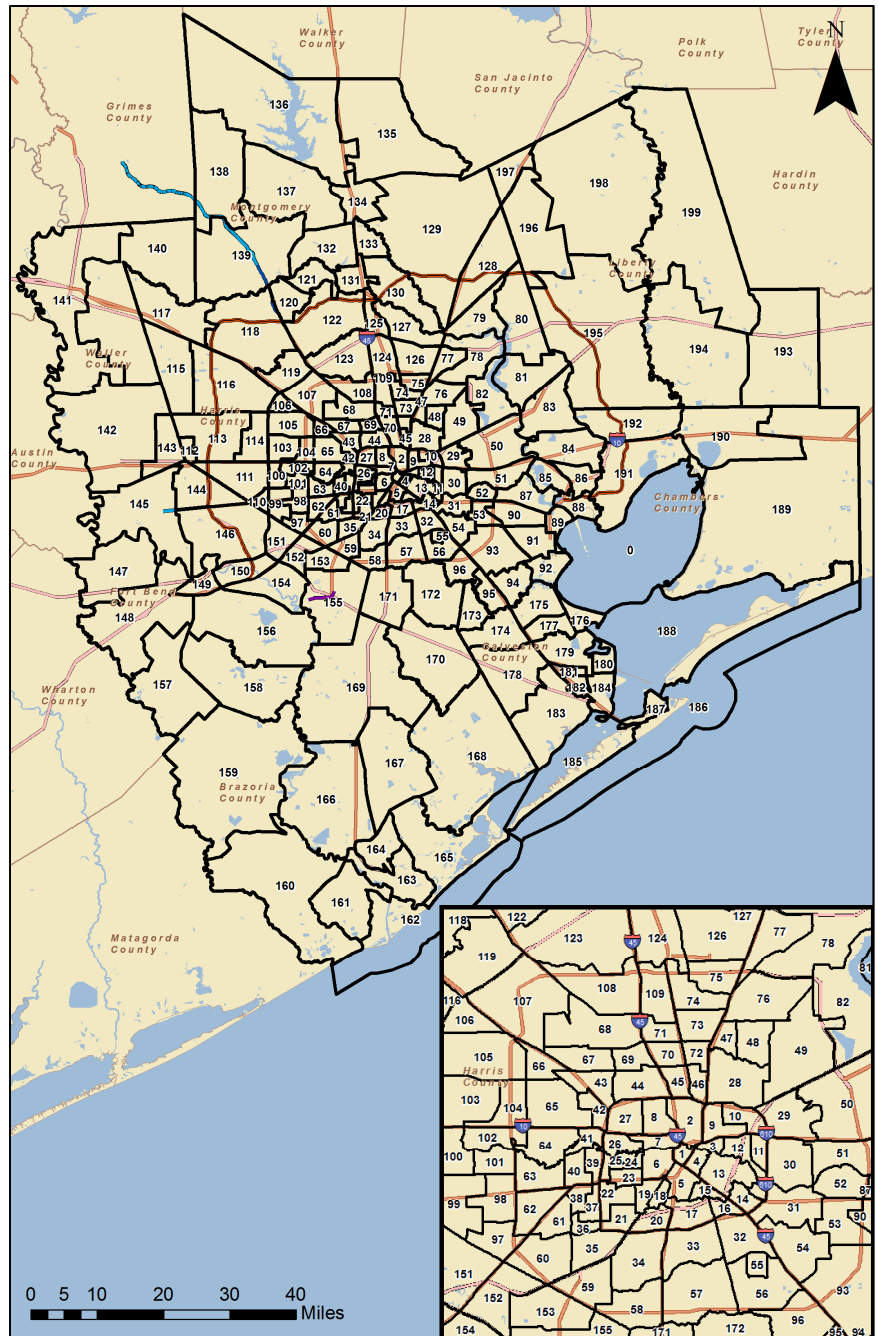
Use of the CDS-defined Regional Analysis Zones (RAZ)

In past forecasting projects, CDS used H-GAC’s Regional Analysis Zones (RAZ) as an intermediate step in the shift-share process between the county-level control totals and the smaller TAZ geographies. Several years ago, H-GAC discontinued the use of RAZs for issuing and analyzing forecasts. Despite this, CDS continued to use RAZs as an intermediate step in the shift-share process as the TAZ structure H-GAC and CDM-Smith continued to use remained consistent with the RAZ boundaries.

H-GAC has also since developed a new TAZ structure, which CDS is now using for all forecasts going forward. Unlike the old TAZs, this new structure does not conform precisely to the boundaries of the previous RAZs, though the differences are generally fairly minor. Despite these minor differences, the new TAZs can be matched relatively well with a RAZ geography. CDS matched up the new TAZs as closely as possible to the old RAZ boundaries and created a redefined set of RAZs (map to right) fitted to the boundaries of the new TAZs. These zones are similar to H-GAC’s RAZ but are not identical. This was done in order to continue to use the RAZ-level as an intermediate step in the shift-share process and to better enable the use of CDS’ previous forecast work done for the old TAZ structure into the new structure.

Map of CDS-defined Regional Analysis Zones

Eight County Region



Starting with Historical and Forecast Data at the RAZ and TAZ levels

It was beyond the scope of this report and the models available to the project team to produce a complete forecast for the entire Houston metropolitan region and every Traffic Analysis Zone (TAZ) from scratch. CDS began this forecasting process, as it has every forecast since the original 2011 Grand Parkway project, by using its most recent previous forecast as a starting point in terms of shift-share allocations at the RAZ and TAZ levels. This is done to incorporate and build upon previous work and expectations, as none of the transportation projects CDS has been asked to consider are assumed to be planned in lieu of others. CDS then compiled the data on recent trends (1990 to 2010) at the TAZ geographic level and recent forecasts by H-GAC. Those data were evaluated and adjustments were made to the forecasts using a variety of methods.

The 2010 Base

The original CDS forecast done in 2011 began by identifying the appropriate 2010 base year data for population, housing units, and employment. This data has carried through all subsequent forecast projects with one major alteration. Beginning with the Grand Parkway Segments D-I forecast issued in 2015, CDS uses population in households and total households/occupied housing units instead of total population and housing units for both base and forecast years. The following is the process at which this information was obtained.

Population and Households

The 2010 population for TAZs was based on the household and household population at the Census block level from the 2010 Census.

Employment (Jobs)

Determining the 2010 base jobs by RAZ was substantially more difficult than housing and population. The reason is that there are no small area job estimates that are based on reliable data such as the Census. The U.S. Bureau of the Census County Business Patterns provides the most verifiable data but the lowest level of geography available is zip code. For their most recent forecast, H-GAC estimated the number of jobs in small areas using the county appraisal district data, augmented by information from InfoUSA™ and from internal and other sources not revealed to CDS.

One option that CDS has access to is the Nielsen/Claritas Business Facts® database for very small areas (Census block groups) through PCensus for ArcView. Claritas Business Facts® is developed using the InfoUSA™ data file as its base source. The InfoUSA™ database of over 12 million U.S. businesses is mined from over 4,900 Yellow Page directories published each year by Regional Bell Operating Companies (RBOC's) and independent phone companies. InfoUSA™ also compiles records from over 500 Business White Pages, regular White Pages, federal, state and municipal government Blue Pages, annual reports (publicly-held companies) industrial and regional business journals. InfoUSA™ then processes the information through several routines to ensure that the final product will be dependable for use by salespeople and marketers interested in using its contents for mailing campaigns. That includes calling existing and new businesses at least once each year to verify and collect new information.

Another option for current job estimates is to use the square feet of commercial buildings, office, retail, industrial and institutional buildings from the county appraisal districts to estimate the number of jobs

at each facility. CDS applied H-GAC’s stated ratios of square feet per job as in the table on the right. Unfortunately that method did not produce consistent results.

Ultimately, the historical and current employment estimates were developed from a variety of sources. The 1990 and 2000 jobs estimates come from the special tabulations of the U.S. Decennial Census (CTTP) provided by the H-GAC. The 2005 estimates of jobs comes from the H-GAC’s 2005-2035 forecast. The 2010 employment estimate was ultimately based on figures issued by Nielsen/Claritas based on the InfoUSA data previously described.

In all cases the values for the historical and base-year (2010) data for employment and population were adjusted proportionally to match the county-level totals provided by the Texas Workforce Commission/BLS and the CDS 2015 forecast control totals. The historical and projected population and jobs data by (CDS-defined) RAZ is presented in the appendices of this report.

Square Feet per Employee by Building Activity

Building Type	SqFt Per Employee
Education	1,400
Health Care	350
Lodging	917
Retail	500
Office	225
Public Assembly	1,000
Warehouse	1,000
Industrial	625
Mobile	0

Switching the CDS Forecast to the new H-GAC TAZ structure

The new H-GAC TAZ forecast structure required, beginning with the SH 249 toll road project and continuing with the FBCTRA project, differs significantly from the one that formed the basis of CDS’ previous forecasts. The old H-GAC TAZ structure contained 2,954 zones, a number that grew to over 3,500 zones in more recent forecasts as CDS and CDM-Smith divided several TAZs into smaller zones for a variety of purposes. The new H-GAC TAZ structure contains 5,217 zones, and much like with the RAZs, many of these zones do not conform to the boundaries of the old TAZs or the modified zones used in later forecasts.

In order to maintain the work done for previous forecasts, CDS sought to transfer the most recent forecast done using the old zones into the new TAZ structure. This was done through a variety of methods. In cases where the old and new zones where the same or very similar, the forecast assumptions were left unchanged. In other zones, CDS began with the data from the old structure zone or zones that most closely match the new TAZ geography and modified the assumptions based on the new base year historical data and the different expectations that may come from the area being geographically different. Similarly, in new TAZs that make up fractions of older, larger TAZs, CDS divided up the old zone’s forecast data using the base year historical data and its own expectations for the future of the land inside the new TAZs.

Using this process, CDS was able to very nearly duplicate the growth distribution of its most recently issued prior forecast (Grand Parkway segments D through I) in the new H-GAC TAZ structure. This data would later be further adjusted based on CDS’ FBCTRA project-specific research.

Future Transportation Network Assumption

In preparing the small area forecasts, it is clear that future transportation networks and the accessibility of the small area zones are affected by transportation infrastructure improvements over time. It was beyond the scope of this work to develop sophisticated models that took into account all changes in the transportation network including both highways and public transit. Therefore for this analysis it was assumed that transportation improvements would continue over time to serve the existing and new residents of the community and that any transportation funding crisis, regardless of how real it may seem today, will be ultimately resolved because of citizen demands. Therefore, for the purposes of this effort, it was assumed that the relative accessibility of the various zones in the region would not significantly change over time. However, recently opened and planned facilities such as the extension of the Fort Bend Toll Road and the Westpark Toll Road, the SH 249/Tomball Tollway, the Grand Parkway, the Fort Bend and City of Houston Major Thoroughfare Plans, known enhancements to existing facilities such as improvements to US 290, SH 288, I-45 South and I-45 North, and light rail extensions were included.

Contact with Area Agencies and Organizations

In the course of developing small area forecasts for previous Traffic and Revenue studies, CDS sought out the demographic and economic projections and opinions from key public sector agencies and officials serving both the key areas around the toll roads in question and the Houston region as a whole. CDS's goal was to understand the projections used by these organizations and to account for knowledge and insight gained from conversations with the local organizations. Many of the organizations contacted stated that they did not develop their own projections, and instead utilized those provided for the region by H-GAC. As previously mentioned, H-GAC projections were also considered in CDS's efforts herein. Data from these organizations was collected both by contacting the organizations directly and researching publically available data offered on their websites and other sources.

CDS spoke with and reviewed an initial forecast with the following offices and organizations (listed in the order in which meetings took place):

- Fort Bend County Precinct 3
- City of Fulshear
- Fulshear EDC
- Fort Bend County EDC

The comments made by these offices and organizations were factored into many of the adjustments made to the small-area forecasts for this project.

The RAZ-Level Forecasts

The forecasts at the RAZ level of geography were produced using a shift-share forecasting methodology accounting for land availability throughout the process. The methodology involved establishment of county-level forecasts from 2010 to 2040. Then the shares of the future county households, population and jobs were estimated for each 5-year period. An example of the methodology, for Waller County is shown below.

Shift Share Analysis Example										
RAZ Shares – Share of County Job Growth in Each 5-Year Period										
RAZ	1990	2000	2005	2010	2015	2020	2025	2030	2035	2040
140		21.9%	0.8%	13.8%	22.2%	22.4%	22.7%	23.8%	24.3%	24.3%
141		6.9%	4.7%	9.5%	11.1%	10.5%	10.1%	9.7%	9.5%	9.5%
142		67.1%	44.0%	68.1%	33.3%	34.1%	34.1%	34.7%	35.0%	36.0%
143		4.1%	50.5%	8.6%	33.3%	33.0%	33.1%	31.8%	31.1%	30.2%
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

$$\text{Jobs}_{\text{Year } n} = \text{Jobs}_{\text{Year } n-5} + \text{RAZ Share}_{\text{Year } n} \times [\text{County Jobs}_{\text{Year } n} - \text{County Jobs}_{\text{Year } n-5}]$$

Jobs – Total Number of Jobs in the RAZ in the Year Shown										
RAZ	1990	2000	2005	2010	2015	2020	2025	2030	2035	2040
140	4,238	4,729	4,737	5,010	5,868	7,297	9,152	11,140	13,102	14,927
141	1,874	2,029	2,072	2,260	2,691	3,361	4,186	4,995	5,760	6,473
142	1,227	2,729	3,137	4,487	5,774	7,951	10,734	13,634	16,458	19,159
143	274	365	833	1,004	2,291	4,400	7,099	9,750	12,261	14,523
Total	7,612	9,851	10,778	12,761	16,623	23,008	31,172	39,518	47,581	55,082

In each case, the shares of future growth were based on:

- recent history of growth capture
- information on growth from area agencies and organizations
- expected future capture of the growth
- estimation of the capacity of the vacant developable or redevelopable land in the RAZ for new development

Distributing RAZ-Level Forecast Data to the TAZ and SAZ

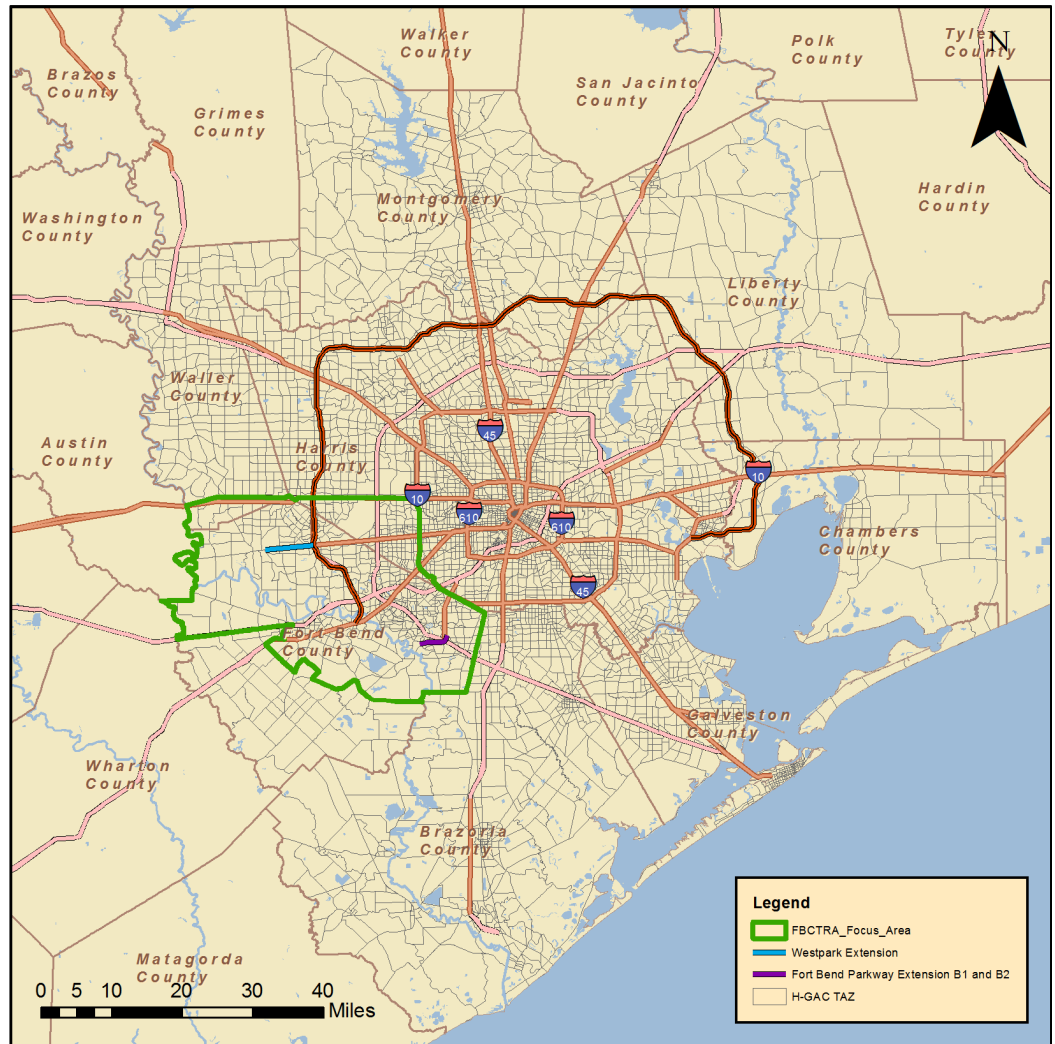
RAZ to TAZ Allocation

The forecasts for the 199 RAZs were distributed to the smaller TAZs, for the entire 8-county region. The map on the right illustrates the 5,217 H-GAC TAZs in the region as well as a “Focus Area” in which particular attention to new and potential development was paid.

The methodology for the distribution of the expected growth within the RAZs to the smaller TAZs was straightforward. For this effort, the CDS team:

1. Reviewed information for each RAZ, including aerial photographs, data from the appraisal districts, information from area agencies and previous TAZ-level forecasts prepared by the H-GAC;
2. Made an assessment as to the current distribution of housing units, jobs and population within each TAZ as a percentage of the total RAZ (using the team knowledge of trends and development plans); and
3. Made an assessment of the future growth of housing and jobs in each TAZ of the expected growth of the entire RAZ; and applied those growth percentages to the expected RAZ total growth to produce estimates of future growth of housing, population and jobs in the smaller zones.

H-GAC Traffic Analysis Zone (TAZ) Structure and Focus Area



Summary of Considered Adjustments

The following tables illustrate the considered changes in the forecasts at the small area (RAZ and TAZ) level. In some cases, change in the forecast was required, in other cases, the original projections adequately included the growth from the newly announced projects or changing conditions. Many of these considered adjustments were noted by the officials and organizations that CDS met with during the course of this project. Nearly all of the items on these lists are located within the Focus Area illustrated on the previous page. There are two tables, one for adjustments related to population and housing (residential developments) and one for adjustments related to employment (commercial developments). A total of 111 TAZ in 18 separate RAZs (population and employment adjustments combined) were specifically examined and adjusted for this forecast.

Population and Housing Adjustments

TAZ	RAZ	County	Note/Adjustment
1735	111	Harris	Significant apartment development ongoing and expected in this zone, Adjusted up
1738	111	Harris	Largely built out part of the Cinco Ranch area, growth should be limited, Adjusted down
1739	111	Harris	Largely built out part of the Cinco Ranch area, growth should be limited, Adjusted down
3616	144	Fort Bend	Largely built out part of the Cinco Ranch area, growth should be limited, Adjusted down
3624	144	Fort Bend	Largely built out part of the Cinco Ranch area, growth should be limited, Adjusted down
3626	144	Fort Bend	Largely built out part of the Cinco Ranch area, growth should be limited, Adjusted down
3627	144	Fort Bend	Largely built out part of the Cinco Ranch area, growth should be limited, Adjusted down
3629	144	Fort Bend	Largely built out part of the Cinco Ranch area, growth should be limited, Adjusted down
3630	144	Fort Bend	Largely built out part of the Cinco Ranch area, growth should be limited, Adjusted down
3632	144	Fort Bend	Largely built out part of the Cinco Ranch area, growth should be limited, Adjusted down
3638	144	Fort Bend	Largely built out part of the Cinco Ranch area, growth should be limited, Adjusted down
3649	144	Fort Bend	Largely built out part of the Cinco Ranch area, growth should be limited, Adjusted down
3651	144	Fort Bend	Largely built out part of the Cinco Ranch area, growth should be limited, Adjusted down
3652	144	Fort Bend	Largely built out part of the Cinco Ranch area, growth should be limited, Adjusted down
3653	144	Fort Bend	Multifamily development has occurred, No adjustment, forecast sufficient
3655	144	Fort Bend	Largely built out part of the Cinco Ranch area, growth should be limited, Adjusted down

TAZ	RAZ	County	Note/Adjustment
3657	144	Fort Bend	Largely built out part of the Cinco Ranch area, growth should be limited, Adjusted down
3658	145	Fort Bend	Much in flood plain, Adjusted down
3659	145	Fort Bend	Much in flood plain, Adjusted down
3660	145	Fort Bend	Part of Twinwood, will be residential, Adjusted up in the out years
3661	145	Fort Bend	Twinwood development proposed, moderately dense clusters of residential surrounded by green space, Adjusted up
3662	145	Fort Bend	Planned subdivision, Fulshear Lakes, bulk here 2015-2020, 7,600 residents projected, Adjusted up slightly
3663	145	Fort Bend	Twinwood development proposed, moderately dense clusters of residential surrounded by green space, Adjusted up
3664	145	Fort Bend	Planned subdivision, Fulshear Lakes, Adjusted up slightly
3666	145	Fort Bend	Much in flood plain, Adjusted down
3667	145	Fort Bend	Westin Lakes, very limited growth, Adjusted down
3671	145	Fort Bend	Part of zone is in Johnson Development possession, Adjusted up
3680	145	Fort Bend	Tamarron Subdivision getting underway, 2022 build-out and 8,320 projected residents, Adjusted up
3681	145	Fort Bend	Planned subdivision, Jordan Ranch, 10,121 residents projected, Adjusted up
3682	145	Fort Bend	Tamarron Subdivision getting underway, 2022 build-out and 8,320 projected residents, Adjusted up
3683	145	Fort Bend	Planned subdivision, Jordan Ranch, Adjusted up
3685	145	Fort Bend	Development to abut sand pit, Adjusted up
3689	145	Fort Bend	Planned subdivision, Foster Farms, Adjusted up
3690	145	Fort Bend	Harrison Tract, all residential, Adjusted up
3691	145	Fort Bend	Planned subdivision, Fulshear Run, 2020 build out, 2,300 projected residents, Adjusted up
3694	145	Fort Bend	Planned subdivision Foster Farms, much is also in flood plain, Adjusted down slightly
3695	145	Fort Bend	Zoned for 1+ acre homes, much in flood plain, Adjusted down
3697	145	Fort Bend	Planned subdivision, Foster Farms, bulk is in this zone, Adjusted up
3698	145	Fort Bend	Planned subdivision, Foster Farms, No adjustment, forecast sufficient
3543	146	Fort Bend	Clinton Wong tract will be developed, No adjustment, forecast sufficient
3594	146	Fort Bend	Too much land to not develop extensively, Adjusted up
3599	146	Fort Bend	Small parcels to develop, probably as apts, No adjustment, forecast sufficient
3811	147	Fort Bend	More growth expected in and around Orchard, Brazos ISD is relatively well-regarded, Adjusted up
3812	147	Fort Bend	More growth expected in and around Orchard, Brazos ISD is relatively well-regarded, Adjusted up
3816	147	Fort Bend	More growth expected in and around Orchard, Brazos ISD is relatively well-regarded, Adjusted up
3817	147	Fort Bend	More growth expected in and around Orchard, Brazos ISD is relatively well-regarded, Adjusted up

TAZ	RAZ	County	Note/Adjustment
3702	150	Fort Bend	Midway partnering with George Foundation to develop land at 762-59 corner, possible mixed use, Adjusted up
3704	150	Fort Bend	Midway partnering with George Foundation to develop land, possible mixed use, Adjusted up
3570	151	Fort Bend	Imperial beginning home sales in 2015, Adjusted up slightly
3572	151	Fort Bend	Imperial beginning home sales in 2016, Adjusted up slightly
3440	154	Fort Bend	Multifamily development, Adjusted up
3496	154	Fort Bend	Proposed wrap multifamily, Adjusted up
3340	155	Fort Bend	Sienna South, 10,000 homes possible, first homes closing in mid-late 2015, Adjusted up slightly
3342	155	Fort Bend	Sienna South, 10,000 homes possible, first homes closing in mid-late 2016, Adjusted up slightly
3344	155	Fort Bend	Sienna South, 10,000 homes possible, first homes closing in mid-late 2017, Adjusted up slightly
3346	155	Fort Bend	Sienna South, 10,000 homes possible, first homes closing in mid-late 2018, Adjusted up slightly
3348	155	Fort Bend	Sienna South, 10,000 homes possible, first homes closing in mid-late 2019, Adjusted up slightly

Employment Adjustments

TAZ	RAZ	County	Note/Adjustment
1507	59	Harris	Bayou Bend Business Park being developed by Stream, 378,000 SF in total, Adjusted up
	59	Harris	Employment growth too low in whole RAZ, Adjusted up slightly
1606	60	Harris	ICO Commercial recently opened 90,000 SF of flex space, Adjusted up
1607	60	Harris	Conor Commercial Real Estate 525,800 SF business park begin construction in late 2015, called Gateway Southwest Industrial Park, Adjusted up
1735	111	Harris	Katy Ranch Crossing development, two new flex space users signed up, retail in zone as well, Adjusted up
1836	113	Harris	Grandway West business park, eventually 780,000 SF total flex space, Adjusted up
1837	113	Harris	Kobelco machinery leased 100,000 SF in the 552,000 SF now in Ten West Crossing, Adjusted up
1845	113	Harris	Mason Creek business park, 700,000 SF of industrial to open soon, Adjusted up
3871	143	Waller	West 10 Business Park, Adjusted up in near term
3874	143	Waller	Point West Business Park, 900 acres, Adjusted up
3875	143	Waller	Point West Business Park, 900 acres, Adjusted up
3609	144	Fort Bend	West 10 Business Park, 419,000 SF Transwestern building is underway, No adjustment, forecast sufficient
3620	144	Fort Bend	Too aggressive, job growth reduced, Adjusted down
3622	144	Fort Bend	New Walmart and shopping, should be 2,000+ jobs between this zone and 3620, Adjusted up
3625	144	Fort Bend	Possible 10+ story office building in the future, Adjusted up in the out years
3629	144	Fort Bend	Not enough room for such high job growth, Adjusted down
3633	144	Fort Bend	Growth should be more limited, Adjusted down
3661	145	Fort Bend	Twinwood development proposed, will have commercial sites, Adjusted up
3662	145	Fort Bend	Some school growth, Adjusted up
3663	145	Fort Bend	Twinwood development proposed, will have commercial sites, Adjusted up
3669	145	Fort Bend	Grocery retail center planned, Adjusted up
3672	145	Fort Bend	Planned for 2 high, 1 middle, 2 elementary schools, and 2 grocery stores, one as a 199,000 SF center, 442 apartments, No adjustment, forecast sufficient
3690	145	Fort Bend	Harrison Tract, all residential, limited jobs, Adjusted down
3691	145	Fort Bend	Business Park and DMAC located here, Adjusted up
3693	145	Fort Bend	To be Fulshear's prime commercial corridor, Adjusted up
3543	146	Fort Bend	Too little job growth, Adjusted up
3545	146	Fort Bend	Limited employment growth in Aliana zones that do not front the Grand Parkway, Adjusted down
3551	146	Fort Bend	Limited employment growth in Aliana zones that do not front the Grand Parkway, Adjusted down
3554	146	Fort Bend	Land not yet closed on, Sugar Land intends to develop a light industrial park, Adjusted up
3555	146	Fort Bend	Limited employment growth in Aliana zones that do not front the Grand Parkway, Adjusted down

TAZ	RAZ	County	Note/Adjustment
3556	146	Fort Bend	Land not yet closed on, Sugar Land intends to develop a light industrial park, Adjusted up
3557	146	Fort Bend	No employment growth, most of it is parkland, Adjusted down
3585	146	Fort Bend	Grocery-anchored shopping center planned, Adjusted up
3589	146	Fort Bend	Elementary school already there and commercial planned along FM 1093, Adjusted up
3590	146	Fort Bend	Shops at Bella Terra, shift growth to first part of development, Adjusted down
3795	148	Fort Bend	Part of Triple Fork industrial park, Adjusted up
3797	148	Fort Bend	Aldi 650,000 SF distribution facility under construction, Triple Fork industrial park, Adjusted up
3722	149	Fort Bend	Job growth expected in Richmond Historic District, Adjusted up
3774	149	Fort Bend	TSTC Fort Bend planned, 6 to 8 building 5,000 student campus, Adjusted up
3781	149	Fort Bend	Brazos Town Center, development continues, Adjusted up
3701	150	Fort Bend	Recently opened County Courthouse, other county government offices to open, Adjusted up
3432	151	Fort Bend	150,000 SF office building and 134 room hotel planned on site to open by 2017, Flour vacating 1 million SF of space when lease expires in 2021 that will need to be absorbed, No adjustment, forecast sufficient
3436	151	Fort Bend	Team Industrial Services corporate headquarters adding 80 jobs immediately with 20 more planned, OptumRx leasing space in Granite Towers II adding 330 jobs, No adjustment, forecast sufficient
3536	151	Fort Bend	Applied Optoelectronics facility expansion from 2016-2026, 500 new jobs, Adjusted up
3571	151	Fort Bend	Nalco-Champion corporate headquarters, 133,510 SF of office space, 860 new jobs and another 250 jobs recaptured from Houston, Adjusted up
3308	152	Fort Bend	2,000,000+ SF mixed use development planned on Texas Instruments campus site, construction to begin in 2016 or 2017, develop in phases, retail (outlet mall)/office/MF/ even warehouse on east end of property, No adjustment, forecast sufficient
3316	152	Fort Bend	Dishaka building 185,000 SF food processing facility, Imperial Linen facility to be built, HCC to expand their campus, No adjustment, forecast sufficient
3320	152	Fort Bend	HC4 purchased former building supply facility for redevelopment, Adjusted up slightly
3322	152	Fort Bend	3,000,000 SF FedEx distribution facility under construction, Adjusted up
3453	152	Fort Bend	Job growth expected, Adjusted up
3458	152	Fort Bend	First Data Telecheck bringing 600 jobs, UnitedHealthcare 800 jobs, and Money Management International 440 jobs into former Unocal building, Adjusted up
3356	153	Fort Bend	HCC Campus relocating from Sienna Plantation 75,000 SF, 2016-2017, Adjusted up
3358	153	Fort Bend	Trammell Crow and Artis Reit to build 127 acre "Park 8-Ninety" business park, 1.75 million SF of office/industrial space possible, 3 buildings initially at 330,000 SF, Adjusted up
3358	153	Fort Bend	Trammel Crow developing Tang City Mall site (127 acres) into three 100,000 SF flex buildings, No adjustment, forecast sufficient

TAZ	RAZ	County	Note/Adjustment
3360	153	Fort Bend	Lakeview Business Park, 240,000 SF of flex space in new buildings plus expansion of SWE and Lufkin buildings, 800-1,500 jobs expected to be added by build-out, Adjusted up slightly
3439	154	Fort Bend	Small medical office and retail under construction, Adjusted up slightly
3440	154	Fort Bend	40,000 to 100,000 SF office under construction and proposed, new Costco now open , Adjusted up
3465	154	Fort Bend	Sugar Land Town Square office buildings, 100 jobs from Cosentino America, No adjustment, forecast sufficient
3495	154	Fort Bend	UH campus expansion expected, No adjustment, forecast sufficient
3496	154	Fort Bend	Overflow development from 3497, mixed-use retail/midrise office, wrap multifamily, hotel/conference center, Adjusted up
3497	154	Fort Bend	Texas Instruments 40,000 SF expansion of 160,000 sf facility with 375 jobs total as well as new Flour building by 2021 with 2,000 employees guaranteed to the City of Sugar Land and 1 million SF, Adjusted up
3710	154	Fort Bend	Marriott hotel planned at US 59 at Williams Way, Adjusted up
3333	155	Fort Bend	HCC Campus closing, No adjustment, forecast sufficient
3755	156	Fort Bend	Rosenberg Business Park, 184 acres, No adjustment, forecast sufficient
3756	156	Fort Bend	400,000 SF outlet mall to be built by Paragon Outlet Partners, 1,000+ jobs possible, opening 2016 or 2017, Adjusted up
3758	156	Fort Bend	Brazos Town Center, development continues, Adjusted up slightly

Disaggregation of Households and Employment by Type

In addition to producing forecasts using H-GAC’s new TAZ structure, CDS was tasked with providing disaggregated forecasts for households and employment as H-GAC does. The household forecast was disaggregated by multiple characteristics: household size, number of workers living in household, and household income level. The employment disaggregation is more straightforward, dividing up the total number of jobs into ten industry-specific categories. All of these categories and disaggregations were defined by H-GAC, and CDS was tasked with matching H-GAC’s format in the data that was delivered. The process CDS used to produce these disaggregated forecasts is described in the figures below. CDS did not provide this disaggregation for Grimes County, as there was no preexisting forecast to work with.

Household Disaggregation

Task	Step	Action
Create master file of households by size, by TAZ for CDS projections	1	Create 2010 base file of number of HHs by size by TAZ from Census
	2	Compute average HH size by TAZ
	3	Create table of breakdown of HHs by size for typical TAZs by average HH size
	4	Using average HH size for each TAZ in future periods, compute distribution of HHs by size by TAZ in all future periods
Create starting Base Demographic File	5	Use H-GAC file percentages of workers per HH and HH income by HH size to compute TAZ breakdowns of all variables for all future periods – using our number of HHs by size – rounded to integers
	6	Locate TAZs where the CDS forecast contains data but the H-GAC forecast does not and fill these gaps with shares from similar nearby TAZs
Make adjustments in the Focus Area based upon reasonable expectation of demographic shifts	7	From the Base Demographic File completed in 5, Compute the average number of workers per household and the average income of each TAZ into future periods
	8	Evaluate each TAZ in the Focus Area on future average income projections and make adjustment to the Base Demographic File based on CDS expectations of future income shifts.
	9	Evaluate each TAZ in the Focus Area on future average workers per HH projections and make adjustment to the Base Demographic File based on CDS expectations of future demographic shifts.

Example Household Disaggregated Data File Structure

The resultant file for each TAZ may look like this, with a maximum of 70 records per TAZ. There are 5 categories for HH size, 3 for workers, and 5 for income (see chart to the right for income category definitions)

TAZ	HHSZ	WORKERS	HH INCOME	HHS
1	1	0	0	2
1	1	1	0	3
1	1	1	1	1
1	1	1	3	9
1	2	0	4	4
1	2	1	1	6
1	2	2+	2	12
1	2	2+	3	25
1	3	1	2	11
1	3	2+	3	6
1	4	1	0	11
1	4	2+	1	2
1	4	2+	2	5
1	5+	1	0	1
1	5+	2+	2	1

H-GAC Income Range Categories

Income Code	Household Income Range
0	\$0- 22K
1	\$23-40K
2	\$41-65K
3	\$66-100K
4	\$101K+

Employment Disaggregation

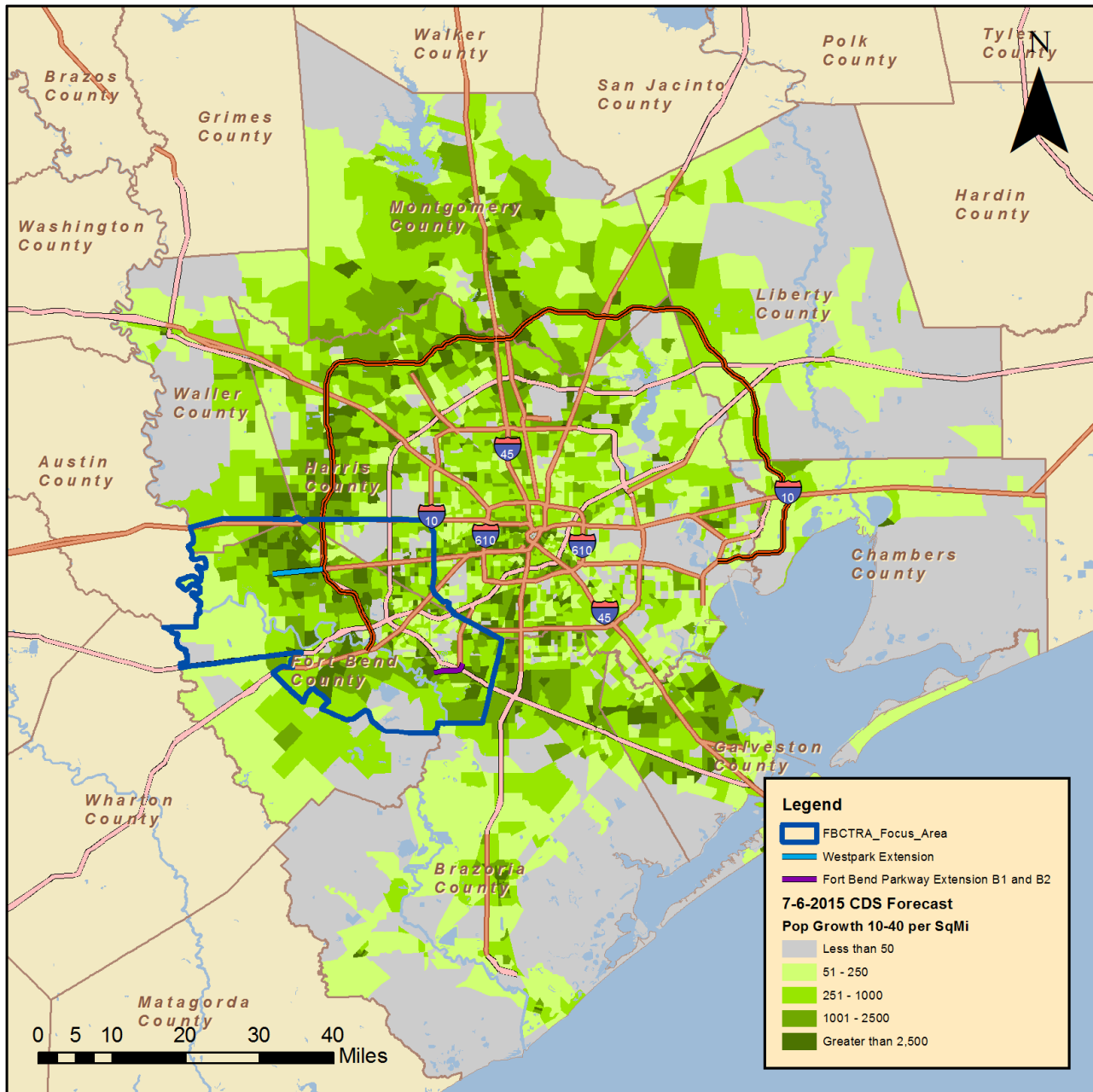
Task	Step	Action
Create starting Base Employment File	1	Use H-GAC file percentages of jobs by land use category and apply to CDS jobs forecast to compute TAZ breakdowns of all categories for all future periods.
	2	Locate TAZs where the CDS forecast contains data but the H-GAC forecast does not and fill these gaps with shares from similar nearby TAZs
Make adjustments in the Focus Area	3	Within the focus area only, evaluate each TAZ to determine if the distribution of jobs by category is reasonable based on current trends and CDS expectations.
	4	Make adjustments as necessary and create the final jobs file.

H-GAC Employment Categories

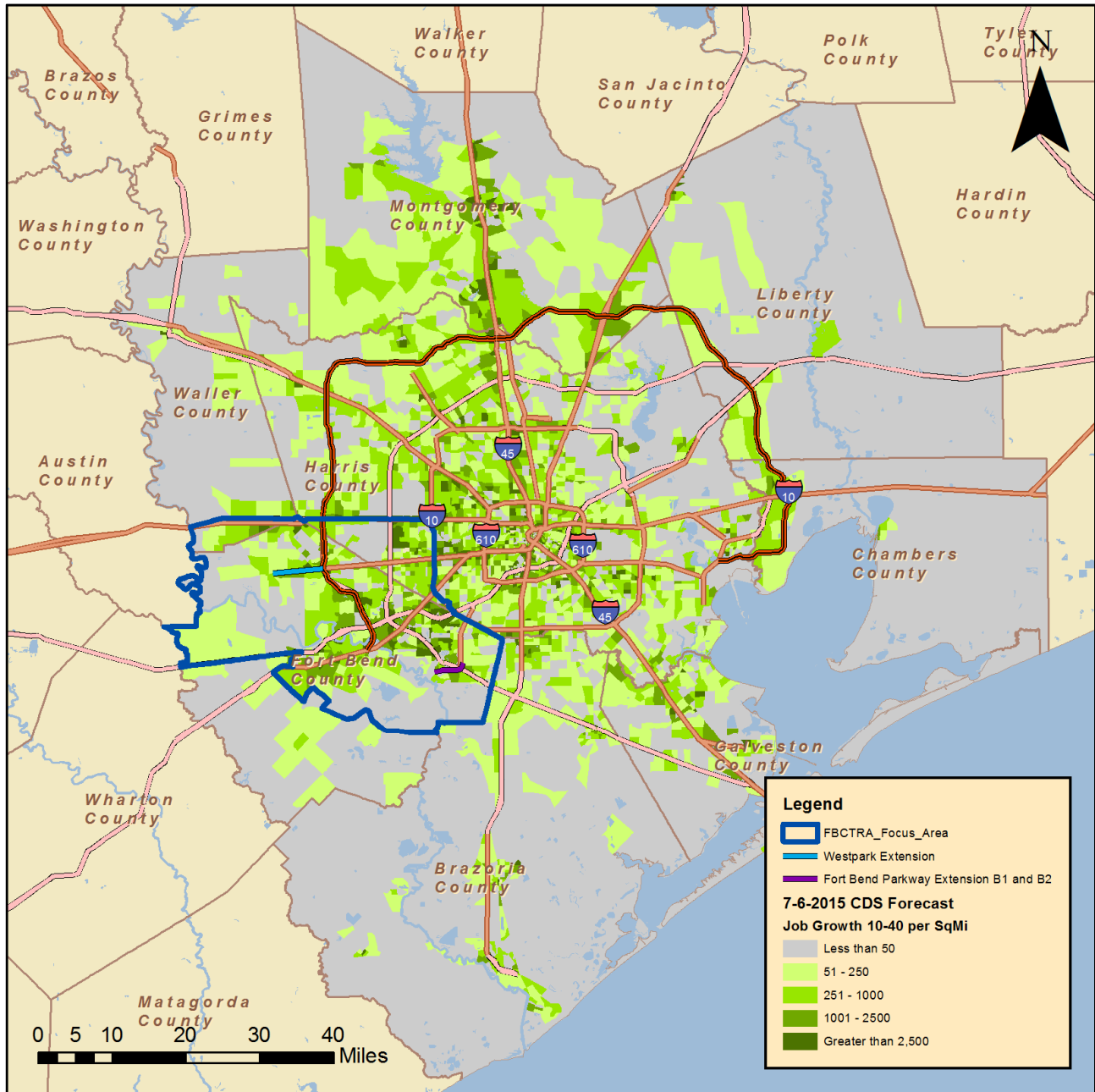
Abbreviation	Description
EDUK12	Primary and secondary education
EDUPOST	Post-secondary education
ENTERTAIN	Entertainment and media *
RESTAUR	Restaurant and hospitality *
RETAIL	Retail
INDUST	Industrial and manufacturing
OFFICE	Office, non-medical
MED1	Hospital and clinic
MED2	Medical professional
GOVERN	Government, public agency

* These two categories remain in H-GAC’s disaggregated forecast structure but contain no data throughout every TAZ and forecast year. CDS also does not forecast jobs for these categories, but retains their place in the table structure. Jobs that would fall in these two categories are assumed to be located in the retail category.

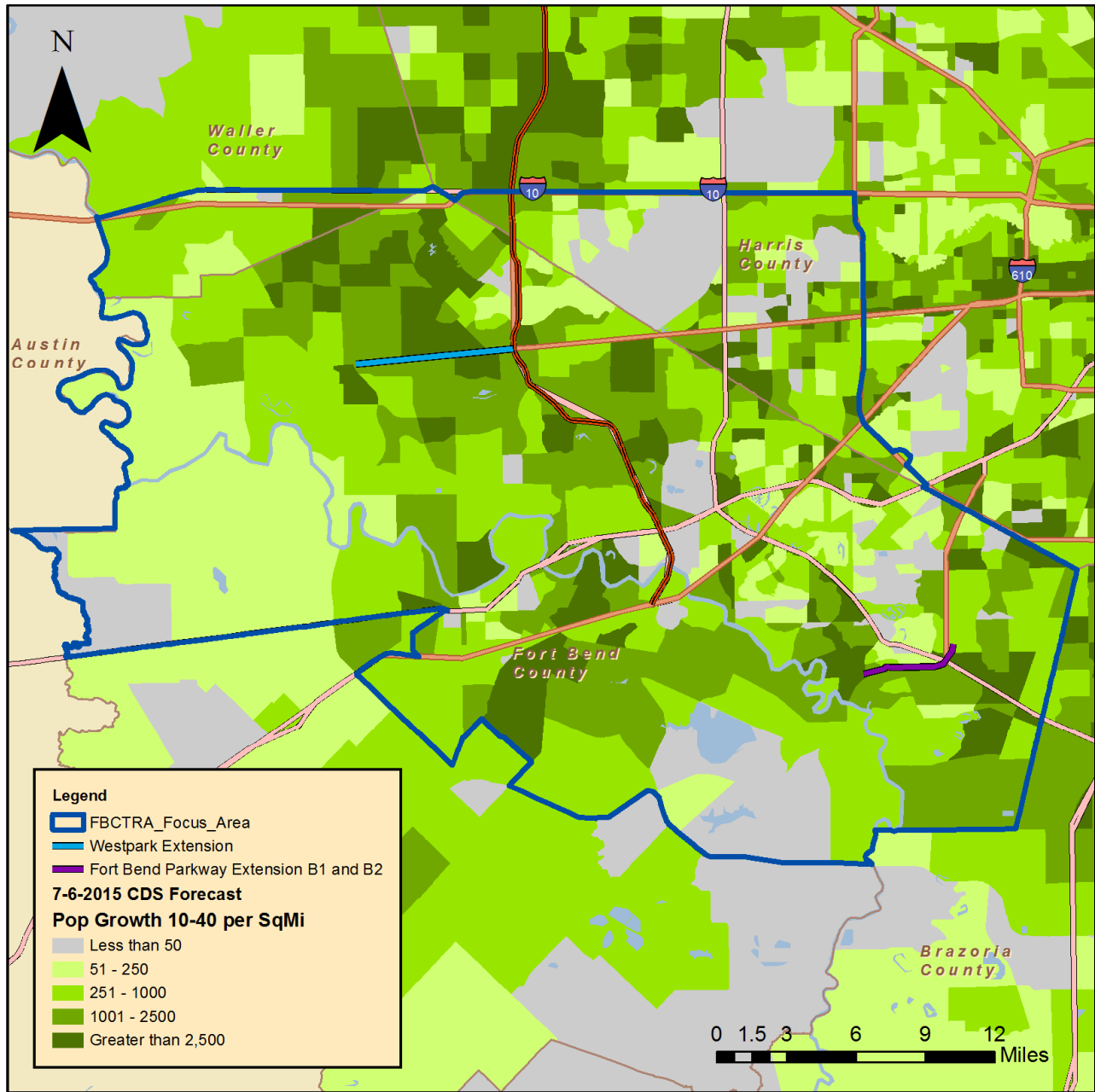
2010 – 2040 Projected Population Growth per Square Mile by TAZ



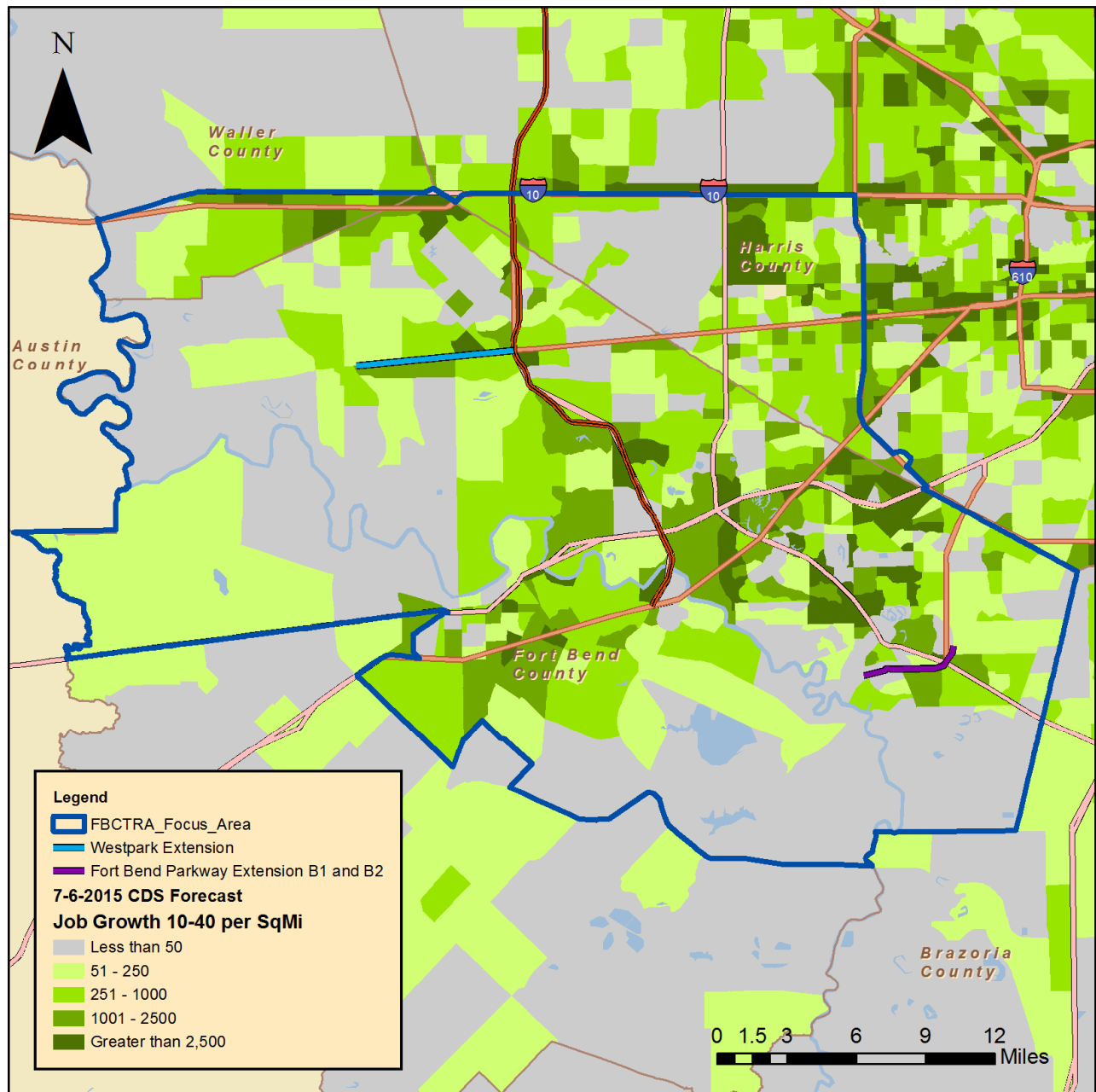
2010 – 2040 Projected Job Growth per Square Mile by TAZ



2010 – 2040 Projected Population Growth per Square Mile by TAZ – Focus Area



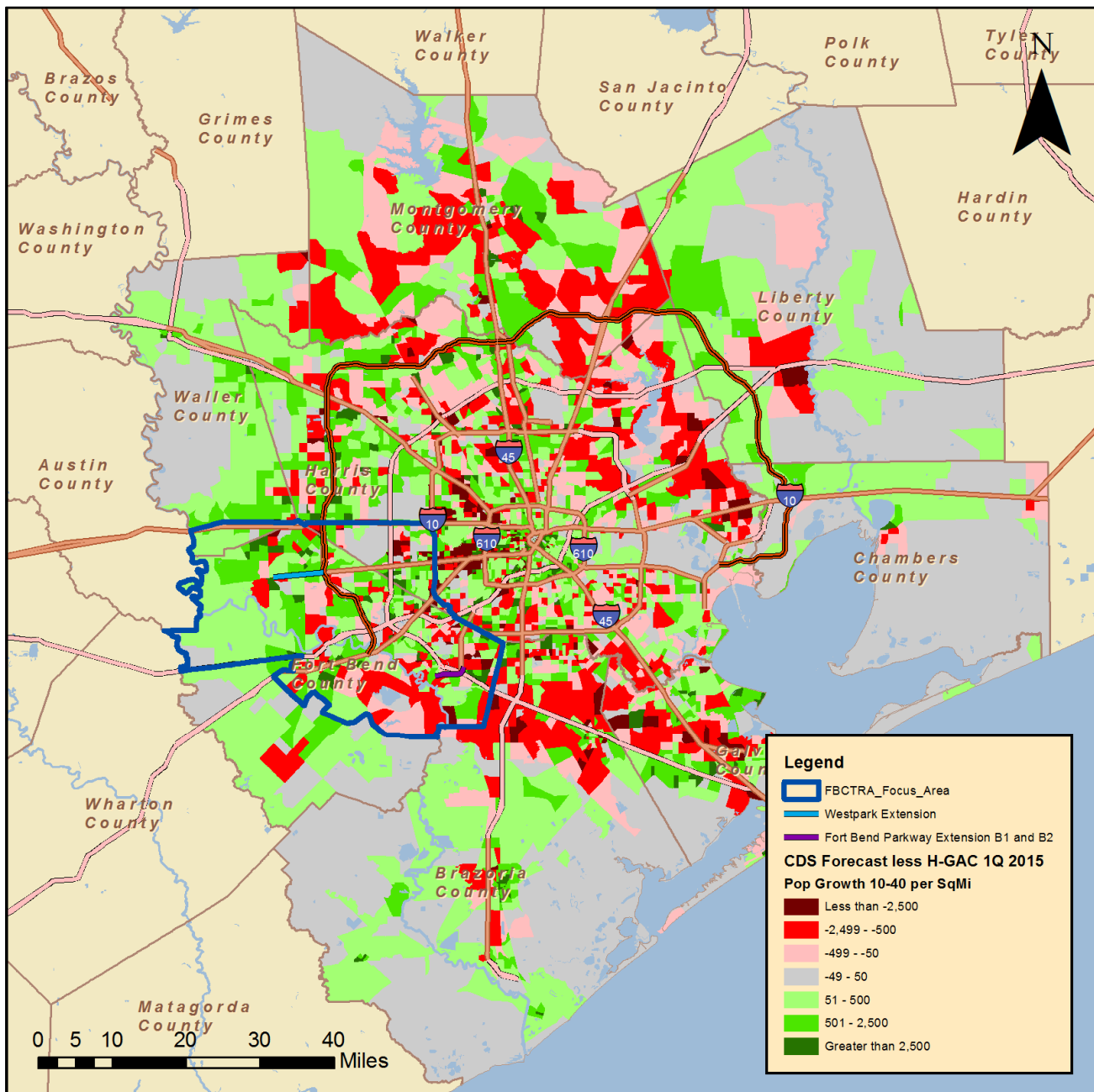
2010 – 2040 Projected Job Growth per Square Mile by TAZ – Focus Area



The following charts compare this most recent CDS forecast with the H-GAC 2040 forecast provided to CDS in the first quarter of 2015. The green areas are where the CDS forecast of population or job growth from 2010 to 2040 is greater than that of H-GAC. The red areas are those where CDS' forecasts are lower than H-GAC. These charts divide the change by the area of the zone to eliminate bias for large vs. small zones. It is important to note that the H-GAC forecasts are expected to be modified and updated every quarter for the foreseeable future. No Grimes County data is mapped, as H-GAC does not forecast Grimes County.

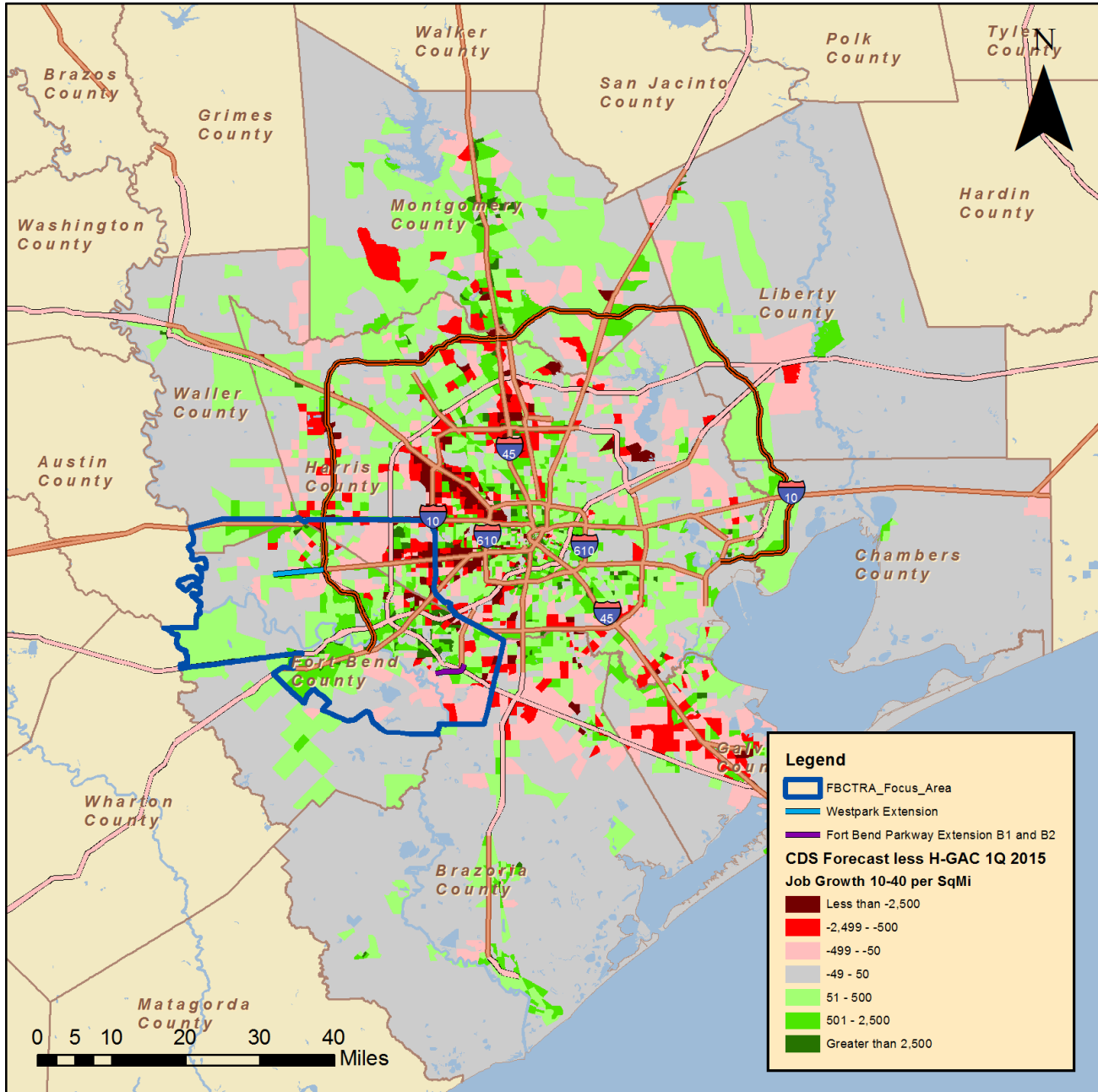
Comparison of Population Growth Density 2010 – 2040

CDS Forecast Compared with 1Q 2015 H-GAC 2040 Forecast by TAZ



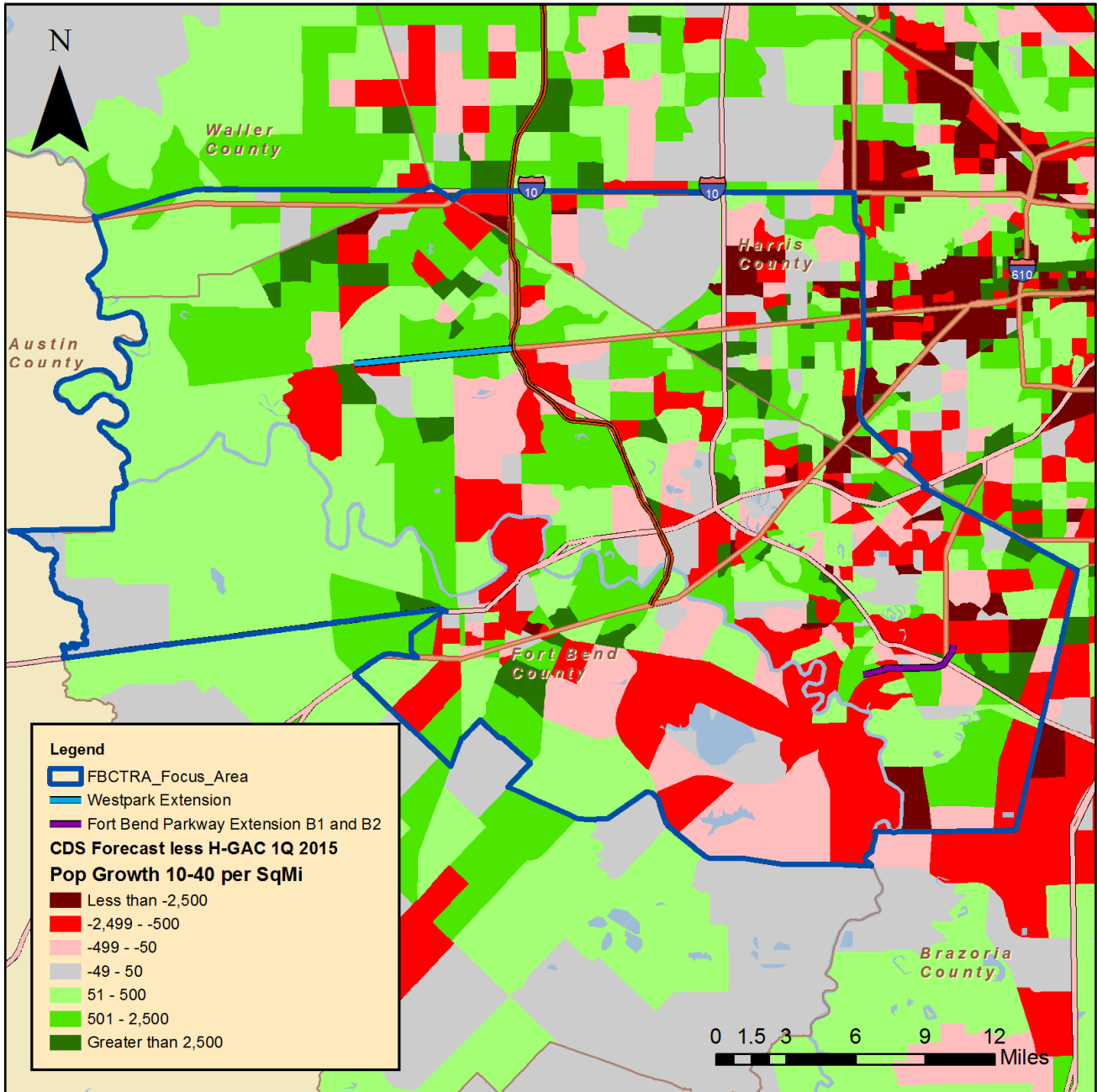
Comparison of Job Growth Density 2010 – 2040

CDS Forecast Compared with 1Q 2015 H-GAC 2040 Forecast by TAZ



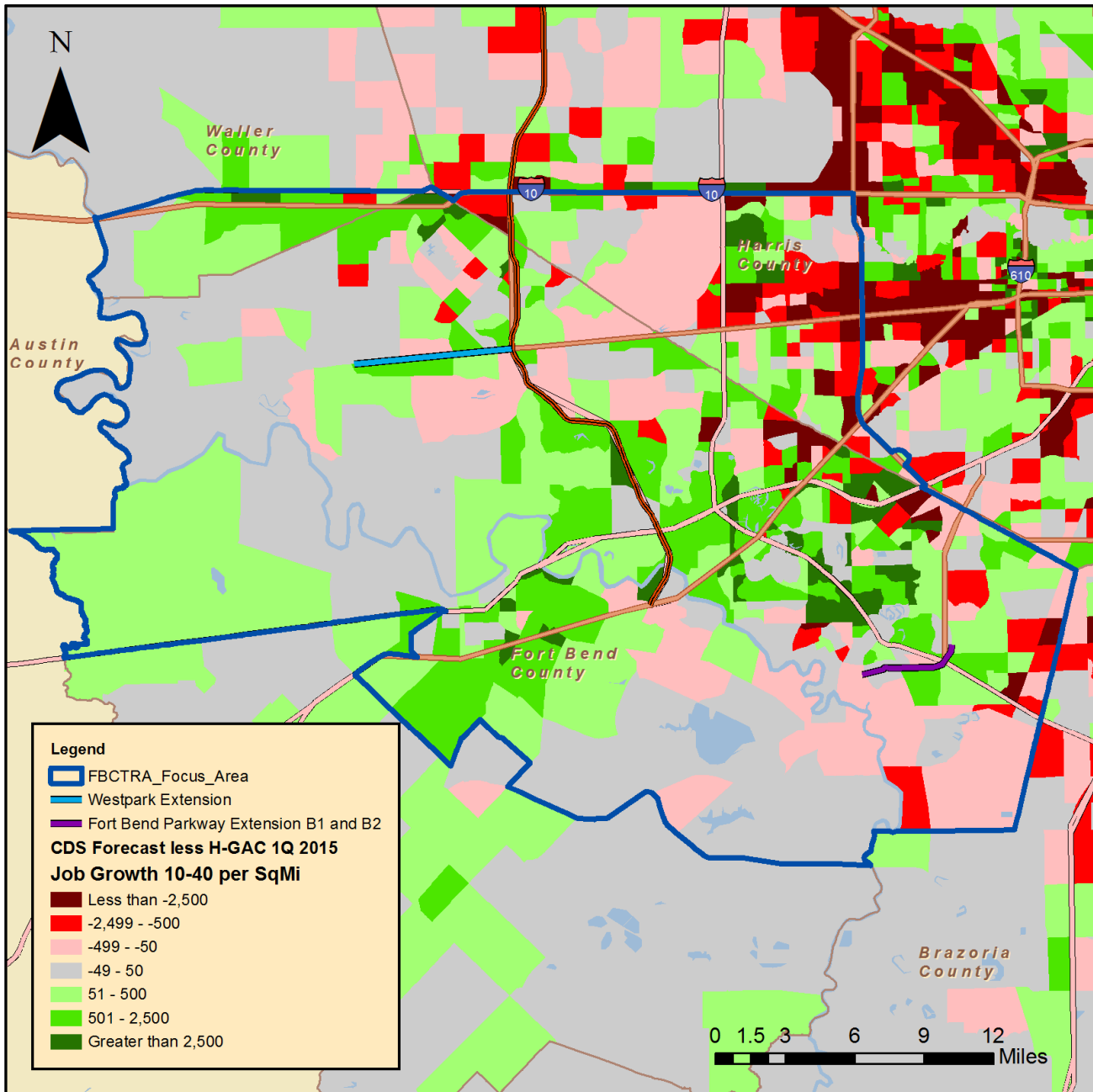
Comparison of Population Growth Density in Focus Area 2010 – 2040

CDS Forecast Compared with 1Q 2015 H-GAC 2040 Forecast by TAZ



Comparison of Job Growth Density in Focus Area 2010 – 2040

CDS Forecast Compared with 1Q 2015 H-GAC 2040 Forecast by TAZ



Project Deliverables

In addition to this report, several electronic datasets for the forecast were produced and sent to CDM Smith. A list of the finalized and delivered files is below.

1. Excel spreadsheet files:

- a. *7-6-2015 CDS Forecast 2010-2040 Data and Summary.xlsx*
- b. *taz5217_employment_2010_CDS_7-6-15.xlsx*
- c. *taz5217_employment_2015_CDS_7-6-15.xlsx*
- d. *taz5217_employment_2020_CDS_7-6-15.xlsx*
- e. *taz5217_employment_2025_CDS_7-6-15.xlsx*
- f. *taz5217_employment_2030_CDS_7-6-15.xlsx*
- g. *taz5217_employment_2035_CDS_7-6-15.xlsx*
- h. *taz5217_employment_2040_CDS_7-6-15.xlsx*
- i. *taz5217_households_tad_2010_CDS_7-6-15.xlsx*
- j. *taz5217_households_tad_2015_CDS_7-6-15.xlsx*
- k. *taz5217_households_tad_2020_CDS_7-6-15.xlsx*
- l. *taz5217_households_tad_2025_CDS_7-6-15.xlsx*
- m. *taz5217_households_tad_2030_CDS_7-6-15.xlsx*
- n. *taz5217_households_tad_2035_CDS_7-6-15.xlsx*
- o. *taz5217_households_tad_2040_CDS_7-6-15.xlsx*

2. ARC GIS shape files:

- a. *7_6_2015_CDS_Forecast_2010_2040_8_County.cpg*
- b. *7_6_2015_CDS_Forecast_2010_2040_8_County.dbf*
- c. *7_6_2015_CDS_Forecast_2010_2040_8_County.prj*
- d. *7_6_2015_CDS_Forecast_2010_2040_8_County.sbn*
- e. *7_6_2015_CDS_Forecast_2010_2040_8_County.sbx*
- f. *7_6_2015_CDS_Forecast_2010_2040_8_County.shp*
- g. *7_6_2015_CDS_Forecast_2010_2040_8_County.shx*

Appendix A – RAZ-Level Forecasts

Population

Harris County Population (RAZ 1 to 127)

RAZ	1990	2000	2005	2010	2015	2020	2025	2030	2035	2040
1	7,059	6,733	7,070	2,298	3,451	5,006	6,426	7,526	8,374	9,048
2	34,882	40,537	38,432	30,622	31,337	32,663	33,433	33,933	34,288	34,561
3	3,451	3,310	3,572	3,691	4,171	5,684	7,013	8,069	8,881	9,522
4	5,224	5,819	6,743	6,466	7,886	10,115	12,441	14,472	16,035	17,276
5	23,136	23,668	24,054	20,031	21,186	23,037	25,023	26,659	27,932	28,961
6	30,347	32,828	33,931	36,071	37,484	39,384	41,119	42,698	43,933	44,969
7	10,008	10,263	11,901	15,368	17,770	20,269	23,377	24,620	25,583	26,362
8	32,026	30,313	28,539	28,984	29,945	31,294	32,241	33,487	34,446	35,220
9	31,094	32,503	31,681	27,745	28,098	28,716	29,163	29,520	29,799	30,023
10	5,500	5,171	4,638	4,780	4,944	5,355	5,789	6,153	6,439	6,667
11	4,305	3,948	4,016	3,610	3,940	4,387	4,805	5,137	5,397	5,606
12	9,001	9,230	9,004	8,408	8,572	8,797	9,006	9,172	9,302	9,407
13	53,057	54,171	50,745	44,820	45,745	46,670	47,084	47,414	47,672	47,879
14	22,863	24,108	23,126	21,761	22,488	24,060	25,488	26,637	27,524	28,226
15	6,816	7,133	8,392	4,797	5,005	5,343	5,654	5,902	6,095	6,250
16	7,891	10,180	11,002	10,077	11,925	13,159	14,577	15,914	17,108	18,211
17	23,623	24,055	24,432	25,495	27,420	29,701	31,665	33,216	34,405	35,344
18	4,360	4,387	4,396	4,918	6,086	7,099	8,046	8,793	9,368	9,833
19	13,164	12,918	12,544	11,944	12,406	13,024	13,504	13,910	14,228	14,481
20	16,649	19,881	20,735	20,746	22,067	23,710	25,242	26,462	27,413	28,179
21	17,650	20,123	20,835	22,611	23,997	25,231	26,082	26,534	26,886	27,170
22	21,524	25,383	27,226	27,444	27,680	28,000	28,298	28,536	28,721	28,871
23	11,567	14,906	14,658	18,139	20,912	24,613	25,754	26,206	26,558	26,842
24	5,799	6,304	5,919	6,227	6,391	6,621	7,516	8,705	9,632	10,412
25	7,210	8,413	8,118	8,057	10,075	12,753	14,890	16,038	16,487	16,858
26	4,247	4,315	5,321	6,293	6,894	7,519	8,090	8,542	8,893	9,177
27	16,446	16,375	17,513	19,927	22,469	23,451	23,942	24,227	24,419	24,564
28	36,343	35,346	33,431	32,781	33,243	34,168	35,303	36,723	37,818	38,685
29	17,507	18,981	18,621	18,219	19,167	20,759	22,336	23,587	24,547	25,305
30	22,071	23,223	22,235	23,448	23,934	24,722	25,477	26,095	26,575	26,956
31	36,736	43,658	42,406	40,868	41,052	41,299	41,526	41,704	41,840	41,950
32	43,282	50,987	50,646	49,203	49,862	51,025	52,165	53,106	53,838	54,418
33	42,160	40,988	40,022	42,021	43,996	46,334	48,346	49,934	51,151	52,111
34	13,848	15,958	16,908	22,329	25,102	28,808	35,305	39,840	43,357	46,203
35	31,636	34,003	32,734	32,165	32,876	34,149	35,530	36,602	37,426	38,081
36	12,130	12,633	12,263	12,095	12,144	12,211	12,273	12,323	12,362	12,393
37	7,537	8,327	8,990	8,720	8,837	9,282	9,777	10,200	10,532	10,797
38	32,158	45,475	45,779	42,538	43,924	45,158	46,009	46,900	47,648	48,240
39	10,144	10,860	11,210	14,922	18,157	22,435	26,273	28,500	30,207	31,585
40	28,108	33,039	35,142	39,480	40,664	42,574	44,465	46,044	47,086	47,914

RAZ	1990	2000	2005	2010	2015	2020	2025	2030	2035	2040
41	8,433	9,898	10,288	10,165	10,279	10,430	10,571	10,681	10,765	11,116
42	4,128	5,086	5,248	5,063	5,557	6,033	6,402	6,683	6,895	7,061
43	27,826	31,932	31,716	30,018	30,480	31,714	31,984	32,243	32,455	32,625
44	31,464	32,420	31,728	29,582	30,735	32,138	33,359	34,326	35,069	35,655
45	17,983	21,232	21,035	20,698	21,045	21,684	22,219	22,636	22,954	23,206
46	9,300	10,846	10,753	11,708	11,988	12,326	12,619	12,851	13,029	13,169
47	9,240	9,568	9,669	9,559	9,679	9,849	10,159	10,283	10,379	10,457
48	17,151	16,225	15,761	15,531	16,213	17,154	18,013	18,705	19,239	19,662
49	17,404	21,503	23,153	29,302	31,433	34,299	36,335	38,140	39,182	39,912
50	70,823	84,595	90,484	101,675	105,582	110,835	115,489	118,195	120,453	122,014
51	8,193	9,263	9,232	9,144	9,168	9,200	9,231	9,254	9,273	9,288
52	22	47	67	0	24	91	402	526	622	700
53	53,656	60,887	59,208	60,762	60,762	61,362	62,099	62,744	63,255	63,662
54	53,537	62,017	62,150	63,936	64,598	66,158	67,786	69,153	70,222	71,071
55	60	34	31	33	42	76	107	231	327	405
56	17,586	23,450	27,229	38,284	41,126	43,723	45,266	46,454	47,383	48,162
57	21,080	21,826	22,604	28,176	31,411	36,351	40,589	42,508	44,009	44,788
58	12,928	15,404	16,031	22,417	24,728	28,428	32,685	36,251	38,009	39,399
59	12,759	14,774	17,103	25,604	28,446	31,630	34,248	36,278	37,667	38,769
60	62,877	79,845	82,704	76,613	76,943	78,106	79,391	80,486	81,347	82,032
61	30,861	38,268	39,039	34,689	34,705	34,729	34,750	34,766	34,779	34,790
62	51,030	70,290	72,699	69,126	69,895	70,934	71,899	72,641	73,222	73,742
63	37,548	43,258	44,563	48,956	50,573	53,657	56,764	58,993	60,722	61,842
64	22,154	22,884	23,092	23,460	23,954	24,642	25,276	25,783	26,177	26,494
65	72,139	85,193	86,253	81,823	82,793	84,480	85,101	85,599	85,984	86,296
66	6,814	8,137	8,104	9,878	10,589	11,544	12,416	13,093	13,614	14,028
67	22,112	27,488	27,790	24,664	26,476	28,747	30,747	32,339	33,563	34,530
68	59,259	67,714	66,482	73,030	74,339	76,193	77,938	79,517	80,906	82,146
69	10,621	10,940	11,425	11,590	12,503	13,635	14,628	15,416	16,022	16,500
70	21,482	26,282	26,742	28,847	29,040	29,344	29,624	29,847	30,020	30,160
71	11,795	15,152	15,212	17,466	17,821	18,776	19,649	20,325	20,846	21,260
72	10,895	12,591	12,225	11,639	11,663	11,697	11,728	11,803	11,880	11,958
73	17,838	21,347	23,476	23,000	23,049	23,150	23,275	23,523	23,715	23,870
74	17,412	20,111	20,619	20,003	20,970	22,270	23,457	25,036	26,600	27,978
75	6,373	7,181	7,201	10,334	11,982	13,682	16,008	18,038	19,689	21,067
76	9,999	11,306	11,797	16,440	18,170	19,711	20,853	21,699	22,334	22,832
77	11,110	12,956	12,687	16,118	18,051	20,917	23,825	26,307	28,217	29,871
78	25,001	41,496	51,791	72,936	79,844	86,568	91,390	94,854	97,175	98,798
79	41,486	52,748	53,484	56,280	57,247	58,936	61,422	63,406	64,944	66,184
80	7,404	9,538	10,498	13,812	15,313	20,334	24,911	27,899	29,871	31,328
81	9,955	11,421	12,913	15,976	17,443	19,783	21,912	23,729	25,318	26,483
82	2,682	3,263	4,734	13,009	15,810	18,818	21,556	23,373	24,784	25,785
83	8,368	8,830	9,345	9,977	10,973	12,644	15,229	17,500	19,442	21,045
84	18,022	20,803	22,808	29,482	32,220	36,565	40,823	44,230	46,877	48,917
85	8,937	7,745	7,148	6,376	6,514	6,707	6,886	7,030	7,142	7,230
86	45,135	47,632	47,879	50,263	51,911	54,237	56,376	58,104	59,439	60,496
87	25	32	30	8	8	8	8	8	8	8

RAZ	1990	2000	2005	2010	2015	2020	2025	2030	2035	2040
88	6,305	6,204	5,917	6,095	6,191	6,375	6,559	6,712	6,832	6,927
89	10,041	9,574	9,319	8,431	9,090	10,101	11,056	11,834	12,437	12,915
90	42,301	44,920	45,092	49,553	51,447	54,313	56,639	57,993	59,036	59,863
91	13,449	16,266	17,833	18,956	19,430	20,385	21,548	22,676	23,718	24,684
92	14,593	18,368	19,808	20,793	21,946	23,521	24,955	26,108	26,998	27,703
93	45,634	67,185	71,646	79,010	82,665	85,355	87,813	89,719	91,073	92,047
94	42,359	46,270	45,266	48,821	49,305	50,318	51,561	52,556	53,326	53,950
95	16,485	21,585	23,687	27,042	28,372	29,394	30,072	30,549	30,899	31,171
96	39,003	38,650	41,634	53,903	56,869	58,705	59,671	60,257	60,660	60,966
97	43,968	53,531	53,040	53,320	54,638	56,302	57,772	58,943	59,844	60,555
98	34,559	43,660	46,218	50,289	51,979	54,332	56,499	58,726	60,661	62,446
99	41,111	55,811	61,926	71,838	76,095	79,766	83,174	85,797	87,848	89,569
100	16,362	23,565	25,636	32,537	33,294	35,302	35,913	36,372	36,552	36,848
101	31,343	36,953	37,126	34,231	34,231	34,266	34,330	34,379	34,418	34,466
102	30,719	31,640	32,029	32,535	33,854	35,468	36,876	37,993	38,852	39,529
103	114	543	721	463	496	540	1,303	1,333	1,356	1,579
104	21,795	25,103	24,799	23,639	24,823	26,415	27,869	28,997	29,864	30,554
105	23,533	36,702	43,344	46,426	48,320	50,833	53,125	54,850	56,196	57,310
106	8,865	12,732	15,906	17,342	18,307	19,146	19,911	20,487	20,936	21,308
107	42,190	67,320	74,873	84,329	89,272	95,920	100,282	103,440	105,698	107,076
108	29,336	38,191	43,196	51,738	54,343	57,861	61,126	63,639	64,606	65,094
109	25,313	30,555	31,360	31,592	33,249	35,796	38,414	40,670	42,581	44,235
110	18,157	22,395	25,462	29,334	30,895	33,088	35,139	36,758	38,005	39,013
111	29,835	48,607	57,263	61,266	62,415	64,268	65,962	67,299	68,337	69,177
112	6,359	9,611	10,964	11,330	12,631	15,216	17,823	19,991	21,683	23,025
113	27,234	45,245	61,276	110,533	127,421	151,424	173,794	191,232	206,635	220,175
114	27,372	39,961	47,008	67,026	73,031	79,780	82,934	84,179	85,139	85,913
115	665	1,392	1,917	2,062	3,217	8,614	14,289	19,333	24,451	29,965
116	21,618	34,912	49,563	90,894	108,189	130,797	153,499	173,543	188,898	201,581
117	3,312	5,084	5,950	6,440	7,595	12,220	17,895	22,795	27,592	32,239
118	18,576	46,091	68,711	100,709	112,708	136,456	158,308	174,700	188,178	200,124
119	41,607	51,629	58,452	68,047	72,669	77,294	80,416	82,685	84,244	85,401
120	7,587	10,429	11,742	11,709	13,824	17,167	20,513	23,692	26,420	29,334
121	2,329	5,813	7,676	14,152	17,751	23,179	28,798	33,842	37,934	41,172
122	69,796	91,845	105,419	150,318	172,669	200,101	226,779	239,221	247,886	255,054
123	93,646	121,457	132,514	150,909	157,320	164,246	169,068	171,542	172,509	173,159
124	13,861	17,941	22,015	44,226	51,425	58,210	64,554	67,046	69,923	71,392
125	15,643	17,505	18,625	26,658	29,540	33,251	36,405	38,409	40,116	41,494
126	2,905	3,638	4,321	4,832	5,552	6,827	8,215	10,018	11,073	11,909
127	32,857	35,788	39,821	57,461	63,946	70,114	75,222	80,161	83,474	86,712
Total	2,818,203	3,400,582	3,604,235	4,048,360	4,298,411	4,635,546	4,943,934	5,174,007	5,352,918	5,500,979

Montgomery County Population (RAZ 128 to 139)

RAZ	1990	2000	2005	2010	2015	2020	2025	2030	2035	2040
128	16,590	22,420	27,358	29,312	34,511	41,920	51,223	59,617	68,821	76,787
129	27,814	40,085	49,293	60,822	71,219	87,923	110,250	129,138	148,567	167,486
130	3,633	7,026	8,828	31,203	40,885	53,222	67,038	77,352	89,715	101,189
131	24,567	31,077	37,110	35,781	38,997	42,129	44,610	46,709	47,717	48,663
132	21,022	51,447	69,738	81,725	93,786	104,226	110,428	114,625	117,693	119,684
133	4,263	4,778	7,678	10,698	13,604	18,281	24,296	29,512	35,480	42,365
134	22,636	28,640	31,207	33,979	37,106	42,383	48,846	54,125	59,235	64,142
135	17,623	25,523	30,019	35,285	39,160	44,380	51,822	59,167	66,642	74,225
136	18,028	33,425	41,183	53,802	67,875	79,483	91,117	98,508	104,475	109,856
137	6,171	12,641	16,571	21,298	29,339	44,999	64,845	83,732	102,139	122,054
138	2,612	5,142	6,696	6,426	7,293	9,145	12,206	15,483	18,705	22,147
139	17,244	31,582	42,175	52,290	63,547	84,427	110,475	133,560	157,080	181,973
Total	182,203	293,786	367,856	452,621	537,322	652,518	787,156	901,527	1,016,268	1,130,571

Waller County Population (RAZ 140 to 143)

RAZ	1990	2000	2005	2010	2015	2020	2025	2030	2035	2040
140	11,236	16,032	16,776	18,128	20,824	27,281	35,483	46,415	59,328	73,297
141	5,709	7,573	9,539	9,117	9,611	10,932	12,587	14,980	18,334	22,654
142	5,155	7,684	7,833	9,663	11,516	15,975	21,217	28,174	37,194	48,015
143	1,290	1,374	1,616	2,508	5,473	13,868	24,307	35,239	45,569	54,882
Total	23,390	32,663	35,764	39,416	47,424	68,057	93,594	124,808	160,424	198,847

Fort Bend County Population (RAZ 144 to 158)

RAZ	1990	2000	2005	2010	2015	2020	2025	2030	2035	2040
144	2,686	19,074	36,706	77,420	100,654	116,044	126,605	131,931	134,378	135,683
145	3,059	4,656	5,759	10,372	21,519	45,425	72,599	100,583	125,990	148,301
146	31,624	51,744	64,485	111,193	139,061	160,311	180,692	197,482	212,726	229,459
147	1,575	1,865	1,867	1,948	2,628	3,778	5,043	6,221	8,354	11,715
148	4,407	5,655	6,060	7,704	10,027	18,011	26,739	34,537	41,282	48,464
149	29,234	33,803	39,546	35,273	37,249	39,170	40,888	42,389	43,641	44,984
150	4,335	21,407	30,825	33,705	38,352	46,202	53,923	60,735	65,765	69,831
151	30,468	40,185	46,897	51,943	55,428	60,666	64,207	67,296	68,622	70,029
152	16,656	30,337	36,540	36,383	39,017	42,218	45,342	48,070	48,733	49,014
153	38,817	45,727	53,196	50,280	51,442	54,934	56,704	56,858	56,991	57,132
154	23,718	44,277	56,870	61,389	72,837	84,137	93,748	100,699	106,814	113,342
155	28,563	41,940	56,918	78,382	95,808	116,983	137,364	153,582	167,263	180,473
156	2,341	3,343	4,073	11,135	20,293	37,244	56,466	73,843	92,786	112,601
157	4,798	5,843	6,591	6,754	8,793	11,412	14,953	18,814	22,791	28,421
158	3,140	4,594	5,057	5,799	7,158	9,602	12,612	15,701	22,329	31,478
Total	225,421	354,450	451,390	579,680	700,266	846,136	987,886	1,108,739	1,218,464	1,330,928

Brazoria County Population (RAZ 159 to 172)

RAZ	1990	2000	2005	2010	2015	2020	2025	2030	2035	2040
159	11,591	11,937	12,894	12,036	13,325	15,595	18,471	21,109	23,599	26,100
160	16,761	17,949	19,044	16,742	17,699	19,306	21,159	23,099	24,925	27,096
161	2,998	3,026	3,011	2,844	3,282	3,922	4,688	5,033	5,357	5,746
162	6,931	7,131	7,029	6,593	7,031	7,671	8,054	8,744	9,521	10,431
163	9,784	13,052	13,860	13,619	14,495	15,773	17,305	17,995	18,643	19,293
164	31,015	33,090	33,718	33,770	34,918	36,204	36,945	37,592	38,200	38,821
165	1,377	1,785	1,852	1,672	1,863	2,185	2,555	2,879	3,183	3,493
166	10,860	13,137	14,177	13,503	16,188	21,297	27,606	33,512	39,299	45,196
167	18,756	20,668	20,337	20,083	22,768	27,877	34,557	40,462	46,555	52,762
168	1,917	2,297	2,479	2,727	2,946	3,330	3,866	4,556	5,852	7,799
169	11,299	15,111	16,177	11,324	14,502	23,499	35,544	48,980	62,777	79,803
170	31,835	38,268	40,021	41,776	47,347	57,797	71,104	83,355	95,414	109,547
171	8,164	21,190	32,473	65,628	76,769	93,368	110,175	124,878	137,511	146,344
172	28,419	43,126	56,266	60,140	68,682	80,977	92,882	100,233	105,976	110,098
Total	191,707	241,767	273,338	302,457	341,814	408,799	484,911	552,427	616,813	682,530

Galveston County Population (RAZ 173 to 188)

RAZ	1990	2000	2005	2010	2015	2020	2025	2030	2035	2040
173	15,214	21,432	25,192	25,319	26,988	29,614	30,753	31,503	32,112	32,721
174	13,089	17,610	24,581	38,985	47,186	62,852	78,765	90,846	100,269	106,607
175	20,133	32,714	40,104	47,881	55,368	65,412	74,605	78,688	79,662	81,132
176	9,641	12,215	12,391	14,387	15,578	18,159	21,588	25,006	28,352	31,947
177	16,382	18,387	18,614	21,382	23,386	26,827	31,004	35,036	38,942	43,123
178	16,471	19,615	20,841	22,073	23,570	29,114	37,774	46,834	55,843	65,573
179	4,059	5,643	5,878	8,180	10,176	13,617	19,313	26,118	33,888	42,830
180	24,800	25,325	26,603	25,748	26,247	27,001	27,115	27,187	27,243	27,298
181	9,756	8,806	9,824	9,263	10,065	10,728	11,140	11,395	11,594	11,789
182	11,848	11,197	11,084	10,673	11,070	12,097	13,534	14,990	16,424	17,966
183	7,786	8,916	9,873	9,794	10,588	13,371	17,533	22,064	27,188	33,083
184	5,006	5,146	5,160	4,766	5,166	5,766	6,446	7,085	7,698	8,352
185	4,661	6,453	6,746	6,679	7,475	8,988	10,146	10,920	11,556	12,195
186	53,504	50,213	49,103	39,043	39,877	40,927	42,421	43,442	44,415	45,396
187	1,740	1,976	2,161	622	702	1,650	3,250	4,955	6,661	8,507
188	3,310	4,511	4,161	2,397	2,772	3,525	4,387	5,153	5,883	6,619
Total	217,400	250,159	272,316	287,192	316,217	369,648	429,775	481,220	527,729	575,138

Chambers County Population (RAZ 189 to 192)

RAZ	1990	2000	2005	2010	2015	2020	2025	2030	2035	2040
189	7,780	9,788	10,429	9,936	10,592	11,516	12,480	13,360	14,369	15,572
190	2,941	3,188	3,407	2,885	3,851	5,540	7,709	10,180	12,897	16,610
191	5,052	7,797	9,532	15,558	16,782	18,670	20,730	22,608	24,673	27,024
192	4,315	5,258	5,754	6,506	8,438	11,717	15,512	19,170	23,190	27,522
Total	20,088	26,031	29,122	34,885	39,664	47,443	56,431	65,318	75,129	86,728

Liberty County Population (RAZ 193 to 199)

RAZ	1990	2000	2005	2010	2015	2020	2025	2030	2035	2040
193	545	723	825	795	975	1,443	2,093	2,919	4,053	5,326
194	12,006	12,549	13,054	11,915	12,258	13,175	14,443	16,483	19,649	23,594
195	13,936	24,746	26,869	24,107	26,166	31,517	37,854	46,597	56,491	67,448
196	6,192	8,244	9,180	9,516	12,459	20,499	32,396	44,901	56,036	67,930
197	6,014	7,148	7,332	6,586	6,687	7,103	7,881	9,135	11,113	13,367
198	6,245	7,824	8,810	8,774	9,363	10,971	13,350	16,476	20,930	26,877
199	7,787	8,920	9,034	8,836	9,035	10,011	11,615	13,632	16,359	19,416
Total	52,725	70,154	75,104	70,529	76,943	94,719	119,632	150,143	184,631	223,959

Jobs

Harris County Jobs (RAZ 1 to 127)

RAZ	1990	2000	2005	2010	2015	2020	2025	2030	2035	2040
1	131,096	143,372	129,297	147,372	161,175	163,186	169,110	173,795	177,556	181,383
2	14,428	14,288	15,389	17,348	23,537	25,450	27,812	29,630	31,086	32,566
3	12,904	4,411	4,211	4,793	5,415	5,455	5,437	5,405	5,375	5,343
4	10,732	10,053	11,064	11,837	14,650	15,568	16,723	17,618	18,336	19,066
5	13,624	12,600	15,133	15,739	18,553	19,538	20,808	21,797	22,594	23,405
6	35,281	34,724	36,975	35,252	36,785	37,329	38,739	39,812	40,666	41,504
7	16,882	17,668	13,177	14,005	16,790	17,316	17,883	18,098	18,270	18,355
8	14,287	13,813	14,981	16,825	20,614	21,530	22,548	23,301	23,897	24,500
9	4,014	3,899	3,758	3,838	4,492	4,745	5,082	5,346	5,560	5,777
10	8,720	8,249	8,059	8,992	10,891	11,346	11,851	12,225	12,520	12,818
11	5,024	4,185	4,485	6,036	9,103	10,190	11,601	12,674	13,527	14,381
12	11,079	10,268	9,987	11,621	14,487	15,084	15,693	16,129	16,469	16,811
13	23,191	21,600	22,682	24,347	27,213	27,809	28,419	28,854	29,194	29,536
14	3,914	3,739	6,297	6,713	7,330	7,541	7,830	7,938	8,024	8,110
15	12,399	8,294	14,642	14,714	16,357	17,047	17,980	18,718	19,316	19,926
16	5,787	4,968	6,552	7,768	10,856	11,383	11,666	11,774	11,860	11,945
17	8,275	7,908	9,850	12,261	16,465	17,333	18,215	18,844	19,334	19,827
18	45,099	60,437	37,708	74,130	77,913	79,628	81,987	83,866	85,388	86,882
19	15,931	15,109	22,250	24,051	27,038	27,627	28,205	28,612	28,927	29,243
20	20,386	24,252	26,727	28,643	33,244	34,875	36,991	38,599	39,880	41,160
21	7,225	4,880	5,793	7,141	8,597	8,695	8,695	8,695	8,738	8,781
22	11,020	8,790	13,400	13,406	15,302	16,128	17,255	18,149	18,874	19,612
23	52,916	64,887	53,149	52,349	53,894	54,420	55,128	55,666	56,524	57,382
24	4,347	4,213	4,138	4,498	8,281	9,035	10,110	10,612	11,008	11,319
25	10,951	12,440	17,060	17,817	20,772	21,760	23,013	23,986	24,768	25,563
26	3,319	4,158	3,939	4,276	4,812	4,912	5,006	5,071	5,121	5,171
27	24,641	21,351	28,221	30,475	35,635	36,589	37,485	38,100	38,572	39,045
28	6,823	5,415	6,136	6,629	7,824	8,148	8,528	8,816	9,045	9,277
29	7,787	9,683	11,373	12,215	14,008	14,456	14,961	15,338	15,636	15,939
30	5,425	7,306	11,871	12,456	13,988	14,424	14,947	15,345	15,662	15,985
31	19,908	17,061	13,304	14,026	16,089	16,702	17,449	18,021	18,478	18,943
32	16,392	15,253	20,927	21,041	23,922	25,137	26,780	28,081	29,134	30,208
33	6,840	5,779	7,635	8,116	9,138	9,394	9,682	9,897	10,067	10,239
34	10,858	10,543	16,085	16,135	19,202	20,507	22,199	23,486	24,767	26,047
35	7,561	7,764	11,726	12,110	13,036	13,458	14,024	14,455	14,712	14,970
36	2,757	2,845	3,081	3,421	3,559	3,606	3,628	3,635	3,638	3,641
37	5,686	7,704	7,902	7,875	8,612	8,946	9,406	9,772	10,068	10,371
38	15,362	14,034	16,702	16,718	17,336	17,547	18,541	19,330	19,969	20,620
39	57,417	65,455	74,551	71,967	84,575	88,094	92,127	94,639	96,618	98,561
40	28,207	29,849	31,939	30,622	32,166	32,693	33,401	33,939	34,368	34,797
41	6,195	7,593	8,001	7,617	7,679	8,206	8,914	8,935	8,952	8,970
42	16,160	22,261	21,164	21,790	23,980	24,689	25,580	26,269	26,822	27,385
43	19,039	25,482	21,921	21,803	24,356	25,519	27,123	28,400	29,434	30,491

RAZ	1990	2000	2005	2010	2015	2020	2025	2030	2035	2040
44	18,672	20,100	19,285	20,221	23,577	24,668	26,041	27,103	27,956	28,823
45	8,097	7,621	8,668	8,698	10,233	10,892	11,786	12,496	13,070	13,656
46	3,072	4,864	3,332	3,482	4,050	4,238	4,476	4,660	4,808	4,959
47	2,181	1,638	3,776	4,113	4,583	4,654	4,709	4,743	4,768	4,792
48	1,693	2,173	2,180	2,241	2,696	2,869	3,099	3,279	3,425	3,573
49	3,466	4,141	5,230	5,549	6,414	6,696	7,066	7,366	7,621	7,877
50	16,632	18,561	19,194	20,422	22,894	23,486	24,140	24,624	25,006	25,392
51	6,754	12,297	15,234	15,205	17,177	18,050	19,247	20,198	20,968	21,754
52	2,645	1,059	1,552	1,461	1,574	1,660	1,788	1,893	1,979	2,066
53	17,293	15,650	21,703	22,369	25,683	26,865	28,395	29,590	30,553	31,533
54	13,992	17,993	23,573	24,883	28,934	30,179	31,715	32,896	33,842	34,803
55	5,382	5,823	2,220	2,149	2,346	2,460	2,626	2,759	2,868	2,979
56	12,243	11,348	12,690	13,503	15,862	16,567	17,428	18,087	18,614	19,150
57	3,172	3,071	4,768	5,509	8,577	9,664	11,074	12,147	13,001	13,854
58	3,063	3,666	4,518	4,870	7,076	8,082	9,695	11,001	11,872	12,649
59	3,626	3,524	4,275	5,076	6,194	6,561	7,046	7,208	7,337	7,463
60	10,970	16,157	12,353	12,820	14,919	15,650	16,588	17,320	17,908	18,507
61	17,964	13,058	21,916	21,681	23,883	24,634	25,643	26,410	27,022	27,634
62	29,433	32,187	34,593	33,714	36,185	37,133	38,407	39,483	41,200	43,011
63	31,034	39,113	42,891	42,292	46,495	48,075	50,693	52,893	54,706	56,640
64	12,549	14,767	16,994	16,370	18,194	19,241	20,748	21,964	22,953	23,964
65	26,716	31,206	33,472	34,566	38,597	39,924	41,600	42,898	43,941	45,002
66	15,903	27,599	26,678	26,761	30,191	31,658	33,649	35,228	36,506	37,810
67	9,398	16,571	17,091	17,583	19,653	20,362	21,268	21,974	22,541	23,118
68	7,959	9,380	11,883	12,847	15,255	15,922	16,710	17,308	17,784	18,268
69	4,609	3,965	5,164	5,455	6,483	6,816	7,233	7,555	7,814	8,077
70	6,038	5,316	5,671	5,958	7,023	7,373	7,816	8,158	8,433	8,713
71	5,785	6,435	5,948	6,026	7,234	7,729	8,396	8,923	9,349	9,783
72	2,991	2,823	4,890	5,564	6,492	6,628	6,729	6,790	6,833	6,876
73	6,566	4,731	4,701	5,153	6,236	6,529	6,870	7,128	7,334	7,542
74	6,439	10,235	12,804	12,882	15,254	15,859	16,549	17,066	17,476	17,891
75	6,094	14,867	13,417	13,317	15,126	15,957	17,103	18,017	18,757	19,512
76	1,535	1,550	2,322	2,792	3,409	3,490	3,543	3,570	3,589	3,607
77	9,531	10,367	9,551	10,471	11,677	11,837	11,941	11,997	12,034	12,071
78	3,450	7,206	9,028	9,404	11,247	11,900	12,745	13,404	13,935	14,476
79	7,462	10,852	9,720	10,031	11,150	11,516	11,977	12,334	12,620	12,912
80	916	1,576	1,178	1,560	2,309	2,482	2,671	2,810	2,919	3,030
81	1,068	1,366	1,168	1,510	2,431	2,757	3,180	3,502	3,929	4,355
82	1,910	993	2,057	2,220	3,904	4,744	6,103	7,101	7,739	8,128
83	1,557	2,890	2,295	2,571	3,343	3,570	3,844	4,054	4,222	4,392
84	7,134	7,814	6,664	7,420	9,084	9,507	9,990	10,351	10,637	10,927
85	6,700	7,091	4,334	4,309	4,813	5,043	5,360	5,613	5,818	6,027
86	17,590	19,394	19,262	20,373	22,905	23,569	24,338	24,915	25,374	25,839
87	18,213	9,220	7,305	6,917	7,505	7,918	8,531	9,029	9,435	9,851
88	449	1,461	1,453	1,693	3,226	3,879	4,866	5,724	6,492	7,346
89	9,472	7,764	5,956	6,524	7,499	7,698	7,898	8,041	8,151	8,263
90	6,028	19,940	16,719	17,020	19,151	19,963	21,033	21,875	22,554	23,246

RAZ	1990	2000	2005	2010	2015	2020	2025	2030	2035	2040
91	5,739	9,865	8,140	7,888	8,953	9,519	10,323	10,970	11,495	12,032
92	3,663	10,075	6,509	6,659	7,582	7,926	8,377	8,731	9,016	9,307
93	14,408	27,825	26,217	28,130	32,101	33,073	34,161	34,968	35,607	36,254
94	44,760	36,687	42,258	41,060	43,424	44,078	44,481	45,288	45,927	46,574
95	5,367	7,378	9,006	10,000	11,072	11,145	11,241	11,315	11,373	11,431
96	5,973	8,476	10,852	11,759	13,603	14,047	14,539	14,904	15,191	15,483
97	12,637	17,139	15,030	15,600	17,728	18,431	19,319	20,007	20,560	21,122
98	16,275	22,769	25,052	25,035	27,042	27,885	29,017	30,094	30,952	31,810
99	9,702	10,929	10,200	10,593	11,928	12,421	13,141	13,891	14,482	15,062
100	9,665	15,192	13,768	23,941	39,700	42,813	46,209	48,706	50,459	51,236
101	10,966	16,968	14,224	14,938	16,352	16,687	17,056	17,328	17,542	17,760
102	29,548	21,214	23,541	23,900	25,445	26,690	27,844	28,743	29,540	30,046
103	879	557	1,419	1,456	2,383	2,910	4,325	5,402	6,260	7,284
104	15,980	27,527	27,687	27,080	29,918	31,060	32,826	34,324	35,519	36,491
105	6,603	22,725	31,149	30,967	34,248	35,909	38,218	40,016	41,530	43,007
106	1,763	7,136	10,583	10,982	12,126	12,467	12,885	13,204	13,460	13,720
107	11,316	31,415	29,074	30,217	34,423	35,805	37,548	38,900	39,984	41,088
108	5,996	15,264	15,492	16,209	18,286	19,116	20,610	21,609	22,326	22,871
109	24,333	33,477	32,591	31,955	36,312	38,470	41,495	43,916	45,881	47,888
110	5,623	4,753	3,233	3,529	4,060	4,173	4,291	4,375	4,442	4,508
111	6,501	15,291	13,360	14,079	15,932	16,564	17,419	18,072	18,588	19,361
112	4,294	3,866	3,722	3,976	4,602	4,824	5,092	5,296	5,418	5,541
113	2,065	6,248	8,497	9,372	13,130	14,570	16,534	18,033	19,373	20,921
114	6,052	17,100	20,920	21,389	29,906	31,763	33,529	34,927	36,503	38,137
115	38	236	387	807	2,373	4,886	6,903	7,908	8,620	9,320
116	2,226	6,849	7,575	8,078	9,957	11,618	14,301	16,345	18,128	20,171
117	171	893	940	1,294	2,547	3,101	3,906	4,519	5,005	5,495
118	1,836	8,867	9,451	11,421	14,553	15,937	17,950	19,482	20,698	21,924
119	13,495	27,605	15,891	16,750	19,706	21,149	22,221	23,047	23,709	24,383
120	5,668	9,165	8,887	9,771	12,243	13,516	15,108	16,122	16,784	17,457
121	48	447	409	712	1,964	2,297	2,699	3,006	3,249	3,494
122	10,178	21,715	23,170	24,693	40,351	46,356	56,971	61,025	64,194	65,829
123	34,009	44,302	50,188	50,764	63,128	67,044	70,971	73,964	75,098	76,079
124	9,575	14,194	18,993	20,060	22,252	22,916	23,453	23,657	23,819	23,901
125	5,168	7,207	5,576	5,894	7,146	7,479	7,785	8,018	8,205	8,395
126	15,816	27,792	12,666	12,908	13,834	14,150	14,575	14,898	15,155	15,413
127	5,374	5,900	4,443	4,706	5,958	6,401	7,072	7,583	7,867	8,156
Total	1,539,045	1,855,054	1,906,018	2,026,916	2,344,680	2,449,192	2,587,309	2,687,748	2,768,407	2,846,949

Montgomery County Jobs (RAZ 128 to 139)

RAZ	1990	2000	2005	2010	2015	2020	2025	2030	2035	2040
128	1,058	6,400	6,374	8,675	14,044	18,200	24,924	30,618	36,681	43,370
129	9,741	6,848	5,967	7,136	10,119	14,141	20,444	26,080	31,813	38,478
130	207	527	1,290	1,761	2,954	4,072	6,873	9,255	11,570	13,903
131	5,155	13,348	21,143	22,795	27,006	29,890	33,754	36,525	38,634	40,287
132	879	20,041	20,532	24,051	31,209	36,125	43,129	48,358	52,216	54,993
133	2,571	952	2,507	3,002	6,592	9,745	14,830	19,373	23,567	27,791
134	9,432	16,260	16,681	20,188	29,911	36,885	46,605	54,825	63,153	71,665
135	2,915	6,844	6,300	8,502	14,878	19,267	26,492	32,815	38,828	45,714
136	9,044	11,448	12,601	15,272	18,851	22,039	26,809	31,324	35,731	40,337
137	110	1,668	2,958	3,711	6,097	8,064	11,566	14,645	17,842	21,175
138	651	740	542	658	1,255	1,702	2,402	3,128	3,955	5,066
139	1,505	4,558	11,589	14,213	18,574	21,631	26,808	31,749	36,828	42,568
Total	43,268	89,634	108,484	129,965	181,490	221,760	284,636	338,696	390,819	445,347

Waller County Jobs (RAZ 140 to 143)

RAZ	1990	2000	2005	2010	2015	2020	2025	2030	2035	2040
140	4,238	4,729	4,737	5,438	6,186	7,003	8,961	10,865	12,626	15,016
141	1,874	2,029	2,072	2,453	2,829	3,212	4,083	4,857	5,545	6,477
142	1,227	2,729	3,137	4,870	5,993	7,238	10,174	12,951	15,487	19,025
143	274	365	833	1,090	2,212	3,419	6,266	8,804	11,059	14,023
Total	7,612	9,851	10,778	13,851	17,220	20,872	29,483	37,477	44,718	54,541

Fort Bend County Jobs (RAZ 144 to 158)

RAZ	1990	2000	2005	2010	2015	2020	2025	2030	2035	2040
144	1,071	5,672	5,265	6,781	11,904	15,791	22,743	28,927	34,763	41,506
145	323	925	1,896	2,608	3,873	4,976	7,227	9,664	11,619	13,237
146	6,359	5,763	5,038	6,733	13,305	18,930	28,991	37,940	46,385	55,551
147	90	365	417	681	1,318	1,801	2,666	3,434	4,160	4,999
148	484	1,948	2,783	3,779	5,477	6,766	9,071	11,121	13,056	15,292
149	10,100	12,870	19,693	23,328	27,793	30,240	33,759	36,110	37,714	38,898
150	609	6,528	5,132	6,194	8,932	11,379	16,306	21,008	25,820	31,212
151	12,881	21,542	21,683	24,282	29,759	32,206	36,429	39,367	41,506	43,534
152	11,046	23,221	27,177	30,993	38,191	43,683	52,648	59,144	64,075	68,145
153	4,103	4,813	7,685	8,837	11,628	13,746	17,533	20,903	24,082	27,757
154	1,159	8,726	6,697	8,785	13,254	16,623	22,520	27,481	32,370	37,762
155	1,348	4,048	4,234	6,276	10,184	13,148	18,451	23,169	27,620	32,764
156	403	1,939	2,972	3,619	6,968	9,509	14,054	18,098	21,913	26,322
157	516	790	1,421	1,783	2,341	2,764	3,522	4,196	4,832	5,567
158	56	619	843	1,305	2,253	2,971	4,257	5,401	6,480	7,727
Total	50,548	99,769	112,936	135,985	187,180	224,534	290,176	345,962	396,396	450,272

Brazoria County Jobs (RAZ 159 to 172)

RAZ	1990	2000	2005	2010	2015	2020	2025	2030	2035	2040
159	13,316	3,510	3,239	3,291	3,438	3,755	4,424	5,093	5,466	6,063
160	2,216	3,740	2,267	2,560	3,037	3,271	3,673	4,063	4,425	4,904
161	125	272	181	169	173	218	334	387	402	413
162	9,642	1,429	1,057	1,113	1,908	2,297	2,766	3,156	3,415	3,714
163	9,158	16,650	10,909	11,924	13,545	14,304	15,803	16,558	17,648	18,720
164	9,373	11,582	15,108	16,058	18,084	18,812	19,609	20,567	22,120	23,657
165	191	1,038	418	409	472	505	558	592	623	653
166	1,794	4,228	4,703	5,327	6,421	7,254	8,415	9,857	10,738	11,750
167	4,931	6,548	6,379	6,930	8,069	8,377	8,997	9,482	10,152	11,055
168	4,229	1,795	296	372	1,166	1,633	2,035	2,370	2,576	2,816
169	89	2,819	1,288	1,350	2,940	3,795	5,403	6,741	8,292	10,091
170	9,330	11,200	10,679	11,773	13,664	14,509	16,122	17,215	18,378	20,203
171	130	1,455	4,707	5,719	8,247	10,323	14,096	17,087	19,610	22,359
172	6,426	11,226	19,019	20,624	23,595	24,689	26,113	27,360	28,574	29,674
Total	70,950	77,492	80,250	87,619	104,760	113,741	128,346	140,527	152,419	166,074

Galveston County Jobs (RAZ 173 to 188)

RAZ	1990	2000	2005	2010	2015	2020	2025	2030	2035	2040
173	2,455	5,573	3,417	3,609	5,201	6,147	7,713	9,004	10,179	11,487
174	1,475	3,563	2,122	2,569	5,198	6,685	9,261	11,373	13,293	15,302
175	8,695	9,705	11,520	11,674	13,531	14,560	16,254	17,658	18,933	20,308
176	1,643	2,757	5,161	5,264	5,665	5,793	5,949	6,062	6,161	6,269
177	4,734	4,052	3,327	3,495	4,913	5,759	7,158	8,313	9,363	10,532
178	730	3,643	8,585	8,573	9,558	10,116	11,025	11,771	12,448	13,202
179	2,077	4,584	2,076	2,577	5,255	6,743	9,150	11,119	12,908	14,896
180	6,212	6,454	2,708	2,845	3,496	3,869	4,331	4,586	4,818	4,943
181	965	2,628	1,868	2,038	3,333	4,106	5,384	6,438	7,397	8,464
182	3,240	2,714	1,794	1,780	1,858	1,904	1,981	2,044	2,101	2,165
183	1,155	2,676	5,506	5,578	5,667	5,759	5,906	6,027	6,137	6,259
184	11,834	6,926	5,569	5,348	5,841	6,120	6,574	7,009	7,405	7,781
185	474	2,461	2,568	2,730	3,055	3,242	3,696	4,079	4,427	4,802
186	32,604	32,759	34,664	31,708	31,872	31,967	32,122	32,251	32,368	32,494
187	1,806	3,283	4,878	4,910	5,731	6,289	7,198	8,130	8,977	9,730
188	125	360	1,193	1,467	1,796	1,889	2,040	2,053	2,053	2,066
Total	80,224	94,138	96,956	96,165	111,970	120,947	135,743	147,918	158,967	170,701

Chambers County Jobs (RAZ 189 to 192)

RAZ	1990	2000	2005	2010	2015	2020	2025	2030	2035	2040
189	2,174	2,997	1,925	1,216	1,464	1,620	1,863	2,138	2,432	2,767
190	100	197	312	383	539	639	862	1,150	1,536	1,976
191	2,292	2,497	2,781	3,414	5,124	6,231	7,978	9,961	12,085	14,505
192	1,482	2,597	3,769	4,625	6,024	6,919	8,325	9,920	11,627	13,571
Total	6,048	8,288	8,787	9,637	13,150	15,409	19,029	23,169	27,681	32,819

Liberty County Jobs (RAZ 193 to 199)

RAZ	1990	2000	2005	2010	2015	2020	2025	2030	2035	2040
193	1	27	45	40	61	105	217	366	551	769
194	7,233	7,228	7,371	6,577	7,358	8,080	9,626	11,599	14,091	17,042
195	1,826	3,828	4,631	3,931	4,935	5,799	7,635	9,948	12,784	16,109
196	8	1,077	1,007	746	1,136	1,677	3,610	6,077	8,568	10,781
197	3,634	4,828	5,129	4,206	4,976	5,663	7,118	8,946	11,187	13,869
198	985	77	75	51	179	288	518	806	1,160	1,575
199	564	839	603	942	1,065	1,178	1,341	1,548	1,809	1,965
Total	14,251	17,904	18,861	16,492	19,710	22,789	30,064	39,290	50,149	62,109

Households

Harris County Households (RAZ 1 to 127)

RAZ	1990	2000	2005	2010	2015	2020	2025	2030	2035	2040
1	374	1,619	1,971	1,736	2,237	2,808	3,335	3,751	4,044	4,283
2	10,542	11,538	11,594	10,140	10,450	10,937	11,223	11,412	11,535	11,632
3	1,078	1,158	1,348	1,324	1,533	2,088	2,582	2,981	3,261	3,489
4	1,446	1,699	2,549	2,949	3,566	4,384	5,248	6,016	6,556	6,996
5	9,045	11,087	11,771	9,434	9,936	10,615	11,353	11,971	12,411	12,776
6	16,219	21,213	23,005	21,916	22,530	23,227	23,872	24,469	24,895	25,263
7	3,367	4,536	6,850	8,311	9,354	10,272	11,426	11,896	12,229	12,505
8	12,969	14,627	15,182	14,061	14,478	14,974	15,326	15,796	16,128	16,402
9	10,003	11,452	11,343	9,195	9,349	9,575	9,741	9,876	9,973	10,052
10	1,762	1,940	1,942	1,675	1,746	1,897	2,058	2,196	2,295	2,376
11	1,532	1,577	1,572	1,386	1,529	1,694	1,849	1,974	2,064	2,138
12	2,362	2,690	2,689	2,396	2,467	2,550	2,627	2,690	2,735	2,772
13	14,790	16,918	16,917	14,261	14,663	15,002	15,156	15,281	15,370	15,444
14	6,450	6,839	7,038	6,325	6,641	7,218	7,748	8,183	8,489	8,738
15	1,600	1,818	2,026	1,978	2,068	2,192	2,308	2,402	2,468	2,523
16	2,299	2,795	2,988	2,900	3,703	4,156	4,683	5,188	5,600	5,991
17	8,147	9,627	10,720	10,040	10,876	11,714	12,443	13,029	13,440	13,773
18	1,753	2,322	2,931	2,711	3,218	3,590	3,942	4,224	4,423	4,588
19	5,525	6,152	6,352	5,825	6,026	6,252	6,431	6,584	6,694	6,784
20	9,011	12,015	12,950	11,886	12,460	13,063	13,632	14,093	14,422	14,693
21	8,821	11,044	11,964	11,208	11,810	12,263	12,579	12,750	12,872	12,972
22	9,188	10,872	11,146	10,770	10,872	10,990	11,101	11,191	11,255	11,308
23	7,104	10,645	12,138	11,431	12,635	13,994	14,418	14,589	14,710	14,811
24	2,671	3,144	3,118	2,800	2,871	2,956	3,288	3,738	4,058	4,334
25	3,798	4,993	4,866	4,461	5,338	6,321	7,114	7,549	7,704	7,835
26	2,056	3,045	3,584	3,465	3,726	3,955	4,168	4,338	4,460	4,561
27	6,666	7,110	8,910	9,719	10,823	11,184	11,366	11,474	11,540	11,591
28	11,507	12,889	12,847	11,023	11,224	11,563	11,985	12,522	12,900	13,207
29	5,475	6,122	6,328	5,591	6,003	6,587	7,173	7,646	7,978	8,246
30	6,884	7,280	7,431	6,877	7,088	7,377	7,658	7,892	8,057	8,192
31	12,082	13,410	13,441	11,573	11,653	11,744	11,828	11,895	11,942	11,981
32	15,495	17,122	17,278	15,486	15,772	16,199	16,623	16,978	17,231	17,437
33	13,286	14,835	15,588	14,527	15,385	16,243	16,991	17,591	18,011	18,352
34	4,150	4,854	6,353	7,252	8,456	9,817	12,230	13,945	15,159	16,169
35	11,968	13,643	13,705	12,835	13,144	13,611	14,124	14,529	14,814	15,046
36	5,453	5,677	5,681	5,201	5,222	5,247	5,270	5,289	5,302	5,313
37	3,086	3,219	3,259	3,108	3,159	3,322	3,506	3,666	3,781	3,875
38	12,302	17,052	16,947	14,208	14,810	15,263	15,579	15,916	16,174	16,384
39	5,562	6,901	8,683	8,701	10,106	11,677	13,103	13,944	14,534	15,023
40	16,015	20,912	21,831	19,854	20,368	21,070	21,772	22,369	22,729	23,022
41	4,214	5,599	5,602	5,244	5,293	5,349	5,401	5,443	5,472	5,596
42	1,388	1,627	1,871	1,691	1,906	2,080	2,218	2,323	2,397	2,456
43	11,146	12,679	12,889	11,503	11,704	12,157	12,257	12,355	12,428	12,489

RAZ	1990	2000	2005	2010	2015	2020	2025	2030	2035	2040
44	11,715	13,028	13,194	11,639	12,140	12,655	13,108	13,474	13,731	13,939
45	5,814	6,826	6,922	6,437	6,588	6,822	7,021	7,179	7,289	7,378
46	2,967	3,584	3,815	3,586	3,708	3,832	3,940	4,028	4,090	4,139
47	2,666	3,040	3,083	2,850	2,902	2,964	3,080	3,127	3,160	3,187
48	4,816	5,357	5,621	5,339	5,635	5,981	6,300	6,561	6,746	6,896
49	5,222	6,664	7,957	8,386	9,312	10,364	11,120	11,802	12,162	12,421
50	23,744	28,681	31,401	30,774	32,471	34,400	36,128	37,151	37,931	38,485
51	2,642	3,003	2,940	2,573	2,583	2,595	2,607	2,616	2,622	2,627
52	0	14	7	0	10	35	151	197	231	258
53	18,273	20,795	20,883	18,756	18,756	18,976	19,250	19,494	19,670	19,815
54	18,281	20,855	21,268	19,149	19,437	20,010	20,614	21,131	21,500	21,801
55	20	19	18	15	19	31	43	90	123	150
56	6,504	8,488	10,509	11,589	12,823	13,777	14,350	14,799	15,120	15,396
57	6,599	7,901	9,720	9,950	11,355	13,169	14,743	15,469	15,987	16,263
58	3,714	4,711	6,022	6,858	7,862	9,220	10,802	12,149	12,757	13,250
59	3,728	4,581	6,306	7,436	8,670	9,840	10,812	11,579	12,059	12,450
60	24,817	30,700	31,395	27,662	27,805	28,232	28,710	29,124	29,421	29,664
61	12,561	14,390	14,255	12,202	12,209	12,218	12,225	12,232	12,236	12,240
62	21,980	27,244	27,946	23,891	24,225	24,607	24,965	25,245	25,446	25,630
63	20,752	25,388	26,444	24,484	25,186	26,319	27,473	28,315	28,913	29,310
64	9,024	10,094	9,746	9,108	9,323	9,575	9,811	10,002	10,138	10,251
65	24,874	29,351	30,052	27,307	27,728	28,348	28,578	28,767	28,900	29,010
66	3,107	3,546	3,808	3,428	3,737	4,087	4,411	4,667	4,847	4,994
67	9,470	12,181	12,540	9,685	10,472	11,306	12,049	12,651	13,073	13,416
68	19,653	22,598	23,925	22,767	23,335	24,016	24,664	25,261	25,741	26,181
69	3,459	4,018	4,218	3,973	4,370	4,785	5,154	5,452	5,661	5,831
70	6,770	7,940	8,322	7,944	8,028	8,140	8,243	8,328	8,388	8,437
71	3,784	4,538	4,685	4,497	4,651	5,002	5,326	5,582	5,762	5,909
72	3,055	3,447	3,417	2,973	2,983	2,996	3,008	3,036	3,063	3,090
73	4,918	5,926	6,152	5,814	5,835	5,873	5,919	6,012	6,079	6,134
74	4,937	5,850	5,809	5,249	5,669	6,146	6,587	7,184	7,724	8,213
75	2,108	2,468	3,214	3,590	4,306	4,930	5,794	6,561	7,131	7,620
76	3,116	3,774	5,074	5,549	6,300	6,866	7,290	7,610	7,829	8,006
77	4,228	5,018	5,583	5,462	6,302	7,354	8,434	9,372	10,032	10,619
78	7,411	13,141	19,072	23,928	26,928	29,397	31,188	32,498	33,299	33,875
79	13,346	18,983	20,509	20,650	21,070	21,690	22,614	23,364	23,895	24,335
80	2432	3,543	4,340	4,713	5,365	7,208	8,909	10,038	10,719	11,236
81	3,387	4,213	5,096	5,589	6,226	7,085	7,876	8,563	9,112	9,525
82	886	1150	2,891	4,330	5,546	6,651	7,668	8,355	8,842	9,197
83	2,768	3,378	3,632	3,479	3,911	4,525	5,485	6,344	7,014	7,583
84	6,031	7,741	9,300	10,079	11,268	12,864	14,445	15,733	16,647	17,371
85	3,041	3,066	2,798	2,250	2,310	2,381	2,447	2,502	2,540	2,572
86	16,157	18,770	19,855	17,717	18,433	19,287	20,081	20,734	21,196	21,570
87	12	4	3	3	3	3	3	3	3	3
88	1996	2,306	2,321	2,005	2,046	2,114	2,183	2,241	2,282	2,316
89	3,454	3,908	3,916	3,274	3,560	3,931	4,286	4,580	4,789	4,958
90	13,662	15,795	16,894	17,129	17,952	19,004	19,868	20,380	20,740	21,034

RAZ	1990	2000	2005	2010	2015	2020	2025	2030	2035	2040
91	4,363	5,823	6,384	6,643	6,849	7,199	7,632	8,058	8,418	8,760
92	6,091	8,160	8,824	8,308	8,809	9,387	9,920	10,356	10,663	10,913
93	16,891	24,924	27,420	28,383	29,970	30,958	31,871	32,592	33,059	33,405
94	18,643	22,377	23,686	22,276	22,486	22,858	23,320	23,696	23,962	24,183
95	5,913	8,084	9,322	9,988	10,566	10,941	11,193	11,373	11,494	11,590
96	12,693	13,212	16,021	17,912	19,200	19,874	20,233	20,455	20,594	20,702
97	17,196	19,628	19,881	17,370	17,943	18,554	19,099	19,542	19,853	20,105
98	13,321	17,850	19,445	18,702	19,436	20,300	21,105	21,947	22,615	23,248
99	16,312	21,274	24,348	24,388	26,237	27,585	28,851	29,842	30,551	31,161
100	8,043	13,029	15,132	15,549	15,878	16,615	16,842	17,016	17,078	17,183
101	12,900	17,346	17,500	15,317	15,317	15,330	15,354	15,372	15,385	15,403
102	11,075	12,411	13,367	12,636	13,209	13,802	14,325	14,747	15,043	15,284
103	43	365	360	228	242	258	542	553	561	640
104	7,650	8,900	9,222	8,432	8,946	9,531	10,071	10,497	10,797	11,041
105	8,637	13,004	14,614	15,332	16,155	17,078	17,929	18,581	19,046	19,441
106	3,082	4,673	5,786	6,468	6,887	7,195	7,479	7,697	7,852	7,984
107	13,698	24,358	28,447	30,212	32,359	34,800	36,420	37,614	38,394	38,883
108	9,714	12,021	14,019	14,581	15,712	17,004	18,217	19,167	19,501	19,674
109	8,665	10,216	10,273	9,132	9,852	10,787	11,759	12,612	13,272	13,859
110	5,906	8,018	9,412	9,680	10,358	11,163	11,925	12,537	12,968	13,325
111	9,237	16,285	19,412	21,493	21,992	22,672	23,302	23,807	24,166	24,463
112	2,019	3,124	3,503	3,750	4,315	5,264	6,233	7,052	7,636	8,112
113	8,708	14,422	24,335	32,549	39,884	48,698	57,007	63,598	68,918	73,721
114	9,179	13,908	18,776	22,070	24,678	27,156	28,328	28,799	29,130	29,404
115	216	474	565	587	1,089	3,070	5,178	7,085	8,853	10,808
116	7,181	11,572	21,125	29,133	36,645	44,946	53,379	60,955	66,259	70,757
117	1087	1840	2038	2,052	2,554	4,252	6,360	8,212	9,869	11,517
118	5,925	15,567	24,931	32,988	38,199	46,920	55,036	61,232	65,887	70,125
119	13,722	18,967	22,993	25,340	27,347	29,046	30,205	31,063	31,601	32,012
120	2,860	4,318	4,802	4,796	5,715	6,942	8,185	9,387	10,329	11,363
121	916	2237	3774.5	4,706	6,269	8,262	10,349	12,256	13,669	14,818
122	22,100	31,153	42,481	50,854	60,562	70,635	80,544	85,247	88,239	90,782
123	36,416	49,508	56,439	55,318	58,102	60,646	62,437	63,372	63,706	63,936
124	6,102	8,045	12,022	13,770	16,897	19,388	21,745	22,686	23,680	24,201
125	5,932	7,169	8,844	9,385	10,637	12,000	13,171	13,928	14,518	15,007
126	1,174	1,624	1,871	1,910	2,223	2,691	3,206	3,888	4,252	4,549
127	10,499	12,212	16,133	18,731	21,548	23,812	25,710	27,577	28,721	29,870
Total	1,018,601	1,288,410	1,443,554	1,436,014	1,544,617	1,668,412	1,782,959	1,869,923	1,931,719	1,984,237

Montgomery County Households (RAZ 128 to 139)

RAZ	1990	2000	2005	2010	2015	2020	2025	2030	2035	2040
128	5,440	8,453	10,146	10,816	12,817	15,653	19,321	22,277	25,524	28,170
129	9,139	14,289	18,118	20,123	24,126	30,518	39,322	45,972	52,826	59,112
130	1156	2386	6,477	10,153	13,880	18,602	24,050	27,681	32,042	35,854
131	8,836	12,726	14,282	14,555	15,793	16,992	17,970	18,709	19,065	19,379
132	7058	17,858	25,381	31,007	35,650	39,646	42,091	43,569	44,651	45,313
133	1,344	1595	2,648	3,482	4,601	6,391	8,763	10,599	12,704	14,992
134	8,336	11,027	12,075	12,133	13,337	15,356	17,905	19,763	21,566	23,196
135	5,714	8,761	10,629	11,372	12,864	14,861	17,796	20,382	23,019	25,538
136	7,100	16,462	21,423	21,962	27,380	31,822	36,410	39,012	41,117	42,905
137	2347	5,091	6,599	7,594	10,690	16,682	24,508	31,158	37,652	44,268
138	918	1938	2266	2,332	2,666	3,375	4,581	5,735	6,872	8,015
139	5,616	11,038	14,593	17,151	21,485	29,475	39,746	47,874	56,172	64,442
Total	63,004	111,624	144,634	162,680	195,289	239,373	292,463	332,731	373,209	411,184

Waller County Households (RAZ 140 to 143)

RAZ	1990	2000	2005	2010	2015	2020	2025	2030	2035	2040
140	3,119	5,328	6,389	6,601	7,596	9,882	12,832	16,679	21,372	26,362
141	2,126	3,128	3,483	3,422	3,604	4,072	4,667	5,509	6,728	8,272
142	1,655	2,849	3,259	3,207	3,891	5,469	7,354	9,803	13,081	16,947
143	347	431	657	831	1,926	4,897	8,651	12,498	16,253	19,580
Total	7,247	11,736	13,788	14,061	17,018	24,319	33,504	44,489	57,434	71,160

Fort Bend County Households (RAZ 144 to 158)

RAZ	1990	2000	2005	2010	2015	2020	2025	2030	2035	2040
144	990	6,336	15,739	24,220	32,126	37,187	40,769	42,544	43,390	43,834
145	1092	1749	2,831	3,644	7,437	15,298	24,514	33,840	42,628	50,217
146	9,069	15,572	25,778	34,470	43,953	50,941	57,852	63,448	68,721	74,413
147	480	647	734	695	926	1,305	1,733	2,126	2,864	4,007
148	1402	1,998	2,356	2,505	3,296	5,921	8,881	11,479	13,813	16,255
149	9,046	11,083	11,941	11,754	12,426	13,058	13,641	14,141	14,574	15,031
150	1418	6,160	8,524	10,524	12,105	14,687	17,305	19,575	21,315	22,698
151	9,625	14,008	16,374	18,001	19,187	20,909	22,110	23,140	23,598	24,077
152	5,554	10,462	12,110	13,198	14,094	15,147	16,206	17,115	17,345	17,440
153	11,551	14,114	15,441	16,019	16,414	17,563	18,163	18,214	18,260	18,308
154	7,155	13,979	17,423	20,232	24,127	27,843	31,103	33,419	35,534	37,755
155	8,475	12,920	19,472	24,452	30,382	37,345	44,256	49,661	54,393	58,887
156	807	1,450	2,663	3,582	6,698	12,272	18,791	24,582	31,134	37,875
157	1,597	2,101	2,345	2,409	3,103	3,964	5,165	6,452	7,827	9,742
158	1,041	1,634	1,892	1,988	2,450	3,254	4,275	5,304	7,597	10,709
Total	69,302	114,213	155,621	187,693	228,727	276,692	324,764	365,041	402,993	441,248

Brazoria County Households (RAZ 159 to 172)

RAZ	1990	2000	2005	2010	2015	2020	2025	2030	2035	2040
159	4,071	4,886	5,062	4,592	5,033	5,812	6,809	7,695	8,556	9,394
160	5,385	6,951	7,176	6,393	6,720	7,272	7,914	8,565	9,197	9,925
161	1036	1203	1171.5	1,035	1,185	1,404	1,670	1,786	1,898	2,028
162	2,330	2,717	2,656	2,066	2,216	2,435	2,568	2,800	3,069	3,374
163	3,402	5,525	5,768	5,150	5,449	5,888	6,419	6,651	6,875	7,093
164	11,001	12,854	13,329	12,509	12,902	13,343	13,600	13,817	14,027	14,235
165	561	1,661	1878	765	830	941	1,069	1,178	1,283	1,387
166	3,232	4,408	4,812	4,806	5,724	7,477	9,664	11,648	13,649	15,626
167	6,360	7,684	7,885	7,401	8,319	10,072	12,388	14,371	16,478	18,559
168	676	1,020	1114.5	1,025	1,100	1,232	1,417	1,649	2,097	2,750
169	1909	3,068	3,550	3,648	4,734	7,822	11,998	16,509	21,280	26,989
170	10,898	14,138	15,029	14,691	16,595	20,182	24,795	28,909	33,079	37,818
171	2877	7,927	15,900	22,350	26,159	31,855	37,682	42,619	46,987	49,949
172	9,738	15,728	18,725	20,322	23,242	27,462	31,589	34,057	36,043	37,425
Total	63,476	89,770	104,053	106,753	120,208	143,196	169,582	192,254	214,517	236,552

Galveston County Households (RAZ 173 to 188)

RAZ	1990	2000	2005	2010	2015	2020	2025	2030	2035	2040
173	5,008	7,354	8,255	8,861	9,487	10,393	10,888	11,212	11,482	11,766
174	4,299	6,146	9,833	13,016	15,443	19,978	24,688	28,185	31,000	32,858
175	7,485	13,241	16,665	18,578	21,117	24,589	27,838	29,250	29,597	30,112
176	3,565	5,639	5,991	5,372	5,839	6,740	8,187	9,633	11,133	12,820
177	5,693	6,863	7,463	7,541	8,188	9,283	10,641	11,924	13,206	14,553
178	5623	7,321	7,990	8,053	8,659	10,500	13,440	16,448	19,536	22,808
179	1,563	2,242	3,056	3,302	4,076	5,280	7,686	10,569	14,077	18,319
180	8,929	9,968	10,096	9,243	9,424	9,678	9,727	9,758	9,783	9,808
181	3809	3,744	4,048	3,744	4,052	4,282	4,456	4,564	4,653	4,744
182	4,419	4,678	4,661	4,078	4,236	4,595	5,204	5,823	6,465	7,188
183	2,862	3,861	4,067	3,677	3,992	4,967	6,721	8,412	10,387	12,617
184	1,873	2,644	2,797	2,203	2,316	2,510	2,795	3,068	3,355	3,672
185	2159	6,229	7,436	3,309	3,262	3,661	4,153	4,495	4,836	5,181
186	21,731	24,590	24,611	16,892	17,338	17,786	18,479	18,920	19,384	19,864
187	421	664	519	274	320	686	1,361	2,077	2,822	3,679
188	1274	5424	4,066	1,071	969	1,123	1,449	1,750	2,052	2,385
Total	80,713	110,608	121,550	109,214	118,718	136,050	157,713	176,089	193,769	212,375

Chambers County Households (RAZ 189 to 192)

RAZ	1990	2000	2005	2010	2015	2020	2025	2030	2035	2040
189	2,758	4,016	4,047	3,567	3,785	4,092	4,421	4,716	5,067	5,478
190	1031	1352	1327	1,118	1,439	2,000	2,741	3,569	4,513	5,783
191	1,675	2,899	4,189	5,061	5,468	6,095	6,798	7,428	8,145	8,949
192	1,397	1,933	2,184	2,243	2,886	3,975	5,270	6,497	7,893	9,375
Total	6,861	10,200	11,746	11,989	13,579	16,163	19,230	22,211	25,618	29,585

Liberty County Households (RAZ 193 to 199)

RAZ	1990	2000	2005	2010	2015	2020	2025	2030	2035	2040
193	197	293	302	290	354	520	756	1,050	1,468	1,932
194	4,262	5,000	4,998	4,428	4,550	4,876	5,336	6,062	7,230	8,665
195	4,688	7,665	8,460	8,274	9,009	10,910	13,209	16,319	19,969	23,956
196	2174	3,129	3,396	3,262	4,312	7,169	11,485	15,934	20,041	24,369
197	1,943	2,621	2,634	2,346	2,382	2,530	2,812	3,258	3,988	4,808
198	2211	3267	3444.5	3,128	3,338	3,909	4,773	5,885	7,528	9,692
199	2871	4109	4188	3,401	3,472	3,819	4,401	5,118	6,124	7,237
Total	18,346	26,084	27,422	25,129	27,417	33,734	42,773	53,626	66,347	80,659

Appendix B – Quote Sources

Boyd Nash-Stacey – Houston Chronicle, November 19, 2014

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Greater Houston Partnership Employment Forecast – GHP, December 11, 2014

<https://www.houston.org/pdf/research/quickview/Employment-Forecast.pdf>

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