VOLUNTARY DISCLOSURE FILING

Filed by the Texas Transportation Commission

Date of Filing: January 29, 2020

Evaluation and Confirmation of Central Texas Turnpike System

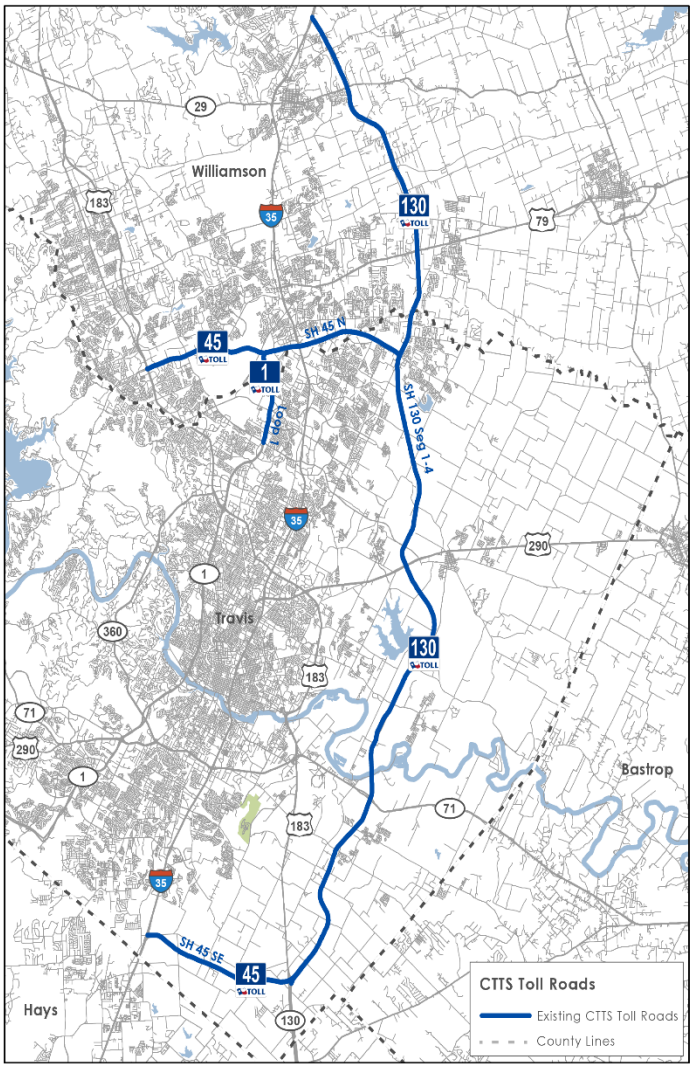
2018 Traffic and Revenue Study Forecast

In connection with the offering by the Texas Transportation Commission (the "Commission") of the proposed Central Texas Turnpike System Revenue Refunding Bonds (the "Bonds"), Stantec Consulting Services Inc, ("Stantec"), the acting Traffic Consultant for the Commission in connection with the Central Texas Turnpike System (the "System"), reviewed the report they prepared titled Central Texas Turnpike System 2018 Traffic & Revenue Study dated August 29, 2018 (the "2018 Report") to determine if changes to the underlying economics and other conditions warrant any change to the original forecast.

Stantec has issued a letter dated as of January 21, 2020 (the "2020 Update Letter") updating the 2018 Report. For more information regarding the System, the 2020 Update Letter and the 2018 Report, please refer to the Preliminary Official Statement dated January 28, 2020, for the Commission's Bonds which is accessible here and contains updated information regarding the System including the 2020 Update Letter and the 2018 Report. After pricing the Bonds, the final Official Statement will also be filed under the base CUSIPs for the Bonds.

This filing is not required to be provided by the Commission or the Texas Department of Transportation ("TxDOT") pursuant to their respective contractual continuing disclosure undertaking relating to their outstanding obligations and, accordingly, should not be construed as obligating the Commission or TxDOT to provide such additional information in future continuing disclosure filings or to provide any updates to the information contained in this filing. The information contained in this filing is being provided on a voluntary basis to provide updated financial information and operating data relating to the System, the 2020 Update Letter and the 2018 Report. Neither the Commission nor TxDOT makes any representation or warranty concerning the usefulness of the information contained in this filing to a decision to invest in, hold, or sell the Bonds or any outstanding obligations of the Commission or TxDOT.

Central Texas Turnpike System
2018 Traffic & Revenue Study



Prepared by:

Stantec Consulting Services Inc.

August 29, 2018

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EXECUTIVE SUMMARY

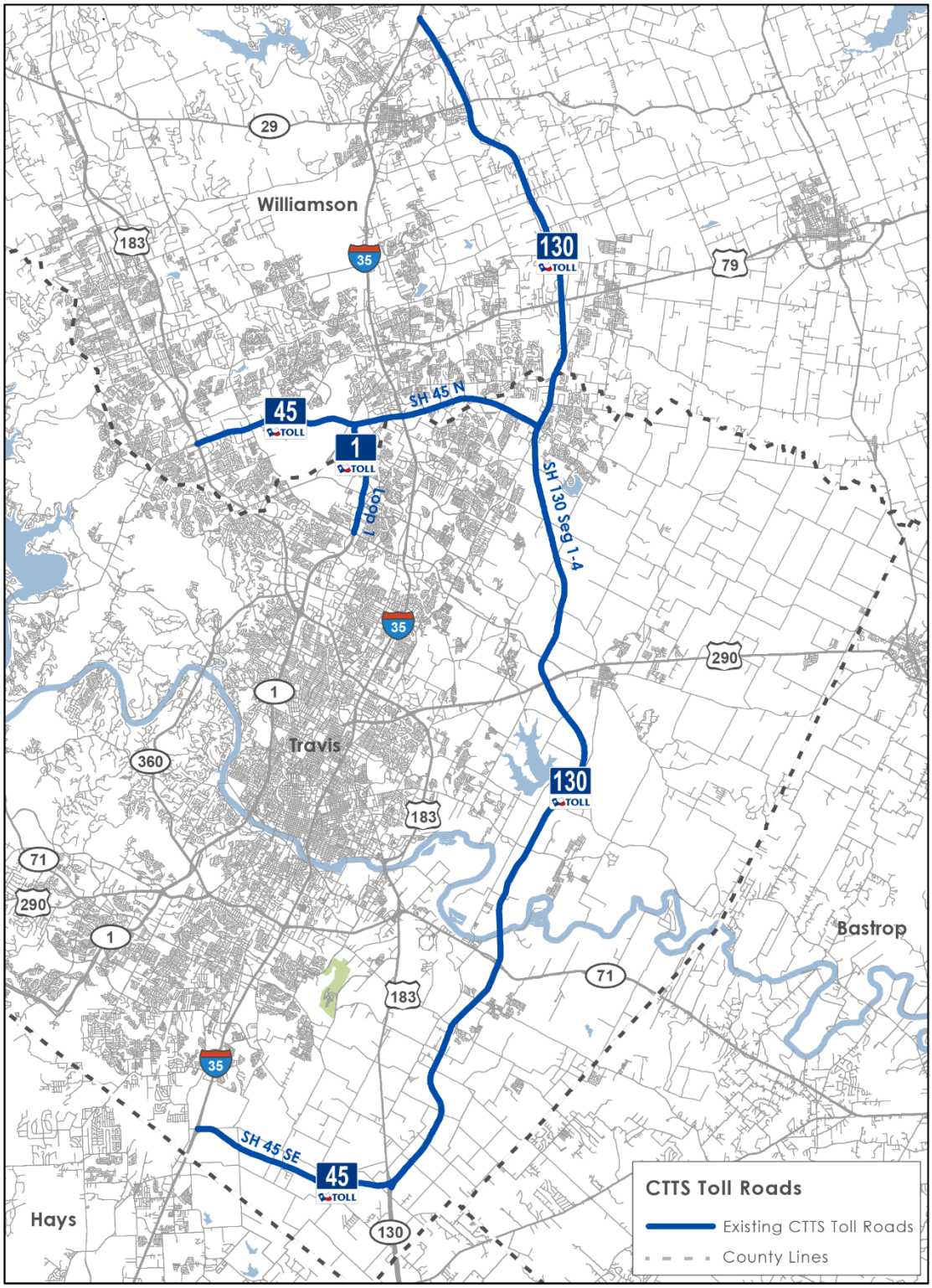
Stantec Consulting Services Inc. (Stantec) conducted this comprehensive Level 2+ Study to develop projections of traffic and toll revenues through 2042 for the Central Texas Turnpike System (CTTS) in the Austin area. The CTTS is owned by the Texas Transportation Commission, the governing body of the Texas Department of Transportation (TxDOT) and operated by TxDOT. There are other toll roads operating in the Austin region which are owned by the Central Texas Regional Mobility Authority (CTRMA). TxDOT is the only toll authority providing transponders in central Texas, branded as TxTag, and in that role TxDOT works collaboratively to provide a seamless system of toll facilities for serving local and regional travel in Austin.

Introduction (Chapter 1)

The CTTS is a 72.8-mile toll road system in the Austin area with four existing elements, as shown in Figure ES. 1:

- SH 45 N extends from US 183 east to SH 130 (12.8 miles);
- Loop 1 extends from SH 45 N south to Parmer Lane (4 miles);
- SH 130 extends from IH-35 in Georgetown south to US 183/SH 45 SE south of the Austin-Bergstrom International Airport (49 miles); and
- SH 45 SE extends from US 183/SH 130 west to IH-35 (7 miles).

Figure ES. 1 CTTS Toll Roads and Study Area



SH 45 N, Loop 1, and SH 130 opened in segments starting in 2006. SH 45 SE opened in May 2009 and became part of the CTTS in September 2012. The CTTS serves both commuter and through traffic in the Austin area.

On each of the CTTS elements, toll collection is by Electronic Toll Collection (ETC) and Pay by Mail (PBM), whereby the toll for the PBM transaction is billed after the trip, based on the identification of the vehicle owner via the vehicle's license plate.

Regional Transportation Network (Chapter 2)

Toll roads in the Austin area, in addition to the CTTS toll roads owned and operated by TxDOT, include 183A, 290E, MoPac North (MoPac N) Express Lanes, and SH 71 E Express Lanes owned and operated by Central Texas Regional Mobility Authority (CTRMA) and SH 130 Segments 5 & 6 south of Austin. SH 130 Segments 5 & 6 was financed, constructed, and is operated by SH 130 Concession Company, LLC (the SH 130 Concession), a private concessionaire, pursuant to a 52-year concession agreement executed in 2007. TxDOT provides a common transponder tag (TxTag) for all of these toll facilities and also provides back office services to the concessionaire.

The major non-tolled routes in the Austin area which act as either feeder or competing routes with the CTTS elements include: IH-35, US 183 (Bell Boulevard/Research Boulevard), FM 734 (Parmer Lane/Ronald Reagan Boulevard), County Route 30 (Gattis School Road), US 79 (Palm Valley Boulevard), FM 1431 (Whitestone Boulevard) and FM 973. In some cases, one of these roads can be a feeder to one CTTS element and a competing route for a different CTTS element.

The latest available plans for proposed toll road projects were obtained from CTRMA and TxDOT. For other roadway projects, Stantec used the Capital Area Metropolitan Planning Organization (CAMPO) 2040 Regional Transportation Plan (RTP), adopted May 11, 2015, along with amendments in September of 2015. Based on the degree of commitment (feasibility studies, funding, ROW status, and program inclusion) and status updates following the RTP update, judgments were made as to whether or not to include projects in the future highway networks. Assumptions regarding future key network improvements reflect the most current information available and were reviewed and approved by TxDOT at the time of this study.

Existing Travel Patterns (Chapter 3)

For the 2018 Study, traffic counts were recorded at over 230 locations along a series of screenlines and other key locations in the Austin region and on competing and feeder routes. Additional data sources included approximately 480 counts from recent CTRMA studies, about 150 counts along the IH-35 corridor, data collected during prior studies for the CTTS projects, as well as data obtained through the TxDOT traffic database. The TxDOT database contributed 2,922 Annual Average Daily Traffic (AADT) counts from the TxDOT 2015 count maps, 154 classification counts from TxDOT's truck count program, and 247 counts from the TxDOT Automatic Traffic Recorder (ATR) & Vehicle Classification (VC) count databases. Stantec also obtained transaction data for all toll roads that were in operation in 2017. While there was some overlap in the actual count locations, in total, traffic count data was available for 4,673 highway links for purposes of model calibration including 397 counts that were detailed vehicle classification counts used to quantify truck volumes.

Travel time and speed data were collected using both the Nokla's proprietary HERE travel time database and SigAlert's database for sections of the primary non-tolled routes that compete with the CTTS system, which include IH-35, the non-tolled section of Loop 1, US 183, FM 973, SH 360, Parmer Lane, US 79, and RM 620. HERE data for autos are obtained from a number of sources including mobile phones, vehicles, and portable navigation devices. For trucks, data are obtained from the American Transportation Research Institute leveraging embedded fleet systems.

Toll Collection (Chapter 4)

Since January 2013, TxDOT has operated the CTTS elements as cashless facilities, using only two methods of toll collection: ETC and PBM. Drivers using ETC automatically pay the toll with their TxTag or other tags covered under interoperability agreements, while drivers without a recognizable transponder have their license plate photographed at the pay points. TxDOT then mails a bill to the registered owner of the vehicle to collect payment.

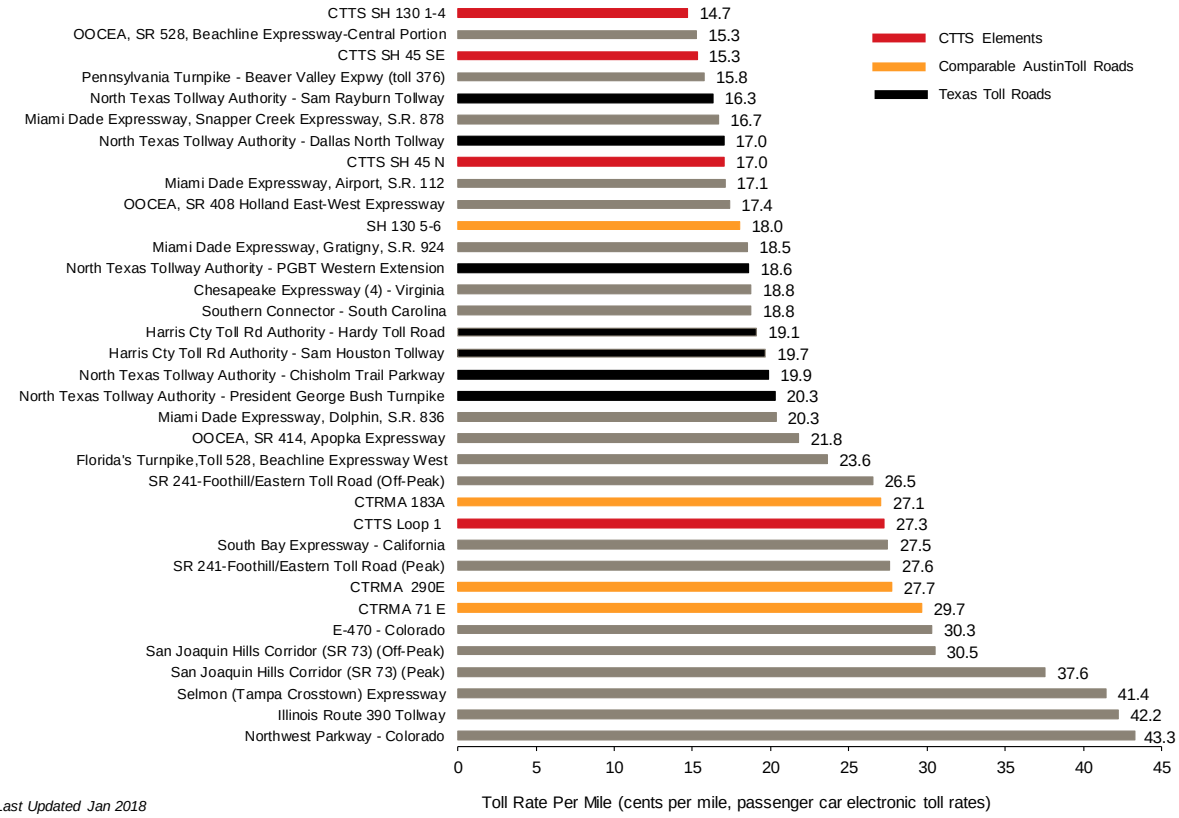
Current passenger ETC toll rates for a full-length trip on each of the CTTS elements is shown in Table ES. 1. There is a 33 percent surcharge on PBM transactions. Vehicles with more than two axles pay a higher toll based on the (n - 1) formula whereby the toll is equal to the passenger car toll times the vehicle's number of axles less one. For SH 130 and SH 45 SE, the maximum toll charge is limited to the rate for a 4-axle vehicle to encourage truck usage.

Table ES. 1 2018 Passenger Car Toll Rates on CTTS Elements

CTTS Element	Full Length Distance (miles)	Full Length Toll	Per Mile Rate
SH 45 N	12.8	$2.18	$0.17
Loop 1	4.0	$1.09	$0.27
SH 130 Segments 1 - 4	49.0	$7.20	$0.15
SH 45 SE	7.0	$1.07	$0.15

Passenger car ETC toll rates for the CTTS elements are compared to rates for similar toll roads in Figure ES. 2.

Figure ES. 2 Toll Rates per Mile on CTTS Elements and Comparable Toll Roads



Last Updated Jan 2018

The future toll rates for the CTTS facilities are based on the current toll rates in 2018, escalated annually at the annual inflation rate. This escalation policy was adopted by the Texas Transportation Commission in 2013 whereby tolls are escalated annually on January 1st based on the Toll Rate Escalation Percentage, as calculated on each Toll Escalation Determination Date. The Toll Rate Escalation Percentage is the Consumer Price Index – Urban (CPI-U) on October 1st, the Toll Escalation Determination Date of each year, based on the twelve-month period ending August 31st of the current year. Figure ES. 3 shows historical annual CPI-U growth trends and the forecasted trend used for the 2018 Study, while Table ES. 2 shows, in detail, the recent and projected annual CPI-U growth rates used for developing future toll rates for the 2018 Study. For the 27-year period, from 1990 to the present, the average annual growth rate is calculated to be 2.4 percent. For the 37-year period from 1980 to the present, the average annual growth rate is greater, at 3.0 percent.

Figure ES. 3 Annual Consumer Price Index - Historical and Projected

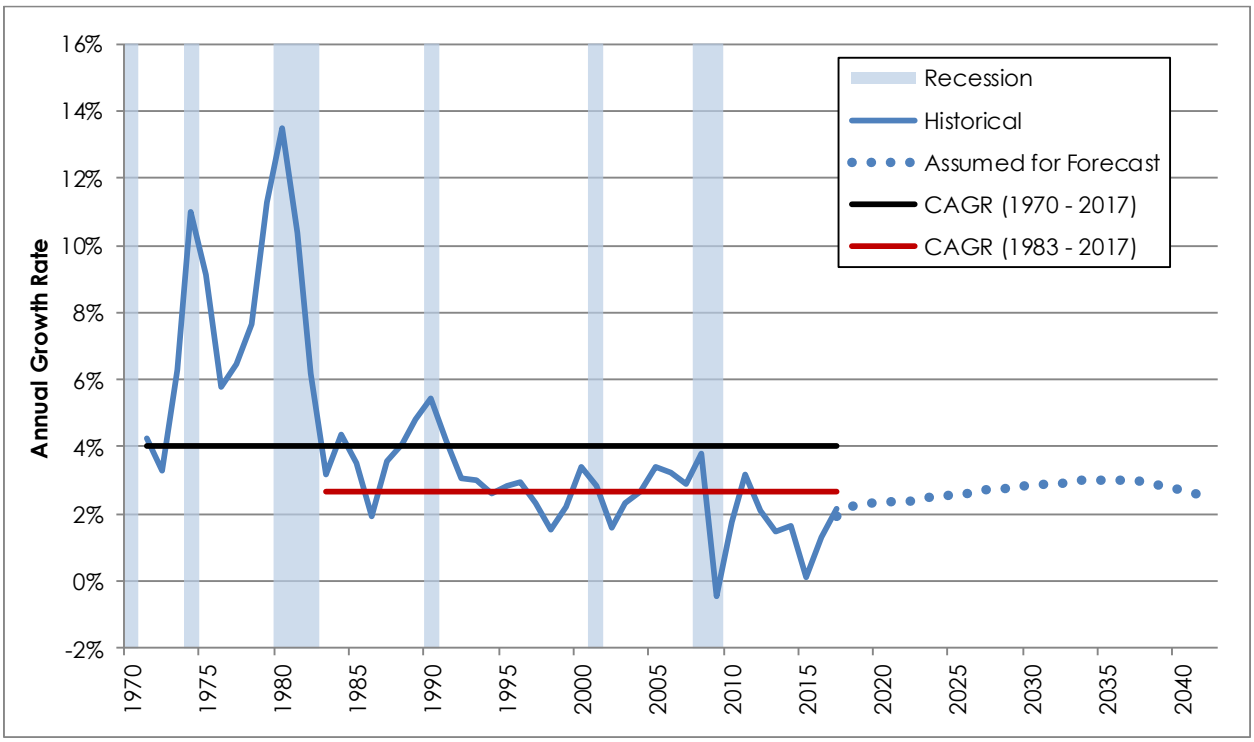


Table ES. 2 Annual Toll Escalation – Recent and Projected

Year	Annual Escalation
2014 (Aug 2012 - Aug 2013)	1.5%
2015 (Aug 2013 - Aug 2014)	1.7%
2016 (Aug 2014 - Aug 2015)	0.2%
2017 (Aug 2015 - Aug 2016)	1.1%
2018 (Aug 2016 - Aug 2017)	1.9%
2019	2.2%
2020	2.3%
2021	2.3%
2022	2.4%
2023	2.4%
2024	2.5%
2025	2.5%
2026	2.6%
2027	2.6%
2028	2.7%
2029	2.7%
2030	2.8%
2031	2.8%
2032	2.9%
2033	2.9%
2034	3.0%
2035	3.0%
2036	3.0%
2037	3.0%
2038	3.0%
2039	2.9%
2040	2.8%
2041	2.7%
2042	2.6%
2017 - 2042	2.7%

Socioeconomic Data (Chapter 6)

The study area included in the regional transportation model used for the CTTS traffic forecast includes six counties in the CAMPO model area (Travis, Williamson, Hayes, Bastrop, Caldwell, and Burnet) and five counties in the Alamo Area Metropolitan Planning Organization (AAMPO) model area (Bexar, Guadalupe, Comal, Wilson, and Kendall).

Starting with the estimated population for 2016, growth is anticipated to taper down from the annual average rate of 2.6 percent between 2010 and 2016 to 2.0 percent between 2016 and 2020. After that, it continues to slow down, reaching an annual growth rate of 1.8 percent between 2020 and 2030, and 1.7 percent between 2030 and 2040. The forecast of future population and average annual growth rate for the eleven counties are presented in Table ES. 3.

Table ES. 3 Population Forecast for the Study Area, 2016 – 2040

Region	County	Population Control Totals			
		2016	2020	2030	2040
CAMPO	Bastrop	81,710	88,109	105,696	125,672
	Burnet	45,182	46,683	51,639	55,412
	Caldwell	39,848	43,480	50,339	57,616
	Hays	205,074	231,129	295,569	399,673
	Travis	1,204,220	1,314,093	1,563,432	1,801,138
	Williamson	526,718	583,417	757,309	984,479
	Total	2,102,752	2,306,911	2,823,984	3,423,990
AAMPO	Bexar	1,928,696	2,045,074	2,351,596	2,678,541
	Comal	134,782	147,364	183,147	225,827
	Guadalupe	155,264	170,618	217,790	271,000
	Kendall	42,542	47,586	60,288	73,221
	Wilson	48,481	51,684	60,348	71,589
	Total	2,309,765	2,462,326	2,873,169	3,320,178
Study Area Total		**4,412,517**	**4,769,237**	**5,697,153**	**6,744,168**
Region	**County**	**Growth Rates**			
		2016	**2020**	**2030**	**2040**
CAMPO	Bastrop		1.9%	1.8%	1.7%
	Burnet		0.8%	1.0%	0.7%
	Caldwell		2.2%	1.5%	1.4%
	Hays		3.0%	2.5%	3.1%
	Travis		2.2%	1.8%	1.4%
	Williamson		2.6%	2.6%	2.7%
	Total		2.3%	2.0%	1.9%
AAMPO	Bexar		1.5%	1.4%	1.3%
	Comal		2.3%	2.2%	2.1%
	Guadalupe		2.4%	2.5%	2.2%
	Kendall		2.8%	2.4%	2.0%
	Wilson		1.6%	1.6%	1.7%
	Total		1.6%	1.6%	1.5%
Study Area Total			**2.0%**	**1.8%**	**1.7%**

Employment growth is anticipated to taper down from the rate of 2.1 percent between 2016 and 2020 to 1.8 percent between 2020 and 2030. After that, growth continues to slow down, reaching an annual growth rate of 1.6 percent between 2030 and 2040. The forecast of future employment for the eleven counties is presented in Table ES. 4.

Table ES. 4 Employment Forecast for the Study Area, 2016 – 2040

Region	County	Employment Control Totals			
		2016	2020	2030	2040
CAMPO	Bastrop	18,855	20,352	25,446	32,732
	Burnet	13,184	14,880	18,135	22,099
	Caldwell	8,579	9,285	11,517	14,561
	Hays	63,683	73,095	98,021	124,711
	Travis	704,707	762,715	883,257	991,374
	Williamson	156,834	176,480	225,362	281,677
	Total	965,842	1,056,807	1,261,738	1,467,154
AAMPO	Bexar	841,664	905,194	1,060,224	1,231,801
	Comal	53,131	60,328	82,300	107,492
	Guadalupe	38,631	43,281	56,050	69,948
	Kendall	14,873	16,980	22,744	29,053
	Wilson	7,636	8,342	10,154	12,028
	Total	955,935	1,034,125	1,231,472	1,450,322
Study Area Total		**1,921,777**	**2,090,932**	**2,493,210**	**2,917,476**

Region	County	Growth Rates			
		2016	2020	2030	2040
CAMPO	Bastrop		1.9%	2.3%	2.5%
	Burnet		3.1%	2.0%	2.0%
	Caldwell		2.0%	2.2%	2.4%
	Hays		3.5%	3.0%	2.4%
	Travis		2.0%	1.5%	1.2%
	Williamson		3.0%	2.5%	2.3%
	Total		2.3%	1.8%	1.5%
AAMPO	Bexar		1.8%	1.6%	1.5%
	Comal		3.2%	3.2%	2.7%
	Guadalupe		2.9%	2.6%	2.2%
	Kendall		3.4%	3.0%	2.5%
	Wilson		2.2%	2.0%	1.7%
	Total		2.0%	1.8%	1.6%
Study Area Total			**2.1%**	**1.8%**	**1.6%**

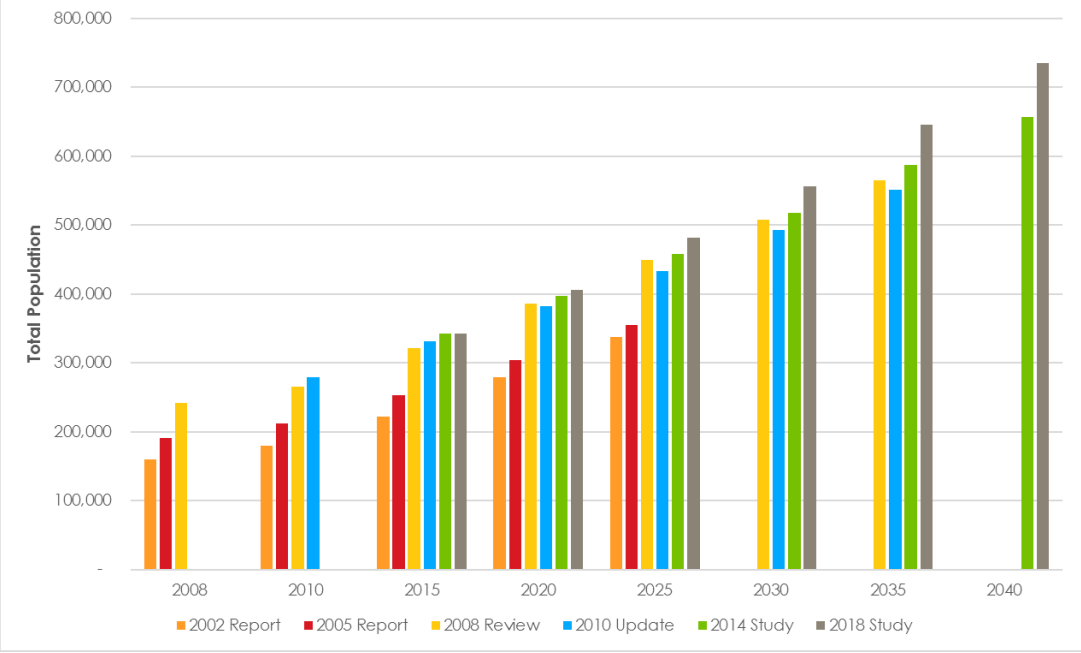
As part of Stantec's review of previous socioeconomic forecasts, Stantec compared the population and employment forecasts from all of the previous reports in the rapidly developing 'greenfield' corridor served by SH 130 Segments 1 – 4. In Table ES. 5 and Figure ES. 4, the population estimates developed for each of the CTTS forecasts prepared since the initial forecasts in 2002 are provided by horizon year. A comparison of "known" data to previous forecasts shows that the previous estimates have been consistently lower than the actual growth within the corridor. For example, the forecasted 2008 population was estimated to be 190,431 for the 2005 Report. In 2010, when the 2008 data was available for use, the population in 2008 was adjusted upwards to 241,651. The "known" data is shown in yellow in the tables below.

Table ES. 5 Comparison of SH 130 Corridor Population Forecasts

Traffic T & R Forecast Study	Population Forecast by Year							
	2008	2010	2015	2020	2025	2030	2035	2040
2002 Report	159,233	179,944	221,540	279,286	337,031			
2005 Report	190,431	212,047	252,764	303,911	355,057			
2008 Review	241,651	264,792	321,591	385,541	449,490	507,450	565,410	
2010 Update		278,729	331,458	382,188	432,918	492,174	551,430	
2014 Study			342,412	396,864	457,428	517,991	587,372	656,752
2018 Study			342,199	405,669	480,993	556,316	645,428	734,540

Source: [1] Michael Bomba, PhD.
Note: [1] Where inputs were not developed for the specific forecast year, values were interpolated using available estimates. The 2015 population estimates for the 2018 Study were interpolated using the 2010 estimates from the 2012 Update and the estimates for 2020 developed by Dr. Bomba for the 2018 Study.

Figure ES. 4 Comparison of SH 130 Corridor Population Forecasts



Source: [1] Michael Bomba, PhD.

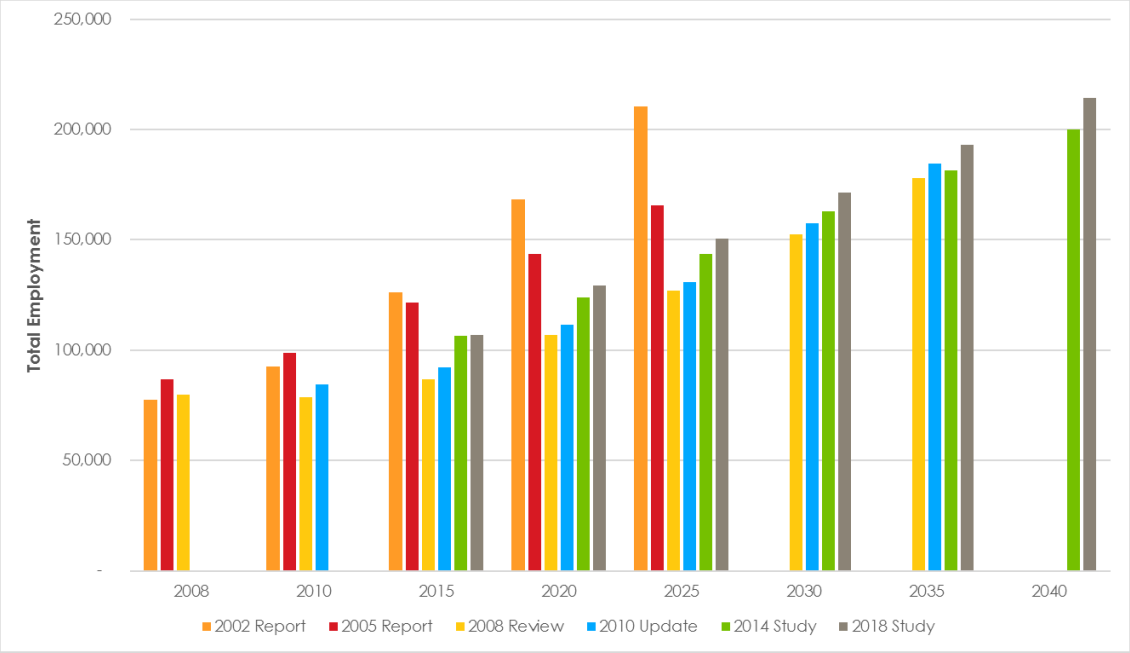
Similarly, the employment forecasts shown in Table ES. 6 and in Figure ES. 5 have been revised upwards for subsequent updates to better reflect known conditions, except for the 2008 forecasts produced in 2005 which did not account for the impending recession. The fact that forecasts are consistently adjusted upwards once data is known underscores the conservative approach taken in developing population and employment forecasts.

Table ES. 6 Comparison of SH 130 Corridor Employment Forecasts

Traffic T & R Forecast Study	Employment Forecast by Year							
	2008	2010	2015	2020	2025	2030	2035	2040
2002 Report	77,619	92,752	126,152	168,376	210,599			
2005 Report	86,866	98,637	121,764	143,660	165,555			
2008 Review	80,009	78,698	86,598	106,774	126,949	152,436	177,923	
2010 Update		84,295	92,317	111,578	130,839	157,685	184,531	
2014 Study			106,627	123,857	143,488	163,119	181,499	199,879
2018 Study			106,865	129,435	150,458	171,480	192,944	214,408

Source: [1] Michael Bomba, PhD.
Note: [1] Where inputs were not developed for the specific forecast year, values were interpolated using available estimates. The 2015 population estimates for the 2018 Study were interpolated using the 2010 estimates from the 2012 Update and the estimates for 2020 developed by Dr. Bomba for the 2018 Study.

Figure ES. 5 Comparison of SH 130 Corridor Employment Forecasts



Source: [1] Michael Bomba, PhD.

Model Validation and Refinement (Chapter 7)

In preparing estimates of traffic and toll revenue for the CTTS elements, it was necessary to update the travel demand modeling process to reflect growth in the Austin region and the expansion of the toll road system. The model development effort included combining the CAMPO and the Alamo Area Metropolitan Planning Organization (AAMPO) models to include the areas encompassed by both the Austin and San Antonio regions.

The new model utilized the existing toll diversion process as the basis for estimating tolled traffic. For the 2016 model calibration year, the temporary discounts for trucks using SH 130 and SH 45 SE were included since the discounts were applicable for eight months of that year. Several adjustments to the existing procedures were implemented as part of the development process. As an initial step, the value of time for each purpose was adjusted to reflect the increase in household incomes for the current calibration year 2016. Two payment methods are currently available, ETC and PBM. For the PBM market segment, the relevant surcharge was applied to the base toll at each pay point, and the positive bias term associated with transponder payments was also applied since these trips have the convenience of not needing to stop to pay tolls as they would if paying by cash. In addition, the diversion model was modified to permit toll choice to occur where time savings were minimal or negative based on the observed 2016 ETC transaction data. Under the revised model, toll choice is permitted for paths where the toll path is up to two minutes longer than the non-toll path. The diversion model transitions the estimated choice shares towards zero as the time savings approaches the minimum permitted value to ensure that the toll traffic and revenue stream has a lower contribution from trips with minimal or negative time savings. Lastly, since the individual toll facilities have now been in operation for more than five years, a general bias against toll roads by those trips that have the highest frequency or are work related are not incorporated into the choice evaluation. These travelers, due to their frequency of travel, are now assumed to elect to use or avoid the toll road based strictly on the time savings and associated costs.

Based on data collected from field studies, toll road records, and model output, the model was calibrated to ensure that the modeling process adequately replicates both the observed traffic volumes and the observed speeds by time-of-day for each of the project corridors. The calibration was also structured to replicate the observed traffic and transactions by payment method to the extent feasible for each toll road by pay point.

To develop toll elasticity curves for the 2018 Study, the transportation model was run using a range of toll values above and below the existing toll rates for the 2016 calibration year, as well as with the future toll rates and networks for the year 2030. These elasticity estimates for each year are a function of both the overall travel demand and network conditions, in terms of competing roadways and congestion that exist for both years. For this analysis, a number of alternative toll rates were expressed as multiples of the base tolls. The multiples range from 0.25 to 6.0 and reveal how traffic and revenues change at different toll levels. The results were plotted for the four facilities as shown in Figure ES. 6 through Figure ES. 9. The transactions and revenues for 2016 are shown in solid lines while the dashed lines represent the same values in 2030 horizon year.

Figure ES. 6 Toll Sensitivity – SH 130

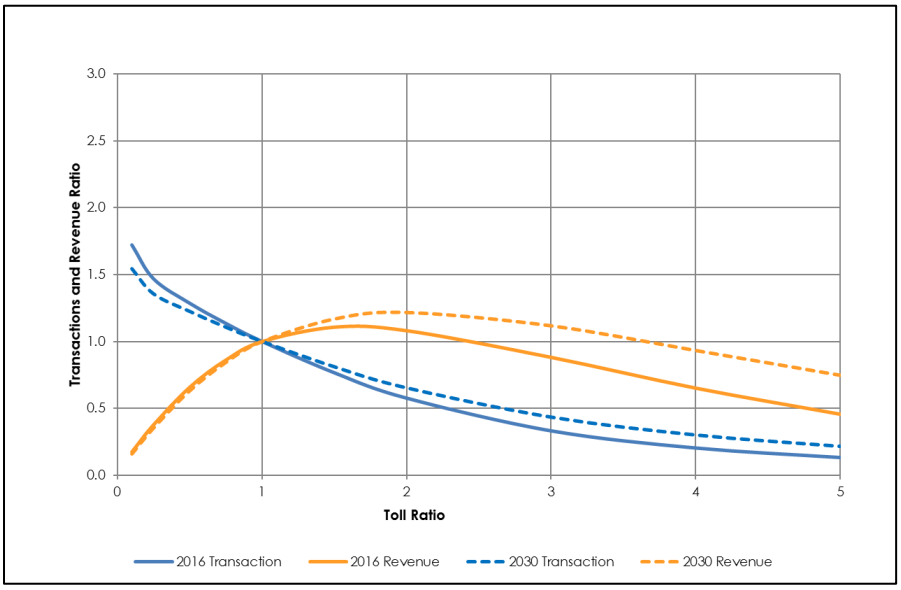


Figure ES. 7 Toll Sensitivity – SH 45 N

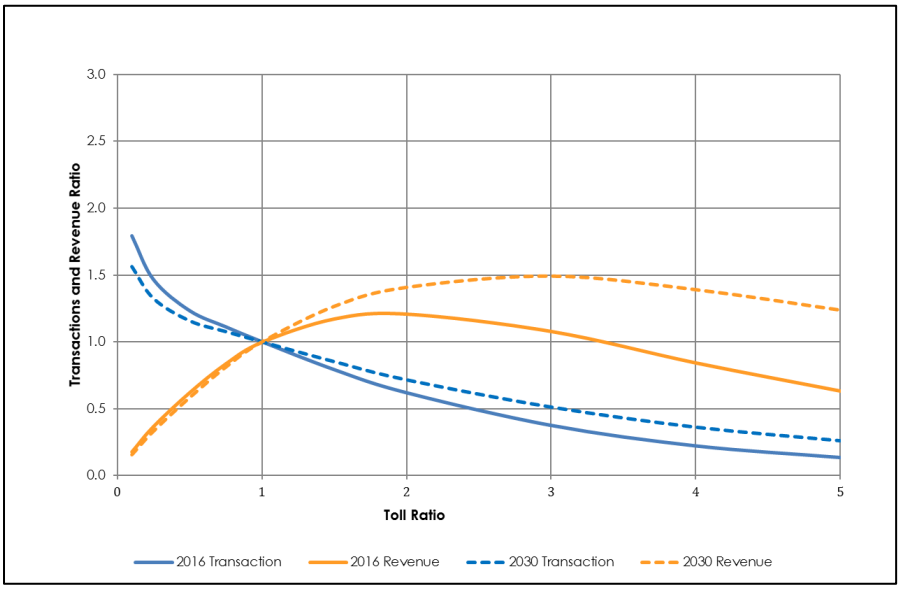


Figure ES. 8 Toll Sensitivity – Loop 1

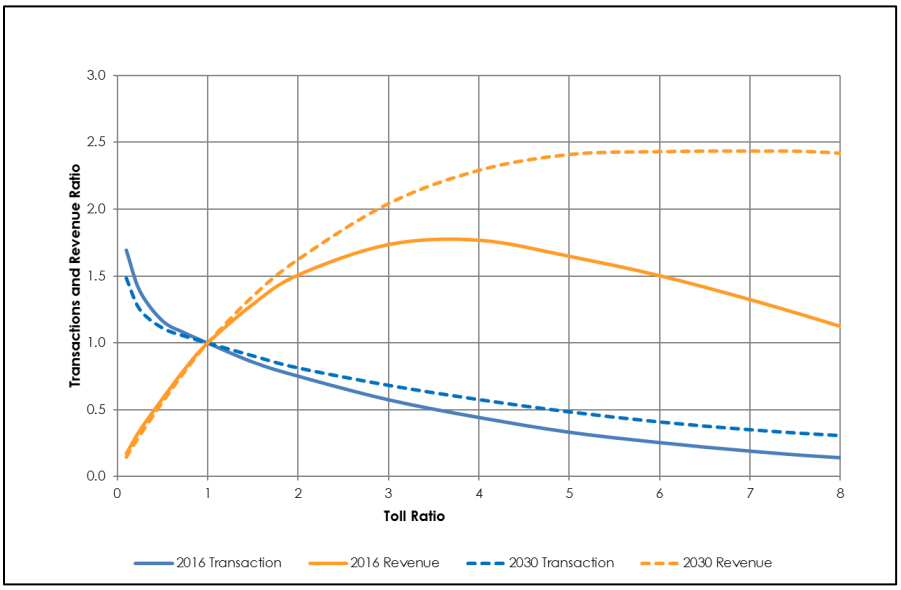
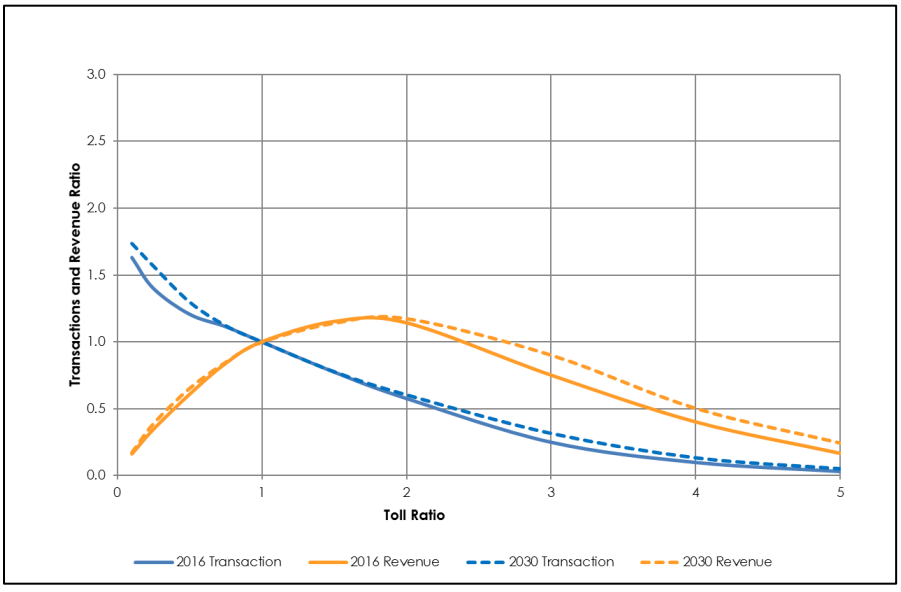


Figure ES. 9 Toll Sensitivity – SH 45 SE



For the future year 2030 conditions, the elasticity values decline indicating that the roadways become less elastic, primarily due to increasing congestion on the competing roadways as a result of on-going development and growth in traffic. Loop 1 has the lowest elasticity, while SH 130 has a much higher elasticity. The inelasticity of Loop 1 can be attributed primarily to the level of congestion on the competing roads, such as US 183, Parmer Lane, and IH-35.

Traffic & Revenue Forecasts (Chapter 8)

Stantec developed traffic and toll revenue forecasts for each of the CTTS elements based on the travel demand model which incorporated future year network assumptions and revised socioeconomic forecasts. The travel demand modeling process, including the application of the individual MPO models and the toll diversion model, were applied to selected horizon years (2018 to 2025, 2030, and 2040) to create annual traffic estimates from FY 2018 to FY 2042. Model years other than 2020, 2030, and 2040 were used to estimate the impact of key toll facility network improvements such as MoPac N Express Lanes (2017), SH 71 E (2017), 183S toll road (2019 to 2020), 290E Phase III (2021), SH 130 widening (2021), 183N Express Lanes (2024), and MoPac S Express Lanes (2024). Intermediate year estimates were developed via interpolation techniques and the years beyond 2040 were estimated via extrapolation.

Stantec reviewed the model-based forecasts, summarized the estimated traffic for each of the corridor screenlines and reviewed the detailed schematic diagrams for each horizon year. To prepare the final transactions and revenue streams by vehicle type and payment type, the model-based forecasts were reviewed and adjusted as necessary to account for any unacceptable model variation. Transaction and revenue streams prepared for each CTTS roadway include the key metrics related to payment type and vehicle type, along with both average weekday and annual estimates for total transactions and paying transactions using collection efficiency statistics provided by TxDOT. These statistics reflect TxDOT's current collection trends over the latest full fiscal year (FY 2016) for which adequate aging of PBM invoices is available.

The estimates of traffic and toll revenue presented in this report are based on certain tolling and traffic assumptions for each CTTS element derived from observed traffic conditions. Estimates also take into account future toll road assumptions, as well as local and national conditions. Assumptions for future years are based on discussions with TxDOT and local government agencies, as well as Stantec's professional judgment. The 2018 base case assumptions are summarized in Table ES. 7.

Table ES. 7 Summary of Tolling and Traffic Characteristic Assumptions: Base Case – 2018

Assumptions Related to	Element			
	SH 45 N	Loop 1	SH 130	SH 45 SE
Vehicle Type Distribution				
Autos	97.0%	98.3%	90.0%	89.4%
Trucks	3.0%	1.7%	10.0%	10.6%
Payment Type Distribution - Passenger Cars				
PBM	27.7%	27.8%	37.2%	31.6%
ETC	72.3%	72.2%	62.8%	68.4%
Payment Type Distribution - Trucks				
PBM	27.7%	31.0%	39.6%	47.6%
ETC	72.3%	69.0%	60.4%	52.4%
Toll Ratios				
Truck/Auto Ratio - ETC	2.86	2.79	2.72	2.75
Truck/Auto Ratio - PBM	2.98	3.00	2.79	2.80
PBM/ETC Toll Rate	1.33	1.33	1.33	1.33
Collection Rates				
PBM	51.1%	51.1%	51.1%	51.1%
ETC	99.3%	99.3%	99.3%	99.3%
Full Length Trip				
Distance	12.8	4.0	49.0	7.0
Rate per Mile	$0.17	$0.27	$0.15	$0.15
Toll Cost (ETC)	$2.18	$1.09	$7.20	$1.07
Annualization Factor	320	320	325	325

The forecasts prepared for the 2014 Study and the 2018 Study are shown in Table ES. 8. Average weekday paying transactions for FY 2016 and FY 2017 were 5 and 7 percent higher than forecasted in the 2014 Study. In the 2018 Study, the system-wide value of paying transactions is approximately 8 percent higher in the early years of the forecast due primarily to the higher level of recent growth in both SH 130 and SH 45 SE. The difference in paying transactions does decrease to about 2 percent by FY 2030 and generally is about 3 to 8 percent higher thereafter to 2042. In contrast, revenue is approximately 9 percent higher in FY 2018 and then gradually declines to equal the values from the 2014 Study by FY 2028. This gradual decline towards the prior forecast values is due to several changes in the forecasting assumptions from the conditions used in the prior forecasts.

These changes include:

- Lower toll escalation rates in the early forecast years;
- Lower share of ETC transactions;
- Lower annualization factors on both SH 130 and SH 45 SE; and
- Reduced share of SH 130 truck traffic.

Table ES. 8 Comparison of 2014 and 2018 CTTS Transaction and Toll Revenue Forecasts

Fiscal Year	Average Weekday Paying Transactions			Annual Toll Revenue (in $000s)		
	2014 Study	2018 Study	% Difference	2014 Study	2018 Study	% Difference
2008	*186,366*	*186,366*	0%	***$48,906***	***$48,906***	0%
2009	*204,433*	*204,433*	0%	***$58,914***	***$58,914***	0%
2010	*217,953*	*217,953*	0%	***$66,144***	***$66,144***	0%
2011	*228,905*	*228,905*	0%	***$68,822***	***$68,822***	0%
2012	*246,593*	*246,593*	0%	***$75,695***	***$75,695***	0%
2013	*266,619*	*266,619*	0%	***$103,985***	***$103,985***	0%
2014	*278,516*	*278,516*	0%	***$125,163***	***$125,163***	0%
2015	320,983	*323,450*	1%	$140,665	***$151,630***	8%
2016	339,503	*357,930*	5%	$152,900	***$170,657***	12%
2017	356,732	*383,178*	7%	$165,020	***$184,818***	12%
2018	373,638	403,177	8%	$177,330	$192,455	9%
2019	389,942	422,226	8%	$189,621	$207,500	9%
2020	405,435	432,317	7%	$201,669	$216,186	7%
2021	419,040	450,649	8%	$213,939	$231,650	8%
2022	431,900	466,328	8%	$226,707	$245,561	8%
2023	444,839	479,314	8%	$240,119	$258,008	7%
2024	457,859	486,675	6%	$254,159	$268,295	6%
2025	470,965	494,437	5%	$268,800	$278,222	4%
2026	484,160	505,009	4%	$284,637	$290,828	2%
2027	497,445	516,054	4%	$301,477	$304,835	1%
2028	510,823	527,100	3%	$319,104	$319,387	0%
2029	524,295	538,144	3%	$337,549	$334,501	-1%
2030	537,863	549,189	2%	$356,850	$350,198	-2%
2031	549,931	563,585	2%	$376,822	$369,246	-2%
2032	561,271	579,655	3%	$397,611	$390,429	-2%
2033	572,670	595,725	4%	$419,370	$412,471	-2%
2034	584,130	611,796	5%	$442,139	$435,403	-2%
2035	595,651	627,866	5%	$465,962	$459,255	-1%
2036	607,234	643,937	6%	$490,885	$484,064	-1%
2037	618,881	660,007	7%	$516,956	$509,858	-1%
2038	630,592	676,079	7%	$544,224	$536,675	-1%
2039	642,369	692,149	8%	$572,739	$564,553	-1%
2040	654,212	708,219	8%	$602,557	$593,526	-1%
2041	665,668	721,859	8%	$632,448	$622,777	-2%
2042	676,943	734,300	8%	$662,988	$652,787	-2%
FY 18-42 Total	13,307,756	14,085,796	6%	$9,496,662	$9,528,670	0%

Notes: (1) SH 45 SE opened in May 2009 but did not become part of the CTTS until September 2012; therefore, it is not included in CTTS totals until FY 2013.
(2) Revenue includes PBM surcharge (33 percent of ETC toll).
(3) ***Actual Annual Revenue (may not equal the sum of values shown for each facility due to rounding)***

Sensitivity Analysis (Chapter 9)

In addition to the assumptions used for the base case, a broad range of alternative assumptions could be used in preparing the traffic and revenue for the CTTS elements. For the 2018 Study, three sensitivity trials were run to assess the impacts of the following changes to the forecasts:

- Reduced CPI growth: 0.25 percent lower than the base case;
- Reduced trip growth: 20 percent less than the base case; and
- Reduced Value of Time: 10 percent less than the base case.

Average weekday toll revenues for each sensitivity trial and the corresponding percent change in toll revenue when compared to the base case are provided in Table ES. 9.

Table ES. 9 Average Weekday Revenue Comparison for the Sensitivity Trials

Model Year	Average Weekday Toll Revenue						
	Base Revenue	Sensitivity 1 (Reduced CPI)		Sensitivity 2 (Reduced Growth)		Sensitivity 3 (Reduced VOT)	
		Revenue	% Difference	Revenue	% Difference	Revenue	% Difference
2020	$696,817	$691,770	-0.7%	$675,476	-3.1%	$663,120	-4.8%
2030	$1,144,145	$1,107,979	-3.2%	$1,051,352	-8.1%	$1,098,072	-4.0%
2040	$2,009,355	$1,900,854	-5.4%	$1,803,465	-10.2%	$1,957,864	-2.6%

1.0 INTRODUCTION

Acting as Traffic Consultant to the Texas Transportation Commission under the Indenture of Trust dated July 15, 2002, as amended and supplemented, Stantec Consulting Services Inc. (Stantec) prepared this comprehensive Level 2+ Study. The study includes projections of traffic and toll revenues through 2042 for the Central Texas Turnpike System (CTTS) in the Austin area. The CTTS is owned by the Texas Transportation Commission, which is the governing body of the Texas Department of Transportation (TxDOT) and is operated by TxDOT. The CTTS comprises four tolled elements - SH 45 N, Loop 1, SH 130 (Segments 1 – 4), and SH 45 SE.

1.1 CENTRAL TEXAS TURNPIKE SYSTEM

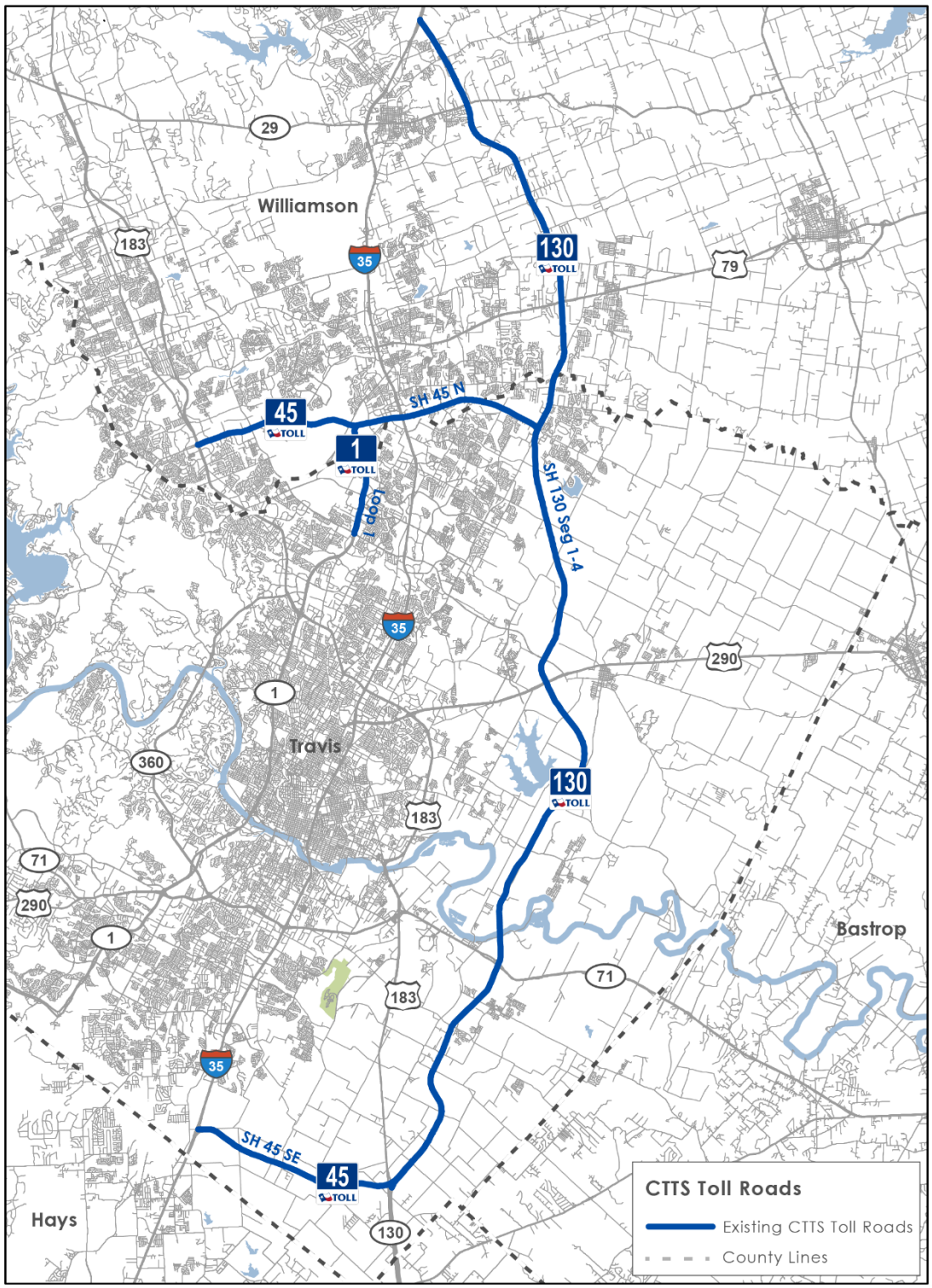
The CTTS is a 72.8-mile turnpike system in the Austin area with four existing elements:

- SH 45 N extends from US 183 east to SH 130 (12.8 miles);
- Loop 1 extends from SH 45 N south to Parmer Lane (4 miles);
- SH 130 (Segments 1 - 4) extends from IH-35 in Georgetown south to US 183/SH 45 SE south of the Austin-Bergstrom International Airport (49 miles); and
- SH 45 SE extends from US 183/SH 130 west to IH-35 (7 miles).

SH 45 N, Loop 1, and SH 130 opened in segments starting in late 2006 and tolling commenced in January of 2007. SH 45 SE opened in May 2009 and became part of the CTTS in September 2012. The CTTS serves both commuter and through traffic in the Austin area. The CTTS elements in the Austin area are shown in Figure 1.1.

On each of the CTTS elements, toll collection is by Electronic Toll Collection (ETC) and Pay by Mail (PBM), whereby the patron is billed after the trip based on the identification of the vehicle's license plate. Cash collection was an option on SH 45 N, Loop 1, and SH 130 until being discontinued on January 1, 2013.

Figure 1.1 CTTS Toll Roads and Study Area



1.2 STUDY PURPOSE, METHODOLOGY, AND HISTORY

The purpose of this study is to provide an update to the traffic and revenue forecasts prepared previously in 2014 in connection with a prior bond financing of the CTTS. The projections presented in this report have taken into account: historical traffic and toll revenue performance; toll structure; economic, population, employment and other demographic forecasts in the Austin/San Antonio metropolitan areas; traffic capacities of the roadway network in the region; and current and programmed construction activities on the regional toll roads (CTTS, Central Texas Regional Mobility Authority (CTRMA) and SH 130 Concession Company LLC (the SH 130 Concession)) and the non-toll highway network in the region.

The transportation model used for the forecasting process was developed by Stantec for the CTTS based on the model developed by the Capital Area Metropolitan Planning Organization (CAMPO) and supplemented by an extension to the south to include the San Antonio region. The modeled area within the San Antonio region was obtained from the regional model prepared by the Alamo Area Metropolitan Planning Organization (AAMPO).

Previous studies for the CTTS prepared by Stantec staff date back to 2002 for the original financing of the system. At that time, there were no toll roads in Austin. After CTTS opened to traffic and was expanded, updated studies were prepared in 2005, 2008, 2010, 2012, and most recently, in 2014. These studies, including the current study, and the terms used to reference them in this report are shown in Table 1.1.

Table 1.1 CTTS Traffic & Revenue Studies

Date	Report Title	Reference Used Herein[1]
July 22, 2002	Central Texas Turnpike System 2002 Project Traffic and Revenue Forecast	2002 Report
December 8, 2005	Central Texas Turnpike System 2002 Project Traffic and Revenue Forecast, 2005 Update	2005 Report
February 11, 2009	Central Texas Turnpike System 2008 Project Review	2008 Review
December 20, 2010	Central Texas Turnpike System 2010 Project Traffic and Revenue Forecast	2010 Update
September 20, 2012	Central Texas Turnpike System 2012 Project Traffic and Revenue Forecast	2012 Update
December 30, 2014	Central Texas Turnpike System 2014 Traffic and Revenue Study	2014 Study
February 28, 2018	Central Texas Turnpike System 2018 Traffic and Revenue Study	2018 Study

Notes: (1) The 2002 Report, 2005 Report, 2008 Review, 2010 Update, 2012 Update, and 2014 Study are all collectively referred to as "the previous reports".

1.3 ORGANIZATION OF THE REPORT

The remainder of this report is organized in the following chapters:

Chapter 2 – Regional Transportation Network. This chapter describes the CTTS, other toll roads, and the non-toll highway system in the Austin area and proposed key network improvements.

Chapter 3 – Existing Travel Patterns. This chapter presents a summary of traffic counts, travel time data and other information used in developing the forecasts and discusses travel patterns in the area.

Chapter 4 – Toll Collection. This chapter presents the methods of toll collection and toll rates on the CTTS system and future toll policy.

Chapter 5 – Historical CTTS Toll Transactions and Revenue. This chapter presents the history of toll road traffic performance in terms of number and type of transactions, payment type, and daily and seasonal traffic activity. This chapter also presents historical toll revenues for the CTTS elements.

Chapter 6 – Socioeconomic Review. This chapter describes historical trends as well as existing and forecasted socioeconomic conditions, and the assumptions used to assess future development in the CTTS study area.

Chapter 7 – Model Validation and Refinement. This chapter explains the methodology used to produce travel demand forecasts for the CTTS study area, based upon Stantec's integrated model developed from the CAMPO and AAMPO models. The toll diversion model developed by Stantec staff and the results of the model validation are also described.

Chapter 8 – Traffic and Revenue Forecasts. This chapter presents updates to the 35-year forecasts of traffic and revenue for each of the CTTS elements and summarizes the assumptions and conditions used in preparing the forecasts. Also included is an allocation process for preparing monthly forecasts of transactions and toll revenue.

Chapter 9 – Sensitivities. This chapter shows the changes in the traffic and revenue forecast using different underlying parameters, such as value of time or roadway development timing.

1.4 CONSULTANT TEAM

Stantec, founded in 1954, provides professional consulting services in planning, engineering, architecture, interior design, landscape architecture, surveying, environmental sciences, project management, and project economics for infrastructure and facilities projects, including studies within the Austin area for more than 15 years. Stantec supports public and private sector clients in a diverse range of markets, at every stage, from initial concept and financial feasibility to project completion and beyond. Stantec services are offered through approximately 22,000 employees operating out of more than 400 locations on 6 continents. Stantec trades on the New York Stock Exchange and on the Toronto Stock Exchange under the symbol STN.

Stantec has prepared traffic and revenue financing studies that have been the basis for the sale of more than $42 billion in revenue bonds. Drawing upon a depth in transportation planning and over 35 years of experience in the toll facility industry, Stantec staff advises clients on establishing screening criteria for potential toll facility corridors, completing investment-grade traffic and revenue analyses, developing financial plans and appropriate toll structures, determining the extent to which a proposed toll facility could provide financing for itself and/or other highway projects, maximizing revenue potential, planning and designing for the future, and solving operational problems.

Stantec led the team for the 2018 Study and was responsible for project management, coordination, model development and forecasting traffic and revenues for the CTTS. Stantec staff prepared the current report as well as all prior studies and updates.

Three firms assisted in the preparation of this study. These firms were involved in previous traffic and revenue studies for CTTS. They are:

- Michael S. Bomba., PhD., (Dr. Bomba) provided the socioeconomic review and employment and population projections used in the traffic model. Income projections for the future year were also provided.
- Ally General Solutions, LLC (AGS) provided traffic counts for non-toll locations within the study area.
- Alliance Transportation Group (ATG) provided local engineering support in identifying regional highway network improvements.

2.0 REGIONAL TRANSPORTATION NETWORK

The regional transportation network in the Austin area consists of tolled and non-tolled roads. Toll roads in the Austin area, in addition to the CTTS toll roads owned and operated by TxDOT, include 183A, 290E, MoPac North (MoPac N) Express Lanes, and SH 71 E Express Lanes owned and operated by Central Texas Regional Mobility Authority (CTRMA) and SH 130 Segments 5 & 6 south of Austin. SH 130 Segments 5 & 6 was financed, constructed, and is operated by SH 130 Concession Company, LLC (the SH 130 Concession), a private concessionaire, pursuant to a 52-year concession agreement executed in 2007. TxDOT provides a common transponder tag (TxTag) for all of these toll facilities and also provides back office services to the concessionaire. The existing toll road network in the Austin area is shown in Figure 2.1. This chapter includes a description of the existing network and the proposed key network improvements.

2.1 CTTS

The CTTS is a 72.8-mile toll road system in the Austin metropolitan area comprised of four elements: SH 45 N, Loop 1, SH 130 (Segments 1 – 4) and SH 45 SE. SH 130 opened in phases between 2006 and 2008; Loop 1 and SH 45 N East, the portion east of Loop 1, opened in 2006 and SH 45 N West, the portion west of Loop 1, opened in 2007. SH 45 SE opened in May 2009 and became part of the CTTS in September 2012. Since the CTTS elements were the first toll roads in the Austin area, the roads opened with reduced rate tolls or toll-free. Tolls were gradually introduced as the public became more familiar with the advantages of using the toll facilities. Toll payment on all CTTS elements is by ETC or PBM; there are no operational cash toll booths. A chronology of major events for the CTTS elements is shown in Table 2.1.

SH 45 N is an east-west route located in southern Williamson and northern Travis counties, northeast of Austin. The 12.8-mile toll road extends from US 183 eastward to SH 130. SH 45 N connects with the north/south routes SH 130, IH-35, Loop 1, and US 183/183A. The western section serves commuter traffic from central Austin to the northern and western suburbs as well as several shopping areas and through traffic. The eastern section serves the northeast suburbs of Austin and through traffic.

The eastern portion of SH 45 N was opened to traffic in November 2006 and the remaining western portion was completed and opened in spring 2007. The O'Connor Drive interchange opened to traffic on August 21, 2014. The road has three main lanes plus three frontage road lanes in each direction, except for one section which has two main lanes in each direction from SH 130 to west of Heatherwilde Boulevard in the westbound direction and from west of A.W. Grimes Boulevard to SH 130 in the eastbound direction. Frontage roads are parallel to the mainline both east and west of the Loop 1 interchange; however, they are not continuous through the Loop 1 interchange and at the east end of SH 45 N. Direct access and egress is provided for certain movements to and from local streets, while others require frontage road connections. There are two mainline pay points and gantries on ramps serving seven interchanges on SH 45 N.

Figure 2.1 Existing CTTS and Other Toll Roads in Study Area

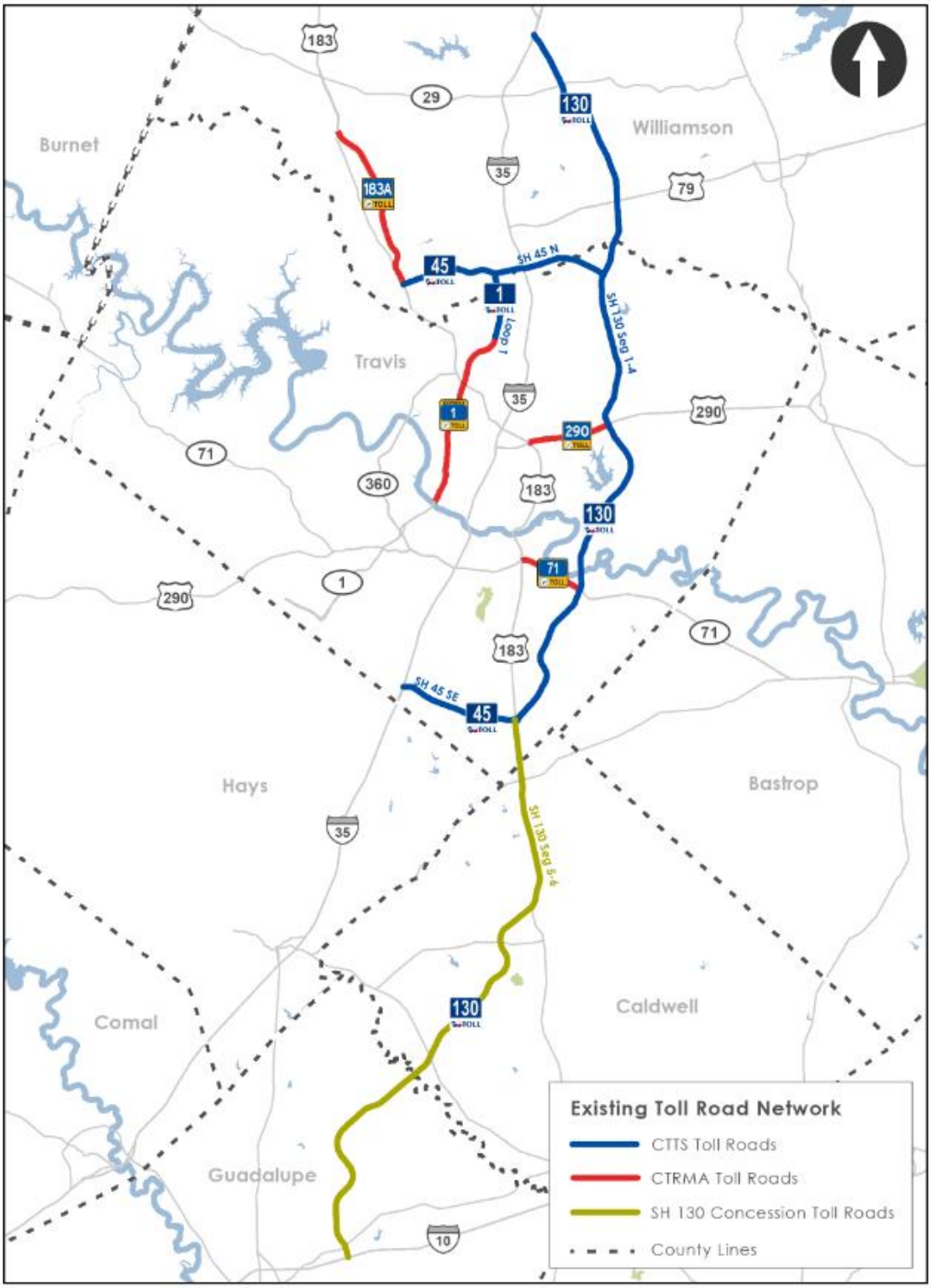


Table 2.1 Chronology of CTTS Events

Date	Event
October 2006	Loop 1, SH 45 N East and SH 130 Segment 2 open toll free
December 2006	SH 130 Segment 1 opens toll free
January 2007	Begin tolling - cash tolls full rate and ETC toll free for all open toll facilities
January 2007	PBM pilot program established
February 2007	Cash tolls full rate and ETC half rate for all open facilities
March 2007	Full rate tolls for all open facilities
August 2007	SH 45 N West opens with full rate tolls
September 2007	SH 130 Segment 3 opens with full rate tolls
April 2008	SH 130 Segment 4 opens with full rate tolls
September 2008	SH 45 N Heatherwilde Boulevard ramps open with full rate tolls
May 2009	SH 45 SE opens as TxDOT toll road; ETC toll free, PBM full rate, no cash tolls (shape-based rates)
June 2009	SH 45 SE ETC half rate and PBM full rate
July 2009	SH 45 SE full rate tolls
March 2011	Truck tolls discounted (capped at 4-Axle rate) on SH 130 & SH 45 SE
2011	Signalization improvements on SH 45 N frontage road at A.W. Grimes Boulevard
Sept/Oct 2011	Speed limits changed from 70 mph to 75 mph on SH 45 N; from 65/70 to 75 mph on IH-35 north of Georgetown
December 2011	Truck tolls discounted (pay auto rate) on SH 130 & SH 45 SE - 1 Month Pilot Program
January 2012	SH 130 Cameron Road ramps open with full rate tolls (shape based-rates)
March 2012	Speed limits changed from 75 mph to 80 mph on SH 130 Segments 1 - 4 and SH 45 SE
August 2012	New toll escalation policy adopted
August 2012	System-wide cashless operations adopted
August 2012	January 2013 toll increases adopted
September 2012	SH 45 SE becomes part of CTTS
September 2012	PBM adopted as a permanent payment method
December 2012	Introduction of toll free program for Disabled Veterans and Medal of Honor and Purple Heart recipients paid by the State Highway Fund (SHF)
January 2013	System-wide toll increases are implemented along with cashless operations
February 2013	Truck tolls discounted (pay auto rate) on SH 130 & SH 45 SE - 1 Month Pilot Program
April - December 2013	Truck tolls discounted (pay auto rate) on SH 130 & SH 45 SE - Extended Pilot Program
April 2013	Shape-based toll rate replaced by axle-based toll rates on SH 45 SE and SH 130 Cameron Road ramps
January 2014	First toll increase based on the CPI-U following adoption of annual toll escalation policy
August 2014	Opening of SH 45 N/O'Connor Drive ramps
April - October 2016	Truck tolls discounted (pay 3-axle rate) on SH 130 & SH 45 SE - Pilot Program Phase I
November 2016 - August 2017	Truck tolls discounted (pay 2-axle rate for ETC owners) on SH 130 & SH 45 SE - Pilot Program Phase II

Loop 1 is a north-south route extending some 23 miles from SH 45N in Williamson County to SH 45 in south west Austin. The route provides a western bypass around Austin for commuter and other traffic between the northern and western suburbs and downtown Austin. The 4-mile tolled section of Loop 1 that is part of the CTTS extends southward from a connection with SH 45 N to the intersection with Parmer Lane and opened to traffic in November 2006. It serves as a connector between SH 45 N and the MoPac N Express Lanes and the non-tolled Loop 1 general purpose lanes to the south. The Loop 1 Toll Road has three lanes in each direction on the southern end and four lanes in each direction on the northern end. Access and egress is via parallel frontage roads south of Shoreline Drive. There are pay points at one mainline location and on ramps serving two interchanges.

SH 130 Segments 1 – 4 extend from IH-35 in Georgetown in Williamson County on the north side of Austin to US 183/SH 45 SE south of Austin-Bergstrom International Airport in Travis County. On its southern end, the 49-mile toll road connects with SH 45 SE, which provides access to IH-35. SH 130 also connects with SH 130 Segments 5 & 6, a toll road operated by the SH 130 Concession. The full 90-mile SH 130 toll route provides an alternate route to IH-35 and a bypass of the city of Austin for through trips. The route also serves local trips in the corridor east of Austin. There are pay points at four mainline locations and on ramps at 16 interchanges on SH 130 Segments 1 - 4.

SH 130 opened in phases between November 2006 and May 2008. The Cameron Road interchange opened to traffic in January 2012. Discontinuous frontage roads parallel the four-lane toll road.

SH 45 SE serves as a 7-mile connector for traffic between the southern end of SH 130 Segment 4 and IH-35 in Travis County south of Austin. The four-lane toll road has one mainline pay point near its western terminus and two sets of ramps with pay points at the N. Turnersville Road and FM 1625 interchanges. SH 45 SE was constructed using state highway funds and opened in May 2009 and operated by TxDOT independently of the CTTS until September 2012 when it became part of CTTS.

2.2 OTHER TOLL ROADS IN AUSTIN AREA

Other toll roads in the Austin area include 183A, 290E, MoPac N Express Lanes, and SH 71 E Express Lanes owned and operated by CTRMA and SH 130 Segments 5 & 6 financed, constructed, and operated by a concessionaire pursuant to a 52-year concession agreement executed in March 2007.

183A is a six-lane, controlled access highway approximately 11.6 miles long that functions as a central arterial through Leander and Cedar Park in Williamson County. 183A interacts with CTTS through its interchange at the western terminus of SH 45 N. The road is primarily a commuter route, but it also provides access to and egress from the northwest Austin shopping areas.

Phase I of 183A opened to traffic in March 2007 providing mainline and frontage road service from SH 45 N to just north of FM 1431. The toll road was opened with reduced rate tolls and full tolling began in July 2007. Phase II opened in April 2012 and extended the mainline toll lanes from FM 1431 to CR 276, approximately 5.1 miles. In December 2008, cash tolls were eliminated; all toll payments are either by ETC or PBM.

290E is a six-lane, controlled access highway approximately 6.2 miles in length with associated ramps, frontage roads and toll collection facilities located in the City of Austin, Travis County. Tolling is at two mainline locations and at four interchanges. Currently two phases of the final project configuration have been completed:

- *290E Phase I/Phase II Interim Milestone:* The 290E Phase I project is four tolled direct connectors and associated pavement at the US 183 interchange that provides direct access to and from 290E Project mainlines. Phase II Interim Milestone extends 290E from the direct connectors about 1.4 miles east to Chimney Hill Boulevard. This phase opened January 2013.

- *290E Phase II:* The 290E Phase II Project is an approximately 6.2-mile toll road project located along the existing US 290 corridor between US 183 and just east of SH 130. Within these limits, the corridor consists of three tolled mainline lanes and three free frontage road lanes in each direction. This phase of the project opened May 2014.

MoPac N Express Lanes are 11-mile long, variably-priced, tolled lanes in each direction between Cesar Chavez Street and Parmer Lane. Drivers can access the MoPac N Express Lanes at Cesar Chavez Street, Far West Boulevard and Anderson Lane, or at Parmer Lane. The northbound portion of the northbound express lane opened on October 15, 2016; the entire northbound express lane opened on October 7, 2017; the southbound express lane opened two weeks later on October 21, 2017.

SH 71 E Express Lanes are a four-mile long toll road with one to two lanes in each direction along SH 71 from Presidential Boulevard to SH 130 in east Austin. The project also includes overpasses at FM 973 and SH 130, a reconfigured intersection at FM 973, reconstructed frontage roads, and

improved pedestrian and bike access on both sides of the highway. The SH 71 E Express Lanes opened to traffic on February 28, 2017, with the first full month being March of 2017.

SH 130 Segments 5 & 6, operated by the SH 130 Concession, extend 41 miles from the southern terminus of the CTTS SH 130 element to a connection with I-10 northeast of Seguin. SH 130 Segments 5 & 6 opened to traffic in October 2012 and consist of two toll lanes in each direction. US 183 serves as a parallel frontage road system from the Segment 4 terminus of SH 130 to Lockhart, primarily within the limits of Segment 5. There are pay points at two mainline locations and on ramps serving seven interchanges on the road. The toll collection system is structured to collect tolls by either ETC or PBM. In contrast to all other Austin area toll roads, toll rates for SH 130 segments 5 & 6 are based on the shape of the vehicle (passenger car, single unit or tractor trailer) rather than the number of axles.

The full SH 130 route (the CTTS SH 130 Segments 1 - 4 and Segments 5 & 6 of the SH 130 Concession) and a segment of I-10 provide a long-distance eastern bypass around the City of Austin. The SH 130 Concession Segments 5 & 6 interact with the CTTS SH 130 element since together the roads provide the major portion of an alternative to IH-35 for long distance traffic between Austin and San Antonio. SH 130 Segments 5 & 6 also interact with SH 45 SE, providing a continuous limited access facility from Lockhart into Austin via IH-35.

2.3 NON-TOLL ROADWAY NETWORK IN AUSTIN

The major routes in the Austin area which act as either feeder or competing routes with the CTTS elements include: IH-35, US 183 (Bell Boulevard/Research Boulevard), FM 734 (Parmer Lane), CR 30 (Gattis School Road), US 79 (Palm Valley Boulevard), FM 1431 (Whitestone Boulevard) and FM 973. In some cases, one of these roads can be a feeder to one CTTS element and a competing route for a different CTTS element.

Stantec has developed two broad categories to provide an indication of how various highway elements relate to each other as “feeders” (F) or “competitors” (C) for specific trip patterns. Generally speaking, if a roadway intersects with another roadway they are considered feeders to each other for selected travel movements, while if two roadways are parallel and in some close proximity to each other, they are considered to be competitors for some portion of trip patterns. Due to the increasingly complex system of roadways in the Austin region, each new or expanded roadway serves multiple trip patterns and the interrelationship seldom fits neatly into one or the other category (i.e., the new or expanded roadway may carry both feeder and competitor traffic).

A quantitative method of determining the interrelationships would be to remove individual roadway elements from the travel demand model and compare the traffic forecasts without the element in place. The multitude of projects planned for this region would make this approach impractical. For purposes of this study, Stantec has applied a more qualitative method of using engineering judgment to establish the effect of roadway improvements on individual CTTS elements or segments within CTTS elements, noting that a new or expanded roadway may function as a feeder to one CTTS element/segment and a competitor to another. The limitation is that the scale of the impact cannot be estimated easily and, in the case of competitive elements, the impact applies differently to drivers depending on the specific trip pattern for which the elements are truly competitive. The relationships between these routes and the CTTS elements are summarized in Table 2.2.

Table 2.2 Relationships between Existing Non-Toll Routes and CTTS Elements

Route #	Route Name	Effect on CTTS Element	
		F/C[1]	Element
IH-35	-	C	SH 130
		C	Loop 1
US 183	Bell Boulevard/Research Boulevard	F	SH 45 N
		C	SH 130
		C	Loop 1
FM 734	Parmer Lane	F	SH 45 N
		F	SH 130
CR 30	Gattis School Road	F	SH 130
		C	SH 45 N
US 79	Palm Valley Blvd.	F	SH 130
		C	SH 45 N
FM 1431	Whitestone Blvd.	C	SH 45 N
FM 973	-	C	SH 130

Notes: (1) F = feeder; C = competitor
(2) Classification of a project as a feeder/collector based on qualitative professional judgment.

IH-35, a major north-south US route from Canada to Mexico, carries local traffic in the Austin area in addition to long distance traffic. The route has two to six lanes in each direction, plus frontage roads. In addition to the surface route, there is an elevated four-lane express route through the Austin Central Business District (CBD). IH-35 is a competing route to SH 130 for long distance through trips. According to TxDOT, in 2017, IH-35 in Travis County was the second most congested road in Texas for all traffic and the most congested road in Texas for trucks.

US 183 (Bell Boulevard/Research Boulevard) begins at US 90 in Luling, continues northward to Lockhart and then intersects SH 130 Segment 5 acting as its frontage road until it reaches SH 45 SE. At the southern terminus of Segment 4 of SH 130, US 183 continues along the east side of downtown Austin and then turns northwest just north of the city. The route is a 4-lane divided highway with frontage roads between US 290 and SH 45 N.

US 183 interacts with three elements of the CTTS. At the western terminus of SH 45 N, US 183 acts as a competing route to both Loop 1 and the western section of SH 45 N for certain travel patterns. For other trip patterns US 183 would be considered a feeder route for SH 45 N. It is parallel to Loop 1 and, therefore, the section of US 183 between SH 45 N and Loop 1 is a competitor to that CTTS element. US 183 is also a competitor to the southern sections of SH 130.

Parmer Lane (FM 734) extends from US 290 east of Austin in a northwesterly direction to the suburbs northwest of Austin. The road intersects with SH 130; Loop 1, at the northern terminus of the CTRMA owned and operated MoPac N Express Lanes and south of the CTTS tolled portion; and with SH 45 N. The road is an arterial with four lanes on its eastern and western ends and six lanes in the more populated central portion. Parmer Lane is a feeder route for SH 45 N and SH 130.

Gattis School Road (CR 30) and US 79 (Palm Valley Boulevard) compete with the eastern section of SH 45 N. Gattis School Road is an east/west 4-lane arterial route north of Austin, between IH-35 and SH 130. It is approximately three miles north of SH 45 N and the nearest competing route to the eastern section of SH 45 N. US 79 also extends from IH-35 easterly to SH 130, parallel to the eastern section of SH 45 N. The road is a 4-lane arterial approximately one mile north of SH 45 N. Both Gattis School Road and US 79 have interchanges with SH 130 and therefore act as feeder routes to that CTTS element.

FM 1431 (Whitestone Boulevard) competes with the western section of SH 45 N. Whitestone Boulevard is a 4-lane arterial approximately five miles north of SH 45 N, extending from US 183 east to IH-35. The section between Parmer Lane and Sam Bass Road was recently upgraded to a six-lane arterial.

FM 973 competes with SH 130 between US 290 and US 183. FM 973 is a north/south 2-lane arterial extending over 20 miles from its southern terminus with US 183 to US 290. The roadway was recently realigned and widened at its intersection with SH 71 as part of the SH 71 E Express Lane Project. The roadway parallels the alignment of SH 130 through mostly rural farmland.

2.4 TRANSIT

The Capital Metropolitan Transportation Authority (Capital Metro), operator of Austin's regional public transportation system, provides limited bus and light rail service in the area. MetroRail, the 32-mile light rail line, operates between Leander and downtown Austin on Monday through Friday and between Lakeline and downtown Austin on Saturday. The system has nine stations and three Park & Ride facilities. The MetroRail line is also shared with freight line service. The route parallels sections of 183A, SH 45 N and Loop 1; however, it provides limited competition to the CTTS elements due to the limited schedule.

Average daily ridership on a weekday in Spring 2017 (mid-January to early June) is approximately 3,000 passengers, according to Capital Metro's ridership reports. In January 2018, Capital Metro added more capacity to morning and evening service by running two paired trips, six times a day. Three paired trips run out of the Leander Station in the morning, and three paired trips depart from the Downtown Station in the evening.

2.5 RECENT AND PROPOSED KEY NETWORK IMPROVEMENTS

Stantec used a regional transportation planning model originally developed by CAMPO and expanded to include the region in the AAMPO model encompassing San Antonio. Key recent and proposed improvements to toll roads and toll-free routes in the region were applied to the networks used for the base model year 2016 and for future model years 2020, 2030, and 2040 (all model years discussed in this section represent calendar years).

The latest available plans for proposed toll road projects were obtained from CTRMA and TxDOT. For other roadway projects, Stantec used the CAMPO 2040 Regional Transportation Plan (RTP), adopted May 11, 2015, along with the September 2015 amendment. Based on the degree of commitment (feasibility studies, funding, ROW status, and program inclusion) and status updates following the RTP update, judgments were made as to whether or not to include projects in the future highway networks, or whether to defer project completion to the following calendar year to allow for delays in actual construction. As an example, in some cases projects with anticipated completion dates late in a given year were modeled as opening in the following year in order to be conservative for revenue estimation. Assumptions regarding future key network improvements were approved by TxDOT at the time of this study and do reflect the information available as of June 2018 about the status of the projects.

Several toll road projects in the Austin area, including managed lanes with dynamic pricing, as well as expressways, are currently in the planning or development stages. These new facilities will be owned and operated by CTRMA. In addition, widening of SH 130 Segments 2 & 3 is also planned project being implemented by TxDOT as part of maintaining acceptable levels of service given the strong growth in the SH 130 corridor. The description and anticipated schedule for these projects, as currently envisioned, are shown in Table 2.3.

Table 2.3 Proposed Toll Facilities in Austin Area

Roadway	Tolling Plan Concept Managed Lane (Dynamic Pricing) or Toll Road (Fixed Toll Rate)	Anticipated Opening Date	Length (approximate)	Full Length Toll	Toll Rate per mile	Lane Configuration	Operator
183S	Toll Road	Aug 1, 2019 (Interim Build), Aug 1, 2020 (Full Build)	8.0	$2.31 (in 2020$)	$0.29 (in 2020$)	3 lanes per direction from US 290 to SH 71. Direct connectors on 183S to 290E (NB to EB and WB to SB) and 183S to SH 71 E (SB to WB and EB to NB)	CTRMA
290E Phase III	Toll Road	2021	-	$0.61 (in 2021$) on SB-WB and NB-WB DCs, EB-SB DC Toll-free	-	3 1-lane direct connectors between SB SH 130 and WB 290E, between NB SH 130 and WB 290E, and between EB 290E and SB SH 130	CTRMA/ TxDOT
SH 130 Widening[1]	Toll Road	Aug 2020 (Segment 2) Sep 2020 (Segment 3)	Seg 2 & 3	No change	No change	1 additional lane in both directions, Segment 2 from SH 45 N (just north of FM 685) to US 290, Segment 3 from US 290 to just north of SH 71 interchange (SB 3rd lane tapers out just after SH 71 exit ramp, NB lane comes on as free lane where SH 71 merges in)	TxDOT
SH 45 SW	Toll Road	Jan, 2020	3.4	$0.98 (in 2020$)	$0.29 (in 2020$)	2 lanes per direction from Loop 1 to FM 1626	CTRMA
183N Express Lanes	Managed Lane (3+ axle vehicles not allowed)	2024	8.0	$0.60 (in 2024$) (minimum rate)	No maximum, dynamic pricing	1 express lane per direction from Northern Terminus to Lake Creek Parkway, 2 express per direction from Lake Creek Parkway to Loop 1. Direct connectors on 183N to MoPac N Express Lanes (SB to SB and NB to NB).	CTRMA
MoPac S Express Lanes	Managed Lane (3+ axle vehicles not allowed)	2024	8.0	$0.90 (in 2024$) (minimum rate)	No maximum, dynamic pricing	Two express lanes with elevated ramps near Barton Skyway, tolled direct connectors to Oak Hill Pkwy (SB to WB and EB to NB)	CTRMA

Notes: [1] The widening of SH 130 Segments 2 & 3 were both coded in the 2021 model year.

2.5.1 2013 – 2016 Key Network Improvements

A number of major network changes have been completed and opened to traffic between 2013 and 2016. These improvements were incorporated into the model to update it to the base year 2016:

- Phase II of 290E, a limited-access toll road, was opened to traffic in May 2014. The project is constructed within the expanded median of US 290 and connects US 183 and SH 130 (see Section 2.2 for further information about this roadway).
- The O'Connor Drive interchange on SH 45 N opened to traffic in August 2014, providing an improved connection between SH 45 N/Loop 1 toll roads and FM 620.
- A new northbound frontage road from Westinghouse Road to SH 29 along IH-35 was completed in November 2015.
- New frontage roads and interchange improvements were completed on SH 71 from Montopolis Drive to US 183 in 2015.
- SH 195 was upgraded to a four-lane divided facility from the Bell County Line to IH-35. Phase 1 – from the Bell County Line to south of SH 138 – was opened to traffic in October 2014. Phase 2 – from SH 138 to south of Ronald Reagan Boulevard – was opened to traffic in 2016. Phase 3 – from south of Ronald Reagan Boulevard to IH-35 reached substantial completion in July 2015.
- Howard Lane was extended as a 4-lane divided arterial from Harris Branch Parkway to SH 130 in January 2016.
- The 290E Phase III interim intersection improvement project, completed in September 2016, added a second turn lane from the southbound SH 130 frontage road to the eastbound 290E frontage road to relieve congestion for southbound SH 130 drivers trying to access the 290E toll road on-ramp into Austin.
- In October 2016, a portion of the northbound MoPac N Express Lanes, from RM 2222 (Northland Drive) to FM 734 (Parmer Lane), opened to traffic.

2.5.2 2017 – 2020 Key Network Improvements

Several toll road projects have been completed or are scheduled to be completed between 2017 and 2020. The SH 71 E Express Lanes between Presidential Boulevard and SH 130 opened to traffic on February 28, 2017 and the MoPac N Express Lanes between Cesar Chavez Street and FM 734 (Parmer Lane) were completed in October 2017. 183S, which is currently under construction and is scheduled to be completed in phases between 2019 and 2020, will provide toll lanes in the center of US 183 between US 290 and SH 71. The SH 45 SW toll road is planned to open between Loop 1 and FM 1626 in 2020.

Non-toll road projects include the construction of direct connectors between IH-35 and US 183, the widening of FM 620, FM 1626, and FM 969, as well as the realignment and widening of FM 1460 from Quail Valley Drive to University Boulevard, and the construction of the Southwest Bypass in Georgetown. The improvements listed in Table 2.4 and shown in Figure 2.2 were included in the 2020 regional transportation model. Table 2.4 includes their relationship to the CTTS elements, based on professional judgment.

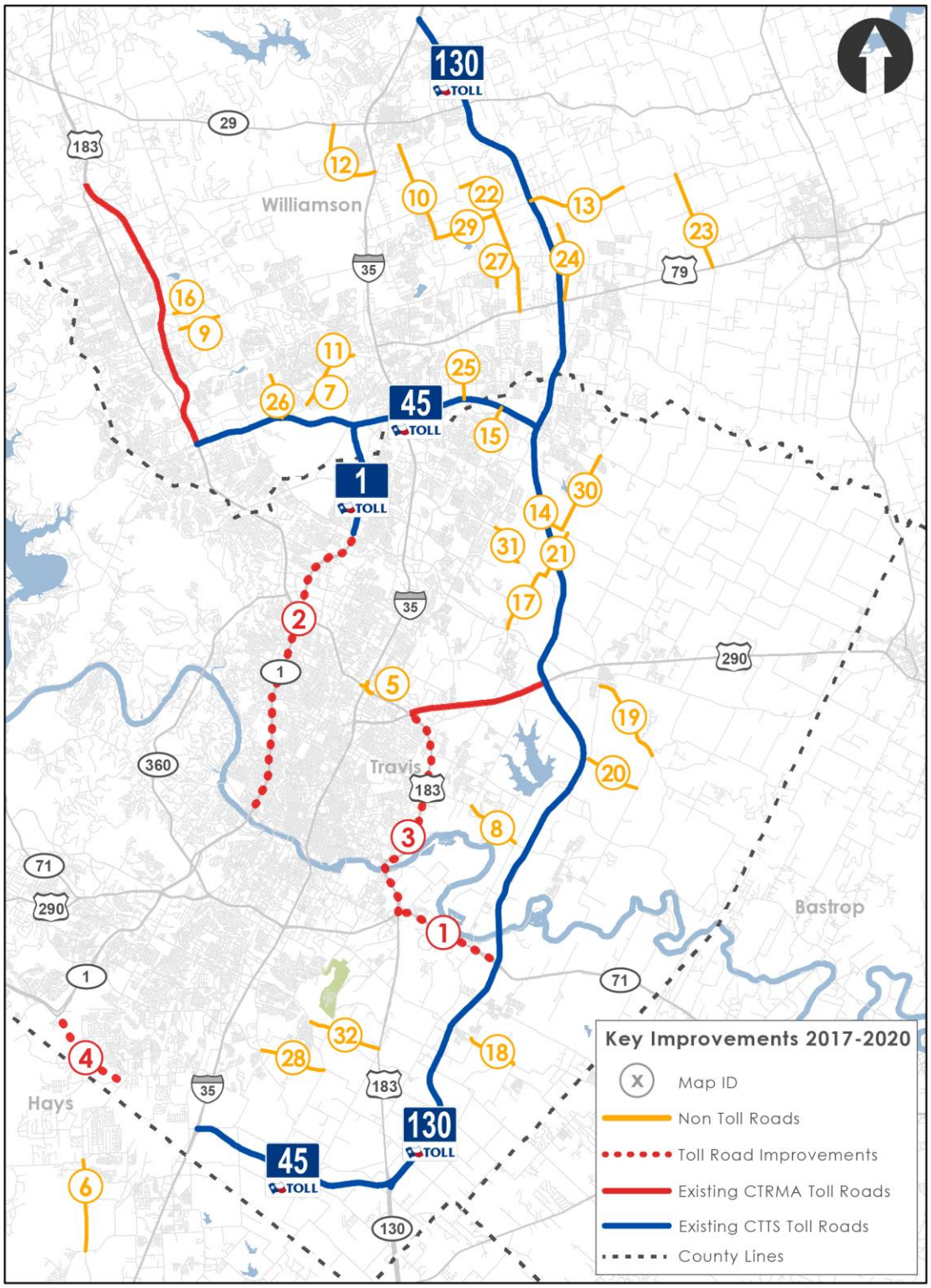
As demonstrated in this section and the following sections covering more distant horizon years, there are a multitude of planned projects in the Austin area over the course of the forecast period. While Stantec has provided judgment regarding whether individual projects act as competitors or feeders to the CTTS, the estimated future system-wide traffic, as well as the transactions and revenue discussed in Chapter 8, reflect the interaction of all the projects. Independent studies attempting to isolate the impacts of any single improvement project may result in different conclusions regarding the level of competition or support an individual project provides to CTTS. These differences can arise from any number of different conditions, including refinements to planned improvements and changes in tolling policies from the sponsoring agencies. Refer to Section 2.3 for additional discussion of the limitations of the qualitative method for determining feeder and competitor routes utilized in this study.

Table 2.4 Key Network Improvements, 2017 – 2020

Map ID	Route Name/Number	Planned Improvement	Limits	Opening Year	Effect on CTTS Element	
					F/C[1]	Element
Toll Roads						
1	SH 71 E Express Lanes	New Toll Road	Between Presidential Blvd and SH 130	2017	F	SH 130
2	MoPac N Express Lanes	New Managed Lanes	Between Fm 734 (Parmer Ln) and Cesar Chavez St	2017	F	Loop 1
3	183S	New Toll Road	Between US 290 and SH 71; Direct connectors to/from 290E and SH 71 E Express Lanes	Phased 2019 to 2020	C	SH 130
4	SH 45 SW	New Toll Road	Between Loop 1 and FM 1626	2020	NA	-
Non Toll Roads						
US Highways						
5	IH-35/US 183	Construct Direct Connectors	From IH-35 SB to US 183 SB and US 183 NB and from US 183 NB to IH-35 NB.	2020	C	SH 130
State Highways						
6	FM 1626	Widening project	FM 967 to FM 2770	2017	NA	-
7	RM 620	Widening project	Cornerwood Dr to Wyoming Springs	2018	F	SH 45 N
8	FM 969	Widening project	FM 3177 (Decker Lane) to FM 973	2019	F	SH 130
9	FM 1431	Widening project	Cottonwood Creek Trail to Market Street	2019	NA	-
10	FM 1460	Realignment and widening project	Quail Valley Drive to University Blvd	2020	C	SH 130
11	RM 620	Widening project	Wyoming Springs Drive to Deep Wood Drive	2020	F	SH 45 N
12	Southwest Bypass	New segment	SH 29 to IH-35	2020	NA	-
Other						
13	Chandler Road	Widening project	SH 130 to FM 1660	2017	F	SH 130
14	E. Pecan Street	Upgrade project	SH 130 to Weiss Lane	2017	F	SH 130
15	Heatherwilde Blvd	Widening project	SH 45 N to Wilke Ln	2017	F	SH 45 N
16	New Hope Drive	New segment	Cottonwood Creek Trail to Ronald Reagan Blvd	2018	NA	-
17	Cameron Road	Widening project and new segment	Howard Ln to SH 130	2019	F	SH 130
18	Elroy Road	Widening project	Ross Rd to Fagerquist Rd	2019	F	SH 130
19	Blake-Manor Rd	Widening project	FM 973 to Taylor Ln	2020	F	SH 130
20	Braker Ln	New segment	FM 973 to Taylor Ln	2020	F	SH 130
21	Cameron Road	Widening project	SH 130 to Pflugerville East Rd	2020	F	SH 130
22	Red Bud Ln	Widening project	CR 110 to Old Settlers Blvd	2020	C	SH 130
23	CR 101	Widening project	US 79 to Chandler Ln	2020	C	SH 130
24	CR 108	Widening project	US 79 to CR 118	2020	C	SH 130
25	Kenny Fort Boulevard	New segment	Forest Creek Drive to SH 45 N	2020	F	SH 45 N
					C	SH 130
26	Pearson Ranch Road	New segment	Avery Ranch Boulevard to SH 45 N/RM 620	2020	F	SH 45 N
27	Southwestern Blvd/CR 110	Widening project	CR 111/Westinghouse Rd - US 79	2020	C	SH 130
28	Slaughter Lane	New segment	Pleasant Vally Rd to McKinney Falls Pkwy	2020	C	SH 45 SE
29	University Boulevard	Widening project	FM 1460 to CR 110	2020	F	SH 130
30	Weiss Ln	Widening project	Cele Rd to Cameron Rd	2020	C	SH 130
31	Wells Branch Parkway	Widening project	Immanuel Rd to Killingsworth Ln	2020	F	SH 130
32	William Cannon Drive	Widening project and new segment	Running Water Dr to US 183	2020	C	SH 45 SE

Notes: (1) F = feeder; C = competitor
(2) Classification of a project as a feeder/competitor based on qualitative professional judgment.

Figure 2.2 Key Network Improvements Map 2017-2020



2.5.3 2021 – 2030 Key Network Improvements

During the period between 2020 and 2030 several new toll facilities and improvements to existing toll roads will be completed. In late 2020, SH 130 will add an additional travel lane in each direction within Segment 2 from SH 45 N to US 290, and within Segment 3 between US 290 and SH 71. However, for modeling purposes, both projects were coded in the travel demand model as opening in 2021. Both The 183N Express Lanes and the MoPac S Express Lanes are scheduled to open in in 2024.

Additionally, 290E Phase III will be open in 2021, and involves the construction of three 1-lane direct connectors between southbound SH 130 and westbound 290E, between northbound SH 130 and westbound 290E, and from eastbound 290E and southbound SH 130. TxDOT is funding the US 290 eastbound-southbound direct connector with available CTTS revenues, which will be non-tolled. CTRMA will finance the construction of the tolled direct connector bridges from northbound and southbound SH 130 to the westbound 290E toll road.

Major non-toll road projects scheduled to open between 2021 and 2030 include widening US 79 from IH-35 to east of FM 1460, as well as widening US 183 from SH 71 to SH 130 to a six-lane divided or Super 6, as well as the Oak Hill Parkway. Other non-toll road projects include completing the upgrade and widening of SH 29, SE 1, and the SE Inner Loop, the realignment and widening of FM 1660, and the realignment and construction of FM 973, in addition to the widening of FM 969 and FM 812. TxDOT also plans to widen RM 620 from US 183 to SH 71 W from four to six lanes in 2030. Additionally, SH 21 will be widened through several projects from SH 80 in San Marcos to SH 71 in Bastrop, from a two-lane undivided roadway to a four-lane divided roadway. While this improvement is further south of Austin than most other improvements, these projects along SH 21 effectively improve the roadway's attractiveness as a southern bypass route around southeast Austin, making it a competitor to SH 45 SE for some long-distance trips.

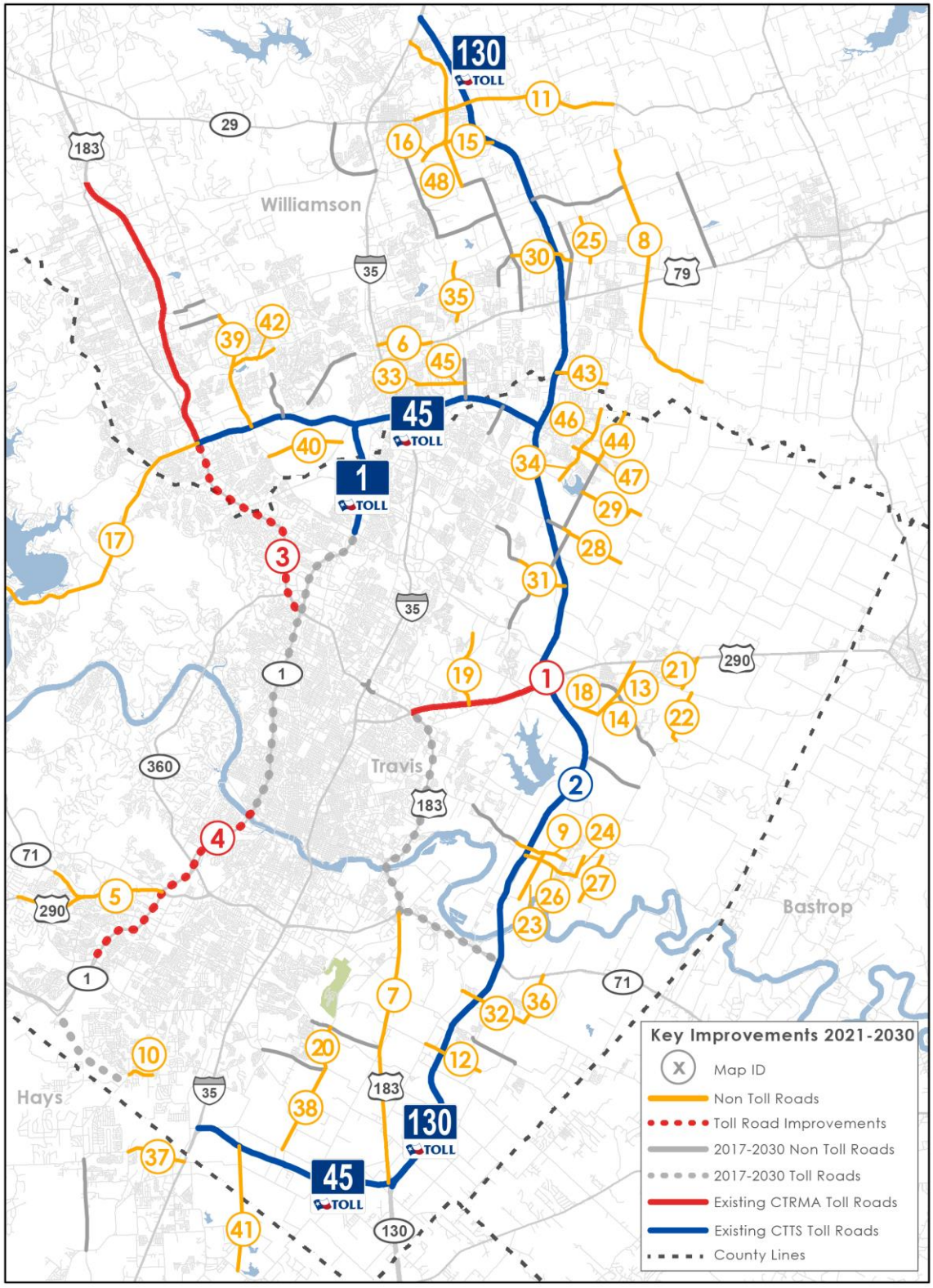
Other roadways scheduled for improvements are Parmer Lane, Anderson Mill Road, McKinney Falls Parkway, and Turnersville Road. These projects and the others noted in Table 2.5 and shown in Figure 2.3 were included in the regional highway network for 2030. Also shown in Table 2.5 is the relationship to the CTTS elements, based on professional judgment. In order to better visualize how the network will be built out over time, improvements from the previous forecast period are displayed on the map in grey.

Table 2.5 Key Network Improvements, 2021 – 2030

Map ID	Route Name/Number	Planned Improvement	Limits	Opening Year	Effect on CTTS Element	
					F/C[1]	Element
Toll Roads						
1	290E Phase III	Connector ramps	Between 290E and SH 130	2021	F	SH 130
2	SH 130	Widening project	Segments 2 & 3 (SH 45 N to SH 71)	2021	NA	-
3	183N Express Lanes	New Managed Lanes	Loop 1 to Lake Creek Parkway; Direct connectors to MoPac N Express Lanes	2024	C	SH 45 N/Loop 1
4	MoPac S Express Lanes	New Managed Lanes	Cesar Chavez St to Slaughter Lane; Direct connectors to 290W	2024	C	SH 130
					F	Loop 1
Non Toll Roads						
US Highways						
5	Oak Hill Parkway / US 290	Widening project	FM 1826 to Loop 1; Direct connectors to SH 71	2023	NA	-
6	US 79	Widening project	IH-35 to east of FM 1460	2024	C	SH 45 N
7	US 183 South	Widening project	SH 71 to SH 130	2027	C	SH 130
State Highways						
8	FM 1660	Upgrade and realignment project	CR 101 to FM 3349	2021	C	SH 130
9	FM 969	Widening project	FM 973 to Hunters Bend Rd	2021	F	SH 130
10	FM 1626	Widening project	Manchaca Rd to Brodie Ln	2021	NA	-
11	SH 29	Widening project	Haven Ln to FM 1660	2023	F	SH 130
12	FM 812	Widening project	FM 973 to Maha Loop Rd	2027	F	SH 130
13	FM 973 Relocation	Upgrade and realignment project	US 290 to FM 973	2027	C	SH 130
14	FM 973	New segment	FM 973 to Blake Manor Rd	2029	C	SH 130
15	SE 1	New segment	SE Inner Loop to SH 130	2030	F	SH 130
16	SE Inner Loop Seg 2 & 3	Widening project	Sam Houston Ave to SH 29	2030	F	SH 130
17	RM 620	Widening	US 183 to SH 71	2030	F	SH 45 N
-	SH 21	Widening	SH 80 to SH 71	2030	C	SH 45 SE
Other						
18	Wild Horse Connector	New segment	FM 973 to Parmer Ln	2021	F	SH 130
19	Arterial A	New segment	US 290 to Samsung Blvd	2022	NA	-
20	McKinney Falls Pkwy	Widening project and new segment	William Cannon Dr to Slaughter Ln	2022	F	SH 45 SE
21	Old Kimbro Rd	Widening project	US 290 to Littig Rd	2023	NA	-
22	Parsons Rd	Widening project and new segment	Littig Rd to Lockwood Rd	2023	NA	-
23	Arterial B	New segment	FM 969 to Harold Green Rd	2024	C	SH 130
24	Arterial C	New segment	FM 969 to Deaf Smith Blvd	2024	NA	-
25	CR 119	New segment	CR 100 to CR 164	2024	C	SH 130
26	Deaf Smith Blvd	New segment	Arterial C to SH 130	2025	F	SH 130
27	Dunlap Rd	Upgrade project	FM 969 to S Dunlap Rd	2025	NA	-
28	E. Pecan Street	Widening project	Weiss Ln to Cameron Rd	2025	F	SH 130
29	Jesse Bohls Rd	Widening project	Weiss Ln to Cameron Rd	2025	F	SH 130
30	Limmer Loop	Widening project	CR 110 to CR 108	2025	F	SH 130
31	Wells Branch Parkway	New segment	Killingsworth Ln to SH 130	2025	F	SH 130
32	Pearce Ln	Widening project	FM 973 to Maha Loop Rd	2026	F	SH 130
33	Gattis School Rd	Widening project	Greenlawn Blvd to Double Creek Dr	2027	C	SH 45 N
34	Hidden Lake Blvd	New segment	Kelly Ln to Pflugerville Pkwy	2027	C	SH 130
35	Kenny Fort Blvd	New segment	CR 112 to Chandler Creek Dr	2027	C	SH 130
					F	SH 45 N
36	Maha Loop/Kellam Rd	Widening project	SH 71 to Pearce Ln	2027	C	SH 130
37	Manchaca Springs Rd	New segment	FM 967 to IH-35	2027	NA	-
38	McKinney Falls Pkwy	Widening project	Slaughter Ln to FM 1327	2027	F	SH 45 SE
39	Parmer Ln	Widening project	RM 1431 to SH 45 N	2027	F	SH 45 N
40	Anderson Mill Rd	New segment	Parmer Ln to RM 620	2027	C	SH 45 N
41	Turnersville Rd	Widening project and new segment	SH 45 SE to FM 2001	2027	F	SH 45 SE
42	Brushy Creek Rd	Widening project	Parmer Ln to Ranch Trails	2030	C	SH 45 N
43	Gattis School Rd	Widening project	SH 130 to Hodde/Weiss Ln	2030	F	SH 130
44	Weiss Ln	Widening project	Rowe Ln to Kelly Ln	2030	F	SH 130
45	Gattis School Rd	Widening project	Double Creek Dr to Kenney Fort Blvd	2030	C	SH 45 N
46	Jake's Hill Rd	New segment	Rowe Ln to Kelly Ln	2030	C	SH 130
47	Kelly Ln	Widening project	Moorlynch Ave to Weiss Ln	2030	F	SH 130
					F	SH 45 N
48	Southwestern Blvd	Widening project	Inner Loops to CR 111/Westinghouse Rd	2030	C	SH 130

Notes: (1) F = feeder; C = competitor
(2) Classification of a project as a feeder/competitor based on qualitative professional judgment.

Figure 2.3 Key Network Improvements Map 2021-2030



One significant project still in the early development stages is a capacity improvement to a 33-mile segment of IH-35 from Georgetown to San Marcos. The project (named Capital Express which is a part of the Mobility35 Program) generally adds two lanes in each direction through Travis and Southern Williamson counties. The lane type for the additional lanes has not been finalized but is intended to be some type of managed lane. The overall project has many separate elements which include some isolated spot improvements such as auxiliary lanes and collector-distributor lanes at critical locations. There are several stand-alone projects that are a part of the Mobility35 program that are currently under construction, and more in various earlier stages of project development. Since the full scope of the project has not been determined, the cost of the project and funding sources also remain undetermined. However, it is assumed that due to the congested traffic conditions on IH-35, the project would likely be built in phases, with the most critical segment in central Austin contingent on the construction of other improvements that would provide additional capacity as bypasses during the construction phase. Those contingent facilities are the 183S (assumed to be completed by 2020 for the current study) and the MoPac N Express Lanes which opened to traffic in 2017.

In terms of the construction schedule, a project of this magnitude could be constructed in upwards of ten years; however, and as stated above, the scope and funding sources have not yet been identified. Assuming that project construction will require significant detours of existing traffic for extensive periods of time, it is anticipated that, should this project actually be constructed, it would have a potential positive impact on CTTS revenue during the construction period. After construction is completed, some of the diverted traffic will likely continue to use CTTS elements producing a long-term revenue increase. Given the uncertainty of the project and significant construction costs that lack committed funding at this time, a decision was made not to include this project in the background network for the forecast of future traffic.

2.5.4 2031 – 2040 Key Network Improvements

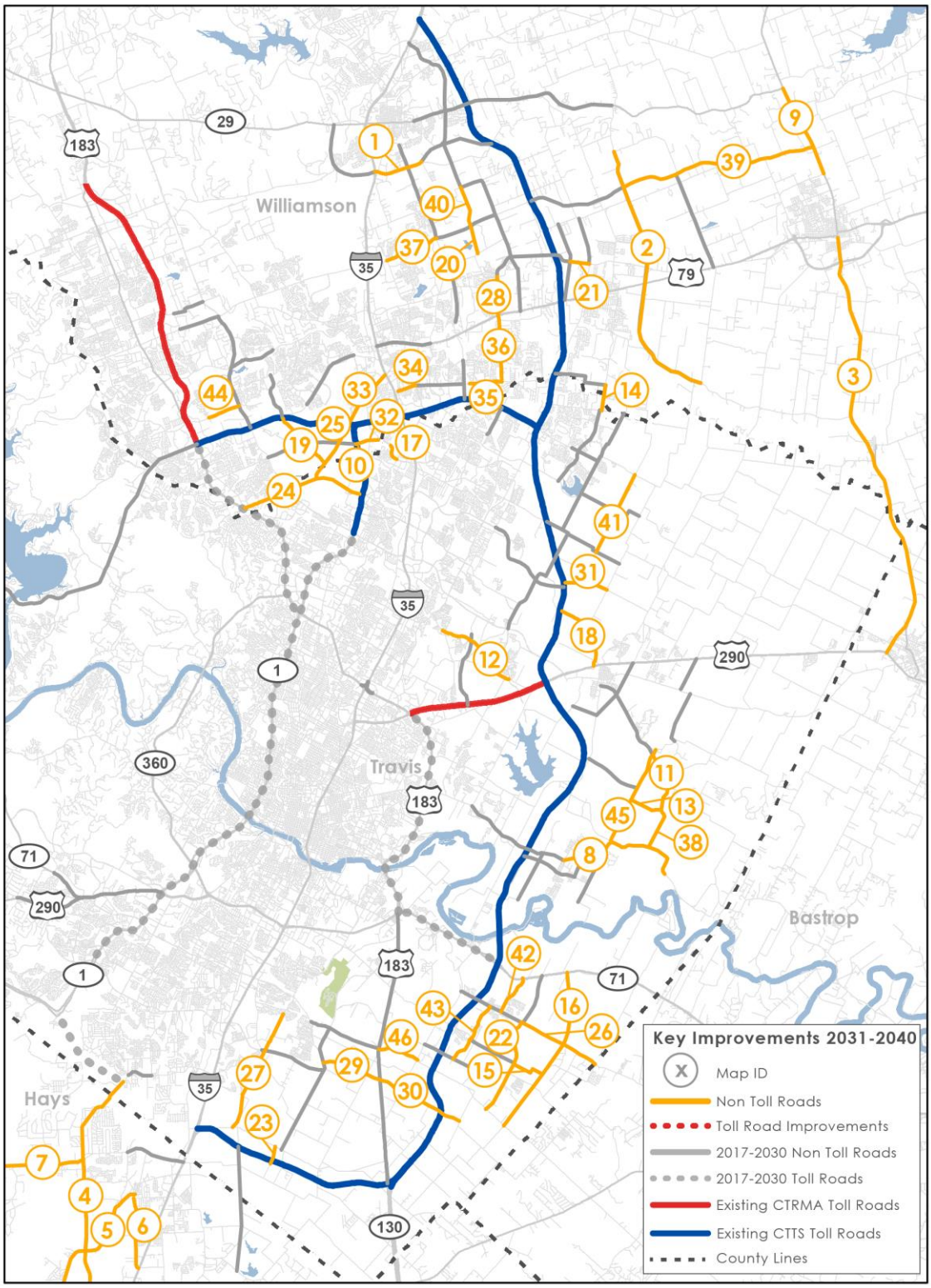
There are no toll roads scheduled for completion during the period 2031 through 2040; however major non-toll road projects include widening SH 95 from Elgin to Taylor, as well as from SH 29 to FM 397. Additional upgrades are programmed for the SE Inner Loop, FM 1660, FM 967, FM 969, and FM 1626 and FM 2770 in Hays County. These projects and the others listed in Table 2.6 and shown in Figure 2.4 have been included in the highway network for the 2040 model year. The relationship of these projects to the CTTS element is also shown in Table 2.6.

Table 2.6 Key Network Improvements, 2031 – 2040

Map ID	Route Name/Number	Planned Improvement	Limits	Opening Year	Effect on CTTS Element	
					F/C[1]	Element
Non Toll Roads						
State Highways						
1	SE Inner Loop Seg 1	Widening project	IH-35 to Sam Houston Ave	2032	F	SH 130
2	FM 1660	Widening project	CR 101 to FM 3349	2035	C	SH 130
3	SH 95	Upgrade and widening project	Elgin to Taylor	2035	C	SH 130
4	FM 1626	Upgrade and widening project	SH 45 SW to IH-35	2040	NA	-
5	FM 2770	Upgrade and Widening project	Main St to FM 150	2040	NA	-
6	FM 967	Widening project	Goforth Rd to IH-35	2040	NA	-
7	FM 967	Widening project	FM 1826 to FM 1626	2040	NA	-
8	FM 969	Widening project	Hunters Bend to Webberville City Limit	2040	F	SH 130
9	SH 95	Upgrade and widening project	SH 29 to FM 397	2040	C	SH 130
Other						
10	Anderson Mill	New segment	Loop 1 Crossover	2032	F	Loop 1
					C	SH 45 N
11	Blake-Manor Rd	Widening project	Taylor Ln to Burleson Manor Rd	2032	NA	-
12	Braker Ln	New segment	Dessau Rd to Harris Branch Pkwy	2032	F	SH 130
13	Braker Ln	New segment	Taylor Ln to Burleson Manor Rd	2032	NA	-
14	CR 137/Arterial A	Widening project	CR 138 to Rowe Ln	2032	NA	-
15	Fagerquist Rd	Widening project	Elroy Rd to Four Daughters Rd	2032	F	SH 130
16	Four Daughters Rd	New segment	SH 71 to FM 812	2032	C	SH 130
17	Grand Ave Pkwy	Upgrade project and new segment	Existing Grand Ave Pkwy/Anderson Mill Rd to Bratton Ln	2032	F	Loop 1
					C	SH 45 N
18	Gregg-Manor Rd	Upgrade project and new segment	SH 130 to US 290	2032	F	SH 130
19	Howard Ln	Upgrade project and new segment	SH 45 N to Loop 1	2032	F	SH 45 N
					C	Loop 1
20	Kenny Fort Blvd	New segment	University Blvd to CR 112	2032	C	SH 130
21	Limmer Loop/CR 164	Upgrade project	CR 108 to CR 119	2032	F	SH 130
22	Maha Loop Rd	Upgrade project and new segment	Pearce Ln to FM 812	2032	C	SH 130
23	McKinney Falls Pkwy	Widening project	FM 1327 to Turnersville	2032	F	SH 45 SE
24	McNeil Dr	Widening project	US 183 to Howard Ln	2032	C	SH 45 N
					F	Loop 1
25	McNeil Rd	Widening project	McNeil Dr/Howard Ln to SH 45 N	2032	F	SH 45 N
					C	Loop 1
26	Pearce Ln	Widening project	Maha Loop Rd to Wolf Ln	2032	F	SH 130
27	Pleasant Valley Rd	Upgrade project and new segment	Onion Creek Dr to CR 105/Turnersville Rd	2032	F	SH 45 SE
28	Red Bud Ln	Widening project	CR 117 to US 79	2032	C	SH 130
					F	SH 45 N
29	Slaughter Ln	New segment	McKinney Falls Pkwy to FM 973	2032	F	SH 130
					C	SH 45 SE
30	Slaughter Ln/Moore Rd	Widening project	FM 973 to Maha Loop Rd	2032	F	SH 130
31	Wells Branch Pkwy	New segment	SH 130 to Fuchs Grove Rd	2032	F	SH 130
32	Anderson Mill	New segment	Loop 1 to Grand Ave Pkwy	2033	F	Loop 1
					C	SH 45 N
33	McNeil Rd	Widening project	Travis County Line to IH-35	2035	F	SH 45 N
34	Gattis School Rd	Widening project	Mays St to Greenlawn Blvd	2037	F	SH 130
					C	SH 45 N
35	Gattis School Rd	Widening project	Kenny Fort Blvd to Red Bud Lane	2037	F	SH 130
					C	SH 45 N
36	Red Bud Ln	Widening project	US 79 to Gattis School Rd	2037	C	SH 130
					F	SH 45 N
37	University Blvd	Widening project	Sunrise Rd to FM 1460	2037	F	SH 130
38	Burleson-Manor Rd	New segment	Blake-Manor Rd to FM 969	2040	NA	-
39	Chandler Rd	Widening project	FM 1660 to SH 95	2040	F	SH 130
40	Kenny Fort Blvd	New segment	Round Rock ETJ to University Blvd	2040	C	SH 130
41	Melber Ln	New segment	Kelly Ln and Cameron Rd	2040	C	SH 130
42	Ross Rd	Widening project	SH 71 to Elroy Rd	2040	C	SH 130
43	Ross Rd	New segment	Elroy Rd to McAngus Rd	2040	C	SH 130
44	Lakeline Blvd	Widening project	Lyndhurst to Parmer Ln	2040	C	SH 45 N
45	Taylor Ln	Widening project	Lockwood Rd to FM 969	2040	C	SH 130
46	William Cannon Dr	New segment	US 183 to FM 812	2040	F	SH 130

Notes: (1) F = feeder; C = competitor
(2) Classification of a project as a feeder/competitor based on qualitative professional judgment.

Figure 2.4 Key Network Improvements Map 2031-2040



3.0 EXISTING TRAVEL PATTERNS

An extensive traffic data collection program was undertaken to obtain information for validating the output of the regional transportation model. Surveys conducted in the Austin region included traffic and vehicle classification counts using Automatic Traffic Recorder (ATR) tubes and video cameras. Data for speeds were obtained from independent sources, including HERE and SigAlert databases.

3.1 TRAFFIC VOLUMES

The data collection program for the 2018 Study was conducted by Ally General Solutions, LLC (AGS). The data were gathered in the May – June 2017 period. Traffic counts were recorded at over 230 locations. Traffic counts were collected along a series of screenlines and other key locations along the traffic corridors of the toll roads in the Austin region and on competing and feeder routes.

Locations of screenlines are shown in Figure 3.1 and Figure 3.2. Figure 3.1 displays the screenlines used as part of the overall regional model calibration, which covers the long-distance travel between Austin and San Antonio southward into the areas where IH-35 competes with segments 5 & 6 of SH 130. Figure 3.2 displays the screenlines and counts in the focused area served by the CTTS roadways.

Additional data sources were available for use in the 2018 study. These sources included approximately 480 counts from recent CTRMA studies, about 150 counts along the IH-35 corridor for a recent TxDOT study, data collected for the previous reports, as well as data obtained through the TxDOT traffic database. The TxDOT database contributed 2,922 Annual Average Daily Traffic (AADT) counts from the TxDOT 2015 count maps, 154 classification counts from TxDOT's truck count program, and 247 counts from the TxDOT ATR & Vehicle Classification (VC) count databases. Stantec also obtained transaction data for all toll roads that were in operation in 2017. While there was some overlap in the actual count locations, in total, traffic count data was available for 4,673 highway links for purposes of model calibration including 397 counts that were detailed vehicle classification counts used to quantify truck volumes.

Figure 3.1 Overall Screenline Map

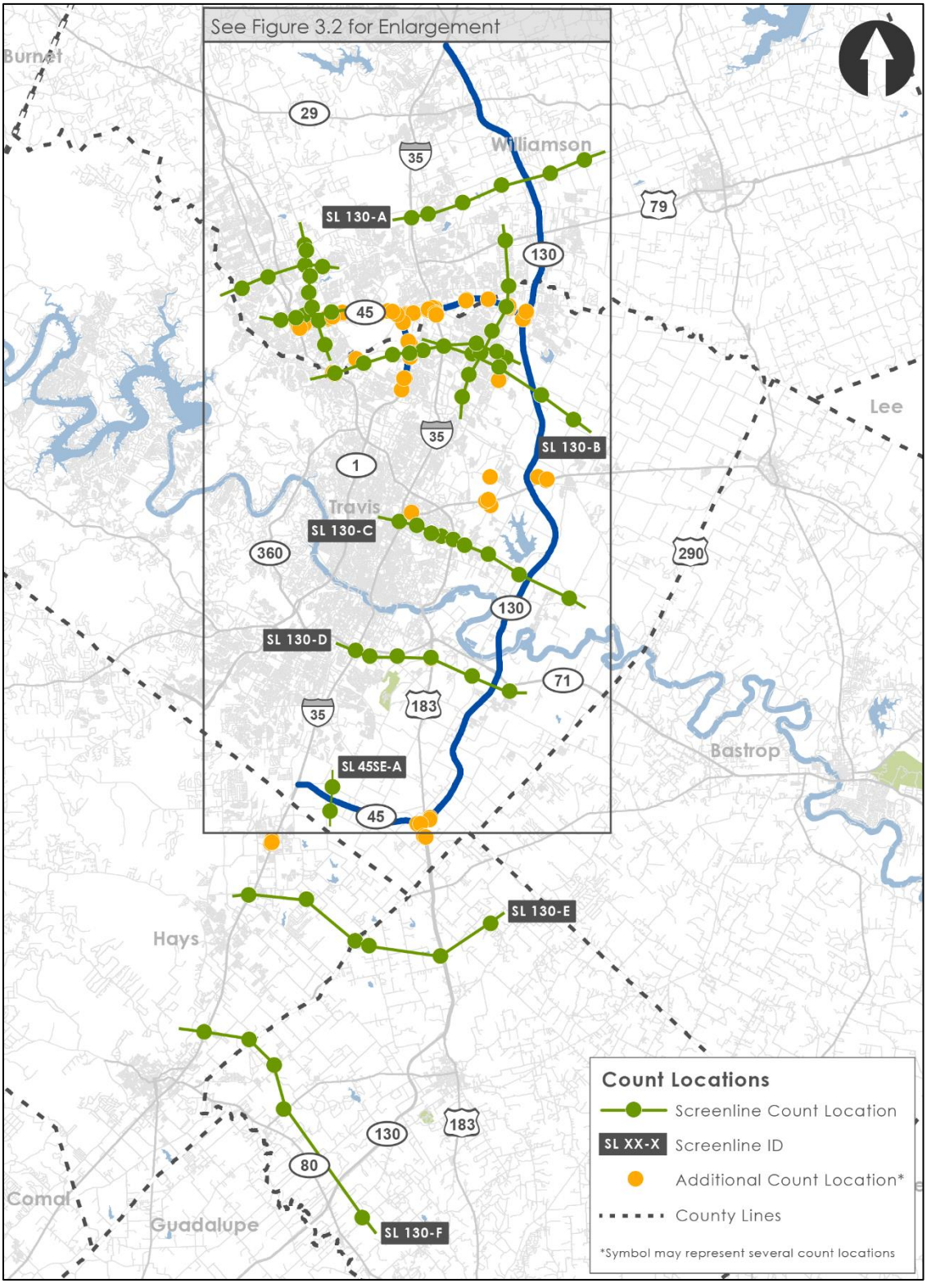
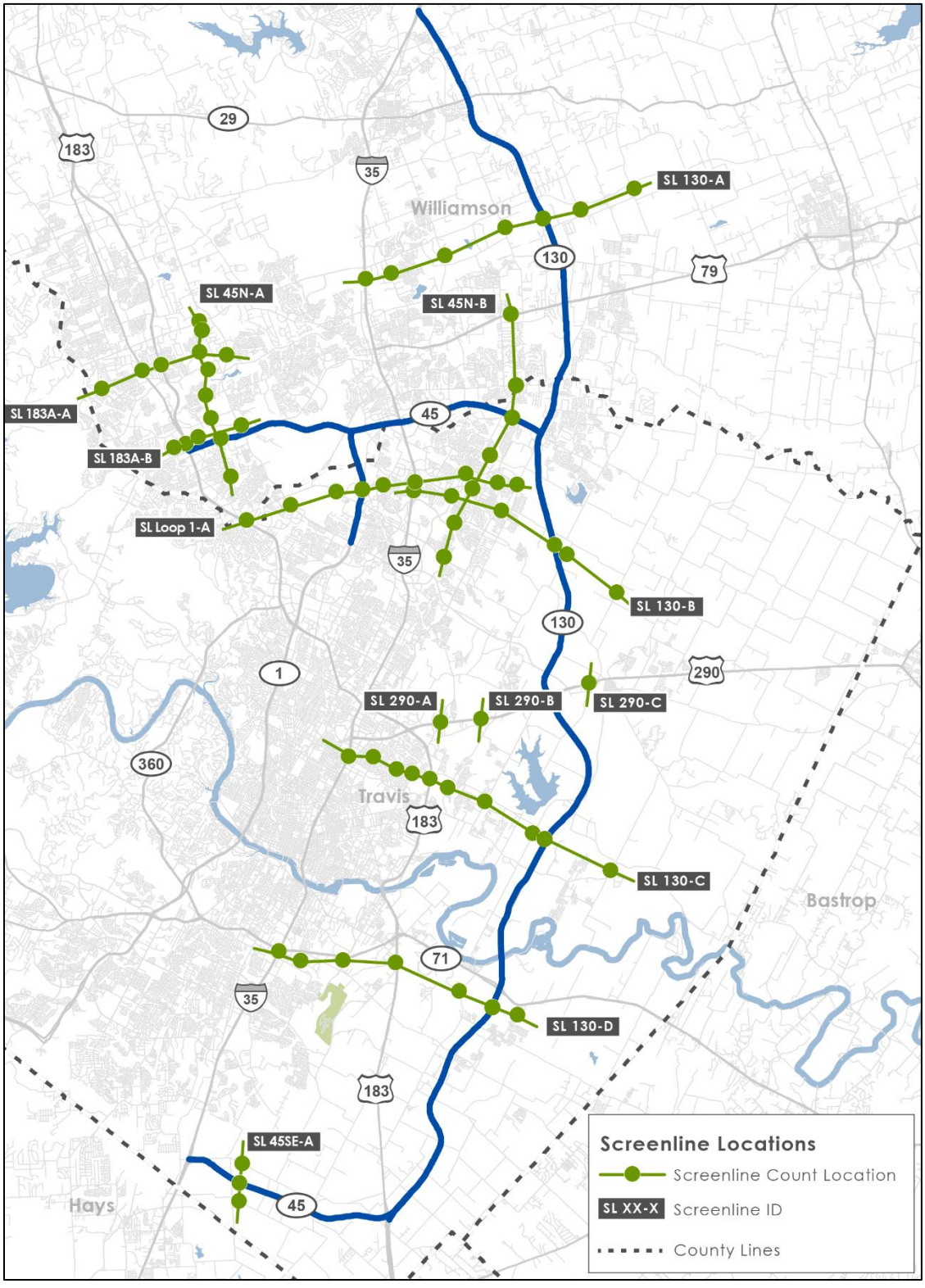


Figure 3.2 Project Area Screenline Map



The screenline locations are intended to capture the toll road traffic at the respective mainline toll pay points and the non-toll road traffic on adjacent competing roadways. The observed average weekday traffic volumes, broken down by vehicle type for each screenline count location, are shown in Table 3.1 for SH 130 and Table 3.2 for SH 45 N, Loop 1, and SH 45 SE. Table 3.3 shows the observed traffic volumes at key locations along 183A and 290E.

Table 3.1 lists the screenline volumes for the CTTS SH 130 element (Segments 1 - 4) as well as the two screenlines for the southern section that is operated separately as a concession (Segments 5 & 6), and which is not part of the CTTS. The 2017 counts collected for this study were adjusted uniformly to reflect the 2016 volumes used in calibration. Trucks, which are defined as vehicles with three or more axles, are generally between 8 and 15 percent of all traffic. For the CTTS SH 130 element, the toll road captures approximately 9 to 18 percent of the total traffic along the screenlines. For Segments 5 & 6, the toll road share of screenline traffic is lower at approximately 4 to 6 percent.

Table 3.2 shows the screenline volumes for SH 45 N, Loop 1, and SH 45 SE. For these screenlines, the toll roads tend to have a larger share of the overall traffic ranging between 10 percent and 24 percent, except for the SH 45 SE screenline which has few alternatives and as a result captures 57 percent. The share of trucks on these toll roads tends be much lower, ranging from approximately 2 to 5 percent, except for SH 45 SE which is a feeder route for long-distance traffic to SH 130. Notes:

(1) Truck volumes shown include 3+ axle vehicles.

Table 3.3 lists screenline volumes across 290E and 183A, which are owned and operated by CTRMA. Along 290E, the mainlines and frontage roads tend to have a similar share of overall traffic, with volumes ranging from approximately 20,000 on both the mainlines and frontage roads east of Parmer Ln to approximately 35,000 on both the mainlines and frontage roads west of Springdale Road. However, truck shares are greater on the frontage roads than the tolled mainline. For the 183A screenlines, the toll road carries the largest share of traffic ranging from 24 percent to 36 percent, followed closely by US 183 which represents a non-tolled parallel facility, ranging from 21 percent to 24 percent.

Table 3.1 2016 Average Weekday Screenline Volumes for SH 130

	Route	Auto	Truck	% Truck	Total	% of Total
SH 130						
Screenline 130-A	IH 35	138,501	19,385	12.3%	157,886	69.2%
	CR 115	16,609	1,077	6.1%	17,686	7.8%
	FM 1460	14,817	852	5.4%	15,669	6.9%
	CR 110	4,634	390	7.8%	5,024	2.2%
	SH 130	**24,422**	**4,411**	**15.3%**	**28,833**	**12.6%**
	CR 100	704	44	5.8%	748	0.3%
	FM 1660	1,887	418	18.1%	2,306	1.0%
	Total	201,574	26,578	11.6%	228,152	100.0%
Screenline 130-B	IH 35	157,400	18,286	10.4%	175,686	63.3%
	Heatherwilde Blvd	11,150	324	2.8%	11,475	4.1%
	Dessau / FM 685	22,074	2,042	8.5%	24,116	8.7%
	Immanuel	6,029	601	9.1%	6,630	2.4%
	SH 130	**44,912**	**5,752**	**11.4%**	**50,664**	**18.3%**
	Cameron Rd	4,014	178	4.2%	4,192	1.5%
	Fuchs Grove	3,776	791	17.3%	4,567	1.6%
	Total	249,356	27,974	10.1%	277,330	100.0%
Screenline 130-C	IH 35	222,372	19,413	8.0%	241,785	54.1%
	Cameron Rd.	14,636	1,407	8.8%	16,044	3.6%
	Berkman Dr.	13,407	1,168	8.0%	14,576	3.3%
	Manor Rd.	9,471	710	7.0%	10,181	2.3%
	Springdale Rd.	9,847	688	6.5%	10,535	2.4%
	US 183	67,230	3,816	5.4%	71,046	15.9%
	Johnny Morris Rd.	5,060	326	6.1%	5,386	1.2%
	FM 3177	14,190	980	6.5%	15,170	3.4%
	FM 973	8,006	1,010	11.2%	9,016	2.0%
	SH 130	**40,767**	**5,687**	**12.2%**	**46,454**	**10.4%**
	FM 969	5,559	813	12.8%	6,372	1.4%
	Total	410,546	36,019	8.1%	446,565	100.0%
Screenline 130-D	IH 35	177,527	21,342	10.7%	198,869	61.7%
	Todd Ln.	12,524	1,750	12.3%	14,274	4.4%
	Stassney Ln.	23,102	2,175	8.6%	25,277	7.8%
	US 183	29,315	4,236	12.6%	33,551	10.4%
	FM 973	11,715	1,152	9.0%	12,867	4.0%
	SH 130	**25,890**	**4,864**	**15.8%**	**30,754**	**9.5%**
	Ross Rd.	6,177	569	8.4%	6,747	2.1%
	Total	286,249	36,089	11.2%	322,338	100.0%
Screenline 130-E	IH 35	125,424	15,368	10.9%	140,792	79.1%
	Goforth Rd (FM 157)	3,072	139	4.3%	3,211	1.8%
	SH 21	8,913	1,684	15.9%	10,597	6.0%
	FM 2001	1,383	164	10.6%	1,547	0.9%
	US 183 - SH130 Frontage	9,341	1,058	10.2%	10,399	5.8%
	SH 130 Seg 5 ML	**8,859**	**2,356**	**21.0%**	**11,215**	**6.3%**
	FM 1854	282	19	6.4%	301	0.2%
	Total	157,274	20,788	11.7%	178,062	100.0%
Screenline 130-F	IH 35	107,529	19,881	15.6%	127,410	83.6%
	SH 21	7,938	1,923	19.5%	9,861	6.5%
	FM 1984	1,419	64	4.3%	1,483	1.0%
	SH 1342	5,288	347	6.2%	5,635	3.7%
	SH 130 Seg 6 ML	**4,778**	**1,907**	**28.5%**	**6,685**	**4.4%**
	State Park Rd (FM 20)	1,330	34	2.5%	1,365	0.9%
	Total	128,282	24,156	15.8%	152,438	100.0%

Notes: [1] Truck volumes shown include 3+ axle vehicles.

Table 3.2 2016 Average Weekday Screenline Volumes for SH 45 N, Loop 1, and SH 45 SE

	Route	Auto	Truck	% Truck	Total	% of Total
SH 45 N						
Screenline 45N-A	FM 1431	34,376	3,758	9.9%	38,133	18.1%
	Colonial Parkway	6,522	119	1.8%	6,641	3.2%
	Brushy Creek Rd.	12,829	440	3.3%	13,269	6.3%
	Avery Ranch Blvd.	15,127	1,104	6.8%	16,232	7.7%
	Lakeline Blvd.	9,242	640	6.5%	9,882	4.7%
	SH 45 NW Mainline	**49,571**	**1,740**	**3.4%**	**51,311**	**24.4%**
	SH 45 NW Frontage	29,025	1,178	3.9%	30,203	14.4%
	Anderson Mill Rd.	16,422	626	3.7%	17,048	8.1%
	McNeil Dr.	25,842	1,776	6.4%	27,618	13.1%
	Total	198,956	11,382	5.4%	210,338	100.0%
Screenline 45N-B	US 79	29,800	2,041	6.4%	31,841	17.1%
	CR 168/Gattis School Rd.	17,404	826	4.5%	18,231	9.8%
	SH 45 NE Mainline	**40,891**	**2,003**	**4.7%**	**42,894**	**23.1%**
	SH 45 NE Frontage	12,401	643	4.9%	13,044	7.0%
	Pflugerville Loop Rd.	16,726	1,063	6.0%	17,789	9.6%
	FM 1825/Pecan St.	15,926	1,950	10.9%	17,876	9.6%
	Wells Branch Pkwy	20,383	852	4.0%	21,235	11.4%
	Howard Lane	21,396	1,478	6.5%	22,873	12.3%
	Total	174,927	10,857	5.8%	185,784	100.0%
Loop 1						
Screenline Loop 1-A	US 183	190,698	5,592	2.8%	196,290	30.8%
	Parmer Lane	39,452	3,859	8.9%	43,311	6.8%
	Howard Lane	17,233	800	4.4%	18,033	2.8%
	FM 1325/Loop 1 SR	21,220	1,051	4.7%	22,272	3.5%
	Loop 1 Mainline	**66,147**	**1,277**	**1.9%**	**67,424**	**10.6%**
	Bratton Lane	9,683	868	8.2%	10,551	1.7%
	IH 35	157,400	18,286	10.4%	175,686	27.5%
	Heatherwilde	16,201	380	2.3%	16,581	2.6%
	N Railroad Rd	5,749	271	4.5%	6,020	0.9%
	FM 685	29,610	1,843	5.9%	31,453	4.9%
	SH 130	44,912	5,752	11.4%	50,664	7.9%
	Total	598,305	39,980	6.3%	638,285	100.0%
SH 45 SE						
Screenline 45SE-A	FM 1327	12,321	1,465	10.6%	13,785	40.5%
	SH 45 SE Mainline	**16,735**	**2,490**	**13.0%**	**19,225**	**56.5%**
	Turnersville Rd.	1,014	30	2.8%	1,043	3.1%
	Total	30,069	3,984	11.7%	34,054	100.0%

Notes: (1) Truck volumes shown include 3+ axle vehicles.

Table 3.3 2016 Average Weekday Screenline Volumes for 290E and 183A

	Route	Auto	Truck [1]	% Truck	Total	% of Total
290E Corridor						
290E Mainline	West of Springdale Rd. [2]	33,460	2,506	7.0%	35,966	21.1%
	West of Giles Ln.	30,699	1,521	4.7%	32,220	18.9%
	East of Parmer Ln.	18,502	1,126	5.7%	19,628	11.5%
290E Frontage	West of Springdale Rd. [2]	32,939	3,994	10.8%	36,934	21.6%
	West of Giles Ln.	22,936	2,503	9.8%	25,440	14.9%
	East of Parmer Ln.	17,874	2,704	13.1%	20,578	12.1%
	Total	156,411	14,354	8.4%	170,765	100%
183A						
Screenline 183A-A	Lakeline Blvd	23,919	1,157	4.6%	25,076	15.2%
	US 183	36,285	3,621	9.1%	39,906	24.1%
	183A Mainline	**57,767**	**2,308**	**3.8%**	**60,075**	**36.3%**
	Vista Ridge Blvd	7,040	204	2.8%	7,245	4.4%
	Parmer Ln	30,905	2,126	6.4%	33,031	20.0%
	Total	155,917	9,417	5.7%	165,333	100%
Screenline 183A-B	Pecan Park Blvd	7,739	216	2.7%	7,955	4.0%
	US 183	38,657	4,279	10.0%	42,936	21.3%
	183A Mainline	**46,193**	**1,371**	**2.9%**	**47,564**	**23.6%**
	US 183 SB On-Ramp	29,009	968	3.2%	29,977	14.9%
	US 183/SH 45 DC	19,201	1,397	6.8%	20,598	10.2%
	Lake Creek Pkwy	13,713	909	6.2%	14,622	7.3%
	Parmer Ln	33,882	3,645	9.7%	37,527	18.7%
	Total	188,395	12,785	6.4%	201,180	100%

Notes: (1) Truck volumes shown include 3+ axle vehicles.
(2) Auto and truck volumes estimated; total volumes are actual.

3.2 TRAVEL SPEEDS

Travel time and speed data were collected using both the HERE and SigAlert databases for sections of the primary non-tolled routes that compete with the CTTS system, which include IH-35, the non-tolled section of Loop 1, US 183, FM 973, SH 360, Parmer Lane, US 79, and RM 620. The HERE data, provided by TxDOT, were available for the locations shown in

Figure 3.3. The HERE data for autos are obtained from a number of sources including mobile phones, vehicles, and portable navigation devices. For trucks, data are obtained from the American Transportation Research Institute leveraging embedded fleet systems.

SigAlert is a publicly available website that provides real-time traffic speeds on freeways and some major arterials. Stantec has been continuously gathering data for all interstates and arterials in the Austin region over the last five years and has an extensive monthly database for each roadway. SigAlert data rely primarily on monitoring real-time traffic performance devices maintained by public agencies in each region. The SigAlert data from October 2016 were used to supplement and validate the HERE data. Both SigAlert and the HERE data sets are estimates of travel time and given the different sources of data, there is some variation in the estimated travel times.

Table 3.4 summarizes the average speeds across segments of each roadway for both AM and PM peaks, midday, and nighttime periods. As expected, speeds for SH 130, SH 45 N, and SH 45 SE are well above 65 MPH throughout the day. Loop 1 has slightly slower speeds because the data include both the tolled and non-tolled sections of Loop 1. In the table, IH-35 is summarized by three segments, each of which includes shorter, more congested portions during particular time periods. While midday and nighttime speeds for IH-35 generally range between 50 to 70 MPH, the peak period congested speeds in the peak travel direction are reduced to less than 45 MPH.

Speeds by smaller, individual sections of these roadways in the primary project area are shown for the AM peak period, PM peak period, midday period, and nighttime period in Figure 3.4 through Figure 3.7. From the figures, it is clear that IH-35 has congestion through central Austin for all periods of the day, with speeds below 25 mph, and that Loop 1 and US 183 within Austin also have significant congestion during the peak periods.

Figure 3.3 Travel Time Data Location Map

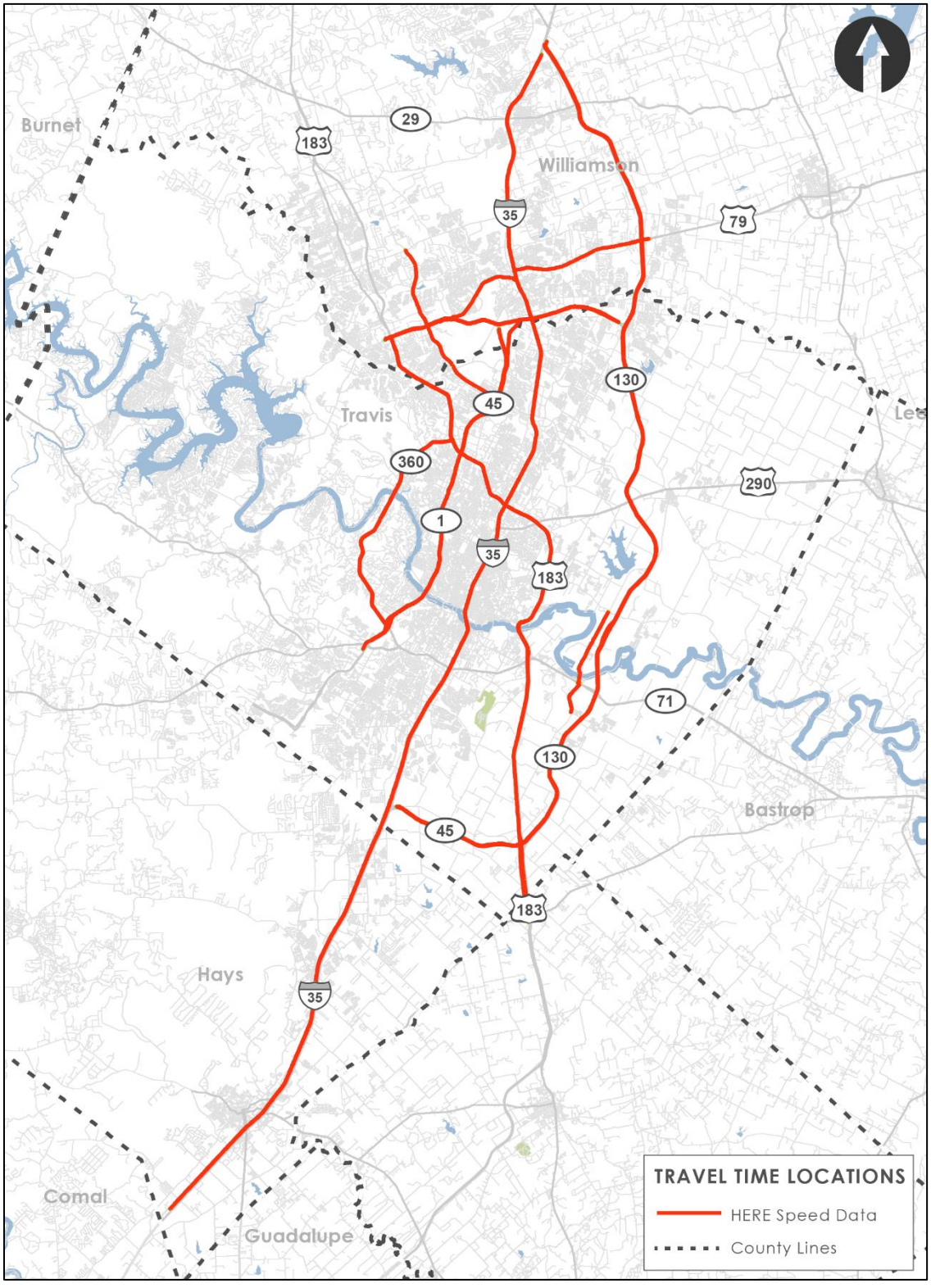


Table 3.4 Existing Speeds – Averages by Segments (mph)

Route	Section Limits		Direction	Distance	AM (6AM-10AM)		Midday (10AM-3PM)		PM (3PM-7PM)		Nighttime (7PM-6AM)	
				(mi)	HERE	SigAlert	HERE	SigAlert	HERE	SigAlert	HERE	SigAlert
IH 35	SH 130	MLK Blvd.	NB	29	63	73	62	73	46	63	63	73
			SB	29	46	62	58	70	45	69	58	73
	MLK Blvd.	SH 80	NB	29	44	61	53	65	43	59	62	71
			SB	30	64	73	59	70	40	60	59	71
	SH 80	FM 1102 (HERE) or Loop 1604 (SigAlert)	NB	9	67	70	66	69	65	68	65	70
			SB	9	67	66	66	68	65	67	66	68
Loop 1	SH 45 N	US 290 W	NB	19	50	60	56	63	36	52	54	64
			SB	20	47	56	59	64	37	53	59	65
SH 130	IH 35	US 183	NB	47	69	78	69	78	68	77	66	78
			SB	47	69	77	69	77	68	76	69	77
SH 45 N	US 183	SH 130	EB	13	70	75	69	75	70	75	66	75
			WB	13	69	77	70	78	71	77	70	78
US 183	SH 45 N	Manor Rd.	NB	14	57	64	60	65	40	56	60	65
			SB	14	48	59	60	66	57	64	60	66
	Manor Rd.	SH 130	NB	17	36	52	41	56	34	50	46	61
			SB	17	39	52	42	55	31	46	42	57
	SH 130	FM 1185 (HERE) or IH 10 (SigAlert)	NB	3	43	55	40	55	40	55	37	55
			SB	3	52	57	53	56	54	56	53	58
SH 360	US 183	Loop 1	NB	13	37	50	36	50	26	41	43	55
			SB	13	35	48	39	52	29	43	39	56
US 79	IH 35	SH 130	EB	7	35	51	36	52	32	49	39	53
			WB	7	34	49	33	48	31	45	33	51
FM 973	Pearce Ln.	FM 969	NB	6	27	--	27	--	28	--	30	--
			SB	6	23	--	27	--	29	--	27	--
FM 620	US 183 (SigAlert) or SH 45 N (HERE)	IH 35	EB	6	32	49	32	52	29	45	33	54
			WB	6	34	50	33	49	31	47	33	52
FM 974/ Parmer Ln.	FM 1431	Loop 1	NB	10	32	--	34	--	31	--	36	--
			SB	10	33	--	35	--	30	--	35	--
Loop 1 Frontage	SH 45 EB Frontage	US 183	NB	5	26	--	30	--	28	--	31	--
			SB	5	27	--	28	--	27	--	28	--
SH 45 SE	IH 35	US 183	EB	7	70	77	68	77	69	77	66	77
			WB	7	69	78	69	78	70	78	69	78

Figure 3.4 AM Existing Speeds

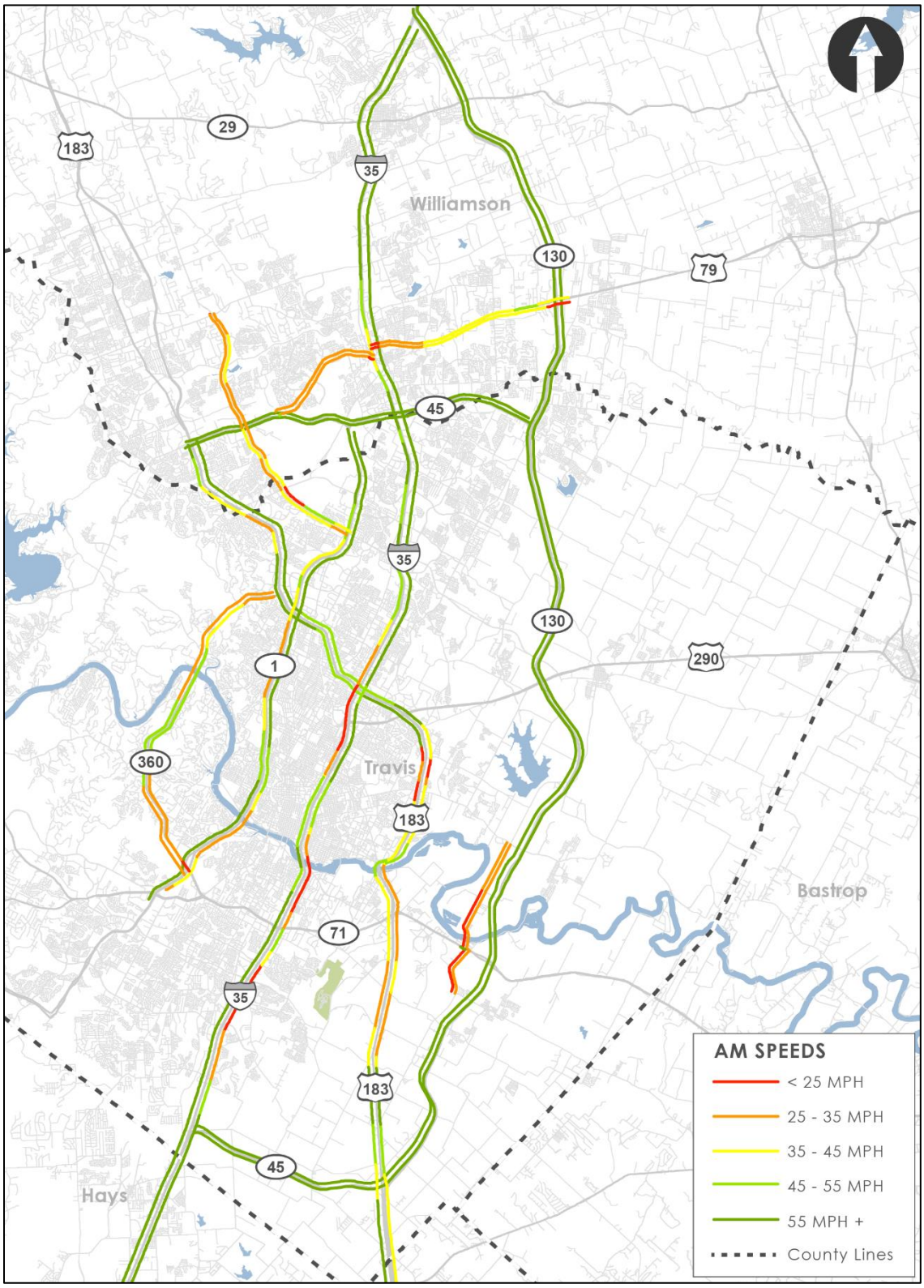


Figure 3.5 PM Existing Speeds

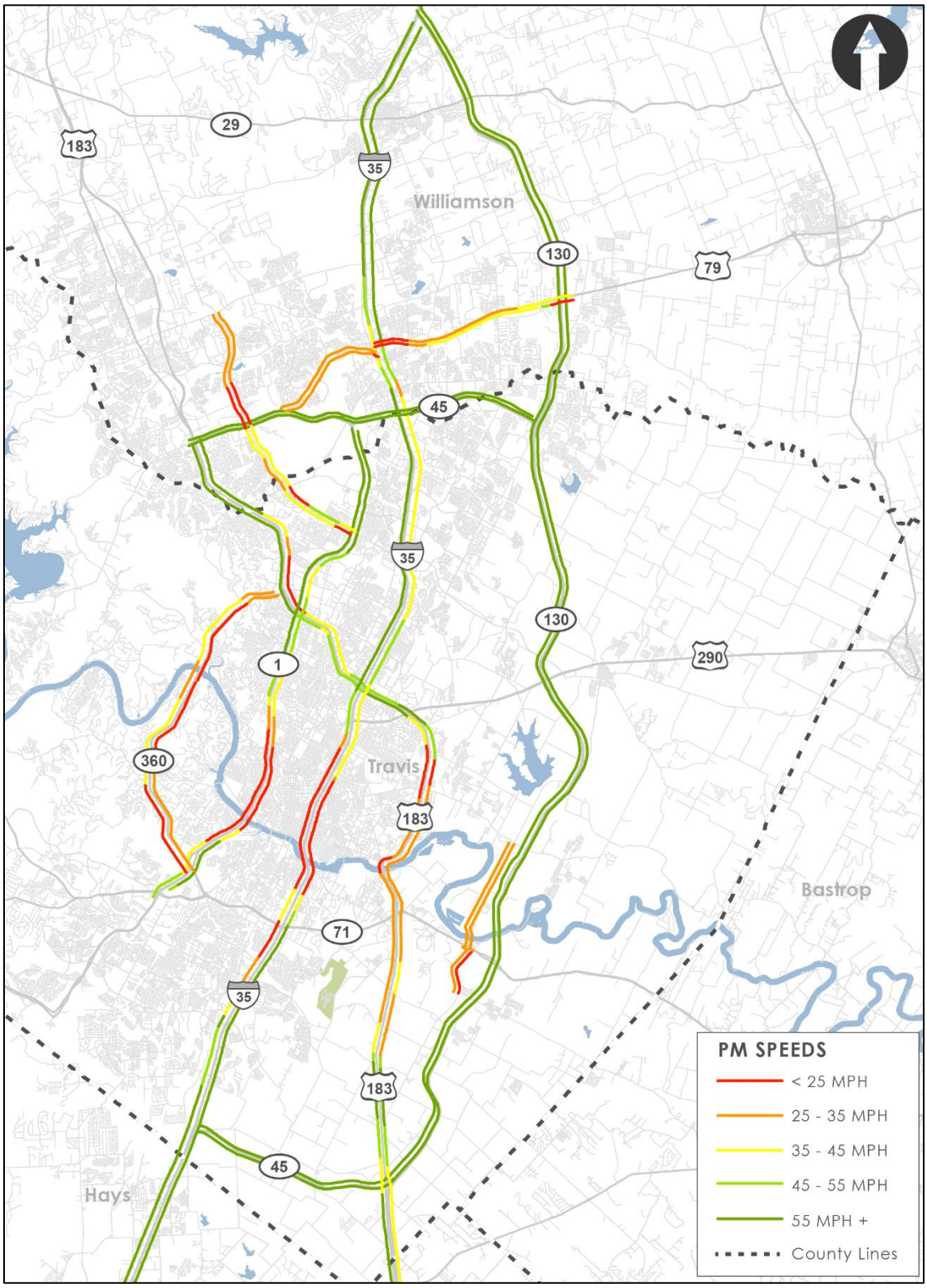


Figure 3.6 Midday Existing Speeds

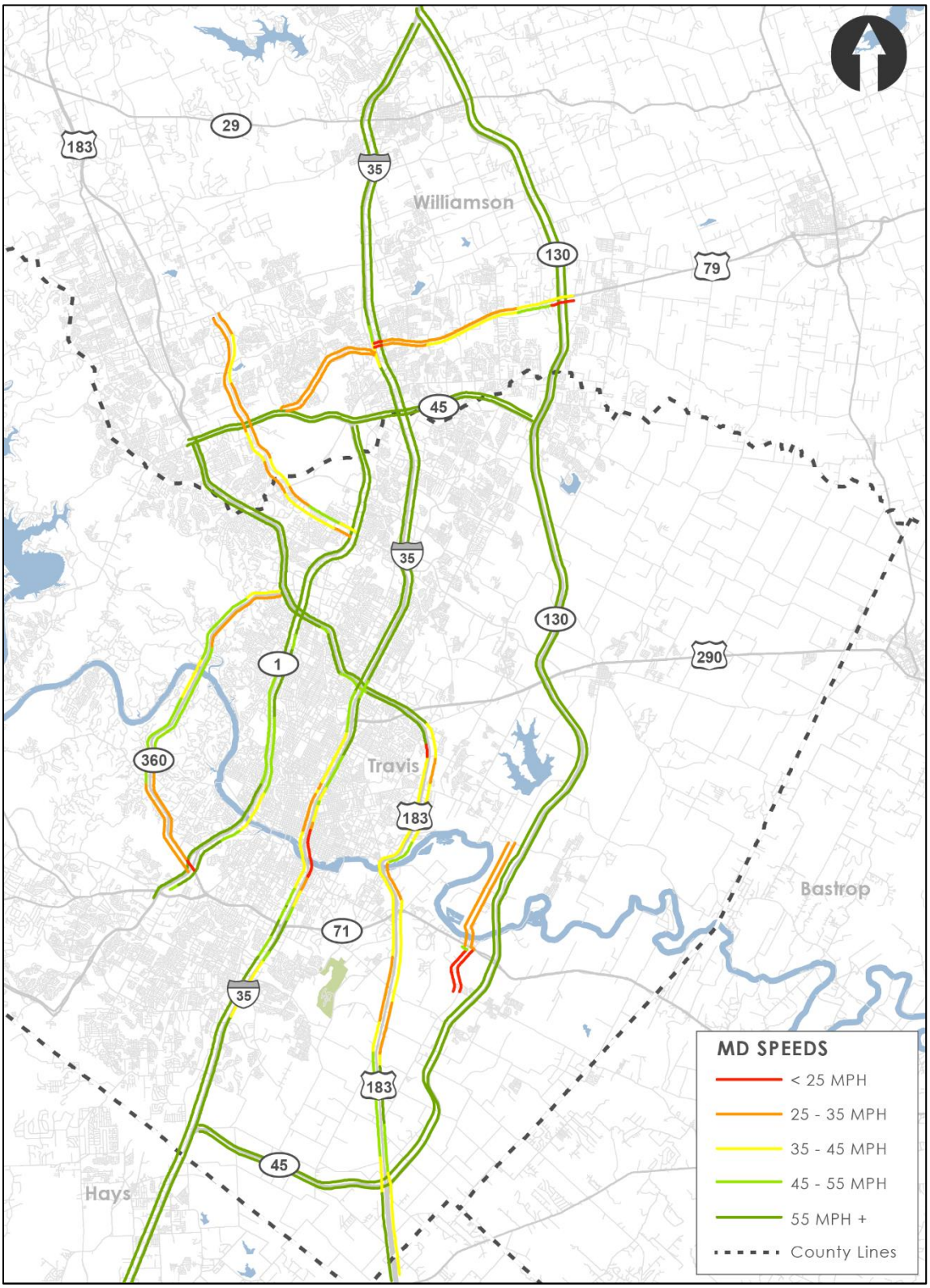
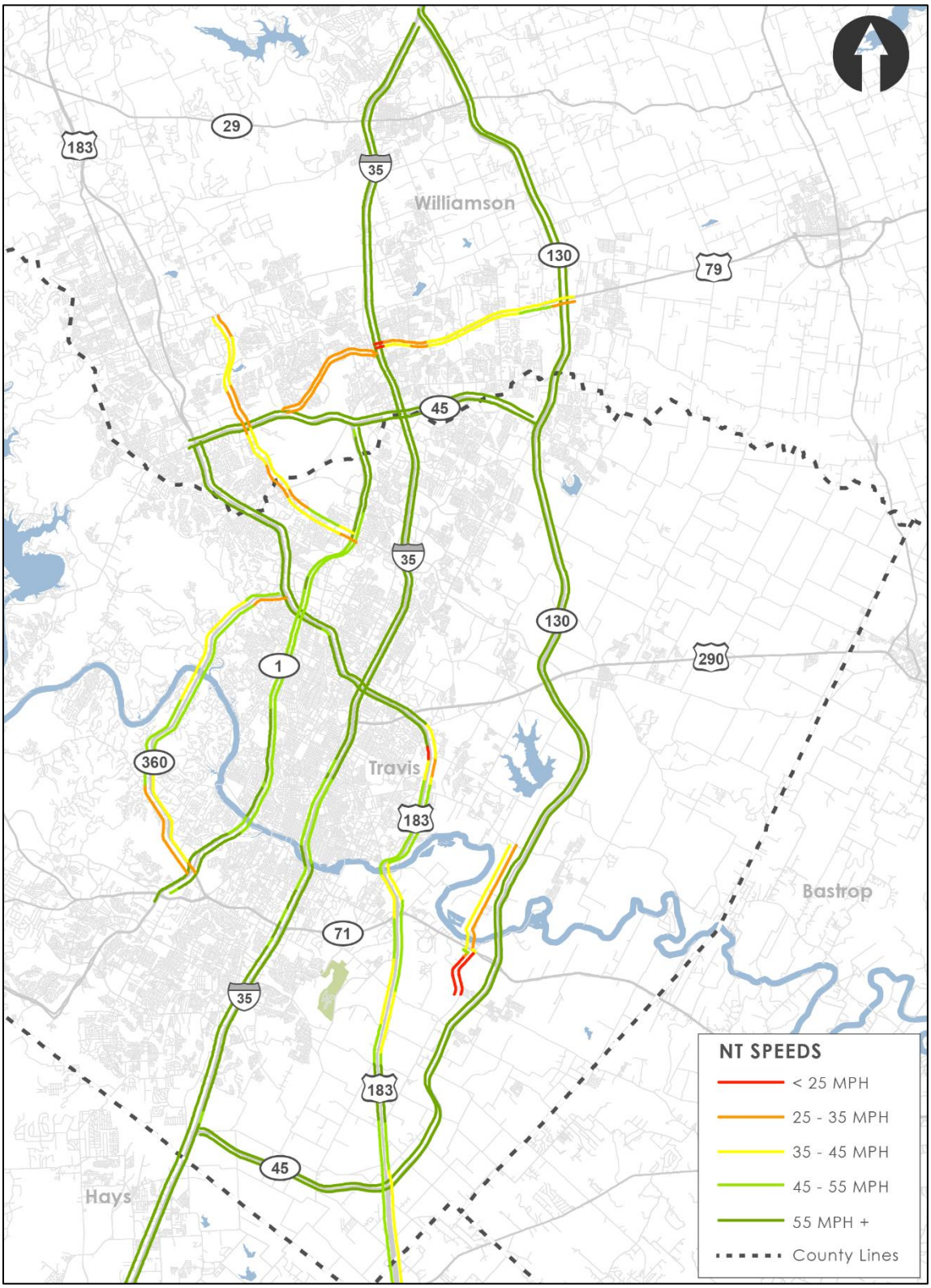


Figure 3.7 Nighttime Existing Speeds



4.0 TOLL COLLECTION

This chapter presents TxDOT's toll collection policy for the CTTS, including methods of toll collection, toll rates, and violation procedures, as well as the policy regarding future rates. Future toll rates and tolling assumptions used to develop the forecasts for this study are also presented in this chapter.

4.1 METHODS OF TOLL COLLECTION

Since January 2013, TxDOT operates the CTTS as a cashless system using only two methods of toll collection: ETC and Pay by Mail (PBM). Drivers using ETC automatically pay the toll with their TxTag or other transponder tags covered under interoperability agreements, while drivers without a recognizable transponder have their license plate photographed at the pay points. TxDOT then mails an invoice to the registered owner of the vehicle to collect payment. Each of these options are discussed briefly below with more detail regarding invoicing and collection procedures for PBM transactions provided later in Section 4.5.

ETC & Interoperability

Drivers with a properly mounted transponder and a sufficiently funded transponder account automatically pay the toll with their TxTag or other interoperable transponders. The ETC transponder payment method requires that drivers attach a small sticker to the windshields of the vehicles containing a thin transponder which sends a signal to the electronic tolling equipment as the vehicle crosses a tolling point. TxDOT's ETC transponder is branded as a TxTag. TxDOT's toll collection system is also interoperable with all tags issued in Texas, including those issued by Harris County Toll Road Authority and North Texas Tollway Authority, under the terms of a 2007 Interlocal Agreement. This agreement was superseded by the Central US Interoperability Agreement (CUSIOP Agreement) in 2017, which includes all Texas toll entities either directly or under an agreement with CTRMA, in addition to the Oklahoma Turnpike Authority and Kansas Turnpike Authority. Most recently, the Commission authorized TxDOT to enter into a separate supplemental interoperability agreement (SSIOP) with other Texas toll entities, the Oklahoma Turnpike Authority, the Kansas Turnpike Authority, and Florida's Turnpike Enterprise related to the interoperability of their respective ETC programs through the use of the Central US Interoperability Hub and the Southeast US Interoperability Hub.

Pay by Mail (PBM)

When a driver crosses a tolling point and a valid ETC transponder is not recognized, an image of the vehicle's license plate is captured, and if there is an existing customer toll account with sufficient funds associated with that license plate, the transaction is posted to such account and processed as an ETC transponder payment. For those customers that use a CTTS facility without a valid and sufficiently funded transponder account, these transactions are referred to as 'Pay by Mail' or PBM. Note that there is a 33 percent surcharge on PBM transactions and the tolls from these transactions are invoiced to the owner of the vehicle on a monthly basis.

4.2 HISTORICAL AND CURRENT TOLL RATES

The historical toll rates for 2-axle vehicles using SH 45 N and Loop 1, SH 130, and SH 45 SE are shown in Table 4.1, Table 4.2, and Table 4.3, respectively. Each facility opened with a phased toll schedule: toll free to half rate to full rate. SH 45 SE was originally constructed as a cashless facility which opened after the other elements of the CTTS were opened; therefore, cash rates are not shown for this roadway.

The toll rates remained the same from each road's opening until the system-wide toll increases were implemented in January 2013 for SH 45 N, Loop 1, and SH 130. Subsequent increases were made in January of 2014, 2015, 2017, and 2018 for all facilities, including SH 45 SE. These increases were part of the annual toll escalation process adopted in 2013, under which tolls will increase annually based on the prior 12-month Consumer Price Index - Urban (CPI-U Index).

Table 4.1 SH 45 N and Loop 1 Historical and Current Toll Rates, 2-axle vehicles

Dates	SH 45 N and Loop 1					
	Mainline Plazas			Ramps		
	ETC	Pay by Mail	Cash	ETC	Pay by Mail	Cash
Nov-06 to Dec-06	Open Toll Free					
Jan-07	-	-	$0.75	-	-	$0.50
Feb-07	$0.34	-	$0.75	$0.23	-	$0.50
Mar-07 to Dec-12	$0.68	$0.90	$0.75	$0.45	$0.60	$0.50
2013	$1.02	$1.36	-	Varies by Location		
2014	$1.04	$1.38	-	Varies by Location		
2015	$1.06	$1.41	-	Varies by Location		
2016	$1.06	$1.41	-	Varies by Location		
2017	$1.07	$1.42	-	Varies by Location		
2018	$1.09	$1.45	-	Varies by Location		

Table 4.2 SH 130 Historical and Current Toll Rates, 2-axle vehicles

Dates	SH 130					
	Mainline Plazas			Ramps		
	ETC	Pay by Mail	Cash	ETC	Pay by Mail	Cash
Nov-06 to Dec-06	Open Toll Free					
Jan-07	-	-	$1.50	-	-	$0.50
Feb-07	$0.68	-	$1.50	$0.23	-	$0.50
Mar-07 to Dec-12	$1.35	$1.80	$1.50	$0.45	$0.60	$0.50
2013	$1.69	$2.24	-	Varies by Location		
2014	$1.72	$2.29	-	Varies by Location		
2015	$1.75	$2.33	-	Varies by Location		
2016	$1.75	$2.33	-	Varies by Location		
2017	$1.77	$2.35	-	Varies by Location		
2018	$1.80	$2.39	-	Varies by Location		

Table 4.3 SH 45 SE Historical and Current Toll Rates, 2-axle vehicles

Dates	SH 45 SE			
	Mainline Plazas		Ramps	
	ETC	Pay by Mail	ETC	Pay by Mail
May-09	Open Toll Free			
Jun-09	$0.50	-	$0.33	-
Jul-09 to Dec-13	$1.00	$1.33	$0.66	$0.88
2014	$1.02	$1.36	$0.67	$0.89
2015	$1.04	$1.38	$0.68	$0.90
2016	$1.04	$1.38	$0.68	$0.90
2017	$1.05	$1.40	$0.69	$0.92
2018	$1.07	$1.42	$0.70	$0.93

As shown in the tables above, there is a 33 percent surcharge on PBM transactions. Vehicles with more than two axles pay a proportionately higher toll using the (n-1) formula whereby the toll is equal to the passenger car toll times the vehicle's number of axles less one. For instance, a 3-axle vehicle pays two times the passenger car rate. The maximum truck toll rate for SH 130 and SH 45 SE is capped at the 4-axle rate, which is three times the auto rate. This limitation was implemented to encourage long-distance truck traffic to utilize the CTTS as an alternative to IH-35 through Austin. Current 2018 toll rates for 4-axle vehicles are shown for each CTTS element in Table 4.4.

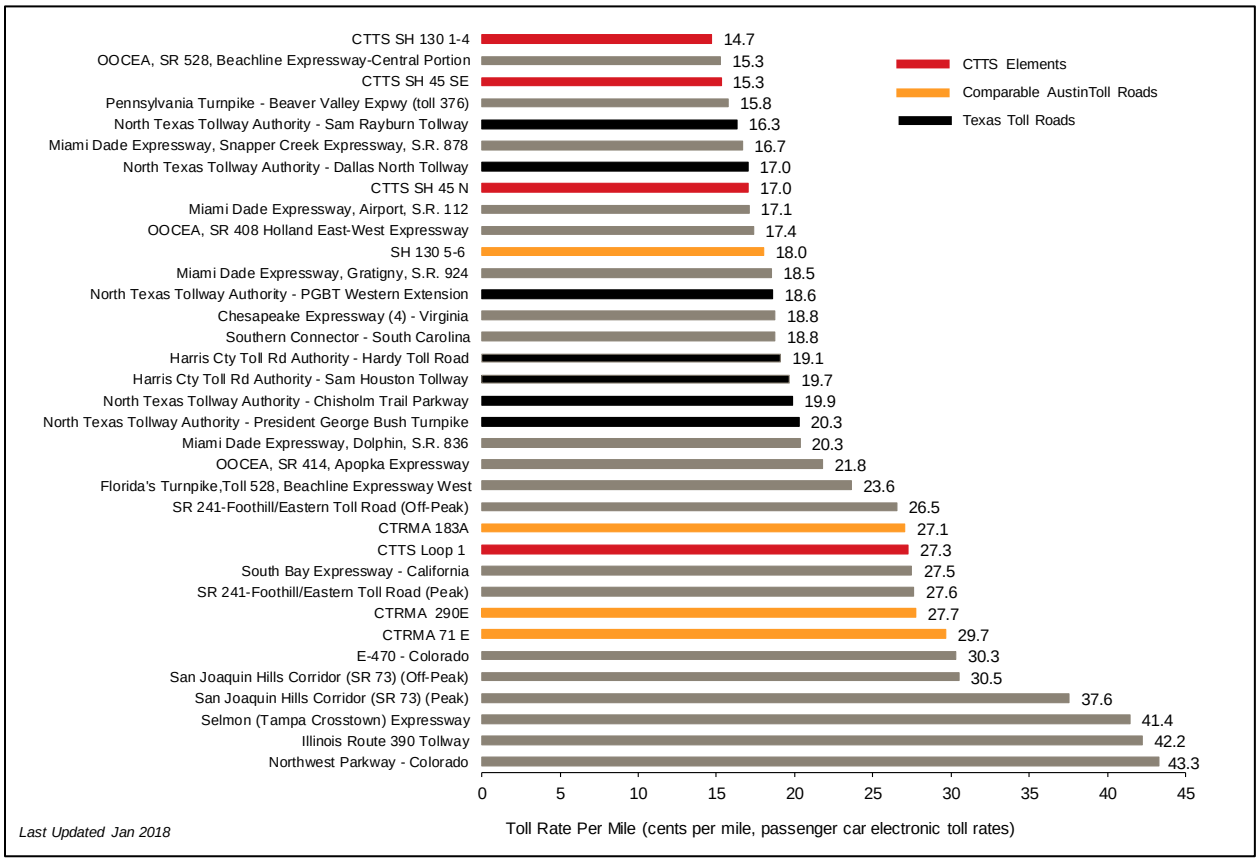
Table 4.4 CTTS 2018 Toll Rates, 4-axle vehicles

CTTS Element	Mainline Plazas	
	ETC	Pay by Mail
SH 45 N	$3.27	$4.35
Loop 1	$3.27	$4.35
SH 130	$5.40	$7.18
SH 45 SE	$3.21	$4.27

Notes: [1] Effective March 2011, truck tolls capped at 4-axle rate on SH 130 and SH 45 SE.

As shown in Figure 4.1, the per-mile ETC toll rates for passenger cars on CTTS facilities are comparable to, or lower than, the rates at various facilities across the United States. Loop 1 has a higher toll rate per mile than the other CTTS elements due to the relatively short length of the facility (4 miles), and uniform mainline tolls established at the initial opening more than ten years ago. The reasonable rate of inflation used for the toll escalation rate will ensure that CTTS toll rates stay within a comparable range assuming similar CPI rate escalation on such other toll facilities.

Figure 4.1 Comparable Passenger Car ETC Toll Rates per Mile



4.3 POLICY REGARDING FUTURE RATES

The future toll rates for the CTTS facilities are based on the current toll rates in 2018, escalated annually at the annual inflation rate. This escalation policy was adopted by the Texas Transportation Commission in 2013 whereby tolls are escalated annually on January 1st based on the Toll Rate Escalation Percentage, as calculated on each Toll Escalation Determination Date. The Toll Rate Escalation Percentage is the Consumer Price Index – Urban (CPI-U) on October 1st, the Toll Escalation Determination Date of each year, based on the twelve-month period ending August 31st of the current year. Table 4.5 shows historical CPI-U annual averages as well as several average annual growth rates depicting long-term trends. For the 27-year period from 1990 to the present, the average annual growth rate is calculated to be 2.4 percent. For the 37-year period from 1980 to the present, the average annual growth rate is greater, at 3.0 percent.

Table 4.5 Annual Consumer Price Index – Historical since 1970

Year	Annual CPI-U [1] (1982-84=100)	Compound Annual Growth Rate
1970	39	
1980	82	7.8%
1990	131	4.7%
2000	172	2.8%
2010	218	2.4%
2017	245	1.7%
Compound Annual Growth Rate		
1970 - 2017		4.0%
1980 - 2017		3.0%
1990 - 2017		2.4%
2000 - 2017		2.1%
2010 - 2017		1.7%

Notes: (1) CPI-U values shown are nominal U.S. city average, all items, seasonally-adjusted annual averages.

Per the adopted escalation policy, the actual level of tolls for any future year will be based on the CPI-U, and the resulting toll revenues will change as a function of both the change in transactions and the change in the toll values. The first inflation-based annual escalation was implemented in January 2014 when tolls were increased 1.5 percent. Table 4.6 shows recent annual CPI-U data as well as the toll increases since 2014. Each toll increase was based on the prior 12-month period from August of each year, which is different than the calendar year changes listed in the top section of the table. The last section of Table 4.6 lists the projected annual escalation rates used for developing future toll rates in this study.

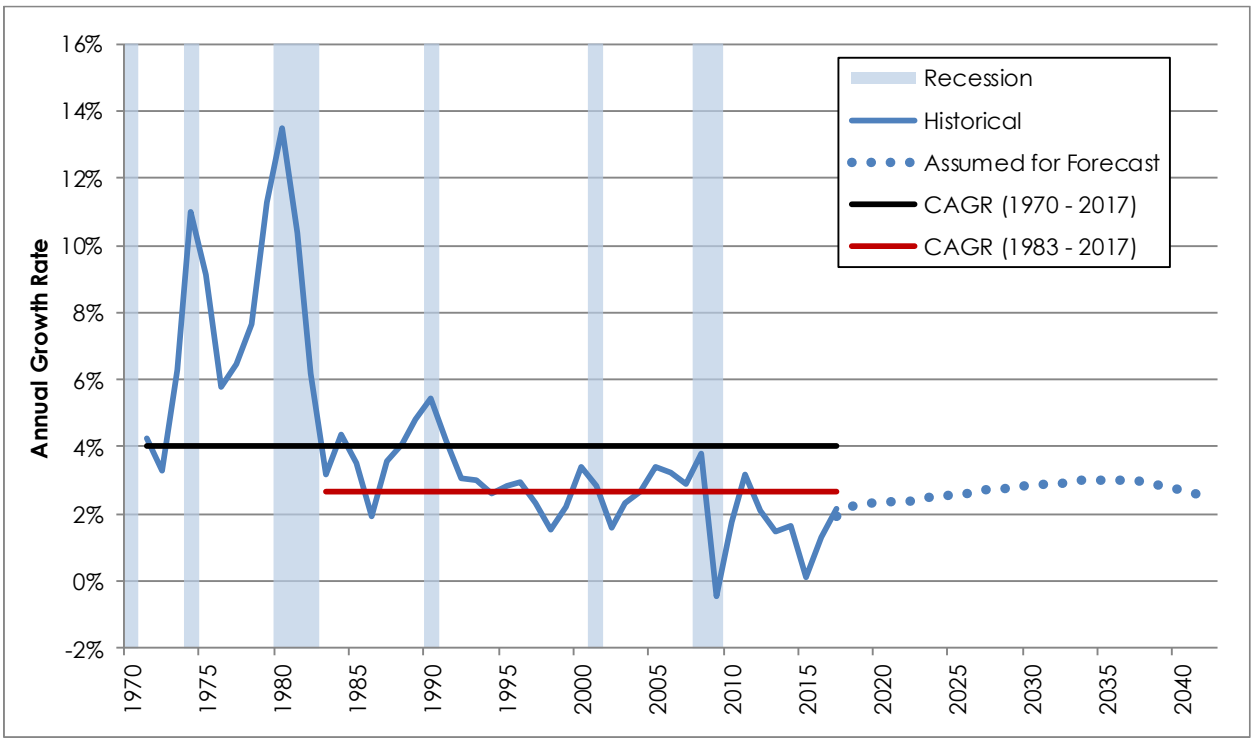
Considering these trends, Stantec found it reasonable to escalate inflation as listed in Table 4.6. The assumed annual escalation rates begin close to the more recent data at 2.2 percent in 2019, then gradually increase to 3.0 percent by 2034 and continue at that level through 2038 and then decrease slightly thereafter. The historical and projected average annual growth rates are also shown in Figure 4.2 below. Toll escalation for the other toll roads in the region are based on the respective policy for each toll facility. The annual base rates for CTRMA's facilities are also based on changes in CPI-U, similar to CTTS. Toll rates for SH 130 Segments 5 & 6 are assumed to escalate based on a historical relationship between CPI and Texas Gross State Product (GSP) per capita, as this facility escalates tolls via changes in the Texas GSP per capita.

Table 4.6 Annual Consumer Price Index – Recent and Projected

Year	Annual CPI-U [1] (1982-84=100)	Annual Rate of Change
2008	215	
2009	214	-0.4%
2010	218	1.8%
2011	225	3.1%
2012	230	2.1%
2013	233	1.5%
2014	237	1.6%
2015	237	0.1%
2016	240	1.3%
2017	245	2.1%
Annual Toll Escalation		
2014 (Aug 2012 - Aug 2013)		1.5%
2015 (Aug 2013 - Aug 2014)		1.7%
2016 (Aug 2014 - Aug 2015)		0.2%
2017 (Aug 2015 - Aug 2016)		1.1%
2018 (Aug 2016 - Aug 2017)		1.9%
2019		2.2%
2020		2.3%
2021		2.3%
2022		2.4%
2023		2.4%
2024		2.5%
2025		2.5%
2026		2.6%
2027		2.6%
2028		2.7%
2029		2.7%
2030		2.8%
2031		2.8%
2032		2.9%
2033		2.9%
2034		3.0%
2035		3.0%
2036		3.0%
2037		3.0%
2038		3.0%
2039		2.9%
2040		2.8%
2041		2.7%
2042		2.6%
2017 - 2042		2.7%

Notes: (1) CPI-U values shown are nominal U.S. city average, all items, seasonally adjusted annual averages.
(2) Projected assumed for forecast.

Figure 4.2 Annual Consumer Price Index – Historical and Projected



4.4 FUTURE TOLL RATES

The assumed toll rates on each CTTS facility for each model year, as well as the existing 2018 toll rates, are shown in Table 4.7, Table 4.8, Table 4.9, and Table 4.10 below. The surcharge of 33 percent for PBM transactions is assumed to continue throughout all model years. Vehicles having more than two axles will continue to pay a proportionately higher toll using the (n-1) formula in the same way these vehicles currently do. Consistent with TxDOT's current policy described previously, truck tolls for SH 130 and SH 45 SE are capped at the rate of a 4-axle vehicle.

A full-length trip using ETC on SH 45 N currently costs $2.18 in 2018, and by 2040, the toll for the same trip increases to $3.92. The per mile rate for the 12.8-mile full-length trip on SH 45 N is $0.17 in 2018, increasing to $0.31 in 2040. On Loop 1, a full-length trip costs $1.09 today for ETC transactions, but will increase to $1.96 in 2040. The per mile toll rate on Loop 1 for a full-length trip of four miles is currently $0.27 and will increase to $0.49 in 2040.

Table 4.7 SH 45 N Toll Schedule (Autos)

Toll Location	Payment Type	2016*	2017	2018*	2020*	2030*	2040*
Lake Creek ML Plaza	Pay by Mail	$1.41	$1.42	$1.45	$1.52	$1.95	$2.60
	ETC	$1.06	$1.07	$1.09	$1.14	$1.47	$1.96
Parmer Ln (FM 734) Ramps	Pay by Mail	$1.21	$1.22	$1.25	$1.31	$1.68	$2.24
	ETC	$0.91	$0.92	$0.94	$0.98	$1.26	$1.69
RM 620 (Howard Ln) Ramps	Pay by Mail	$1.21	$1.22	$1.25	$1.31	$1.68	$2.24
	ETC	$0.91	$0.92	$0.94	$0.98	$1.26	$1.69
O'Connor Dr Ramps	Pay by Mail	$1.24	$1.25	$1.28	$1.33	$1.72	$2.29
	ETC	$0.93	$0.94	$0.96	$1.00	$1.29	$1.72
Greenlawn Ramps	Pay by Mail	$0.93	$0.94	$0.96	$1.00	$1.29	$1.72
	ETC	$0.70	$0.71	$0.72	$0.75	$0.97	$1.29
AW Grimes Ramps	Pay by Mail	$0.93	$0.94	$0.96	$1.00	$1.29	$1.72
	ETC	$0.70	$0.71	$0.72	$0.75	$0.97	$1.29
Schultz Ln (Arterial A) Ramps	Pay by Mail	$1.41	$1.42	$1.45	$1.52	$1.95	$2.60
	ETC	$1.06	$1.07	$1.09	$1.14	$1.47	$1.96
Wilke Ln (Heatherwide) Ramps	Pay by Mail	$1.41	$1.42	$1.45	$1.52	$1.95	$2.60
	ETC	$1.06	$1.07	$1.09	$1.14	$1.47	$1.96
Heatherwide ML Plaza	Pay by Mail	$1.41	$1.42	$1.45	$1.52	$1.95	$2.60
	ETC	$1.06	$1.07	$1.09	$1.14	$1.47	$1.96
Full Length Trip	Distance	12.8	12.8	12.8	12.8	12.8	12.8
	Rate per Mile	$0.17	$0.17	$0.17	$0.18	$0.23	$0.31
	Toll Cost (ETC)	$2.12	$2.14	$2.18	$2.28	$2.94	$3.92

Notes: (1) Rate per mile shown for a full-length trip is equal to the total toll cost divided by the distance.
(2) Toll cost for a full-length trip is equal to the sum of the mainline plaza tolls.
(3) The assumed annual escalation rates are as shown in Table 4.6.
(4) Toll rates shown for 2016 through 2018 are actual; toll rates shown for 2020, 2030 and 2040 are assumed based on the escalation rates shown in Table 4.6.
(5) Years shown with an asterisk (*) are model years.

Table 4.8 Loop 1 Toll Schedule (Autos)

Toll Location	Payment Type	2016*	2017	2018*	2020*	2030*	2040*
Howard Ln / Wells Branch Ramps	Pay by Mail	$0.93	$0.94	$0.96	$1.00	$1.29	$1.72
	ETC	$0.70	$0.71	$0.72	$0.75	$0.97	$1.29
Merrilltown ML Plaza	Pay by Mail	$1.41	$1.42	$1.45	$1.52	$1.95	$2.60
	ETC	$1.06	$1.07	$1.09	$1.14	$1.47	$1.96
Shoreline Dr Ramps	Pay by Mail	$0.93	$0.94	$0.96	$1.00	$1.29	$1.72
	ETC	$0.70	$0.71	$0.72	$0.75	$0.97	$1.29
Full Length Trip	Distance	4.0	4.0	4.0	4.0	4.0	4.0
	Rate per Mile	$0.27	$0.27	$0.27	$0.28	$0.37	$0.49
	Toll Cost (ETC)	$1.06	$1.07	$1.09	$1.14	$1.47	$1.96

Notes: (1) Rate per mile shown for a full-length trip is equal to the total toll cost divided by the distance.
(2) Toll cost for a full-length trip is equal to the sum of the mainline plaza tolls.
(3) The assumed annual escalation rates are as shown in Table 4.6.
(4) Toll rates shown for 2016 through 2018 are actual; toll rates shown for 2020, 2030 and 2040 are assumed based on the escalation rates shown in Table 4.6.
(5) Years shown with an asterisk (*) are model years.

To travel the full length of 49 miles on SH 130 Segments 1-4 today, the toll cost is $7.20 using ETC or $0.15 per mile. By 2040, the same full-length trip on this road increases to $12.92 for a per mile rate of $0.26. On SH 45 SE, the current ETC cost for a full-length trip is $1.07 and increases to $1.92 by 2040. The per-mile rate for a full-length seven-mile trip will increase from $0.15 in 2014 to $0.27 in 2040.

Table 4.9 SH 130 Toll Schedule (Autos)

Toll Location	Payment Type	2016*	2017	2018*	2020*	2030*	2040*
Segment 1 ML Plaza	Pay by Mail	$2.33	$2.35	$2.39	$2.50	$3.22	$4.30
	ETC	$1.75	$1.77	$1.80	$1.88	$2.42	$3.23
Segment 2 ML Plaza	Pay by Mail	$2.33	$2.35	$2.39	$2.50	$3.22	$4.30
	ETC	$1.75	$1.77	$1.80	$1.88	$2.42	$3.23
Segment 3 ML Plaza	Pay by Mail	$2.33	$2.35	$2.39	$2.50	$3.22	$4.30
	ETC	$1.75	$1.77	$1.80	$1.88	$2.42	$3.23
Segment 4 ML Plaza	Pay by Mail	$2.33	$2.35	$2.39	$2.50	$3.22	$4.30
	ETC	$1.75	$1.77	$1.80	$1.88	$2.42	$3.23
Cameron Rd Ramps	Pay by Mail	$2.33	$2.35	$2.39	$2.50	$3.22	$4.30
	ETC	$1.75	$1.77	$1.80	$1.88	$2.42	$3.23
FM 104, Pecan St, Gregg Manor, FM 973, FM 969, Pearce Ln, and FM 812 Ramps	Pay by Mail	$0.77	$0.78	$0.80	$0.83	$1.07	$1.43
	ETC	$0.58	$0.59	$0.60	$0.63	$0.81	$1.08
US 79, CR 138, Chandler Rd and Elroy Rd Ramps	Pay by Mail	$1.00	$1.01	$1.02	$1.07	$1.38	$1.84
	ETC	$0.75	$0.76	$0.77	$0.81	$1.04	$1.38
SH 29, Blue Bluff, Harold Green, and Moore Rd Ramps	Pay by Mail	$0.63	$0.64	$0.65	$0.68	$0.88	$1.17
	ETC	$0.47	$0.48	$0.49	$0.51	$0.66	$0.88
Full Length Trip	Distance	49.0	49.0	49.0	49.0	49.0	49.0
	Rate per Mile	$0.14	$0.14	$0.15	$0.15	$0.20	$0.26
	Toll Cost (ETC)	$7.00	$7.08	$7.20	$7.52	$9.68	$12.92

Notes: (1) Rate per mile shown for a full-length trip is equal to the total toll cost divided by the distance.
(2) Toll cost for a full-length trip is equal to the sum of the mainline plaza tolls.
(3) The assumed annual escalation rates are as shown in Table 4.6.
(4) Toll rates shown for 2016 through 2018 are actual; toll rates shown for 2020, 2030 and 2040 are assumed based on the escalation rates shown in Table 4.6.
(5) Years shown with an asterisk (*) are model years.

Table 4.10 SH 45 SE Toll Schedule (Autos)

Toll Location	Payment Type	2016*	2017	2018*	2020*	2030*	2040*
Mainline Plaza	Pay by Mail	$1.38	$1.40	$1.42	$1.49	$1.91	$2.55
	ETC	$1.04	$1.05	$1.07	$1.12	$1.44	$1.92
Turnersville Rd Ramps	Pay by Mail	$0.90	$0.92	$0.93	$0.97	$1.25	$1.67
	ETC	$0.68	$0.69	$0.70	$0.73	$0.94	$1.26
FM 1625 Ramps	Pay by Mail	$0.90	$0.92	$0.93	$0.97	$1.25	$1.67
	ETC	$0.68	$0.69	$0.70	$0.73	$0.94	$1.26
Full Length Trip	Distance	7.0	7.0	7.0	7.0	7.0	7.0
	Rate per Mile	$0.15	$0.15	$0.15	$0.16	$0.21	$0.27
	Toll Cost (ETC)	$1.04	$1.05	$1.07	$1.12	$1.44	$1.92

Notes: (1) Rate per mile shown for a full-length trip is equal to the total toll cost divided by the distance.
(2) Toll cost for a full-length trip is equal to the sum of the mainline plaza tolls.
(3) The assumed annual escalation rates are as shown in Table 4.6.
(4) Toll rates shown for 2016 through 2018 are actual; toll rates shown for 2020, 2030 and 2040 are assumed based on the escalation rates shown in Table 4.6.
(5) Years shown with an asterisk (*) are model years.

4.5 TOLL PAYMENT AND NON-PAYMENT PROCEDURES

Transponder-Based Payments

Transponders systems use small electronic devices mounted within vehicles (as an example TxTag are stickers) that are read by tolling equipment as the vehicle crosses a tolling point. Each TxTag transponder is tied to a pre-paid customer toll account and funds are withdrawn daily by TxDOT from such account as tolls are incurred. A single toll account can have multiple TxTag transponders associated with such account. ETC transactions are processed on the CTTS using TxTag as well as ETC transponders issued by other interoperable toll entities. During fiscal year 2016, approximately 61.6% of the total toll transactions processed for the CTTS were attributable to ETC transponder accounts, of these transactions 53.9% were TxTag and 7.7% were other interoperable tags.

As discussed earlier in this chapter, the CTTS toll collection system is interoperable with all tags issued in Texas, including those issued by Harris County Toll Road Authority and North Texas Tollway Authority, as well as those from the Oklahoma Turnpike Authority and Kansas Turnpike Authority. The interoperability terms are governed by the 2017 Central US Interoperability Agreement (CUSIOP Agreement), which also revised the interoperability transaction fees paid by the toll road owner to the transponder issuer. TxDOT expects to enter into one or more additional interoperability agreement(s) involving other states in the near future in order to comply with the federal Moving Ahead for Progress in the 21st Century Act (also known as MAP 21) which requires that all toll facilities on federal-aid highways implement technologies or business practices that provide for the interoperability of ETC programs, meaning all facilities can read all transponders to provide a seamless process to all patrons on all facilities nationwide. A recent Commission decision authorized TxDOT to enter into a separate supplemental interoperability agreement (SSIOP) with other Texas toll entities, the Oklahoma Turnpike Authority, the Kansas Turnpike Authority, and Florida's Turnpike Enterprise related to the interoperability of their respective ETC programs through the use of the Central US Interoperability Hub and the Southeast US Interoperability Hub. The Southeast US Interoperability Hub is owned, operated and maintained by Florida's Turnpike Enterprise and provides for interoperability of transponders on multiple facilities in the states of Florida, North Carolina, South Carolina, Georgia, and Alabama. TxDOT anticipates that it will take several months before this new interoperability agreement is fully implemented following its execution by the parties.

Pay by Mail Processing

For drivers who choose not to use ETC methods and pay the lower ETC toll rate, the PBM option as described above is available. Under the PBM process, if a driver crosses a tolling point and a valid ETC transponder is not recognized, an image of the vehicle's license plate is captured and if there is an existing customer toll account with sufficient funds for that license plate, the transaction is posted to such account and processed as an ETC transponder payment. Customers that use a CTTS facility without a valid and sufficiently funded transponder account are considered PBM transactions and are invoiced for the amount of the toll due on a monthly basis. Certain image-based transactions that occur on the CTTS are not able to be invoiced because the license plate

could not be read accurately, the vehicle was exempt from payment of tolls, or for other technical reasons.

According to the latest full fiscal year statistics (FY 2016), which provides for adequate aging of all PBM invoices, approximately 51 percent of the image-based transactions were collected. Of these, 82 percent were collected during the PBM resolution or within three months after the invoice was issued. The remainder (18 percent) were paid after the initial three-month period. Under the newly implemented state statute known as Senate Bill 312 (SB 312) requirements and related administrative rules, customers who fail to pay the toll amount due within thirty days of the date of the invoice are charged an administrative fee of $4 per unpaid invoice per month per registered owner, with a maximum of $48 in administrative fees per registered owner in a twelve-month period. The following section provides further background on the specific requirements and changes contained within Senate Bill 312.

Senate Bill 312

Senate Bill 312 was passed by the 85th Texas Legislature with a required implementation date of March 1, 2018. The legislation included a number of provisions related to invoicing and administrative fees for TxDOT toll roads. Since the CTTS already used the PBM process for invoicing transactions, the most significant tolling changes to the CTTS were related to the assessment of administrative fees, the requirement to allow electronic invoicing, and a restriction to only take an individual to court once per year for non-payment of tolls. Prior to the implementation of SB 312, administrative fees were transaction based and the violation, collection and court fee per transaction could escalate from $5 to $25 to $100 per transaction if the individual did not pay and the transaction was filed in court. SB 312 changed the administrative fee structure from a transaction-based fee to an invoice-based fee and included a maximum administrative fee of $48 per twelve-month period per registered owner and also required TxDOT to create administrative rules prior to program implementation. TxDOT rules restrict the administrative invoice fee to $4 per invoice per registered owner with a cap of $48 per registered owner per twelve-month period. They also include a toll dispute process for customers.

The administrative fee of $4 begins on the second invoice, which is for non-payment after 30 days from the first invoice. A person continues to be charged $4 per monthly invoice for non-payment as long as there are unpaid tolls or fees up to the $48 cap. If an individual receives a mailed invoice, they will also be assessed the $1.15 statement fee each month. The statement fee is assessed under a different statutory authority and is not included in the $48 cap.

In the past, administrative fees were roadway specific because they were assessed on a specific transaction. An invoice that includes the new administrative fee for non-payment could include transactions from multiple toll roads in addition to the System, so the new fee is no longer roadway specific. Note that the projected revenue forecasts in Chapter 8 do not include any revenue from these administrative fees.

Habitual Violator Program

In June 2013, additional toll enforcement legislation authorized new toll enforcement tools to pursue habitual violators throughout Texas, which legislation was not impacted by SB 312. Habitual violators are those with more than 100 unpaid tolls in a one-year period and who have been sent at least two notices of non-payment. The 2013 legislation provides more authority to enforce nonpayment, including publishing violator names, certain address information and amounts due on websites, and banning the vehicles from using toll roads operated by TxDOT, including the CTTS. If caught driving on a prohibited toll road after being banned and ticketed, the violator's vehicle may be impounded. The legislation also include authority to report habitual violators to county tax-assessor collectors, who are responsible for vehicle registration. County tax-assessor collectors have discretion, and are therefore not required, to block the renewal of habitual violators vehicle registration based on non-payment of tolls. This program has been used on the System previously to a limited extent, and TxDOT is in the process of formulating a policy and related procedures to expand the past program.

4.6 CUSTOMER ACCOUNT FEES

In addition to statement fees outlined above in the PBM process, the TxTag customer license and use agreement also outlines several other types of customer account fees that may be assessed. In prior CTTS revenue forecasts, estimates of revenue generated from customer service center fees were included as part of the CTTS revenue forecasts in order to highlight that this added revenue was available to offset some of the administrative and operations costs of the CTTS. In the previous 2014 CTTS Report forecasts, the customer service fee revenues were estimated to be approximately 10 percent of the forecasted revenue in 2015 but declined to approximately 4.7 percent by the end of the forecast period. Given the recent changes in administrative fees generated by the SB 312 legislative requirements and the re-examination of the allocation of customer service center fee revenue, a decision was made not to incorporate estimates of customer service center fees or administrative fees in the CTTS forecasted revenue stream. Therefore, while the revenue from such fees will remain available to support CTTS administrative costs, the projected revenue forecasts in Chapter 8 do not include any revenue from these fees.

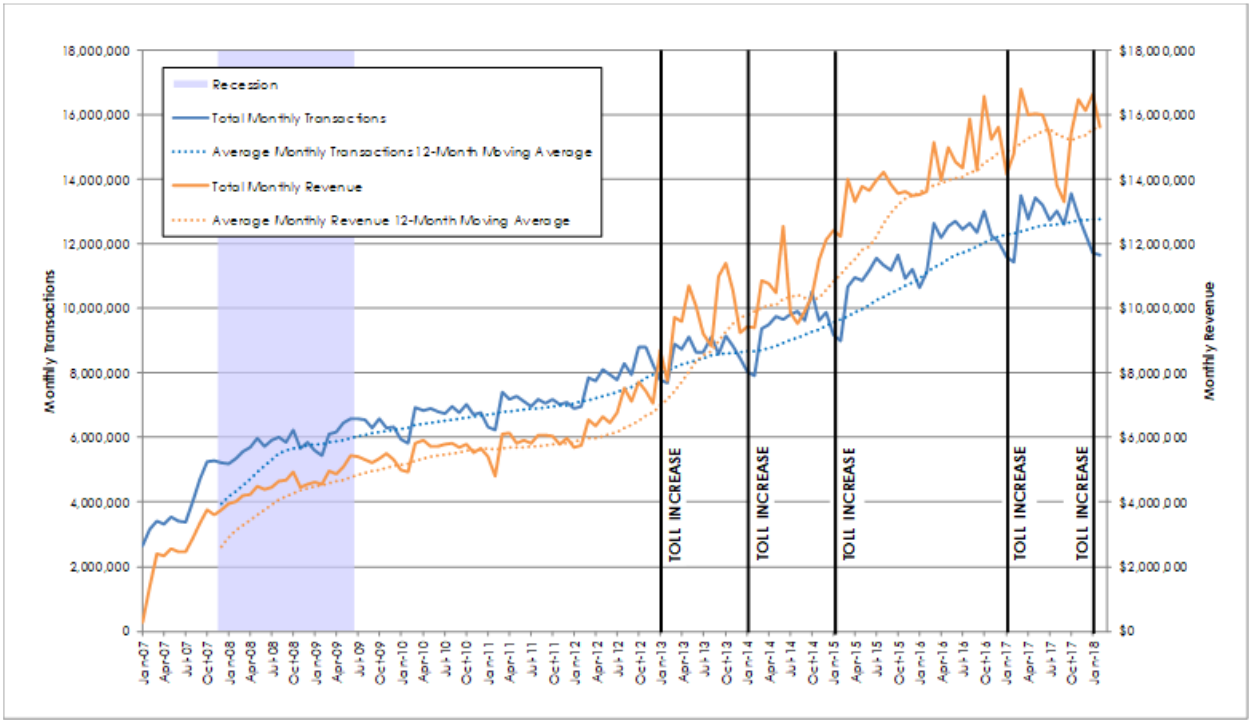
5.0 HISTORICAL CTTS TOLL TRANSACTIONS AND REVENUE

Transactions for CTTS toll facilities have been reviewed since November 2006 when the first phases of SH 45 N, Loop 1, and SH 130 opened to traffic. Historical transaction and revenue data, as presented within this chapter, provide a comprehensive record of the transaction and revenue growth, vehicle distribution, weekday and seasonal patterns, payment methods and transaction payment status. It should also be noted that the recognition of revenue by payment method varies, where ETC and Cash revenue (during the period when available) were recognized at the time of the transaction, whereas PBM revenue was recognized at the time the toll invoices were paid. These historical characteristics are the foundation for the assumptions in this study about future conditions and trends of the facilities.

5.1 MONTHLY AND ANNUAL TRANSACTIONS AND REVENUE

Total transactions and revenue across the CTTS facilities have gradually increased since tolling began in January 2007. Figure 5.1 below shows the historical performance of the CTTS facilities by month and 12-month moving averages for total transactions and revenue.

Figure 5.1 CTTS Historical Transactions and Revenue



As shown in the figure, the facilities opened with strong growth in traffic due to ramp up. An additional factor affecting revenue growth was the toll phasing that occurred during 2007 as part of the introductory marketing period where the facilities opened in a toll-free condition and transitioned to half rates and subsequently to full rates over several months. Growth then flattened out somewhat at the start of the recession at the end of 2007. Transaction and revenue growths have been fairly parallel, progressing at a similar growth rate until January 2013 when revenues increased as a result of a toll increase. In September 2012, SH 45 SE became a part of the CTTS, and the toll road's transactions and revenue were added to the CTTS total. In looking at the annual patterns of transactions and revenue across the historical data, there is a clear reduction in traffic and revenue during the winter months. This is due to multiple factors, most notably the inclement weather conditions that tend to suppress travel and construction activity.

The total annual transactions and revenue by calendar year, as reported in the CTTS annual reports, are shown in Table 5.1 and Table 5.2. Annual transactions and revenue by fiscal year are shown in Table 5.3 and Table 5.4, respectively. CTTS's fiscal year runs from September 1 through August 31 of the succeeding calendar year.

The transaction growth of 63.4 percent for SH 45 N in CY 2008 reflects the opening of SH 45 N West in August 2007 and the Heatherwilde ramps in September 2008. Since then, SH 45 N maintained fairly steady transaction growth until CY 2013 which showed much lower growth due to the CTTS system-wide toll rate increase implemented in January 2013. Despite the flattened growth in transactions of 0.7 percent in CY 2013, revenue increased 49.1 percent, showing the impact of the toll rate increase. The high transaction and revenue growths in CY 2015 reflect the opening of the O'Connor Drive ramps in August 2014. Transaction growth on SH 45 N has gradually returned to moderate levels since 2015 with a 3.5 percent increase for CY 2017. For the first two months of CY 2018, transactions and revenue have increased by 1.9 percent and 5.0 percent respectively when compared the same months in 2017. Revenue growth for CY 2017 has similar trends with a 3.3 percent increase. Annual toll increases occurring in January tend to result in more significant revenue growth than transaction growth on all corridors. Because there was no toll increase in CY 2016 (see Chapter 4), revenue growth for CY 2016 (8.7 percent on SH 45 N) was less significant than transaction growth (10.1 percent on SH 45 N).

Loop 1 has also sustained its transaction and revenue growth from CY 2007 through CY 2013 with fairly parallel growth rates. In CY 2013, the toll rate increase had an impact on performance. Although there was a 2.2 percent loss of transactions, there was an increase in revenue of 39.3 percent. In CY 2016, the recent year without a toll increase, transaction growth outpaced revenue growth at 8.3 percent and 5.9 percent, respectively. During CY 2017 transactions increased by 5.7 percent and revenue increased by 5.2 percent. For the first two months of CY 2018, transactions are 5.2 percent higher and revenue is 10.1 percent higher than the same period in 2017. This strong level of growth is likely due to the completion of the MoPac North managed lanes in late 2017. Construction-related congestion on Loop1 adjacent to the new managed lanes likely restricted traffic flow, thus suppressing some traffic during months of 2017 prior to October.

SH 130 experienced very high transaction growth in the early years due to the phased opening of Segment 3 in November 2007 and Segment 4 in July 2008. In CY 2012, transactions and revenue both increased notably by approximately 19 percent due to the opening of the Cameron Road ramps in January and Segments 5 & 6 in October along with on-going development in this largely rural corridor. Although Segments 5 & 6 are not operated by TxDOT, they interact with the CTTS portion of SH 130 (Segments 1 - 4), as they add continuity as a competing roadway to IH-35 for long-distance traffic. Transactions have generally increased by over 13 percent each year, driven primarily by increased development within the corridor. Revenue has increased by approximately 17 percent. For CY 2017 the rate of growth declined, with transaction and revenue growth of 4.9 percent and 3.6 percent. During the first two months of CY 2018 transactions increased slightly by 0.1 percent and revenue increased by 14.6 percent over the same months in 2017. This lower level of transaction growth is likely related to completion of construction on Loop 1. During the multi-year construction of the MoPac North managed lanes, construction congestion likely diverted some traffic from Loop 1 onto IH-35, thus temporarily increasing congestion for that facility. The subsequent completion of the MoPac North managed lanes In October of 2017 improved traffic flow on Loop 1 and some traffic was diverted back to Loop 1 from IH-35. Since SH 130 competes with IH-35 for certain trip patterns, the improved conditions on IH-35 likely diverted some traffic from SH 130.

Due to the length of SH 130, the growth rates by segment have varied. Although not shown in a table, from 2009 to 2017, Segment 2 has the highest number of transactions and has a compounded annual growth rate of approximately 11 percent. Segment 3, which has the second-highest number of transactions has a compounded annual growth rate of approximately 14 percent over that period. Segments 1 and 4 have about the same number of transactions, which are the lowest of the four segments. However, Segment 4 has a higher compounded annual growth rate of approximately 19 percent, while Segment 1 has grown at an average rate of about 14 percent per year. The variations in the growth rates are a function of the existing level of development adjacent to each segment and the rate of new development being added each year. Segment 2 is primarily serving the more developed Round Rock and Pflugerville areas, while the areas near Segment 4 are largely undeveloped.

As of September 2012, SH 45 SE has been operated by CTTS and therefore contributes to the CTTS total transactions and revenue. Since then, the facility has experienced strong growth similar to SH 130, also driven by increased development nearby. However, for CY 2017, transactions increased at a slower pace of 0.5 percent while revenue increased 2.3 percent. For the first two months of CY 2018, transactions are 1.9 percent lower and revenue is 6.7 percent higher than the same period in 2017. The reduced level of transactions is likely related to diversion of traffic described for SH 130 and may be transitory as on-going growth in the SH 130 corridor impacts SH 45 SE.

Table 5.1 Total Annual Calendar Year Transactions by CTTS Element

Calendar Year	SH 45 N	% Change	Loop 1	% Change	SH 130	% Change	SH 45 SE [1]	% Change	Total	% Change
2007	18,495,000		16,506,800		12,378,900		-	-	**47,380,700**	
2008	30,213,200	63.4%	17,315,600	4.9%	21,562,200	74.2%	-	-	**69,091,000**	**45.8%**
2009	31,632,100	4.7%	17,511,400	1.1%	25,879,300	20.0%	-	-	**75,022,800**	**8.6%**
2010	32,602,600	3.1%	18,372,700	4.9%	29,272,300	13.1%	-	-	**80,247,600**	**7.0%**
2011	33,917,100	4.0%	19,100,800	4.0%	31,101,100	6.2%	-	-	**84,119,000**	**4.8%**
2012	36,867,000	8.7%	20,086,700	5.2%	37,094,700	19.3%	1,410,600	-	**95,459,000**	**13.5%**
2013	37,132,540	0.7%	19,636,600	-2.2%	42,574,500	14.8%	4,395,200	211.6%	**103,738,840**	**8.7%**
2014	39,551,656	6.5%	20,279,971	3.3%	48,865,191	14.8%	4,994,527	13.6%	**113,691,345**	**9.6%**
2015	44,144,793	11.6%	21,967,513	8.3%	57,872,427	18.4%	5,845,084	17.0%	**129,829,817**	**14.2%**
2016	48,581,594	10.1%	23,799,579	8.3%	67,610,309	16.8%	6,720,649	15.0%	**146,712,131**	**13.0%**
2017	50,299,627	3.5%	25,144,317	5.7%	70,902,060	4.9%	6,753,791	0.5%	**153,099,795**	**4.4%**
First 2 Months of Calendar Year (January - February)										
2017	7,827,269		3,940,831		10,299,615		982,490		**23,050,205**	
2018 [2]	7,975,712	1.9%	4,145,142	5.2%	10,311,637	0.1%	963,594	-1.9%	**23,396,085**	**1.5%**

Notes: (1) SH 45 SE opened to traffic in May 2009 but did not become part of the CTTS until September 2012. As a result, the large Increase in 2013 is due to results for 2012 representing only part of year.
(2) Total transaction data was only available up to February 2018 at the time this report. therefore, CY 2018 transactions shown are from only two months of the calendar year.

Table 5.2 Total Annual Calendar Year Toll Revenue by CTTS Element

Calendar Year	SH 45 N	% Change	Loop 1	% Change	SH 130	% Change	SH 45 SE [1]	% Change	Total	% Change
2007 [2]	-	-	-	-	-	-	-	-	**$31,241,900**	
2008 [2]	-	-	-	-	-	-	-	-	**$53,038,800**	**69.8%**
2009 [2]	-	-	-	-	-	-	-	-	**$61,674,400**	**16.3%**
2010	$19,894,000	-	$12,060,000	-	$35,498,600	-	-	-	**$67,452,600**	**9.4%**
2011	$20,667,900	3.9%	$12,513,700	3.8%	$36,839,900	3.8%	-	-	**$70,021,500**	**3.8%**
2012	$22,503,400	8.9%	$13,101,800	4.7%	$43,902,000	19.2%	$1,643,200	-	**$81,150,400**	**15.9%**
2013	$33,543,600	49.1%	$18,247,200	39.3%	$61,005,700	39.0%	$4,015,900	144.4%	**$116,812,400**	**43.9%**
2014	$34,764,361	3.6%	$18,450,347	1.1%	$68,766,956	12.7%	$4,972,801	23.8%	**$126,954,465**	**8.7%**
2015	$40,668,729	17.0%	$21,182,525	14.8%	$93,812,589	36.4%	$6,546,252	31.6%	**$162,210,100**	**27.8%**
2016	$44,192,903	8.7%	$22,423,451	5.9%	$104,051,717	10.9%	$7,201,825	10.0%	**$177,869,899**	**9.7%**
2017	$45,634,969	3.3%	$23,598,251	5.2%	$107,805,934	3.6%	$7,369,530	2.3%	**$184,408,685**	**3.7%**
First 2 Months of Calendar Year (January - February)										
2017	$7,264,875		$3,774,917		$16,812,403		$1,140,554		**$28,992,749**	
2018 [3]	$7,631,306	5.0%	$4,157,722	10.1%	$19,266,025	14.6%	$1,216,756	6.7%	**$32,271,806**	**11.3%**

Notes: (1) SH 45 SE opened to traffic in May 2009 but did not become part of the CTTS until September 2012.
(2) Revenue for PBM patrons was not allocated by each toll facility until September 2009; therefore, only total CTTS revenue is shown for CY 2007 through CY 2009.
(3) Total revenue data was only available up to February 2018 at the time this report. therefore, CY 2018 transactions shown are from only two months of the calendar year.
(4) Total revenues may not equal the sum of values shown due to rounding.

Table 5.3 Total Annual Fiscal Year Transactions by CTTS Element

Fiscal Year	SH 45 N	% Change	Loop 1	% Change	SH 130	% Change	SH 45 SE [1]	% Change	Total	% Change
2008	29,458,300		17,194,700		19,287,000		-	-	65,940,000	
2009	31,269,500	6.1%	17,381,000	1.1%	24,457,300	26.8%	-	-	73,107,800	10.9%
2010	32,166,700	2.9%	18,064,100	3.9%	28,298,300	15.7%	-	-	78,529,100	7.4%
2011	33,543,300	4.3%	18,883,100	4.5%	30,583,200	8.1%	-	-	83,009,600	5.7%
2012	35,790,100	6.7%	19,889,700	5.3%	34,352,100	12.3%	-	-	90,031,900	8.5%
2013	37,126,440	3.7%	19,715,300	-0.9%	41,365,500	20.4%	4,300,000	-	102,507,240	13.9%
2014	38,255,800	3.0%	19,839,100	0.6%	46,210,700	11.7%	4,743,000	10.3%	109,048,600	6.4%
2015	42,686,069	11.6%	21,468,026	8.2%	54,785,716	18.6%	5,565,864	17.3%	124,505,675	14.2%
2016	47,447,472	11.2%	23,191,211	8.0%	64,822,453	18.3%	6,512,755	17.0%	141,973,891	14.0%
2017	49,790,143	4.9%	24,727,377	6.6%	70,241,133	8.4%	6,742,689	3.5%	151,501,342	6.7%
First 6 Months of Fiscal Year (September - February)										
2017	24,182,171		12,003,757		33,380,473		3,226,931		72,793,332	
2018 [2]	24,840,098	2.7%	12,625,008	5.2%	34,053,422	2.0%	3,219,137	-0.2%	74,737,665	2.7%

Notes: (1) SH 45 SE opened to traffic in May 2009 but did not become part of the CTTS until September 2012 (FY 2013).
(2) Total transaction data was only available up to February 2018 at the time this report. therefore, FY 2018 transactions shown are from only six months of the fiscal year.

Table 5.4 Total Annual Fiscal Year Toll Revenue by CTTS Element

Fiscal Year	SH 45 N	% Change	Loop 1	% Change	SH 130	% Change	SH 45 SE [1]	% Change	Total	% Change
2008 [2]	-	-	-	-	-	-	-	-	$48,905,800	
2009 [2]	-	-	-	-	-	-	-	-	$58,913,900	20.5%
2010	$19,798,600	-	$11,936,900	-	$34,408,300	-	-	-	$66,143,800	12.3%
2011	$20,268,200	2.4%	$12,316,600	3.2%	$36,237,000	5.3%	-	-	$68,821,800	4.0%
2012	$21,944,600	8.3%	$13,015,100	5.7%	$40,735,000	12.4%	-	-	$75,694,700	10.0%
2013	$29,075,300	32.5%	$16,142,700	24.0%	$54,492,200	33.8%	$4,274,300	-	$103,984,500	37.4%
2014	$34,830,800	19.8%	$18,559,800	15.0%	$67,092,300	23.1%	$4,679,700	9.5%	$125,162,600	20.4%
2015	$38,957,075	11.8%	$20,458,635	10.2%	$86,195,287	28.5%	$6,019,081	28.6%	$151,630,078	21.1%
2016	$42,730,689	9.7%	$21,725,581	6.2%	$99,303,415	15.2%	$6,896,860	14.6%	$170,656,545	12.5%
2017	$45,496,303	6.5%	$23,348,544	7.5%	$108,614,674	9.4%	$7,358,409	6.7%	$184,817,929	8.3%
First 6 Months of Fiscal Year (September - February)										
2017	$22,417,405		$11,487,225		$53,206,365		$3,650,591		$90,761,588	
2018 [2]	$22,922,502	2.3%	$12,119,737	5.5%	$54,851,248	3.1%	$3,737,913	2.4%	$93,631,401	3.2%

Notes: (1) SH 45 SE opened to traffic in May 2009 but did not become part of the CTTS until September 2012 (FY 2013).
(2) Revenue for PBM patrons was not allocated by each toll facility until September 2009 (FY 2010); therefore, only total CTTS revenue is shown for FY 2008 and FY 2009.
(3) Total revenue data was only available up to February 2018 at the time this report. therefore, FY 2018 transactions shown are from only six months of the fiscal year. Total revenue may not equal the sum of values shown due to rounding.

Table 5.5 shows the average toll per transaction for the CTTS elements by fiscal year. The tolls per transaction for fiscal years 2010 through 2012 are nearly identical since tolls were held constant during this period. Tolls were also not increased in 2016 hence the small difference between FY 2015 and FY 2016. The minor variations are likely due to variation in the recognition of the PBM revenue between fiscal years. There was a significant increase in the toll value per transaction for FY 2013 and FY 2014, reflecting the large increase in tolls that was implemented in January 2013. Increases in average toll are also observed in FY 2015 and FY 2017 due to the January 2015 and January 2017 CPI-based increase in toll rates.

Table 5.5 Average Toll Per Transaction by CTTS Element

Fiscal Year	SH 45 N	% Change	Loop 1	% Change	SH 130	% Change	SH 45 SE	% Change	Total	% Change
2008	-	-	-	-	-	-	-	-	**$0.74**	
2009	-	-	-	-	-	-	-	-	**$0.81**	**8.7%**
2010	$0.62	-	$0.66	-	$1.22	-	-	-	**$0.84**	**4.5%**
2011	$0.60	-1.8%	$0.65	-1.3%	$1.18	-2.6%	-	-	**$0.83**	**-1.6%**
2012	$0.61	1.5%	$0.65	0.3%	$1.19	0.1%	-	-	**$0.84**	**1.4%**
2013	$0.78	27.7%	$0.82	25.1%	$1.32	11.1%	$0.99	-	**$1.01**	**20.7%**
2014	$0.91	16.3%	$0.94	14.3%	$1.45	10.2%	$0.99	-0.7%	**$1.15**	**13.1%**
2015	$0.91	0.2%	$0.95	1.9%	$1.57	8.4%	$1.08	9.6%	**$1.22**	**6.1%**
2016	$0.90	-1.3%	$0.94	-1.7%	$1.53	-2.6%	$1.06	-2.1%	**$1.20**	**-1.3%**
2017	$0.91	1.5%	$0.94	0.8%	$1.55	0.9%	$1.09	3.1%	**$1.22**	**1.5%**

Table 5.6 and Table 5.7 set forth the unaudited total system transactions and toll revenue by month for FY 2013 through FY 2017, as well as the first six months of FY 2018.

Table 5.6 Historical System Total Transactions

Month	FY 2013		FY 2014		FY 2015		FY 2016		FY 2017		FY 2018 [3]	
	Total Transactions (in 000s)	% Change Over Prior Year	Total Transactions (in 000s)	% Change Over Prior Year	Total Transactions (in 000s)	% Change Over Prior Year	Total Transactions (in 000s)	% Change Over Prior Year	Total Transactions (in 000s)	% Change Over Prior Year	Total Transactions (in 000s)	% Change Over Prior Year
September	7,951	8%	8,573	8%	9,647	13%	11,195	16%	12,354	10%	12,627	2%
October	8,797	18%	9,160	4%	10,512	15%	11,650	11%	13,039	12%	13,552	4%
November	8,805	20%	8,854	1%	9,645	9%	10,928	13%	12,264	12%	12,867	5%
December	8,253	12%	8,452	2%	9,877	17%	11,232	14%	12,086	8%	12,296	2%
January	7,798	9%	8,041	3%	9,182	14%	10,658	16%	11,614	9%	11,739	1%
February	7,684	6%	7,928	3%	9,009	14%	11,116	23%	11,436	3%	11,657	2%
March	8,899	8%	9,376	5%	10,695	14%	12,643	18%	13,504	7%		
April	8,759	8%	9,511	9%	10,967	15%	12,202	11%	12,782	5%		
May	9,124	8%	9,754	7%	10,867	11%	12,543	15%	13,453	7%		
June	8,655	4%	9,664	12%	11,189	16%	12,716	14%	13,209	4%		
July	8,648	6%	9,814	13%	11,555	18%	12,443	8%	12,731	2%		
August	9,135	5%	9,922	9%	11,361	15%	12,647	11%	13,030	3%		
Total	**102,507**	**9%**	**109,049**	**6%**	**124,506**	**14%**	**141,974**	**14%**	**151,501**	**7%**	**74,738**	

Notes: [1] System transactions are shown in the month in which they occur. As used herein, System transactions occur when each vehicle crosses a tolling station within the System, including all ETC, PBM, and non-invoiced transactions.
[2] Transactions shown include SH 45 N, Loop 1, SH 130 and SH 45 SE.
[3] Total transaction data was only available up to February 2018 at the time this report. therefore, FY 2018 transactions shown are from only six months of the fiscal year.

Table 5.7 Historical System Toll Revenue

Month	FY 2013		FY 2014		FY 2015		FY 2016		FY 2017		FY 2018 [3]	
	Revenue (in $000s)	% Change Over Prior Year	Revenue (in $000s)	% Change Over Prior Year	Revenue (in $000s)	% Change Over Prior Year	Revenue (in $000s)	% Change Over Prior Year	Revenue (in $000s)	% Change Over Prior Year	Revenue (in $000s)	% Change Over Prior Year
September	$7,131	11%	$11,007	54%	$9,922	-10%	$13,840	39%	$14,290	3%	$13,302	-7%
October	$7,734	22%	$11,397	47%	$10,382	-9%	$13,582	31%	$16,570	22%	$15,433	-7%
November	$7,435	22%	$10,543	42%	$11,519	9%	$13,627	18%	$15,264	12%	$16,496	8%
December	$7,056	12%	$9,237	31%	$12,152	32%	$13,506	11%	$15,644	16%	$16,129	3%
January	$8,708	46%	$9,440	8%	$12,416	32%	$13,534	9%	$14,180	5%	$16,638	17%
February	$7,773	28%	$9,399	21%	$12,248	30%	$13,625	11%	$14,813	9%	$15,633	6%
March	$9,722	40%	$10,878	12%	$14,006	29%	$15,162	8%	$16,802	11%		
April	$9,615	44%	$10,776	12%	$13,310	24%	$13,970	5%	$16,017	15%		
May	$10,711	52%	$10,502	-2%	$13,804	31%	$15,004	9%	$16,037	7%		
June	$10,064	48%	$12,559	25%	$13,657	9%	$14,555	7%	$16,005	10%		
July	$9,209	28%	$9,877	7%	$13,982	42%	$14,369	3%	$15,367	7%		
August	$8,826	10%	$9,549	8%	$14,232	49%	$15,882	12%	$13,830	-13%		
Total	**$103,985**	**30%**	**$125,163**	**20%**	**$151,630**	**21%**	**$170,657**	**13%**	**$184,818**	**8%**	**$93,631**	

Notes: [1] Toll revenues from ETC payment method are shown on an accrual basis. Toll revenues from PBM payment method are shown on a cash basis. Total annual revenue differs from results shown in the audited financials of the System due to adjustments to reflect PBM revenues earned but not collected, less allowance for doubtful accounts.
[2] Toll revenues shown include SH 45 N, Loop 1, SH 130 and SH 45 SE.
[3] Total revenue data was only available up to February 2018 at the time this report. therefore, FY 2018 transactions shown are from only six months of the fiscal year.

5.2 VEHICLE CLASS DISTRIBUTION

The distribution of traffic by vehicle class has also been historically monitored for each CTTS facility. These values are derived from the toll transaction data, which do not identify 2-axle, 6-tire trucks as a separate category. Therefore, the auto statistics include all autos as well as 2-axle, 6-tire trucks and the truck statistics include all trucks with 3+ axles. As shown by the tables below, the distribution of trucks and autos among ETC transactions for each facility has remained fairly consistent throughout the years, but the percent of trucks and autos varies between facilities and payment type. Table 5.8 displays the historical vehicle distributions for each CTTS facility.

Table 5.8 Historical Fiscal Year Average Vehicle Distributions by CTTS Facility

Fiscal Year	SH 45 N and Loop 1				SH 130				SH 45 SE			
	ETC		Pay by Mail		ETC		Pay by Mail		ETC		Pay by Mail	
	% Autos [1]	% Trucks	% Autos [1]	% Trucks	% Autos [1]	% Trucks	% Autos [1]	% Trucks	% Autos [1]	% Trucks	% Autos [1]	% Trucks
2007 [2]	98.0%	2.0%	-	-	94.5%	5.5%	-	-	-	-	-	-
2008 [2]	97.9%	2.1%	-	-	93.2%	6.8%	-	-	-	-	-	-
2009 [2]	98.2%	1.8%	-	-	93.2%	6.8%	-	-	91.1%	8.9%	-	-
2010 [2]	98.4%	1.6%	-	-	93.2%	6.8%	-	-	90.9%	9.1%	-	-
2011 [2]	98.3%	1.7%	-	-	93.1%	6.9%	-	-	90.2%	9.8%	-	-
2012 [2]	98.2%	1.8%	-	-	92.7%	7.3%	-	-	88.2%	11.8%	-	-
2013 [2]	97.9%	2.1%	-	-	92.2%	7.8%	-	-	88.8%	11.2%	-	-
2014 [2]	97.7%	2.3%	-	-	91.8%	8.2%	-	-	90.2%	9.8%	-	-
2015	97.8%	2.2%	97.3%	2.7%	92.0%	8.0%	86.9%	13.1%	90.5%	9.5%	86.3%	13.7%
2016	97.7%	2.3%	97.3%	2.7%	91.2%	8.8%	88.1%	11.9%	89.8%	10.2%	87.4%	12.6%
2017	97.6%	2.4%	97.3%	2.7%	90.0%	10.0%	87.5%	12.5%	88.6%	11.4%	86.3%	13.7%

Notes: (1) "Autos" includes 2-axle, 6-tire trucks and "Trucks" incudes all 3+ axle vehicles.
(2) Vehicle type data were only available for ETC transactions until January 2014; therefore, vehicle type distributions for PBM transactions are only shown for FY 2015 through FY 2017.

Table 5.9 displays the most recent fiscal year's vehicle distributions for each CTTS facility by month.

Table 5.9 FY 2017 Vehicle Distribution by CTTS Facility

Month-Year	SH 45 N and Loop 1				SH 130				SH 45 SE			
	ETC		Pay by Mail		ETC		Pay by Mail		ETC		Pay by Mail	
	% Autos [1]	% Trucks	% Autos [1]	% Trucks	% Autos [1]	% Trucks	% Autos [1]	% Trucks	% Autos [1]	% Trucks	% Autos [1]	% Trucks
Sep-16	97.5%	2.5%	97.3%	2.7%	90.5%	9.5%	87.6%	12.4%	89.3%	10.7%	86.7%	13.3%
Oct-16	97.5%	2.5%	97.4%	2.6%	90.4%	9.6%	87.7%	12.3%	89.1%	10.9%	86.5%	13.5%
Nov-16	97.7%	2.3%	97.6%	2.4%	91.0%	9.0%	88.2%	11.8%	89.9%	10.1%	87.1%	12.9%
Dec-16	97.9%	2.1%	97.6%	2.4%	91.0%	9.0%	88.2%	11.8%	89.8%	10.2%	86.9%	13.1%
Jan-17	97.9%	2.1%	97.6%	2.4%	90.4%	9.6%	87.6%	12.4%	88.9%	11.1%	86.2%	13.8%
Feb-17	97.6%	2.4%	97.4%	2.6%	90.1%	9.9%	87.3%	12.7%	88.8%	11.2%	86.0%	14.0%
Mar-17	97.5%	2.5%	97.2%	2.8%	89.9%	10.1%	87.5%	12.5%	88.5%	11.5%	86.3%	13.7%
Apr-17	97.6%	2.4%	97.4%	2.6%	90.1%	9.9%	87.8%	12.2%	88.6%	11.4%	86.8%	13.2%
May-17	97.5%	2.5%	97.3%	2.7%	89.8%	10.2%	87.6%	12.4%	88.1%	11.9%	86.3%	13.7%
Jun-17	97.3%	2.7%	97.2%	2.8%	88.9%	11.1%	87.5%	12.5%	87.5%	12.5%	86.3%	13.7%
Jul-17	97.5%	2.5%	97.2%	2.8%	89.6%	10.4%	87.4%	12.6%	88.1%	11.9%	85.7%	14.3%
Aug-17	97.6%	2.4%	97.1%	2.9%	88.8%	11.2%	85.7%	14.3%	86.8%	13.2%	84.0%	16.0%
FY 2017	**97.6%**	**2.4%**	**97.3%**	**2.7%**	**90.0%**	**10.0%**	**87.5%**	**12.5%**	**88.6%**	**11.4%**	**86.3%**	**13.7%**

SH 45 N and Loop 1 are integrated toll roads since they intersect and many vehicles use both roads for the same trip. As such, their vehicle distribution data are summarized together. The percent of trucks is low, hovering around 2 percent since the roads have opened. The truck share on SH 45 N and Loop 1 is similar between ETC and PBM transactions with trucks averaging 2.4 and 2.7 percent of total traffic, respectively, for FY 2017.

SH 130 has a greater proportion of trucks with an average of 10 percent of ETC transactions for FY 2017; PBM transactions have a slightly greater average truck share of 12.5 percent. As shown in Table 5.8, SH 130 opened with approximately 5.5 percent trucks, and has slowly increased to its current level. These statistics have been influenced by a series of temporary truck rate discounts that have been implemented for selected periods during 2012, 2013, 2016, and 2017. These temporary discounts encouraged commercial traffic to try SH 130 and improved traffic flow through Austin thus increasing safety for travelers. These discounts were represented in the modeling process for the purposes of replicating traffic for the 2016 calibration year, but the forecasts developed for the 2018 Study do not use the discounts since they were terminated in August 2017.

SH 45 SE has the highest portion of trucks of the CTTS facilities with an average of 11.4 percent of ETC transactions for FY 2017. Similar to SH 130, the truck share is higher for PBM transactions with a FY 2017 average of 13.7 percent. The historical vehicle distribution ranges between 9 and 12 percent but has been consistently between 10 and 14 percent recently.

5.3 WEEKDAY AND SEASONAL PATTERNS

Seasonal transaction patterns for FY 2017 are summarized in Table 5.10 by showing the monthly and quarterly distributions for each facility. The CTTS fiscal year begins on September 1, making each quarter correlate to typical seasonal months. Across all facilities, the winter months in Quarter 2 have the fewest number of transactions, while the spring (Quarter 3) has the highest number of transactions.

Table 5.10 Monthly and Quarterly Transaction Distribution for FY 2017

Month-Year	SH 45 N and Loop 1	SH 130	SH 45 SE	Total
Sep-16	8.2%	8.1%	8.1%	**8.2%**
Oct-16	8.5%	8.7%	9.0%	**8.6%**
Nov-16	8.0%	8.2%	8.4%	**8.1%**
Dec-16	8.1%	7.8%	7.7%	**8.0%**
Jan-17	8.0%	7.3%	7.2%	**7.7%**
Feb-17	7.7%	7.3%	7.3%	**7.5%**
Mar-17	8.8%	9.0%	9.1%	**8.9%**
Apr-17	8.4%	8.5%	8.5%	**8.4%**
May-17	8.9%	8.9%	8.8%	**8.9%**
Jun-17	8.6%	8.9%	8.8%	**8.7%**
Jul-17	8.2%	8.6%	8.4%	**8.4%**
Aug-17	8.6%	8.6%	8.5%	**8.6%**
Sept - Nov (Q1)	**24.6%**	**25.0%**	**25.5%**	**24.9%**
Dec - Feb (Q2)	**23.9%**	**22.5%**	**22.3%**	**23.2%**
Mar - May (Q3)	**26.1%**	**26.3%**	**26.4%**	**26.2%**
Jun - Aug (Q4)	**25.3%**	**26.1%**	**25.7%**	**25.7%**

The average number of transactions for a weekday, and how it compares to the average number for any day of the year, is summarized for FY 2017 in Table 5.11. For FY 2017, the average weekday traffic was approximately 12 percent greater than the average daily traffic.

Table 5.11 FY 2017 Average Daily and Average Weekday CTTS Traffic Comparison

Month-Year	Average Daily Traffic (ADT)	Average Weekday Daily Traffic (AWDT)	Percent Difference (AWDT/ADT - 1)
Sep-16	411,805	461,991	12%
Oct-16	420,610	468,701	11%
Nov-16	408,803	461,748	13%
Dec-16	389,870	446,548	15%
Jan-17	374,653	426,876	14%
Feb-17	408,428	459,637	13%
Mar-17	435,601	476,424	9%
Apr-17	426,055	479,751	13%
May-17	433,953	480,966	11%
Jun-17	440,298	484,240	10%
Jul-17	410,673	469,779	14%
Aug-17	420,335	475,451	13%
FY 2017	**415,072**	**466,550**	**12%**
		FY 2017 Annualization Factor	***325***

These data were also used to develop annualization factors to be used in the traffic and revenue forecasts by converting weekday traffic volumes into annual volumes for each CTTS facility. The annualization factors vary for each facility depending on the characteristics of the road. For Loop 1 and SH 45 N, the annualization factor is approximately 320, while for SH 130, it is slightly higher at 325, due to higher levels of weekend traffic. SH 45 SE also has an annualization factor of approximately 325, generally consistent with the trends from SH 130.

5.4 PAYMENT METHOD DISTRIBUTION

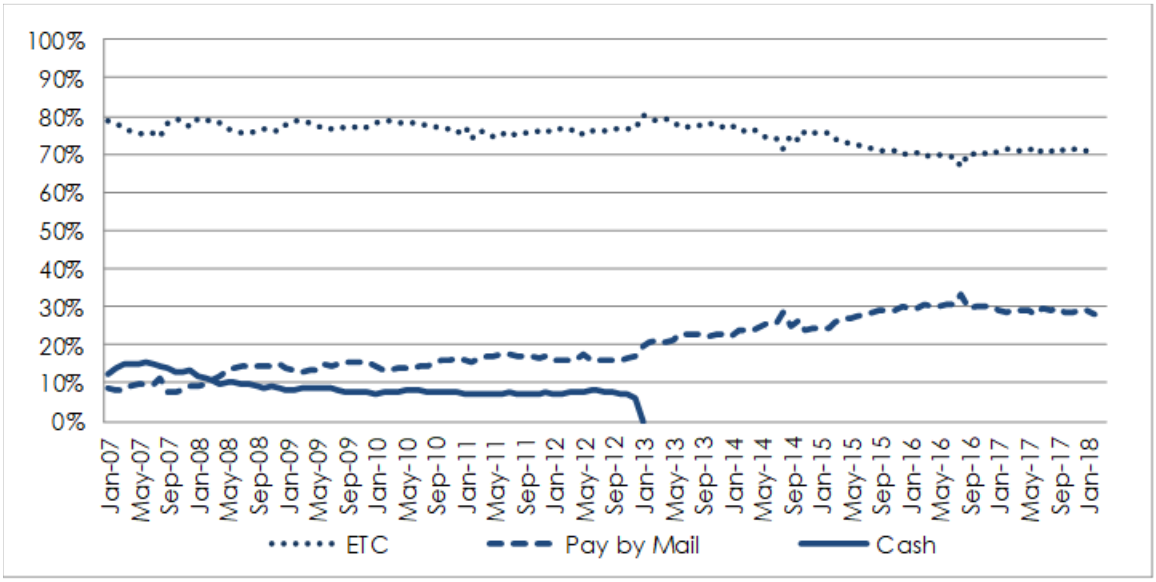
As previously discussed in Chapter 4 of this report, prior to January 2013, CTTS had three methods of toll collection: cash, ETC, and PBM. Since January 2013, all facilities are operated cashless, therefore, the payment method distribution for FY 2017 of the different CTTS facilities shown in Table 5.12 includes only the ETC and PBM methods.

Table 5.12 FY 2017 Payment Method Distribution by CTTS Facility

Month-Year	SH 45 N and Loop 1		SH 130		SH 45 SE		Total	
	% ETC	% Pay by Mail	% ETC	% Pay by Mail	% ETC	% Pay by Mail	% ETC	% Pay by Mail
Sep-16	70.4%	29.6%	62.1%	37.9%	59.9%	40.1%	66.1%	33.9%
Oct-16	69.8%	30.2%	61.6%	38.4%	60.0%	40.0%	65.5%	34.5%
Nov-16	70.2%	29.8%	61.8%	38.2%	60.7%	39.3%	65.8%	34.2%
Dec-16	70.1%	29.9%	61.7%	38.3%	60.6%	39.4%	65.9%	34.1%
Jan-17	71.0%	29.0%	63.1%	36.9%	62.2%	37.8%	67.1%	32.9%
Feb-17	71.3%	28.7%	63.2%	36.8%	62.8%	37.2%	67.3%	32.7%
Mar-17	71.1%	28.9%	62.9%	37.1%	61.7%	38.3%	66.8%	33.2%
Apr-17	71.1%	28.9%	63.5%	36.5%	62.1%	37.9%	67.2%	32.8%
May-17	70.8%	29.2%	62.1%	37.9%	60.4%	39.6%	66.3%	33.7%
Jun-17	72.1%	27.9%	64.0%	36.0%	62.7%	37.3%	67.8%	32.2%
Jul-17	70.2%	29.8%	61.4%	38.6%	60.2%	39.8%	65.6%	34.4%
Aug-17	70.9%	29.1%	57.1%	42.9%	56.3%	43.7%	63.8%	36.2%
FY 2017	**70.7%**	**29.3%**	**62.0%**	**38.0%**	**60.8%**	**39.2%**	**66.3%**	**33.7%**

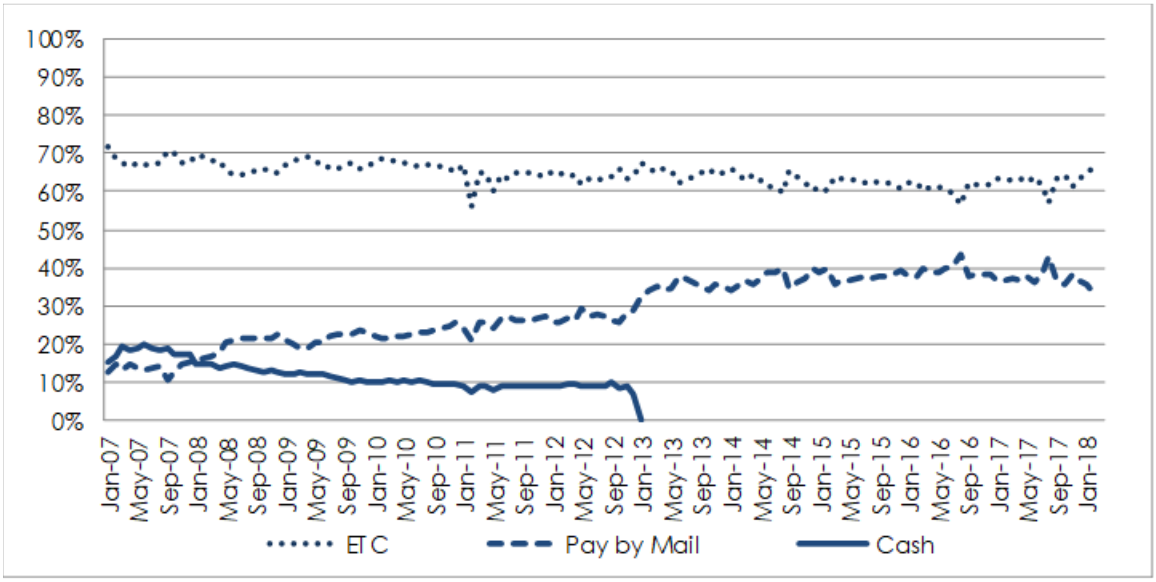
Again, SH 45 N and Loop 1 are summarized together because of their similarities in traffic behavior and relationship to each other. In FY 2017, 70.7 percent of the traffic on these two facilities paid by ETC, the highest rate of ETC usage on the CTTS facilities. The historical distribution is shown in Figure 5.2. As shown in the figure, the share of transactions using PBM is growing gradually, which could be a result of more infrequent travelers using the toll road system.

Figure 5.2 SH 45 N and Loop 1 Historical Payment Method Distribution



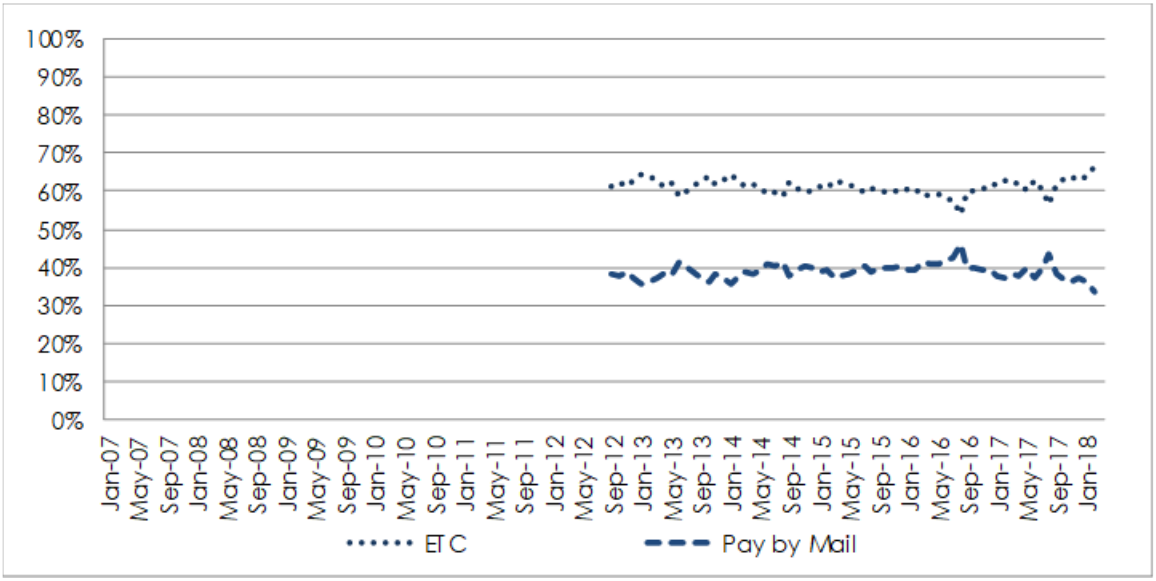
SH 130 currently has ETC and PBM transactions with FY 2017 averages of 62 percent and 38 percent, respectively. Looking at the historical distribution for this toll road in Figure 5.3, the percent of ETC transactions began at approximately 70 percent, and has slowly decreased since. This is due to the formal adoption of the PBM payment method and the removal of the cash payment option. Since the transition to the Conduent system and business rules for delinquent accounts in 2014, the share of transactions identified as PBM has gradually increased. This increase is most likely due to more use by infrequent travelers.

Figure 5.3 SH 130 Historical Payment Method Distribution



SH 45 SE has always operated as cashless since it began operations as a TxDOT toll road in May 2009. When SH 45 SE became part of CTTS in September 2012, approximately 60 percent of transactions were ETC transactions; ETC transactions have remained at that level since. Currently, it has an FY 2017 average payment method distribution of 60.8 percent for ETC and 39.2 percent for PBM. The historical distribution since joining the CTTS is shown in Figure 5.4.

Figure 5.4 SH 45 SE Historical Payment Method Distribution



5.5 TRANSACTION PAYMENT STATUS

With the introduction of cashless toll collection, Stantec has been monitoring the effective collection rates for ETC and PBM transactions. For this report, the collection statistics for FY 2016, the latest full year of data available at the time of this report, were obtained from TxDOT.

The FY 2016 data are summarized in Table 5.13. These data provide the distribution of FY 2016 transactions for the CTTS by payment type and by payment status (paid/unpaid transactions). The data show that of all transactions, approximately 62 percent were ETC-based transactions (including the nearly 8 percent interoperable transactions from transponders from other agencies) and 38 percent were image-based transactions.

Paid transactions include both regular payment of the tolls from patrons as well as payments reimbursed from TxDOT for the free passage allowed for selected veteran categories. These veterans' waivers were 2.5 percent of the total transactions. For the non-paying transaction category, the table summarizes *unbilled* PBM transactions where it was not possible to invoice patrons either due to bad images or lack of acceptable vehicle registration information. The *unpaid* category includes PBM transactions for which payment was not received as well as non-revenue ETC transactions and invalid ETC tags. For the combined ETC category approximately 99.3 percent of all transactions were paid while the PBM category had only 51.1 percent of transactions paid.

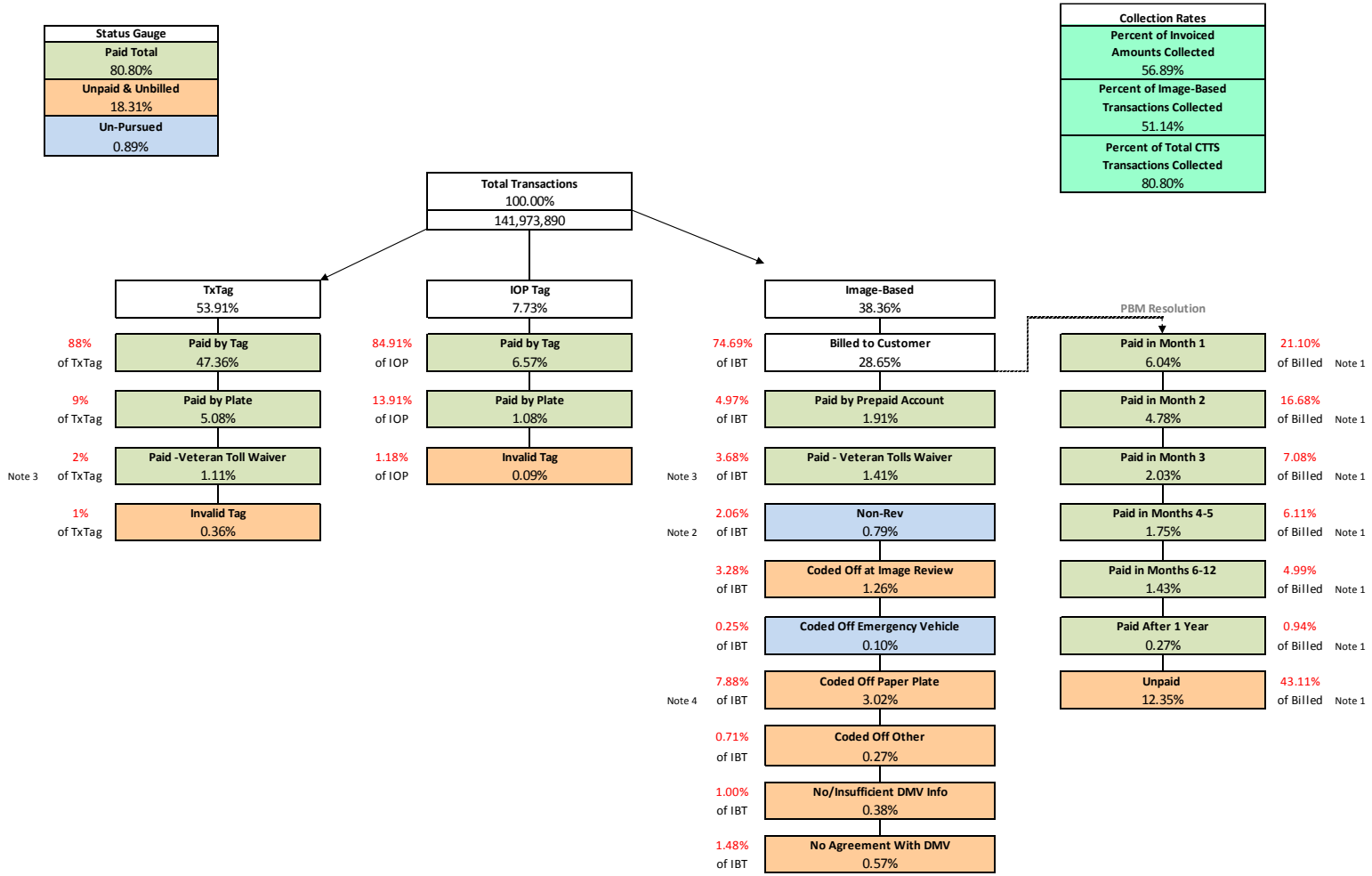
Table 5.13 FY 2016 CTTS Transaction Payment Status

Payment Type	Paid Transactions		Non-Paying Transactions			Total Transactions	Percent Paid
	Regular [1]	Vet. Waiver [2]	Unpaid [3]	Unbilled	Total		
ETC	74,443,726	1,579,314	515,445	-	515,445	76,538,485	99.3%
ETC - InterOP	10,849,749	-	129,051	-	129,051	10,978,800	
Image Based (PBM)	25,844,147	2,002,716	17,534,803	9,074,938	26,609,741	54,456,604	51.1%
Total	111,137,622	3,582,030	18,179,299	9,074,938	27,254,237	141,973,889	80.8%
Percent of Total Transactions							
ETC	52.4%	1.1%	0.4%	-	0.4%	53.9%	
ETC - InterOP	7.6%	-	0.1%	-	0.1%	7.7%	
Image Based (PBM)	18.2%	1.4%	12.4%	6.4%	18.7%	38.4%	
Total	78.3%	2.5%	12.8%	6.4%	19.2%	100.0%	

Notes: (1) Includes ETC transactions that were Paid by Plate (images that were subsequently linked to transponder accounts)
(2) CTTS Revenue Fund reimbursed by TxDOT
(3) Includes ETC & InterOP rejects/invalid tag

Figure 5.5 displays a flow chart with a further break down of transactions by payment type for FY 2016. The collection data reflect the collection status based on conditions that have occurred since the adoption of new laws that allow TxDOT to pursue habitual violators, including vehicle registration hold and a dedicated administrative hearing process. The data also include the changes in collection procedures that were implemented by the new toll system operator (Conduent) and other issues associated with that transition along with any subsequent changes.

Figure 5.5 CTTS Transactions Processing Flow Chart, FY 2016



Note 1: Pay By Mail Resolution is based on the Pay By Mail Resolution Report as of 8/31/2017.
Note 2: Non-Revenue transactions post as zero-dollar transactions and are authorized free passage per CTTS Bond Indenture.
Note 3: Veteran Toll Waiver Program transactions post as zero-dollar, are authorized free passage per TTC Minute Order 113247 and are paid to the CTTS Revenue Fund by TxDOT.
Note 4: In April 2017 TxDOT discontinued coding off paper plate transactions and began pursuing these transactions through standard plate image processes.

6.0 SOCIOECONOMIC DATA

This section of the report discusses socioeconomic indicators that are used to identify growth in the region that encompasses the Austin Area toll roads and are included in the regional transportation model. This discussion presents recent demographic and economic trends and projections of future levels of activity in the area, a comparison of revised county control figures for population and employment with previous forecasts, a description of the methodology used to update information on the Transportation Analysis Zone (TAZ) level and a summary of interviews of local government representatives regarding proposed development in the Austin region.

The socioeconomic review and the employment and population projections used in the traffic model were developed by Michael S. Bomba, PhD. Dr. Bomba has extensive experience in the Austin area and has been retained by Stantec to provide socioeconomic data forecasts for the Austin area toll roads since the late 1990s. For this project, Stantec staff helped conduct field reviews and interviews with local government agencies to assist Dr. Bomba in the preparation of the base year socioeconomic estimates and forecasts.

As part of this analysis, Dr. Bomba reviewed the development trends in the individual markets for residential and commercial development. The review effort also considered the existing utility capacity and plans for expansion to confirm the reasonableness of the local development plans. The revised forecasts prepared from this analysis are structured to provide a reasonable estimate of future activity that would be considered conservative for the purposes of estimating future demand for the region's toll facilities. The full report prepared by Dr. Bomba is presented in Appendix A of this report and summarized here.

6.1 REGIONAL TRENDS

Since the 2014 Study, CAMPO has updated the model's TAZ structure and its socioeconomic data to include Burnet County. As such, the full area covered by the regional transportation model used for the CTTS traffic forecast now includes six counties in the CAMPO model area (Travis, Williamson, Hays, Bastrop, Caldwell, and Burnet) and five counties in the AAMPO model area (Bexar, Guadalupe, Comal, Wilson, and Kendall). These counties are shown in Figure 6.1.
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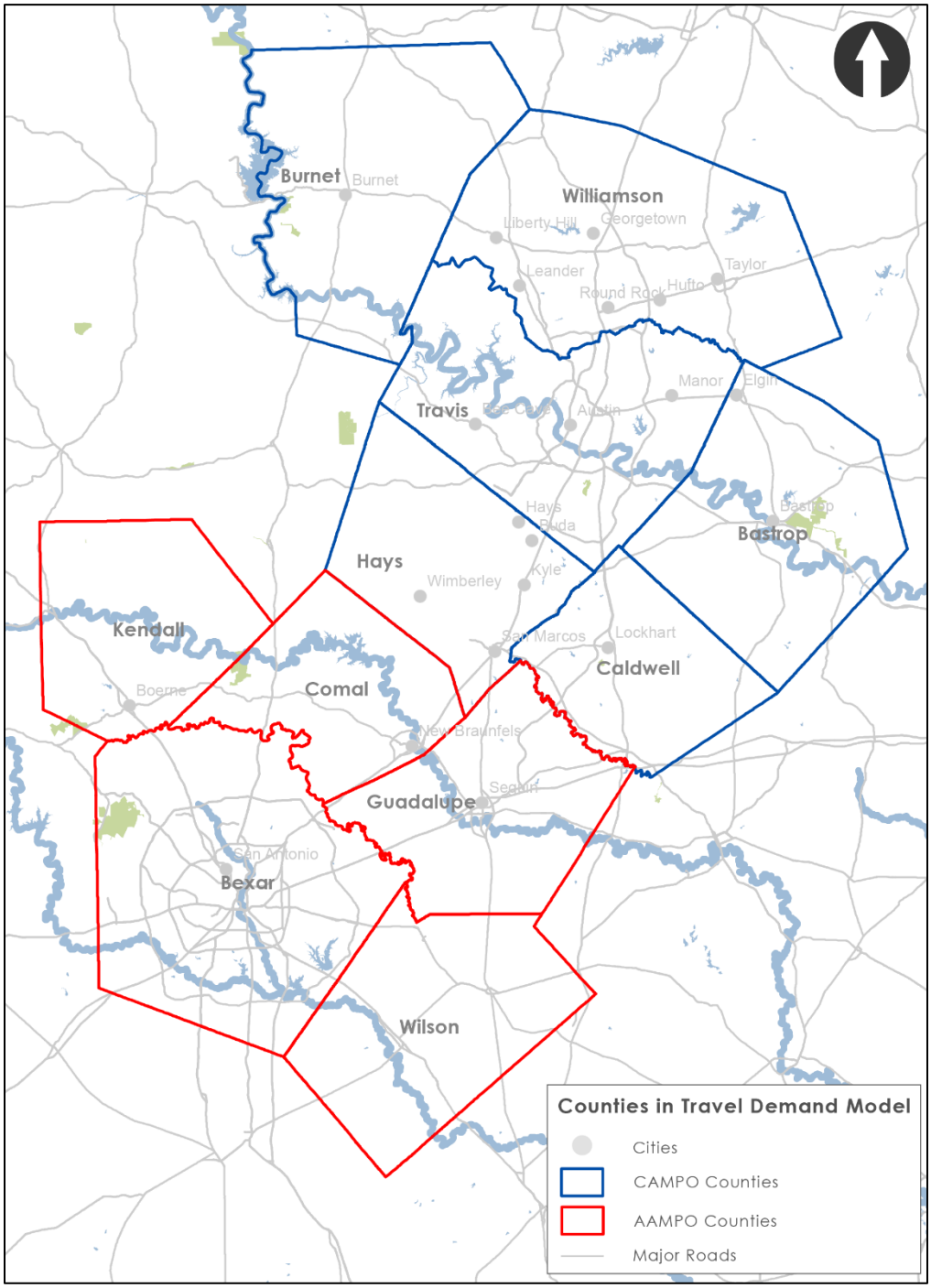
Figure 6.1 Counties in Transportation Model



Source: [1] CAMPO travel demand model and AAMPO travel demand model.

6.1.1 Regional Population

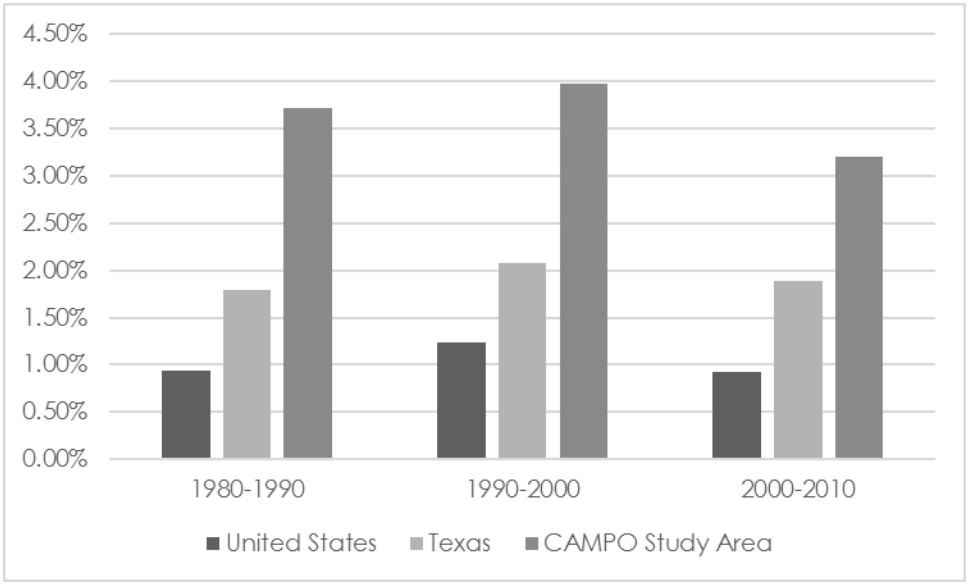
The population of the State of Texas has grown rapidly since 1980, increasing from 14.2 million to more than 25.1 million residents in 2010. Between 2000 and 2010, Texas added 4.3 million residents, making it the fastest growing state in terms of total population. Most of this population increase was in the urban areas of the state. Population growth in the CAMPO study area has nearly tripled since 1980. Table 6.1 and Figure 6.2 compare population growth in the United States, Texas, and the CAMPO study area since 1980.

Table 6.1 U.S., Texas, and CAMPO Study Area Population, 1980 – 2010

Census Year	United States		Texas		CAMPO Study Area	
	Population	Average Annual Rate of Growth	Population	Average Annual Rate of Growth	Population	Average Annual Rate of Growth
1980	226,546,000		14,229,000		602,854	
1990	248,710,000	0.9%	16,987,000	1.8%	868,904	3.7%
2000	281,422,000	1.2%	20,852,000	2.1%	1,283,911	4.0%
2010	308,748,000	0.9%	25,146,000	1.9%	1,759,039	3.2%

Source: [1] U.S. Census Bureau, 2010.

Figure 6.2 Population Growth in the U.S., Texas, and CAMPO Study Area 1980 – 2010



Source: [1] U.S. Census Bureau, 2010.

More recent estimates show that the population of the CAMPO study area has continued to grow since 2010. The data in Table 6.2 provides population counts from the 2000 and 2010 decennial U.S. Censuses, as well as the U.S. Census Bureau's 2016 population estimates. The largest overall population increase between 2010 and 2016 occurred in Travis County, with more than 175,000 new residents between the 2010 decennial Census and the 2016 estimates. Williamson County also grew strongly during this same period with approximately 106,000 new residents between 2010 and 2016, followed by Hays County with more than 47,000 new residents. However, since the 2010 U.S. Census, the rate of population growth in all of the counties, with the exception of Travis County, has slowed.

Table 6.2 Recent Population Trends in CAMPO Study Area, 2000-2016

County	Total Population			Total Change	Average Annual Change		CAGR	
	2000	2010	2016	2010-16	2000-10	2010-16	2000-10	2010-16
Bastrop	57,733	74,171	82,733	8,562	1,644	1,427	2.54%	1.84%
Burnet	34,147	42,750	46,243	3,493	860	582	2.27%	1.32%
Caldwell	32,194	38,066	41,161	3,095	587	516	1.69%	1.31%
Hays	97,589	157,107	204,470	47,363	5,952	7,894	4.88%	4.49%
Travis	812,281	1,024,266	1,199,323	175,057	21,199	29,176	2.35%	2.66%
Williamson	249,967	422,679	528,718	106,039	17,271	17,673	5.39%	3.80%
TOTAL	1,283,911	1,759,039	2,102,648	343,609	47,513	57,268	3.20%	1.80%

Source: [1] U.S. Census Bureau, 2010 and 2017.

U.S. Census Bureau data show that the populations of the five counties in the AAMPO study area also grew strongly between 2010 and 2016, adding almost 279,000 new residents, as shown in Table 6.3. Most of this population growth occurred in Bexar County, which added almost 214,000 residents since the 2010 decennial Census. Guadalupe and Comal Counties also increased their populations during this period, adding approximately 24,000 and 26,000 new residents, respectively. Kendall County's population grew by over 9,100 residents during this period, while Wilson County grew by over 5,500 residents. However, since 2010, the overall rate of population growth has slowed, except for Comal and Kendall Counties.

Table 6.3 Recent Population Trends in AAMPO Study Area, 2000-2016

County	Total Population			Total Change	Average Annual Change		CAGR	
	2000	2010	2016	2010-16	2000-10	2010-16	2000-10	2010-16
Bexar	1,392,931	1,714,773	1,928,680	213,907	32,184	35,651	2.10%	1.98%
Comal	78,021	108,472	134,788	26,316	3,045	4,386	3.35%	3.69%
Guadalupe	89,023	131,533	155,265	23,732	4,251	3,955	3.98%	2.80%
Kendall	23,743	33,410	42,540	9,130	967	1,522	3.47%	4.11%
Wilson	32,408	42,918	48,480	5,562	1,051	927	2.85%	2.05%
TOTAL	1,616,126	2,031,106	2,309,753	278,647	41,498	46,441	2.31%	2.17%

Source: [1] U.S. Census Bureau, 2010 and 2017.

Total population in the 11-county study area increased at an average annual rate of 2.7 percent between 1980 and 2016, increasing from 1.7 million to 4.4 million. The regional growth rate was relatively steady over the period and continues to be strong, at 2.6 percent between 2010 and 2016. Population for each county for census years 1980 through 2010 and the latest estimate for 2016 from the U.S. Census Bureau is shown in Table 6.4.

Table 6.4 Historical Population in Study Area, 1980-2013

Population						
Region	**County**	**1980**	**1990**	**2000**	**2010**	**2016**
CAMPO	Bastrop	24,726	38,263	57,733	74,171	82,733
	Burnet	17,803	22,677	34,147	42,750	46,243
	Caldwell	23,637	26,392	32,194	38,066	41,161
	Hays	40,594	65,614	97,589	157,107	204,470
	Travis	419,573	576,407	812,281	1,024,266	1,199,323
	Williamson	76,521	139,551	249,967	422,679	528,718
	Total	602,854	868,904	1,283,911	1,759,039	2,102,648
AAMPO	Bexar	988,880	1,185,394	1,392,931	1,714,773	1,928,680
	Comal	36,446	51,832	78,021	108,472	134,788
	Guadalupe	46,708	64,873	89,023	131,533	155,265
	Kendall	10,635	14,589	23,743	33,410	42,540
	Wilson	16,756	22,650	32,408	42,918	48,480
	Total	1,099,425	1,339,338	1,616,126	2,031,106	2,309,753
Study Area Total		**1,702,279**	**2,208,242**	**2,900,037**	**3,790,145**	**4,412,401**
Growth Rates						
Region	**County**	**1980**	**1990**	**2000**	**2010**	**2016**
CAMPO	Bastrop		4.5%	4.2%	2.5%	1.8%
	Burnet		2.4%	4.2%	2.3%	1.3%
	Caldwell		1.1%	2.0%	1.7%	1.3%
	Hays		4.9%	4.0%	4.9%	4.5%
	Travis		3.2%	3.5%	2.3%	2.7%
	Williamson		6.2%	6.0%	5.4%	3.8%
	Total		3.7%	4.0%	3.2%	3.0%
AAMPO	Bexar		1.8%	1.6%	2.1%	2.0%
	Comal		3.6%	4.2%	3.4%	3.7%
	Guadalupe		3.3%	3.2%	4.0%	2.8%
	Kendall		3.2%	5.0%	3.5%	4.1%
	Wilson		3.1%	3.6%	2.8%	2.1%
	Total		2.0%	1.9%	2.3%	2.2%
Study Area Total			**2.6%**	**2.8%**	**2.7%**	**2.6%**

Source: [1] U.S. Census Bureau, 2010 and 2017.

For this study, Dr. Bomba prepared an update of the estimates of population included in the CAMPO and AAMPO models to reflect recent development in the areas served by the toll roads in the Austin region. At the regional level and county level, the AAMPO area population remained unchanged. Population in the CAMPO area, while largely unchanged at the regional level, was slightly redistributed among the CAMPO counties, as shown in Table 6.5.

Table 6.5 Comparison of Census and Adjusted 2016 Population for Study Area

Region	County	2016 Population		Difference	
		Census	Adjusted	Number	Percent
CAMPO	Bastrop	82,733	81,710	-1,000	-1.2%
	Burnet	46,243	45,182	-1,061	-2.3%
	Caldwell	41,161	39,848	-1,313	-3.2%
	Hays	204,470	205,074	604	0.3%
	Travis	1,199,323	1,204,220	4,897	0.4%
	Williamson	528,718	526,718	-2,000	-0.4%
	Total	2,102,648	2,102,752	104	0.0%

Source: (1) U.S. Census Bureau, 2010 and 2017.
(2) Michael Bomba, PhD.

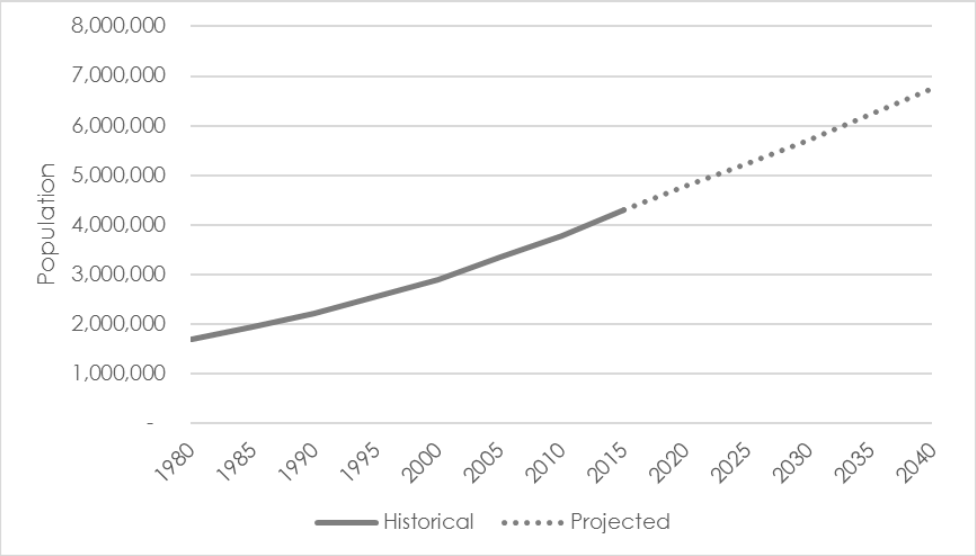
Starting with the adjusted population for 2016 presented above, growth is anticipated to taper down from the annual average rate of 2 percent between 2016 and 2020 to 1.8 percent between 2020 and 2030. After that, it remains fairly constant, slowing slightly to an annual growth rate of 1.7 percent between 2030 and 2040. The forecast of future population for the eleven counties is presented in Table 6.6 and historical and projected population growth are shown in Figure 6.3.

Table 6.6 Population Forecast for the Study Area, 2016 – 2040

Region	County	Population Control Totals			
		2016	2020	2030	2040
CAMPO	Bastrop	81,710	88,109	105,696	125,672
	Burnet	45,182	46,683	51,639	55,412
	Caldwell	39,848	43,480	50,339	57,616
	Hays	205,074	231,129	295,569	399,673
	Travis	1,204,220	1,314,093	1,563,432	1,801,138
	Williamson	526,718	583,417	757,309	984,479
	Total	2,102,752	2,306,911	2,823,984	3,423,990
AAMPO	Bexar	1,928,696	2,045,074	2,351,596	2,678,541
	Comal	134,782	147,364	183,147	225,827
	Guadalupe	155,264	170,618	217,790	271,000
	Kendall	42,542	47,586	60,288	73,221
	Wilson	48,481	51,684	60,348	71,589
	Total	2,309,765	2,462,326	2,873,169	3,320,178
Study Area Total		**4,412,517**	**4,769,237**	**5,697,153**	**6,744,168**
Region	**County**	**Growth Rates**			
		2016	**2020**	**2030**	**2040**
CAMPO	Bastrop		1.9%	1.8%	1.7%
	Burnet		0.8%	1.0%	0.7%
	Caldwell		2.2%	1.5%	1.4%
	Hays		3.0%	2.5%	3.1%
	Travis		2.2%	1.8%	1.4%
	Williamson		2.6%	2.6%	2.7%
	Total		2.3%	2.0%	1.9%
AAMPO	Bexar		1.5%	1.4%	1.3%
	Comal		2.3%	2.2%	2.1%
	Guadalupe		2.4%	2.5%	2.2%
	Kendall		2.8%	2.4%	2.0%
	Wilson		1.6%	1.6%	1.7%
	Total		1.6%	1.6%	1.5%
Study Area Total			**2.0%**	**1.8%**	**1.7%**

Source: [1] Michael Bomba, PhD.

Figure 6.3 Historical and Projected Population in Study Region, 1980 – 2040



Source: (1) U.S. Census Bureau (1980-2010).
(2) Michael Bomba, PhD (2016-2040).

Table 6.7 shows the differences between the 2014 Study's county population forecast control totals and the adjusted county control totals for the 2018 Study. During each forecast year in the 2018 Study, the population control totals are somewhat higher than they were in the 2014 Study, particularly in the later years.

Table 6.7 Comparison of 2014 and 2017 Projections of Population

Year	Estimated Population		Difference	
	2014 Study	2018 Study	Number	Percent
CAMPO Counties[1]				
2016	2,010,394	2,057,570	47,176	2.3%
2020	2,188,195	2,260,228	72,033	3.3%
2030	2,653,953	2,772,345	118,392	4.5%
2040	3,165,572	3,368,578	203,006	6.4%
AAMPO Counties				
2016	2,221,539	2,309,765	88,226	4.0%
2020	2,361,686	2,462,326	100,640	4.3%
2030	2,696,522	2,873,169	176,647	6.6%
2040	3,071,448	3,320,178	248,730	8.1%
Total Region				
2016	4,231,933	4,367,335	135,402	3.2%
2020	4,549,881	4,722,554	172,673	3.8%
2030	5,350,475	5,645,514	295,039	5.5%
2040	6,237,020	6,688,756	451,736	7.2%

Source: (1) Michael Bomba, PhD.
Note: (1) For the comparison to the 2014 Study, Burnet County was not included in the 2018 Study estimates above, since it was not included in the CAMPO model prior to the 2018 Study.

6.1.2 Regional Employment

Employment growth in Texas has outpaced the U.S. for nine of the last ten years. In 2016, employment at the state level grew at an annual rate of 1.3 percent, slightly less than 1.7 percent for the nation, overall. The Austin region's economy is generally recognized as one of the most resilient in the nation, particularly during and following the 2008 - 2009 Recession. As the state capital and home to the University of Texas, Austin adds a degree of stability to the local economy. Employment in the Austin metropolitan area has increased from 243,800 in 1980 to nearly 1 million jobs in 2016, as reported by the U.S. Bureau of Labor Statistics. This increase amounts to a compounded annual growth rate of 4 percent.

According to CAMPO, the largest employers in the greater Austin area are in the government, universities, technology, warehouse and distribution and health care sectors. Major employers (over 6,000 employees) include:

- Apple;
- Austin Independent School District;
- City of Austin;
- Dell Technologies;
- Federal Government (mainly IRS);
- IBM Corp.;
- Samsung Austin Semiconductor;
- Seton Healthcare Family;
- St. David's Healthcare Family;
- State of Texas; and
- University of Texas at Austin.

Table 6.8 and Source: [1] Michael Bomba, PhD.
Note: [1] See Figure 6.4 for locations.

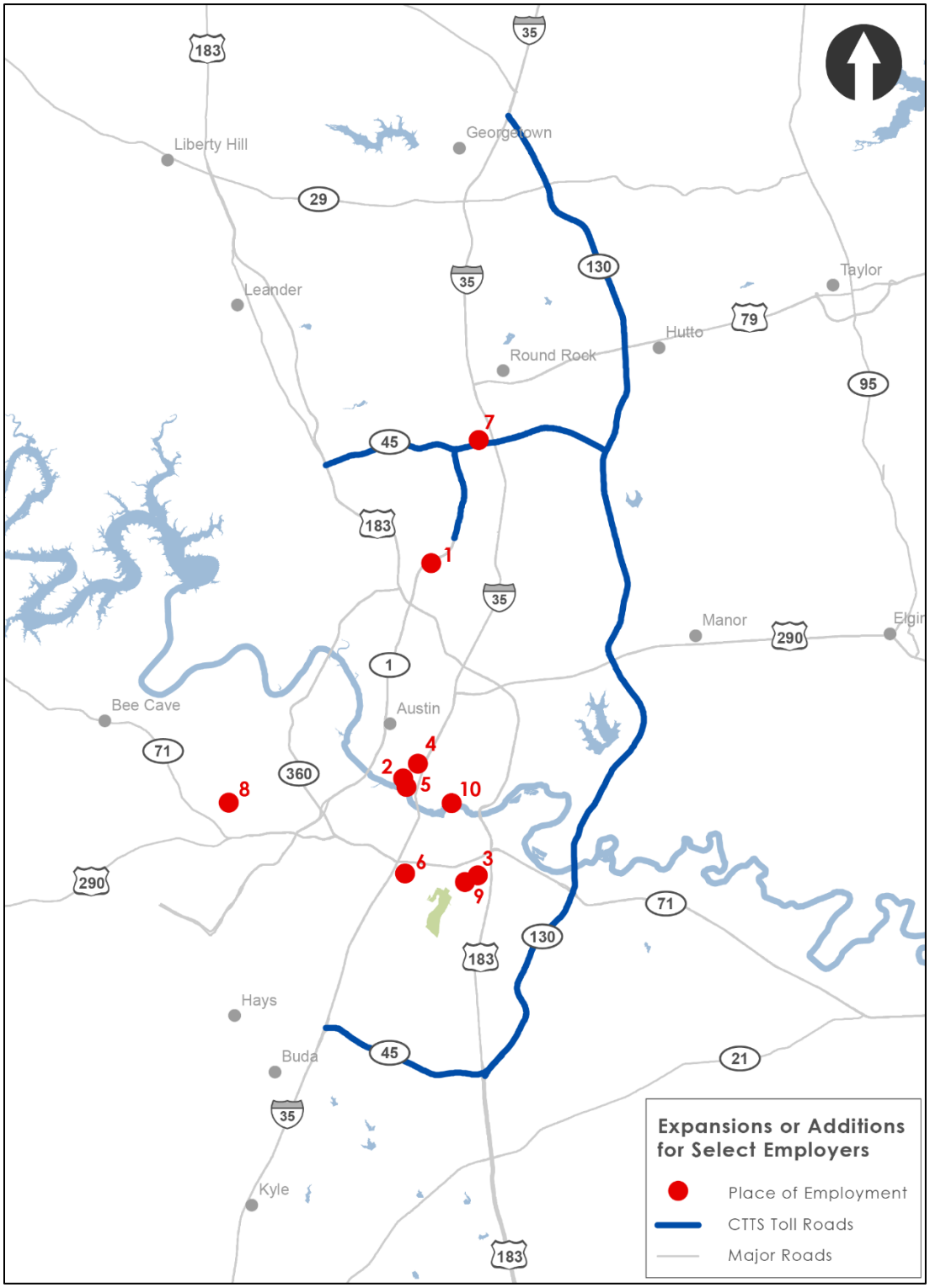
Figure 6.4 show the locations of selected major employers in the Austin region that recently located to the area or have announced expansion plans, and their number of employees. Merck & Company was a notable new employer, which was drawn to the region because of the University of Texas at Austin's new Dell Medical School. It is anticipated that the new medical school, in combination with the region's strengths in computing, will draw many more employers in the biomedical research field. Geographically, several employers are located near one of the CTTS facilities.

Table 6.8 Select Major Employers (New and Recent Expansions)

Map ID	Employer	Type of Operation	Announced Jobs
1	Homeaway	Online vacation home rentals (Hdq.)	2,200
2	Facebook	Online operations center	1,000
3	Seton Healthcare Family	Innovation and call center	650
4	Merck & Company	IT innovation center	600
5	Main Street Hub	Social media solutions (Hdq.)	400
6	Republic National Distribution	Beverage distribution (Hdq.)	300
7	TG	Student financial aid nonprofit (Hdq.)	300
8	Yeti Coolers	Cooler and accessors manufacturer	250
9	Opcity	Online real estate service (Hdq.)	200
10	FloSports	Online broadcasting network (Hdq.)	175

Source: [1] Michael Bomba, PhD.
Note: [1] See Figure 6.4 for locations.

Figure 6.4 Expansions or Additions for Select Employers in the Austin MSA



Source: [1] Michael Bomba, PhD.

Data for the San Antonio – New Braunfels Metropolitan Area are only available since 1990 and show that employment in that area has increased from 547,500 in 1990 to more than 1 million in 2016. In 1990, employment in the CAMPO study area was approximately 75 percent of that in the AAMPO study area. In 2016, the two regions have nearly identical levels of employment. Historical employment in the two metropolitan areas is summarized in Table 6.9.

Table 6.9 Historical Employment in Study Area

Region	MSA	Employment				
		1980	1990	2000	2010	2016
CAMPO	Austin-Round Rock MSA	243,800	396,100	684,000	785,600	999,800
AAMPO	San Antonio-New Braunfels MSA		547,500	753,900	855,000	1,016,500
Study Area Total			**943,600**	**1,437,900**	**1,640,600**	**2,016,300**
CAMPO	Austin-Round Rock MSA		5.0%	5.6%	1.4%	4.1%
AAMPO	San Antonio-New Braunfels MSA			3.3%	1.3%	2.9%
Study Area Total				**4.3%**	**1.3%**	**3.5%**

Source: [1] BLS Current Employment Statistics (CES), 2017.
Note: [1] The Austin-Round Rock MSA does not include Burnet County. The San Antonio-New Braunfels MSA includes Medina, Atacosta, and Bandera Counties, in addition to the AAMPO counties.

Detailed annual data by county is shown in Table 6.10 for the period 2007 through 2016. With the exception of 2009, when the number of jobs decreased due to the recession, employment has been increasing on a steady basis, reaching a growth peak between 2014 - 2015. Since then growth in employment, while still very healthy, has slowed slightly from 4.0 percent to 3.4 percent. According to CAMPO, Austin has had significant increases in health care, professional and management positions, and arts, entertainment and food industries while manufacturing jobs are decreasing. There is a demand for high-tech workers due to the presence of computer and internet firms serving the increasing demand for their products. As previously noted, growth is also expected in the biomedical research field due to the presence of the new medical school and the region's strengths in computing. Growth has been both in suburban areas and in the Austin CBD.

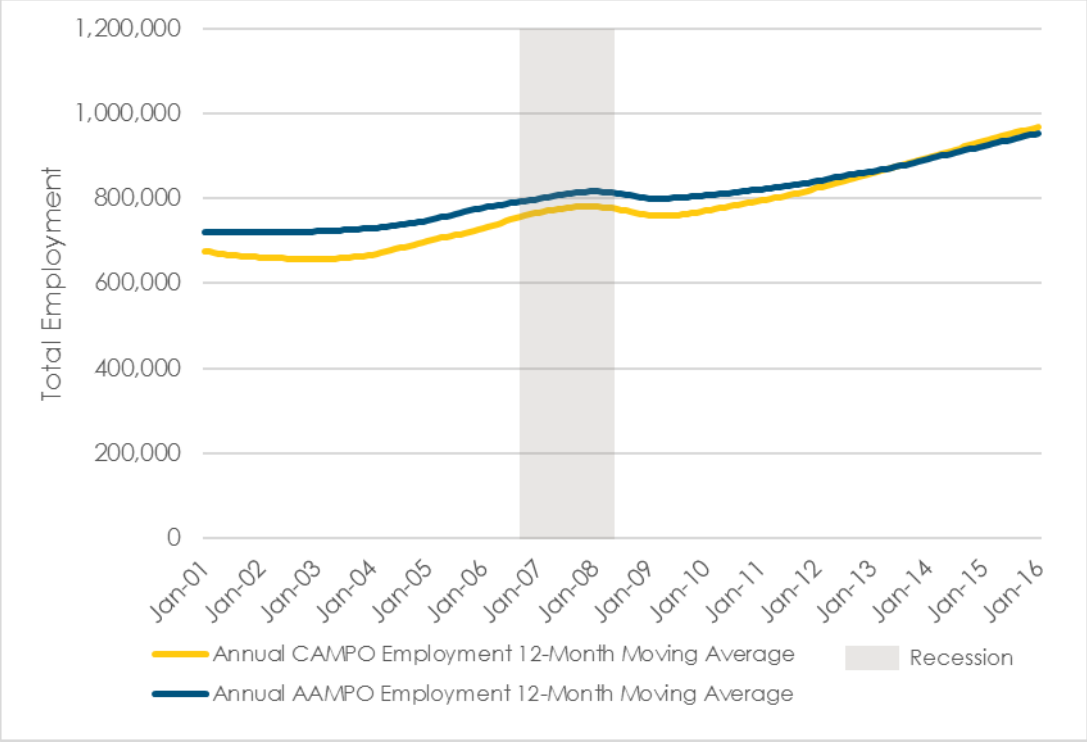
Table 6.10 Employment by County, 2007 – 2016

Region	County	Employment									
		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
CAMPO	Bastrop	13,335	13,883	14,143	14,283	14,032	14,120	15,083	15,516	16,321	18,855
	Burnet	12,514	12,670	12,115	12,204	12,366	12,232	12,595	13,360	13,221	13,184
	Caldwell	6,583	6,871	6,712	6,929	7,441	7,729	8,017	8,116	8,103	8,579
	Hays	47,714	46,748	47,510	48,616	50,577	52,585	55,297	57,849	60,654	63,683
	Travis	569,200	578,961	559,751	567,693	581,510	604,648	628,224	655,305	687,067	704,707
	Williamson	117,842	121,725	119,984	120,860	128,863	133,518	139,166	145,135	150,953	156,834
	Total	767,188	780,858	760,215	770,585	794,789	824,832	858,382	895,281	936,319	965,842
AAMPO	Bexar	716,666	730,302	715,292	722,147	732,527	749,534	770,531	793,727	818,499	841,664
	Comal	36,955	39,034	39,173	39,332	41,073	42,249	42,800	44,952	48,500	53,131
	Guadalupe	28,787	29,887	28,825	28,932	29,983	30,602	31,484	33,021	34,126	38,631
	Kendall	10,176	10,674	10,755	10,654	11,243	11,675	12,081	12,669	14,021	14,873
	Wilson	6,400	6,546	6,419	6,490	6,645	6,683	7,072	7,447	7,664	7,636
	Total	798,984	816,443	800,464	807,555	821,471	840,743	863,968	891,816	922,810	955,935
Study Area Total		**1,566,172**	**1,597,301**	**1,560,679**	**1,578,140**	**1,616,260**	**1,665,575**	**1,722,350**	**1,787,097**	**1,859,129**	**1,921,777**
Region	**County**	**Growth Rates**									
		2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
CAMPO	Bastrop		4.1%	1.9%	1.0%	-1.8%	0.6%	6.8%	2.9%	5.2%	15.5%
	Burnet		1.2%	-4.4%	0.7%	1.3%	-1.1%	3.0%	6.1%	-1.0%	-0.3%
	Caldwell		4.4%	-2.3%	3.2%	7.4%	3.9%	3.7%	1.2%	-0.2%	5.9%
	Hays		-2.0%	1.6%	2.3%	4.0%	4.0%	5.2%	4.6%	4.8%	5.0%
	Travis		1.7%	-3.3%	1.4%	2.4%	4.0%	3.9%	4.3%	4.8%	2.6%
	Williamson		3.3%	-1.4%	0.7%	6.6%	3.6%	4.2%	4.3%	4.0%	3.9%
	Total		1.8%	-2.6%	1.4%	3.1%	3.8%	4.1%	4.3%	4.6%	3.2%
AAMPO	Bexar		1.9%	-2.1%	1.0%	1.4%	2.3%	2.8%	3.0%	3.1%	2.8%
	Comal		5.6%	0.4%	0.4%	4.4%	2.9%	1.3%	5.0%	7.9%	9.5%
	Guadalupe		3.8%	-3.6%	0.4%	3.6%	2.1%	2.9%	4.9%	3.3%	13.2%
	Kendall		4.9%	0.8%	-0.9%	5.5%	3.8%	3.5%	4.9%	10.7%	6.1%
	Wilson		2.3%	-1.9%	1.1%	2.4%	0.6%	5.8%	5.3%	2.9%	-0.4%
	Total		2.2%	-2.0%	0.9%	1.7%	2.3%	2.8%	3.2%	3.5%	3.6%
Study Area Total			**2.0%**	**-2.3%**	**1.1%**	**2.4%**	**3.1%**	**3.4%**	**3.8%**	**4.0%**	**3.4%**

Source: (1) Data from 2007 to 2015 is from BLS Quarterly Census of Employment and Wages (QCEW), 2017.
(2) Data for 2016 reflects estimates by Michael Bomba, PhD.

Employment in the CAMPO and AAMPO areas is shown graphically in Figure 6.5 for the period 2001 through 2016. The effects of the recession can be seen in the downturn in 2009 and the rebound since then. Employment levels are now higher than before the recession and total employment levels for both the CAMPO and AAMPO areas exceed 950,000 in 2016. Since 2014, the employment in the CAMPO counties exceeded that of the AAMPO area.

Figure 6.5 Employment in Study Area, 2001 - 2016



The forecast of future employment for the eleven counties is presented in Table 6.11. Growth is anticipated to taper down from the rate of 2.1 percent from 2016 to 2020 and 1.8 percent in 2030 to 1.6 percent between 2030 and 2040.

Table 6.11 Employment Forecast for Study Area, 2016 – 2040

Region	County	Employment Control Totals			
		2016	2020	2030	2040
CAMPO	Bastrop	18,855	20,352	25,446	32,732
	Burnet	13,184	14,880	18,135	22,099
	Caldwell	8,579	9,285	11,517	14,561
	Hays	63,683	73,095	98,021	124,711
	Travis	704,707	762,715	883,257	991,374
	Williamson	156,834	176,480	225,362	281,677
	Total	965,842	1,056,807	1,261,738	1,467,154
AAMPO	Bexar	841,664	905,194	1,060,224	1,231,801
	Comal	53,131	60,328	82,300	107,492
	Guadalupe	38,631	43,281	56,050	69,948
	Kendall	14,873	16,980	22,744	29,053
	Wilson	7,636	8,342	10,154	12,028
	Total	955,935	1,034,125	1,231,472	1,450,322
Study Area Total		**1,921,777**	**2,090,932**	**2,493,210**	**2,917,476**
Region	**County**	**Growth Rates**			
		2016	**2020**	**2030**	**2040**
CAMPO	Bastrop		1.9%	2.3%	2.5%
	Burnet		3.1%	2.0%	2.0%
	Caldwell		2.0%	2.2%	2.4%
	Hays		3.5%	3.0%	2.4%
	Travis		2.0%	1.5%	1.2%
	Williamson		3.0%	2.5%	2.3%
	Total		2.3%	1.8%	1.5%
AAMPO	Bexar		1.8%	1.6%	1.5%
	Comal		3.2%	3.2%	2.7%
	Guadalupe		2.9%	2.6%	2.2%
	Kendall		3.4%	3.0%	2.5%
	Wilson		2.2%	2.0%	1.7%
	Total		2.0%	1.8%	1.6%
Study Area Total			**2.1%**	**1.8%**	**1.6%**

Source: [1] Michael Bomba, PhD.

A comparison of the employment projections prepared for the 2014 Study and the forecasts used in the current study, is shown in Table 6.12. The 2018 Study employment control totals are higher than the 2014 Study, due to more recent data that show stronger employment growth during the past few years. Bexar and Travis Counties are the major source of the additional employment but most of the other counties contributed positively, as well. The notable exception is Caldwell County, which had lower employment for each forecast year and Bastrop County during 2040.

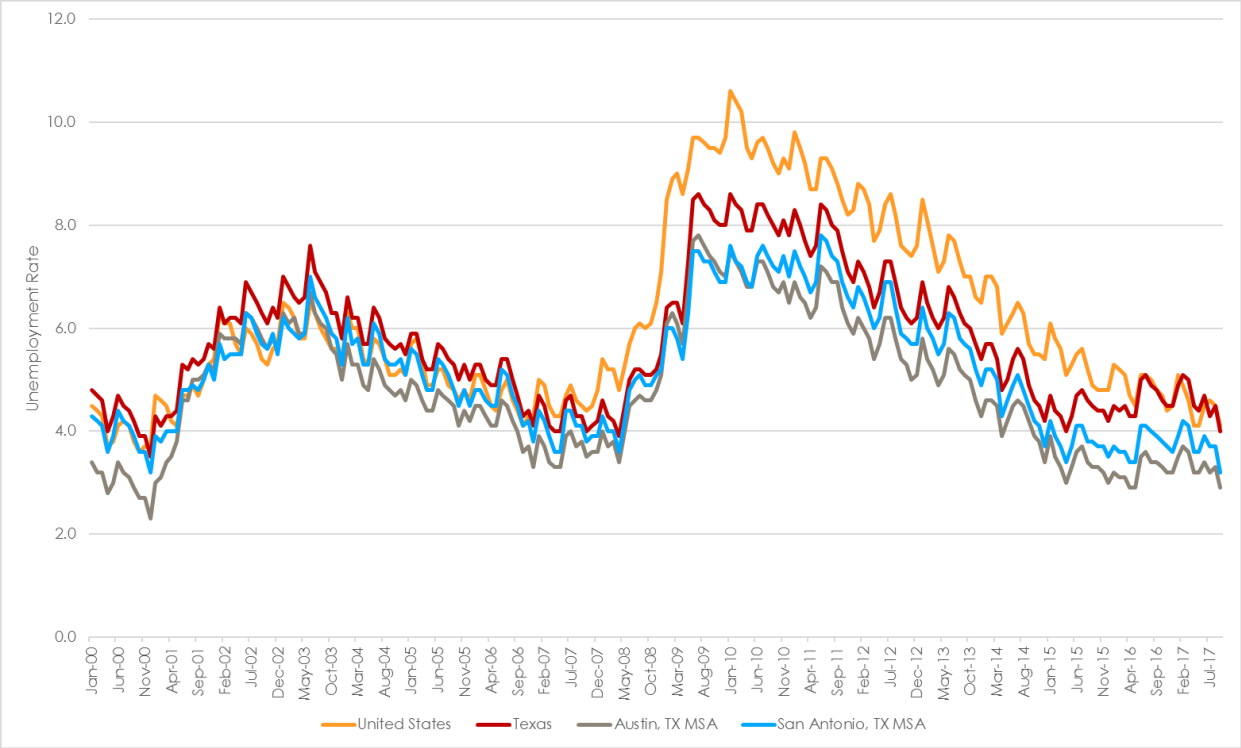
Table 6.12 Comparison of 2014 and 2016 Projections of Employment

Year	Estimated Employment		Difference	
	2014 Study	2018 Study	Number	Percent
CAMPO Counties[1]				
2016	907,255	952,658	45,403	5.0%
2020	980,887	1,041,927	61,040	6.2%
2030	1,173,551	1,243,603	70,052	6.0%
2040	1,375,006	1,445,055	70,049	5.1%
AAMPO Counties				
2016	906,519	955,935	49,416	5.5%
2020	966,259	1,034,125	67,866	7.0%
2030	1,122,948	1,231,472	108,524	9.7%
2040	1,292,984	1,450,322	157,338	12.2%
Total Region				
2016	1,813,774	1,908,593	94,819	5.2%
2020	1,947,146	2,076,052	128,906	6.6%
2030	2,296,499	2,475,075	178,576	7.8%
2040	2,667,990	2,895,377	227,387	8.5%

Source: [1] Michael Bomba, PhD.
Note: [1] For the comparison to the 2014 Study, Burnet County was not included in the 2018 Study estimates, since it was not included in the CAMPO model prior to the 2018 Study.

Figure 6.6 shows the unemployment rates for the United States, Texas, the Austin-Round Rock MSA, and the San Antonio-New Braunfels MSA. These data show the unemployment rate in the region has been below the overall unemployment rate in Texas during most of the period between January 2000 and September 2017. Both the Austin-Round Rock MSA and the San Antonio-New Braunfels MSA experienced their lowest unemployment rates in 2000. During the recession that began in 2001, the regional unemployment rate for both areas peaked at approximately 7 percent. As the regional and national economy recovered, employment expanded during the mid-2000s, and unemployment in both areas fell to less than 4.0 percent. During the 2008-2009 Recession, the regional unemployment rate reached 7.4 percent in the Austin-Round Rock MSA and 7.2 percent in the San Antonio-New Braunfels MSA. Between 2011 and 2017, the regional unemployment rate consistently fell through 2015, and has remained relatively steady going forward at 2.9 percent for the Austin-Round Rock MSA and 3.2 percent for the San Antonio-New Braunfels MSA during September 2017.

Figure 6.6 Comparison of Unemployment Rates, 2000-2017



Source: [1] Bureau of Labor Statistics, 2017.

As part of Stantec's review of Dr. Bomba's forecasts, Stantec compared the population and employment forecasts from all of the previous reports in the rapidly developing 'greenfield' corridor served by SH 130 Segments 1-4. In Table 6.13 and Figure 6.7, the population estimates developed for each of the CTTS forecasts prepared since the initial forecasts in 2002 are provided by horizon year. A comparison of "known" data to previous forecasts shows that Dr. Bomba's estimates are consistently lower than the actual growth within the corridor. For example, Dr. Bomba forecasted the 2008 population to be 190,431 for the 2005 Report. In 2010, when the 2008 data was available for use, Dr. Bomba adjusted his original forecast upwards to 241,651. The "known" data is shown in yellow in the tables below.

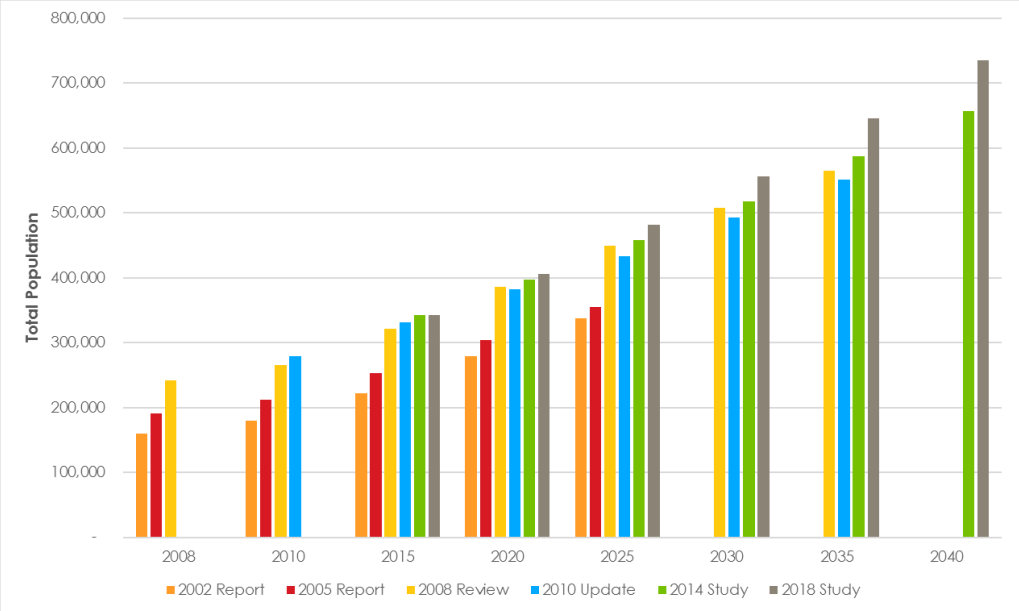
A comparison of the 2015 population estimates is more difficult, since the base year for the 2018 Study is 2016, and as such, 2015 estimates were not developed. However, a comparison to an interpolated value using the 2012 Update estimates of 2010 population and the forecasted 2020 population from the current update show the estimated 2015 population to be almost identical to the forecasted 2015 population for the 2014 Study.

Table 6.13 Comparison of SH 130 Population Forecasts Across CTTS Studies

Traffic T & R Forecast Study	Population Forecast by Year							
	2008	2010	2015	2020	2025	2030	2035	2040
2002 Report	159,233	179,944	221,540	279,286	337,031			
2005 Report	190,431	212,047	252,764	303,911	355,057			
2008 Review	241,651	264,792	321,591	385,541	449,490	507,450	565,410	
2010 Update		278,729	331,458	382,188	432,918	492,174	551,430	
2014 Study			342,412	396,864	457,428	517,991	587,372	656,752
2018 Study			342,199	405,669	480,993	556,316	645,428	734,540

Source: [1] Michael Bomba, PhD.
Note: [1] Where inputs were not developed for the specific forecast year, values were interpolated using available estimates. The 2015 population estimates for the 2018 Study were interpolated using the 2010 estimates from the 2012 Update and the estimates for 2020 developed by Dr. Bomba for the 2018 Study.

Figure 6.7 Comparison of SH 130 Population Forecasts Across CTTS Studies



Source: [1] Michael Bomba, PhD.

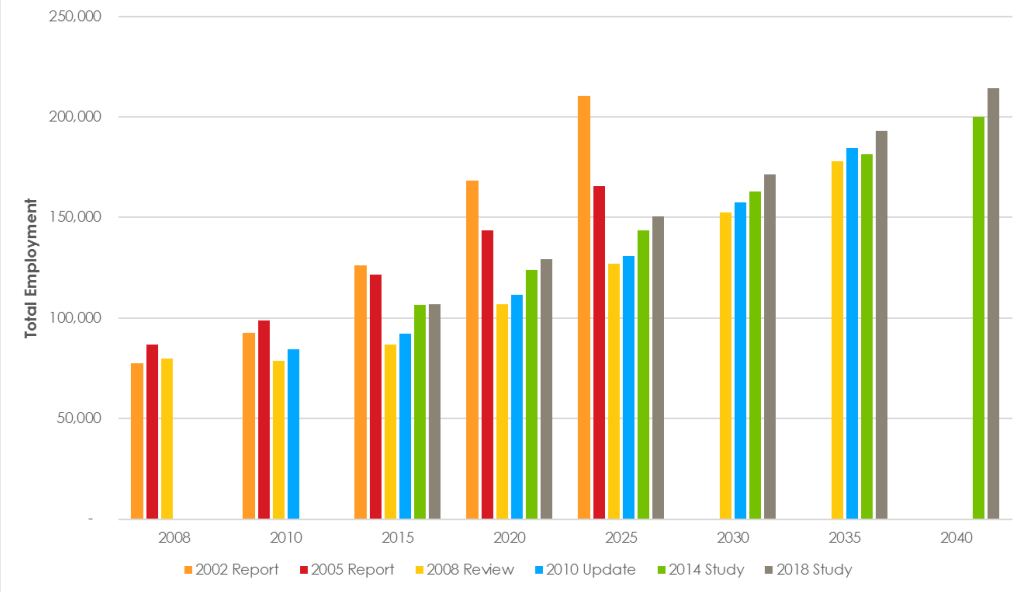
Similarly, the employment forecasts shown in Table 6.14 and Figure 6.8 have been revised upwards for subsequent updates to better reflect known conditions, except for the forecasts produced in 2005 which did not account for the impending recession. Again, the interpolated value using the 2012 CTTS study estimate of 2010 employment and the 2020 forecast for this study is almost identical to the forecasted 2015 employment produced for the 2014 CTTS study. The fact that forecasts are consistently adjusted upwards once data is known underscores the conservative approach taken by Dr. Bomba in developing population and employment forecasts.

Table 6.14 Comparison of SH 130 Employment Forecasts Across CTTS Studies

Traffic T & R Forecast Study	Employment Forecast by Year							
	2008	2010	2015	2020	2025	2030	2035	2040
2002 Report	77,619	92,752	126,152	168,376	210,599			
2005 Report	86,866	98,637	121,764	143,660	165,555			
2008 Review	80,009	78,698	86,598	106,774	126,949	152,436	177,923	
2010 Update		84,295	92,317	111,578	130,839	157,685	184,531	
2014 Study			106,627	123,857	143,488	163,119	181,499	199,879
2018 Study			106,865	129,435	150,458	171,480	192,944	214,408

Source: [1] Michael Bomba, PhD.
Note: [1] Where inputs were not developed for the specific forecast year, values were interpolated using available estimates. The 2015 population estimates for the 2018 Study were interpolated using the 2010 estimates from the 2012 Update and the estimates for 2020 developed by Dr. Bomba for the 2018 Study.

Figure 6.8 Comparison of SH 130 Employment Forecasts Across CTTS Studies



Source: [1] Michael Bomba, PhD.

6.2 UPDATE OF TAZ LEVEL ESTIMATES

The socioeconomic baseline (2016) and future forecasts were prepared by Dr. Bomba and Stantec for use in the disaggregated traffic analysis zone (TAZ) system used in the individual travel demand models. In this process, the historical data presented in Section 6.1 is analyzed and the base year estimates and future year forecast control totals are divided amongst individual TAZs.

6.2.1 Methodology

Base Year Methodology

In order to establish base year socioeconomic data, a visual housing count of new single-family and multifamily dwelling units was undertaken, by comparing 2010 and 2016 digital aerial photography in GIS. New residential development was delineated and the single-family units were counted. An example is shown in Figure 6.9. The rooftop comparison was completed for the entire study area shown in Figure 6.10.

Figure 6.9 Example of Orthographic Review

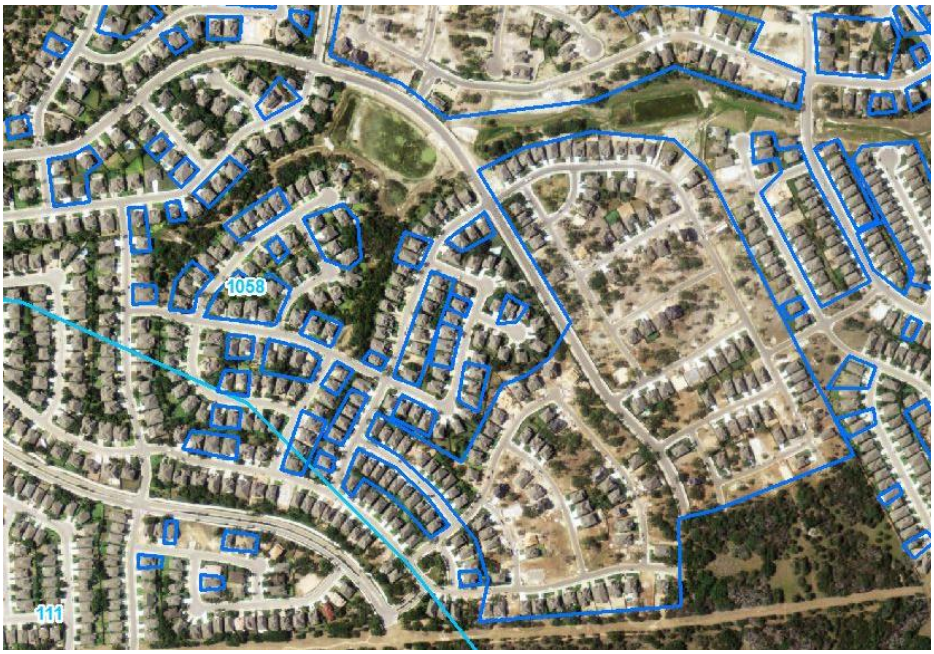
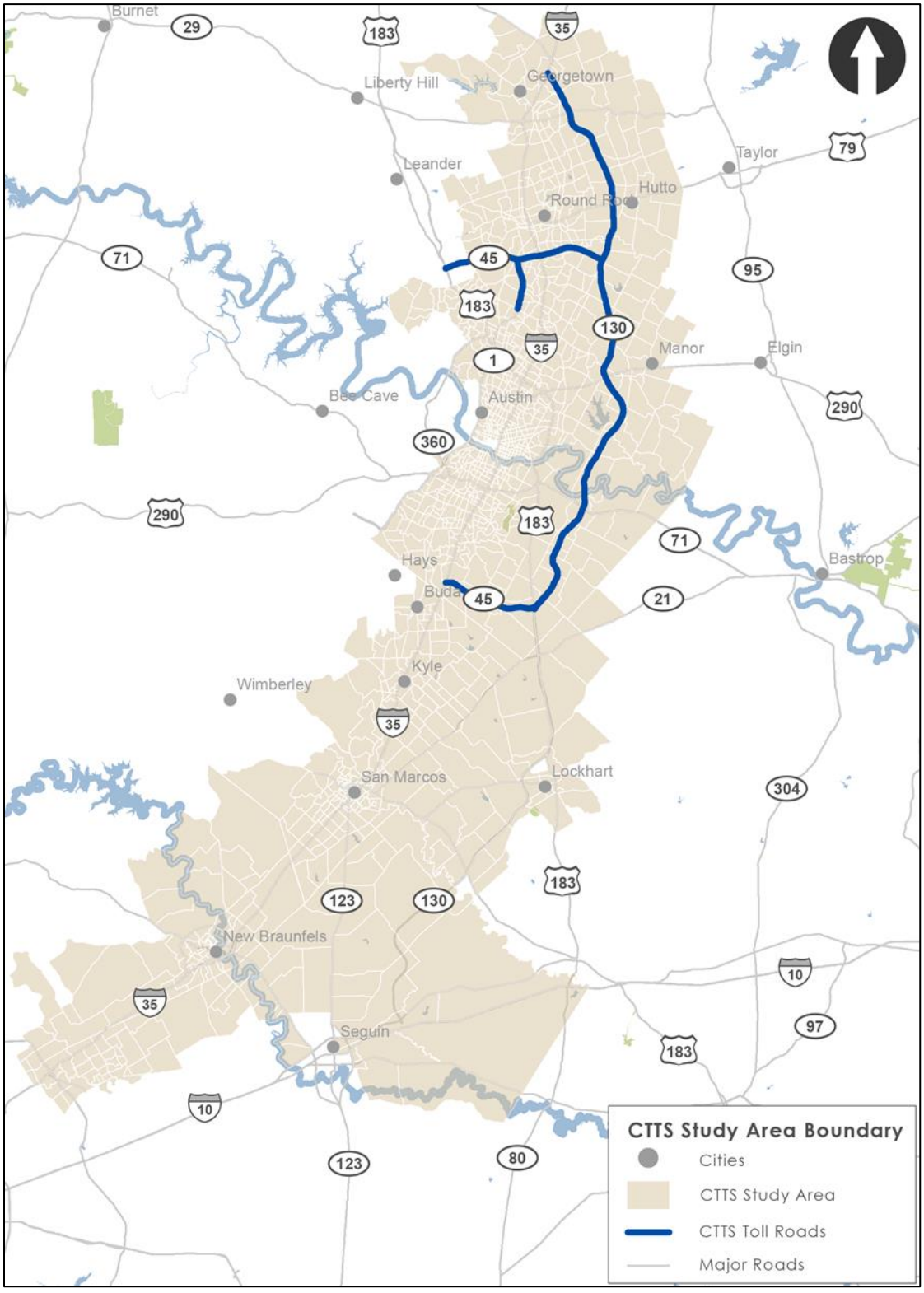


Figure 6.10 CTTS Study Area



Dwelling unit counts for multifamily projects were derived from data provided by local governments, industry market research, company websites, or apartment locator websites. Along with assumptions of vacant housing absorption, the 2010-2016 housing unit count was multiplied by each TAZ's estimated persons per household and added to CAMPO's and AAMPO's 2010 population and households estimates to develop the 2016 base year population and household estimates for the entire project study area. This information was used to generate baseline demographic data for each TAZ in the study area. Outside of the project study area, the populations of the TAZs were interpolated between the MPO's 2010 base year and the 2020 forecast year, then adjusted to subarea population control totals.

The 2016 employment data were adjusted by assuming a portion of employment growth was absorbed into vacant commercial space or was added to firm rosters without requiring additional floor space. Additionally, new commercial developments were also identified using the digital aerial photography. Once these commercial facilities or schools were identified, 2013 firm-level employment data from the Texas Workforce Commission assisted with developing employment estimates or, if the employers were schools, data from the Texas Education Agency (TEA) were used. Using the TWC data and Google Maps, information from local chambers of commerce, periodicals, and other sources as a reference, along with professional judgment, the CAMPO TAZ employment data were assessed and adjusted as necessary. Finally, estimates of median household income in the study area were maintained from CAMPO's and AAMPO's revised 2010 estimates. All data were then reviewed by Stantec staff to ensure internal consistency (e.g., ratio of population to households, check of employment totals against different employment categories, etc.). For additional development information, see discussion of forecast development in Appendix A.

Future Conditions Methodology

Socioeconomic forecasts were developed using a combination of the MPO's forecasts and a series of interviews with individual municipalities. Socioeconomic interviews were conducted with communities and counties in the study area (see Table 6.15) to provide an updated assessment of potential future near-term and long-term growth parcels. Municipality representatives were asked to identify parcels that would experience new residential or commercial development; to quantify the type of development (number of dwelling units for single- or multi-family residential, and square footage or employee counts for commercial development); and to specify a development timeframe if possible. In addition to these quantitative statements about specific development parcels, they were also asked to describe other factors that may influence development in their jurisdiction. These included factors such as the development of new parks, schools, municipal buildings, and other parameters, such as the water and wastewater capacity, the extent of the utility network, and potential environmental constraints. A list of the municipalities that were interviewed is shown in Table 6.15. These comments were recorded directly on a large-scale aerial map during the meeting by municipality representatives and/or Stantec interviewers. The projections were then compared against the MPO baseline forecasts, and an updated socioeconomic forecast for each TAZ in the study area was developed.

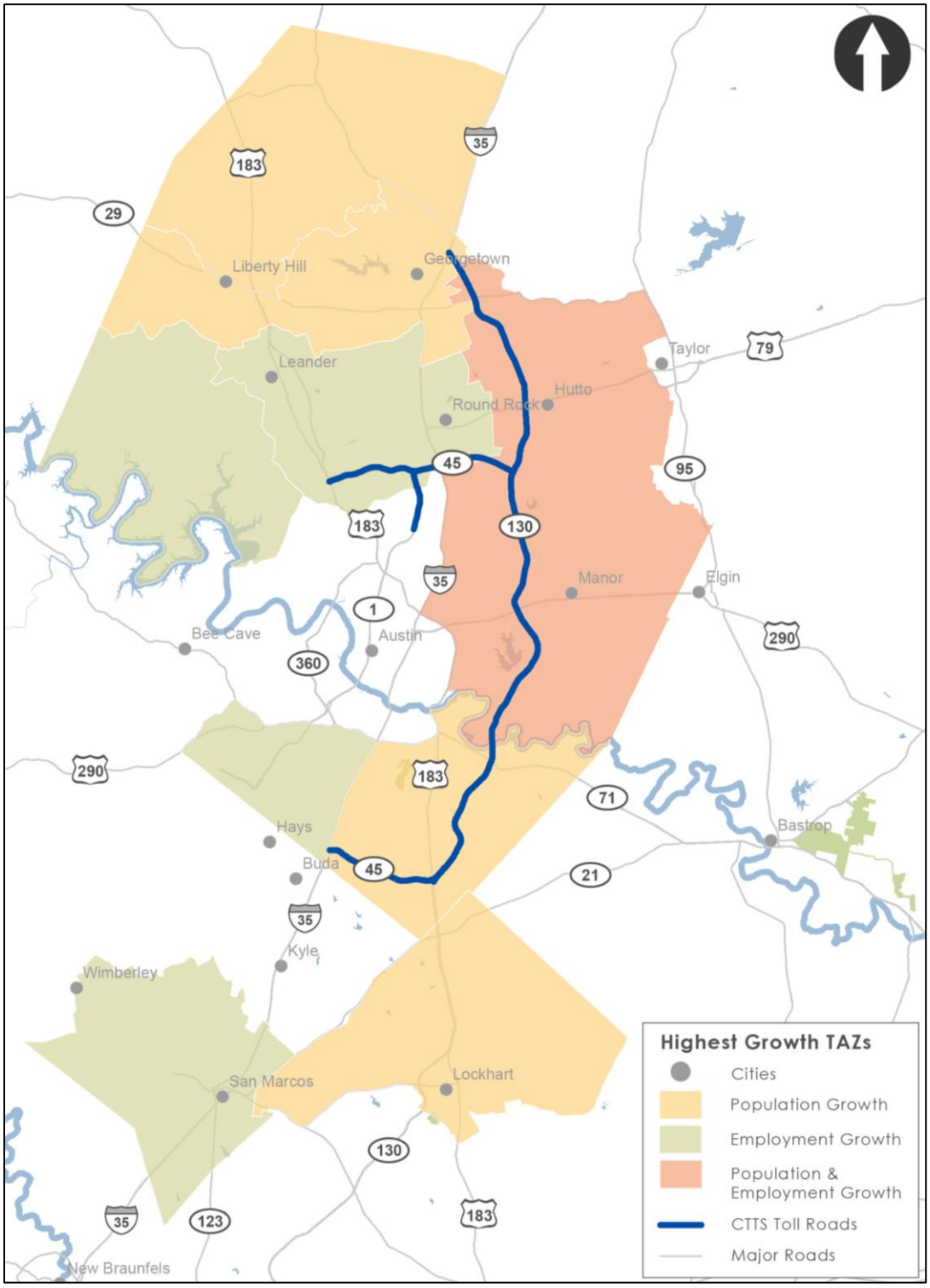
Table 6.15 Socioeconomic Interviews Conducted

Jurisdiction	Date
City of Lockhart	Jul-17
City of Round Rock	Oct-16
City of Georgetown	Nov-16
City of Hutto	Oct-16
City of Manor	Oct-16
City of Kyle	Oct-16
Travis County	Oct-16
City of Pflugerville	Nov-16
City of Buda	Oct-16
Hays County	Jul-17
City of Schertz	Jul-17
City of Cedar Park	Oct-16
City of Leander	Oct-16
City of Seguin	Jul-17
City of Universal City	Jul-17
City of Garden Ridge	Jul-17
City of Selma	Jul-17
City of Cibolo	Jul-17
City New Braunfels	Jul-17
Bexar County	Jul-17

6.2.2 TAZ Population & Employment

The fastest population growth rates are expected outside of the City of Austin, in the areas to the northwest near the cities of Liberty Hill and Georgetown, as well as along the SH 130 corridor in east Austin and the SH 45 SW corridor in southern Travis County. There is also a high rate of population growth in Caldwell County, although the absolute difference is less significant. Figure 6.11 and Table 6.16 through Table 6.17 show the highest growth TAZs in terms of population and employment between 2016 and 2020.

Figure 6.11 Near Term High-Growth TAZ Sectors (2016-2020)



Source: [1] Michael Bomba, PhD.
Note: [1] See Table 6.16 and Table 6.17

Table 6.16 2016-2020 Forecasted Compounded Annual Growth Rates - Population

Sector	2016 Population	2020 Population	Difference	CAGR
8 - Travis	210,812	241,650	30,838	3.47%
9 - Travis	89,776	105,925	16,149	4.22%
7 - Williamson	76,629	88,379	11,750	3.63%
15 - Williamson	50,260	58,094	7,834	3.69%
13 - Williamson	22,225	27,226	5,001	5.20%
20 - Caldwell	24,817	28,557	3,740	3.57%

Source: [1] Michael Bomba, PhD.

Table 6.17 shows the highest growth TAZs in terms of employment between 2016 and 2020. Several of the high growth TAZs in terms of population are also leading the study area in terms of employment growth, particularly along the SH 130 corridor. Additionally, there is high employment growth in northwest Austin in Cedar Park, Leander, and Round Rock, as well as south of SH 71 in southern Travis County near the proposed SH 45 SW corridor and along the IH-35 corridor near San Marcos.

Table 6.17 2016-2020 Forecasted Compounded Annual Growth Rates - Employment

Sector	2016 Employment	2020 Employment	Difference	CAGR
8 - Travis	72,535	81,486	8,951	2.95%
6 - Williamson	114,475	128,686	14,211	2.97%
2 - Travis	52,938	59,087	6,149	2.79%
11 - Hays	36,928	43,611	6,683	4.25%
15 - Williamson	8,206	10,428	2,222	6.17%
5 - Travis	6,265	7,557	1,292	4.80%
0 - Burnet	13,184	14,880	1,696	3.07%

Source: [1] Michael Bomba, PhD.

6.3 REGIONAL DEVELOPMENT TRENDS

As mentioned above, interviews were conducted with community and county representatives to provide an assessment of near-term and long-term growth. While the interview process identified hundreds of developments in all parts of the map, the following section provides a broad overview of the larger-scale developments near the toll roads in the Austin region and along the competitor roads. The Austin and San Antonio regional economies have experienced consistent growth over the past decade, and that economic strength was reflected in the information gathered from the interviews. All the communities have new developments that are either ongoing or planned; many of them have developed or plan to develop catalysts to growth -- among them, their location along a major arterial, a favorable development environment, a well-managed water supply, and/or a strong utility network. Many communities have zoned certain parcels to encourage new development. Each region has a large supply of developable land at the urbanized periphery. Additionally, on the outer edges of development in both regions, there are generally many vacant parcels of developable land and land that could be redeveloped into higher densities, if land prices justify it. Table 6.18 lists key developments in the study area, project details, and development status which correspond to Figure 6.12.

Table 6.18 Key Developments in the Study Area

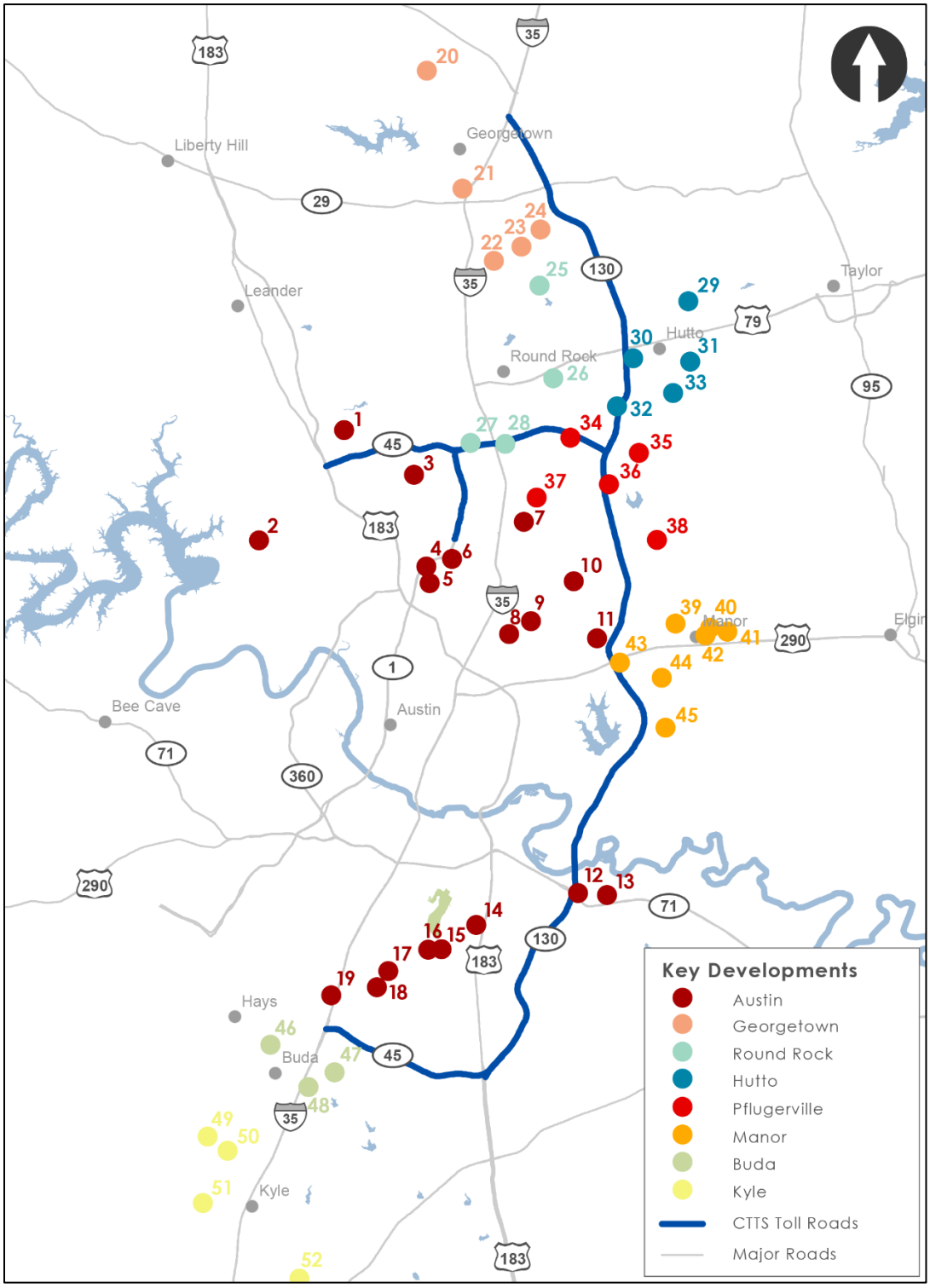
Map ID	Name	Details	Status
1	Northwoods at Avery Ranch	815 single-family lots	Ongoing construction
2	Trails at 620	300,000 sq ft of retail	Under construction
3	Robinson Ranch	6,000-acre ranch available for development	No construction activity
4	Domain 11 & 12 Office Buildings	315,000 sq ft of office space	Completed
5	Domain Tower & Flatiron/Domain	310,000 sq ft of office space and a 372-unit apartment complex	Completed
6	North Austin Medical Center	Planned Unit Development (PUD) with 1.8 million sq ft of medical office space	Ongoing construction
7	Northtown MUD	2,951 single-family homes, 1,626 townhomes, 4,186 apartments	Ongoing construction
8	Pioneer Hill Subdivision	671 lots and apartments	Under construction
9	Pioneer Crossing PUD	2,925 lots	Under construction
10	Cantarra Subdivision	1,126 lots	Under construction
11	Bellingham Meadows Phases 1 & 2	629-lot subdivision	Under construction
12	Riverbend Landing Section 1	600 single-family lots and 11.6 acres of retail space	Approved
13	Watersedge PUD	1,254 single-family homes, 323 apartments, 244 townhomes, and 388,900 sq ft of retail	Approved
14	Addison Subdivision	500 single-family homes, 225 apartments, some retail	Under construction
15	Easton Park Subdivision	6,500 single-family homes, 1,500 apartments	Under construction
16	Vista Point Subdivision	344 single-family homes	Under construction
17	Goodnight Ranch Subdivision	1,192 single-family homes, 2,645 apartments, 696 townhomes	Under construction
18	Bradshaw Crossing	921 lots	Under construction
19	Estancia Hill Country	385 single-family homes, 1.9 million sq ft corporate campus, 1.5 million sq ft office space. May also include hotel, hospital, and multi-family housing	Under construction
20	Sun City	Approximately 7,000 homes already built	Under construction
21	Wolf Ranch Retail and Residential	209 lots and proposed apartments and townhomes	Under construction
22	Teravista Georgetown	1,200 lots	Under construction
23	La Conterra Subdivision	500 lots	Under construction
24	Saddlecreek Subdivision	1,220 lots	Under construction
25	Vizcaya	1,192 single-family lots	Under construction
26	Kalhari Water Resort	1,000 room resort	Proposed

(Cont. on next page)

Map ID	Name	Details	Status
27	La Frontera	102,000 sq ft of retail and 95,000 sq ft office building under construction; recently built 42,000 sq ft and 98,000 sq ft office buildings and 91-room and 140-room hotels	Completed/Under construction
28	The District	1 million sq ft of multifamily, hotels, retail, and office	Proposed
29	Hutto Highlands Subdivision	700 lots	Proposed
30	Hutto Crossing	400 single-family lots and 310 apartments	Under construction
31	Meadows at Cottonwood Creek Subdivision	854 lots	Approved
32	HEB Plus!	121,000 sq ft grocery store and 24,500 sq ft of retail space	Completed
33	Brooklands Subdivision	609 lots	Approved
34	Living Space Furniture Store	530,000 sq ft retail store and warehouse	Under construction
35	Blackhawk Subdivision	3,500 lots	Under construction
36	Scott & White Medical Center	97,474 sq ft hospital	Under construction
37	Commons at Heatherwilde/Pecan	1,250 residential units	Proposed
38	Carmel Subdivision	2,317 lots	Proposed
39	Shadowglen	3,500 lot subdivision	Under construction
40	Sky Village	1,500 lot subdivision	Proposed
41	Presidential Glen	905 lot subdivision	Under construction
42	Presidential Meadows	1,550 lot subdivision	Under construction
43	Capitol Wright Distribution	700-employee, 500,000 sq ft headquarters and distribution center	Completed
44	Lagos Subdivision	2,300 lots	Proposed
45	Whisper Valley PUD	2,047-acre PUD; 4,737 single-family homes, 1,451 apartments, 231,070 sq ft of office space, 429,130 sq ft of retail	Under construction
46	Proposed Subdivision	400 lots	Proposed
47	Sunfield PUD	6,950 single-family homes	Under construction
48	Buda Hospital	Size unknown	Proposed
49	Nance Subdivision	9,000 lots	Conceptual
50	Plum Creek PUD Phase 2	1,400 lots	Proposed
51	Blanco River Ranch	3,500 lots	Proposed
52	Pecan Woods	2,600 lots	Design Phase

Source: [1] Michael Bomba, PhD.
Note: [1] See Figure 6.12.

Figure 6.12 Key Developments in the Study Area



Source: [1] Michael Bomba, PhD.
Note: [1] See Table 6.18.

6.3.1 Austin

Development in the city of Austin has generally been widespread, even reaching areas where growth has not been seen for some time. Historically, the city's eastern side has not attracted significant development, but attitudes have changed and middle-income and upper-middle income households' growing need for affordable housing (as well as gentrification that has attracted young professionals and higher-income households) have encouraged new development projects. Additionally, the linear form of the Austin metropolitan area means that many locations in eastern Travis County currently provide relatively quick commutes to central Austin, which are unavailable from any other direction without paying significantly more for housing. As a result, various residential development projects are planned or underway within the CTTS study area.

West of IH-35 from Travis County Line to US 183

In far North Austin, an important location for future development will be the Robinson Ranch, which is a 6,000-acre parcel. At present, its owners are mining limestone and are not opening sections of land for development. As a result, it is difficult to know when Robinson Ranch will be made available for significant residential and commercial construction. At the southeast corner of SH 45 N and Loop 1, the Preston Park (278 lots) and Travesia (84 lots) subdivisions are under construction. Additionally, the Mansions at Travesia apartments (518 units) were recently completed, as were the Art at Bratton's Edge Apartments (76 units) and the Allegre Point Apartments (184 units) further south. Up to 450 more apartments are proposed on the same tract of land as Allegre Point. Continuing south, a multifamily project called Terraces at Scofield Ridge (350 units) is under review on the southeast corner of Loop 1 and Grand Avenue Parkway. To the east, the Scofield Farm Meadows Condominiums (49 units) and the Walnut Park Apartments (277 units) are under construction. At the Domain Development, 372 units are under construction for a project called Flatiron. Nearby on North Burnet Road, the Broadstone Burnet Apartments (352 units) are under construction and on Braker Lane the North Burnet Gateway Apartments (423 units) are also being built.

Commercial development in this portion of the CTTS study area has been concentrated in The Domain development, which has just added two office buildings with 315,000 square feet of office space. Also at The Domain, a 310,000-square foot office space is under construction and its Rock Rose district has opened, which has added a large number of restaurants, bars, and stores. There has also been greater utilization of flex space and industrial space in the area bounded by Loop 1 and Metric Boulevard and Gracy Farms Lane and US 183. As office rents rise in Austin, a number of companies are utilizing cheaper flex space as office rather than renting traditional office buildings. This area has also become popular for microbreweries, which along with The Domain and Top Golf, are giving some needed cachet to a part of Austin that has regularly been ignored. Another area with planned, ongoing, or recent commercial development is between Loop 1 and IH-35, south of SH 45 N. Most of the new development in this area is warehousing and industrial. Lastly, there has been infilling of vacant land between Lamar Boulevard to its intersection with IH-35, north of Walnut Creek.

East of IH-35 from Pflugerville to US 290

There are three large Municipal Utility Districts (MUD) or Planned Unit Developments (PUDs) in northeast Austin. The Northtown MUD is located due south of the city of Pflugerville. The developer has started construction and it is proposed to have 2,951 single-family units, 1,626 townhomes, 4,186 apartments, along with retail, office, industrial, and schools. Pioneer Crossing is located further south and oriented around Dessau Road. The Pioneer Crossing PUD is under construction and planned for 2,925 single-family homes. The Harris Branch PUD is located along Harris Branch Parkway and was originally proposed to have 3,787 single-family homes and 1,160 apartments. Over the past decade, construction in the Harris Branch PUD has occurred on an intermittent and limited basis. In addition to these large MUDs or PUDs, there are a number of smaller subdivisions that are proposed or under construction. The Fort Dessau subdivision is under construction and will have 86 condominiums, 50 duplex units, and 160 single-family homes. Nearby, the Harris Ridge Condominiums will have 108 units. A small infill subdivision along Yager Lane, called the Enclave of The Springs (46 lots), was under construction during the field survey. Further east, the Entrada and Fossil Creek subdivisions have been approved for 822 lots and 933 lots, respectively, but there was no activity at the time of the field survey. Nearby, the Cantarra subdivision (1,126 lots) continues to build out. The Pioneer Hill subdivision on Dessau Road (671 lots and apartments) is under construction and, east along Parmer Lane near its intersection with SH 130, the Bellingham subdivision (629 lots) is under construction. There are two multifamily complexes being developed. One complex, called IO at Tech Ridge (351 units), was partially built, but stalled during the field survey. Another complex called Austin Waters (unit information unavailable) was proposed and may now be under construction, along with an assisted living facility on Yager Lane that was also under construction.

Commercial development in this portion of the study area is dispersed throughout and occurs primarily on vacant parcels along major arterials or in commercial parks. The highest concentration of recent commercial development has been in the Parmer Business Park within the Tech Ridge development, which is located between Parmer Lane and Howard Lane. Recently, two buildings with approximately 192,000 square foot office buildings were built along McAllen Pass Drive. Four more buildings are under construction, one office building with 116,000 square feet of space and three more flexspace buildings totaling 350,000 square feet. Additionally, 3M will build its own 272,000 square foot office building in the same development (Anderson, 2017). In addition to these projects there are also plans to build additional office, flexspace/industrial, and retail buildings on other tracts within Tech Ridge. Business parks are also concentrated north and east of the intersection of US 183 and US 290. Within these business parks, new construction projects have consisted of both office and industrial/warehousing. Retail development in this part of the study area has primarily occurred as free-standing buildings and as small, strip shopping centers.

West of US 183 from US 290 to SH 71

Some of the major development projects within the urbanized core of Austin that are within or adjacent to the CTTS study area include the Mueller Airport redevelopment, Crestview Station, and the ACC Highland Center. Among these developments, the Mueller Airport redevelopment (which lies just outside the CTTS study area) is unquestionably the largest with approximately 4,900 single-family and multifamily units expected at full build out. Construction at the site has been underway for a number of years and is expected to continue for several more, as market conditions have accelerated the original timeline. The Crestview Station project is a transit-oriented-development built around a Capital Metro commuter rail station that is being constructed in phases. The project is a mixed-use development with retail, office, single-family homes, and multifamily units. Collectively, there will be 1,350 residential units when it is fully built out. The ACC Highland Center is a partial redevelopment of the existing Highland Mall and there are 1,250 multifamily units planned for a future phase of the project. The first phase of its multifamily construction is underway. The Mueller redevelopment, in particular, has been a catalyst for the area bordered by IH-35, US 183, Airport Boulevard, and US 290. In the last few years, home values in these neighborhoods have increased significantly, due to demand for central city proximity and a supply of renovated housing stock. However, to date, this trend has only led to a replacing of lower-income households with higher-income households and infill construction. There has been little densification of the neighborhood up to this point.

As land prices rise, particularly west of IH-35, developers are infilling vacant parcels and subdividing single-family lots in a piecemeal manner. They are also taking low-density commercial properties and building multi-story residential projects, typically with retail and office units on the bottom floor. Burnet Road and Lamar Boulevard are popular corridors for these types of projects, since there is an abundance of these low-density (in some cases dilapidated) retail properties that can be redeveloped into residential and commercial space with much higher rents.

Major commercial projects in central Austin include the Mueller Airport redevelopment, which is planned for 3.0 million square feet of commercial space and 790,000 square feet of retail development. A significant portion of this commercial space has already been built, including the Dell Children's Medical Center, The Thinkery (a children's museum), the Austin Independent School District's Performing Arts Center, various medical office buildings, and a large amount of strip center retail and big box retail. To some degree, the retail development at Mueller has absorbed much of the demand in the area and other commercial areas are not yet revitalizing, despite rapidly increasing household income and property values. The ACC Highland Center is the redevelopment of a portion of the existing Highland Mall into an Austin Community College campus. The low density of Highland Mall and surrounding properties coupled within rising land values suggests that redevelopment projects will be occurring in this area for some time.

East of US 183 from US 290 to SH 71

The pace of residential development in this portion of the CTTS study area is beginning to pick up, but is still slower than areas north of US 290. Between Loyola Lane and FM 969, the Trinity Meadows (957 lots) and the Loma Vista (lot information unavailable) subdivisions have had modest amounts of new construction. Building also continues in the Austin Colony subdivision (73 lots) along FM 969, east of SH 130. Along US 183, near its crossing of the Colorado River, the Knollwood on the Colorado River subdivision is platted for 257 single-family homes and the construction of its homes continues. Many of the subdivision projects in this area are planned and have not yet started. South of US 290 and on the west side of FM 3177, the Parker Creek Ranch (418 lots) and the Loma Vista (no lot information available) subdivisions are being proposed. The Indian Hills (1,522 multifamily units) and the Lariat B Ranch subdivision (981 lots) have been approved, but there has been no activity. The East Parke subdivision (124 lots) has been proposed at the northeast corner of US 183 and Loyola Lane. The right-of-ways for the streets have been cleared, but the project appears to have stalled. Further south, the Hornsby Glen subdivision has been approved for 538 lots. Along SH 71 and east of SH 71, Riverbend Landing (600 lots) and the Watersedge PUD with 1,254 single-family homes, 323 apartments, and 244 townhomes are proposed. On the south side of US 290 and north of Old Manor Road, the Terrace at Walnut Creek Apartments were under construction (329 units).

At the periphery of downtown Austin, redevelopment is occurring along Riverside Drive, east of IH-35. These new projects are mixed use residential/retail (unlike the buildings they are replacing) and they are redeveloping at higher densities and with much higher rents. Several projects grouped near Riverside Drive's intersection with IH-35 will collectively have 3,105 apartments, 7,746 square feet of office space; and 219,406 square feet of retail space. The redevelopment trend along the Riverside Drive corridor is expected to continue over the long-term, since there are many aged properties on large parcels that would become attractive as land prices increase. Further east in the Montopolis neighborhood, a number of smaller infill residential subdivisions are being proposed or constructed. Dwelling units in these subdivisions are typically single-family homes on small lots or townhomes or shared lot dwelling units. Some of the subdivisions include the Townhomes at Park Place (55 units), Riverside Homes (lot information unavailable), and Shire's Court (290 units).

A commercial park located at the southeast corner of SH 130 and US 290, called Parmer Center, is the location of a new beverage distributor, which has approximately 700 workers. It is the first business to locate in this park. Within this part of Far East Austin, there are several other large-scale projects have been proposed, but none have advanced to actual construction. At present, there is a commercial development proposed north of Decker Lake, along Lindell Lane, has been proposed. Nearby, the Wildhorse PUD is proposed to have more than 5,800 homes, almost 6.3 million square feet of commercial development, and an 800-room hotel. Between Loyola Lane and FM 969, a 45-acre warehouse and office development is proposed at the southwest corner of Decker Lane and Loyola Lane, but there has been no construction.

East of IH-35 and between Lady Bird Lake and SH 71, perhaps the highest concentration of new commercial development has been at the redeveloped properties along Lakeshore Drive and Riverside Drive, particularly on the ground floor of new apartment buildings. There has also been some new construction on the northeast corner of East Riverside Drive and East Ben White Boulevard, namely hotels serving the Austin-Bergstrom International Airport (ABIA)

South of SH 71 to Buda

Areas south of SH 71 and within the CTTS study area have generally experienced slower growth over the past decade than locations in northeastern Hays County or north of US 290 in Travis County. However, there is renewed interest from developers, as they seek areas of Austin with affordable land. South of SH 71 and east of US 183, there has been relatively little residential construction, but there are several proposed developments. Along Ross Road and south of Pearce Lane, two subdivisions are being reviewed by the City of Austin, which are the Cactus Rose Mobile Home Park and one for stick-built homes. On the northeast corner of Ross Road and Elroy Road, a multifamily development has also been approved.

The most significant residential project underway (west of US 183) is Easton Park, which is proposed to have up to 10,000 housing units and other retail and commercial development. Easton Park is located between US 183 and Thaxton Road, south of FM 812. The first phase of the project is underway, but incentives for affordable housing were struck down by a court. It is not clear if this ruling will affect the viability of the project (Barragan, 2015 and Findell, 2016). To the north of Easton Park and along US 183, single-family homes in the Addison subdivision (500 lots and 225 apartments) are under construction. Development also continues in the Colorado Crossing subdivision (949 lots). Due west of Easton Park, construction is also underway on the Vista Point (344 lots) and the Springfield subdivisions (337 lots). To the south of Springfield, several tracts have also been approved for multifamily construction. Further west, on either side of Slaughter Lane, the Goodnight Ranch subdivision has started construction, which is proposed to have 1,192 single-family homes, 2,645 apartments, and 696 townhomes. Adjacent to Goodnight Ranch, the McKinney Heights subdivision (925 lots) is nearing its build out. Continuing south along Bradshaw Road, there is construction in the Bradshaw Crossing (921 lots) and Legends Way (289 lots) subdivisions. Several more subdivisions nearby are either approved for construction or under review by the City of Austin. The Vistas of Austin subdivision (669 lots) is approved and lies due east of Bradshaw Crossing. South and east of Legends Way subdivision are the proposed Bella Fortuna (467 lots) and Cascades at Onion Creek (467 lots and 250 multifamily units) subdivisions. On the west side of IH-35, south of Onion Creek is the Estancia Hill Country development which is planned for 385 single-family homes and 1,600 apartments and townhomes. Construction has started on its single-family homes.

South of SH 71 and east of US 183, new commercial development has been limited. The number of enplanements at ABIA continues to grow, which has required more employees to serve these passengers. There were also two hotels recently constructed on the airport property. To the south, the Circuit of the Americas motorsport and entertainment facility, built in 2012, continues to host Formula One races and other sporting events and concerts. However, the facility has not led to

any meaningful redevelopment of adjacent rural land. One new and notable employer in this area has been the NLand Surf Park, which is a 14-acre artificial surfing lagoon with a small brewery. West of US 183 and south of SH 71, commercial development has been more active, particularly in the Met Center commercial park and other commercial parks located along Burleson Road and E Stassney Lane, where several large industrial tilt wall buildings were under construction during the field survey. On the west side of IH-35, south of Onion Creek is the Estancia Hill Country development, which is proposed to have 1.9 million square feet of corporate office space, 1.5 million square feet of general office space, a hotel, and a hospital. Commercial construction at this development has not yet begun.

6.3.2 Georgetown

The city of Georgetown's development pattern is currently concentrated in its west and northwest, as well as to the east and southeast towards SH 130. Among Georgetown's largest residential developments, the Sun City "active adult" community continues to expand. There are also a number of other parcels on the northwest side of Georgetown that are expected to be developed during the next five years. Along Williams Drive, the Deer Haven (70 lots), the Gardens at Verde Vista (149 lots), and the Lakeside (300 lots) subdivisions under construction. Further south, adjacent to Wolf Ranch's retail development, townhome and apartment projects are being planned, along with 209 single-family homes that have already started construction. The Water Oak subdivision, which lies adjacent to the CTTS study area on SH 29, has 1,500 acres available for development and will have up to 3,000 single-family units. Closer to SH 130, on the northeast corner of Rockride Lane and Sam Houston Boulevard, a 1,220-lot subdivision called Saddlecreek is being proposed, along with a 200-lot addition to the Pinnacle subdivision. Due east of the Pinnacle subdivision, on the west side of Maple Street, a 300-lot subdivision is also being planned. South of Georgetown, in an unincorporated area that is also due north of the city of Round Rock, another phase of the Teravista development continues to add a large number of single-family homes, as does the La Conterra subdivision. A number of new multifamily developments are being planned, are under construction, or were recently completed in Georgetown, which are shown below in Table 6.19.

Table 6.19 Recent and Future Multifamily Projects in the City of Georgetown

Apartments		
Name	**Total Number of Units**	**Status**
Carroll at Rivery Ranch	272	Under construction
Hlllstone at Wolf Ranch	332	Completed
Kaia Pointe	102	Under construction
Live Oak Apartments	108	Under construction
Mansions of Georgetown	438	Completed
Merritt Heritage	244	Under construction
Retreat at Wolf Ranch	303	Completed
Retreat at Wolf Ranch Phase 2	259	Under construction
The Delaney at Georgetown Village	120	Completed
Third and Rock Court	12	Under construction
Villas of Georgetown	264	Proposed
Townhomes		
Name	**Total Number of Units**	**Status**
Holly Street Townhomes	24	Completed
Condominiums		
Name	**Total Number of Units**	**Status**
Gardens at Verde Vista	160	Completed
Gatlin Creek	70	Proposed
Old Mill Crossing	99	Completed

Source: [1] Marczynski, 2017.

The most concentrated commercial construction has been at the Wolf Ranch development, which recently added a full-service Sheraton Hotel. Smaller commercial projects have occurred throughout the city, including new construction along the Williams Drive corridor and some site redevelopment in the downtown area. A new middle school was under construction in Georgetown at the southeast corner of Rockride Lane and SE Inner Loop.

6.3.3 Round Rock

Round Rock continues to be one of the primary recipients of suburban growth in the Austin region, although its rate of growth has slowed over the last decade, as other cities compete and as its supply of developable land diminishes. At present, there are a number of residential subdivision projects planned or underway, these include: the Freeman Tract, Avery North, Warner Ranch, and Kenney Fort. There will also be expansions of the Paloma and Sienna subdivisions, which fall within the jurisdiction of municipal utility districts (MUDs) and outside the City of Round Rock's boundaries. Table 6.20 identifies all the residential projects in the city of Round Rock that are either proposed, in review, approved, or under construction. Collectively, these projects will add thousands of new housing units to this portion of the CTTS study area.

Table 6.20 Residential Construction Projects in the City of Round Rock, 2015-2017

Development	Total Number of Lots
Single-Family Subdivisions	
Freeman	228
Avery North/Vizcaya	1,192
Turtle Creek Phases 5 & 6	101
Warner Ranch	274
Meritage/GLO	194
Kenney Fort	202
Bodeman/HR 79	65
Madsen	285
Glen Ellyn Tract	194
Northfields Phases 1 & 2	194
Arden Park	118
Detached Single-Family Common Lot	
Gardens at Mayfield Ranch	130
Mayfield Ranch	89
Sunrise Condos	100
Wallin Tract	100
Diamond Oaks	130
Cottages at Meadow Lake	33
Duplex	
Turtle Creek Phase 8	N/A
Spring Street Townhomes	12
Townhomes	
Legends Village Condos	109
Cottages at Round Rock Town Center Phase 2	24
Turtle Creek Townhomes	28
University Village Townhomes	58
Wyoming Springs Townhomes/Rockwell Village Condos	58
Donnell Park Townhomes	149
Multifamily	
Arrington Ridge	312
Waters at Sunrise	288
Avery Center South	238
Kenny Crossing	248
Holly Brook Ranch	336
Bartz II	296
Springs at Round Rock	260
University Village Apartments	292
Meadowlake Multifamily	254
Senior Assisted Living	
Cedar Ridge Assisted Living	164
The Enclave at Round Rock	170
Sundara Assisted Living	32
Affinity Round Rock	170
Poets Walk	68

Source: [1] City of Round Rock, 2016.
Note: [1] Table provides the total number of lots or units in each development. The number of residential units constructed between 2015 and 2017 may be less than the total.

Various commercial projects were underway or proposed in Round Rock during the field visit. One of the most significant projects is the Kalahari Resort, which is still in the planning stages. It will include a 1,000-room hotel and waterpark with an African theme. The resort expects to hire 700 employees and will be located along US 79, east of Kenney Fort Road. Recently completed, the Scott & White Cancer Center is located on the northeast corner of University Boulevard and Mays Street in a four-story structure. One of the most active areas in Round Rock for new commercial development has been the La Frontera site at the northwest corner of SH 45 N and IH-35. Over the last two years, several projects have been completed there, including: a 91-room hotel and a 140-room hotel. Additionally, a 42,000 square-foot college campus and 98,000 square foot office building were recently built. A former big box store was demolished and 102,000 square feet of retail strip was being constructed at the time of the field survey. Additional retail on this site (i.e. pad sites) is expected in the future. Developers have also started construction of a 95,000 square-foot office building in July 2016. Further east, a mixed-use project with 1.0 million square feet called "The District" was recently announced. It will have Class-A office space, residential, hospitality, and retail uses and it will be located along SH 45 N and N. Greenlawn Boulevard.

6.3.4 Hutto

Located east of SH 130 in Williamson County, population growth in the city of Hutto has outpaced the surrounding area. Since the 2000 U.S. Census, when its population was 1,451 residents, the City of Hutto has grown approximately 1,542 percent to its estimated 2016 population of 23,832 residents. North of US 79, new development is anticipated in the Hutto Highlands subdivision (700 lots) and the Mager Meadows subdivision (200 lots). South of US 79, active residential developments include: Hutto Crossing (400 lots); the Park at Brush Creek, Glenwood; and the Riverwalk (400 lots) subdivisions. In the southeast quadrant of Hutto and south of County Road 499, 854 single-family homes are expected in the Meadows at Cottonwood Creek subdivision and 500 more single-family homes on an adjacent parcel. The Brooklands subdivision, which is south of FM 1660, is proposed to have 609 lots. Near this subdivision, an 80-unit multifamily senior complex is being proposed.

Although Hutto has grown to a sizeable population in a short period of time, commercial development has historically lagged, due to the lack of population density required to attract the interest of national chains and the city's proximity of extensive retail and services in nearby Round Rock. However, a large HEB grocery store and other strip commercial development was recently built at the northwest corner of SH 130 and Gattis School Road to serve the city and eastern Round Rock. The SH 79 corridor provides opportunities for new development, with easy access to SH 130. However, high-traffic retail development on the south side of SH 79 will probably be limited, due to the active Union Pacific track.

6.3.5 Pflugerville

The City of Pflugerville is viewed by many as an attractive location due its affordable housing and its relative proximity to Austin. This interest has extended to developers, who have been attracted to the SH 130 corridor. During the field survey, there was a strong pace of construction in many of the city's subdivisions. Table 6.21 provides an inventory of Pflugerville's existing subdivisions and remaining lots to be developed or multifamily units or townhomes to be built. Developers have almost 11,000 housing units in active or approved projects for future construction.

Table 6.21 Subdivisions under Construction or Approved in the City of Pflugerville

Development	Total Units Built	Remaining Units
Avalon Subdivision	968	532
Blackhawk Subdivision	1,192	2,309
Blackhawk Far East	0	637
Branson Condominiums	3	130
Carmel Subdivision	0	2,317
Carrington Court Subdivision	83	50
Commerce Place Apartments	628	287
Commons at Heatherwilde/Pecan	0	1,250
Emerson Apartments	170	214
Falcon Pointe Subdivision	1,608	97
Highland Park Subdivision	1,131	141
Highlands Apartments	257	35
Huntington Park Subdivision	0	128
Kuemple Townshomes	0	18
Mansions at Stone Hill Apartments Pha	148	251
Paradise Cove Condominiums	0	17
Penley Park Subdivision	46	115
The Reserve at West Creek Subdivision	589	15
Sorento Subdivision	199	745
Senson Farms Condominiums	26	112
Verona Subdivision	87	237
Village on Legacy Subdivision	62	262
The Villages of Hidden Lake Subdivisior	1,153	132
Vine Creek Subdivision	0	82
Walden Square	0	82
TOTAL	**8,350**	**10,915**

Source: [1] City of Pflugerville, 2017.

Table 6.22 shows three new subdivisions that were under review with the City of Pflugerville's Planning Department. These three subdivisions would add 355 lots to the city's inventory.

Table 6.22 Subdivisions under Planning Review in the City of Pflugerville

Development	Total Number of Proposed Lots
Becker Farms Subdivision	83
Commons at Rowe Lane Subdivision	246
Maynard Subdivision	26
TOTAL	**355**

Source: [1] City of Pflugerville, 2017.

Along with its robust residential market, Pflugerville is also experiencing considerable commercial development. Some of the city's more significant projects, currently under construction, include:

- An Aldi grocery store at the southeast corner of FM 685 and Pfennig Lane
- Heritage Lakes at Pflugerville – 90 independent living units, 52 senior cottages, 16 supported living units, 65 assisted living units, and 50 skilled nursing units
- A 530,000 square foot Living Spaces furniture store, southwest corner of SH 45 N and Heatherwilde Boulevard
- A Marriott Courtyard at the southwest corner of E. Pecan Boulevard and SH 130
- An elementary school on Hodde Lane, north of Cele Road.
- A high school on Weiss Road, south of E. Pflugerville Parkway
- Pflugerville Hospital, a 97,474-square foot Scott & White facility on the northeast corner of SH 130 and East Pflugerville Parkway.

Other projects that are still in the planning stages include: a Costco that is being proposed on the southeast corner of SH 130 and Kelly Lane; a medical and professional building that is proposed at the southwest corner of E. Pflugerville Parkway and FM 685; and an assisted living facility that is proposed at the northwest corner of Wells Branch Parkway and S. 10th Street.

6.3.6 Manor

Manor is a small city that lies due east of the city of Austin. During the mid-2000s, Manor was a growing suburb, but was impacted negatively by the 2008-2009 Recession. Since the recovery, Manor's growth has accelerated. As of June 2017, Manor had more than 8,000 lots in various phases of planning or construction. Ongoing or proposed residential projects include: Presidential Glen (360 lots); Presidential Heights (600 lots); Stonewater (350 lots); Stonewater North (270 lots); Shadow Glen (1,500 lots); Presidential Meadows (875 lots); Lagos (2,300 lots); the Village at Manor Commons (370 lots); and Sky Village (1,500 lots). Into the future, Manor is poised to be surrounded by more than 9,000 lots to the south in the proposed Indian Hills subdivision, Whisper Valley subdivision, and other projects.

Commercial development has been slow to follow residential growth in Manor. Its relative close proximity to retail and services in Austin, coupled with lower population densities, has historically resulted in little commercial development. Current commercial projects include the construction of a new elementary school on the south side of the city along FM 973 and the New Tech Middle School along US 290. The Shadowview Lakeside Shopping Center at Lexington Street and US 290 is now completed and is adding tenants. Restaurants and fast food restaurants are located there, along with a medical clinic and a cell phone store. Nearby, another medical clinic is being built.

6.3.7 Buda

Located due south of Austin, in Hays County, Buda is expected to be the recipient of a significant volume of single-family residential development over the coming decades. Although Buda's historic center is located west of IH-35, recent residential development has been on both sides of the roadway. On the west side of IH-35, development is currently underway in the Garlic Creek, Elm Grove, Whispering Hollow, and Summer Pointe subdivisions. Several new subdivisions are being proposed along RR 967, which include: White Oak Preserve (245 lots); a subdivision north of Haleys Way Drive (400 lots); a subdivision north of Dodgen Trail (239 lots); and a subdivision west of Carpenter Elementary School (150 lots). To the east of IH-35, the largest residential project underway is the Sunfield development, which will be a mix of residential, industrial, and commercial land uses. The proposed 2030 build-out for Sunfield is 6,950 lots and several hundred single-family homes have already been built. Single-family construction also continues in the Stonefield, Stoneridge, and Meadow Park subdivisions. Additionally, a small subdivision with 127 lots is being proposed along Hillside Terrace Drive, between Goforth Road and FM 2001. There are multifamily projects proposed on the west side of IH-35 along Firecracker Road and at the southwest corner of Old Goforth Road and FM 2001 (250 to 300 units).

Outside of continued, piecemeal development within existing areas platted and zoned for commercial purposes, the primary commercial project proposed in the city is a hospital at the southwest corner of White Wing Trail and FM 2001.

6.3.8 Kyle

Kyle continues to be a rapidly growing Hays County suburb, located between Austin and San Marcos. Bisected by IH-35, new residential development is occurring on both sides of the roadway (See Table 6.23). On the west side of IH-35, construction continues in the Plum Creek development, where an additional 1,400 single-family dwelling units are planned for the second phase of the Plum Creek subdivision, as well as 170 new single-family homes within the first phase. Within existing subdivisions, there was single-family construction in the Creekside and Brooks Crossing subdivisions. Construction was starting on Phase 1 of Cypress Forest subdivision and to its north, along N. Old Stagecoach Road, Phases 1&2 of the Blanco River Ranch subdivision and Cypress Forrest Phase 2 (73 lots) are being proposed. Further south, in the Stagecoach Forest subdivision, 270 lots are planned at the southeast corner of S. Old Stagecoach Road and W. Center Street. Multifamily projects include the Fairways Landing (216 units) along Kohler's Crossing and the Oaks on Marketplace (255 units). On the east side of IH-35, there was ongoing construction in the Lakeside Crossing subdivision, Phase 1 of the Crosswinds subdivision is under construction with 233 lots, along with homes in the Bunton Creek Reserve (125 lots), Brookside, and Cool Springs (373 lots) subdivisions.

Table 6.23 Proposed or Active Subdivisions in the City of Kyle

Project	Total Number of Units	Status	Estimated Start
Anthem	2,200	In Design	2017
Ariza Apartments	349	In Review	2017
Blanco River Ranch	3,500	In Design	2017
BRI/McCoy	8,000	Concept	2020
Brooks R-3-3	300	Concept	2018
Brookside Phases 3&4	150	Under Construction	2017
Bunton Creek Reserve	355	In Review	2017
Cool Springs	372	Approved	2017
Creekside Village	280	Under Construction	2016
Crosswinds MUD	1,750	Under Construction	2017
Cypress Forest	337	Under Construction	2016
Hays Junction Apartments	207	Under Construction	2016
Intermandeco/Driskell	600	Concept	2018
Kyle Estates East (Walton)	2,500	Concept	2018
Kyle Estates West (Walton)	2,600	Concept	2018
La Salle MUD	10,000	Concept	2018
Lehman Tract	150	Concept	2020
Nance	9,000	Concept	2022
Oaks on Marketplace	254	Under Construction	2016
Pecan Woods	2,600	In Design	2018
Plum Creek Phase 2	1,404	In Review	2017
Plum Creek Vue Apartments	180	In Review	2017
Stagecoach Forest	270	In Review	2017
Sunset Hills	210	In Review	2017
Twin Creeks	400	Concept	2018
Woodlands Phases 3 & 4	300	Under Construction	2017

Source: [1] City of Kyle, 2017.

Commercial development is scattered throughout the city, as stand-alone buildings or small strip retail centers. The construction of larger retail buildings has occurred primarily in the Village at Kyle and Kyle Marketplace shopping centers.

7.0 MODEL VALIDATION AND REFINEMENT

Stantec updated the existing travel demand model to reflect growth in the Austin region and the expansion of the toll road system. The updated model incorporates additional data on toll road performance including the impacts of toll increases since 2013 and the early stages of the MoPac N Express Lanes. The objective of the model update is to provide a more robust tool for modeling the CTTS toll roads as well as other local toll roads that influence traffic on the CTTS.

The modeled area includes an expanded area south of Austin that encompasses San Antonio and the rest of the region covered by AAMPO's regional transportation model. The larger model area is intended to capture anticipated growth in the IH-35 corridor southward towards San Antonio and ensures zones and facilities that could influence traffic volumes on the various CTTS roadways, primarily SH 130 and SH 45 SE, are incorporated into the modeling process. Additionally, the recently expanded travel demand model for CAMPO now includes Burnet County, in addition to Bastrop, Caldwell, Hays, Travis, and Williamson counties.

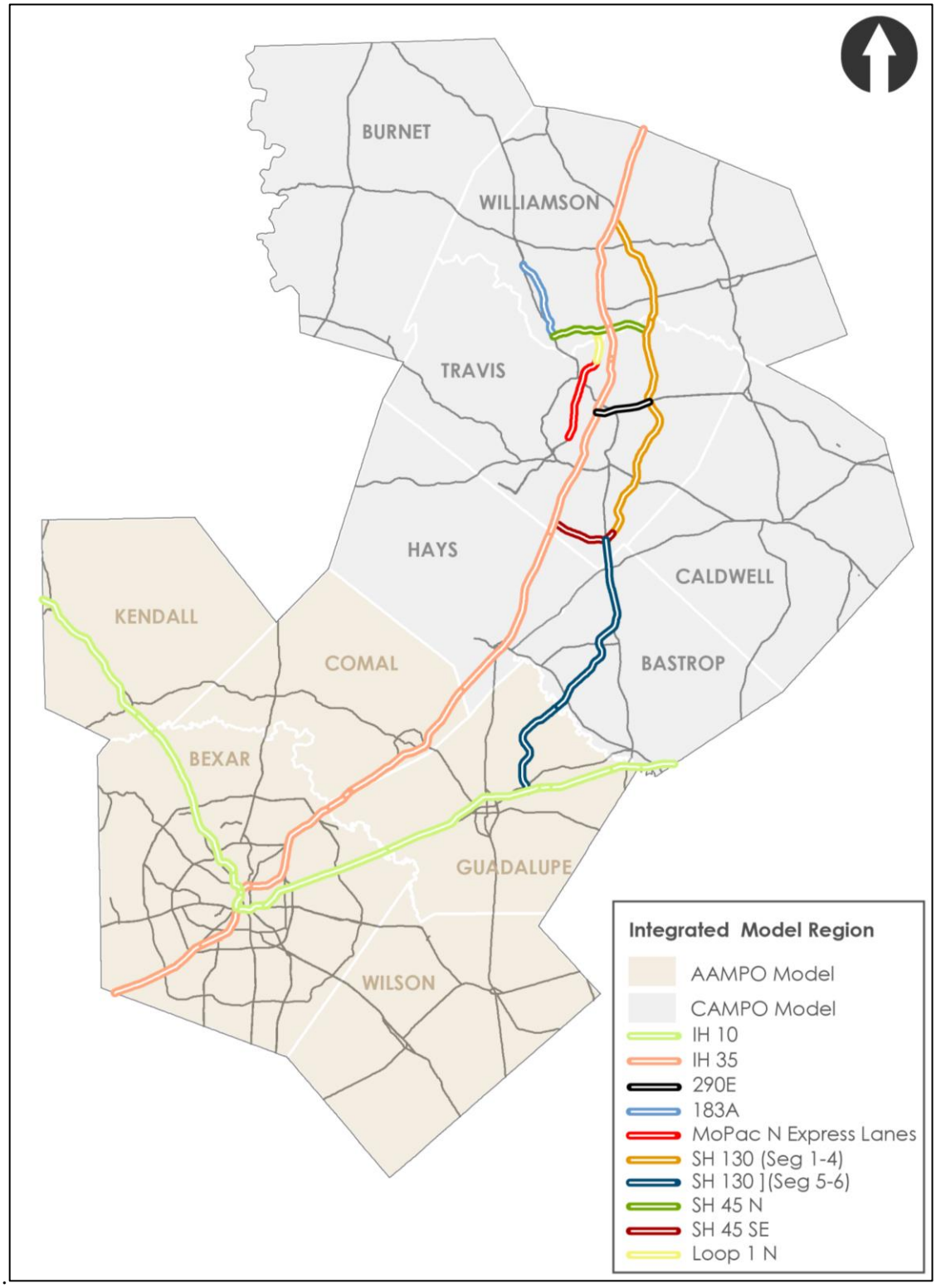
Stantec also updated the toll diversion modeling techniques to provide greater flexibility in representing the variations in toll policy utilized by TxDOT and CTRMA, including several managed lane facilities recently completed or in the planning process. This includes the separate modeling of 2-axle 6-tire trucks in the diversion model, to allow these vehicles (medium trucks) to potential use managed lane facilities that would prohibit larger trucks. The modeling process was further refined to provide variation in the methods of payments by subregion based on assumptions of transponder ownership by household income.

These enhancements improve the modeling process by better forecasting the growing region surrounding Austin, and by allowing the process to be more responsive to a wide range of potential changes in toll policies, as well as specific conditions that will influence traffic diversion for the next generation of toll facilities.

7.1 TRAVEL DEMAND MODEL DEVELOPMENT

The model development effort was designed specifically to take advantage of the latest versions of the CAMPO and AAMPO regional models that encompass the expanded study area and to refine the toll diversion process originally developed for the 2002 Report. The expanded study area encompassing both the CAMPO and AAMPO regional models is shown in Figure 7.1. The recently expanded CAMPO model now includes a sixth county (Burnet), which extends the model area further north and west of Austin. The AAMPO regional transportation model was recently updated and calibrated to the year 2010. The common boundary of these regional models is along the Hays-Comal and Caldwell-Guadalupe County lines.

Figure 7.1 Austin – San-Antonio Integrated Model Region



In order to integrate the individual regional models into a single unified modeling process, it was necessary to merge the network and vehicle trip tables. The regional models are utilized to estimate total vehicle trips in the study area. Each of the regional models is executed from trip generation through trip distribution and mode choice using the revised socioeconomic data described in Chapter 6 to create vehicle trips by trip purpose and vehicle type (SOV, HOV, and Truck). The networks from each regional model were compared and a decision was made to adopt the network facility type–area type definitions as well the speeds and capacities from the CAMPO model. Similarly, the resulting vehicle trip tables from the execution of both regional models were integrated using the trip purpose designations from the CAMPO model. The use of the CAMPO model network parameters and trip purposes for the final integrated model reflect the fact that CTTS and CTRMA toll facilities are entirely within the Austin modeled region, and the Austin model represents a more advanced modeling process.

As part of the model development, it was recognized that several specific issues would influence the approach to model calibration. In contrast to the model development for the original 2002 Report, the current model calibration would need to replicate volumes across the entire study area and traffic on the recently completed toll facilities. The latest available socioeconomic data available for both regions (2016) was set as the calibration year. As a result, the study utilized a network updated to 2016 conditions, consistent with the speed and travel time data collected for the prior 2014 Study.

The new model utilizes the existing toll diversion process as the basis for estimating tolled traffic. For the 2016 model calibration year, the temporary discounts for trucks using SH 130 and SH 45 SE were included since the discounts were applicable for eight months of that year.

Toll diversion equations were established for each of six trip purposes, including:

- Home Based Work (HBW);
- Home Based Shopping (HBS);
- Home Based School (HBSch);
- Home Based Other (HBO);
- Work Based Other (WBO); and
- Other Based Other (OBO).

The current toll diversion process utilizes the existing toll diversion equations as the basis for the forecasts. The formula is a basic binary logit equation and is defined as follows:

$$\text{Toll Share} = 1 / (1 + e^{U})$$

where:

Toll Share	= Probability of selecting a toll road
e	= Base of natural logarithm (ln)
U (work)	= a * ($Time_{TR}$-$Time_{FR}$) + b *(Cost)/ln(Inc) + C_{TR} + C_{ETC}
U (nonwork)	= a * ($Time_{TR}$-$Time_{FR}$) + b *(Cost) + C_{TR} + C_{ETC}
$Time_{TR}$	= Toll road travel time in minutes
$Time_{FR}$	= Non-toll road travel time in minutes
Cost	= Toll in dollars
Inc	= Annual income / 1000
C_{TR}	= Constant for toll road bias
C_{ETC}	= Constant for ETC bias
a,b	= Coefficients

Several adjustments to the existing procedures were implemented as part of the development process. As an initial step, the value of time for each purpose was adjusted to reflect the increase in household incomes in the Austin region between 1997, the calibration year of the original 2002 Report, and the current calibration year 2016. The values of time were increased and the resulting weighted average of all trip purposes for autos ($19.16 per hour) is 57.4 percent of Austin's 2016 median household income of $69,465 per year, nearly identical to the percentage for 1997. Table 7.1 lists the coefficients for each trip purpose as well as the bias terms and equivalent minute values for the toll bias term and ETC bias term applicable to all payment methods. The toll bias term discourages toll choice, but the ETC bias term encourages toll choice due to the ease of payment and the open road tolling aspects of transponder usage.

Table 7.1 Toll Diversion Model Coefficients

Trip Purpose	Time (Min) (Alpha)	Cost ($) (Beta)[1]	VOT ($/hr)	Bias Terms			
				Values		Equivalent Minutes	
				Toll	ETC	Toll	ETC
HBW	0.1053	1.1790	$ 22.73	0.0000	-0.4440	0.0	-4.2
HBS	0.0754	0.3307	$ 13.68	0.0936	-0.3635	1.2	-4.8
HBSCH	0.0777	0.3705	$ 12.58	0.0816	-0.3339	1.1	-4.3
HBO	0.0441	0.1366	$ 19.38	0.0858	-0.2475	1.9	-5.6
NHBW	0.1396	1.6264	$ 21.84	0.0000	-0.5100	0.0	-3.7
NHBO	0.0872	0.2655	$ 19.70	0.1334	-0.4470	1.5	-5.1
Medium TRK	0.0724	0.1808	$ 24.03	0.1007	-0.3760	1.4	-5.2
Heavy TRK	0.0575	0.0592	$ 58.27	0.3375	0.0000	5.9	0.0

Notes: (1) HBW and WBO purposes use toll costs divided by LN (Income/1000).
(2) All cost coefficients were scaled from 1997 values in the original 2002 Report to the year 2016.
(3) All time coefficients were retained as in the original 2002 Report, except for trucks.

For the 2016 calibration year, the model assumed two payment methods, ETC and PBM, the two payment options currently available. For the PBM market segment, the relevant surcharge was applied to the base toll at each pay point, and the positive bias term associated with transponder payments was also applied since these trips have the convenience of not needing to stop to pay tolls as they would if paying by cash.

The diversion model was modified to permit toll choice to occur where time savings were minimal or negative based on the observed ETC transaction data that were collected in 2016. Under the revised model, toll choice is permitted for paths where the toll path is up to two minutes longer than the non-toll path. The diversion model transitions the estimated choice shares towards zero as the time savings approaches the minimum permitted value to ensure that the toll traffic and revenue stream has a lower contribution from trips with minimal or negative time savings.

Lastly, since the individual toll facilities have now been in operation for more than five years, a general bias against toll roads by those trips that have the highest frequency or are work related are not incorporated into the choice evaluation. These travelers, due to their frequency of travel, are now assumed to elect to use or avoid the toll road based strictly on the time savings and associated costs.

The toll shares for each auto purpose as a function of time savings for a $2.00 toll are shown in Figure 7.2 through Figure 7.7. Figure 7.8 shows the toll shares for medium trucks as a function of time savings for a $2.00 toll. In each graph, two lines are shown depicting the shares for trips paying with ETC and with PBM. Since the PBM option includes a 33 percent toll surcharge, the share of toll traffic is lower than the ETC payment option. The predicted toll shares shown in these figures are also reduced further if the time difference between the tolled and non-tolled paths approaches the minimum time savings value.

Figure 7.9 shows the toll shares for heavy trucks as a function of time savings for a $6.00 toll, reflecting the higher cost of multi-axle trucks. The truck purpose has similar toll shares by time saving interval as this purpose has a higher value of time which partially offsets the higher toll rates.

Figure 7.2 Toll Diversion for Home Based Work (Auto) Trips - $2.00 Toll

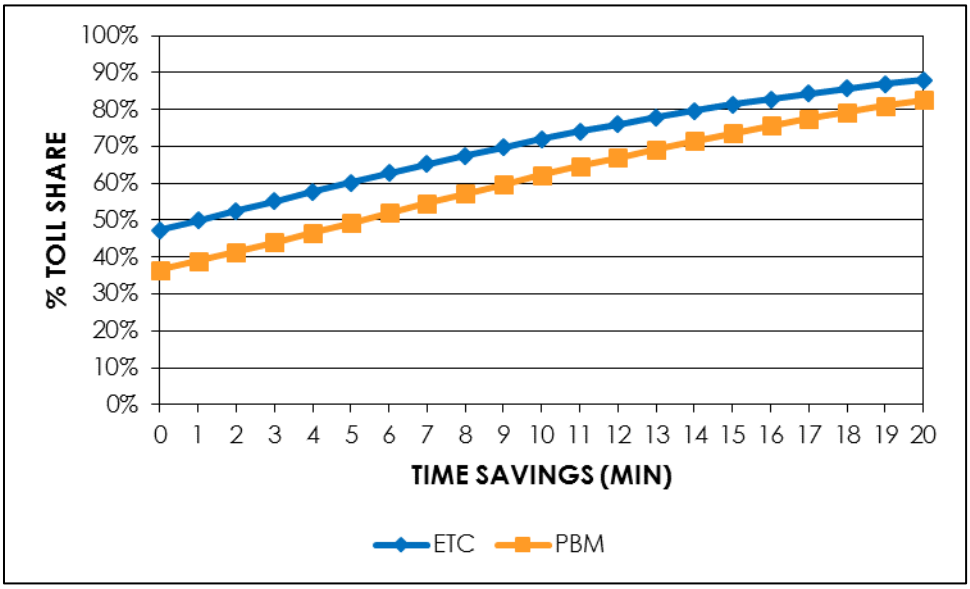


Figure 7.3 Toll Diversion for Home Based Shopping (Auto) Trips - $2.00 Toll

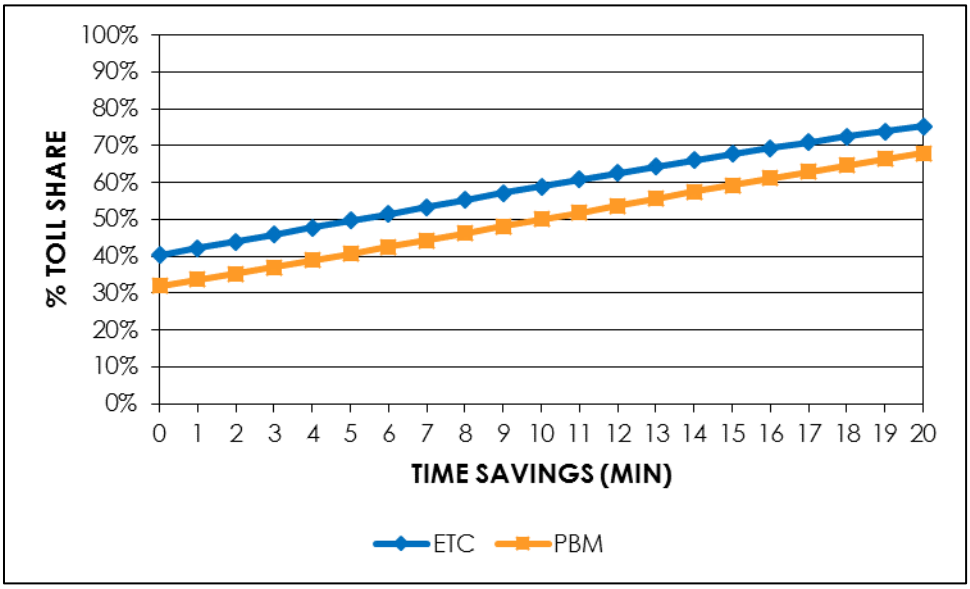


Figure 7.4 Toll Diversion for Home Based School (Auto) Trips - $2.00 Toll

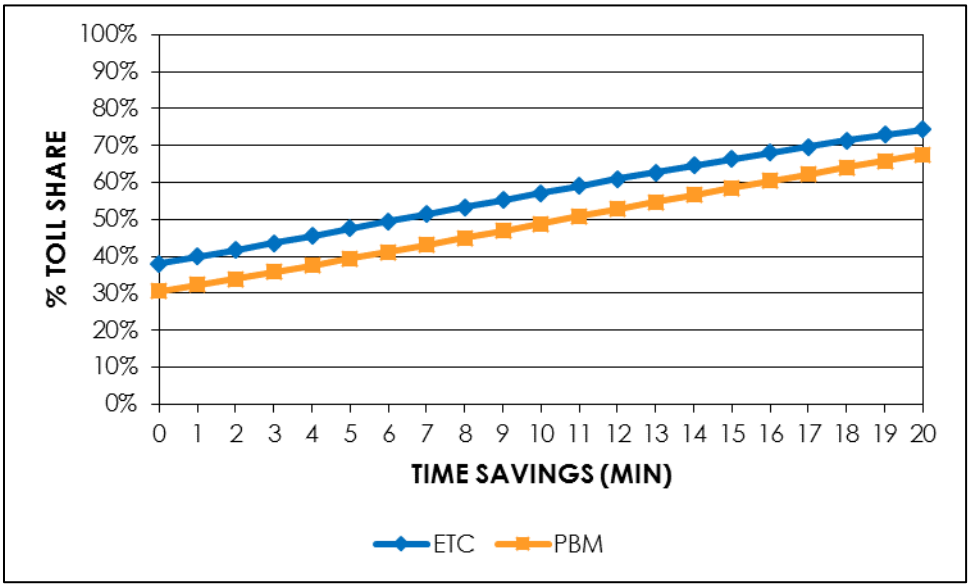


Figure 7.5 Toll Diversion for Home Based Other (Auto) Trips - $2.00 Toll

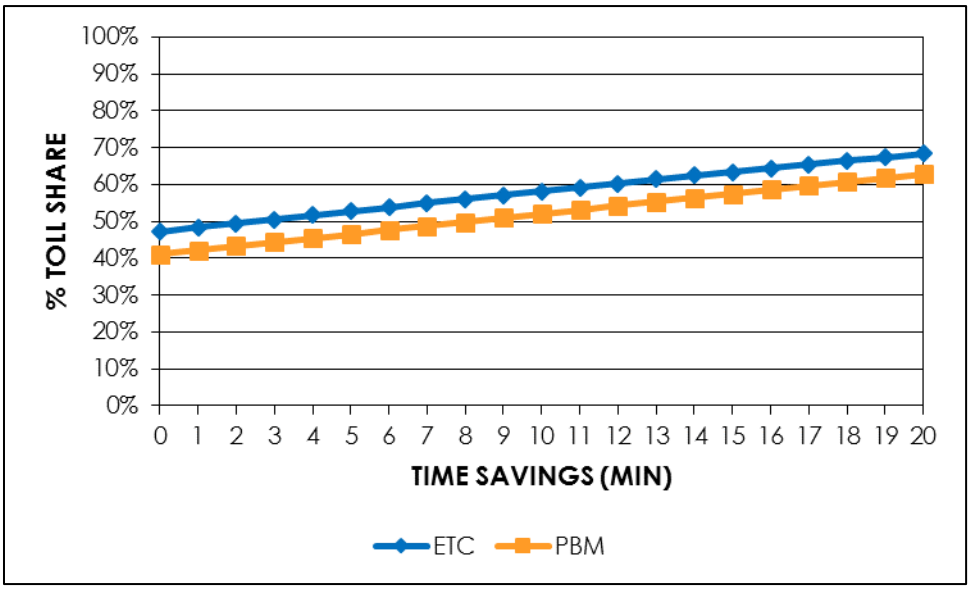


Figure 7.6 Toll Diversion for Work Based Other (Auto) Trips - $2.00 Toll

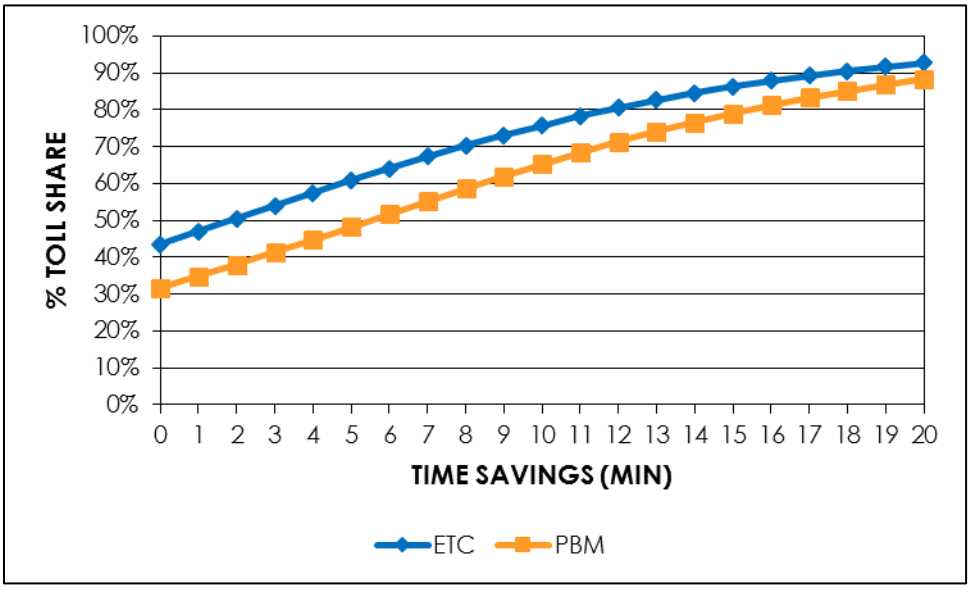


Figure 7.7 Toll Diversion for Other Based Other (Auto) Trips - $2.00 Toll

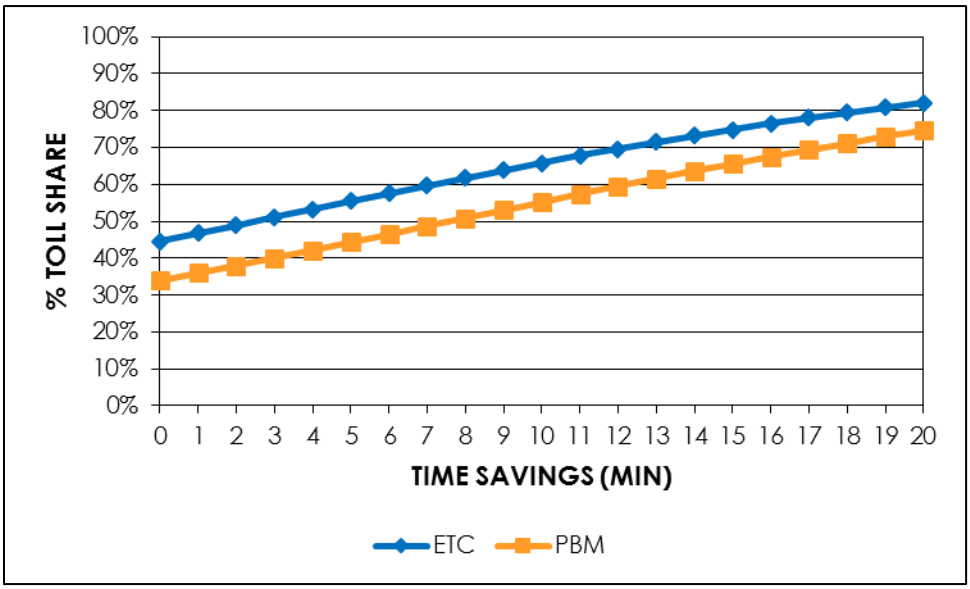


Figure 7.8 Toll Diversion for Medium Trucks - $2.00 Toll

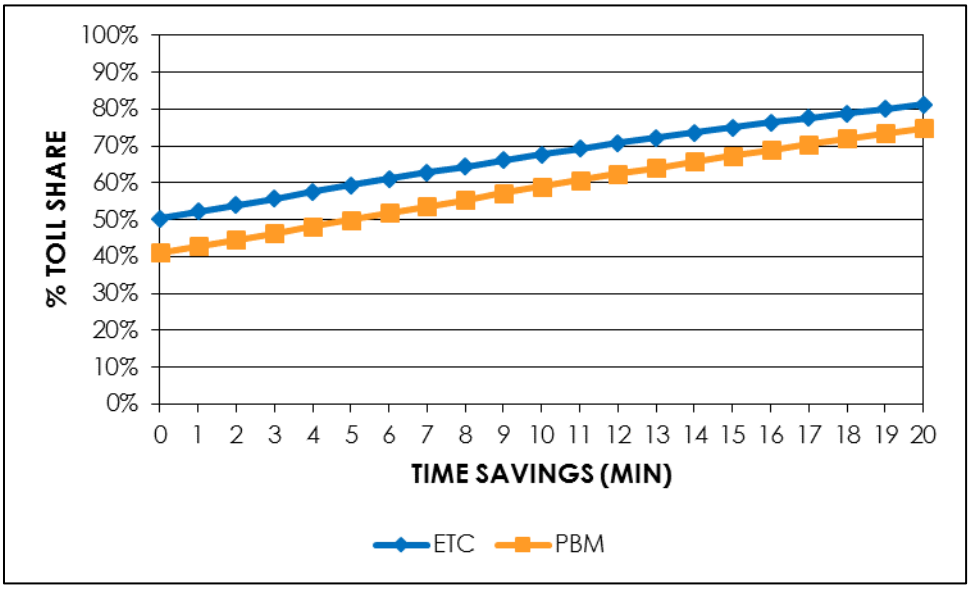
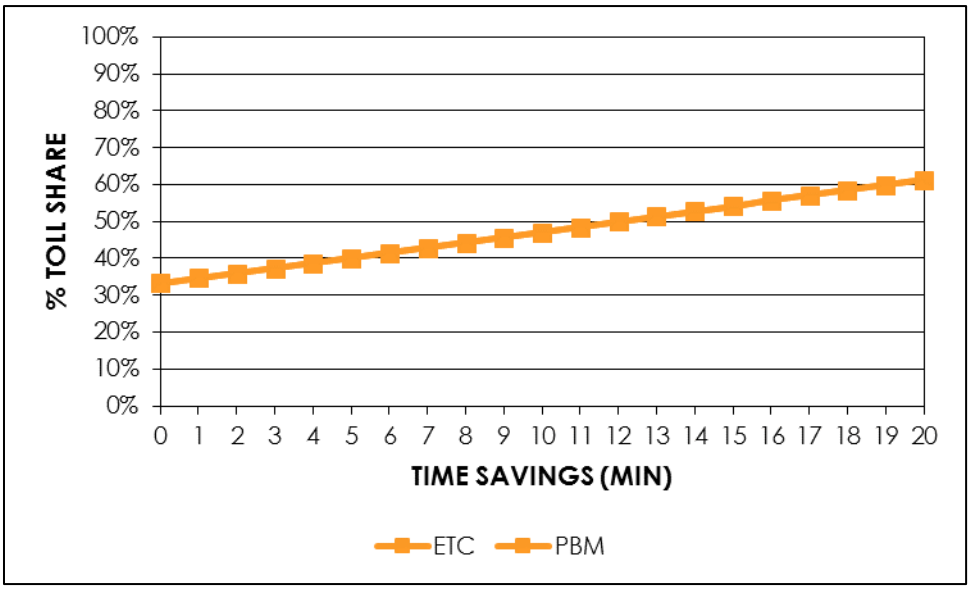


Figure 7.9 Toll Diversion for Heavy Trucks - $6.00 Toll



Notes: (1) The ETC bias for truck is assumed to be 0. Therefore, PBM and ETC toll shares are identical by time savings.

7.1.1 Highway Assignment Process Modifications

In preparation for the modeling of projects with variable tolling policies, the highway assignment process was modified to provide a fourth time-of-day period. This new period was created by partitioning the 'off-peak' period into separate midday and nighttime periods. Consistent with the existing highway assignment process, trips are assigned to the network for four specific time-of-day conditions. The hours within each of these four periods are as follows:

- AM Peak (4-hours)– 6:00 AM to 10:00 AM;
- Midday (5 hours) - 10:00 AM to 3:00 PM;
- PM Peak (4-hours)– 3:00 PM to 7:00 PM; and
- Nighttime (11 hours) – 7:00 PM to 6:00 AM.

The CAMPO model's current volume delay functions (VDFs) were adopted for the assignment process and were augmented with a routine to estimate queuing at roadway intersections and merge points on limited access roadways. The queuing formula estimates the additional time encountered when traffic volumes exceed the physical capacity of a roadway segment. This modification is only enabled on a roadway segment if a traffic control device (signals, stop signs, or yield signs) is present and the roadway segment's volume/capacity ratio exceeds a value of 1.0. As part of the model calibration, the 'free flow' speeds, link capacities, and queuing routines were refined as necessary to ensure that the model adequately replicated both peak and off-peak speeds for the primary roadway facilities in each toll road corridor.

7.2 MODEL CALIBRATION

The objective of the model calibration was to ensure that the modeling process adequately replicates both the observed traffic volumes and the observed speeds by time-of-day for each of the CTTS corridors. The calibration was also structured to replicate the observed traffic and transactions by payment method to the extent feasible for each toll road by pay point. It should be noted that the calibration was performed solely on the integrated model highway assignment process and toll diversion routines and no adjustments were made to the individual regional models.

7.2.1 Speed Calibration

The first step of calibration was to adjust assumed free flow speeds to replicate off-peak speeds, which generally reflect uncongested conditions. Peak speeds were then adjusted in an iterative process, which included refinements to the capacity and the queuing formula to ensure estimated speeds replicate observed values and that the overall traffic assigned to the roadways replicate observed volumes on a daily basis. This approach for calibration of peak speeds was adopted since period-specific traffic counts were available only at a limited number of locations throughout the region. Volumes and vehicle-miles traveled (VMT) were also summarized on a regional basis to evaluate the assignment process on an aggregate level.

As part of the speed calibration effort, Stantec utilized multiple passively observed speed data from both SigAlert and HERE for corridors across the study region. Speed data were collected for both directions during the four time-of-day periods. The observed data obtained as part of the data collection effort for the prior 2014 Study were also utilized as another reference point for this analysis. Table 7.2 shows the results of the speed calibration in terms of observed and estimated travel time and speed by corridor and by time-of-day. These corridors were depicted earlier in Chapter 3. Most of the roadways shown are located primarily in the Austin region within the corridors of the individual roadways. Two roadway segments, as noted in the table, are south of Austin and include facilities that generally parallel the alignment of SH 130 Segments 5 & 6 (which are not part of the CTTS). The results indicate that the estimated speeds are within reasonable tolerance of both HERE and SigAlert data, with a level of consistency that is acceptable for the purposes of model calibration.

Table 7.2 Speed Calibration Summary

Route	Section Limits		Direction	Distance (mi)	AM (6AM-10AM)				Midday (10AM-3PM)				PM (3PM-7PM)				Nighttime (7PM-6AM)			
					Observed			Estimated	Observed			Estimated	Observed			Estimated	Observed			Estimated
					2014 CTTS	HERE	SigAlert		2014 CTTS	HERE	SigAlert		2014 CTTS	HERE	SigAlert		2014 CTTS	HERE	SigAlert	
IH 35	SH 130	MLK Blvd.	NB	29	66	63	73	58	65	62	73	54	53	46	63	44	65	63	73	62
			SB	29	50	46	62	45	60	58	70	56	54	45	69	55	60	58	73	56
	MLK Blvd.	SH 80	NB	29	53	44	61	54	64	53	65	59	59	43	59	60	64	62	71	64
			SB	30	69	64	73	61	65	59	70	59	47	40	60	49	65	59	71	60
	SH 80[1]	Loop 1604[1]	NB	9	70	67	75	64	71	66	75	63	67	65	73	63	71	65	75	65
			SB	9	64	67	75	65	70	66	75	64	64	65	75	63	70	66	75	65
Loop 1	SH 45 N	US 290 W	NB	19	53	50	60	53	66	56	63	59	43	36	52	49	66	54	64	63
			SB	20	52	47	56	53	68	59	64	61	43	37	53	52	68	59	65	61
SH 130	IH 35	US 183	NB	47	73	69	78	71	71	69	78	74	72	68	77	68	71	66	78	75
			SB	47	72	69	77	69	71	69	77	74	72	68	76	70	71	69	77	74
SH 45 N	US 183	SH 130	EB	13	66	70	75	67	71	69	75	68	68	70	75	63	71	66	75	68
			WB	13	68	69	77	63	74	70	78	68	66	71	77	66	74	70	78	68
US 183	SH 45 N	Manor Rd.	NB	14	67	57	64	55	67	60	65	55	47	40	56	45	67	60	65	61
			SB	14	56	48	59	44	66	60	66	57	68	57	64	57	66	60	66	57
	Manor Rd.	SH 130	NB	17	31	36	52	36	45	41	56	43	36	34	50	38	45	46	61	48
			SB	17	42	39	52	40	47	42	55	42	32	31	46	34	47	42	57	42
	SH 130[1]	IH 10[1]	NB	3	53	43	60	48	54	40	60	52	55	40	60	53	54	37	60	52
			SB	3	52	52	60	53	54	52	60	52	52	53	59	48	54	52	60	52
SH 360	US 183	Loop 1	NB	13	36	37	50	39	46	36	50	46	24	26	41	39	46	43	55	50
			SB	13	30	35	48	44	45	39	52	47	34	29	43	38	45	39	56	47
US 79	IH 35	SH 130	EB	7	40	35	51	45	40	36	52	45	37	32	49	42	40	39	53	46
			WB	7	31	34	49	43	35	33	48	45	33	31	45	45	35	33	51	46
FM 973	Pearce Ln.	FM 969	NB	6	36	27	--	34	39	27	--	46	38	28	--	35	39	30	--	51
			SB	6	36	23	--	39	42	27	--	44	39	29	--	31	42	27	--	44
RM 620	US 183	IH 35	EB	6	33	32	51	37	36	32	53	38	30	29	45	35	36	33	55	40
			WB	6	30	34	49	36	39	33	49	38	30	31	47	35	39	33	53	38
Parmer Ln.	FM 1431	Loop 1	NB	10	38	32	--	44	47	34	--	43	37	31	--	33	47	36	--	45
			SB	10	34	33	--	34	38	35	--	43	35	30	--	43	38	35	--	44
Loop 1 Frontage	SH 45 EB Frontage	US 183	NB	5	28	27	--	35	27	29	--	35	25	27	--	33	27	30	--	35
			SB	5	27	27	--	37	30	29	--	40	32	27	--	39	30	29	--	40
SH 45 SE	IH 35	US 183	EB	7	77	70	77	77	76	68	77	77	78	69	77	77	76	66	77	77
			WB	7	78	69	78	77	78	69	78	77	78	70	78	77	78	69	78	77

Notes: [1] Segments noted are south of Austin and include facilities that are generally parallel to the alignment of SH 130 Segments 5 & 6 (which are not part of the CTTS).

7.2.2 Aggregate Calibration by Facility Type and Area Type

After the regional calibration analysis of speeds was completed, the calibration of traffic within each corridor was performed. This process included the replication of traffic by screenline total and individual roadways as well as by vehicle type. This analysis included the use of our in-house trip table adjustment routine to ensure that the aggregate travel across each screenline replicated the observed traffic by vehicle type.

The aggregate calibration by facility type and area type was performed for both traffic volumes as well as VMT. This calibration utilized more than 4,578 link counts that were collected from several different sources. These data include the TxDOT 2016 AADT Traffic Maps and a limited set of classification counts provided by TxDOT, as well as other existing counts obtained from prior studies conducted by Stantec in the Austin region. Classification counts along the screenlines were also obtained by Stantec's subconsultant (AGS) to provide current estimates for all roadways intersected by the screenlines. Stantec also obtained the 2016 transactions by pay point for all toll facilities in the region, including all CTRMA facilities in operation in 2016. In situations where multiple counts were available for an individual roadway segment, the most reliable count data was determined using the following hierarchy: TxDOT transaction data first, then classification counts collected for this project, and then lastly either counts from previous reports or TxDOT counts.

The VMT and volume comparison summaries are listed in Table 7.3 and Table 7.4. Table 7.3 lists the aggregate comparison of volume and VMT by facility type for the entire region. The replication of both volume and VMT is acceptable. For the limited-access facility type which includes toll roads, the estimated volume ratios are almost identical, and VMT ratios are slightly higher than observed at 1.02.

Table 7.3 Volume and VMT Comparison by Facility Type

Facility Type	Number of Counts	Volume			VMT		
		Observed	Estimated	EST/OBS	Observed	Estimated	EST/OBS
Limited-Access Facility	616	34,675,169	34,757,311	1.00	15,145,009	15,521,101	1.02
Expressway	14	444,784	453,980	1.02	146,788	151,593	1.03
Principal Arterial Divided	456	6,972,715	7,446,570	1.07	2,887,379	3,158,313	1.09
Principal Arterial with Central Left Turn	426	5,727,054	4,804,553	0.84	2,172,377	1,835,688	0.85
Principal Arterial Undivided	673	3,706,851	4,060,447	1.10	2,367,727	2,843,948	1.20
Minor Arterial Divided	29	297,716	297,531	1.00	225,535	224,190	0.99
Minor Arterial Central Left Turn	58	388,576	316,980	0.82	213,947	172,261	0.81
Minor Arterial Undivided	926	2,316,857	2,074,133	0.90	2,162,711	2,004,104	0.93
Frontage Road	538	24,396,238	24,133,878	0.99	6,890,389	7,170,065	1.04
Collector/Local	441	668,655	661,896	0.99	1,058,335	1,193,292	1.13
Ramp	401	3,225,873	3,315,747	1.03	833,841	846,721	1.02
TOTAL	**4,578**	**82,820,488**	**82,323,024**	**0.99**	**34,104,038**	**35,121,274**	**1.03**

Table 7.4 provides a similar summary by area type. Except for the outlying rural areas, all of the area type classifications are within 5 percent of the observed values.

Table 7.4 Volume and VMT Comparison by Area Type

Facility Type	Number of Counts	Volume			VMT		
		Observed	Estimated	EST/OBS	Observed	Estimated	EST/OBS
CBD	21	1,408,951	1,448,833	1.03	261,377	270,328	1.03
CBD Fringe	608	29,015,357	27,803,346	0.96	7,899,008	7,608,129	0.96
Urban	898	24,963,151	24,224,846	0.97	7,806,370	7,541,170	0.97
Suburban	1456	20,146,491	20,309,044	1.01	10,323,651	10,234,609	0.99
Rural	1595	7,286,538	8,536,955	1.17	7,813,633	9,467,038	1.21
TOTAL	**4,578**	**82,820,488**	**82,323,024**	**0.99**	**34,104,038**	**35,121,274**	**1.03**

While not listed separately in the tables, volumes and VMT for truck traffic by facility type and area type were performed and the level of variation was similar to the aggregate values listed in these tables. The regional ratio of estimated to observed VMT is 1.03 and the ratio of estimated to observed traffic volume is 0.99.

7.2.3 Screenline Calibration

The final element of the calibration was to adjust the toll diversion model equations to replicate the observed traffic by vehicle type and payment method across each of the toll corridors. This analysis resulted in adjustments to the assumed market segments by payment type in each subarea as well as minor adjustments to the toll and ETC bias constants.

The screenline calibration was performed to ensure that the aggregate demand within each toll road corridor replicates the observed traffic. As part of this calibration, an in-house routine was applied to minimize any variation between estimated and observed demand across each of the screenlines. The adjustment provides a matrix of 'base year' trip changes (either increases or reductions) that is then retained for application in each of the horizon years. Since these trips are stored as a matrix, these additional trips are not tied to specific roadways and can be diverted to different routes in exactly the same manner as the trips estimated directly by the model. As a result of the screenline calibration, for origin-destination zonal pairs where trip changes were provided by the adjustment routine, the net change in trips was an increase of 1.2 percent with an increase of auto trips being offset by reductions in truck trips. Since the magnitude of the additional trips is held constant for all future years, their contribution to the overall assignment results are further minimized in each successive horizon year as the underlying model trip tables continue to increase due to growth in the region's population and employment.

A series of screenlines were developed within each of the toll road corridors to intersect each of the mainline toll plazas and parallel locations on the adjacent non-tolled roads. Four screenlines were created for SH 130, two for SH 45 N, one for Loop 1, and one for SH 45 SE. These eight screenlines are a subset of all the screenlines analyzed in the region-wide calibration and are consistent with the CTTS screenlines displayed earlier in Chapter 3. Two additional screenlines were also created to quantify demand for the 183A toll facility for calibration purposes and several small cut lines were added for the recently completed 290E toll road. Figure 7.10 shows the screenline locations within each toll road corridor. The following tables list the screenline calibration results for total traffic and by mode. Table 7.5 summarizes the screenlines intercepting SH 130, including the two southernmost segments (Segments 5 & 6) which are not part of the CTTS system. Table 7.6 summarizes the remaining CTTS elements. Table 7.7 includes all CTRMA toll roads that were in operation in 2016, including the 183A and 290E toll roads.

Figure 7.10 Calibration Screenline Locations

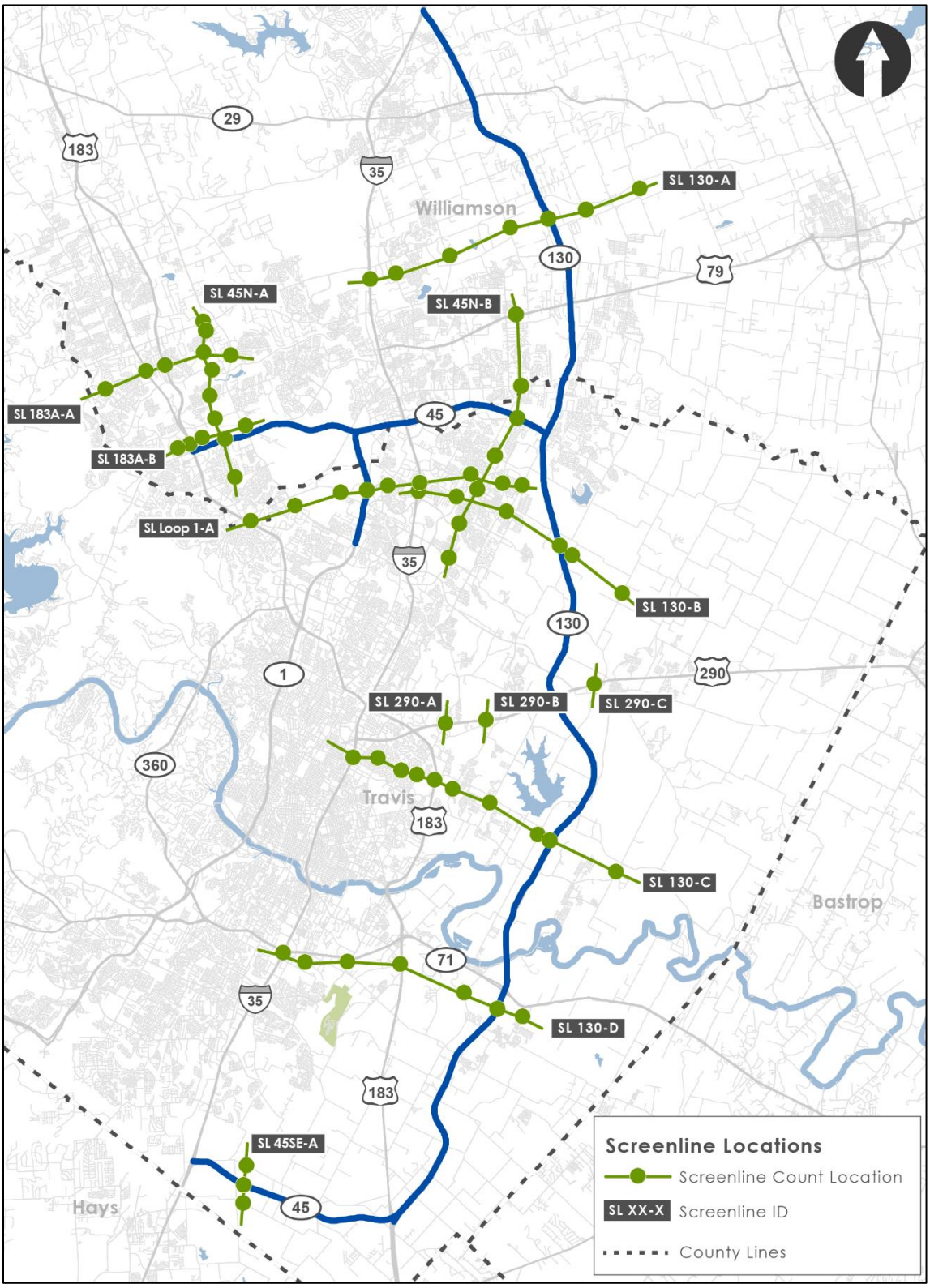


Table 7.5 Screenline Comparison – SH 130

Route		Auto		Truck		% Truck		Total		% of Total	
		Observed	Estimated	Observed	Estimated	Observed	Estimated	Observed	Estimated	Observed	Estimated
SH 130											
Screenline 130-A	IH 35	138,501	145,226	19,385	19,676	12.3%	11.9%	157,886	164,902	69.2%	69.6%
	CR 115	16,609	16,626	1,077	1,098	6.1%	6.2%	17,686	17,724	7.8%	7.5%
	FM 1460	14,817	14,676	852	975	5.4%	6.2%	15,669	15,651	6.9%	6.6%
	CR 110	4,634	5,397	390	1,114	7.8%	17.1%	5,024	6,511	2.2%	2.7%
	SH 130	**24,422**	**24,523**	**4,411**	**4,431**	**15.3%**	**15.3%**	**28,833**	**28,954**	**12.6%**	**12.2%**
	CR 100	704	897	44	116	5.8%	11.4%	748	1,013	0.3%	0.4%
	FM 1660	1,887	1,877	418	455	18.1%	19.5%	2,306	2,333	1.0%	1.0%
	Total	201,574	209,223	26,578	27,866	11.6%	11.8%	228,152	237,089	100.0%	100.0%
Screenline 130-B	IH 35	157,400	172,378	18,286	20,332	10.4%	10.6%	175,686	192,710	63.3%	60.3%
	Heatherwilde Blvd	11,150	17,518	324	906	2.8%	4.9%	11,475	18,424	4.1%	5.8%
	Dessau / FM 685	22,074	29,798	2,042	4,214	8.5%	12.4%	24,116	34,011	8.7%	10.6%
	Immanuel	6,029	5,933	601	708	9.1%	10.7%	6,630	6,641	2.4%	2.1%
	SH 130	**44,912**	**45,900**	**5,752**	**5,633**	**11.4%**	**10.9%**	**50,664**	**51,533**	**18.3%**	**16.1%**
	Cameron Rd	4,014	4,888	178	4,169	4.2%	46.0%	4,192	9,057	1.5%	2.8%
	Fuchs Grove	3,776	3,603	791	3,852	17.3%	51.7%	4,567	7,455	1.6%	2.3%
	Total	249,356	280,018	27,974	39,814	10.1%	12.4%	277,330	319,831	100.0%	100.0%
Screenline 130-C	IH 35	222,372	227,691	19,413	20,650	8.0%	8.3%	241,785	248,340	54.1%	53.2%
	Cameron Rd.	14,636	16,571	1,407	1,592	8.8%	8.8%	16,044	18,163	3.6%	3.9%
	Berkman Dr.	13,407	12,005	1,168	1,097	8.0%	8.4%	14,576	13,102	3.3%	2.8%
	Manor Rd.	9,471	11,861	710	918	7.0%	7.2%	10,181	12,779	2.3%	2.7%
	Springdale Rd.	9,847	9,349	688	702	6.5%	7.0%	10,535	10,051	2.4%	2.2%
	US 183	67,230	68,888	3,816	3,936	5.4%	5.4%	71,046	72,824	15.9%	15.6%
	Johnny Morris Rd.	5,060	5,222	326	397	6.1%	7.1%	5,386	5,619	1.2%	1.2%
	FM 3177	14,190	15,769	980	2,494	6.5%	13.7%	15,170	18,263	3.4%	3.9%
	FM 973	8,006	10,438	1,010	2,238	11.2%	17.7%	9,016	12,676	2.0%	2.7%
	SH 130	**40,767**	**41,636**	**5,687**	**5,880**	**12.2%**	**12.4%**	**46,454**	**47,516**	**10.4%**	**10.2%**
	FM 969	5,559	6,524	813	924	12.8%	12.4%	6,372	7,448	1.4%	1.6%
	Total	410,546	425,952	36,019	40,828	8.1%	8.7%	446,565	466,780	100.0%	100.0%
Screenline 130-D	IH 35	177,527	179,116	21,342	22,013	10.7%	10.9%	198,869	201,129	61.7%	60.2%
	Todd Ln.	12,524	12,754	1,750	1,749	12.3%	12.1%	14,274	14,503	4.4%	4.3%
	Stassney Ln.	23,102	22,909	2,175	2,831	8.6%	11.0%	25,277	25,740	7.8%	7.7%
	US 183	29,315	31,747	4,236	5,373	12.6%	14.5%	33,551	37,120	10.4%	11.1%
	FM 973	11,715	14,445	1,152	2,279	9.0%	13.6%	12,867	16,723	4.0%	5.0%
	SH 130	**25,890**	**25,067**	**4,864**	**4,981**	**15.8%**	**16.6%**	**30,754**	**30,048**	**9.5%**	**9.0%**
	Ross Rd.	6,177	7,515	569	1,354	8.4%	15.3%	6,747	8,868	2.1%	2.7%
	Total	286,249	293,553	36,089	40,579	11.2%	12.1%	322,338	334,131	100.0%	100.0%
Screenline 130-E	IH 35	125,424	128,921	15,368	14,593	10.9%	10.2%	140,792	143,514	77.5%	76.0%
	Goforth Rd (FM 157)	3,072	3,162	139	208	4.3%	6.2%	3,211	3,370	1.8%	1.8%
	SH 21	8,913	9,008	1,684	1,664	15.9%	15.6%	10,597	10,672	5.8%	5.7%
	FM 2001	1,383	1,389	164	305	10.6%	18.0%	1,547	1,694	0.9%	0.9%
	US 183 - SH130 Frontage	9,341	12,018	1,058	2,404	10.2%	16.7%	10,399	14,422	5.7%	7.6%
	SH 130 Seg 5 ML	**8,859**	**9,734**	**2,356**	**1,574**	**21.0%**	**13.9%**	**11,215**	**11,308**	**6.2%**	**6.0%**
	FM 1854	3,714	3,727	128	132	3.3%	3.4%	3,842	3,859	2.1%	2.0%
	Total	160,705	167,959	20,897	20,880	11.5%	11.1%	181,602	188,839	100.0%	100.0%
Screenline 130-F	IH 35	107,529	100,811	19,881	18,663	15.6%	15.6%	127,410	119,473	83.6%	79.4%
	SH 21	7,938	8,042	1,923	1,984	19.5%	19.8%	9,861	10,026	6.5%	6.7%
	FM 1984	1,419	1,375	64	140	4.3%	9.3%	1,483	1,516	1.0%	1.0%
	SH 1342	5,288	6,705	347	1,872	6.2%	21.8%	5,635	8,577	3.7%	5.7%
	SH 130 Seg 6 ML	**4,778**	**4,850**	**1,907**	**1,989**	**28.5%**	**29.1%**	**6,685**	**6,838**	**4.4%**	**4.5%**
	State Park Rd (FM 20)	1,330	2,862	34	1,157	2.5%	28.8%	1,365	4,018	0.9%	2.7%
	Total	128,282	124,644	24,156	25,804	15.8%	17.2%	152,438	150,448	100.0%	100.0%

Table 7.6 Screenline Comparison – SH 45 N, Loop 1, and SH 45 SE

Route		Auto		Truck		% Truck		Total		% of Total	
		Observed	Estimated	Observed	Estimated	Observed	Estimated	Observed	Estimated	Observed	Estimated
SH 45 N											
Screenline 45N-A	FM 1431	34,376	33,847	3,758	3,746	9.9%	10.0%	38,133	37,593	18.1%	15.7%
	Colonial Parkway	6,522	6,414	119	202	1.8%	3.1%	6,641	6,616	3.2%	2.8%
	Brushy Creek Rd.	12,829	20,426	440	1,826	3.3%	8.2%	13,269	22,252	6.3%	9.3%
	Avery Ranch Blvd.	15,127	21,184	1,104	1,853	6.8%	8.0%	16,232	23,036	7.7%	9.6%
	Lakeline Blvd.	9,242	10,911	640	1,554	6.5%	12.5%	9,882	12,465	4.7%	5.2%
	SH 45 NW ML	**49,571**	**54,554**	**1,740**	**1,783**	**3.4%**	**3.2%**	**51,311**	**56,337**	**24.4%**	**23.6%**
	SH 45 NW Frontage	29,025	28,790	1,178	1,290	3.9%	4.3%	30,203	30,080	14.4%	12.6%
	Anderson Mill Rd.	16,422	19,006	626	1,108	3.7%	5.5%	17,048	20,114	8.1%	8.4%
	McNeil Dr.	25,842	28,320	1,776	2,029	6.4%	6.7%	27,618	30,349	13.1%	12.7%
	Total	198,956	223,451	11,382	15,389	5.4%	6.4%	210,338	238,840	100.0%	100.0%
Screenline 45N-B	US 79	29,800	30,523	2,041	2,137	6.4%	6.5%	31,841	32,660	17.1%	17.4%
	CR 168/Gattis School Rd.	17,404	16,684	826	863	4.5%	4.9%	18,231	17,547	9.8%	9.4%
	SH 45 NE ML	**40,891**	**41,152**	**2,003**	**1,739**	**4.7%**	**4.1%**	**42,894**	**42,891**	**23.1%**	**22.9%**
	SH 45 NE Frontage	12,401	12,513	643	864	4.9%	6.5%	13,044	13,376	7.0%	7.1%
	Pflugerville Loop Rd.	16,726	18,981	1,063	1,261	6.0%	6.2%	17,789	20,242	9.6%	10.8%
	FM 1825/Pecan St.	15,926	15,859	1,950	1,941	10.9%	10.9%	17,876	17,800	9.6%	9.5%
	Wells Branch Pkwy	20,383	19,231	852	850	4.0%	4.2%	21,235	20,081	11.4%	10.7%
	Howard Lane	21,396	20,971	1,478	1,811	6.5%	7.9%	22,873	22,781	12.3%	12.2%
	Total	174,927	175,913	10,857	11,466	5.8%	6.1%	185,784	187,379	100.0%	100.0%
Loop 1											
Screenline Loop 1-A	US 183	190,698	189,815	5,592	5,863	2.8%	3.0%	196,290	195,678	30.8%	29.9%
	Parmer Lane	39,452	40,735	3,859	4,101	8.9%	9.1%	43,311	44,836	6.8%	6.8%
	Howard Lane	17,233	21,613	800	724	4.4%	3.2%	18,033	22,336	2.8%	3.4%
	FM 1325/Loop 1 SR	21,220	9,912	1,051	535	4.7%	5.1%	22,272	10,447	3.5%	1.6%
	Loop 1 Mainline Plaza	**66,147**	**68,555**	**1,277**	**1,262**	**1.9%**	**1.8%**	**67,424**	**69,817**	**10.6%**	**10.7%**
	Bratton Lane	9,683	9,333	868	868	8.2%	8.5%	10,551	10,201	1.7%	1.6%
	IH 35	157,400	172,378	18,286	20,332	10.4%	10.6%	175,686	192,710	27.5%	29.4%
	Heatherwilde	16,201	15,252	380	613	2.3%	3.9%	16,581	15,866	2.6%	2.4%
	N Railroad Rd	5,749	5,749	271	523	4.5%	8.3%	6,020	6,272	0.9%	1.0%
	FM 685	29,610	31,418	1,843	3,526	5.9%	10.1%	31,453	34,944	4.9%	5.3%
	SH 130	44,912	45,900	5,752	5,633	11.4%	10.9%	50,664	51,533	7.9%	7.9%
	Total	598,305	610,662	39,980	43,978	6.3%	6.7%	638,285	654,640	100.0%	100.0%
SH 45 SE											
Screenline 45SE-A	FM 1327	12,321	13,312	1,465	2,076	10.6%	13.5%	13,785	15,388	40.5%	44.4%
	SH 45 SE ML	**16,735**	**16,083**	**2,490**	**2,325**	**13.0%**	**12.6%**	**19,225**	**18,408**	**56.5%**	**53.2%**
	Turnersville Rd.	1,014	726	30	106	2.8%	12.7%	1,043	832	3.1%	2.4%
	Total	30,069	30,121	3,984	4,506	11.7%	13.0%	34,054	34,627	100.0%	100.0%

Table 7.7 Screenline Comparison – 183A and 290E

Route		Auto		Truck		% Truck		Total		% of Total	
		Observed	Estimated	Observed	Estimated	Observed	Estimated	Observed	Estimated	Observed	Estimated
183A											
Screenline 183A-A	Lakeline Blvd	23,919	27,740	1,157	1,542	4.6%	5.3%	25,076	29,283	15.2%	15.3%
	US 183	36,285	42,282	3,621	4,370	9.1%	9.4%	39,906	46,652	24.1%	24.4%
	183A ML	**57,767**	**62,679**	**2,308**	**2,445**	**3.8%**	**3.8%**	**60,075**	**65,124**	**36.3%**	**34.1%**
	Vista Ridge Blvd	7,040	12,026	204	1,167	2.8%	8.8%	7,245	13,193	4.4%	6.9%
	Parmer Ln	30,905	32,820	2,126	3,791	6.4%	10.4%	33,031	36,611	20.0%	19.2%
	Total	155,917	177,547	9,417	13,315	5.7%	7.0%	165,333	190,862	100.0%	100.0%
Screenline 183A-B	Pecan Park Blvd	7,739	7,876	216	350	2.7%	4.3%	7,955	8,226	4.0%	3.5%
	US 183	38,657	53,666	4,279	4,730	10.0%	8.1%	42,936	58,396	21.3%	24.6%
	183A ML	**46,193**	**48,750**	**1,371**	**1,412**	**2.9%**	**2.8%**	**47,564**	**50,162**	**23.6%**	**21.1%**
	US 183 SB On-Ramp	28,223	39,233	1,754	2,438	5.9%	5.9%	29,977	41,671	14.9%	17.5%
	US 183/SH 45 DC	19,201	19,569	1,397	1,041	6.8%	5.0%	20,598	20,610	10.2%	8.7%
	Lake Creek Pkwy	13,713	14,120	909	1,760	6.2%	11.1%	14,622	15,880	7.3%	6.7%
	Parmer Ln	33,882	38,764	3,645	4,099	9.7%	9.6%	37,527	42,863	18.7%	18.0%
	Total	187,609	221,979	13,571	15,829	6.7%	6.7%	201,180	237,808	100.0%	100.0%
US - 290E											
SL 290E - A	**290E ML**	**33,119**	**29,703**	**2,847**	**2,536**	**7.9%**	**7.9%**	**35,966**	**32,239**	**52.1%**	**52.3%**
	290E Frontage Rd	30,409	27,044	6,524	5,682	17.7%	17.4%	36,934	32,727	47.9%	47.7%
	Total	63,528	56,747	9,371	8,219	25.6%	25.2%	72,900	64,965	100.0%	100.0%
SL 290E - B	**290E ML**	30,699	30,728	1,521	1,672	4.7%	5.2%	32,220	32,400	57.2%	56.4%
	290E Frontage Rd	22,936	23,728	2,503	4,255	9.8%	15.2%	25,440	27,983	42.8%	43.6%
	Total	53,636	54,456	4,024	5,927	14.6%	20.4%	57,660	60,383	100.0%	100.0%
SL 290E - C	**290E ML**	18,502	18,274	1,126	1,830	5.7%	9.1%	19,628	20,104	50.9%	35.4%
	290E Frontage Rd	17,874	33,296	2,704	4,569	13.1%	12.1%	20,578	37,865	49.1%	64.6%
	Total	36,375	51,570	3,830	6,399	18.9%	21.2%	40,206	57,969	100.0%	100.0%

Total traffic on each of the CTTS element screenlines is well within acceptable tolerances of the total counts. The total estimated traffic for each screenline is slightly higher than the total observed traffic, but the traffic on the toll facilities are generally close to the observed counts. For each corridor, the distribution of traffic among competing roadways along the screenlines is also within acceptable tolerances and traffic volumes at the mainline plazas (shown in bold) on the toll facilities are estimated adequately.

The allocation of the traffic by vehicle type (auto and truck) provides an adequate replication of the observed data. At an aggregate level, the estimated truck percentage of total vehicles across screenlines is generally within 1 to 2 percent of the observed percentage for the CTTS elements. The estimated truck percentages at the toll facilities were also estimated reasonably well. The truck traffic presented in these summaries includes trucks with 3+ axles.

7.2.4 Calibration of Toll Transactions by Mode and by Payment Method

The final element of the calibration was focused on replicating toll transactions by both vehicle type and payment method. For this analysis, Stantec utilized the model-estimated number of transactions by pay point, vehicle type, and payment method and compared these estimates to observed transaction data provided by TxDOT and CTRMA.

Table 7.8 and Table 7.9 provide a comparison of the estimated and observed transactions by vehicle type at all CTTS and CTRMA facilities by pay point. As shown in Table 7.8, the estimated total transactions along SH 130 are approximately 2.8 percent higher when compared to the

observed values, and approximately 3.3 percent lower along SH 45 SE. The allocation of auto and truck shares for SH 130 and SH 45 SE are close to the observed values, with trucks accounting for just over 10 percent of the transactions. Table 7.9 shows that estimated total transactions on SH 45 N and Loop 1 are approximately 2.5 percent and 1.7 percent higher than observed values, respectively. For Loop 1, SH 45 N and CTRMA's 183A and 290E toll roads, estimated truck shares are approximately within 1 percent of the observed truck shares. While the total transactions for each toll road vary from the observed totals, the transactions by vehicle type on a percentage basis demonstrate a good replication of the observed data.

Table 7.8 2016 Average Weekday Toll Transactions by Pay Point and Vehicle Type

	Crossroad	Type	Vehicle Type						Total		
			Auto			Truck					
			Observed	Estimated	%Diff	Observed	Estimated	%Diff	Observed	Estimated	%Diff
SH 130	SH 29	Ramp	1,383	1,391	0.6%	197	197	0.1%	1,580	1,589	0.5%
	FM 104	Ramp	161	448	178.3%	19	23	19.5%	180	471	161.6%
	Chandler Rd	Ramp	951	959	0.9%	186	185	-0.3%	1,137	1,145	0.7%
	N. of CR 109	**Mainline**	**24,422**	**24,523**	**0.4%**	**4,411**	**4,431**	**0.5%**	**28,833**	**28,954**	**0.4%**
	US 79	Ramp	14,128	14,935	5.7%	975	1,146	17.5%	15,103	16,081	6.5%
	CR 138	Ramp	9,979	10,054	0.8%	358	419	17.1%	10,337	10,473	1.3%
	Pecan St	Ramp	3,228	3,161	-2.1%	242	234	-3.2%	3,470	3,396	-2.1%
	N. of Cameron Rd	**Mainline**	**44,912**	**45,900**	**2.2%**	**5,752**	**5,633**	**-2.1%**	**50,664**	**51,533**	**1.7%**
	Cameron Rd	Ramp	681	528	-22.4%	93	212	128.3%	774	740	-4.3%
	Howard Ln / Gregg Manor	Ramp	1,127	994	-11.8%	136	137	1.0%	1,263	1,132	-10.4%
	Blue Bluff Rd.	Ramp	193	375	94.4%	19	52	175.6%	212	428	101.7%
	Bloor Rd / FM 973	Ramp	791	793	0.3%	44	44	0.1%	835	838	0.3%
	N. of FM 969	**Mainline**	**40,767**	**41,636**	**2.1%**	**5,687**	**5,880**	**3.4%**	**46,454**	**47,516**	**2.3%**
	FM 969	Ramp	6,563	8,428	28.4%	611	707	15.7%	7,174	9,134	27.3%
	Harold Green Rd	Ramp	1,230	1,323	7.5%	406	432	6.4%	1,636	1,755	7.3%
	Pearce Ln.	Ramp	2,859	3,320	16.1%	148	217	46.4%	3,007	3,536	17.6%
	N. of Elroy Rd	**Mainline**	**25,890**	**25,067**	**-3.2%**	**4,864**	**4,981**	**2.4%**	**30,754**	**30,048**	**-2.3%**
	Elroy Rd	Ramp	622	564	-9.3%	62	70	13.1%	684	634	-7.3%
	FM 812	Ramp	541	577	6.6%	85	103	20.8%	626	679	8.5%
	Moore Rd	Ramp	175	517	195.6%	45	100	122.4%	220	617	180.6%
	TOTAL MAINLINE		**135,991**	**137,125**	**0.8%**	**20,714**	**20,925**	**1.0%**	**156,705**	**158,050**	**0.9%**
	% Share MAINLINE		**86.8%**	**86.8%**		**13.2%**	**13.2%**				
	TOTAL RAMPS		**43,931**	**47,840**	**8.9%**	**3,533**	**4,067**	**15.1%**	**47,464**	**51,907**	**9.4%**
	% Share RAMPS		**92.6%**	**92.2%**		**7.4%**	**7.8%**				
	TOTAL		**180,603**	**185,494**	**2.7%**	**24,340**	**25,204**	**3.5%**	**204,943**	**210,698**	**2.8%**
	% Share TOTAL		**88.1%**	**88.0%**		**11.9%**	**12.0%**				
SH 45 SE	Turnersville Rd	Ramp	211	199	-5.7%	21	21	0.3%	232	220	-5.1%
	ML Plaza	**Mainline**	**16,735**	**16,083**	**-3.9%**	**2,490**	**2,325**	**-6.6%**	**19,225**	**18,408**	**-4.3%**
	FM 1625	Ramp	630	764	21.3%	170	195	14.7%	800	959	19.9%
	TOTAL MAINLINE		**16,735**	**16,083**	**-3.9%**	**2,490**	**2,325**	**-6.6%**	**19,225**	**18,408**	**-4.3%**
	% Share TOTAL		**87.0%**	**87.4%**		**13.0%**	**12.6%**				
	TOTAL RAMPS		**841**	**963**	**14.5%**	**191**	**216**	**13.2%**	**1,032**	**1,179**	**14.3%**
	% Share TOTAL		**81.5%**	**81.7%**		**18.5%**	**18.3%**				
	TOTAL		**17,576**	**17,046**	**-3.0%**	**2,681**	**2,541**	**-5.2%**	**20,257**	**19,587**	**-3.3%**
	% Share TOTAL		**86.8%**	**87.0%**		**13.2%**	**13.0%**				

Notes: (1) % SHARE = % of total by vehicle type

Table 7.9 2016 Average Weekday Toll Transactions by Pay Point and Vehicle Type (continued)

	Crossroad	Type	Vehicle Type						Total		
			Auto			Truck					
			Observed	Estimated	%Diff	Observed	Estimated	%Diff	Observed	Estimated	%Diff
SH 45 N	**W. ML Plaza**	**Mainline**	**49,571**	**54,554**	**10.1%**	**1,740**	**1,783**	**2.5%**	**51,311**	**56,337**	**9.8%**
	Parmer Ln.	Ramp	9,257	9,079	-1.9%	232	228	-1.5%	9,489	9,307	-1.9%
	FM 620	Ramp	2,427	1,966	-19.0%	67	29	-57.2%	2,494	1,995	-20.0%
	O'Conner Dr - SH 45N	Ramp	3,561	3,287	-7.7%	79	73	-7.2%	3,640	3,360	-7.7%
	O'Conner Dr -Loop 1	Ramp	6,426	5,798	-9.8%	36	25	-31.8%	6,462	5,822	-9.9%
	Greenlawn	Ramp	8,210	7,859	-4.3%	190	181	-4.8%	8,400	8,040	-4.3%
	CR 170	Ramp	10,812	11,258	4.1%	174	177	1.4%	10,986	11,434	4.1%
	Arterial A	Ramp	4,726	4,537	-4.0%	66	64	-3.1%	4,792	4,601	-4.0%
	Heatherwilde	Ramp	8,479	8,840	4.3%	149	150	0.3%	8,628	8,990	4.2%
	E. ML Plaza	**Mainline**	**40,891**	**41,152**	**0.6%**	**2,003**	**1,739**	**-13.2%**	**42,894**	**42,891**	**0.0%**
	TOTAL MAINLINE		**90,462**	**95,706**	**5.8%**	**3,743**	**3,522**	**-5.9%**	**94,205**	**99,227**	**5.3%**
	% Share TOTAL		**96.0%**	**96.5%**		**4.0%**	**3.5%**				
	TOTAL RAMPS		**53,898**	**52,624**	**-2.4%**	**993**	**926**	**-6.8%**	**54,891**	**53,550**	**-2.4%**
	% Share TOTAL		**98.2%**	**98.3%**		**1.8%**	**1.7%**				
	TOTAL		**144,360**	**148,330**	**2.8%**	**4,736**	**4,448**	**-6.1%**	**149,096**	**152,778**	**2.5%**
	% Share TOTAL		**96.8%**	**97.1%**		**3.2%**	**2.9%**				
Loop 1	Shoreline Dr	Ramp	944	993	5.2%	22	22	0.1%	966	1,015	5.1%
	ML Plaza	**Mainline**	**66,147**	**68,555**	**3.6%**	**1,277**	**1,262**	**-1.2%**	**67,424**	**69,817**	**3.5%**
	Howard	Ramp	5,468	4,378	-19.9%	130	29	-77.5%	5,598	4,407	-21.3%
	TOTAL MAINLINE		**66,147**	**68,555**	**3.6%**	**1,277**	**1,262**	**-1.2%**	**67,424**	**69,817**	**3.5%**
	% Share TOTAL		**98.1%**	**98.2%**		**1.9%**	**1.8%**				
	TOTAL RAMPS		**6,412**	**5,371**	**-16.2%**	**152**	**51**	**-66.3%**	**6,564**	**5,422**	**-17.4%**
	% Share TOTAL		**97.7%**	**99.1%**		**2.3%**	**0.9%**				
	TOTAL		**72,559**	**73,926**	**1.9%**	**1,429**	**1,313**	**-8.1%**	**73,988**	**75,239**	**1.7%**
	% Share TOTAL		**98.1%**	**98.3%**		**1.9%**	**1.7%**				
183A	Crystal Falls Pkwy	Ramp	640	641	0.2%	36	39	7.0%	676	680	0.6%
	Crystal Falls ML	**Mainline**	**30,074**	**32,197**	**7.1%**	**1,774**	**1,847**	**4.2%**	**31,848**	**34,044**	**6.9%**
	Scottsdale Dr	Ramp	1,134	1,098	-3.2%	16	245	1440.7%	1,150	1,343	16.8%
	Park St. ML	**Mainline**	**57,767**	**62,679**	**8.5%**	**2,308**	**2,445**	**5.9%**	**60,075**	**65,124**	**8.4%**
	Brushy Creek	Ramp	10,007	11,665	16.6%	155	179	14.9%	10,162	11,843	16.5%
	Lakeline ML	**Mainline**	**46,193**	**48,750**	**5.5%**	**1,371**	**1,412**	**3.0%**	**47,564**	**50,162**	**5.5%**
	TOTAL MAINLINE		**134,034**	**143,626**	**7.2%**	**5,453**	**5,704**	**4.6%**	**139,487**	**149,330**	**7.1%**
	% Share TOTAL		**96.1%**	**96.2%**		**3.9%**	**3.8%**				
	TOTAL RAMPS		**11,781**	**13,404**	**13.8%**	**207**	**462**	**123.0%**	**11,988**	**13,867**	**15.7%**
	% Share TOTAL		**98.3%**	**96.7%**		**1.7%**	**3.3%**				
	TOTAL		**145,814**	**157,031**	**7.7%**	**5,661**	**6,166**	**8.9%**	**151,475**	**163,197**	**7.7%**
	% Share TOTAL		**96.3%**	**96.2%**		**3.7%**	**3.8%**				
290E	US 183 DC	Ramp	13,896	12,994	-6.5%	1,177	1,016	-13.7%	15,073	14,010	-7.1%
	Springdale	Ramp	943	899	-4.6%	388	265	-31.8%	1,331	1,164	-12.6%
	Giles	Ramp	3,159	3,037	-3.8%	982	863	-12.2%	4,141	3,900	-5.8%
	Giles ML	**Mainline**	**30,699**	**29,650**	**-3.4%**	**1,521**	**1,490**	**-2.0%**	**32,220**	**31,140**	**-3.4%**
	Harris Branch	Ramp	917	903	-1.5%	355	337	-5.0%	1,272	1,241	-2.5%
	Parmer	**Mainline**	**18,502**	**18,648**	**0.8%**	**1,126**	**1,108**	**-1.7%**	**19,628**	**19,756**	**0.7%**
	TOTAL MAINLINE		**49,201**	**48,298**	**-1.8%**	**2,647**	**2,597**	**-1.9%**	**51,848**	**50,896**	**-1.8%**
	% Share TOTAL		**94.9%**	**94.9%**		**5.1%**	**5.1%**				
	TOTAL RAMPS		**18,914**	**17,834**	**-5.7%**	**2,903**	**2,481**	**-14.5%**	**21,817**	**20,315**	**-6.9%**
	% Share TOTAL		**86.7%**	**87.8%**		**13.3%**	**12.2%**				
	TOTAL		**68,115**	**66,132**	**-2.9%**	**5,550**	**5,078**	**-8.5%**	**73,665**	**71,210**	**-3.3%**
	% Share TOTAL		**92.5%**	**92.9%**		**7.5%**	**7.1%**				

Notes: [1] % SHARE = % of total by vehicle type

A summary of the shares of total transactions by payment method and a separate summary by vehicle type are shown in Table 7.10 through Table 7.12. As shown in the tables, the model generally provides an adequate share of transactions by payment type for the total on each facility, as well as separately for autos and trucks. The largest difference is underestimation of PBM shares on SH 45 SE, primarily with autos. Trucks using the 290E and 183A toll roads are estimated to have higher PBM shares than what is observed, but the total volumes are relatively small.

Table 7.10 2016 Average Weekday Total Transactions by Payment Method

	Crossroad	Type	Payment Methods					
			ETC			Pay by Mail		
			Observed	Estimated	%Diff	Observed	Estimated	%Diff
SH 130	MAINLINE	Total	96,435	98,319	2.0%	60,270	59,731	-0.9%
		% Share	61.5%	62.2%		38.5%	37.8%	
	RAMPS	Total	29,744	34,696	16.6%	18,494	17,951	-2.9%
		% Share	61.7%	65.9%		38.3%	34.1%	
	TOTAL	**Total**	**126,179**	**133,015**	**5.4%**	**78,764**	**77,683**	**-1.4%**
		% Share	**61.6%**	**63.1%**		**38.4%**	**36.9%**	
SH 45 SE	MAINLINE	Total	11,558	12,535	8.5%	7,667	5,873	-23.4%
		% Share	60.1%	68.1%		39.9%	31.9%	
	RAMPS	Total	562	805	43.2%	470	375	-20.3%
		% Share	54.5%	68.2%		45.5%	31.8%	
	TOTAL	**Total**	**12,120**	**13,339**	**10.1%**	**8,137**	**6,247**	**-23.2%**
		% Share	**59.8%**	**68.1%**		**40.2%**	**31.9%**	
SH 45 N	MAINLINE	Total	65,083	70,364	8.1%	29,122	28,864	-0.9%
		% Share	69.1%	70.9%		30.9%	29.1%	
	RAMPS	Total	39,261	39,624	0.9%	15,630	13,926	-10.9%
		% Share	71.5%	74.0%		28.5%	26.0%	
	TOTAL	**Total**	**104,344**	**109,988**	**5.4%**	**44,752**	**42,790**	**-4.4%**
		% Share	**70.0%**	**72.0%**		**30.0%**	**28.0%**	
Loop 1	MAINLINE	Total	47,843	50,413	5.4%	19,581	19,404	-0.9%
		% Share	71.0%	72.2%		29.0%	27.8%	
	RAMPS	Total	4,300	4,534	5.4%	2,264	888	-60.8%
		% Share	65.5%	83.6%		34.5%	16.4%	
	TOTAL	**Total**	**52,143**	**54,947**	**5.4%**	**21,845**	**20,292**	**-7.1%**
		% Share	**70.5%**	**73.0%**		**29.5%**	**27.0%**	
183A	MAINLINE	Total	93,220	102,540	10.0%	46,267	46,790	1.1%
		% Share	66.8%	68.7%		33.2%	31.3%	
	RAMPS	Total	8,566	9,464	10.5%	3,422	4,403	28.7%
		% Share	71.5%	68.2%		28.5%	31.8%	
	TOTAL	**Total**	**101,786**	**112,004**	**10.0%**	**49,689**	**51,193**	**3.0%**
		% Share	**67.2%**	**68.6%**		**32.8%**	**31.4%**	
290E	MAINLINE	Total	31,246	33,142	6.1%	20,602	19,362	-6.0%
		% Share	60.3%	63.1%		39.7%	36.9%	
	RAMPS	Total	13,372	13,678	2.3%	8,445	8,803	4.2%
		% Share	61.3%	60.8%		38.7%	39.2%	
	TOTAL	**Total**	**44,618**	**46,821**	**4.9%**	**29,047**	**28,165**	**-3.0%**
		% Share	**60.6%**	**62.4%**		**39.4%**	**37.6%**	

Table 7.11 2016 Average Weekday Auto Transactions by Payment Method

	Crossroad	Type	Payment Methods					
			ETC			Pay by Mail		
			Observed	Estimated	%Diff	Observed	Estimated	%Diff
SH 130	MAINLINE	Total	84,852	86,026	1.4%	51,139	51,100	-0.1%
		% Share	62.4%	62.7%		37.6%	37.3%	
	RAMPS	Total	27,598	32,185	16.6%	17,014	16,184	-4.9%
		% Share	61.9%	66.5%		38.1%	33.5%	
	TOTAL	**Total**	**112,450**	**118,210**	**5.1%**	**68,153**	**67,284**	**-1.3%**
		% Share	**62.3%**	**63.7%**		**37.7%**	**36.3%**	
SH 45 SE	MAINLINE	Total	10,171	11,387	12.0%	6,564	4,696	-28.5%
		% Share	60.8%	70.8%		39.2%	29.2%	
	RAMPS	Total	456	656	43.9%	385	307	-20.3%
		% Share	54.2%	68.1%		45.8%	31.9%	
	TOTAL	**Total**	**10,627**	**12,043**	**13.3%**	**6,949**	**5,003**	**-28.0%**
		% Share	**60.5%**	**70.7%**		**39.5%**	**29.3%**	
SH 45 N	MAINLINE	Total	62,505	67,899	8.6%	27,957	27,806	-0.5%
		% Share	69.1%	70.9%		30.9%	29.1%	
	RAMPS	Total	38,575	38,891	0.8%	15,323	13,733	-10.4%
		% Share	71.6%	73.9%		28.4%	26.1%	
	TOTAL	**Total**	**101,080**	**106,791**	**5.6%**	**43,280**	**41,540**	**-4.0%**
		% Share	**70.0%**	**72.0%**		**30.0%**	**28.0%**	
Loop 1	MAINLINE	Total	47,022	49,532	5.3%	19,125	19,023	-0.5%
		% Share	71.1%	72.3%		28.9%	27.7%	
	RAMPS	Total	4,203	4,500	7.1%	2,209	871	-60.6%
		% Share	65.5%	83.8%		34.5%	16.2%	
	TOTAL	**Total**	**51,225**	**54,032**	**5.5%**	**21,334**	**19,894**	**-6.8%**
		% Share	**70.6%**	**73.1%**		**29.4%**	**26.9%**	
183A	MAINLINE	Total	89,876	99,355	10.5%	44,158	44,272	0.3%
		% Share	67.1%	69.2%		32.9%	30.8%	
	RAMPS	Total	8,425	9,216	9.4%	3,356	4,189	24.8%
		% Share	71.5%	68.8%		28.5%	31.2%	
	TOTAL	**Total**	**98,301**	**108,570**	**10.4%**	**47,513**	**48,461**	**2.0%**
		% Share	**67.4%**	**69.1%**		**32.6%**	**30.9%**	
290E	MAINLINE	Total	29,647	31,022	4.6%	19,554	17,979	-8.1%
		% Share	60.3%	63.3%		39.7%	36.7%	
	RAMPS	Total	11,444	11,752	2.7%	7,470	7,814	4.6%
		% Share	60.5%	60.1%		39.5%	39.9%	
	TOTAL	**Total**	**41,091**	**42,775**	**4.1%**	**27,024**	**25,794**	**-4.6%**
		% Share	**60.3%**	**62.4%**		**39.7%**	**37.6%**	

Table 7.12 2016 Average Weekday Truck Transactions by Payment Method

	Crossroad	Type	Payment Methods					
			ETC			Pay by Mail		
			Observed	Estimated	%Diff	Observed	Estimated	%Diff
SH 130	MAINLINE	Total	11,583	12,293	6.1%	9,131	8,632	-5.5%
		% Share	55.9%	58.7%		44.1%	41.3%	
	RAMPS	Total	2,146	2,512	17.0%	1,480	1,767	19.4%
		% Share	59.2%	58.7%		40.8%	41.3%	
	TOTAL	**Total**	**13,729**	**14,805**	**7.8%**	**10,611**	**10,399**	**-2.0%**
		% Share	**56.4%**	**58.7%**		**43.6%**	**41.3%**	
SH 45 SE	MAINLINE	Total	1,387	1,148	-17.2%	1,103	1,177	6.7%
		% Share	55.7%	49.4%		44.3%	50.6%	
	RAMPS	Total	106	149	40.1%	85	68	-20.5%
		% Share	55.5%	68.7%		44.5%	31.3%	
	TOTAL	**Total**	**1,493**	**1,297**	**-13.1%**	**1,188**	**1,244**	**4.8%**
		% Share	**55.7%**	**51.0%**		**44.3%**	**49.0%**	
SH 45 N	MAINLINE	Total	2,578	2,464	-4.4%	1,165	1,057	-9.2%
		% Share	68.9%	70.0%		31.1%	30.0%	
	RAMPS	Total	686	733	6.9%	307	193	-37.2%
		% Share	69.1%	79.2%		30.9%	20.8%	
	TOTAL	**Total**	**3,264**	**3,197**	**-2.0%**	**1,472**	**1,250**	**-15.1%**
		% Share	**68.9%**	**71.9%**		**31.1%**	**28.1%**	
Loop 1	MAINLINE	Total	821	881	7.3%	456	381	-16.4%
		% Share	64.3%	69.8%		35.7%	30.2%	
	RAMPS	Total	97	34	-65.1%	55	17	-68.4%
		% Share	63.8%	66.1%		36.2%	33.9%	
	TOTAL	**Total**	**918**	**915**	**-0.3%**	**511**	**398**	**-22.0%**
		% Share	**64.2%**	**69.7%**		**35.8%**	**30.3%**	
183A	MAINLINE	Total	3,344	3,186	-4.7%	2,109	2,518	19.4%
		% Share	61.3%	55.8%		38.7%	44.2%	
	RAMPS	Total	141	248	76.0%	67	214	222.3%
		% Share	67.9%	53.6%		32.1%	46.4%	
	TOTAL	**Total**	**3,485**	**3,433**	**-1.5%**	**2,176**	**2,733**	**25.6%**
		% Share	**61.6%**	**55.7%**		**38.4%**	**44.3%**	
290E	MAINLINE	Total	1,599	2,120	32.6%	1,049	1,382	31.8%
		% Share	60.4%	60.5%	0.0%	39.6%	39.5%	0.0%
	RAMPS	Total	1,928	1,926	-0.1%	975	989	1.4%
		% Share	66.4%	66.1%	0.0%	33.6%	33.9%	0.0%
	TOTAL	**Total**	**3,527**	**4,046**	**14.7%**	**2,023**	**2,371**	**17.2%**
		% Share	**63.5%**	**63.0%**	**0.0%**	**36.5%**	**37.0%**	**0.0%**

While the model estimates show some variation against the observed values by pay point location and payment method for each CTTS elements, the resulting average toll per transaction for each roadway is relatively close to the observed values. The comparison for each CTTS element by vehicle type is shown in Table 7.13. The values for SH 130 and SH 45 SE reflect the temporary truck toll discount program that was in place during eight months of the 2016 calibration year. The values are unadjusted model outputs and do not include any modifications for collection efficiency.

Table 7.13 Comparison of Observed and Estimated Toll Cost Per Transaction

Roadway	Auto		Truck		Total	
	Obs	Est	Obs	Est	Obs	Est
SH 130	$1.67	$1.65	$1.82	$1.78	$1.69	$1.67
SH 45 SE	$1.15	$1.12	$1.16	$1.17	$1.16	$1.12
SH 45 N	$1.07	$1.07	$2.80	$2.77	$1.13	$1.12
Loop 1	$1.13	$1.13	$2.86	$2.88	$1.16	$1.16

7.3 ELASTICITY ANALYSIS

In order to develop toll elasticity curves for the 2018 Study, the transportation model was run using the final adjusted toll coefficients listed in Table 7.1 and a range of toll values above and below the existing toll rates for the 2016 calibration year as well with the future toll rates and networks for the year 2030. As a reasonableness check, tests were conducted on the CTTS elements separately. Due to the length of the SH 130 element, elasticity was estimated for each of the four segments. These elasticity estimates for each year are a function of both the overall travel demand and network conditions, in terms of competing roadways and congestion that exist for both years. For this analysis, a number of alternative toll rates were expressed as multiples of the base tolls. The multiples range from 0.25 to 6.0 and reveal how traffic and revenues change at different toll levels. The results were plotted for the four facilities as shown in Figure 7.11 through Figure 7.14. Within each of these figures, the transactions and revenues for 2016 are shown in solid lines while the dashed lines represent the same values in the 2030 horizon year.

Elasticity, as used herein, is the relationship between traffic volume and toll rates and represents the relative decrease in traffic corresponding to a given increase in toll. Elasticity is expressed as a negative value. The higher the absolute value, the more apt a facility is to lose traffic, which can be due to diversions to competing facilities, switches in travel modes, or consolidation and/or elimination of trips.

For 2016 Stantec performed elasticity analysis using the 2016 toll rates. For the future year 2030, the auto and truck tolls are derived from the assumed rates applied with the annual escalation policy over the period from existing 2018 rates to 2030.

Similar to our analysis in the prior 2014 Study, in 2016 Loop 1 has the lowest elasticity at approximately -0.25, while SH 130 has a much higher elasticity with a value at approximately -0.42. The elasticity factor for SH 45 N is -0.38 and for SH 45 SE, the elasticity factor is -0.42. With respect to estimating the optimum point for future revenue forecasts, it is prudent to define points on the revenue curves that are less than the maximum revenue point in order to provide a degree of flexibility which allows for additional revenue to be generated if circumstances require that consideration. The SH 45 SE elasticity curves suggest that the roadway is approaching its optimal revenue, indicating that an increase in tolls would not produce higher revenue in the near term if tolls were increased substantially. Similarly, for 2016 the model estimates that SH 130 revenue is also approaching its optimum revenue. In contrast, the model predicts that the SH 45 N optimum revenue is approximately 1.5 times the base toll. Loop 1, being the most inelastic among the four facilities, has optimum toll levels at approximately 2.0 times the base toll. The inelasticity of Loop 1 can be attributed primarily to the level of congestion on the competing roads, such as US 183, Parmer Lane, and IH-35.

Figure 7.11 SH 130 Toll Sensitivity

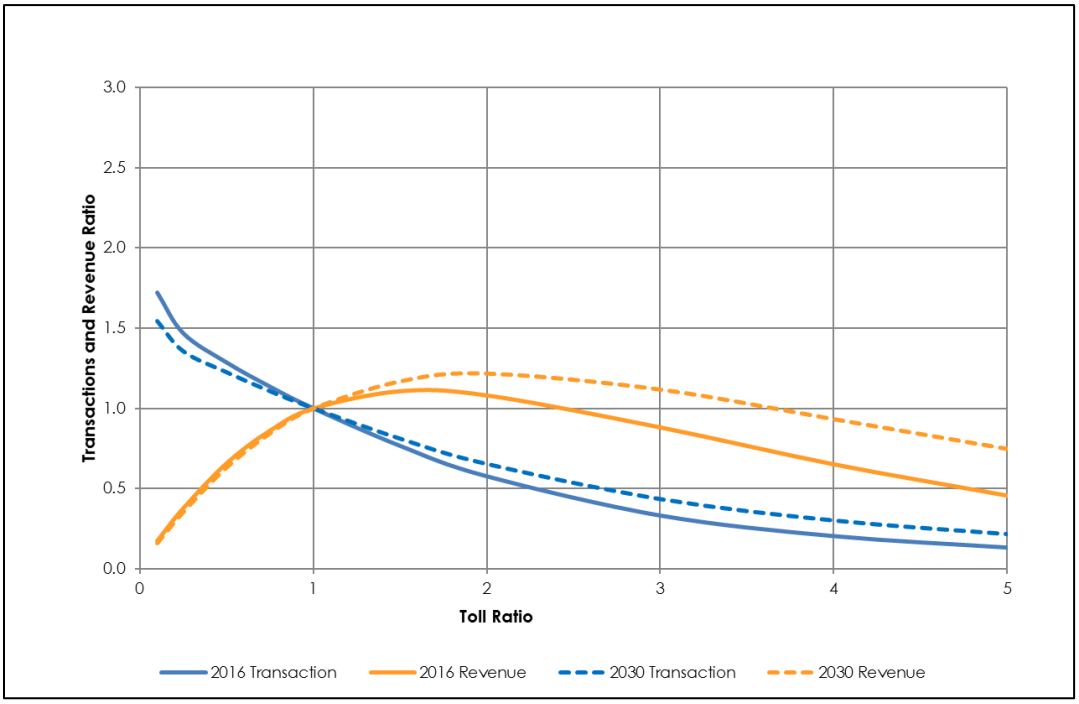


Figure 7.12 SH 45 N Toll Sensitivity

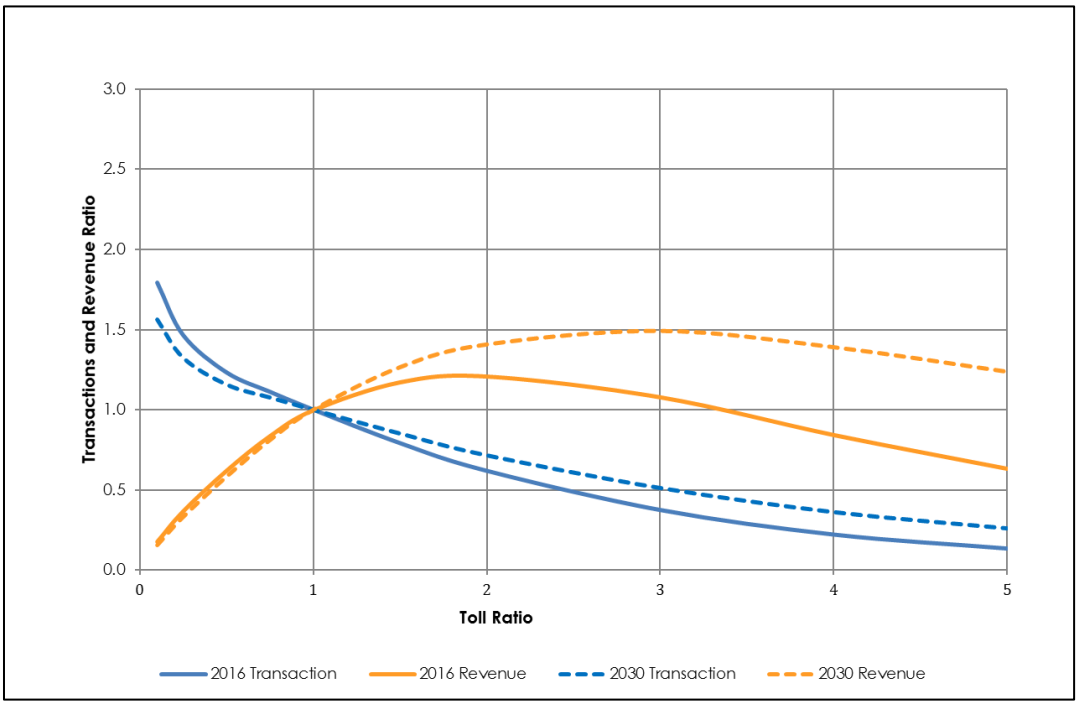


Figure 7.13 Loop 1 Toll Sensitivity

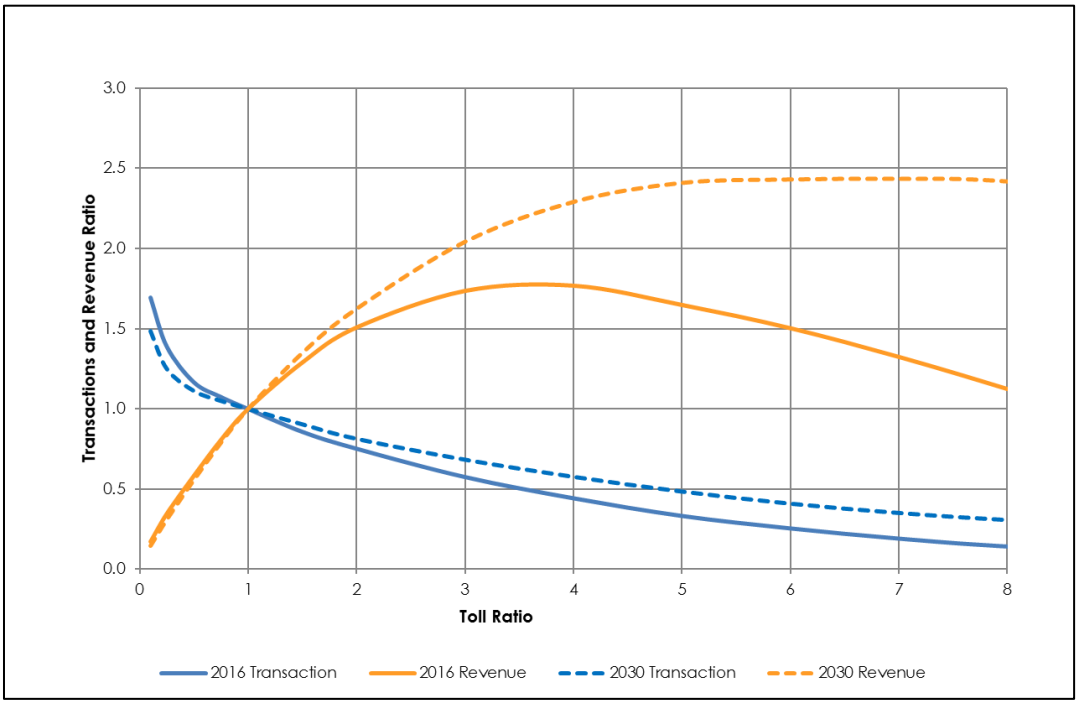
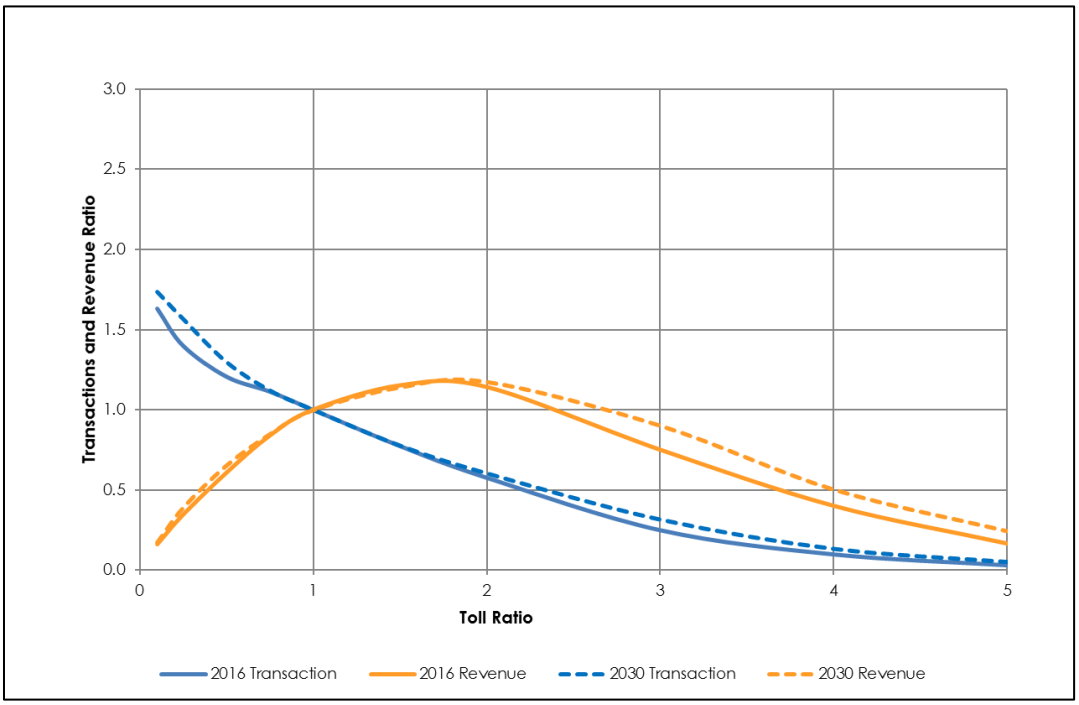


Figure 7.14 SH 45 SE Toll Sensitivity



For the future year 2030 conditions, the elasticity values decline indicating that the roadways become less elastic, due primarily to increasing congestion on the competing roadways from continued development and growth in traffic. The elasticity for SH 130 is reduced significantly to -0.35 as the adjacent arterial roadways become congested with traffic from development in what is currently a largely rural corridor. Elasticity for Loop 1, SH 45 N, and SH 45 SE will also decline to -0.19, -0.28, and -0.40 respectively. These reductions in elasticity indicate that under the future conditions, there will be more flexibility to increase tolls beyond the planned toll escalation assumed in the forecasts, particularly for SH 130. As shown in these figures, the optimum revenue points for each roadway increase most notably for Loop 1.

Due to the length of the SH 130 element and the varying degrees of competition in each of its four segments, separate elasticity calculations were performed to examine the sensitivity to toll rates in each segment for both 2016 and 2030. Figure 7.15 through Figure 7.18 display the transactions and revenue relationships for each segment. Segment 3 of SH 130 has the lowest elasticity, ranging from -0.35 in 2016 to -0.30 in 2030. This is likely due to the orientation of this segment and lack of adjacent arterials that would compete with it in 2016. In contrast, Segment 4 at the southern end of SH 130 is the most elastic with values ranging from -0.52 in 2016 to -0.44 in 2030. The higher level of elasticity is likely due to the competition provided by US 183, which intersects SH 130 at the interchange with SH 45 SE and provides a direct route into southeastern Austin. The elasticity values for Segments 1 and 2 are similar with 2016 values of -0.37 and -0.46 respectively. By 2030 these two segments have elasticity values of -0.30 and -0.37, respectively.

Figure 7.15 SH 130 Segment 1 Toll Sensitivity

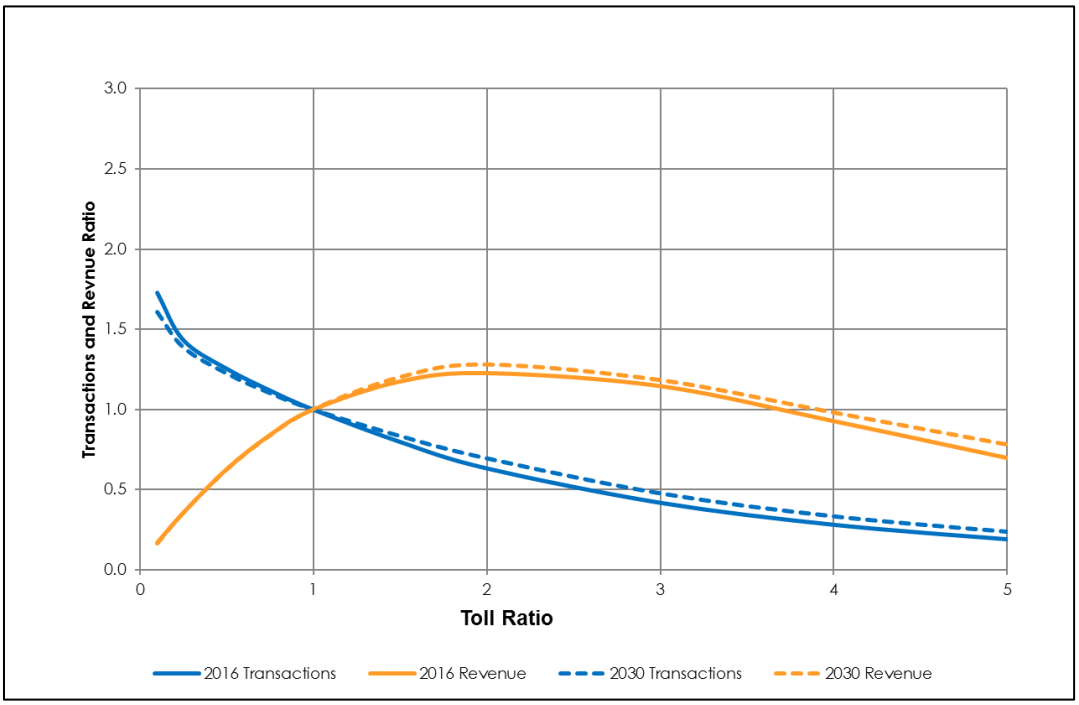


Figure 7.16 SH 130 Segment 2 Toll Sensitivity

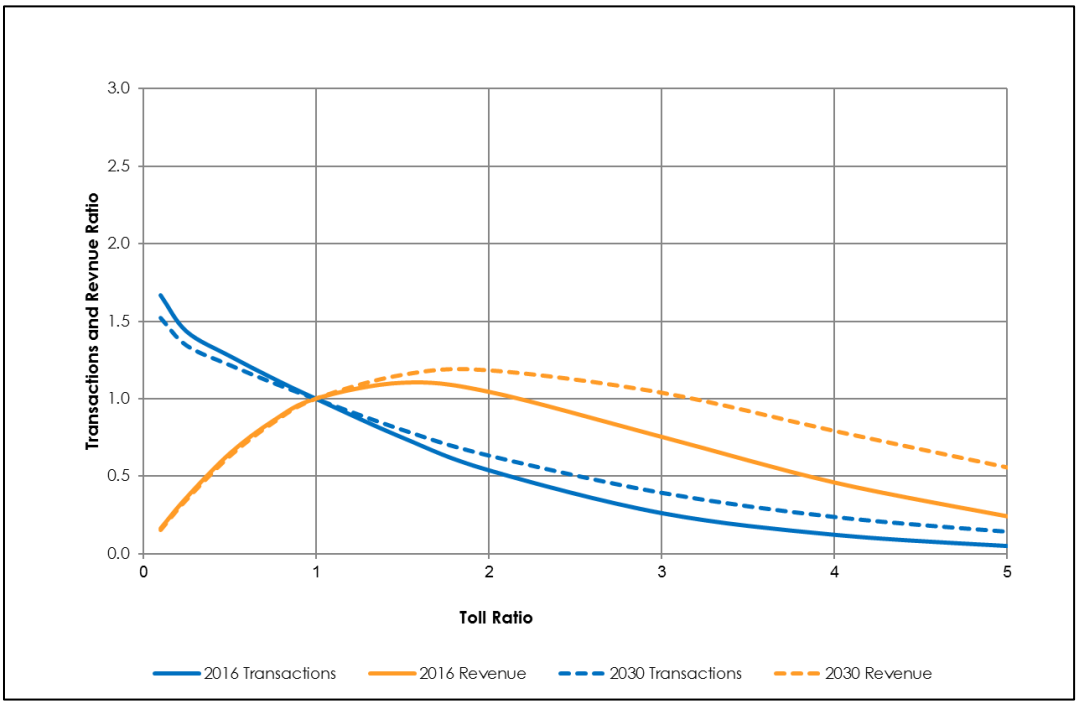


Figure 7.17 SH 130 Segment 3 Toll Sensitivity

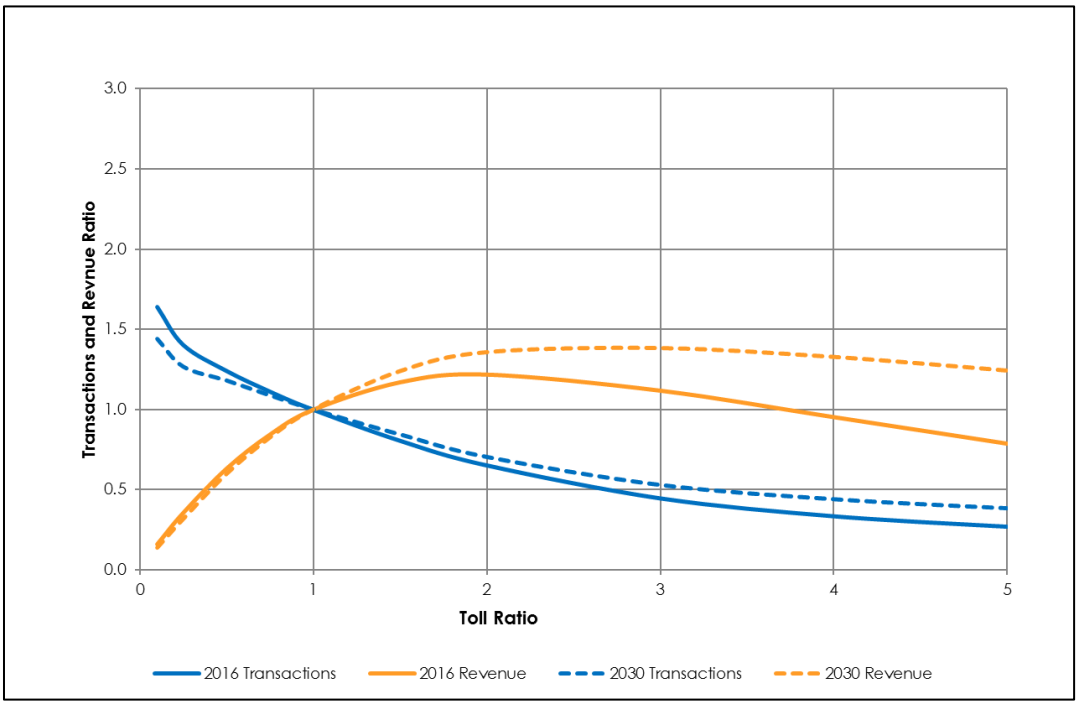
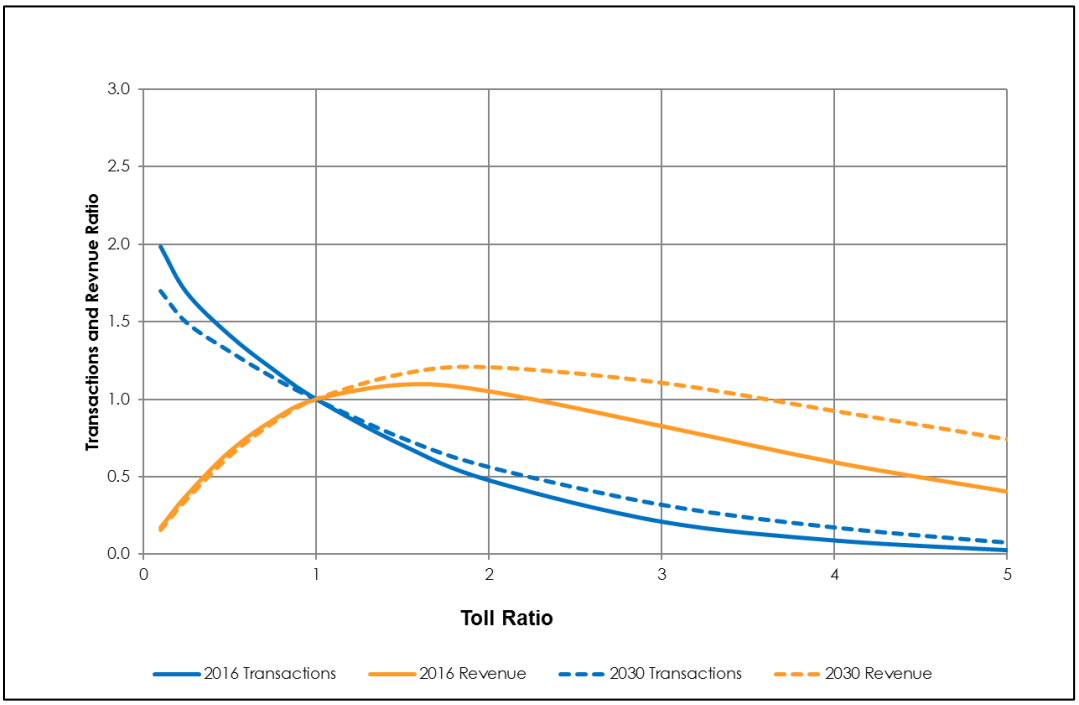


Figure 7.18 SH 130 Segment 4 Toll Sensitivity



8.0 TRAFFIC & REVENUE FORECASTS

Stantec developed traffic and toll revenue forecasts for each of the CTTS elements based on the travel demand model which incorporated the future year network assumptions discussed in Chapter 2 and the revised socioeconomic forecasts discussed in Chapter 6. The travel demand modeling process, including the application of the CAMPO and AAMPO models and the toll diversion model, were applied to selected horizon years (2018 to 2025, 2030, and 2040) to create annual traffic estimates from 2018 to 2042. Model years other than 2020, 2030, and 2040 were used to estimate the impact of key toll facility network improvements such as MoPac N Express Lanes (2017), SH 71 E (2017), 183S toll road (2019 to 2020), 290E Phase III (2021), SH 130 widening (2021), 183N Express Lanes (2024), and MoPac S Express Lanes (2024). Intermediate year estimates were developed via interpolation techniques and the years beyond 2040 were estimated via extrapolation.

Stantec reviewed the model-based forecasts, summarized the estimated traffic for each of the corridor screenlines, and reviewed the detailed schematic diagrams for each horizon year. In order to prepare the final transaction and revenue streams by vehicle type and payment type, the model-based forecasts were reviewed and adjusted as necessary to account for any unacceptable model variation. Transaction and revenue streams were then prepared for each CTTS roadway which include the key metrics related to payment type and vehicle type, along with both average weekday and annual estimates for total transactions and paying transactions using collection statistics provided by TxDOT. Note that the revenue estimates include only the tolls and PBM surcharge for the PBM transactions. Any from revenue from service center fees is not included in the revenue forecasts.

The remaining sections of this chapter provide a separate summary of the model forecasts and transaction and revenue summary for each CTTS element. A combined forecast summing all roadways is provided along with a comparison to the 2014 Study. The estimated monthly transactions and revenue for FY 2018 are also provided for use in the CTTS quarterly and annual reports.

The final sections of this chapter discuss the general forecast assumptions and the disclaimers associated with these forecasts.

8.1 SH 45 N AND LOOP 1

SH 45 N and Loop 1 are integrated toll roads since these roads intersect each other and many vehicles use both roads for the same trip. As such, the model-produced traffic on these roadways was reviewed and analyzed together, rather than as separate elements, in order to develop the transaction and revenue forecasts for SH 45 N and Loop 1.

The toll diversion model produces traffic estimates for several model years including: 2018 to 2025, 2030, and 2040. The initial model forecasts for SH 45 N and Loop 1 have been adjusted by post-processing to account for variations in the base year model calibration estimates and other minor variations in future trends. Specifically, adjustments were made to appropriately reflect the impacts of the recently constructed MoPac N Express Lanes. Gross revenue estimates were then prepared by multiplying the traffic, in terms of transactions, at the toll locations by the effective toll structure by vehicle type and payment type for each year. Adjustments were also included to reflect the effective collection rates for both ETC and PBM transactions. Annual estimates of transactions and revenue for both SH 45 N and Loop 1 were generated using an annualization factor of 320.

8.1.1 SH 45 N and Loop 1 Schematic Traffic Diagrams

The schematic diagrams shown in Figure 8.1 through Figure 8.4 below show average weekday traffic along the individual segments of SH 45 N and Loop 1 for the model (calendar) years 2016, 2020, 2030, and 2040. These diagrams represent the unadjusted model outputs and are intended to provide the reader a sense of the scale of the traffic volumes across the entire facility as well as the entry/exit points. An approximation of the estimated growth for various segments of the roadway can be determined by reviewing these diagrams across the individual horizon years.

Figure 8.1 SH 45 N and Loop 1 Average Weekday Traffic – 2016 Model Calibration Year (Unadjusted Model Output)

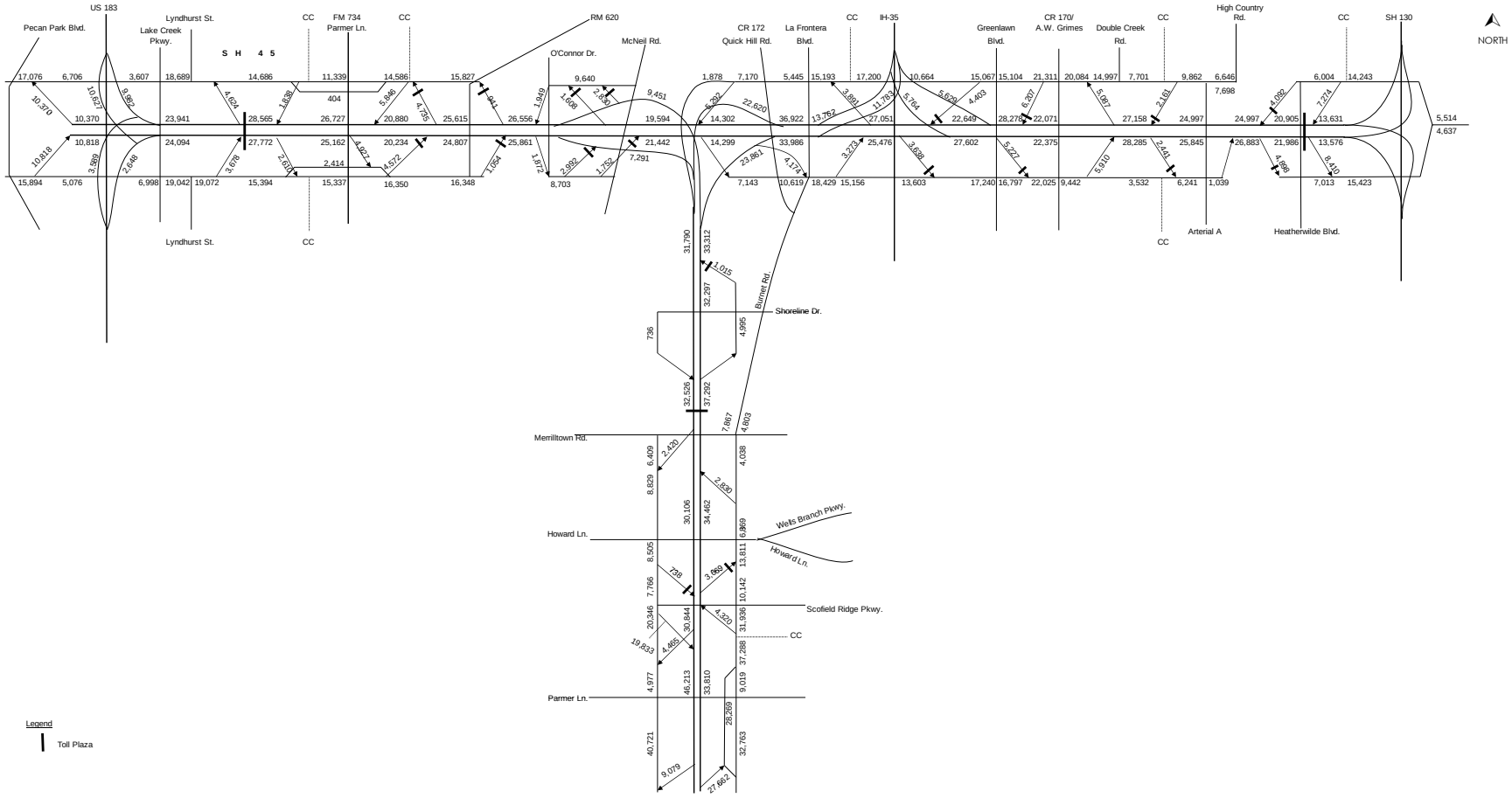


Figure 8.2 SH 45 N and Loop 1 Average Weekday Traffic – 2020 Model Year (Unadjusted Model Output)

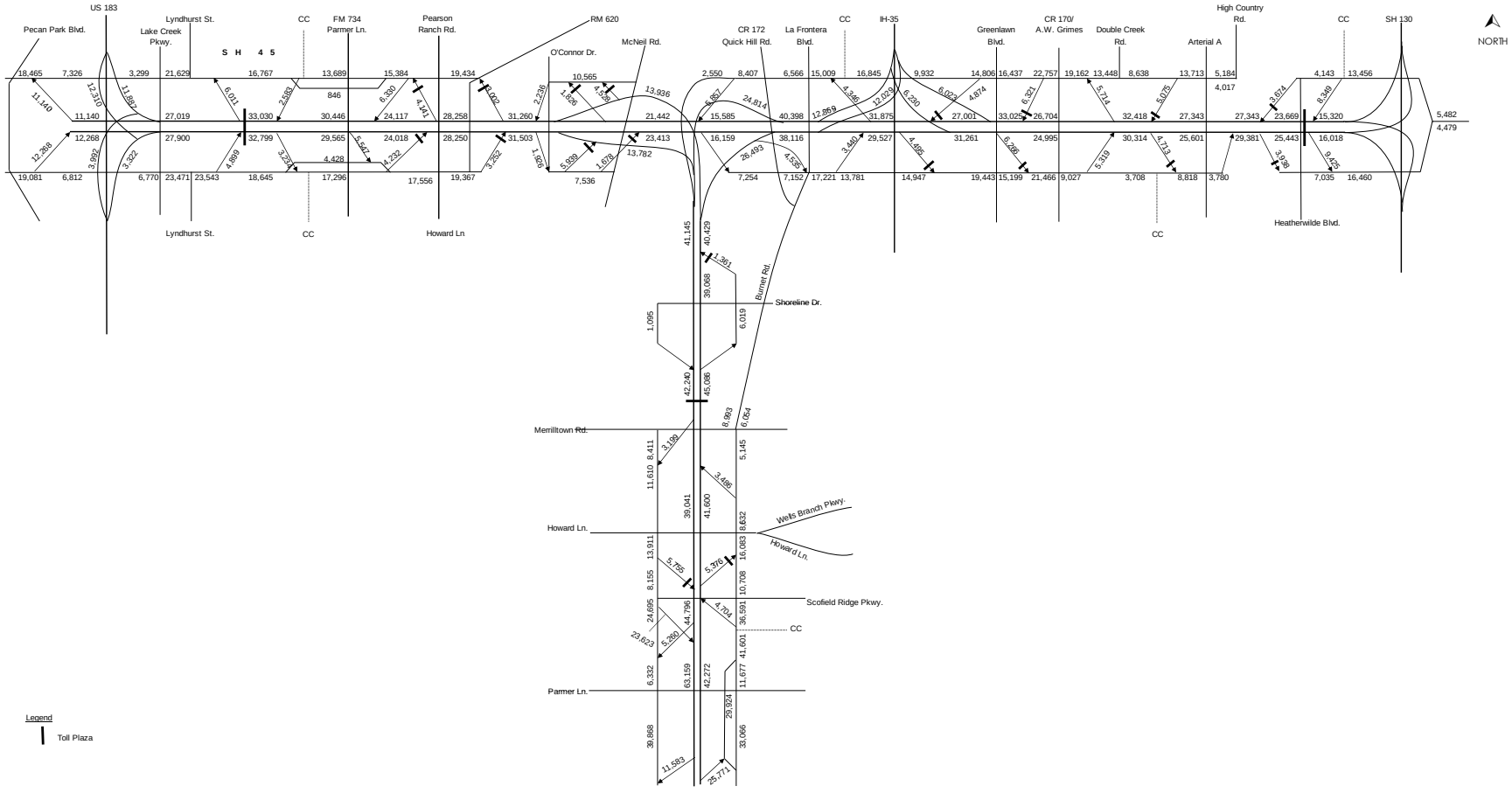


Figure 8.3 SH 45 N and Loop 1 Average Weekday Traffic – 2030 Model Year (Unadjusted Model Output)

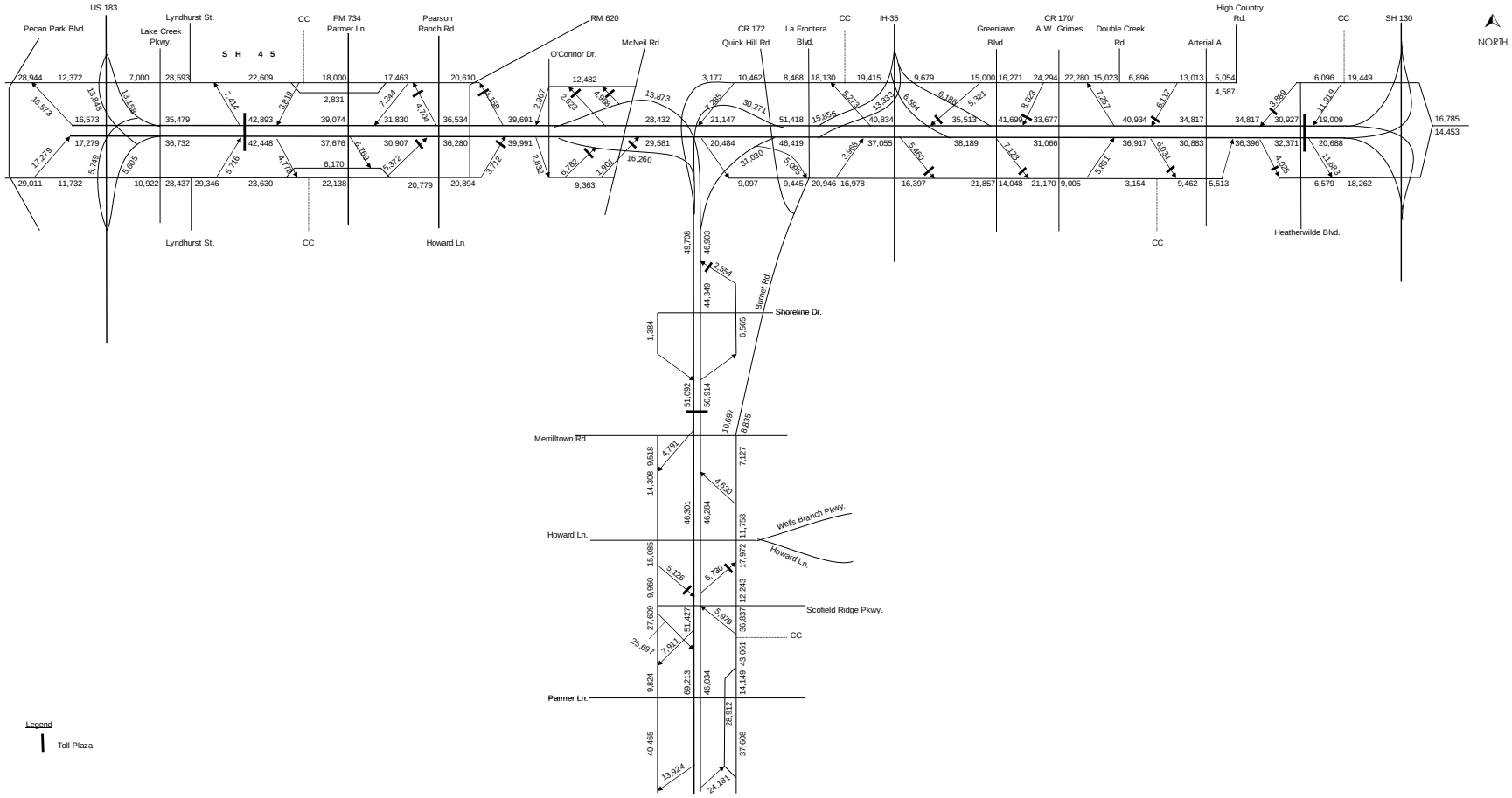
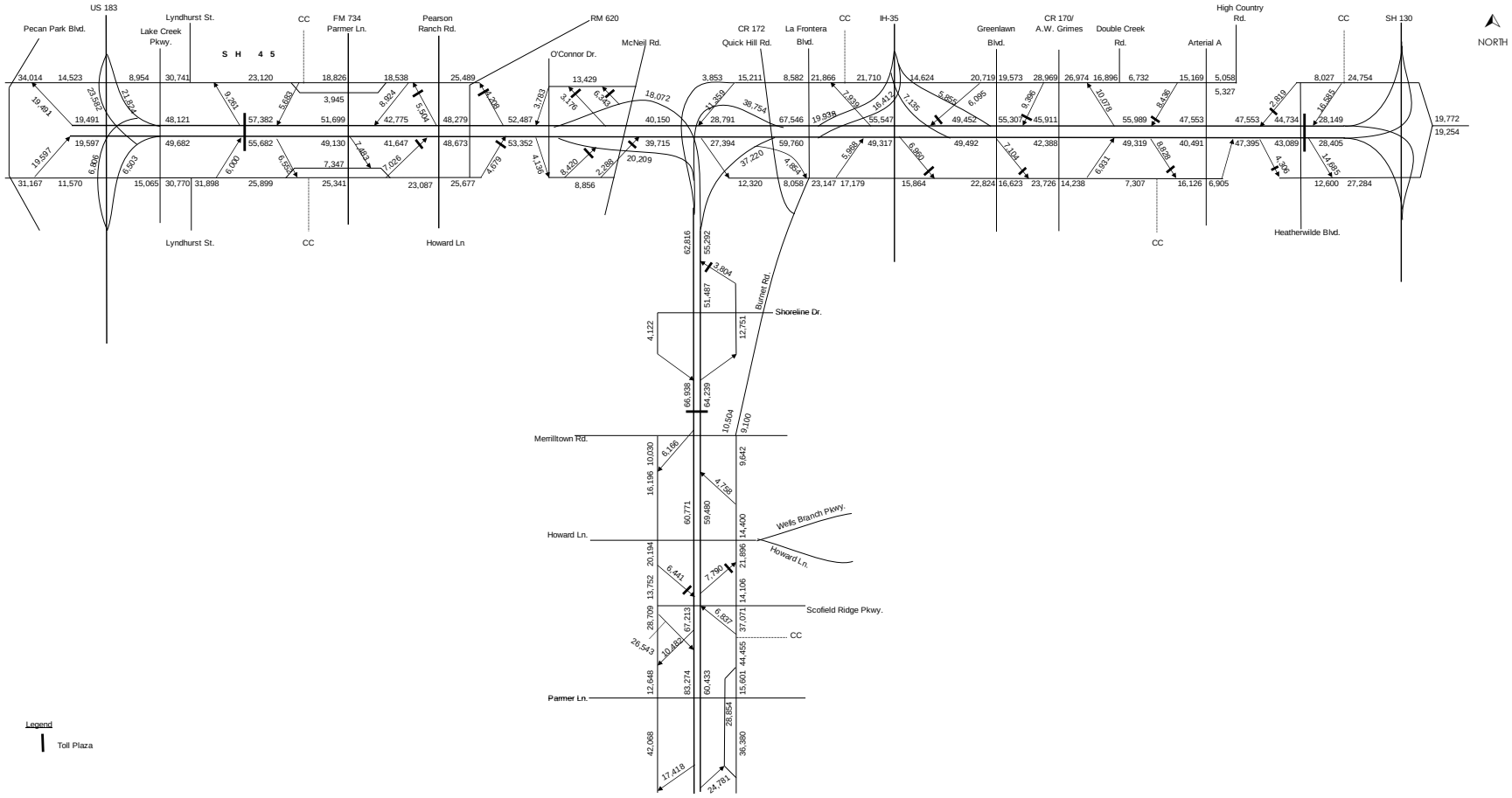


Figure 8.4 SH 45 N and Loop 1 Average Weekday Traffic – 2040 Model Year (Unadjusted Model Output)



8.1.2 SH 45 N and Loop 1 Screenline Analysis

As discussed previously in Chapter 7, a series of screenlines were developed within each of the toll road corridors to intersect each of the mainline toll plazas and parallel locations on the adjacent non-tolled roads. Four screenlines were created for SH 130, two for SH 45 N, one for Loop 1, and one for SH 45 SE. These eight screenlines were used during the model validation process, but also provide insight to how each CTTS element's share of screenline traffic changes throughout the forecast period. The locations of these screenlines are shown in Figure 8.5.

Unadjusted model traffic is shown along these screenlines for 2016, 2018, 2020, 2030, and 2040. As shown in Table 8.1, Screenline 45N-A crosses SH 45 N at its western toll plaza and has a total screenline volume of approximately 239,000 in 2016 and grows to approximately 459,000 in 2040, or about 2.8 percent annually. SH 45 N maintains a fairly constant share of this screenline with 23.6 percent in 2016 and 24.6 percent in 2040. When New Hope Drive opens by 2020, it draws nearly 7 percent of the total screenline traffic off the other roadways, including about 3 percent from SH 45 N. FM 1431, a primary non-toll road competitor to SH 45 N, sees an increase in screenline share of about 2 percent in 2020 due to a roadway expansion. A new segment of Pearson Ranch Road, a feeder to Avery Ranch Boulevard, opens in 2020 causing the 2.5 percent increase in screenline share to Avery Ranch Boulevard. Additional capacity improvements in 2030 to Parmer Lane and RM 620, feeders to SH 45 N, impact the screenline distribution in that model year. Although Lakeline Boulevard is widened by 2040, which lowers the screenline share on several arterials in this screenline, improvements to SH 45 N feeders such as Howard Lane and McNeil Road increase the traffic share on SH 45 N in 2040.

As shown in Table 8.2, Screenline 45N-B crosses SH 45 N at its eastern toll plaza and carries much less traffic than the western end. In 2016, the total screenline traffic was approximately 187,000 and grows to approximately 309,000 in 2040, or about 2.1 percent compounded annually. SH 45 N's share of this screenline gradually increases throughout the forecast from nearly 23 percent in 2016 to over 28 percent in 2040 due to the opening of new Kenney Fort Boulevard segments in 2020 and 2030 and widening of Red Bud Lane in 2040, which both feed SH 45 N. Capacity improvements on Gattis School Road completed by 2040 draw an additional 2 percent of screenline traffic to the competing roadway over the forecast period.

Figure 8.5 CTTS Facility Screenline Locations

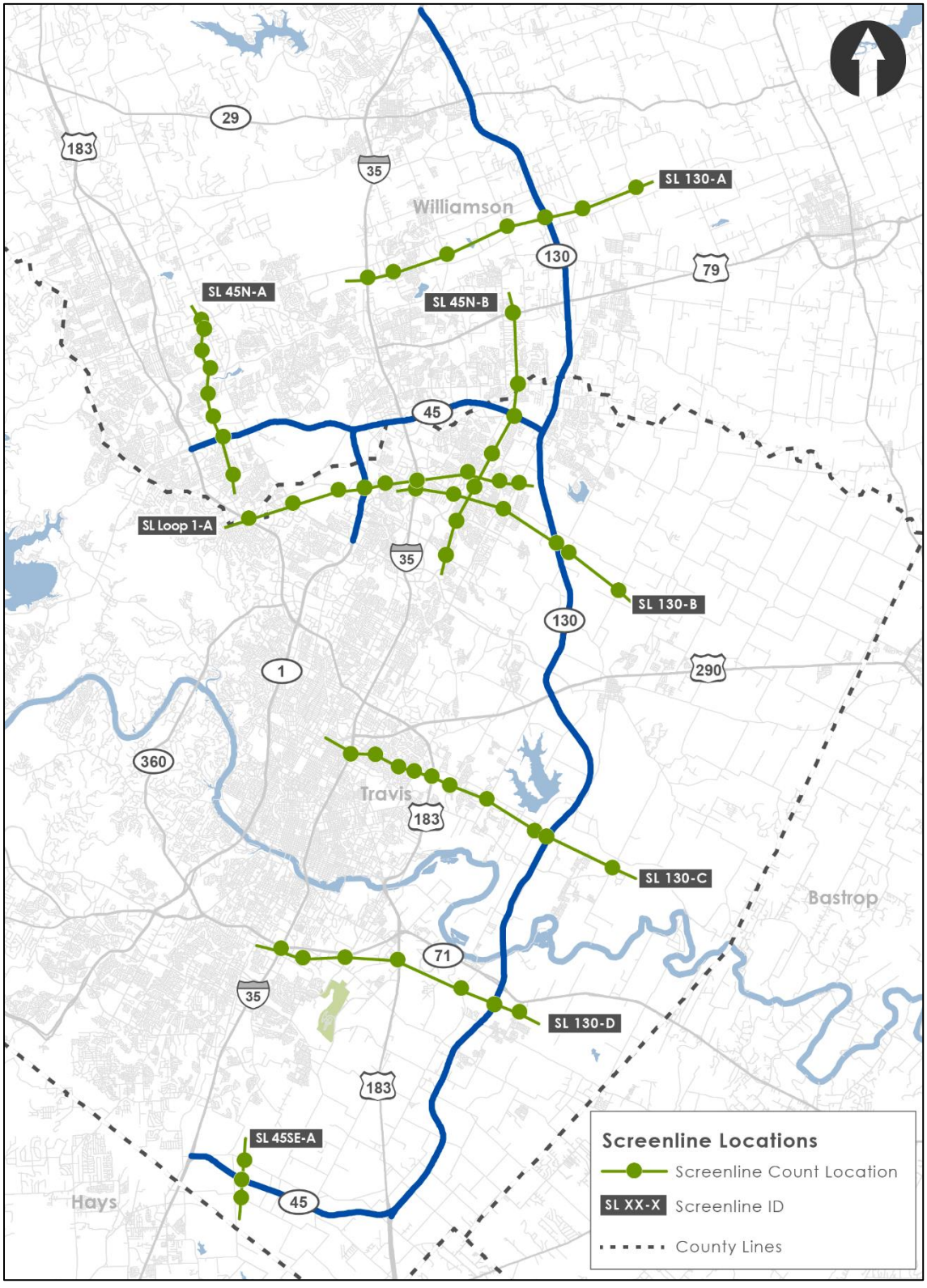


Table 8.1 Screenline 45N-A Unadjusted Model Output

Locations	2016	% of Screenline	2018	% of Screenline	2020	% of Screenline	2030	% of Screenline	2040	% of Screenline
New Hope Drive	NA		NA		19,636	6.7%	25,988	6.8%	24,493	5.3%
FM 1431	37,593	15.7%	32,808	13.2%	44,000	15.0%	49,410	12.9%	52,337	11.4%
Colonial Parkway	6,616	2.8%	6,077	2.5%	5,929	2.0%	10,828	2.8%	14,807	3.2%
Brushy Creek Rd.	22,252	9.3%	23,207	9.4%	21,386	7.3%	32,574	8.5%	34,271	7.5%
Avery Ranch Blvd.	23,036	9.6%	25,624	10.3%	37,646	12.8%	50,815	13.3%	37,662	8.2%
Lakeline Blvd.	12,465	5.2%	14,499	5.9%	8,067	2.8%	14,966	3.9%	35,180	7.7%
SH 45 NW ML	**56,337**	**23.6%**	**62,612**	**25.3%**	**65,828**	**22.4%**	**85,341**	**22.3%**	**113,064**	**24.6%**
SH 45 NW Frontage	30,080	12.6%	31,280	12.6%	35,411	12.0%	46,239	12.1%	49,019	10.7%
Anderson Mill Rd.	20,114	8.4%	19,822	8.0%	22,411	7.6%	26,161	6.8%	33,854	7.4%
McNeil Dr.	30,349	12.7%	31,792	12.8%	33,771	11.5%	39,985	10.5%	64,446	14.0%
TOTAL	**238,840**	**100.0%**	**247,721**	**100.0%**	**294,085**	**100.0%**	**382,306**	**100.0%**	**459,133**	**100.0%**

Table 8.2 Screenline 45N-B Unadjusted Model Output

Locations	2016	% of Screenline	2018	% of Screenline	2020	% of Screenline	2030	% of Screenline	2040	% of Screenline
US 79	32,660	17.4%	34,192	17.3%	30,427	15.3%	30,528	12.5%	38,325	12.4%
CR 168/Gattis School Rd.	17,547	9.4%	20,398	10.3%	21,018	10.6%	23,680	9.7%	34,540	11.2%
SH 45 NE ML	**42,891**	**22.9%**	**45,842**	**23.1%**	**49,112**	**24.7%**	**63,298**	**25.9%**	**87,823**	**28.4%**
SH 45 NE Frontage	13,376	7.1%	11,539	5.8%	11,888	6.0%	14,406	5.9%	22,723	7.4%
Pflugerville Loop Rd.	20,242	10.8%	21,672	10.9%	22,305	11.2%	33,016	13.5%	29,783	9.6%
FM 1825/Pecan St.	17,800	9.5%	18,692	9.4%	19,370	9.7%	22,806	9.3%	22,019	7.1%
Wells Branch Pkwy	20,081	10.7%	21,382	10.8%	22,627	11.4%	27,773	11.4%	39,923	12.9%
Howard Lane	22,781	12.2%	24,434	12.3%	22,429	11.3%	28,848	11.8%	33,986	11.0%
TOTAL	**187,379**	**100.0%**	**198,151**	**100.0%**	**199,175**	**100.0%**	**244,356**	**100.0%**	**309,122**	**100.0%**

As shown in Table 8.3, Screenline Loop 1-A crosses Loop 1 at the mainline plaza south of McNeil Drive as well as other major roadways including US 183, IH-35, and SH 130 with total traffic of approximately 655,000 in 2016 and growing at 1.7 percent annually to approximately 976,000 in 2040. IH-35 and US 183 have the highest share of traffic of about 30 percent each in 2016, then decreasing slightly in 2020 with the opening of the MoPac N Express Lanes in 2017, a feeder to Loop 1. The 183N Express Lanes open by 2030 and may attract over 6 percent of the screenline traffic, drawing traffic from all roads except SH 130 which is expected to be widened by 2021. A widening project along McNeil Drive and new segment of Anderson Mill Road occur by 2040 causing Loop 1's screenline share to increase to 13.0 percent.

Table 8.3 Screenline Loop 1-A Unadjusted Model Output

Locations	2016	% of Screenline	2018	% of Screenline	2020	% of Screenline	2030	% of Screenline	2040	% of Screenline
US 183	195,678	29.9%	200,017	29.2%	206,142	28.8%	222,949	26.1%	243,852	25.0%
183N Express Lanes	NA		NA		NA		56,246	6.6%	69,508	7.1%
Parmer Lane	44,836	6.8%	46,245	6.8%	46,531	6.5%	50,901	6.0%	46,514	4.8%
Howard Lane	22,336	3.4%	22,305	3.3%	24,515	3.4%	26,748	3.1%	31,782	3.3%
FM 1325/Loop 1 Frontage	10,447	1.6%	12,187	1.8%	13,556	1.9%	16,645	2.0%	19,672	2.0%
Loop 1 Mainline Plaza	**69,817**	**10.7%**	**77,579**	**11.3%**	**87,327**	**12.2%**	**102,006**	**12.0%**	**131,176**	**13.4%**
Bratton Lane	10,201	1.6%	10,737	1.6%	11,543	1.6%	12,595	1.5%	13,060	1.3%
IH-35	192,710	29.4%	195,437	28.6%	200,658	28.1%	214,055	25.1%	250,529	25.7%
Heatherwilde Blvd	15,866	2.4%	21,774	3.2%	23,661	3.3%	27,844	3.3%	32,785	3.4%
N Railroad Rd	6,272	1.0%	8,687	1.3%	9,146	1.3%	11,196	1.3%	4,782	0.5%
FM 685	34,944	5.3%	34,146	5.0%	31,956	4.5%	34,240	4.0%	31,428	3.2%
SH 130	51,533	7.9%	54,743	8.0%	59,578	8.3%	77,431	9.1%	100,524	10.3%
TOTAL	**654,640**	**100.0%**	**683,857**	**100.0%**	**714,612**	**100.0%**	**852,856**	**100.0%**	**975,612**	**100.0%**

8.1.3 SH 45 N and Loop 1 Traffic and Revenue Assumptions

Table 8.4 and Table 8.5 provide concise summaries of the underlying assumptions in the transaction and revenue forecasts for SH 45 N and Loop 1, respectively. All truck-related values in the table relate to trucks defined as 3+ axle vehicles, consistent with the transaction reports generated for each toll road by TxDOT. On both roadways, estimated truck transactions are constant throughout the forecast period with 3.0 percent on SH 45 N and 1.7 percent on Loop 1. Auto ETC payment shares are assumed to remain relatively constant at about 72 percent. Truck ETC percentages are assumed to be slightly lower at 67 to 71 percent. The average truck toll multiplier, which reflects the observed distribution of trucks by axle group, varies slightly between payment types but ranges between 2.86 and 2.98 on SH 45 N and between 2.79 and 3.00 on Loop 1. The PBM toll surcharge is assumed to remain at 33 percent of the ETC rate. The collection rates for PBM and ETC transactions reflect the latest available collection data provided by TxDOT and are held constant over the forecast period.

A full-length trip using ETC on SH 45 N costs $2.18 in 2018, and by 2040, the toll for the same trip increases to $3.92. The per mile rate for the 12.8-mile full-length trip is $0.17 in 2018, increasing to $0.31 in 2040. On Loop 1, a full-length trip costs $1.09 in 2018 for ETC transactions but will increase to $1.96 in 2040. The per mile rate on Loop 1 for a full-length trip of four miles is $0.27 in 2018 and will increase to $0.49 in 2040.

Table 8.4 SH 45 N Tolling and Traffic Characteristic Assumptions by Model Year

Model Year	2018	2020	2030	2040
Vehicle Type Distribution				
Autos	97.0%	97.0%	97.0%	97.0%
Trucks	3.0%	3.0%	3.0%	3.0%
Payment Type Distribution - Passenger Cars				
PBM	27.7%	27.7%	27.5%	27.5%
ETC	72.3%	72.3%	72.5%	72.5%
Payment Type Distribution - Trucks				
PBM	27.7%	29.0%	28.9%	28.9%
ETC	72.3%	71.0%	71.1%	71.1%
Toll Ratios				
Truck/Auto Ratio - ETC	2.86	2.86	2.86	2.86
Truck/Auto Ratio - PBM	2.98	2.98	2.98	2.98
PBM/ETC Toll Rate	1.33	1.33	1.33	1.33
Collection Rates				
PBM	51.1%	51.1%	51.1%	51.1%
ETC	99.3%	99.3%	99.3%	99.3%
Full Length Trip				
Distance	12.8	12.8	12.8	12.8
Rate per Mile	$0.17	$0.18	$0.23	$0.31
Toll Cost (ETC)	$2.18	$2.28	$2.94	$3.92
Annualization Factor	320	320	320	320

Table 8.5 Loop 1 Tolling and Traffic Characteristic Assumptions by Model Year

Model Year	2018	2020	2030	2040
Vehicle Type Distribution				
Autos	98.3%	98.3%	98.3%	98.3%
Trucks	1.7%	1.7%	1.7%	1.7%
Payment Type Distribution - Passenger Cars				
PBM	27.8%	28.0%	27.9%	27.9%
ETC	72.2%	72.0%	72.1%	72.1%
Payment Type Distribution - Trucks				
PBM	31.0%	32.4%	31.4%	31.4%
ETC	69.0%	67.6%	68.6%	68.6%
Toll Ratios				
Truck/Auto Ratio - ETC	2.79	2.79	2.79	2.79
Truck/Auto Ratio - PBM	3.00	3.00	3.00	3.00
PBM/ETC Toll Rate	1.33	1.33	1.33	1.33
Collection Rates				
PBM	51.1%	51.1%	51.1%	51.1%
ETC	99.3%	99.3%	99.3%	99.3%
Full Length Trip				
Distance	4.0	4.0	4.0	4.0
Rate per Mile	$0.27	$0.29	$0.37	$0.49
Toll Cost (ETC)	$1.09	$1.14	$1.47	$1.96
Annualization Factor	320	320	320	320

8.1.4 SH 45 N and Loop 1 Transactions and Revenue by Pay Point

The SH 45 N and Loop 1 transaction and revenue statistics by pay point and horizon year are listed in Table 8.6. Both total and paying transactions are provided, where paying transactions reflect the assumptions for collection efficiency for each payment type discussed above. The average toll rates represent a blend of the individual rates by payment type and vehicle type. These blended values include a 33 percent surcharge over the ETC rates for PBM patrons. The values shown are calendar year values, rather than the blended estimates created for each fiscal year shown in the next section.

Total transactions for an average weekday on SH 45 N range from 149,000 in 2016 to 259,000 in 2040, while total paying transactions range from 128,000 in 2016 to 223,000 in 2040, representing an average annual growth rate of 2.3 percent. During the same time period, average weekday revenues range from $141,000 to $459,000, for a growth rate of 5.0 percent, representing transaction growth as well as annual toll rate escalation.

Total transactions for an average weekday on Loop 1 range from 74,000 in 2016 to 126,000 in 2040, while total paying transactions range from 64,000 in 2016 to 108,000 in 2040, representing an average annual growth rate of 2.2 percent. During the same timeframe, average weekday revenue ranges from $71,000 to $223,000 for a growth rate of 4.9 percent.

Table 8.6 SH 45 N and Loop 1 Average Weekday Transactions and Toll Revenue (Adjusted for Calibration)

Toll Location	2016				2018				2020				2030				2040			
	Transactions		Avg. Toll	Revenue	Transactions		Avg. Toll	Revenue	Transactions		Avg. Toll	Revenue	Transactions		Avg. Toll	Revenue	Transactions		Avg. Toll	Revenue
	Total	Paying			Total	Paying			Total	Paying			Total	Paying			Total	Paying		
SH 45 N																				
Lake Creek ML Plaza	**51,312**	**44,048**	**$ 1.18**	**$ 51,851**	**53,908**	**46,337**	**$ 1.21**	**$ 56,261**	**56,677**	**48,714**	**$ 1.27**	**$ 61,850**	**73,200**	**62,967**	**$ 1.64**	**$103,054**	**86,931**	**74,779**	**$ 2.18**	**$163,182**
Parmer Ln (FM 734) Ramps	9,488	8,145	$ 1.01	$ 8,231	9,258	7,958	$ 1.05	$ 8,332	8,550	7,348	$ 1.09	$ 8,021	10,170	8,749	$ 1.40	$ 12,273	12,648	10,880	$ 1.88	$ 20,471
RM 620 (Howard Ln) Ramps	2,494	2,141	$ 1.01	$ 2,164	3,807	3,272	$ 1.05	$ 3,426	7,777	6,684	$ 1.09	$ 7,296	8,541	7,347	$ 1.40	$ 10,307	14,847	12,772	$ 1.88	$ 24,031
O'Connor Dr (SH 45 N) Ramps	3,640	3,125	$ 1.03	$ 3,227	7,466	6,417	$ 1.07	$ 6,863	7,548	6,487	$ 1.11	$ 7,225	9,017	7,756	$ 1.44	$ 11,140	10,095	8,684	$ 1.91	$ 16,630
O'Connor Dr (Loop 1) Ramps	6,459	5,545	$ 1.03	$ 5,727	3,781	3,250	$ 1.07	$ 3,475	5,155	4,431	$ 1.11	$ 4,935	5,782	4,974	$ 1.44	$ 7,143	8,111	6,977	$ 1.91	$ 13,361
Greenlawn Ramps	8,404	7,215	$ 0.78	$ 5,608	8,574	7,370	$ 0.80	$ 5,911	9,263	7,962	$ 0.84	$ 6,650	10,659	9,169	$ 1.08	$ 9,902	11,526	9,915	$ 1.44	$ 14,240
AW Grimes Ramps	10,988	9,433	$ 0.78	$ 7,333	11,468	9,857	$ 0.80	$ 7,906	10,888	9,359	$ 0.84	$ 7,817	13,101	11,270	$ 1.08	$ 12,171	14,273	12,278	$ 1.44	$ 17,634
Schultz Ln (Arterial A) Ramps	4,795	4,116	$ 1.18	$ 4,845	5,436	4,673	$ 1.21	$ 5,673	8,607	7,397	$ 1.27	$ 9,392	10,683	9,190	$ 1.64	$ 15,041	13,556	11,661	$ 2.18	$ 25,447
Wilke Ln (Heatherwilde) Ramps	8,634	7,412	$ 1.18	$ 8,724	9,190	7,899	$ 1.21	$ 9,591	9,434	8,108	$ 1.27	$ 10,295	9,809	8,438	$ 1.64	$ 13,810	8,830	7,596	$ 2.18	$ 16,575
Heatherwilde ML Plaza	**42,893**	**36,821**	**$ 1.18**	**$ 43,344**	**45,991**	**39,532**	**$ 1.21**	**$ 47,999**	**49,271**	**42,349**	**$ 1.27**	**$ 53,769**	**62,805**	**54,026**	**$ 1.64**	**$ 88,421**	**78,682**	**67,683**	**$ 2.18**	**$147,697**
SH 45 N Subtotal	**149,109**	**128,001**		**$141,053**	**158,879**	**136,565**		**$155,438**	**173,170**	**148,840**		**$177,250**	**213,768**	**183,886**		**$283,263**	**259,499**	**223,225**		**$459,268**
Annual Revenue in Millions				**$ 45.1**				**$ 49.7**				**$ 56.7**				**$ 90.6**				**$ 147.0**
Loop 1																				
Shoreline Dr Ramps	964	833	$ 0.76	$ 633	1,030	885	$ 0.78	$ 693	1,169	1,003	$ 0.82	$ 818	2,195	1,884	$ 1.05	$ 1,987	3,214	2,758	$ 1.40	$ 3,870
Merrilltown ML Plaza	**67,422**	**58,272**	**$ 1.15**	**$ 66,992**	**75,550**	**64,893**	**$ 1.19**	**$ 76,903**	**81,895**	**70,232**	**$ 1.24**	**$ 87,093**	**95,661**	**82,093**	**$ 1.60**	**$131,245**	**114,078**	**97,897**	**$ 2.13**	**$208,683**
Howard Ln/Wells Branch Ramps	5,594	4,835	$ 0.76	$ 3,671	6,377	5,477	$ 0.78	$ 4,288	7,101	6,090	$ 0.82	$ 4,968	6,926	5,943	$ 1.05	$ 6,270	8,570	7,355	$ 1.40	$ 10,319
Loop 1 Subtotal	**73,980**	**63,940**		**$ 71,296**	**82,957**	**71,255**		**$ 81,883**	**90,166**	**77,324**		**$ 92,880**	**104,782**	**89,920**		**$139,502**	**125,863**	**108,010**		**$222,871**
Annual Revenue in Millions				**$ 22.8**				**$ 26.2**				**$ 29.7**				**$ 44.6**				**$ 71.3**
TOTAL (SH 45 N and Loop 1)																				
Total	**223,089**	**191,940**		**$212,349**	**241,836**	**207,820**		**$237,321**	**263,337**	**226,164**		**$270,130**	**318,550**	**273,806**		**$422,765**	**385,362**	**331,235**		**$682,139**
Annual Revenue in Millions				**$ 68.0**				**$ 75.9**				**$ 86.4**				**$ 135.3**				**$ 218.3**

Notes: [1] The average toll is calculated by Revenue divided by Paying Transactions.

8.1.5 SH 45 N and Loop 1 Traffic and Revenue Forecasts

Table 8.7 and Table 8.8 provide the forecasted transactions and revenue for the entire 35-year forecast period on a fiscal year basis for SH 45 N and Loop 1, respectively. Average Weekday Traffic (AWT) statistics are provided on the left side of the table, and annual values are provided on the right side along with statistics related to truck traffic. The values for FY 2008 to FY 2017 are the observed transactions and reported revenue for the first ten years of operation. While TxDOT reports transactions in the fiscal year in which they occur, annual revenue is based on the fiscal year in which it is collected. The revenue collected in each fiscal year varies due to the delay in receipt of PBM tolls, the collection efficiency of the PBM transactions, as well as other adjustments implemented by TxDOT. In contrast, the model forecasts assume that transactions and revenue occur simultaneously and therefore do not reflect the lagging pattern of PBM toll revenue receipts.

As shown in Table 8.7, SH 45 N shows an initially steady transaction growth between 2.0 and 4.6 percent until 2024, consistent with the more recently slowing growth in FY 2017 of 5.6 percent. The lower growth in 2024 is likely due to the opening of 183N Express Lanes. For the rest of the forecast period, SH 45 N transaction growth is expected to gradually taper off from 2.3 percent in 2026 to 1.5 percent in 2042. SH 45 N shows similar patterns in revenue growth after FY 2026, ranging from 4.5 to 5.1 percent. The assumed share of paying transactions is relatively constant at approximately 86 percent, as is the combined ETC share (autos and trucks) at approximately 72 percent. Trucks are approximately 3 percent of transactions in FY 2018 and remain constant over the forecast period. Truck revenue shares are also constant at about 8 percent of the total revenue.

As shown in Table 8.8, the recent opening of the MoPac N Express Lanes is expected to cause higher transaction and revenue growth on Loop 1 in FY 2018. In FY 2024, Loop 1 shows a decrease in transactions of 1.3 percent and lower revenue growth of 1.0 percent due to the opening of the 183N Express Lanes which run parallel to Loop 1. For the rest of the forecast period, the road shows steady transaction growth between 1.5 and 2.5 percent. Loop 1 also shows steady revenue growth throughout the forecast between 4.5 and 5.2 percent. The combined ETC share is generally constant at 72 percent. The assumed share of paying transactions is also constant at approximately 86 percent. Trucks are approximately 1.7 percent of transactions throughout the forecast period. The truck revenue share of total revenue is approximately 4.6 percent throughout the forecast.

Table 8.7 SH 45 N Transaction and Revenue Forecasts

Fiscal Year	Average Weekday Transactions (AWT)					Annual Transactions & Revenue					
	Total Transactions (1)	YOY Growth	Total Transactions ETC Share	Paying Transactions (2)	Paying Percentage (2)/(1)	Annual Total Transactions ('000)	Annual Paying Transactions ('000)	Annual Revenue (in $000s)	YOY Growth	Truck Share	
										Paying Transactions	Revenue
2008	***91,057***			*84,058*	*92%*	***29,458***	*27,194*	*$17,987*			
2009	***96,071***	***5.5%***	***77.0%***	*88,687*	*92%*	***31,270***	*28,866*	*$19,882*	***10.5%***		
2010	***98,446***	***2.5%***	***77.8%***	*90,879*	*92%*	***32,167***	*29,694*	***$19,799***	***-0.4%***		
2011	***102,344***	***4.0%***	***75.5%***	*94,478*	*92%*	***33,543***	*30,965*	***$20,268***	***2.4%***		
2012	***109,179***	***6.7%***	***75.9%***	*100,302*	*92%*	***35,790***	*32,880*	***$21,945***	***8.3%***		
2013	***113,674***	***4.1%***	***77.6%***	*100,665*	*89%*	***37,126***	*32,878*	***$29,075***	***32.5%***		
2014	***116,802***	***2.8%***	***75.6%***	*101,640*	*87%*	***38,256***	*33,290*	***$34,831***	***19.8%***		
2015	***131,193***	***12.3%***	***74.2%***	*114,954*	*88%*	***42,686***	*37,402*	***$38,957***	***11.8%***		
2016	***145,611***	***11.0%***	***69.5%***	*123,185*	*85%*	***47,447***	*40,140*	***$42,731***	***9.7%***		
2017	***153,791***	***5.6%***	***70.5%***	*129,682*	*84%*	***49,790***	*41,985*	***$45,496***	***6.5%***		
2018	158,634	3.1%	71.4%	134,855	85%	50,763	43,153	$47,793	5.0%	2.9%	5.7%
2019	163,040	2.8%	72.3%	140,095	86%	52,173	44,830	$51,685	8.1%	3.0%	8.2%
2020	170,487	4.6%	72.3%	146,513	86%	54,556	46,884	$55,366	7.1%	3.0%	8.2%
2021	177,229	4.0%	72.3%	152,303	86%	56,713	48,737	$59,126	6.8%	3.0%	8.2%
2022	180,829	2.0%	72.3%	155,392	86%	57,865	49,725	$61,619	4.2%	3.0%	8.2%
2023	185,281	2.5%	72.3%	159,232	86%	59,290	50,954	$64,593	4.8%	3.0%	8.2%
2024	187,479	1.2%	72.4%	161,198	86%	59,993	51,583	$66,993	3.7%	3.0%	8.2%
2025	190,783	1.8%	72.4%	164,075	86%	61,050	52,504	$69,864	4.3%	3.0%	8.2%
2026	195,200	2.3%	72.4%	167,880	86%	62,464	53,722	$73,406	5.1%	3.0%	8.2%
2027	199,485	2.2%	72.4%	171,574	86%	63,835	54,904	$77,129	5.1%	3.0%	8.2%
2028	203,770	2.1%	72.4%	175,268	86%	65,206	56,086	$81,003	5.0%	3.0%	8.2%
2029	208,055	2.1%	72.4%	178,961	86%	66,578	57,268	$85,034	5.0%	3.0%	8.2%
2030	212,340	2.1%	72.4%	182,655	86%	67,949	58,450	$89,228	4.9%	3.0%	8.2%
2031	216,817	2.1%	72.5%	186,509	86%	69,381	59,683	$93,749	5.1%	3.0%	8.2%
2032	221,390	2.1%	72.5%	190,443	86%	70,845	60,942	$98,537	5.1%	3.0%	8.2%
2033	225,963	2.1%	72.5%	194,376	86%	72,308	62,200	$103,525	5.1%	3.0%	8.2%
2034	230,536	2.0%	72.5%	198,310	86%	73,772	63,459	$108,721	5.0%	3.0%	8.2%
2035	235,110	2.0%	72.5%	202,244	86%	75,235	64,718	$114,133	5.0%	3.0%	8.2%
2036	239,683	1.9%	72.5%	206,178	86%	76,698	65,977	$119,770	4.9%	3.0%	8.2%
2037	244,256	1.9%	72.5%	210,112	86%	78,162	67,236	$125,638	4.9%	3.0%	8.2%
2038	248,829	1.9%	72.5%	214,046	86%	79,625	68,495	$131,748	4.9%	3.0%	8.2%
2039	253,402	1.8%	72.5%	217,980	86%	81,089	69,753	$138,109	4.8%	3.0%	8.2%
2040	257,975	1.8%	72.5%	221,913	86%	82,552	71,012	$144,730	4.8%	3.0%	8.2%
2041	262,094	1.6%	72.5%	225,457	86%	83,870	72,146	$151,419	4.6%	3.0%	8.2%
2042	266,026	1.5%	72.5%	228,839	86%	85,128	73,228	$158,301	4.5%	3.0%	8.2%

Notes: (1) Revenue for PBM patrons was not allocated by each toll facility until September 2009; therefore, annual revenues shown for FY 2008 - FY 2009 are estimated.
(2) ***Actual Average Weekday Transactions and Annual Revenue (FY 2008 – FY 2017)***

Table 8.8 Loop 1 Transaction and Revenue Forecasts

Fiscal Year	Average Weekday Transactions (AWT)					Annual Transactions & Revenue					
	Total Transactions (1)	YOY Growth	Total Transactions ETC Share	Paying Transactions (2)	Paying Percentage (2)/(1)	Annual Total Transactions ('000)	Annual Paying Transactions ('000)	Annual Revenue (in $000s)	YOY Growth	Truck Share	
										Paying Transactions	Revenue
2008	***54,770***			*50,560*	*92%*	***17,195***	*15,873*	*$11,463*			
2009	***55,106***	***0.6%***	***78.0%***	*50,871*	*92%*	***17,381***	*16,045*	*$11,918*	***4.0%***		
2010	***56,900***	***3.3%***	***78.0%***	*52,527*	*92%*	***18,064***	*16,676*	***$11,937***	***0.2%***		
2011	***59,132***	***3.9%***	***76.4%***	*54,587*	*92%*	***18,883***	*17,432*	***$12,317***	***3.2%***		
2012	***62,275***	***5.3%***	***76.2%***	*57,291*	*92%*	***19,890***	*18,298*	***$13,015***	***5.7%***		
2013	***61,885***	***-0.6%***	***78.4%***	*55,032*	*89%*	***19,715***	*17,532*	***$16,143***	***24.0%***		
2014	***61,894***	***0.0%***	***76.4%***	*54,116*	*87%*	***19,839***	*17,346*	***$18,560***	***15.0%***		
2015	***67,189***	***8.6%***	***73.4%***	*58,650*	*87%*	***21,468***	*18,740*	***$20,459***	***10.2%***		
2016	***72,191***	***7.4%***	***70.3%***	*61,360*	*85%*	***23,191***	*19,712*	***$21,726***	***6.2%***		
2017	***77,220***	***7.0%***	***71.3%***	*65,440*	*85%*	***24,727***	*20,955*	***$23,349***	***7.5%***		
2018	82,286	6.6%	71.9%	70,161	85%	26,331	22,452	$25,221	8.0%	1.6%	3.2%
2019	85,316	3.7%	72.1%	73,241	86%	27,301	23,437	$27,281	8.2%	1.7%	4.6%
2020	88,943	4.3%	71.9%	76,294	86%	28,462	24,414	$29,088	6.6%	1.7%	4.6%
2021	91,341	2.7%	71.9%	78,321	86%	29,229	25,063	$30,638	5.3%	1.7%	4.6%
2022	92,785	1.6%	71.9%	79,550	86%	29,691	25,456	$31,759	3.7%	1.7%	4.6%
2023	94,083	1.4%	71.7%	80,590	86%	30,106	25,789	$32,916	3.6%	1.6%	4.6%
2024	92,820	-1.3%	71.7%	79,519	86%	29,702	25,446	$33,256	1.0%	1.6%	4.6%
2025	93,253	0.5%	71.9%	79,948	86%	29,841	25,583	$34,254	3.0%	1.6%	4.6%
2026	95,346	2.2%	71.9%	81,768	86%	30,511	26,166	$35,983	5.0%	1.7%	4.6%
2027	97,523	2.3%	71.9%	83,649	86%	31,207	26,768	$37,851	5.2%	1.7%	4.6%
2028	99,701	2.2%	72.0%	85,531	86%	31,904	27,370	$39,796	5.1%	1.7%	4.6%
2029	101,879	2.2%	72.0%	87,412	86%	32,601	27,972	$41,821	5.1%	1.7%	4.6%
2030	104,056	2.1%	72.0%	89,293	86%	33,298	28,574	$43,929	5.0%	1.7%	4.6%
2031	106,187	2.0%	72.0%	91,126	86%	33,980	29,160	$46,118	5.0%	1.7%	4.6%
2032	108,295	2.0%	72.0%	92,935	86%	34,655	29,739	$48,394	4.9%	1.7%	4.6%
2033	110,404	1.9%	72.0%	94,744	86%	35,329	30,318	$50,763	4.9%	1.7%	4.6%
2034	112,512	1.9%	72.0%	96,553	86%	36,004	30,897	$53,229	4.9%	1.7%	4.6%
2035	114,620	1.9%	72.0%	98,362	86%	36,678	31,476	$55,795	4.8%	1.7%	4.6%
2036	116,728	1.8%	72.0%	100,171	86%	37,353	32,055	$58,465	4.8%	1.7%	4.6%
2037	118,836	1.8%	72.0%	101,980	86%	38,027	32,634	$61,243	4.8%	1.7%	4.6%
2038	120,944	1.8%	72.0%	103,789	86%	38,702	33,213	$64,132	4.7%	1.7%	4.6%
2039	123,052	1.7%	72.0%	105,598	86%	39,377	33,791	$67,138	4.7%	1.7%	4.6%
2040	125,160	1.7%	72.0%	107,407	86%	40,051	34,370	$70,263	4.7%	1.7%	4.6%
2041	127,121	1.6%	72.0%	109,090	86%	40,679	34,909	$73,480	4.6%	1.7%	4.6%
2042	129,028	1.5%	72.0%	110,727	86%	41,289	35,433	$76,819	4.5%	1.7%	4.6%

Notes: (1) Revenue for PBM patrons was not allocated by each toll facility until September 2009; therefore, annual revenues shown for FY 2008 - FY 2009 are estimated.
(2) ***Actual Average Weekday Transactions and Annual Revenue (FY 2008 – FY 2017)***

8.2 SH 130

As noted in the discussion of SH 45 N and Loop 1, the toll diversion model produces traffic estimates for several model years including: 2018 to 2025, 2030, and 2040. The initial model forecasts for SH 130 have been adjusted by post-processing to account for variations in the base year model calibration estimates and other minor variations in future trends. Gross revenue estimates were then prepared by multiplying the traffic, in terms of transactions, at the toll locations by the effective toll structure by vehicle type and payment type for each year. Adjustments were included to reflect the effective collection rates for both ETC and PBM transactions. Annual estimates of transactions and revenue for SH 130 were generated using an annualization factor of 325.

8.2.1 SH 130 Schematic Traffic Diagrams

Figure 8.6 through Figure 8.9 display the traffic along the individual segments of SH 130 for the model (calendar) years 2016, 2020, 2030, and 2040. These diagrams represent the unadjusted model outputs for average weekday transactions and are intended to provide the reader a sense of the scale of the traffic volumes across the entire facility as well as the entry/exit points. An approximation of the estimated growth for various segments of the roadway can be determined by reviewing these diagrams across the individual horizon years.

Figure 8.6 SH 130 Average Weekday Traffic – 2016 Model Calibration Year (Unadjusted Model Output)

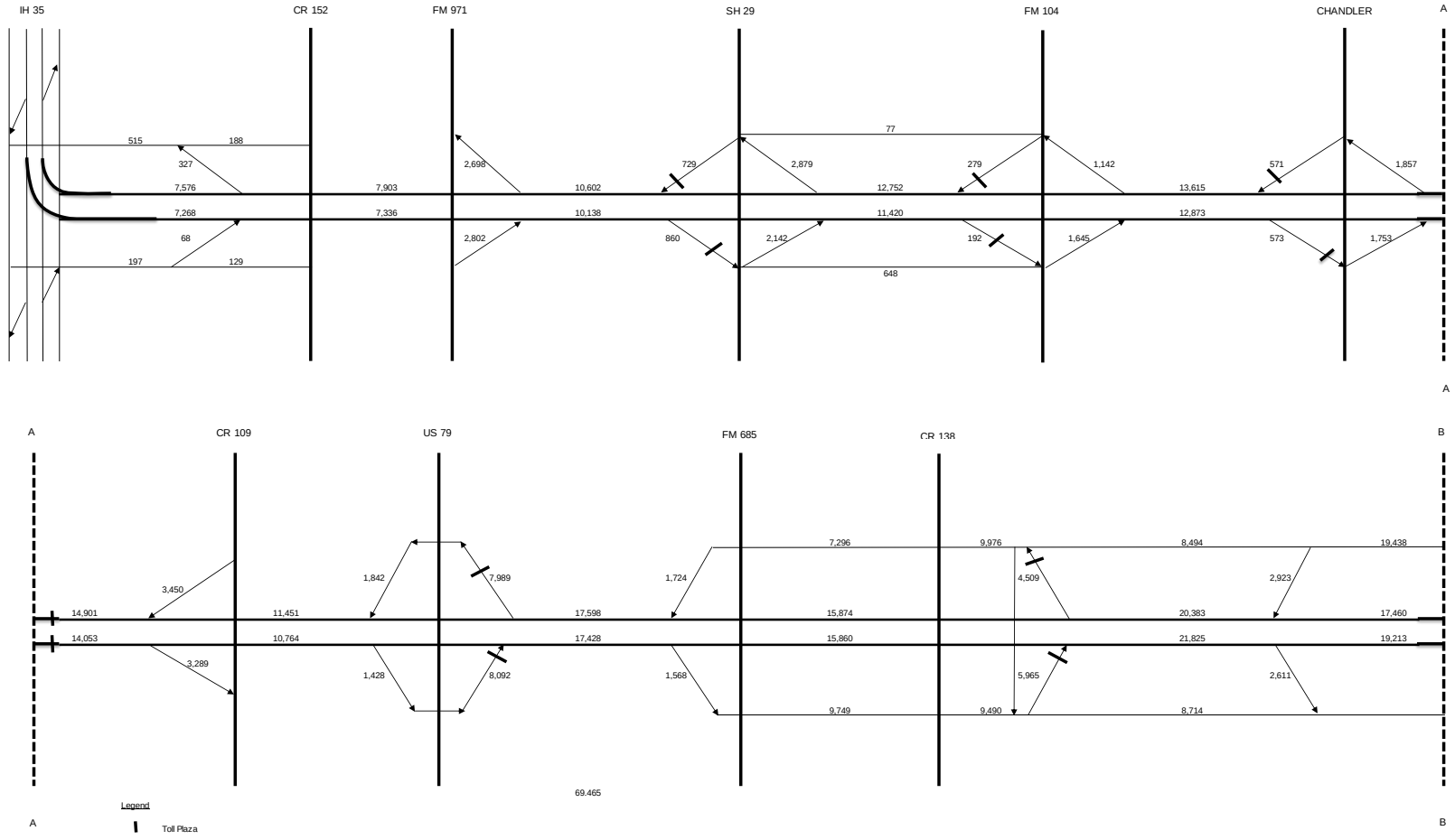


Figure 8.6 SH 130 Average Weekday Traffic – 2016 Model Calibration Year (Unadjusted Model Output) (continued)

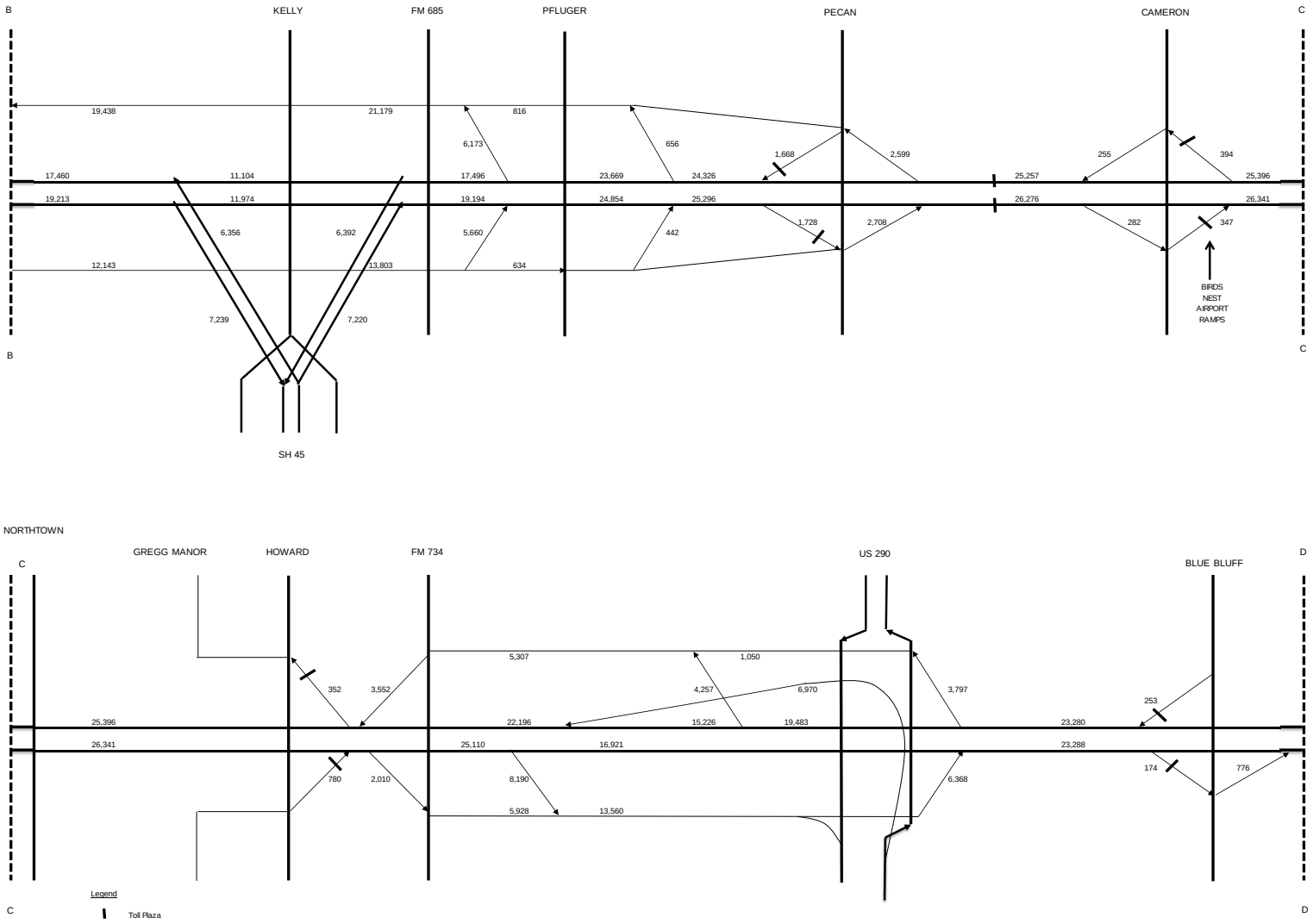


Figure 8.6 SH 130 Average Weekday Traffic – 2016 Model Calibration Year (Unadjusted Model Output) (continued)

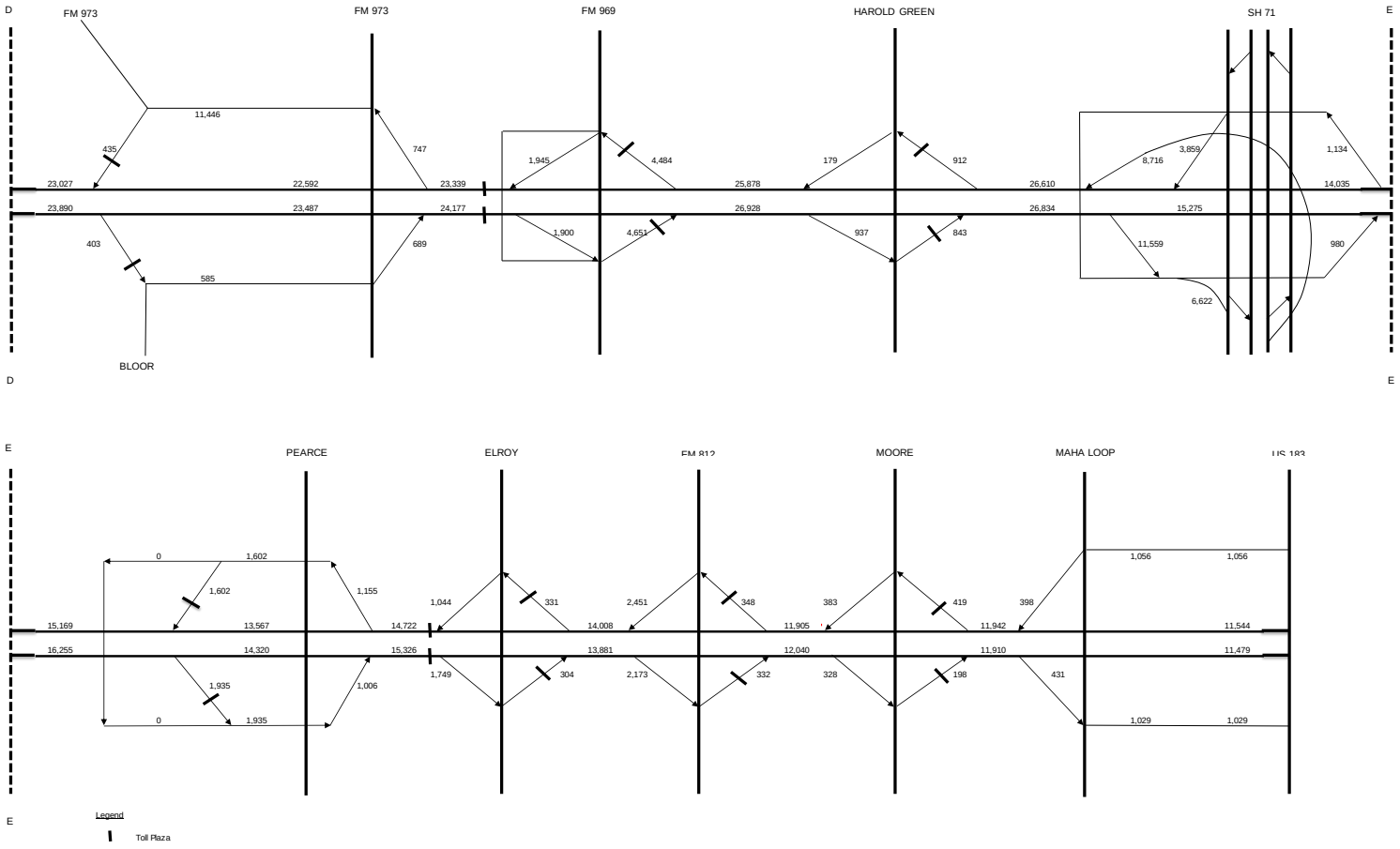


Figure 8.7 SH 130 Average Weekday Traffic – 2020 Model Year (Unadjusted Model Output)

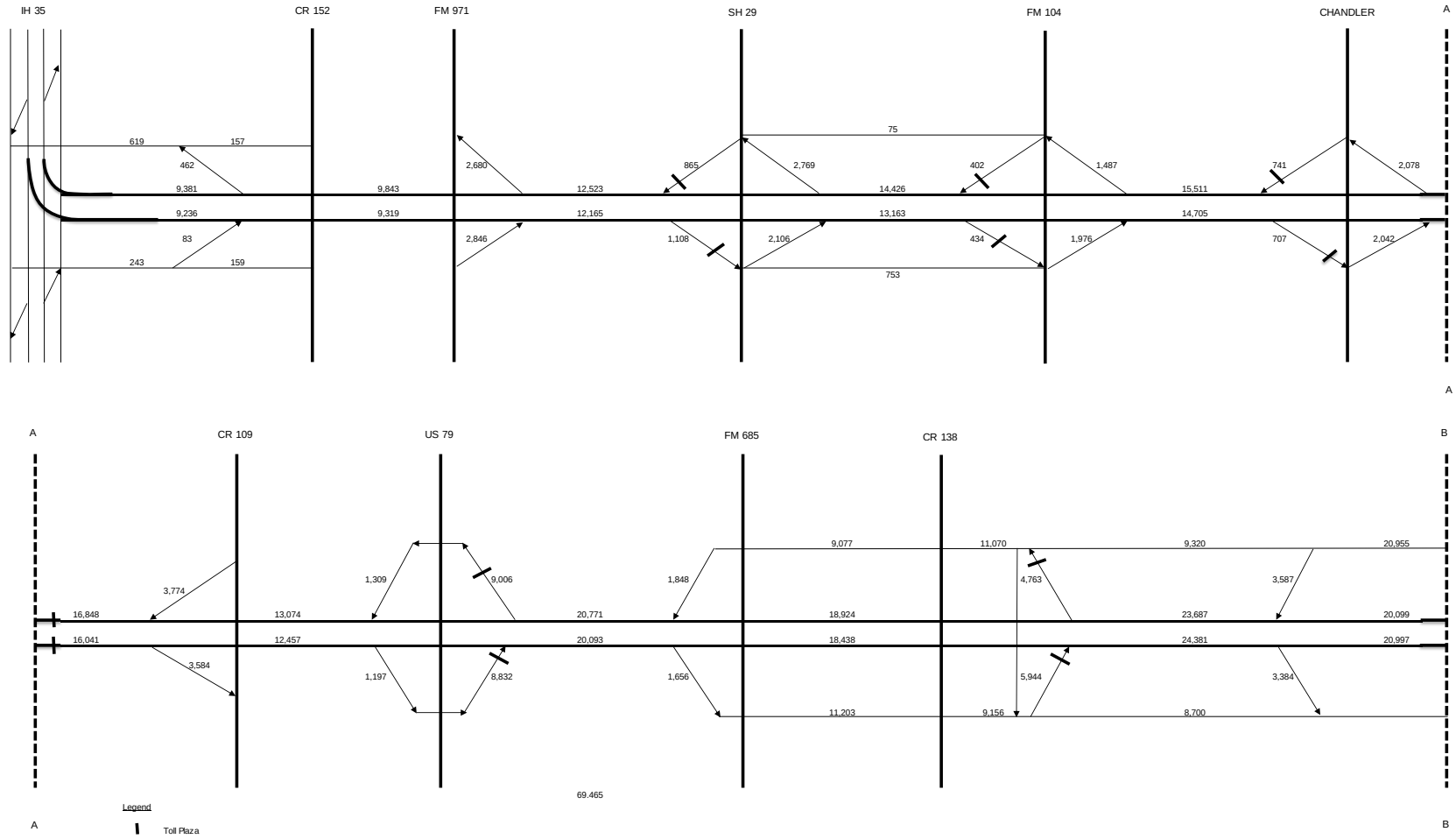


Figure 8.7 SH 130 Average Weekday Traffic – 2020 Model Year (Unadjusted Model Output) (continued)

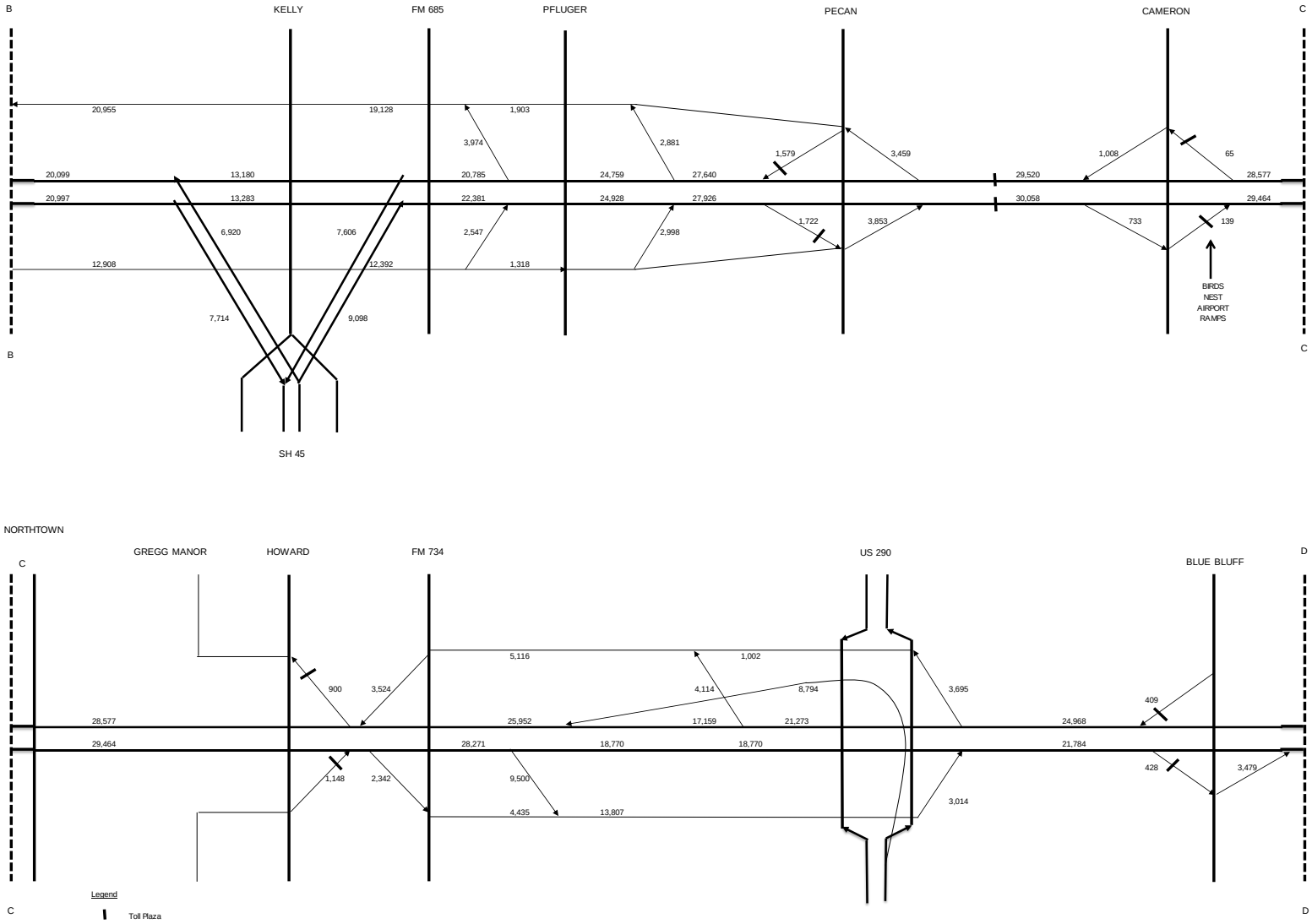


Figure 8.7 SH 130 Average Weekday Traffic – 2020 Model Year (Unadjusted Model Output) (continued)

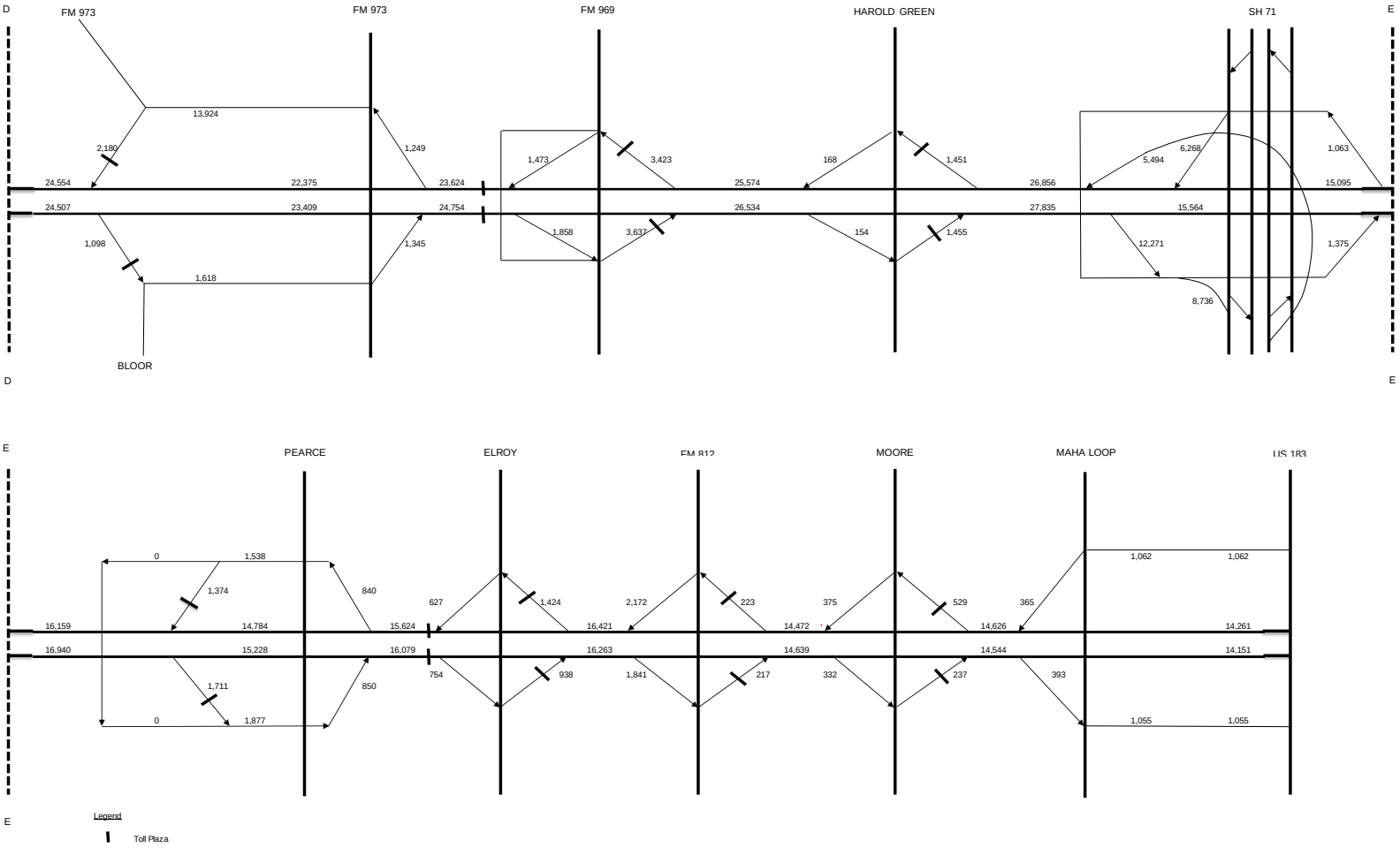


Figure 8.8 SH 130 Average Weekday Traffic – 2030 Model Year (Unadjusted Model Output)

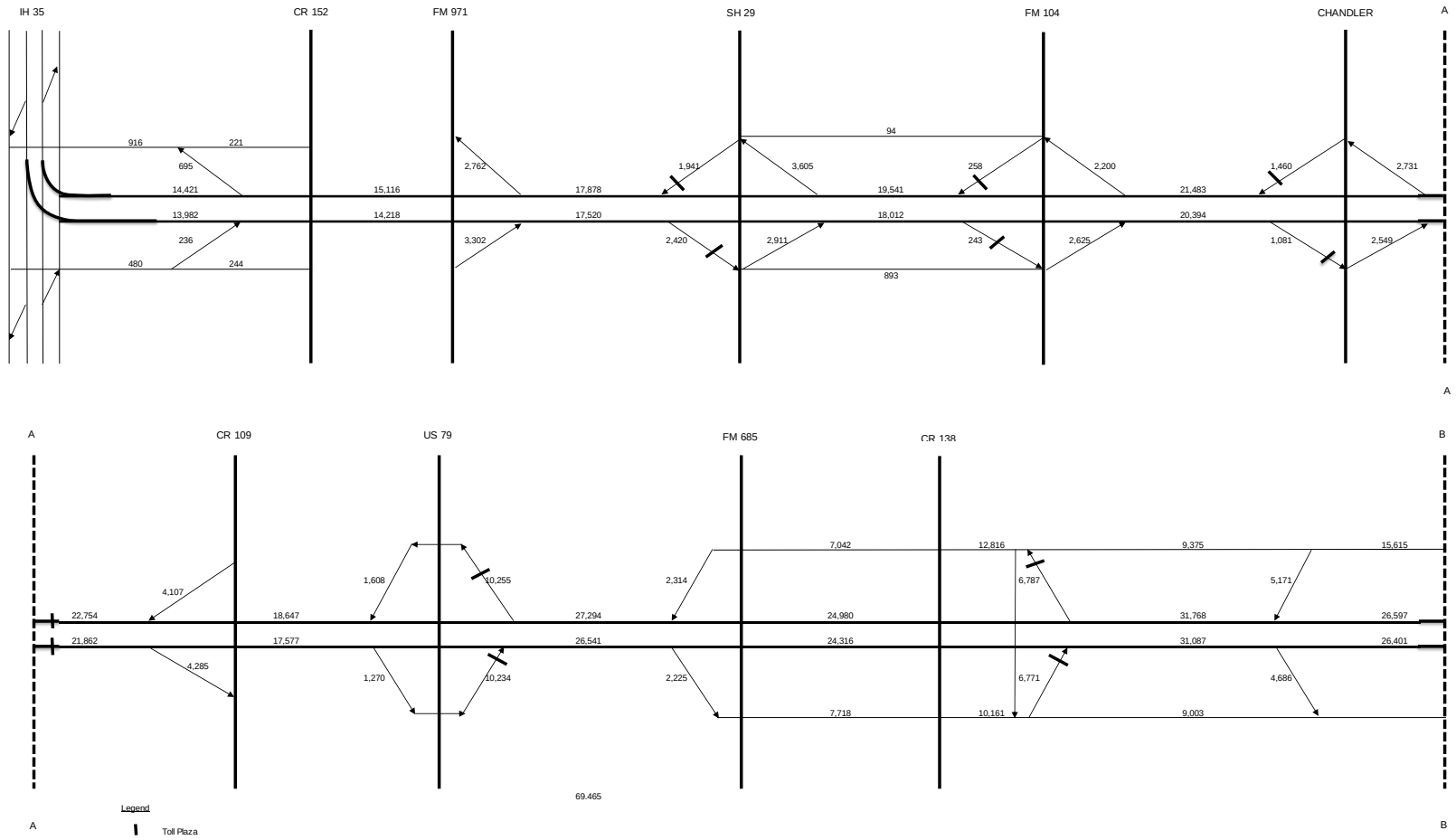


Figure 8.8 SH 130 Average Weekday Traffic – 2030 Model Year (Unadjusted Model Output) (continued)

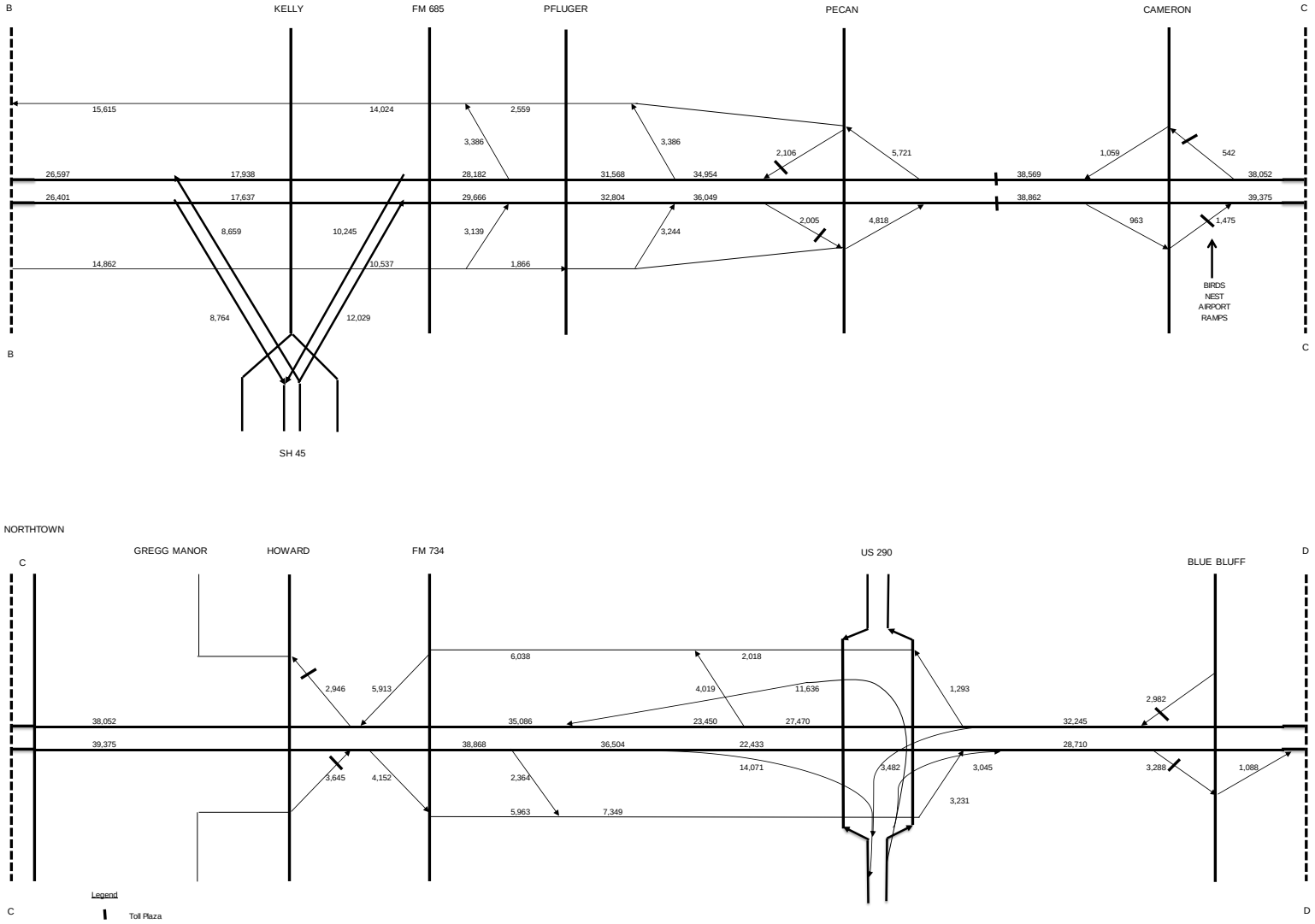


Figure 8.8 SH 130 Average Weekday Traffic – 2030 Model Year (Unadjusted Model Output) (continued)

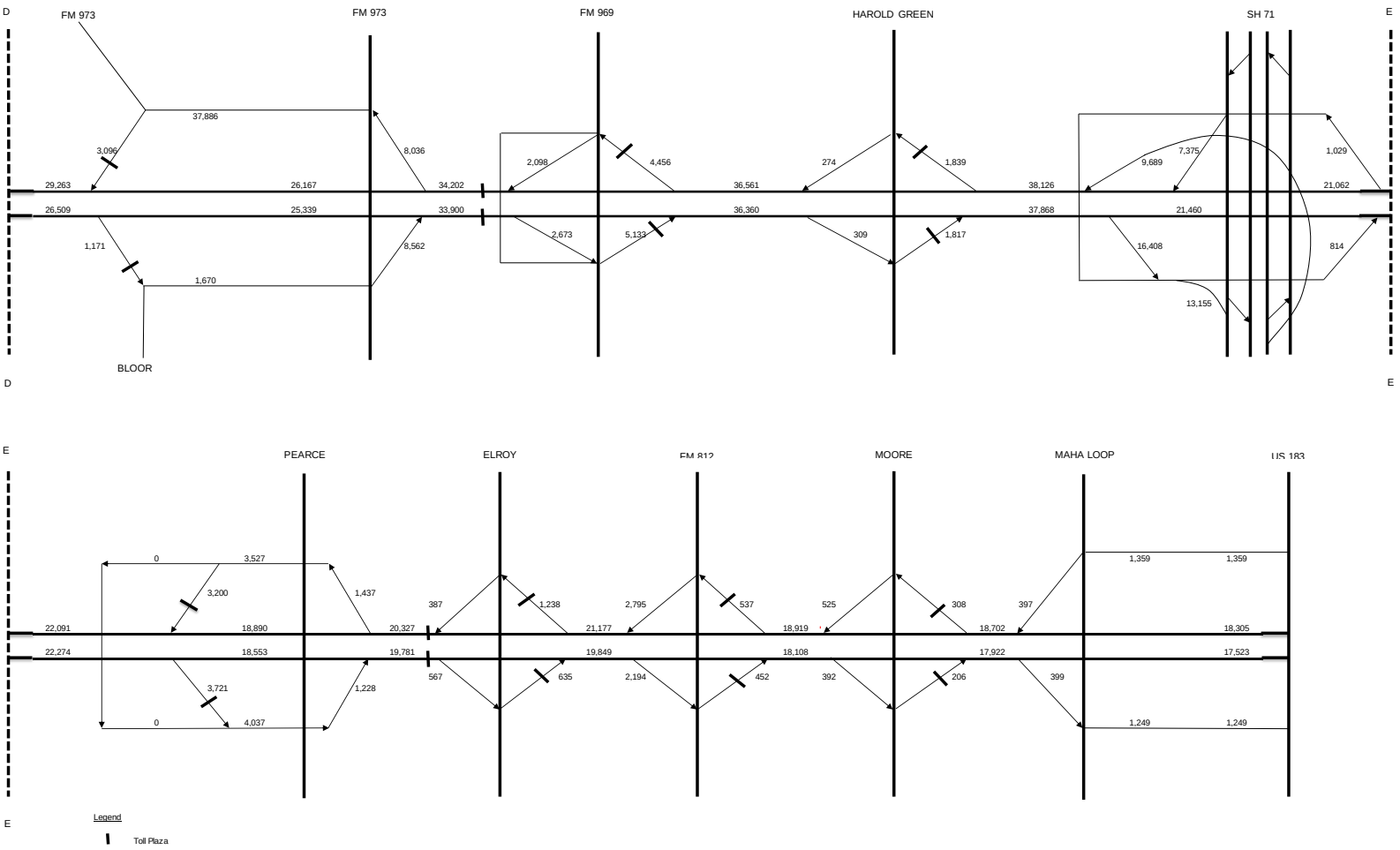


Figure 8.9 SH 130 Average Weekday Traffic – 2040 Model Year (Unadjusted Model Output)

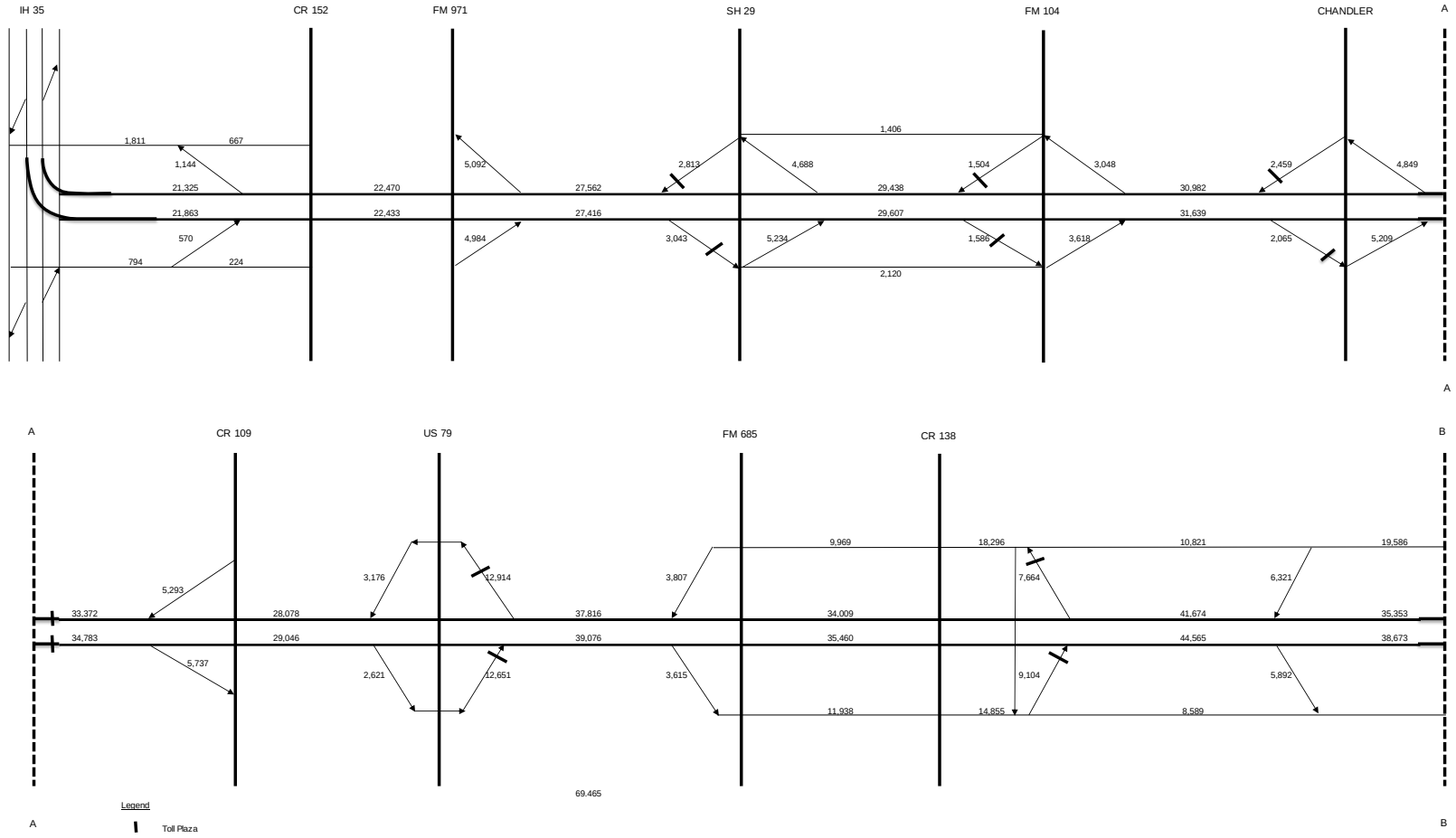


Figure 8.9 SH 130 Average Weekday Traffic – 2040 Model Year (Unadjusted Model Output) (continued)

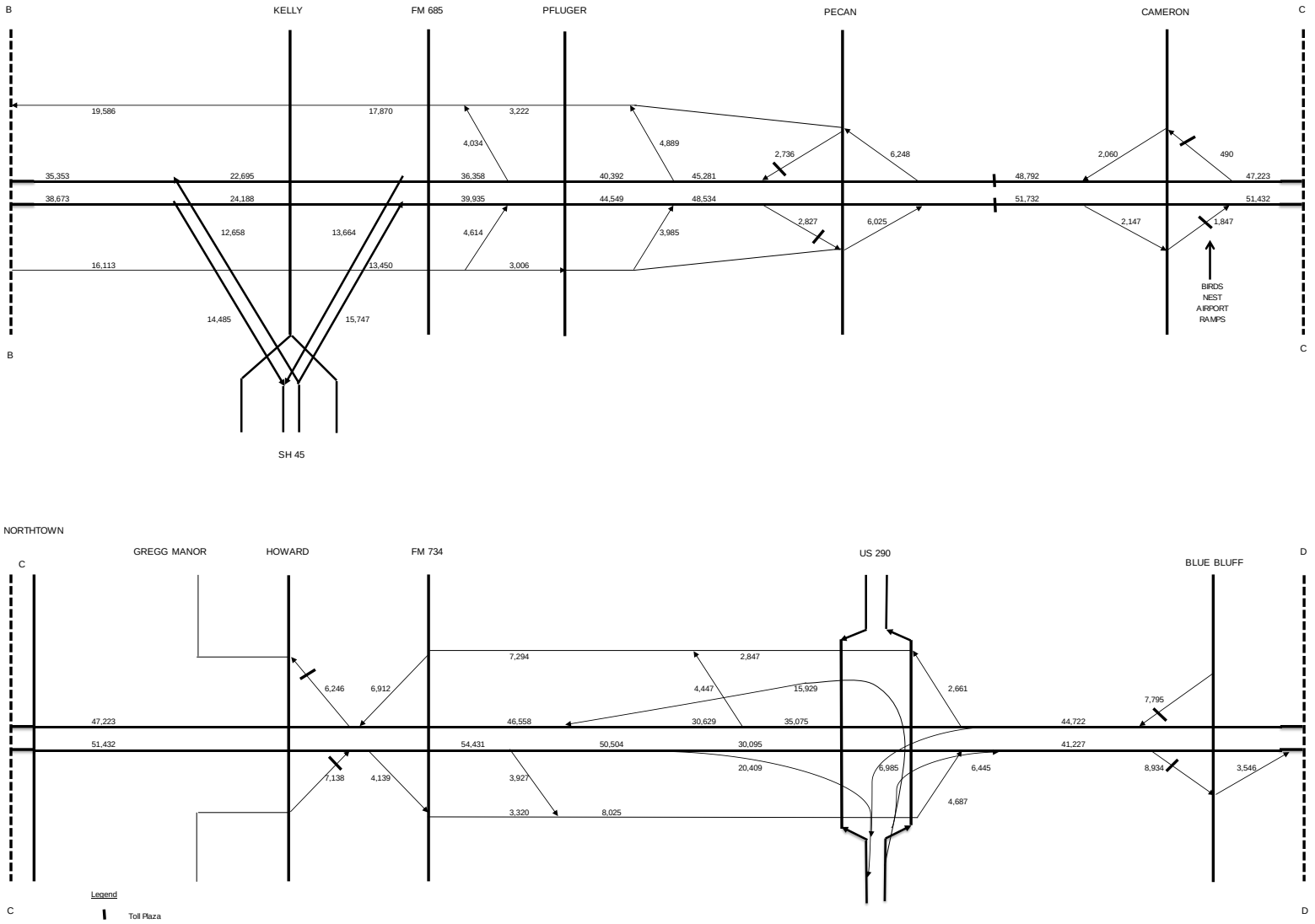
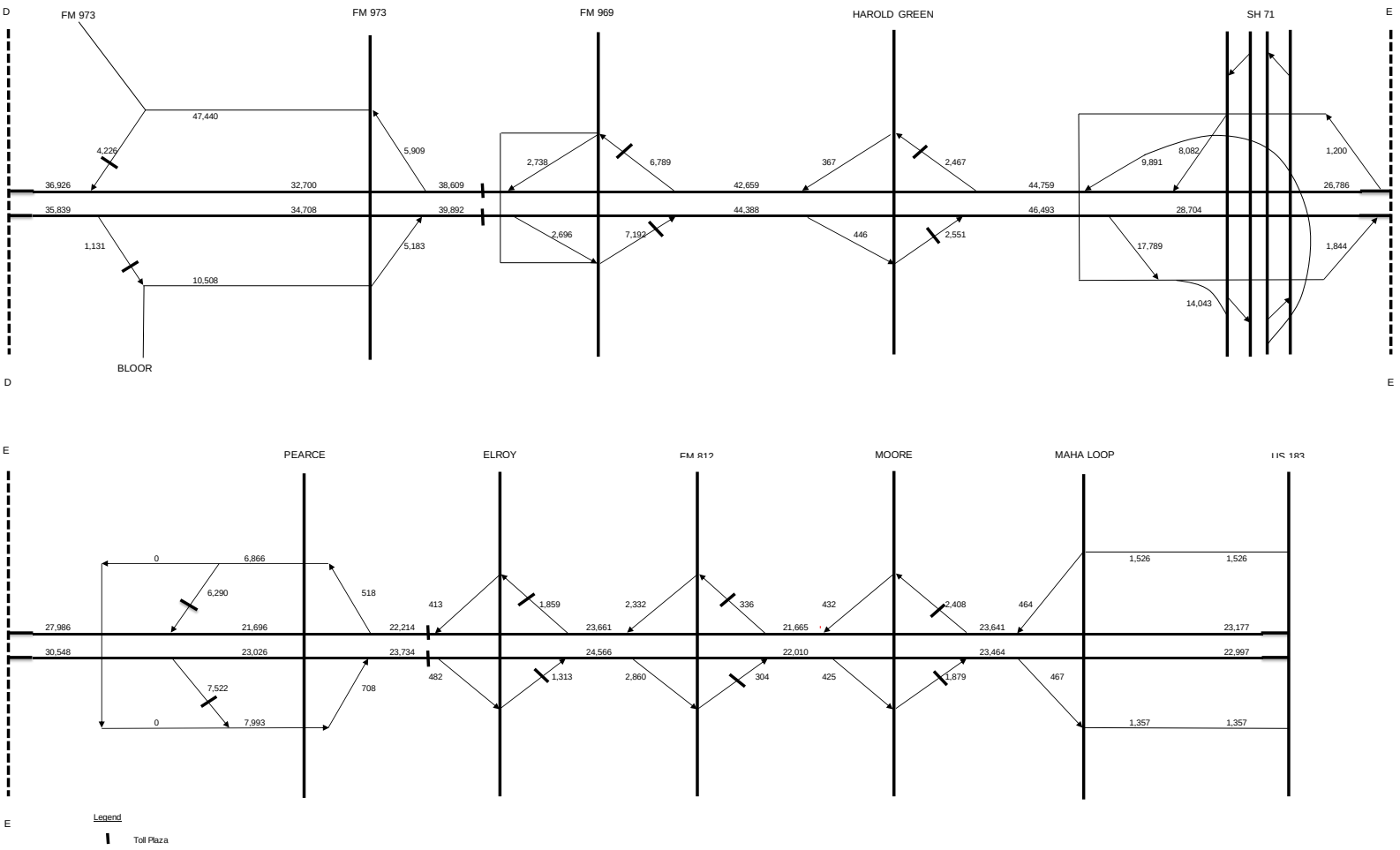


Figure 8.9 SH 130 Average Weekday Traffic – 2040 Model Year (Unadjusted Model Output) (continued)



8.2.2 SH 130 Screenline Analysis

Table 8.9, Table 8.10, Table 8.11, and Table 8.12 show the SH 130 corridor screenlines by horizon year. These screenlines are depicted earlier in this chapter as part of Figure 8.5. These values are unadjusted model estimates for the model's calendar year forecasts and indicate the future demand of traffic in the corridor as estimated by the model as well as the share of traffic using SH 130.

In reviewing these tables, it is evident that IH-35 has the dominant share of traffic on each of the four screenlines. On Screenlines 130-A and 130-B, the share of traffic on SH 130 gradually increases over the forecast period. The total traffic on Screenline 130-A increases from approximately 237,000 in 2016 to 373,000 in 2040, with a compounded annual growth rate of 1.9 percent over the 24-year period. SH 130 traffic is approximately 12 percent of the screenline in 2016 and eventually increases to approximately 18 percent in 2040, despite the opening of Kenney Fort Boulevard. Screenline 130-B, which intersects roadways in the Round Rock area, increases from 320,000 in 2016 to 491,000 in 2040, compounding annually at approximately 1.8 percent. Traffic on SH 130 is generally between 16 to 17 percent of the screenline total until the widening of SH 130 Segments 2 & 3, which occurs by 2021 and is evident starting in 2030. With this improvement, traffic shares increase to over 20 percent by 2040 in Screenline 130-B. The SH 130 widening and on-going development causes traffic on SH 130 to rapidly increase from approximately 60,000 in 2020 to more than 100,000 by 2040.

Table 8.9 Screenline 130-A Unadjusted Model Output

Locations	2016	% of Screenline	2018	% of Screenline	2020	% of Screenline	2030	% of Screenline	2040	% of Screenline
IH-35	164,902	69.6%	166,592	68.4%	170,493	66.9%	187,098	61.6%	212,929	57.0%
CR 115	17,724	7.5%	18,059	7.4%	16,887	6.6%	19,713	6.5%	20,995	5.6%
FM 1460	15,651	6.6%	16,628	6.8%	20,434	8.0%	26,476	8.7%	23,242	6.2%
Kenney Fort Blvd	NA		NA		NA		NA		24,776	6.6%
CR 110	6,511	2.7%	6,804	2.8%	10,329	4.1%	16,310	5.4%	11,149	3.0%
SH 130	**28,954**	**12.2%**	**31,510**	**12.9%**	**32,889**	**12.9%**	**44,617**	**14.7%**	**68,154**	**18.3%**
CR 100	1,013	0.4%	1,295	0.5%	919	0.4%	6,180	2.0%	9,200	2.5%
FM 1660	2,333	1.0%	2,574	1.1%	2,769	1.1%	3,195	1.1%	2,982	0.8%
TOTAL	**237,089**	**100.0%**	**243,462**	**100.0%**	**254,720**	**100.0%**	**303,589**	**100.0%**	**373,427**	**100.0%**

Table 8.10 Screenline 130-B Unadjusted Model Output

Locations	2016	% of Screenline	2018	% of Screenline	2020	% of Screenline	2030	% of Screenline	2040	% of Screenline
IH-35	192,710	60.3%	195,437	58.3%	200,658	56.9%	214,055	52.9%	250,529	51.0%
Heatherwilde Blvd	18,424	5.8%	23,421	7.0%	22,938	6.5%	26,120	6.5%	28,408	5.8%
Dessau / FM 685	34,011	10.6%	35,232	10.5%	33,911	9.6%	41,212	10.2%	46,488	9.5%
Immanuel	6,641	2.1%	7,466	2.2%	7,917	2.2%	11,487	2.8%	13,792	2.8%
SH 130	**51,533**	**16.1%**	**54,743**	**16.3%**	**59,578**	**16.9%**	**77,431**	**19.1%**	**100,524**	**20.5%**
Cameron Rd	9,057	2.8%	10,428	3.1%	19,385	5.5%	26,132	6.5%	21,539	4.4%
Fuchs Grove	7,455	2.3%	8,290	2.5%	8,070	2.3%	8,175	2.0%	30,184	6.1%
TOTAL	**319,831**	**100.0%**	**335,018**	**100.0%**	**352,456**	**100.0%**	**404,613**	**100.0%**	**491,464**	**100.0%**

Traffic along Screenline 130-C that encompasses Segment 3 increases from 467,000 in 2016 to 736,000 in 2040 at a rate of 1.9 percent annually, with SH 130 traffic generally 9 to 11 percent of the screenline total. With the completion of the 183S toll road in 2020, SH 130's traffic share decreases to 8.8 percent. The widening of SH 130 Segments 2 & 3 causes traffic to increase by approximately 20,000 vehicles from 2020 to 2030 and the traffic share returns to over 10 percent from 2030 forward. The southernmost screenline (Screenline 130-D) increases from 334,000 in 2016 to 499,000 in 2040 at a rate of 1.7 percent annually. SH 130 carries approximately 9 percent of this screenline's traffic throughout the forecast period with a slightly lower share in 2020 due to capacity improvements on US 183 (183 South Toll Road). However, SH 130 traffic increases by nearly 9,000 vehicles from 2020 to 2030 as a result of the SH 130 widening in Segments 2 & 3 assumed to be completed by 2021. This increased traffic on SH 130 Segment 4 occurs even though there is a separate widening on US 183 south of SH 71 assumed to be completed by 2027.

Table 8.11 Screenline 130-C Unadjusted Model Output

Locations	2016	% of Screenline	2018	% of Screenline	2020	% of Screenline	2030	% of Screenline	2040	% of Screenline
IH-35	248,340	53.2%	253,650	52.8%	256,529	46.5%	277,329	43.6%	302,533	41.1%
Cameron Rd.	18,163	3.9%	18,208	3.8%	15,030	2.7%	16,563	2.6%	17,172	2.3%
Berkman Dr.	13,102	2.8%	12,887	2.7%	13,786	2.5%	14,309	2.3%	14,102	1.9%
Manor Rd.	12,779	2.7%	13,555	2.8%	17,083	3.1%	20,520	3.2%	22,551	3.1%
Springdale Rd.	10,051	2.2%	10,551	2.2%	8,458	1.5%	9,893	1.6%	9,349	1.3%
US 183	72,824	15.6%	73,706	15.3%	91,792	16.7%	51,874	8.2%	58,187	7.9%
183 South	NA		NA		46,600	8.5%	106,571	16.8%	128,650	17.5%
Johnny Morris Rd.	5,619	1.2%	6,501	1.4%	12,733	2.3%	13,403	2.1%	6,664	0.9%
FM 3177	18,263	3.9%	19,339	4.0%	23,834	4.3%	27,567	4.3%	40,023	5.4%
FM 973	12,676	2.7%	13,209	2.7%	8,607	1.6%	17,634	2.8%	31,699	4.3%
SH 130	**47,516**	**10.2%**	**51,333**	**10.7%**	**48,802**	**8.9%**	**68,103**	**10.7%**	**78,501**	**10.7%**
FM 969	7,448	1.6%	7,848	1.6%	7,841	1.4%	11,815	1.9%	26,136	3.6%
TOTAL	**466,780**	**100.0%**	**480,788**	**100.0%**	**551,094**	**100.0%**	**635,579**	**100.0%**	**735,568**	**100.0%**

Table 8.12 Screenline 130-D Unadjusted Model Output

Locations	2016	% of Screenline	2018	% of Screenline	2020	% of Screenline	2030	% of Screenline	2040	% of Screenline
IH-35	201,129	60.2%	213,505	59.5%	227,841	61.5%	259,458	59.7%	280,935	56.3%
Todd Ln.	14,503	4.3%	15,186	4.2%	14,858	4.0%	15,543	3.6%	19,152	3.8%
Stassney Ln.	25,740	7.7%	26,995	7.5%	26,721	7.2%	29,767	6.9%	32,809	6.6%
US 183	37,120	11.1%	38,543	10.7%	41,368	11.2%	52,930	12.2%	56,170	11.3%
FM 973	16,723	5.0%	24,723	6.9%	21,223	5.7%	29,494	6.8%	50,772	10.2%
SH 130	**30,048**	**9.0%**	**31,596**	**8.8%**	**31,569**	**8.5%**	**40,108**	**9.2%**	**45,948**	**9.2%**
Ross Rd.	8,868	2.7%	8,486	2.4%	6,939	1.9%	7,019	1.6%	13,241	2.7%
TOTAL	**334,132**	**100.0%**	**359,034**	**100.0%**	**370,517**	**100.0%**	**434,318**	**100.0%**	**499,026**	**100.0%**

8.2.3 SH 130 Traffic and Revenue Assumptions

Table 8.13 provides a concise summary of the underlying assumptions in the transaction and revenue forecasts for SH 130. All truck-related values in the table refer to 3+ axle vehicles, consistent with the transaction reports generated for each toll road by TxDOT. Estimated truck transactions decrease from approximately 10 percent in 2018 to 8.5 percent by 2030. Auto ETC payment shares are assumed to be between 60.9 and 62.8 percent, and truck ETC shares are be between 58.5 and 60.4 percent.

The average truck toll multiplier is approximately 2.72 times the auto rate for ETC transactions and approximately 2.79 times the auto rate for PBM transactions, which reflects the observed distribution of trucks by axle group, and TxDOT's policy of capping truck tolls at the rate of a 4-axle vehicle for SH 130. There are no truck discounts assumed during the forecast period similar to the temporary discounts provided during periods in 2016. The PBM toll surcharge is assumed to remain at 33 percent of the ETC rate. The collection rates for PBM and ETC transactions reflect the latest available collection data provided by TxDOT and are held constant over the forecast period. Over the forecast period, the cost to traverse the full length of SH 130 Segments 1-4 will increase from $7.20 in 2018 to approximately $12.92 in 2040. This implies a rate of $0.15 per mile in 2018 which increases to $0.26 by 2040.

Table 8.13 SH 130 Tolling and Traffic Characteristic Assumptions by Model Year

Model Year	2018	2020	2030	2040
Vehicle Type Distribution				
Autos	90.0%	90.1%	91.5%	91.5%
Trucks	10.0%	9.9%	8.5%	8.5%
Payment Type Distribution - Passenger Cars				
PBM	37.2%	37.7%	39.1%	38.0%
ETC	62.8%	62.3%	60.9%	62.0%
Payment Type Distribution - Trucks				
PBM	39.6%	39.7%	40.6%	41.5%
ETC	60.4%	60.3%	59.4%	58.5%
Toll Ratios				
Truck/Auto Ratio - ETC	2.72	2.72	2.72	2.72
Truck/Auto Ratio - PBM	2.79	2.79	2.79	2.79
PBM/ETC Toll Rate	1.33	1.33	1.33	1.33
Collection Rates				
PBM	51.1%	51.1%	51.1%	51.1%
ETC	99.3%	99.3%	99.3%	99.3%
Full Length Trip				
Distance	49.0	49.0	49.0	49.0
Rate per Mile	$0.15	$0.15	$0.20	$0.26
Toll Cost (ETC)	$7.20	$7.52	$9.68	$12.92
Annualization Factor	325	325	325	325

8.2.4 SH 130 Transactions and Revenue by Pay Point

The SH 130 transaction and revenue statistics by pay point and horizon year are listed in Table 8.14. Both total and paying transactions are provided, where paying transactions reflect the assumptions for collection efficiency for each payment type. The average toll rate represents a blend of the individual rates by payment type and vehicle type. This blended value includes a 33 percent surcharge over the ETC rates for PBM patrons. The values shown are calendar year values, rather than the blended estimates created for each fiscal year shown in the next section.

Average weekday total transactions on SH 130 range from 211,000 in 2016 to 433,000 in 2040, and average weekday paying transactions range from 172,000 in 2016 to 350,000 in 2040, representing a compounded annual growth rate of 3.0 percent. During the same timeframe, average weekday revenues range from $311,000 to $1,117,000 and exhibit a compounded annual growth rate of 5.5 percent. The increase reflects both a growth in transactions and the annual increases in the toll rates.

Table 8.14 SH 130 Average Weekday Total Transactions and Toll Revenue (Adjusted for Calibration)

Toll Location	2016				2018				2020				2030				2040			
	Transactions		Avg. Toll	Revenue	Transactions		Avg. Toll	Revenue	Transactions		Avg. Toll	Revenue	Transactions		Avg. Toll	Revenue	Transactions		Avg. Toll	Revenue
	Total	Paying			Total	Paying			Total	Paying			Total	Paying			Total	Paying		
SH 29	1,589	1,253	$0.58	$727	1,724	1,360	$0.64	$865	1,973	1,544	$0.66	$1,014	4,361	3,342	$0.83	$2,776	5,856	4,644	$1.12	$5,219
FM 104	471	338	$0.69	$234	664	490	$0.73	$357	835	645	$0.78	$501	501	396	$0.92	$365	3,090	2,281	$1.29	$2,941
Chandler Rd.	1,145	919	$0.95	$873	1,532	1,236	$1.04	$1,281	1,448	1,172	$1.08	$1,262	2,540	2,114	$1.22	$2,569	4,524	3,759	$1.62	$6,093
N of CR 109 (ML Plaza)	**28,954**	**23,660**	**$2.19**	**$51,773**	**31,510**	**25,600**	**$2.37**	**$60,786**	**32,889**	**26,500**	**$2.47**	**$65,523**	**44,617**	**35,564**	**$3.11**	**$110,615**	**68,154**	**55,175**	**$4.09**	**$225,406**
US 79	16,081	14,009	$0.85	$11,838	17,306	15,092	$0.90	$13,556	17,838	15,558	$0.95	$14,774	20,488	17,963	$1.22	$21,933	25,565	22,367	$1.69	$37,731
CR 138	10,473	9,201	$0.82	$7,516	11,117	9,786	$0.85	$8,300	10,707	9,424	$0.89	$8,377	13,558	11,948	$1.15	$13,690	16,769	14,717	$1.53	$22,457
Pecan St.	3,396	2,932	$0.65	$1,917	3,775	3,292	$0.68	$2,249	3,301	2,903	$0.71	$2,074	4,111	3,634	$0.92	$3,341	5,563	4,883	$1.21	$5,926
N. of Cameron Rd. (ML Plaza)	**51,533**	**42,771**	**$2.09**	**$89,279**	**54,743**	**45,269**	**$2.23**	**$100,876**	**59,578**	**49,022**	**$2.32**	**$113,707**	**77,431**	**63,550**	**$2.95**	**$187,447**	**100,524**	**82,928**	**$3.94**	**$326,728**
Birds' Nest Airport	740	616	$2.44	$1,502	651	547	$2.35	$1,289	204	174	$2.50	$436	2,017	1,722	$2.79	$4,802	2,338	2,006	$3.55	$7,126
Howard Ln/Gregg Manor	1,132	911	$0.71	$646	1,535	1,232	$0.76	$934	2,047	1,632	$0.81	$1,327	6,592	5,300	$0.99	$5,230	13,384	10,831	$1.28	$13,823
Blue Bluff Rd.	428	369	$0.56	$206	718	610	$0.60	$363	838	697	$0.63	$439	6,270	5,124	$0.76	$3,876	16,729	13,674	$1.02	$13,912
Bloor Rd/FM 973	838	733	$0.64	$470	1,074	937	$0.67	$628	3,219	2,791	$0.75	$2,093	4,267	3,665	$0.93	$3,415	5,357	4,578	$1.26	$5,754
N. of FM 969 (ML Plaza)	**47,516**	**37,642**	**$2.16**	**$81,361**	**51,333**	**40,545**	**$2.32**	**$94,050**	**48,802**	**38,176**	**$2.44**	**$93,085**	**68,103**	**52,886**	**$3.09**	**$163,461**	**78,501**	**61,290**	**$4.11**	**$251,988**
FM 969	9,134	6,766	$0.71	$4,777	11,392	8,332	$0.76	$6,307	7,057	5,142	$0.78	$4,027	9,590	6,958	$1.00	$6,956	13,981	10,271	$1.33	$13,664
Harold Green Rd.	1,755	1,319	$0.67	$879	2,496	1,849	$0.74	$1,365	2,898	2,124	$0.76	$1,618	3,656	2,681	$0.95	$2,554	5,018	3,666	$1.20	$4,395
Pearce Ln.	3,536	2,580	$0.70	$1,802	3,394	2,510	$0.76	$1,904	3,048	2,221	$0.78	$1,724	6,921	4,996	$1.05	$5,239	13,811	10,003	$1.41	$14,055
N. of Elroy Rd (ML Plaza)	**30,048**	**24,081**	**$2.24**	**$53,907**	**31,596**	**25,271**	**$2.41**	**$60,898**	**31,569**	**25,017**	**$2.52**	**$63,015**	**40,108**	**31,344**	**$3.14**	**$98,564**	**45,948**	**36,113**	**$4.14**	**$149,589**
Elroy Rd.	634	533	$0.89	$476	911	771	$0.94	$722	2,477	2,124	$1.06	$2,242	1,873	1,572	$1.21	$1,899	3,173	2,703	$1.67	$4,505
FM 812	679	614	$0.69	$425	689	622	$0.76	$476	439	399	$0.76	$304	989	881	$1.03	$904	640	581	$1.28	$742
Moore Rd.	617	534	$0.57	$306	810	683	$0.71	$482	773	649	$0.73	$477	515	445	$0.85	$379	4,287	3,728	$1.22	$4,557
TOTAL	**210,698**	**171,780**		**$310,914**	**228,971**	**186,034**		**$357,688**	**231,942**	**187,915**		**$378,017**	**318,507**	**256,085**		**$640,013**	**433,212**	**350,200**		**$1,116,610**
Total Annual Revenue in Millions				**$101.0**				**$116.2**				**$122.9**				**$208.0**				**$362.9**

Notes: [1] The average toll is calculated by Revenue divided by Paying Transactions.

8.2.5 SH 130 Traffic and Revenue Forecasts

Table 8.15 provides the forecasted transactions and revenue for the entire 35-year forecast period on a fiscal year basis. AWT statistics are provided on the left side of the table, and annual values are provided on the right side along with statistics related to truck traffic. The values for FY 2008 to FY 2017 are the observed transactions and reported revenue for the first ten years of operation. While TxDOT reports transactions in the fiscal year in which they occur, annual revenue is based on the fiscal year in which it is collected. The revenue collected in each fiscal year varies due to the delay in receipt of PBM tolls, the collection efficiency of the PBM transactions as well as other adjustments implemented by TxDOT. In contrast, the model forecasts assume that transactions and revenue occur simultaneously and therefore do not reflect the lagging pattern of PBM toll revenue receipts. The forecasted revenue does account for the loss of revenue from uncollected transactions.

As shown in Table 8.15, SH 130 transaction growth is estimated to be just over 3 percent in FY 2018, reflecting the recent slowdown of growth in the corridor. Transaction growth drops to 0 percent in 2020 when the parallel 183S Toll Road opens. Subsequently in 2021 and 2022, transaction growth increases again to over 5 percent with the widening of SH 130 Segments 2 & 3. For the remainder of the forecast, transaction growth is steady, ranging between 1.7 and 3.7 percent. The forecasted revenue on SH 130 trends similarly to transactions with growth rates between 4 and 6 percent in most years. The assumed share of paying transactions is relatively constant at approximately 81 percent, and the combined ETC share (autos and trucks) is also generally consistent between 60 and 62 percent. Trucks are approximately 10 percent of transactions in FY 2018 but gradually decrease to about 8 percent over the forecast period as more auto transactions result from the on-going growth in the corridor. The share of total revenue from trucks also declines from over 24 percent of the total revenue to nearly 21 percent by FY 2042.

Table 8.15 SH 130 Transaction and Revenue Forecasts

Fiscal Year	Average Weekday Transactions (AWT)					Annual Transactions & Revenue					
	Total Transactions	YOY Growth	Total Transactions ETC Share	Paying Transactions	Paying Percentage	Annual Total Transactions (in 000s)	Annual Paying Transactions (in 000s)	Annual Revenue (in $000s)	YOY Growth	3+ Axle Truck Percentage	
										Paying Transactions	Revenue
2008	***58,306***		***67.0%***	*51,747*	*89%*	***19,287***	*17,117*	*$19,456*			
2009	***73,099***	***25.4%***	***67.0%***	*64,875*	*89%*	***24,457***	*21,706*	*$27,114*	***39.4%***		
2010	***83,997***	***14.9%***	***67.4%***	*74,547*	*89%*	***28,298***	*25,115*	***$34,408***	***26.9%***		
2011	***89,961***	***7.1%***	***64.3%***	*79,840*	*89%*	***30,583***	*27,142*	***$36,237***	***5.3%***		
2012	***101,957***	***13.3%***	***64.0%***	*89,000*	*87%*	***34,352***	*29,986*	***$40,735***	***12.4%***		
2013	***122,476***	***20.1%***	***64.5%***	*100,861*	*82%*	***41,366***	*34,065*	***$54,492***	***33.8%***		
2014	***138,223***	***12.9%***	***63.5%***	*111,557*	*81%*	***46,211***	*37,296*	***$67,092***	***23.1%***		
2015	***165,262***	***19.6%***	***62.8%***	*136,281*	*82%*	***54,786***	*45,178*	***$86,195***	***28.5%***		
2016	***196,330***	***18.8%***	***60.8%***	*157,829*	*80%*	***64,822***	*52,110*	***$99,303***	***15.2%***		
2017	***214,916***	***9.5%***	***62.0%***	*171,694*	*80%*	***70,241***	*56,115*	***$108,615***	***9.4%***		
2018	222,053	3.3%	62.5%	180,511	81%	72,167	58,666	$111,908	3.0%	10.2%	24.1%
2019	234,346	5.5%	62.3%	190,093	81%	76,163	61,780	$120,433	7.6%	9.9%	24.2%
2020	234,391	0.0%	62.1%	189,928	81%	76,177	61,726	$123,127	2.2%	9.8%	24.0%
2021	246,923	5.3%	61.7%	199,652	81%	80,250	64,887	$132,790	7.8%	9.6%	23.5%
2022	260,297	5.4%	61.5%	210,211	81%	84,597	68,319	$142,547	7.3%	9.4%	23.2%
2023	269,852	3.7%	61.5%	217,844	81%	87,702	70,799	$150,430	5.5%	9.3%	22.9%
2024	277,736	2.9%	61.4%	224,123	81%	90,264	72,840	$157,677	4.8%	9.2%	22.8%
2025	282,503	1.7%	61.7%	228,431	81%	91,814	74,240	$163,458	3.7%	9.1%	22.6%
2026	288,378	2.1%	61.8%	233,197	81%	93,723	75,789	$170,512	4.3%	9.0%	22.3%
2027	295,331	2.4%	61.5%	238,479	81%	95,982	77,506	$178,645	4.8%	8.8%	22.0%
2028	302,283	2.4%	61.3%	243,760	81%	98,242	79,222	$187,087	4.7%	8.7%	21.7%
2029	309,236	2.3%	61.1%	249,042	81%	100,502	80,939	$195,847	4.7%	8.6%	21.4%
2030	316,189	2.2%	60.9%	254,324	80%	102,761	82,655	$204,937	4.6%	8.5%	21.2%
2031	326,154	3.2%	60.9%	262,359	80%	106,000	85,267	$216,627	5.7%	8.4%	21.1%
2032	337,624	3.5%	61.0%	271,770	80%	109,728	88,325	$229,906	6.1%	8.4%	21.0%
2033	349,095	3.4%	61.1%	281,182	81%	113,456	91,384	$243,714	6.0%	8.4%	21.0%
2034	360,565	3.3%	61.2%	290,594	81%	117,184	94,443	$258,070	5.9%	8.4%	21.0%
2035	372,036	3.2%	61.3%	300,005	81%	120,912	97,502	$272,992	5.8%	8.4%	20.9%
2036	383,506	3.1%	61.4%	309,417	81%	124,640	100,560	$288,501	5.7%	8.3%	20.9%
2037	394,977	3.0%	61.5%	318,828	81%	128,368	103,619	$304,615	5.6%	8.3%	20.9%
2038	406,448	2.9%	61.5%	328,240	81%	132,095	106,678	$321,356	5.5%	8.3%	20.8%
2039	417,918	2.8%	61.6%	337,651	81%	135,823	109,737	$338,745	5.4%	8.3%	20.8%
2040	429,389	2.7%	61.7%	347,063	81%	139,551	112,795	$356,804	5.3%	8.3%	20.8%
2041	438,844	2.2%	61.7%	354,753	81%	142,624	115,295	$375,015	5.1%	8.3%	20.8%
2042	447,254	1.9%	61.7%	361,551	81%	145,358	117,504	$393,667	5.0%	8.3%	20.8%

Notes: (1) Revenue for PBM patrons was not allocated by each toll facility until September 2009; therefore, annual revenues shown for FY 2008 - FY 2009 are estimated.
(2) ***Actual Average Weekday Transactions and Annual Revenue (FY 2008 – FY 2017)***

8.3 SH 45 SE

Similar to the other roadways, the toll diversion model produces traffic estimates for several model years including: 2018 to 2025, 2030, and 2040. The initial model forecasts for SH 45 SE have been adjusted by post-processing to account for minor variations in future trends. Gross revenue estimates were then prepared by multiplying the traffic, in terms of transactions, at the toll locations by the effective toll structure by vehicle type and payment type for each year. Adjustments were included to reflect the effective collection rates for both ETC and PBM transactions. Similar to SH 130, annual estimates of transactions and revenue were generated using an annualization factor of 325.

8.3.1 SH 45 SE Schematic Traffic Diagrams

Figure 8.10 through Figure 8.13 display the traffic along SH 45 SE for the model (calendar) years 2016, 2020, 2030, and 2040. These diagrams represent the unadjusted model outputs for average weekday transactions and are intended to provide the reader a sense of the scale of the traffic volumes across the facility as well as the interchange areas.

Figure 8.10 SH 45 SE Average Weekday Traffic – 2016 Model Calibration Year (Unadjusted Model Output)

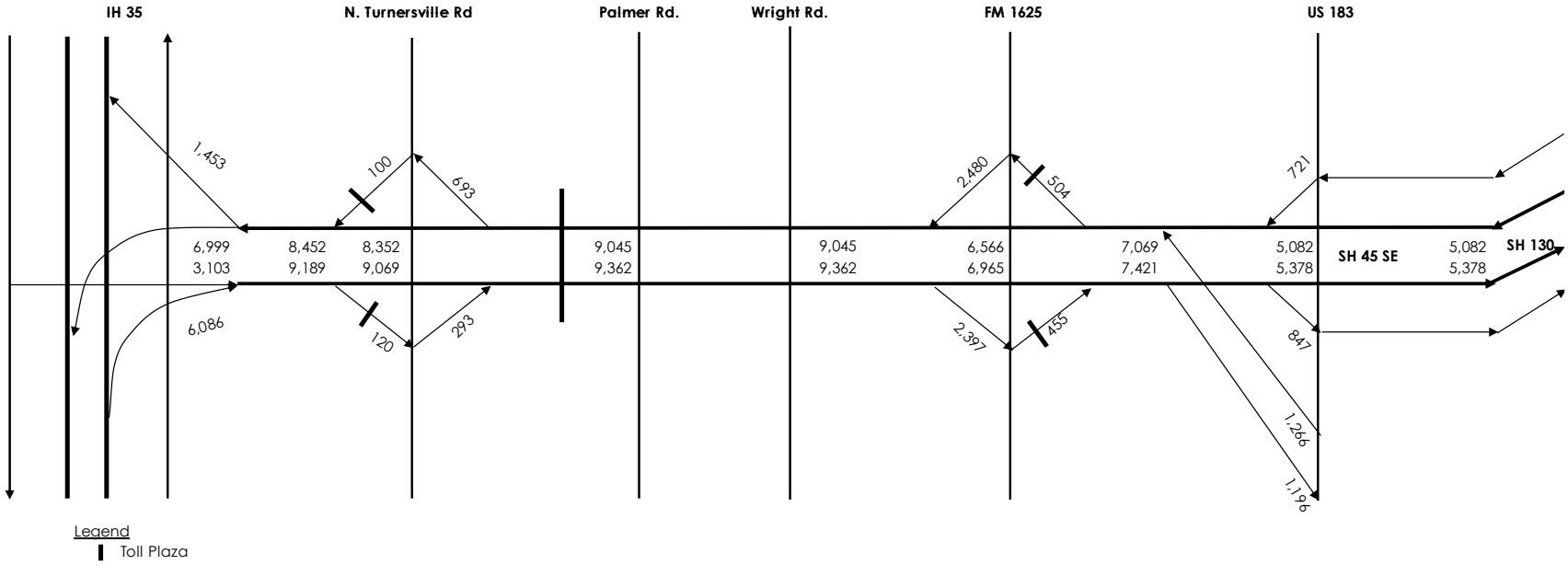


Figure 8.11 SH 45 SE Average Weekday Traffic – 2020 Model Year (Unadjusted Model Output)

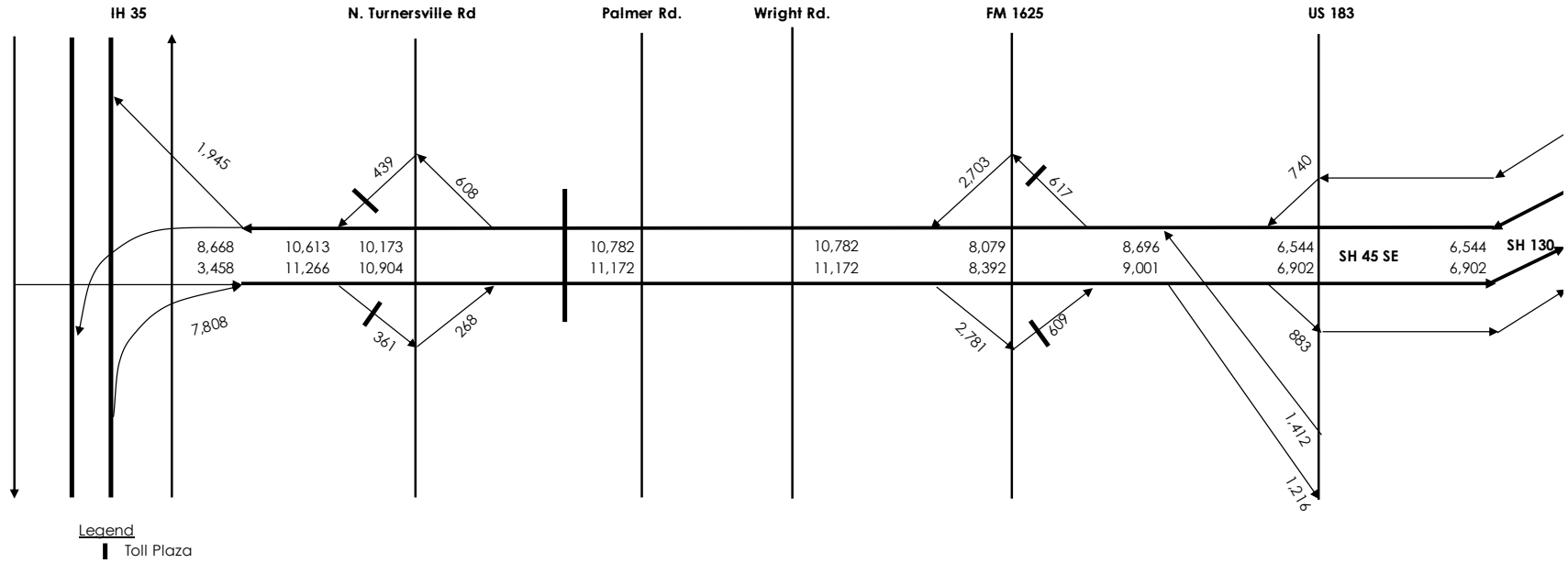


Figure 8.12 SH 45 SE Average Weekday Traffic – 2030 Model Year (Unadjusted Model Output)

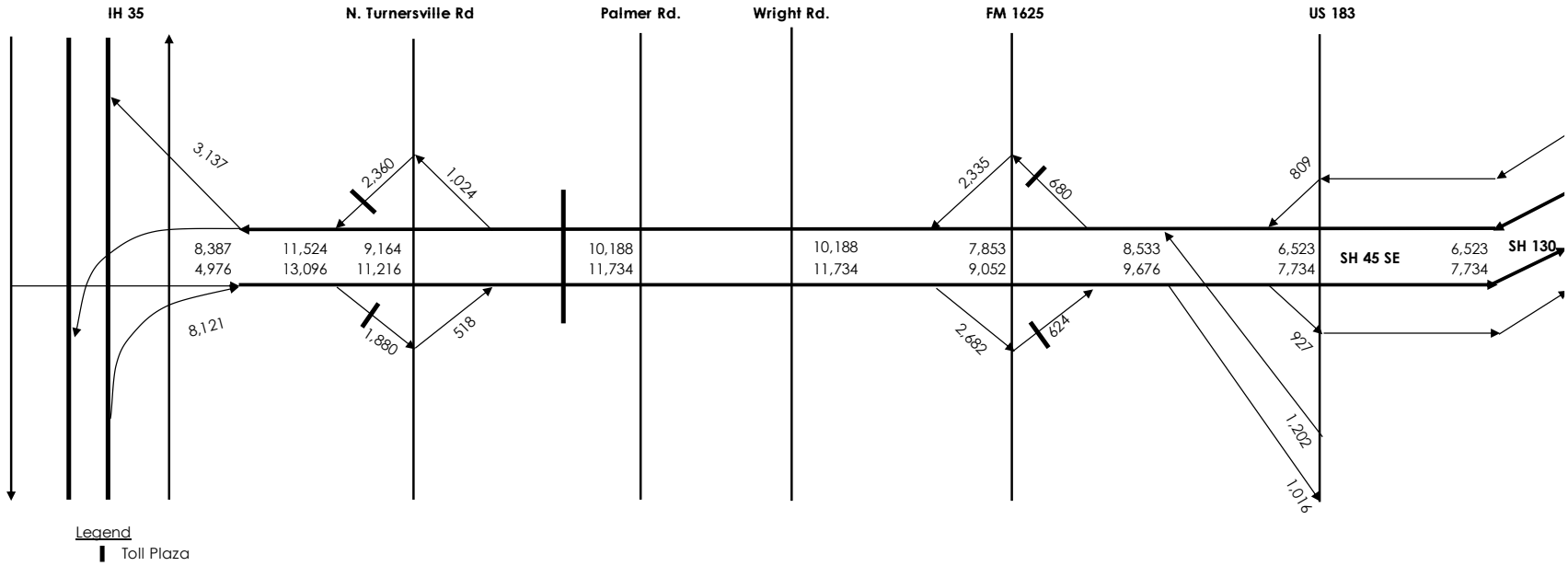
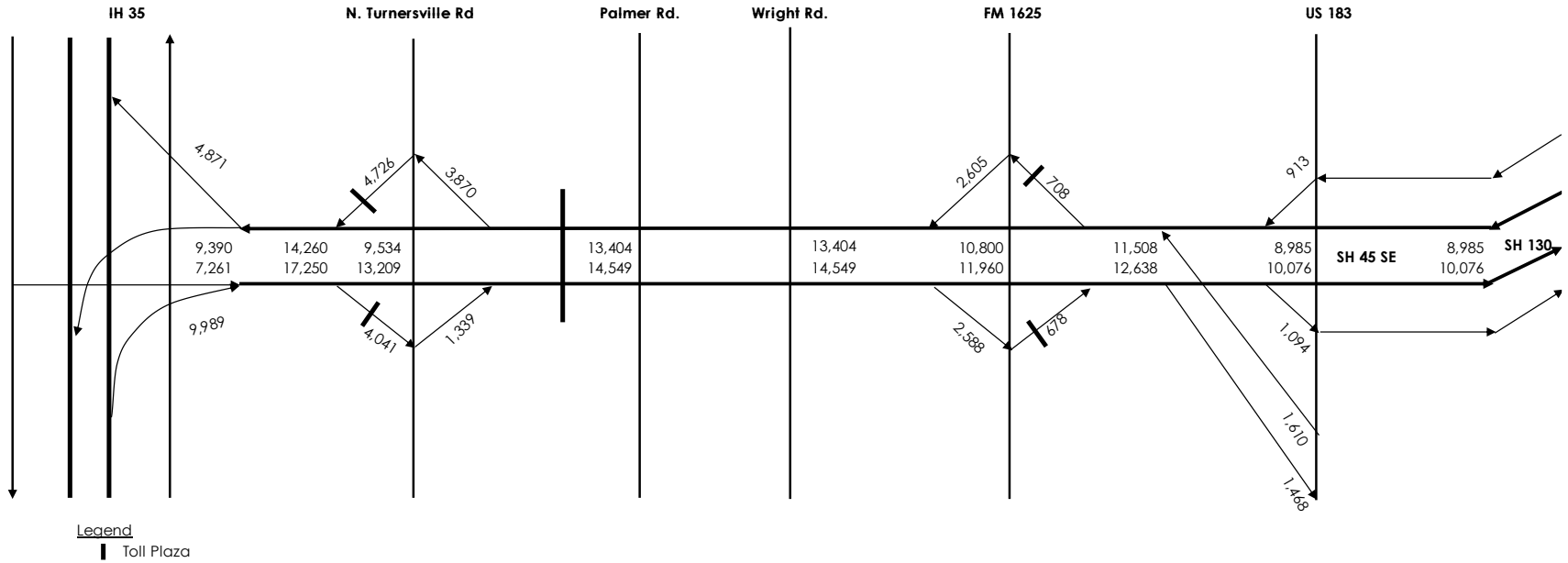


Figure 8.13 SH 45 SE Average Weekday Traffic – 2040 Model Year (Unadjusted Model Output)



8.3.2 SH 45 SE Screenline Analysis

Table 8.16 shows the traffic for the SH 45 SE corridor screenline by horizon year. This screenline is depicted earlier in this chapter as part of Figure 8.5. These values are unadjusted model estimates for the model's calendar year forecasts and indicate the future demand of traffic in the corridor as estimated by the model, as well as the share of traffic using SH 45 SE. SH 45 SE is the dominant roadway in this largely rural and undeveloped corridor. Total screenline traffic increases from approximately 35,000 in 2016 to 58,000 in 2040, which implies a compounded annual growth rate of 2.2 percent over the 24-year period. SH 45 SE gradually increases its share of traffic from 53 percent in 2016 to nearly 56 percent in 2020. The SH 21 widening projects from SH 80 to SH 71 are assumed to occur by 2030 and effectively improve this southern bypass route around southeast Austin, making it a competitor to SH 45 SE for some long-distance trips. In 2030, the share of traffic on SH 45 SE decreases to about 46 percent, but then resumes an increasing share of 48 percent by 2040.

Table 8.16 Screenline 45SE-A Unadjusted Model Output

Locations	2016	% of Screenline	2018	% of Screenline	2020	% of Screenline	2030	% of Screenline	2040	% of Screenline
FM 1327	15,388	44.4%	15,727	42.4%	16,211	41.1%	19,984	42.1%	16,500	28.3%
SH 45 SE ML	**18,408**	**53.2%**	**20,317**	**54.8%**	**21,954**	**55.6%**	**21,922**	**46.2%**	**27,953**	**48.0%**
Turnersville Rd.	832	2.4%	1,051	2.8%	1,292	3.3%	5,571	11.7%	13,798	23.7%
TOTAL	**34,627**	**100.0%**	**37,096**	**100.0%**	**39,458**	**100.0%**	**47,477**	**100.0%**	**58,251**	**100.0%**

8.3.3 SH 45 SE Traffic and Revenue Assumptions

Table 8.17 provides a brief summary of the underlying assumptions in the transaction and revenue forecasts for SH 45 SE. All truck-related values in the table refer to 3+ axle vehicles, consistent with TxDOT's transaction reports. Total estimated truck transactions decrease from approximately 10.6 percent in 2018 to 8.5 percent by 2040. While the auto ETC payment shares are estimated slightly higher than the observed values, the forecast retains the slight increase in ETC payment shares that gradually increase to approximately 70 percent by 2040. This increase likely reflects a growing share of locally-oriented auto trips. In contrast, truck ETC shares are assumed to decrease gradually from about 52 percent in 2018 to nearly 46 percent in 2040. This change is likely related to the growing congestion on IH-35 that forces a growing proportion of infrequent long-distance truck trips lacking transponders onto SH 45 SE. The average truck toll multipliers are approximately 2.75 and 2.80 times the auto rate for ETC and PBM transactions, respectively, which reflects the observed distribution of trucks by axle group and current limitation for truck tolls capped at the rate of a 4-axle vehicle for SH 45 SE.

The PBM toll surcharge is assumed to remain at 33 percent of the ETC rate. Similar to the other CTTS toll roads, the collection rates for PBM and ETC transactions are held constant over the forecast period. Over the forecast period the cost to traverse the full length of SH 45 SE will increase from $1.07 in 2018 to approximately $1.92 in 2040. This implies a rate of $0.15 per mile in 2018 which increases to $0.27 by 2040. An annualization factor of 325 is assumed, consistent with the value used for SH 130.

Table 8.17 SH 45 SE Tolling and Traffic Characteristic Assumptions by Model Year

Model Year	2018	2020	2030	2040
Vehicle Type Distribution				
Autos	89.4%	89.9%	91.4%	91.5%
Trucks	10.6%	10.1%	8.6%	8.5%
Payment Type Distribution - Passenger Cars				
PBM	31.6%	33.7%	30.7%	28.9%
ETC	68.4%	66.3%	69.3%	71.1%
Payment Type Distribution - Trucks				
PBM	47.6%	49.0%	50.7%	54.3%
ETC	52.4%	51.0%	49.3%	45.7%
Toll Ratios				
Truck/Auto Ratio - ETC	2.75	2.75	2.75	2.75
Truck/Auto Ratio - PBM	2.80	2.80	2.80	2.80
PBM/ETC Toll Rate	1.33	1.33	1.33	1.33
Collection Rates				
PBM	51.1%	51.1%	51.1%	51.1%
ETC	99.3%	99.3%	99.3%	99.3%
Full Length Trip				
Distance	7.0	7.0	7.0	7.0
Rate per Mile	$0.15	$0.16	$0.21	$0.27
Toll Cost (ETC)	$1.07	$1.12	$1.44	$1.92
Annualization Factor	325	325	325	325

8.3.4 SH 45 SE Transactions and Revenue by Pay Point

SH 45 SE transaction and revenue statistics by pay point and horizon year are listed in Table 8.18. Both total and paying transactions are provided, where paying transactions reflect the assumptions for collection efficiency for each payment type. The average toll rate represents a blend of the individual rates by payment type and vehicle type. This blended value includes a 33 percent surcharge over the ETC rates for PBM patrons. These values are calendar year values, rather than the blended estimates created for each fiscal year shown in the next section.

Average weekday total transactions on SH 45 SE range from 20,000 in 2016 to 38,000 in 2040, and total paying transactions range from 16,000 in 2016 to 32,000 in 2040, representing a compounded annual growth rate of 2.8 percent. During the same timeframe, average weekday revenues range from $20,000 to $68,000 and exhibit a compounded annual growth rate of 5.2 percent reflecting both the increase in transactions and the assumed annual increase in toll rates.

Table 8.18 SH 45 SE Average Weekday Total Transactions and Toll Revenue (Adjusted for Calibration)

Toll Location	2016				2018				2020				2030				2040			
	Transactions		Avg. Toll	Revenue	Transactions		Avg. Toll	Revenue	Transactions		Avg. Toll	Revenue	Transactions		Avg. Toll	Revenue	Transactions		Avg. Toll	Revenue
	Total	Paying			Total	Paying			Total	Paying			Total	Paying			Total	Paying		
Turnersville Rd	220	181	$0.80	$145	477	388	$0.83	$321	800	651	$0.88	$570	4,241	3,503	$1.07	$3,759	8,767	7,444	$1.43	$10,675
Mainline Plaza - 45 SE	**18,408**	**15,448**	**$1.25**	**$19,336**	**20,317**	**16,909**	**$1.34**	**$22,665**	**21,954**	**18,050**	**$1.40**	**$25,279**	**21,922**	**18,387**	**$1.76**	**$32,447**	**27,953**	**23,570**	**$2.36**	**$55,557**
FM 1625	959	809	$0.88	$714	1,030	868	$0.97	$844	1,226	1,038	$0.99	$1,032	1,304	1,090	$1.24	$1,353	1,386	1,127	$1.63	$1,842
SH 45 SE Total	**19,587**	**16,438**		**$20,194**	**21,824**	**18,165**		**$23,830**	**23,981**	**19,740**		**$26,880**	**27,467**	**22,980**		**$37,559**	**38,105**	**32,141**		**$68,073**
Annual Revenue in Millions				**$6.6**				**$7.7**				**$8.7**				**$12.2**				**$22.1**

Notes: (1) The average toll is calculated by Revenue divided by Paying Transactions.

8.3.5 SH 45 SE Traffic and Revenue Forecasts

Table 8.19 provides the forecasted transactions and revenue for the entire 35-year forecast period on a fiscal year basis. AWT statistics are provided on the left side of the table and annual values are provided on the right side along with statistics related to truck traffic. The values for the years FY 2009 to FY 2017 are the observed transactions and reported revenue for the first nine years of operation.

As shown in the table, SH 45 SE transaction growth during the first five years of the forecast is generally consistent with the recently observed growth of 5.4 percent in FY 2017. The widening of SH 21 southeast of Austin (as described in Chapter 2) provides an alternate route for some long-distance trips and causes slower growth on SH 45 SE between 2025 and 2030. Transaction growth is expected to increase again after 2030 at compounded annual growth rates between 1.9 and 3.8 percent. The assumed share of paying transactions is relatively consistent ranging from 82 to 84 percent, and the combined ETC share (autos and trucks) increases gradually to 69 percent by FY 2042. Revenue growth generally follows a trend ranging between 2.4 and 7.5 percent based on both transaction growth and the annual toll escalation assumed for each year. Paying truck transactions are approximately 10 percent of total paying transactions in FY 2018 but decrease to 7.4 percent over the forecast period as more auto-related traffic from development utilizes the toll road. Truck revenue also decreases from 23.3 percent of the total revenue to 19.6 percent by FY 2042.

Table 8.19 SH 45 SE Transaction and Revenue Forecasts

Fiscal Year	Average Weekday Transactions (AWT)					Annual Transactions & Revenue					
	Total Transactions	YOY Growth	Total Transactions ETC Share	Paying Transactions	Paying Percentage	Annual Total Transactions (in 000s)	Annual Paying Transactions (in 000s)	Annual Revenue (in $000s)	YOY Growth	3+ Axle Truck Percentage	
										Paying Transactions	Revenue
2008											
2009				*6,609*				***$475***			
2010	***8,553***		***63.6%***	*6,952*	*81%*	***2,864***	*2,328*	***$3,210***			
2011	***9,423***	***10.2%***	***62.7%***	*7,659*	*81%*	***3,178***	*2,583*	***$3,596***	***12.0%***		
2012	***11,302***	***19.9%***	***56.6%***	*9,037*	*80%*	***3,842***	*3,072*	***$4,246***	***18.1%***		
2013	***12,636***	***11.8%***	***61.8%***	*10,061*	*80%*	***4,300***	*3,424*	***$4,274***	***0.7%***		
2014	***14,069***	***11.3%***	***61.4%***	*11,203*	*80%*	***4,743***	*3,777*	***$4,680***	***9.5%***		
2015	***16,601***	***18.0%***	***61.0%***	*13,565*	*82%*	***5,566***	*4,548*	***$6,019***	***28.6%***		
2016	***19,573***	***17.9%***	***58.9%***	*15,556*	*79%*	***6,513***	*5,176*	***$6,897***	***14.6%***		
2017	***20,623***	***5.4%***	***60.8%***	*16,362*	*79%*	***6,743***	*5,350*	***$7,358***	***6.7%***		
2018	21,179	2.7%	65.0%	17,650	83%	6,883	5,736	$7,533	2.4%	10.0%	23.3%
2019	22,686	7.1%	65.9%	18,797	83%	7,373	6,109	$8,101	7.5%	9.5%	23.1%
2020	23,754	4.7%	65.0%	19,582	82%	7,720	6,364	$8,605	6.2%	9.3%	22.7%
2021	24,895	4.8%	63.8%	20,373	82%	8,091	6,621	$9,096	5.7%	9.0%	21.9%
2022	25,959	4.3%	63.2%	21,175	82%	8,437	6,882	$9,636	5.9%	8.7%	21.4%
2023	26,571	2.4%	63.0%	21,648	81%	8,636	7,036	$10,069	4.5%	8.6%	21.2%
2024	26,825	1.0%	62.9%	21,835	81%	8,718	7,096	$10,369	3.0%	8.5%	21.0%
2025	26,918	0.3%	63.4%	21,983	82%	8,748	7,144	$10,646	2.7%	8.4%	20.9%
2026	27,010	0.3%	64.2%	22,164	82%	8,778	7,203	$10,927	2.6%	8.3%	20.8%
2027	27,116	0.4%	65.0%	22,352	82%	8,813	7,265	$11,210	2.6%	8.2%	20.5%
2028	27,221	0.4%	65.8%	22,541	83%	8,847	7,326	$11,501	2.6%	8.0%	20.3%
2029	27,326	0.4%	66.5%	22,729	83%	8,881	7,387	$11,799	2.6%	7.9%	20.1%
2030	27,432	0.4%	67.3%	22,917	84%	8,915	7,448	$12,104	2.6%	7.7%	19.9%
2031	28,176	2.7%	67.7%	23,591	84%	9,157	7,667	$12,752	5.4%	7.7%	19.8%
2032	29,240	3.8%	67.9%	24,507	84%	9,503	7,965	$13,592	6.6%	7.6%	19.8%
2033	30,304	3.6%	68.0%	25,423	84%	9,849	8,262	$14,469	6.5%	7.6%	19.7%
2034	31,368	3.5%	68.2%	26,339	84%	10,195	8,560	$15,383	6.3%	7.6%	19.7%
2035	32,432	3.4%	68.3%	27,255	84%	10,540	8,858	$16,335	6.2%	7.5%	19.7%
2036	33,495	3.3%	68.5%	28,171	84%	10,886	9,156	$17,328	6.1%	7.5%	19.7%
2037	34,559	3.2%	68.6%	29,087	84%	11,232	9,453	$18,362	6.0%	7.5%	19.7%
2038	35,623	3.1%	68.7%	30,004	84%	11,578	9,751	$19,439	5.9%	7.4%	19.6%
2039	36,687	3.0%	68.8%	30,920	84%	11,923	10,049	$20,561	5.8%	7.4%	19.6%
2040	37,751	2.9%	68.9%	31,836	84%	12,269	10,347	$21,729	5.7%	7.4%	19.6%
2041	38,601	2.3%	69.0%	32,559	84%	12,545	10,582	$22,863	5.2%	7.4%	19.6%
2042	39,341	1.9%	69.0%	33,183	84%	12,786	10,784	$24,000	5.0%	7.4%	19.6%

Notes: (1) Revenue for PBM patrons was not allocated by each toll facility until September 2009; therefore, annual revenues shown for FY 2008 - FY 2009 are estimated.
(2) ***Actual Average Weekday Transactions and Annual Revenue (FY 2008 – FY 2017)***

8.4 TOTAL CTTS TRAFFIC & REVENUE FORECASTS

Table 8.20 lists the paying AWT transactions and revenue by CTTS roadway, along with a grand total for the system. The growth rate for each estimate is provided as well. Table 8.21 lists the total transactions and annual revenue for the combined CTTS. This table provides all statistics in the same format shown for the individual elements and provides system-wide statistics for total and paying transactions as well as ETC share and truck usage estimates. As stated previously, these revenue estimates include only the tolls and PBM surcharge for the PBM transactions. Any from revenue from service center fees is not included in the revenue forecasts.

Table 8.22 provides a comparison of the paying AWT transactions and annual revenue between the 2014 Study and the current forecasts. As shown in the table, the system-wide value of paying transactions is approximately 8 percent higher in the early years of the forecast due primarily to the higher level of recent growth in both SH 130 and SH 45 SE. The difference in paying transactions does decrease to about 2 percent by FY 2030 and generally is about 3 to 8 percent higher thereafter to 2042. In contrast, revenue is approximately 9 percent higher in FY 2018 and then gradually declines to equal the values from the 2014 Study by FY 2028. This gradual decline towards the prior forecast values is due to several changes in the forecasting assumptions from the conditions used in the prior forecasts. These changes include:

- Lower toll escalation rates in the early forecast years. In the 2014 Study it was assumed that the annual toll escalation would gradually reach 3.0 percent per year by 2025. The 2018 Study assumes gradual escalation up to 3.0 percent by the year 2034, as discussed previously in Chapter 4.
- Lower share of ETC transactions. The 2014 Study had assumed that the system-wide ETC share of transactions would increase towards approximately 75 percent over the forecast period. Recent trends indicate that ETC shares are stable or declining slightly. As a result, the 2018 Study assumed that ETC shares will remain relatively constant over the forecast period, with the exception of SH 45 SE which will have a small increase over the forecast.
- Lower annualization factors. The 2014 Study assumed an annualization factor of 330 on both SH 130 and SH 45 SE. Recent trends indicate that the annualization factor is lower such that the 2018 Study assumptions on both of these roads was reduced to 325. The annualization factors for SH 45 N and Loop 1 remain the same as in the 2014 Study at 320.
- Reduced share of truck traffic in the current forecasts. The new CAMPO regional model had some minor changes in the process for estimating truck traffic and Stantec also partitioned medium and heavy trucks into separate vehicle types to support options for managed lane estimation. Together these changes have resulted in lower levels of future heavy truck traffic for the 2018 forecasts. In the prior 2014 Study, Stantec noted that the older CAMPO model had a tendency to over-estimate truck traffic and Stantec had attempted to restrain truck traffic growth to lower and more reasonable trends consistent with the overall trip generation of the non-commercial trip purposes. Even with that adjustment in the 2014 forecasts, the newer 2018 CTTS heavy truck estimates are still slightly lower than the constrained 2014 values.

The last line of the Table 8.22 shows the summation of the forecasted revenue in nominal dollars from FY 2018 to FY 2042 for the 2014 and 2018 CTTS Reports. While there is variation in the amount of change in revenue by year between the two forecasts, the 2018 CTTS forecast has approximately $32.0 million more revenue during the forecast period.

Table 8.20 Paying Transactions and Revenue Forecasts by CTTS Roadway

Fiscal Year	Average Weekday Paying Transactions						Annual Revenue (in $000s)					
	SH 45 N	Loop 1	SH 130	45 SE	CTTS Total	YOY Growth	SH 45 N	Loop 1	SH 130	45 SE	CTTS Total	YOY Growth
2008	*84,058*	*50,560*	*51,747*		*186,366*		*$17,987*	*$11,463*	*$19,456*		***$48,906***	
2009	*88,687*	*50,871*	*64,875*	*6,609*	*204,433*	*9.7%*	*$19,882*	*$11,918*	*$27,114*	***$475***	***$58,914***	***20.5%***
2010	*90,879*	*52,527*	*74,547*	*6,952*	*217,953*	*6.6%*	***$19,799***	***$11,937***	***$34,408***	***$3,210***	***$66,144***	***12.3%***
2011	*94,478*	*54,587*	*79,840*	*7,659*	*228,905*	*5.0%*	***$20,268***	***$12,317***	***$36,237***	***$3,596***	***$68,822***	***4.0%***
2012	*100,302*	*57,291*	*89,000*	*9,037*	*246,593*	*7.7%*	***$21,945***	***$13,015***	***$40,735***	***$4,246***	***$75,695***	***10.0%***
2013	*100,665*	*55,032*	*100,861*	*10,061*	*266,619*	*8.1%*	***$29,075***	***$16,143***	***$54,492***	***$4,274***	***$103,985***	***37.4%***
2014	*101,640*	*54,116*	*111,557*	*11,203*	*278,516*	*4.5%*	***$34,831***	***$18,560***	***$67,092***	***$4,680***	***$125,163***	***20.4%***
2015	*114,954*	*58,650*	*136,281*	*13,565*	*323,450*	*16.1%*	***$38,957***	***$20,459***	***$86,195***	***$6,019***	***$151,630***	***21.1%***
2016	*123,185*	*61,360*	*157,829*	*15,556*	*357,930*	*10.7%*	***$42,731***	***$21,726***	***$99,303***	***$6,897***	***$170,657***	***12.5%***
2017	*129,682*	*65,440*	*171,694*	*16,362*	*383,178*	*7.1%*	***$45,496***	***$23,349***	***$108,615***	***$7,358***	***$184,818***	***8.3%***
2018	134,855	70,161	180,511	17,650	403,177	5.2%	$47,793	$25,221	$111,908	$7,533	$192,455	4.1%
2019	140,095	73,241	190,093	18,797	422,226	4.7%	$51,685	$27,281	$120,433	$8,101	$207,500	7.8%
2020	146,513	76,294	189,928	19,582	432,317	2.4%	$55,366	$29,088	$123,127	$8,605	$216,186	4.2%
2021	152,303	78,321	199,652	20,373	450,649	4.2%	$59,126	$30,638	$132,790	$9,096	$231,650	7.2%
2022	155,392	79,550	210,211	21,175	466,328	3.5%	$61,619	$31,759	$142,547	$9,636	$245,561	6.0%
2023	159,232	80,590	217,844	21,648	479,314	2.8%	$64,593	$32,916	$150,430	$10,069	$258,008	5.1%
2024	161,198	79,519	224,123	21,835	486,675	1.5%	$66,993	$33,256	$157,677	$10,369	$268,295	4.0%
2025	164,075	79,948	228,431	21,983	494,437	1.6%	$69,864	$34,254	$163,458	$10,646	$278,222	3.7%
2026	167,880	81,768	233,197	22,164	505,009	2.1%	$73,406	$35,983	$170,512	$10,927	$290,828	4.5%
2027	171,574	83,649	238,479	22,352	516,054	2.2%	$77,129	$37,851	$178,645	$11,210	$304,835	4.8%
2028	175,268	85,531	243,760	22,541	527,100	2.1%	$81,003	$39,796	$187,087	$11,501	$319,387	4.8%
2029	178,961	87,412	249,042	22,729	538,144	2.1%	$85,034	$41,821	$195,847	$11,799	$334,501	4.7%
2030	182,655	89,293	254,324	22,917	549,189	2.1%	$89,228	$43,929	$204,937	$12,104	$350,198	4.7%
2031	186,509	91,126	262,359	23,591	563,585	2.6%	$93,749	$46,118	$216,627	$12,752	$369,246	5.4%
2032	190,443	92,935	271,770	24,507	579,655	2.9%	$98,537	$48,394	$229,906	$13,592	$390,429	5.7%
2033	194,376	94,744	281,182	25,423	595,725	2.8%	$103,525	$50,763	$243,714	$14,469	$412,471	5.6%
2034	198,310	96,553	290,594	26,339	611,796	2.7%	$108,721	$53,229	$258,070	$15,383	$435,403	5.6%
2035	202,244	98,362	300,005	27,255	627,866	2.6%	$114,133	$55,795	$272,992	$16,335	$459,255	5.5%
2036	206,178	100,171	309,417	28,171	643,937	2.6%	$119,770	$58,465	$288,501	$17,328	$484,064	5.4%
2037	210,112	101,980	318,828	29,087	660,007	2.5%	$125,638	$61,243	$304,615	$18,362	$509,858	5.3%
2038	214,046	103,789	328,240	30,004	676,079	2.4%	$131,748	$64,132	$321,356	$19,439	$536,675	5.3%
2039	217,980	105,598	337,651	30,920	692,149	2.4%	$138,109	$67,138	$338,745	$20,561	$564,553	5.2%
2040	221,913	107,407	347,063	31,836	708,219	2.3%	$144,730	$70,263	$356,804	$21,729	$593,526	5.1%
2041	225,457	109,090	354,753	32,559	721,859	1.9%	$151,419	$73,480	$375,015	$22,863	$622,777	4.9%
2042	228,839	110,727	361,551	33,183	734,300	1.7%	$158,301	$76,819	$393,667	$24,000	$652,787	4.8%

Notes: (1) SH 45 SE opened in May 2009 but did not become part of the CTTS until September 2012; therefore, it is not included in CTTS totals until FY 2013.
(2) Revenue includes PBM surcharge (33 percent of ETC toll).
(3) ***Actual Annual Revenue (may not equal the sum of values shown for each facility due to rounding)***

Table 8.21 Total CTTS Transaction and Revenue Forecasts

Fiscal Year	Average Weekday Transactions (AWT)					Annual Transactions & Revenue					
	Total Transactions	YOY Growth	Total Transactions ETC Share	Paying Transactions	Paying Percentage	Annual Total Transactions (in 000s)	Annual Paying Transactions (in 000s)	Annual Revenue (in $000s)	YOY Growth	3+ Axle Truck Percentage	
										Paying Transactions	Revenue
2008	***204,133***			*186,366*	*91%*	***65,940***	*60,185*	***$48,906***			
2009	***224,276***	***9.9%***	***73.7%***	*204,433*	*91%*	***73,108***	*66,617*	***$58,914***	***20.5%***		
2010	***239,343***	***6.7%***	***74.1%***	*217,953*	*91%*	***78,529***	*71,485*	***$66,144***	***12.3%***		
2011	***251,437***	***5.1%***	***71.6%***	*228,905*	*91%*	***83,010***	*75,539*	***$68,822***	***4.0%***		
2012	***273,411***	***8.7%***	***71.4%***	*246,593*	*90%*	***90,032***	*81,164*	***$75,695***	***10.0%***		
2013	***310,671***	***13.6%***	***71.8%***	*266,619*	*86%*	***102,507***	*87,898*	***$103,985***	***37.4%***		
2014	***330,988***	***6.5%***	***70.0%***	*278,516*	*84%*	***109,049***	*91,708*	***$125,163***	***20.4%***		
2015	***380,245***	***14.9%***	***68.4%***	*323,450*	*85%*	***124,506***	*105,868*	***$151,630***	***21.1%***		
2016	***433,705***	***14.1%***	***65.2%***	*357,930*	*83%*	***141,974***	*117,138*	***$170,657***	***12.5%***		
2017	***466,550***	***7.6%***	***66.3%***	*383,178*	*82%*	***151,501***	*124,405*	***$184,818***	***8.3%***		
2018	484,152	3.8%	67.1%	403,177	83%	156,144	130,007	$192,455	4.1%	6.3%	16.7%
2019	505,388	4.4%	67.3%	422,226	84%	163,010	136,156	$207,500	7.8%	6.1%	17.6%
2020	517,575	2.4%	67.3%	432,317	84%	166,915	139,388	$216,186	4.2%	6.0%	17.3%
2021	540,388	4.4%	67.0%	450,649	83%	174,283	145,308	$231,650	7.2%	6.0%	17.0%
2022	559,870	3.6%	66.8%	466,328	83%	180,590	150,382	$245,561	6.0%	5.9%	16.9%
2023	575,787	2.8%	66.7%	479,314	83%	185,734	154,578	$258,008	5.1%	5.9%	16.8%
2024	584,860	1.6%	66.6%	486,675	83%	188,677	156,965	$268,295	4.0%	5.9%	16.8%
2025	593,457	1.5%	66.8%	494,437	83%	191,453	159,471	$278,222	3.7%	5.8%	16.7%
2026	605,934	2.1%	66.9%	505,009	83%	195,476	162,880	$290,828	4.5%	5.8%	16.5%
2027	619,455	2.2%	66.8%	516,054	83%	199,837	166,443	$304,835	4.8%	5.7%	16.3%
2028	632,975	2.2%	66.7%	527,100	83%	204,199	170,004	$319,387	4.8%	5.6%	16.1%
2029	646,496	2.1%	66.7%	538,144	83%	208,562	173,566	$334,501	4.7%	5.6%	15.9%
2030	660,017	2.1%	66.6%	549,189	83%	212,923	177,127	$350,198	4.7%	5.5%	15.7%
2031	677,334	2.6%	66.6%	563,585	83%	218,518	181,777	$369,246	5.4%	5.5%	15.7%
2032	696,549	2.8%	66.6%	579,655	83%	224,731	186,971	$390,429	5.7%	5.5%	15.7%
2033	715,766	2.8%	66.7%	595,725	83%	230,942	192,164	$412,471	5.6%	5.5%	15.7%
2034	734,981	2.7%	66.7%	611,796	83%	237,155	197,359	$435,403	5.6%	5.5%	15.7%
2035	754,198	2.6%	66.7%	627,866	83%	243,365	202,554	$459,255	5.5%	5.5%	15.7%
2036	773,412	2.5%	66.7%	643,937	83%	249,577	207,748	$484,064	5.4%	5.6%	15.7%
2037	792,628	2.5%	66.7%	660,007	83%	255,789	212,942	$509,858	5.3%	5.6%	15.7%
2038	811,844	2.4%	66.8%	676,079	83%	262,000	218,137	$536,675	5.3%	5.6%	15.7%
2039	831,059	2.4%	66.8%	692,149	83%	268,212	223,330	$564,553	5.2%	5.6%	15.7%
2040	850,275	2.3%	66.8%	708,219	83%	274,423	228,524	$593,526	5.1%	5.6%	15.7%
2041	866,660	1.9%	66.8%	721,859	83%	279,718	232,932	$622,777	4.9%	5.6%	15.8%
2042	881,649	1.7%	66.8%	734,300	83%	284,561	236,949	$652,787	4.8%	5.6%	15.8%

Notes: (1) SH 45 SE opened in May 2009 but did not become part of the CTTS until September 2012; therefore, it is not included in CTTS totals until FY 2013.
(2) Revenue includes PBM surcharge (33 percent of ETC toll).
(3) ***Actual Annual Revenue (may not equal the sum of values shown for each facility due to rounding)***

Table 8.22 Comparison of 2014 and 2018 CTTS Transaction and Toll Revenue Forecasts

Fiscal Year	Average Weekday Paying Transactions			Annual Toll Revenue (in $000s)		
	2014 Study	2018 Study	% Difference	2014 Study	2018 Study	% Difference
2008	*186,366*	*186,366*	0%	***$48,906***	***$48,906***	0%
2009	*204,433*	*204,433*	0%	***$58,914***	***$58,914***	0%
2010	*217,953*	*217,953*	0%	***$66,144***	***$66,144***	0%
2011	*228,905*	*228,905*	0%	***$68,822***	***$68,822***	0%
2012	*246,593*	*246,593*	0%	***$75,695***	***$75,695***	0%
2013	*266,619*	*266,619*	0%	***$103,985***	***$103,985***	0%
2014	*278,516*	*278,516*	0%	***$125,163***	***$125,163***	0%
2015	320,983	*323,450*	1%	$140,665	***$151,630***	8%
2016	339,503	*357,930*	5%	$152,900	***$170,657***	12%
2017	356,732	*383,178*	7%	$165,020	***$184,818***	12%
2018	373,638	403,177	8%	$177,330	$192,455	9%
2019	389,942	422,226	8%	$189,621	$207,500	9%
2020	405,435	432,317	7%	$201,669	$216,186	7%
2021	419,040	450,649	8%	$213,939	$231,650	8%
2022	431,900	466,328	8%	$226,707	$245,561	8%
2023	444,839	479,314	8%	$240,119	$258,008	7%
2024	457,859	486,675	6%	$254,159	$268,295	6%
2025	470,965	494,437	5%	$268,800	$278,222	4%
2026	484,160	505,009	4%	$284,637	$290,828	2%
2027	497,445	516,054	4%	$301,477	$304,835	1%
2028	510,823	527,100	3%	$319,104	$319,387	0%
2029	524,295	538,144	3%	$337,549	$334,501	-1%
2030	537,863	549,189	2%	$356,850	$350,198	-2%
2031	549,931	563,585	2%	$376,822	$369,246	-2%
2032	561,271	579,655	3%	$397,611	$390,429	-2%
2033	572,670	595,725	4%	$419,370	$412,471	-2%
2034	584,130	611,796	5%	$442,139	$435,403	-2%
2035	595,651	627,866	5%	$465,962	$459,255	-1%
2036	607,234	643,937	6%	$490,885	$484,064	-1%
2037	618,881	660,007	7%	$516,956	$509,858	-1%
2038	630,592	676,079	7%	$544,224	$536,675	-1%
2039	642,369	692,149	8%	$572,739	$564,553	-1%
2040	654,212	708,219	8%	$602,557	$593,526	-1%
2041	665,668	721,859	8%	$632,448	$622,777	-2%
2042	676,943	734,300	8%	$662,988	$652,787	-2%
FY 18-42 Total	13,307,756	14,085,796	6%	$9,496,662	$9,528,670	0%

Notes: (1) SH 45 SE opened in May 2009 but did not become part of the CTTS until September 2012; therefore, it is not included in CTTS totals until FY 2013.
(2) Revenue includes PBM surcharge (33 percent of ETC toll).
(3) ***Actual Annual Revenue (may not equal the sum of values shown for each facility due to rounding)***

Table 8.23 provides a comparison of the total annual transactions by payment method between the 2014 Study and the current forecasts. As shown in the table, FY 2015 total transactions were 2.2 percent higher, FY 2016 total transactions were 10.4 percent higher, and FY 2017 total transactions were 12.4 percent higher than forecasted in the 2014 Study. FY 2017 ETC transactions are approximately 1.4 percent greater than forecasted in the 2014 Study. The 2018 Study estimates that FY 2018 ETC transactions will be 0.7 percent greater than the value from the 2014 forecast, but then generally up to 5.7 percent lower during the remaining years of the forecast period when compared to the 2014 Study. This reduction in ETC usage is due to lower ETC assumptions in the 2018 Study. PBM transactions are between 35 and 47 percent greater throughout the forecast period.

Table 8.23 Comparison of 2014 Study and 2018 Study
CTTS Total Annual Transactions Forecasts

Fiscal Year	Total Annual Transactions (in 000's)								
	ETC			PBM			Total		
	2014 Study	2018 Study	% Difference	2014 Study	2018 Study	% Difference	2014 Study	2018 Study	% Difference
2013	***76,109***	***76,109***	***0.0%***	***26,398***	***26,398***	***0.0%***	***102,507***	***102,507***	***0.0%***
2014	***76,331***	***76,331***	***0.0%***	***32,717***	***32,717***	***0.0%***	***109,049***	***109,049***	***0.0%***
2015	88,404	***85,191***	***-3.6%***	33,416	***39,315***	***17.7%***	121,820	***124,506***	***2.2%***
2016	93,875	***92,529***	***-1.4%***	34,691	***49,445***	***42.5%***	128,566	***141,974***	***10.4%***
2017	98,995	***100,377***	***1.4%***	35,824	***51,124***	***42.7%***	134,819	***151,501***	***12.4%***
2018	104,060	104,741	0.7%	36,848	51,403	39.5%	140,908	156,144	10.8%
2019	108,991	109,665	0.6%	37,732	53,345	41.4%	146,723	163,010	11.1%
2020	113,757	112,231	-1.3%	38,398	54,684	42.4%	152,156	166,915	9.7%
2021	117,674	116,699	-0.8%	39,534	57,584	45.7%	157,208	174,283	10.9%
2022	121,209	120,540	-0.6%	40,950	60,050	46.6%	162,159	180,590	11.4%
2023	124,766	123,792	-0.8%	42,373	61,942	46.2%	167,139	185,734	11.1%
2024	128,345	125,625	-2.1%	43,804	63,052	43.9%	172,149	188,677	9.6%
2025	131,950	127,882	-3.1%	45,239	63,571	40.5%	177,189	191,453	8.1%
2026	135,580	130,688	-3.6%	46,681	64,788	38.8%	182,261	195,476	7.3%
2027	139,236	133,453	-4.2%	48,128	66,384	37.9%	187,364	199,837	6.7%
2028	142,918	136,218	-4.7%	49,582	67,981	37.1%	192,500	204,199	6.1%
2029	146,628	138,983	-5.2%	51,042	69,579	36.3%	197,670	208,562	5.5%
2030	150,365	141,748	-5.7%	52,509	71,175	35.5%	202,874	212,923	5.0%
2031	153,732	145,464	-5.4%	53,732	73,054	36.0%	207,464	218,518	5.3%
2032	156,921	149,655	-4.6%	54,833	75,076	36.9%	211,754	224,731	6.1%
2033	160,127	153,846	-3.9%	55,938	77,096	37.8%	216,065	230,942	6.9%
2034	163,351	158,037	-3.3%	57,046	79,118	38.7%	220,397	237,155	7.6%
2035	166,593	162,228	-2.6%	58,156	81,137	39.5%	224,750	243,365	8.3%
2036	169,854	166,419	-2.0%	59,270	83,158	40.3%	229,124	249,577	8.9%
2037	173,134	170,610	-1.5%	60,387	85,179	41.1%	233,521	255,789	9.5%
2038	176,432	174,801	-0.9%	61,508	87,199	41.8%	237,940	262,000	10.1%
2039	179,751	178,992	-0.4%	62,632	89,220	42.5%	242,382	268,212	10.7%
2040	183,088	183,183	0.1%	63,759	91,240	43.1%	246,847	274,423	11.2%
2041	186,295	186,712	0.2%	64,891	93,006	43.3%	251,186	279,718	11.4%
2042	189,440	189,915	0.3%	66,026	94,646	43.3%	255,466	284,561	11.4%

Notes: (1) Cash payment option was eliminated in January 2013. ETC transactions shown for FY 2013 include cash transactions.

(2) ***Actual Annual Transactions (Total transactions may not equal the sum of values shown due to rounding)***

8.5 MONTHLY TRANSACTION AND REVENUE FORECASTS

This report presents forecasts of transactions and revenue in several formats. Transactions are provided on an AWT as well as annual basis, while revenue is provided on an annual basis. In order to provide estimates of monthly transactions and revenue consistent with the values in the CTTS quarterly reports issued by TxDOT, Stantec developed a procedure to disaggregate the annual values in this report for select fiscal years utilizing observed data from TxDOT quarterly reports. The process implicitly accounts for seasonal variation in traffic due to holiday travel and weather conditions, as well as variation in revenue collection due to a number of factors.

The monthly allocation process utilizes a three-year rolling average distribution pattern that provides a stable allocation method derived from a broad base of historical data. This approach ensures that any exceptional conditions in the patterns of any one year do not distort the overall trends under typical conditions. Since the distribution pattern is based on a rolling three-year period of data for each CTTS roadway, the pattern can change over time to reflect changes in travel patterns as the individual facilities mature, as well as changes in the efficiency of the PBM collection system. As an example, SH 130 currently has a lower percentage of ETC transactions than either Loop 1 or SH 45 N, suggesting that more travelers in this corridor are infrequent users, but with possibly more usage during holiday travel periods. As development in the SH 130 corridor continues, it is possible that more transactions will be related to local travelers making more frequent trips and using ETC. This transition would likely have an impact on the monthly allocation of both transactions and revenue as the transponder patrons would likely exhibit different monthly usage patterns and have a lower toll rate per transaction. Also, revenue collection would be more efficient for ETC transactions than for PBM transactions. For the 2018 Study, the three-year rolling average period encompassed FY 2015 – FY 2017. During this period, the rolling average calculations were influenced by several notable factors. These factors include:

- The construction of the MoPac N Express Lane facility likely impacted transactions on Loop 1. The project was completed in October 2017, just after the end of FY 2017.

- A pilot program of discounted truck tolls on SH 130 and SH 45 SE were in effect from April 2016 to August 2017. The former toll schedule was reactivated on September 1st, 2017.

Table 8.24 provides an example of the three-year rolling average factor calculations for SH 130. The top part of the table lists the monthly SH 130 AWT for each of the last three fiscal years (FY 2015 – FY 2017) as provided by the CTTS quarterly reports. From these values, an annual AWT for each year is calculated which is weighted by number of weekdays in each month. The number of weekdays for each month will vary by year due to the number of weekend days that occur in each month and the extra day from a leap year, if it occurs within the three-year period. The values for each month across all three years are summed along with all the total values for all three years. The monthly indexes are then calculated by dividing the monthly total for the three-year period by the total AWT for all three years, as shown in the last row of this section of the table.

Table 8.24 Monthly Variance for SH 130

SH 130 Average Weekday Transactions (AWT) by Month														
Transaction Value	**FY Term**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Annual**
Monthly AWT Transactions by Fiscal Year	FY 2015	150,764	158,420	160,056	151,036	143,469	153,896	165,999	174,079	175,804	179,467	184,596	180,867	165,262
	FY 2016	184,157	187,124	189,932	180,208	173,564	188,670	203,618	205,044	208,188	213,858	213,968	203,274	196,330
	FY 2017	211,864	216,952	213,972	202,972	189,933	207,739	220,594	220,829	221,764	226,848	220,875	220,702	214,916
Monthly AWT Index	'15-'17 avg.	0.95	0.98	0.98	0.93	0.88	0.95	1.02	1.04	1.05	1.08	1.07	1.05	1.00

SH 130 Total Transactions by Month														
Transaction Value	**FY Term**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Total**
Monthly Transactions by Fiscal Year (in 000s)	FY 2015	4,121	4,538	4,299	4,248	3,835	3,846	4,796	4,856	4,801	5,046	5,288	5,111	54,786
	FY 2016	5,058	5,284	4,977	4,974	4,594	4,941	5,911	5,621	5,815	5,959	5,867	5,822	64,822
	FY 2017	5,704	6,114	5,765	5,499	5,145	5,155	6,305	5,938	6,256	6,233	6,057	6,072	70,241
Monthly Transaction Percentages	'15-'17 avg.	7.8%	8.4%	7.9%	7.8%	7.1%	7.3%	9.0%	8.6%	8.9%	9.1%	9.1%	9.0%	100.0%

SH 130 Toll Revenues by Month														
Revenue Value	**FY Term**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Total**
Monthly Revenue by Fiscal Year (in $000s)	FY 2015	5,319	5,491	6,431	6,787	7,061	7,077	8,091	7,541	7,967	7,925	8,162	8,343	86,195
	FY 2016	8,097	7,869	7,934	7,746	7,684	7,832	8,844	8,116	8,807	8,539	8,507	9,329	99,303
	FY 2017	8,372	9,734	8,997	9,292	8,123	8,689	10,015	9,462	9,474	9,470	9,142	7,846	108,615
Monthly Revenue Percentages	'15-'17 avg.	7.4%	7.9%	7.9%	8.1%	7.8%	8.0%	9.2%	8.5%	8.9%	8.8%	8.8%	8.7%	100.0%

The second section of this table provides the data used to derive the average monthly transaction percentage calculations. The first three rows provide the observed monthly transactions for each of the last three fiscal years (FY 2015 – FY 2017) as provided by the CTTS quarterly reports. The values for each month across all three years are summed along with all three years. The monthly percentages are then calculated by dividing the monthly total for the three-year period by the total transactions for all three years, yielding the percentages shown in the last row of this section of the table.

The final section of this table provides the data used to derive the average monthly revenue percentage calculations. The first three rows contain the observed monthly revenue values for each of the last three fiscal years (FY 2015 – FY 2017) from the CTTS quarterly reports. Similar to the monthly transaction calculations, the values for each month across all three years are summed along with the totals for all three years and the monthly percentages are then calculated. It should be noted that due to variations in the types of transactions (auto versus trucks, ETC versus PBM), the collections processing and the lagging period for recognizing PBM revenue, there will be some variation between the monthly percentage distribution for transactions and revenue.

Table 8.25 lists the AWT by month for each CTTS element. These values include all transactions generated on the toll facilities. In order to develop a monthly pattern demonstrating the expected variation due to seasonal travel, the annual average weekday transactions are initially calculated and an index value is developed by dividing the monthly value by annual average weekday transactions. With an index value of 1.0 representing the annual average value, any months where the index value is greater than 1.0 indicates that the average weekday exceeds the annual average value. An index value less than 1.0 indicates that average weekday transactions are less than the annual average.

Table 8.25 Estimated Monthly Average Weekday Transactions, 2018

SH 45 N														
Transaction Value	**FY Term**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Value**
Monthly AWT Index	2017 Obs.	1.00	1.00	0.98	0.97	0.94	1.00	1.01	1.03	1.04	1.02	0.98	1.01	1.00
	2017 Est. ('15-'17 avg.)	0.98	0.99	0.98	0.96	0.95	0.99	1.00	1.04	1.04	1.04	1.02	1.03	1.00
Monthly AWT Transactions by Fiscal Year	2017 Obs.	154,109	154,202	150,833	148,449	144,988	154,073	155,692	158,321	159,215	157,033	151,458	155,533	**153,791**
	2017 Est.	150,655	151,795	150,062	147,764	145,765	151,648	153,211	159,202	159,878	159,360	156,213	158,138	**153,791**
	2017 Est. (2014 Study)	**136,267**	**137,332**	**136,579**	**132,987**	**130,774**	**135,448**	**137,933**	**144,758**	**145,926**	**145,488**	**143,995**	**145,419**	**139,558**
	2018 Est.	**155,399**	**156,575**	**154,788**	**152,417**	**150,355**	**156,424**	**158,036**	**164,216**	**164,913**	**164,379**	**161,133**	**163,118**	**158,634**

Loop 1														
Transaction Value	**FY Term**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Value**
Monthly AWT Index	2017 Obs.	0.98	0.99	0.98	0.98	0.96	1.01	1.02	1.03	1.02	1.02	0.99	1.01	1.00
	2017 Est. ('15-'17 avg.)	0.97	0.98	0.98	0.97	0.96	1.00	1.00	1.03	1.03	1.03	1.02	1.02	1.00
Monthly AWT Transactions by Fiscal Year	2017 Obs.	75,713	76,161	75,855	75,767	73,967	77,893	78,631	79,280	79,033	78,750	76,602	78,363	**77,220**
	2017 Est.	75,270	75,835	75,687	75,153	74,428	76,941	77,187	79,186	79,240	79,512	78,567	78,981	**77,220**
	2017 Est. (2014 Study)	**76,333**	**76,747**	**76,521**	**74,856**	**74,097**	**76,402**	**77,059**	**79,616**	**80,006**	**80,261**	**79,874**	**79,816**	**77,691**
	2018 Est.	**80,208**	**80,810**	**80,653**	**80,083**	**79,311**	**81,989**	**82,251**	**84,381**	**84,439**	**84,729**	**83,721**	**84,163**	**82,286**

SH 130														
Transaction Value	**FY Term**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Value**
Monthly AWT Index	2017 Obs.	0.99	1.01	1.00	0.94	0.88	0.97	1.03	1.03	1.03	1.06	1.03	1.03	1.00
	2017 Est. ('15-'17 avg.)	0.95	0.98	0.98	0.93	0.88	0.95	1.02	1.04	1.05	1.08	1.07	1.05	1.00
Monthly AWT Transactions by Fiscal Year	2017 Obs.	211,864	216,952	213,972	202,972	189,933	207,739	220,594	220,829	221,764	226,848	220,875	220,702	**214,916**
	2017 Est.	203,836	209,693	210,238	199,150	188,992	205,148	220,025	223,656	225,820	231,194	230,920	225,479	**214,916**
	2017 Est. (2014 Study)	**166,908**	**170,737**	**175,424**	**164,025**	**155,495**	**168,624**	**183,779**	**188,205**	**190,331**	**195,932**	**197,260**	**192,464**	**179,452**
	2018 Est.	**210,604**	**216,656**	**217,220**	**205,763**	**195,267**	**211,960**	**227,331**	**231,083**	**233,318**	**238,871**	**238,589**	**232,967**	**222,053**

SH 45 SE														
Transaction Value	**FY Term**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Value**
Monthly AWT Index	2017 Obs.	0.98	1.04	1.02	0.94	0.87	0.97	1.04	1.03	1.02	1.05	1.01	1.01	1.00
	2017 Est. ('15-'17 avg.)	0.94	0.99	1.00	0.92	0.87	0.95	1.03	1.03	1.04	1.08	1.08	1.05	1.00
Monthly AWT Transactions by Fiscal Year	2017 Obs.	20,305	21,386	21,088	19,360	17,988	19,932	21,507	21,321	20,954	21,609	20,844	20,853	**20,623**
	2017 Est.	19,423	20,435	20,623	18,926	17,874	19,679	21,214	21,342	21,426	22,308	22,210	21,578	**20,623**
	2017 Est. (2014 Study)	**17,039**	**17,661**	**18,430**	**16,610**	**15,764**	**17,363**	**18,949**	**19,134**	**19,436**	**20,202**	**20,403**	**19,716**	**18,427**
	2018 Est.	**19,946**	**20,985**	**21,179**	**19,436**	**18,356**	**20,209**	**21,785**	**21,917**	**22,003**	**22,909**	**22,808**	**22,160**	**21,179**

The first row for each section of Table 8.25 is the observed monthly index values for FY 2017, and second row is the estimated FY 2017 values based on the data from the three-year rolling average for FY 2015 – FY 2017. While there is some variation between the two indexes for several months, the patterns are largely consistent.

The last four rows of each section contain the AWT values for several conditions. The row labeled '2017 Obs.' lists the 2017 observed monthly AWT for FY 2017. The next row labeled '2017 Est.' is a hypothetical allocation of the 2017 observed data using the FY 2015 – FY 2017 rolling average patterns, which simply demonstrates the degree of replication. The following row labeled '2017 Est. (2014 Study)' is provided as a reference to the 2017 estimated monthly AWT from the 2014 Study. These values are based on the prior model forecasts and use the previous rolling average pattern derived from the FY 2014 – FY 2016 period. The final row lists the FY 2018 estimates using the current model forecasts based on the FY 2015 – FY 2017 pattern.

A similar procedure was used to develop monthly patterns for total transactions and toll revenue; however, the monthly percentage distribution was used instead of the index values. The findings are shown in Table 8.26 for total transactions and in Table 8.27 for toll revenues. The values for FY 2018 provided to TxDOT last year for the FY 2018 quarterly reports were calculated prior to the availability of complete statistics for FY 2017 and the new 2018 Study forecasts. Thus, the values in Table 8.27 are slightly different than those shown in the FY 2018 quarterly reports.

Table 8.26 Estimated Monthly Total Transactions, 2018

SH 45 N														
Transaction Value	**FY Term**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Total**
Monthly Transaction Percentages	2017 Obs.	8.2%	8.5%	8.0%	8.1%	8.0%	7.7%	8.8%	8.4%	8.9%	8.6%	8.2%	8.6%	100.0%
	2017 Est. ('15-'17 avg.)	8.1%	8.4%	7.8%	8.1%	7.9%	7.7%	8.6%	8.6%	8.8%	8.7%	8.5%	8.8%	100.0%
Monthly Transactions by Fiscal Year (in 000s)	2017 Obs.	4,106	4,248	3,965	4,036	3,971	3,857	4,385	4,193	4,430	4,264	4,073	4,264	**49,790**
	2017 Est.	4,015	4,207	3,873	4,038	3,914	3,848	4,306	4,272	4,382	4,327	4,237	4,372	**49,790**
	2017 Est. (2014 Study)	**3,570**	**3,781**	**3,473**	**3,593**	**3,469**	**3,412**	**3,803**	**3,871**	**3,934**	**3,888**	**3,882**	**3,983**	**44,658**
	2018 Est.	**4,093**	**4,289**	**3,949**	**4,117**	**3,990**	**3,923**	**4,390**	**4,356**	**4,467**	**4,412**	**4,319**	**4,457**	**50,763**

Loop 1														
Transaction Value	**FY Term**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Total**
Monthly Transaction Percentages	2017 Obs.	8.1%	8.4%	7.9%	8.2%	8.1%	7.8%	8.9%	8.4%	8.8%	8.6%	8.2%	8.6%	100.0%
	2017 Est. ('15-'17 avg.)	8.0%	8.4%	7.8%	8.2%	8.0%	7.8%	8.7%	8.5%	8.7%	8.6%	8.5%	8.7%	100.0%
Monthly Transactions by Fiscal Year (in 000s)	2017 Obs.	1,996	2,073	1,965	2,029	2,010	1,931	2,199	2,077	2,177	2,118	2,031	2,121	**24,727**
	2017 Est.	1,982	2,079	1,920	2,027	1,982	1,934	2,150	2,105	2,148	2,137	2,102	2,160	**24,727**
	2017 Est. (2014 Study)	**1,995**	**2,117**	**1,934**	**2,019**	**1,972**	**1,929**	**2,125**	**2,134**	**2,156**	**2,142**	**2,148**	**2,190**	**24,861**
	2018 Est.	**2,111**	**2,214**	**2,044**	**2,159**	**2,110**	**2,059**	**2,290**	**2,242**	**2,287**	**2,276**	**2,238**	**2,300**	**26,331**

SH 130														
Transaction Value	**FY Term**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Total**
Monthly Transaction Percentages	2017 Obs.	8.1%	8.7%	8.2%	7.8%	7.3%	7.3%	9.0%	8.5%	8.9%	8.9%	8.6%	8.6%	100.0%
	2017 Est. ('15-'17 avg.)	7.8%	8.4%	7.9%	7.8%	7.1%	7.3%	9.0%	8.6%	8.9%	9.1%	9.1%	9.0%	100.0%
Monthly Transactions by Fiscal Year (in 000s)	2017 Obs.	5,704	6,114	5,765	5,499	5,145	5,155	6,305	5,938	6,256	6,233	6,057	6,072	**70,241**
	2017 Est.	5,506	5,896	5,565	5,447	5,022	5,158	6,294	6,073	6,242	6,378	6,368	6,292	**70,241**
	2017 Est. (2014 Study)	**4,532**	**4,846**	**4,666**	**4,544**	**4,157**	**4,292**	**5,274**	**5,197**	**5,276**	**5,456**	**5,533**	**5,445**	**59,219**
	2018 Est.	**5,657**	**6,058**	**5,717**	**5,596**	**5,160**	**5,300**	**6,467**	**6,240**	**6,413**	**6,553**	**6,543**	**6,464**	**72,167**

SH 45 SE														
Transaction Value	**FY Term**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Total**
Monthly Transaction Percentages	2017 Obs.	8.1%	9.0%	8.4%	7.7%	7.2%	7.3%	9.1%	8.5%	8.8%	8.8%	8.4%	8.5%	100.0%
	2017 Est. ('15-'17 avg.)	7.8%	8.5%	8.1%	7.6%	7.0%	7.3%	9.0%	8.6%	8.8%	9.1%	9.1%	9.0%	100.0%
Monthly Transactions by Fiscal Year (in 000s)	2017 Obs.	549	604	569	522	488	494	615	574	590	594	570	572	**6,743**
	2017 Est.	526	576	546	515	473	494	607	581	591	616	614	603	**6,743**
	2017 Est. (2014 Study)	**464**	**502**	**491**	**459**	**418**	**442**	**543**	**529**	**538**	**563**	**573**	**560**	**6,081**
	2018 Est.	**537**	**588**	**558**	**525**	**483**	**505**	**620**	**593**	**604**	**628**	**626**	**616**	**6,883**

Table 8.27 Estimated Monthly Toll Revenue, 2018

SH 45 N														
Revenue Value	**FY Term**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Total**
Monthly Revenue Percentages	2017 Obs.	7.8%	9.0%	8.2%	8.3%	8.0%	8.0%	8.8%	8.6%	8.6%	8.6%	8.1%	7.9%	100.0%
	2017 Est. ('15-'17 avg.)	7.7%	8.2%	8.0%	8.2%	8.1%	8.0%	8.9%	8.6%	8.7%	8.6%	8.4%	8.7%	100.0%
Monthly Revenue by Fiscal Year (in $000s)	2017 Obs.	3,544	4,108	3,745	3,756	3,622	3,643	4,017	3,913	3,931	3,897	3,708	3,613	**45,496**
	2017 Est.	3,495	3,750	3,640	3,718	3,676	3,632	4,045	3,900	3,980	3,905	3,814	3,941	**45,496**
	2017 Est. (2014 Study)	**3,366**	**3,586**	**3,398**	**3,571**	**3,726**	**3,573**	**4,086**	**3,961**	**4,108**	**4,207**	**3,861**	**3,870**	**45,312**
	2018 Est.	**3,671**	**3,939**	**3,824**	**3,906**	**3,862**	**3,815**	**4,249**	**4,097**	**4,181**	**4,102**	**4,007**	**4,140**	**47,793**

Loop 1														
Revenue Value	**FY Term**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Total**
Monthly Revenue Percentages	2017 Obs.	7.7%	8.8%	8.1%	8.4%	8.1%	8.1%	8.9%	8.6%	8.6%	8.6%	8.2%	7.9%	100.0%
	2017 Est. ('15-'17 avg.)	7.6%	8.2%	8.0%	8.3%	8.2%	8.1%	8.9%	8.5%	8.7%	8.5%	8.3%	8.6%	100.0%
Monthly Revenue by Fiscal Year (in $000s)	2017 Obs.	1,801	2,052	1,897	1,962	1,885	1,890	2,083	2,005	2,001	2,005	1,914	1,854	**23,349**
	2017 Est.	1,784	1,906	1,862	1,936	1,923	1,888	2,084	1,988	2,024	1,992	1,949	2,013	**23,349**
	2017 Est. (2014 Study)	**1,947**	**2,079**	**1,963**	**2,001**	**2,182**	**2,074**	**2,344**	**2,265**	**2,324**	**2,390**	**2,194**	**2,184**	**25,948**
	2018 Est.	**1,928**	**2,059**	**2,011**	**2,091**	**2,077**	**2,040**	**2,251**	**2,148**	**2,186**	**2,151**	**2,105**	**2,174**	**25,221**

SH 130														
Revenue Value	**FY Term**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Total**
Monthly Revenue Percentages	2017 Obs.	7.7%	9.0%	8.3%	8.6%	7.5%	8.0%	9.2%	8.7%	8.7%	8.7%	8.4%	7.2%	100.0%
	2017 Est. ('15-'17 avg.)	7.4%	7.9%	7.9%	8.1%	7.8%	8.0%	9.2%	8.5%	8.9%	8.8%	8.8%	8.7%	100.0%
Monthly Revenue by Fiscal Year (in $000s)	2017 Obs.	8,372	9,734	8,997	9,292	8,123	8,689	10,015	9,462	9,474	9,470	9,142	7,846	**108,615**
	2017 Est.	8,046	8,529	8,627	8,798	8,445	8,715	9,953	9,276	9,693	9,577	9,532	9,424	**108,615**
	2017 Est. (2014 Study)	**6,394**	**6,638**	**6,885**	**6,265**	**6,841**	**6,624**	**7,986**	**7,762**	**8,175**	**8,540**	**7,752**	**7,570**	**87,431**
	2018 Est.	**8,290**	**8,787**	**8,889**	**9,065**	**8,701**	**8,979**	**10,254**	**9,557**	**9,987**	**9,868**	**9,821**	**9,709**	**111,908**

SH 45 SE														
Revenue Value	**FY Term**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Total**
Monthly Revenue Percentages	2017 Obs.	7.8%	9.2%	8.5%	8.6%	7.5%	8.0%	9.3%	8.7%	8.6%	8.6%	8.2%	7.0%	100.0%
	2017 Est. ('15-'17 avg.)	7.3%	7.9%	8.1%	8.1%	7.8%	8.1%	9.2%	8.4%	8.8%	8.8%	8.7%	8.7%	100.0%
Monthly Revenue by Fiscal Year (in $000s)	2017 Obs.	574	676	625	635	550	591	686	637	631	633	603	517	**7,358**
	2017 Est.	539	584	598	599	576	594	676	616	650	645	643	638	**7,358**
	2017 Est. (2014 Study)	**458**	**497**	**528**	**506**	**511**	**490**	**578**	**613**	**559**	**573**	**514**	**503**	**6,329**
	2018 Est.	**552**	**598**	**612**	**613**	**590**	**608**	**692**	**630**	**665**	**660**	**658**	**654**	**7,533**

The observed revenue by month for FY 2017 and the estimated patterns from the rolling average process include variations in collections processing, as well as any periodic accounting adjustments. As an example, revenue from the PBM collection process is recognized during the month when the revenue is received whereas the transactions are recognized during the month that they occurred. For these reasons, the monthly variations in revenue are not directly correlated to the monthly variations in transactions.

8.6 GENERAL ASSUMPTIONS

The estimates of traffic and toll revenue presented in this report have been prepared by Stantec based on certain assumptions regarding tolling and traffic characteristics and additional assumptions regarding future toll road and local and national conditions.

The assumptions for each CTTS element regarding toll rates and traffic characteristics summarized in Table 8.28 include the truck toll multiplier, PBM surcharge, payment type distribution (PBM, ETC), vehicle type distribution (autos, trucks), toll evasion, and annualization factors. These factors were developed for each CTTS element based on observed traffic conditions as discussed previously in this report. Assumptions for future years are based on discussions with TxDOT and local government agencies, as well as Stantec's professional judgment.

Table 8.28 Summary of Tolling and Traffic Characteristic Assumptions: Base Case - 2018

Assumptions Related to	Element			
	SH 45 N	Loop 1	SH 130	SH 45 SE
Vehicle Type Distribution				
Autos	97.0%	98.3%	90.0%	89.4%
Trucks	3.0%	1.7%	10.0%	10.6%
Payment Type Distribution - Passenger Cars				
PBM	27.7%	27.8%	37.2%	31.6%
ETC	72.3%	72.2%	62.8%	68.4%
Payment Type Distribution - Trucks				
PBM	27.7%	31.0%	39.6%	47.6%
ETC	72.3%	69.0%	60.4%	52.4%
Toll Ratios				
Truck/Auto Ratio - ETC	2.86	2.79	2.72	2.75
Truck/Auto Ratio - PBM	2.98	3.00	2.79	2.80
PBM/ETC Toll Rate	1.33	1.33	1.33	1.33
Collection Rates				
PBM	51.1%	51.1%	51.1%	51.1%
ETC	99.3%	99.3%	99.3%	99.3%
Full Length Trip				
Distance	12.8	4.0	49.0	7.0
Rate per Mile	$0.17	$0.27	$0.15	$0.15
Toll Cost (ETC)	$2.18	$1.09	$7.20	$1.07
Annualization Factor	320	320	325	325

The estimates of CTTS transactions and toll revenue presented in this report have been prepared by Stantec based on the following assumptions and conditions:

1. Toll rates on the CTTS elements will be escalated on an annual basis on January 1st of each year based on the CPI-U. It is estimated that the rate of inflation will increase as presented in Table 4.6.

2. Toll collection on the CTTS elements will be by ETC or PBM.

3. The surcharge for PBM transactions will remain at 33 percent throughout the forecast period as discussed in Chapter 4.

4. ETC market shares for 2018 will be as presented in Table 8.28 and remain relatively constant for future years as presented earlier in this section.

5. The traffic mix using the CTTS elements will result in toll multipliers (used for toll revenue estimation purposes) for trucks with 3+ axles as presented in Table 8.28 for 2018 and as presented earlier in this section for future years.

6. The current Truck Toll Policy uses an axle-based (N-1) formula whereby tolls for trucks are calculated as (Axles-1) times the auto toll rate. The current policy that limits truck tolls to

the 4-axle rate for SH 130 and SH 45 SE will remain in place. There will be no other discounts or changes to the truck toll policy.

7. The socioeconomic growth discussed in Chapter 6 will occur as forecasted.

8. The CTTS highway network improvements, such as the widening of SH 130 Segments 2&3 as well as all the background network improvements will be constructed as planned and in accordance with the schedule discussed in Chapter 2 of this report. As noted in Chapter 2, given the uncertainty related to costs and funding of the IH-35 Managed Lane project in Austin, a decision was made not to include this project in the background network for the forecast of future traffic.

9. The speed limit policy on limited access roadways will be maintained at current levels.

10. The CTTS elements will be efficiently maintained and operated, but even under the most efficient operation, there will be some toll evasion and revenue "leakage." This has been accounted for in the traffic and revenue forecasts by collection rate adjustments. Assumed collection rate adjustments for 2018 are presented in Table 8.28 and are assumed constant throughout the forecast period.

11. Motor fuel will remain in adequate supply during the forecast period, and motor fuel prices (i.e., the average price for regular gasoline) will not be more than $4.50 per gallon, adjusted for inflation, for sustained periods.

12. Increases in Federal and State motor fuel taxes will not be to the extent that, together with fuel price increases, motor fuel prices will exceed $4.50, adjusted for inflation, for sustained periods.

13. No radical change in travel modes that would drastically curtail motor vehicle use will occur during the forecast period.

14. In the long term, generally normal economic conditions will prevail in the State and the United States, and a major depression, national or State emergency, or prolonged fuel shortage will not occur.

15. Consistent with current agreements, TxDOT will reimburse the appropriate CTTS account the cost of tolls not paid by those customers with eligible specialty license plates registered with Texas Department of Motor Vehicles (TxDMV) to disabled veterans, Purple Heart recipients, and Medal of Honor recipients. TxDOT will also reimburse the appropriate CTTS account for the cost of tolls not paid due to any periodic truck toll rate discounts offered.

8.7 DISCLAIMER

It is Stantec's opinion that the revenue projections presented in this report are reasonable and have been prepared in accordance with accepted practice for investment-grade studies. However, given the uncertainties within the current international and economic climate, Stantec considers it is necessary to state that the traffic and revenue projections are based on the following caveats:

- This report presents the results of Stantec's consideration of the information available to us as of the date hereof and the application of Stantec's experience and professional judgment to that information. It is not a guarantee of any future events or trends.

- The traffic and revenue forecasts will be subject to future economic and social conditions and demographic developments that cannot be predicted with certainty.

- The projections contained in this report, while presented with numerical specificity, are based on a number of estimates and assumptions which, though considered reasonable to us, are inherently subject to significant economic and competitive uncertainties and contingencies, many of which will be beyond Stantec's control and that of TxDOT. In many instances, a broad range of alternative assumptions could be considered reasonable. Changes in the assumptions used could result in material differences in projected outcomes.

- If, for any reason, any of these conditions should change due to changes in the economy or competitive environment, or other factors, the consultant team's opinions or estimates may require amendment or further adjustments.

- Stantec's toll revenue projections only represent its best judgment and Stantec does not warrant or represent that actual toll revenues will not vary from its projections, estimates and forecasts.

Many statements contained in this report, which are not historical facts, are forward-looking statements, which are based on Stantec's opinions, as well as assumptions made by, and information currently available to, the management and staff of Stantec. Because the statements are based on expectations about future events and economic performance and are not statements of fact, actual results may differ materially from those projected. The words "anticipate", "assume", "estimate", "expect", "objective", "projection", "plan", "forecast", "goal", "budget", or similar words are intended to identify forward-looking statements. The words or phrases "to date", "now", "currently", and the like are intended to mean as of the date of this report.

Stantec shall have the right to review, and to require any changes it believes appropriate be made to any official statement, prospectus, private placement memorandum or other document used in connection with any such financing that refers to Stantec, its reports, opinions or other

documents, or services. TxDOT shall provide copies of any such materials to Stantec for review by Stantec and its legal counsel at a reasonable time prior to its use of any such materials. Stantec shall have the right to retain copies of all such materials.

9.0 SENSITIVITY ANALYSIS

The assumptions upon which the 2018 Study transaction and revenue forecasts were based are presented in Chapter 8 of this report. In many instances, a broad range of alternative assumptions could be considered reasonable, which would result in material differences in the forecasts. This chapter of the report provides estimates of the forecast's sensitivity to changes in selected assumptions.

9.1 OVERVIEW OF ANALYSES

As a result of discussions with TxDOT staff, a decision was made to conduct sensitivity trials to assess the impacts of the following three conditions on the forecasts:

- Reduced CPI Growth;
- Reduced Trip Growth; and
- Reduced Value of Time.

The sensitivity trials were conducted for the 2020, 2030, and 2040 model years. Average weekday toll revenues for each sensitivity trial and the corresponding percent change in toll revenue when compared to the unadjusted base forecast are provided in Table 9.1.

Table 9.1 Average Weekday Revenue Comparison for the Sensitivity Trials

Model Year	Average Weekday Toll Revenue						
	Base Revenue	Sensitivity 1 (Reduced CPI)		Sensitivity 2 (Reduced Growth)		Sensitivity 3 (Reduced VOT)	
		Revenue	% Difference	Revenue	% Difference	Revenue	% Difference
2020	$696,817	$691,770	-0.7%	$675,476	-3.1%	$663,120	-4.8%
2030	$1,144,145	$1,107,979	-3.2%	$1,051,352	-8.1%	$1,098,072	-4.0%
2040	$2,009,355	$1,900,854	-5.4%	$1,803,465	-10.2%	$1,957,864	-2.6%

9.2 REDUCED CPI GROWTH

As part of the base forecast, toll rates are escalated annually based on the change in the CPI-U value. The household income of travelers, which influences the ability to pay tolls, is also anticipated to increase over time. As discussed in Chapter 4, Stantec has obtained CPI data from 1970 to 2017. Over the longer term, the annual change in CPI has been 3 to 4 percent, while the most recent 20-year period indicates that CPI average annual growth rate is approximately 2.1 percent. For the period between 2010 and 2017, the CPI increased at a compounded annual growth rate of 1.7 percent and for the most recent CTTS annual toll escalation for CY 2018, the CPI increase was 1.9 percent. The base forecast in the 2018 Study utilizes the longer-term data along with current CPI trends to create a forecast that assumes the CPI increases at 2.3 percent for 2019, followed by small increases until reaching 2.5 percent by 2023. From 2024 to 2033, CPI growth is assumed to increase gradually to 3.0 percent and remain at that growth rate out to 2037. From

2038 to 2042 the CPI rate is assumed to decrease towards 2.5 percent. For this sensitivity trial, CPI growth is 0.25 percent lower than the assumed escalations in the base forecast. For example, the CPI for 2018 was reduced from 2.2 percent to 1.95 percent. Consistent with the base forecast, household income growth is assumed to equal the CPI growth rate in this sensitivity.

As expected, this sensitivity trial results in revenue estimates ranging from 0.7 percent less than the base case in 2020 to 5.4 percent less in 2040. The losses are due to lower toll rates from the reduced escalation rate. There is less impact in 2020 when compared to the base forecast as the change in toll rates are less than in the later years of the forecast.

9.3 REDUCED TRIP GROWTH

Under this sensitivity trial, the projected growth in trips was reduced by 20 percent. This reduction implies a lower level of population and employment growth, which generates a lower level of trip growth.

The lower level of trip growth from this sensitivity trial results in lower revenue estimates in response to lower traffic levels in the study area. This leads to fewer available trips for each facility and less congestion on competing facilities, making it less advantageous to use the CTTS facilities. The reduced revenue ranges from 3.1 percent in 2020 to 10.2 percent in 2040. The impact is less significant in 2020 since the difference in the number of trips is less in the early years than in the more distant horizon years.

9.4 REDUCED VALUE OF TIME

For this sensitivity trial, the estimated value of time for all trip purposes and trucks was reduced by 10 percent. The value of time would still increase throughout the forecast, but the reduced values would remain at 90 percent of the values used in the base forecast.

The reduction in the value of time translates to a lower willingness to pay tolls in order to save travel time, resulting in less revenue. The loss of revenue is less variable than the other sensitivities among model years with losses of 4.8 percent, 4.0 percent, and 2.6 percent in 2020, 2030, and 2040 respectively. This more uniform response is due to the general reduction of the value of time across horizon years, which tends to have a relatively equal impact on the diversion estimates. The slightly lower levels of response in the more distant horizon years reflect the increasing congestion on the background network, which tends to make the CTTS more attractive compared to the non-tolled routes in the future.

APPENDIX A

Technical Memorandum on Socioeconomic Data from Michael Bomba, PhD

TECHNICAL MEMORANDUM

REVIEW OF THE CAPITAL AREA MPO AND ALAMO AREA MPO SOCIOECONOMIC DATA FOR THE CTTS STUDY AREA

This technical memorandum provides an overview of the assessment and adjustment of population and employment data from the Capital Area Metropolitan Planning Organization's (CAMPO) and the Alamo Area Metropolitan Planning Organization's (AAMPO) travel demand models for the 2017 CTTS Update. The first portion of the memorandum will provide regional background information and context that describe current population and employment trends in the two regions. The second portion of the memo will describe the methodology used during the assessment and adjustment of the county control totals and the socioeconomic data at the individual Traffic Analysis Zone (TAZ).

POPULATION TRENDS

Historic Population Trends

In only three decades (1980-2010), the combined population of the six counties in the CAMPO study area tripled from 602,854 residents to 1,759,039 residents (See Table 1). More than half of the population growth during this period was in Travis County, with Williamson County accounting for an additional 30 percent of the growth. Williamson County also experienced the highest rate of population growth, increasing almost six-fold between 1980 and 2010 to 422,679 residents, while Hays County's population increased four-fold to 157,107 residents. Bastrop County's population grew three-fold to 74,171 residents during this same period and Burnet County's population increased 240 percent to 42,750 residents between 1980 and 2010. Caldwell County had the slowest growth rate, but still increased by 61 percent to 38,066 residents.

Population in the San Antonio/Bexar County MPO study area[1] also grew strongly between 1980 and 2010, although at a more measured pace. Table 2 shows the historic populations of Bexar, Comal, Guadalupe, Kendall, and Wilson Counties. Collectively, the population of these five counties grew from 1.1 million residents in 1980 to more than 2.0 million residents during 2010. Almost 78 percent of that population growth occurred in Bexar County, which had a population of 1,714,773 residents in 2010. Among the five counties, Kendall County's population grew most quickly, increasing three-fold during this period to 33,410 residents. Guadalupe County, the second largest county in the region, increased its population by 182 percent between 1980 and 2010 to 131,533 residents, while Comal County (the third largest county) increased by 198 percent to 108,472 residents during this same period. Kendall County also grew strongly, although at a slightly slower pace and had 42,918 residents in 2010.

[1] In addition to the five counties in the San Antonio/Bexar County MPO study area (Bexar, Guadalupe, Comal, Kendall, and Wilson), the San Antonio-New Braunfels MSA also includes Atascosa, Bandera, and Medina Counties.

Table 1: Historic Population for Counties in the Austin-Round Rock MSA, 1980-2010

TOTAL POPULATION

	Bastrop County	Burnet County	Caldwell County	Hays County	Travis County	Williamson County	Total
1980	24,726	17,803	23,637	40,594	419,573	76,521	602,854
1990	38,263	22,677	26,392	65,614	576,407	139,551	868,904
2000	57,733	34,147	32,194	97,589	812,281	249,967	1,283,911
2010	74,171	42,750	38,066	157,107	1,024,266	422,679	1,759,039

TOTAL CHANGE

	Bastrop County	Burnet County	Caldwell County	Hays County	Travis County	Williamson County	Total
1980-1990	13,537	4,874	2,755	25,020	156,834	63,030	266,050
1990-2000	19,470	11,470	5,802	31,975	235,874	110,416	415,007
2000-2010	16,438	8,603	5,872	59,518	211,985	172,712	475,128

COMPOUNDED ANNUAL GROWTH RATE

	Bastrop County	Burnet County	Caldwell County	Hays County	Travis County	Williamson County	Total
1980-1990	4.46%	2.45%	1.11%	4.92%	3.23%	6.19%	3.72%
1990-2000	4.20%	4.18%	2.01%	4.05%	3.49%	6.00%	3.98%
2000-2010	2.54%	2.27%	1.69%	4.88%	2.35%	5.39%	3.20%

Source: U.S. Census Bureau, 2017.

Table 2: Historic Population for Select Counties in the San Antonio-New Braunfels MSA, 1980-2010

			TOTAL POPULATION			
	Bexar County	**Comal County**	**Guadalupe County**	**Kendall County**	**Wilson County**	**Total**
1980	988,880	36,446	46,708	10,635	16,756	1,099,516
1990	1,185,394	51,832	64,873	14,589	22,650	1,339,338
2000	1,392,931	78,021	89,023	23,743	32,408	1,616,126
2010	1,714,773	108,472	131,533	33,410	42,918	2,031,106
			TOTAL CHANGE			
	Bexar County	**Comal County**	**Guadalupe County**	**Kendall County**	**Wilson County**	**Total**
1980-1990	196,514	15,386	18,165	3,954	5,894	239,822
1990-2000	207,537	26,189	24,150	9,154	9,758	276,788
2000-2010	321,842	30,451	42,510	9,667	10,510	414,980
			COMPOUNDED ANNUAL GROWTH RATE			
	Bexar County	**Comal County**	**Guadalupe County**	**Kendall County**	**Wilson County**	**Total**
1980-1990	1.83%	3.58%	3.34%	3.21%	3.06%	1.99%
1990-2000	1.63%	4.17%	3.22%	4.99%	3.65%	1.90%
2000-2010	2.10%	3.35%	3.98%	3.47%	2.85%	2.31%

Source: U.S. Census Bureau, 2017.

Recent Population Trends

More recent estimates show that the population of the CAMPO study area has continued to grow since 2010. The data in Table 3 provides population counts from the 2000 and 2010 decennial U.S. Censuses, as well as the U.S. Census Bureau's 2016 population estimates. The largest overall population increase between 2010 and 2016 occurred in Travis County, with more than 175,000 new residents between the 2010 decennial Census and the 2016 estimates. Williamson County also grew strongly during this same period with approximately 106,000 new residents between 2010 and 2013, followed by Hays County with more than 47,000 new residents. However, since the 2010 U.S. Census, the rate of population growth in all of the counties, with the exception of Travis County, has slowed. During this period, Travis County's population growth accelerated slightly from a CAGR of 2.35 percent between 2000 and 2010 to an estimated CAGR of 2.66 percent between 2010 and 2016. Williamson County's population growth, on the other hand, declined from a 5.39 percent CAGR between 2000 and 2010 to 3.80 percent CAGR from 2010 to 2016. Bastrop County's population growth also slowed considerably from a 2.54 percent CAGR between 2000 and 2010 to a 1.84 percent CAGR between 2010 and 2016. Between 2010 and 2016, Bastrop County added 8,500 residents, while Burnet and Caldwell counties added approximately 3,500 residents and 3,100 residents, respectively.

Table 3: Recent Population Trends for Counties in the Austin-Round Rock MSA, 2000-2016

	TOTAL POPULATION			TOTAL CHANGE	AVERAGE ANNUAL CHANGE		CAGR	
COUNTY	2000	2010	2016	2010-16	2000-10	2010-16	2000-10	2010-16
Bastrop	57,733	74,171	82,733	8,562	1,644	1,427	2.54%	1.84%
Burnet	34,147	42,750	46,243	3,493	860	582	2.27%	1.32%
Caldwell	32,194	38,066	41,161	3,095	587	516	1.69%	1.31%
Hays	97,589	157,107	204,470	47,363	5,952	7,894	4.88%	4.49%
Travis	812,281	1,024,266	1,199,323	175,057	21,199	29,176	2.35%	2.66%
Williamson	249,967	422,679	528,718	106,039	17,271	17,673	5.39%	3.80%
TOTAL	1,283,911	1,759,039	2,102,648	343,609	47,513	57,268	3.20%	1.80%

Source: U.S. Census Bureau, 2017.

U.S. Census Bureau data show that the populations of the five counties in the AAMPO study area also grew strongly between the 2010 and 2016, adding almost 344,000 new residents (See Table 4). Most of this population growth occurred in Bexar County, which added 214,000 residents since the 2010 decennial Census. Guadalupe and Comal Counties also increased their populations during this period, adding almost 24,000 and 26,000 new residents, respectively. Kendall County's population grew by 9,100 residents during this period, while Wilson County grew by 5,500 residents. However, since 2010, the overall rate of population growth has slowed, with the exception of Comal and Kendall counties.

Table 4: Recent Population Trends for Select Counties in the San Antonio-New Braunfels MSA, 2000-2016

	TOTAL POPULATION			TOTAL CHANGE	AVERAGE ANNUAL CHANGE		CAGR	
COUNTY	2000	2010	2016	2010-16	2000-10	2010-16	2000-10	2010-16
Bexar	1,392,931	1,714,773	1,928,680	213,907	32,184	35,651	2.10%	1.98%
Comal	78,021	108,472	134,788	26,316	3,045	4,386	3.35%	3.69%
Guadalupe	89,023	131,533	155,265	23,732	4,251	3,955	3.98%	2.80%
Kendall	23,743	33,410	42,540	9,130	967	1,522	3.47%	4.11%
Wilson	32,408	42,918	48,480	5,562	1,051	927	2.85%	2.05%
TOTAL	1,616,126	2,031,106	2,309,753	278,647	41,498	46,441	2.31%	2.17%

Source: U.S. Census Bureau, 2017.

Placing the growth that has occurred in Central Texas into a national context, between 2000 and 2016, the Austin-Round Rock MSA had the 11th largest population increase in the nation and the San Antonio-New Braunfels MSAs was ranked 15th (See Table 5). Other Texas MSAs in the list include the Dallas-Fort Worth-Arlington MSA, which had the nation's largest population increase during this period, with more than 2.0 million new residents. The Houston-The Woodlands-Sugar Land, TX MSA ranked second, also with more than 2.0 million additional residents.

Table 5: Fastest Growing Metropolitan Areas in the United States (Absolute Change), 2000-2016

RANK	MSA	TOTAL POPULATION			TOTAL CHANGE	AVERAGE ANNUAL CHANGE		CAGR	
		2000	2010	2016	2000-16	2000-10	2010-16	2000-10	2010-16
1	Dallas-Fort Worth-Arlington, TX Metro Area	5,161,544	6,426,214	7,233,323	2,071,779	126,467	134,518	2.22%	1.99%
2	Houston-The Woodlands-Sugar Land, TX Metro Area	4,715,407	5,920,416	6,772,470	2,057,063	120,501	142,009	2.30%	2.27%
3	New York-Newark-Jersey City, NY-NJ-PA Metro Area	18,323,002	19,567,410	20,153,634	1,830,632	124,441	97,704	0.66%	0.49%
4	Atlanta-Sandy Springs-Roswell, GA Metro Area	4,247,981	5,286,728	5,789,700	1,541,719	103,875	83,829	2.21%	1.53%
5	Phoenix-Mesa-Scottsdale, AZ Metro Area	3,251,876	4,192,887	4,661,537	1,409,661	94,101	78,108	2.57%	1.78%
6	Washington-Arlington-Alexandria, DC-VA-MD-WV Metro Area	4,796,183	5,636,232	6,131,977	1,335,794	84,005	82,624	1.63%	1.41%
7	Riverside-San Bernardino-Ontario, CA Metro Area	3,254,821	4,224,851	4,527,837	1,273,016	97,003	50,498	2.64%	1.16%
8	Charlotte-Concord-Gastonia, NC-SC Metro Area	1,330,448	2,217,012	2,474,314	1,143,866	88,656	42,884	5.24%	1.85%
9	Miami-Fort Lauderdale-West Palm Beach, FL Metro Area	5,007,564	5,564,635	6,066,387	1,058,823	55,707	83,625	1.06%	1.45%
10	Los Angeles-Long Beach-Anaheim, CA Metro Area	12,365,627	12,828,837	13,310,447	944,820	46,321	80,268	0.37%	0.62%
11	**Austin-Round Rock, TX Metro Area**	**1,249,763**	**1,716,289**	**2,056,405**	**806,642**	**46,653**	**56,686**	**3.22%**	**3.06%**
12	Orlando-Kissimmee-Sanford, FL Metro Area	1,644,561	2,134,411	2,441,257	796,696	48,985	51,141	2.64%	2.26%
13	Las Vegas-Henderson-Paradise, NV Metro Area	1,375,765	1,951,269	2,155,664	779,899	57,550	34,066	3.56%	1.67%
14	Seattle-Tacoma-Bellevue, WA Metro Area	3,043,878	3,439,809	3,798,902	755,024	39,593	59,849	1.23%	1.67%
15	**San Antonio-New Braunfels, TX Metro Area**	**1,711,703**	**2,142,508**	**2,429,609**	**717,906**	**43,081**	**47,850**	**2.27%**	**2.12%**

Note: Burnet County is not within the Austin-Round Rock MSA.
Source: U.S. Census Bureau, 2017.

Population Projections

Recent population projection scenarios from the Texas State Data Center (TxSDC) for the Austin-Round Rock MSA suggest strong rates of population growth into the future. The projected population for the Austin-Round Rock MSA is expected to be between 2.1 million and almost 4.0 million residents in 2040 (See Table 6). The most conservative scenario, the 0.0 migration scenario, assumes that there will be no net migration and the population will grow solely based upon the number of births and deaths in the region. Given historic migration trends for the region, this scenario seems unlikely. The 0.5 migration scenario assumes that future net migration will be one-half the rate that occurred between the 2000 and 2010 decennial U.S. Censuses and the 1.0 migration scenario assumes that future net migration will be equal to the net migration rate between 2000 and 2010. The historic population growth rate for the Austin-Round Rock MSA suggests that the region's population will likely grow at a rate between the 0.5 and 1.0 migration scenarios, which would add between 1.1 million and 2.2 million residents between 2010 and 2040.

Table 6: Population Projections for the Austin-Round Rock MSA, 2010-2040

		TOTAL POPULATION	
Year	**0.0 Migration Scenario**	**0.5 Migration Scenario**	**1.0 Migration Scenario**
2010	1,716,289	1,716,289	1,716,289
2015	1,802,822	1,893,931	1,990,437
2020	1,877,175	2,077,981	2,306,857
2025	1,935,453	2,258,677	2,653,615
2030	1,985,268	2,441,548	3,035,547
2035	2,027,335	2,630,857	3,466,270
2040	2,062,870	2,829,932	3,960,317
		ANNUAL AVERAGE GROWTH	
Year	**0.0 Migration Scenario**	**0.5 Migration Scenario**	**1.0 Migration Scenario**
2010-2015	17,307	35,528	54,830
2015-2020	14,871	36,810	63,284
2020-2025	11,656	36,139	69,352
2020-2030	9,963	36,574	76,386
2030-2035	8,413	37,862	86,145
2035-2040	7,107	39,815	98,809
		COMPOUNDED ANNUAL GROWTH RATE	
Year	**0.0 Migration Scenario**	**0.5 Migration Scenario**	**1.0 Migration Scenario**
2010-2015	0.99%	1.99%	3.01%
2015-2020	0.81%	1.87%	2.99%
2020-2025	0.61%	1.68%	2.84%
2020-2030	0.51%	1.57%	2.73%
2030-2035	0.42%	1.50%	2.69%
2035-2040	0.35%	1.47%	2.70%

Source: Texas State Data Center, 2017.

Table 7 breaks down the TxSDC's population projections for each of the six counties in the Austin-Round Rock MSA. The TxSDC's population projections anticipate that suburban counties, particularly Williamson and Hays Counties, will generate the most population growth in the future. Assuming that net future migration rates in Williamson County and Hays County are equal to past migration rates, then Williamson County will grow by almost 1.0 million residents between 2010 and 2040 and Hays County will grow by approximately 400,000 residents. Travis County's growth, despite its larger population, is expected to increase by approximately 700,000 residents under the most optimistic scenario. Under the less optimistic 0.5 migration scenario, Travis County would experience a total population growth of 450,000 new residents, while Williamson County's population would grow by 402,000 residents and Hays County's population would increase by almost 190,000 residents. Bastrop County's population is projected to grow between 8,000 and 121,000 residents by 2040, depending upon the growth scenario. Burnet County's projected growth ranges from 1,650 to almost 29,000 new residents. Caldwell County has a similar, narrower range with the population projected between roughly 5,000 and 40,000 new residents in 2040.

Table 7: Population Projections for Counties in the Austin-Round Rock MSA, 2010-2040

	Bastrop County	Burnet County	Caldwell County	Hays County	Travis County	Williamson County	Total
2010	74,171	42,750	38,066	157,107	1,024,266	422,679	1,759,039
2015	75,875	43,071	39,139	169,708	1,079,590	438,510	1,845,893
2020	77,713	43,529	40,260	183,040	1,125,881	450,281	1,920,704
2025	79,706	44,004	41,282	192,968	1,160,326	461,171	1,979,457
2030	81,327	44,299	42,011	202,195	1,187,826	471,909	2,029,567
2035	82,230	44,354	42,416	210,268	1,211,356	481,065	2,071,689
2040	82,528	44,408	42,586	218,271	1,232,915	486,570	2,107,278
	Bastrop County	**Burnet County**	**Caldwell County**	**Hays County**	**Travis County**	**Williamson County**	**Total**
2010	74,171	42,750	38,066	157,107	1,024,266	422,679	1,759,039
2015	80,780	45,144	41,100	182,893	1,111,829	477,329	1,939,075
2020	88,279	47,748	44,401	211,934	1,198,485	534,882	2,125,729
2025	96,872	50,370	47,921	240,993	1,274,999	597,892	2,309,047
2030	106,301	52,700	51,327	273,247	1,342,829	667,844	2,494,248
2035	115,997	54,674	54,485	308,142	1,407,810	744,423	2,685,531
2040	125,914	56,473	57,444	346,625	1,474,822	825,127	2,886,405
	Bastrop County	**Burnet County**	**Caldwell County**	**Hays County**	**Travis County**	**Williamson County**	**Total**
2010	74,171	42,750	38,066	157,107	1,024,266	422,679	1,759,039
2015	86,175	47,386	43,322	197,298	1,144,887	518,755	2,037,823
2020	100,746	52,456	49,202	246,119	1,277,007	633,783	2,359,313
2025	118,785	57,772	55,862	302,494	1,403,841	772,633	2,711,387
2030	140,463	62,876	63,015	372,120	1,519,407	940,542	3,098,423
2035	165,796	67,447	70,177	455,930	1,631,951	1,142,416	3,533,717
2040	195,452	71,614	77,373	556,982	1,749,761	1,380,749	4,031,931

Source: Texas State Data Center, 2017.

The population of the San Antonio-New Braunfels MSA's is not anticipated to grow as rapidly as will the population of the Austin-Round Rock MSA. In fact, the population of the Austin-Round Rock MSA could potentially eclipse the San Antonio-New Braunfels MSA in size. Table 8 shows that the projected population for the San Antonio-New Braunfels MSA is expected to grow to between 2.5 million and 3.7 million residents by 2040. As with the Austin-Round Rock MSA, the conservative 0.0 migration scenario is unlikely in the San Antonio-New Braunfels MSA, given its historic role as a destination for migrants and its continued attractiveness into the future. The 0.5 migration scenario projects that the region would add almost 1.0 million new residents between 2010 and 2040, while the 1.0 migration scenario would result in almost 1.6 million new residents in the region. Given the region's historic population growth trends and its prospects for future growth, it will likely grow at a rate between the 0.5 and 1.0 migration scenarios.

Table 8: Population Projections for the San Antonio-New Braunfels MSA, 2010-2040

		TOTAL POPULATION	
Year	**0.0 Migration Scenario**	**0.5 Migration Scenario**	**1.0 Migration Scenario**
2010	2,142,508	2,142,508	2,142,508
2015	2,231,119	2,305,006	2,380,005
2020	2,313,475	2,471,484	2,635,183
2025	2,387,867	2,639,052	2,904,769
2030	2,450,959	2,802,711	3,182,644
2035	2,500,341	2,956,514	3,459,143
2040	2,538,919	3,103,481	3,735,981
		ANNUAL AVERAGE GROWTH	
Year	**0.0 Migration Scenario**	**0.5 Migration Scenario**	**1.0 Migration Scenario**
2010-2015	17,722	32,500	47,499
2015-2020	16,471	33,296	51,036
2020-2025	14,878	33,514	53,917
2020-2030	12,618	32,732	55,575
2030-2035	9,876	30,761	55,300
2035-2040	7,716	29,393	55,368
		COMPOUNDED ANNUAL GROWTH RATE	
Year	**0.0 Migration Scenario**	**0.5 Migration Scenario**	**1.0 Migration Scenario**
2010-2015	0.81%	1.47%	2.12%
2015-2020	0.73%	1.40%	2.06%
2020-2025	0.64%	1.32%	1.97%
2020-2030	0.52%	1.21%	1.84%
2030-2035	0.40%	1.07%	1.68%
2035-2040	0.31%	0.97%	1.55%

Source: Texas State Data Center, 2017.

Table 9 shows the SDC's population projections for five counties in the Alamo Area MPO. Unlike the Austin-Round Rock MSA, most of the future population growth is expected in the

core (i.e. Bexar County), with less total population growth in the suburban counties. Bexar County is projected to add between 363,000 and 1.1 million new residents, depending upon the growth scenario. The region as a whole is projected to add between 383,000 and 1.5 million resident, which demonstrates the future influence of Bexar County on the region's population growth.

Table 9: Population Projections for Select Counties in the San Antonio-New Braunfels MSA, 2010-2040

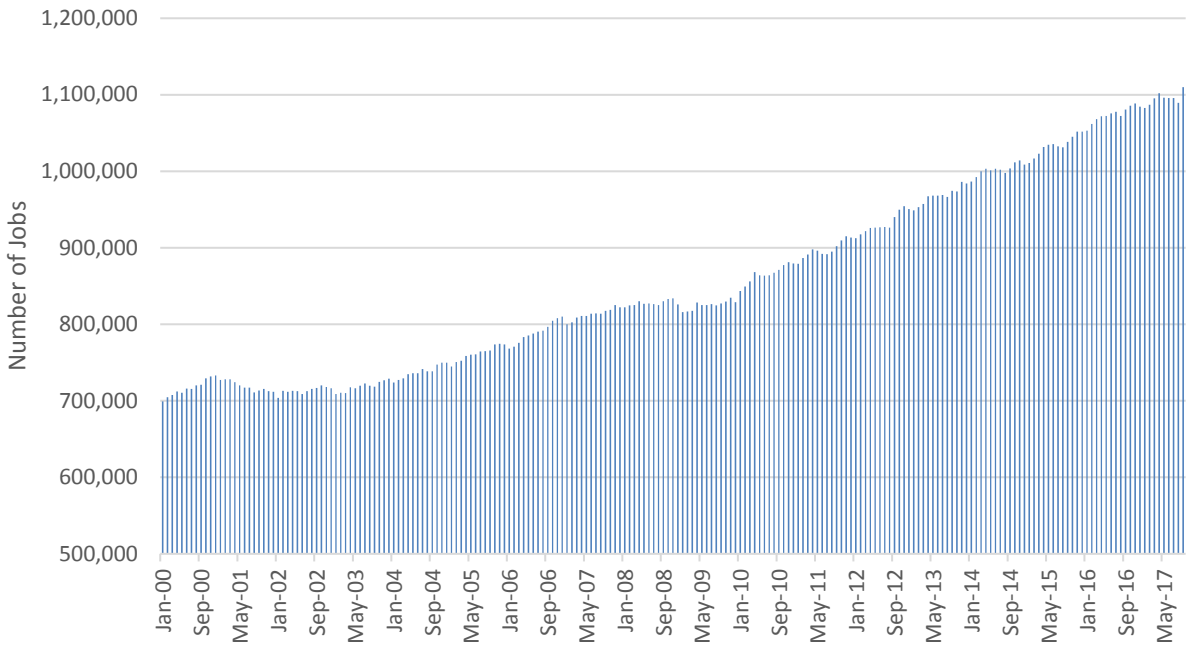
			0.0 MIGRATION SCENARIO			
	Bexar County	**Comal County**	**Guadalupe County**	**Kendall County**	**Wilson County**	**Total**
2010	1,714,773	108,472	131,533	33,410	42,918	2,031,106
2015	1,796,183	109,695	134,678	33,418	43,370	2,117,344
2020	1,870,689	110,894	137,706	33,619	44,034	2,196,942
2025	1,936,446	112,228	140,832	34,018	44,848	2,268,372
2030	1,992,798	113,146	143,384	34,317	45,458	2,329,103
2035	2,039,291	113,145	144,734	34,293	45,553	2,377,016
2040	2,078,166	112,556	144,899	33,973	45,125	2,414,719
			0.5 MIGRATION SCENARIO			
	Bexar County	**Comal County**	**Guadalupe County**	**Kendall County**	**Wilson County**	**Total**
2010	1,714,773	108,472	131,533	33,410	42,918	2,031,106
2015	1,839,926	118,571	144,847	36,090	46,488	2,185,922
2020	1,967,590	128,974	158,712	38,847	50,232	2,344,355
2025	2,094,216	139,835	173,662	41,733	54,172	2,503,618
2030	2,216,912	150,591	189,140	44,741	58,085	2,659,469
2035	2,331,743	160,515	204,763	47,658	61,693	2,806,372
2040	2,442,098	169,835	220,138	50,357	64,775	2,947,203
			1.0 MIGRATION SCENARIO			
	Bexar County	**Comal County**	**Guadalupe County**	**Kendall County**	**Wilson County**	**Total**
2010	1,714,773	108,472	131,533	33,410	42,918	2,031,106
2015	1,882,834	128,347	155,621	38,993	49,833	2,255,628
2020	2,062,088	150,366	182,526	44,958	57,292	2,497,230
2025	2,249,392	174,432	212,677	51,307	65,174	2,752,982
2030	2,439,700	199,936	246,038	58,229	73,396	3,017,299
2035	2,625,647	226,007	282,445	65,617	81,650	3,281,366
2040	2,809,942	252,268	321,869	73,221	89,858	3,547,158

Source: Texas State Data Center, 2017.

EMPLOYMENT TRENDS

The Austin-Round Rock MSA's economy is generally recognized as one of the more dynamic in the nation. The data in Figure 1 show the total employment between January 2001 and September 2017, based upon the Bureau of Labor Statistics Quarterly Census of Employment and Wages (QCEW) figures. The overall employment trend in the region was strongly positive during this period, with the economy gaining more than 410,000 jobs and growing by roughly 60 percent. During September 2017, the Austin-Round Rock MSA had a total employment of 1,109,796 jobs. Historically, the 2008-2009 Recession had a relatively modest impact on the Austin MSA, compared to other regions in the United States. The 2001 Recession, which had concentrated impacts on the technology industry, appears to have had a more significant affected the local employment and for a longer period (reaching into late-2003, before recovery began).

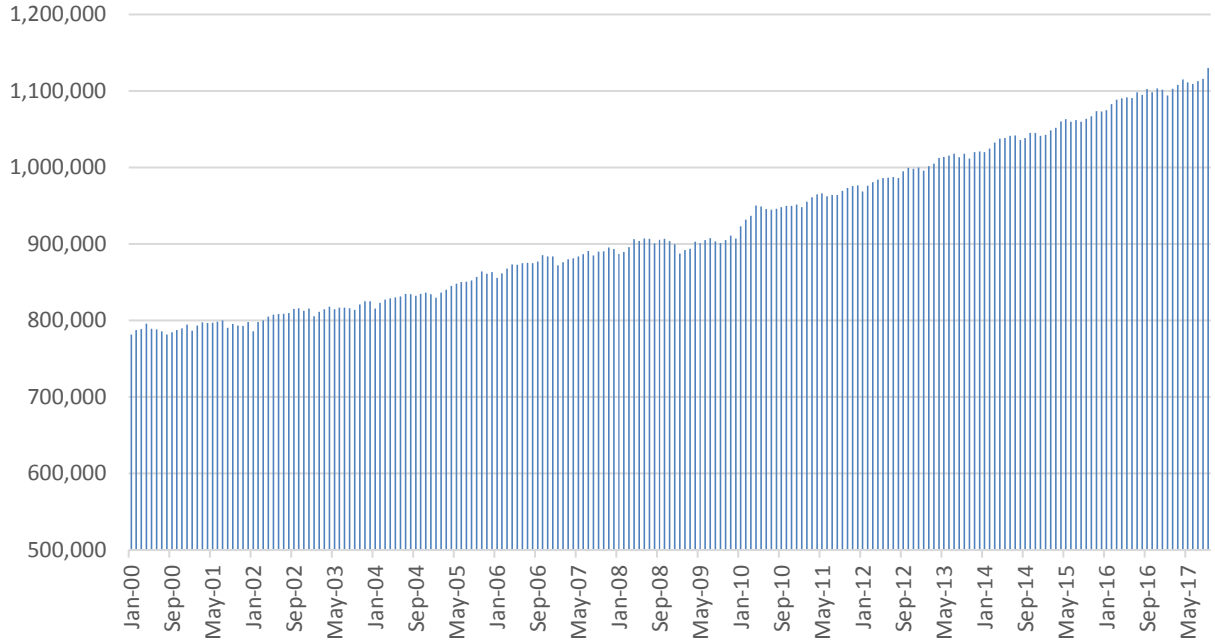
Figure 1: Total Employment in the Austin-Round Rock MSA, January 2000-September 2017



Note: Figure based upon Quarterly Census of Employment and Wages (QCEW) data.
Source: U.S. Bureau of Labor Statistics, 2017.

Employment growth in the San Antonio-New Braunfels MSA also fared comparatively well, although the overall amount trailed the Austin-Round Rock MSA. The San Antonio-New Braunfels MSA had roughly 782,000 jobs during January 2001, which grew to 1,130,000 jobs during September 2017 (See Figure 2). The overall growth rate during this period was 45 percent or a total increase of roughly 350,000 jobs. Like the Austin-Round Rock MSA, the San Antonio-New Braunfels MSA was not severely affected by the 2008-2009 Recession and experienced almost no significant consequence from the 2001 Recession.

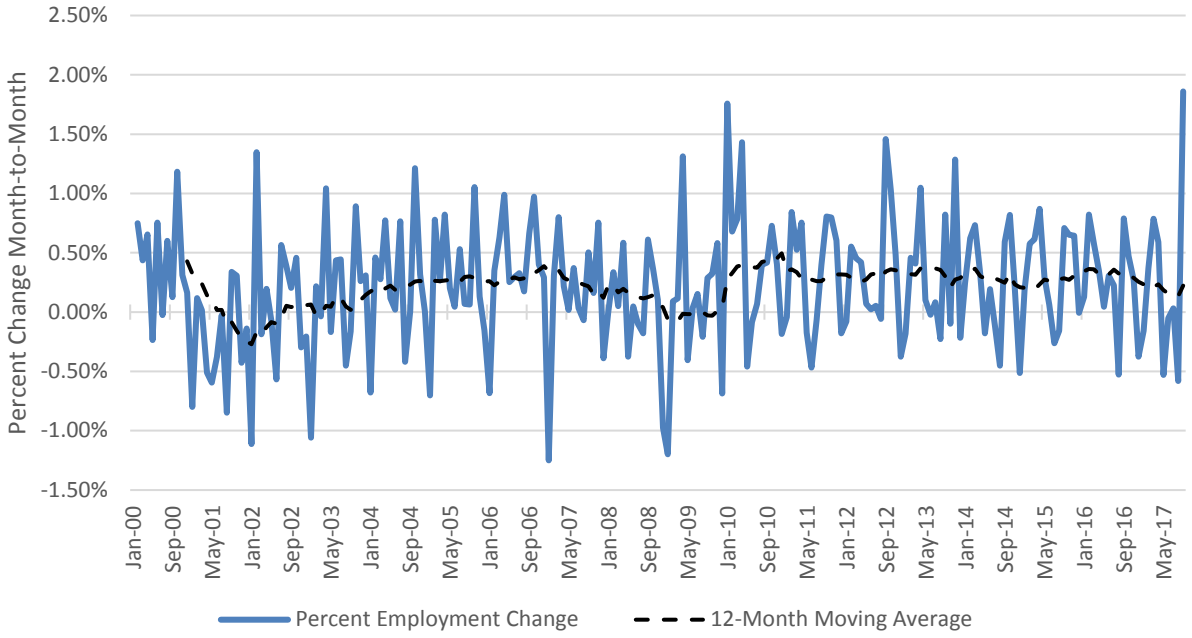
Figure 2: Total Employment in the San Antonio-New Braunfels MSA, January 2000-September 2017



Note: Figure based upon Quarterly Census of Employment and Wages (QCEW) data.
Source: U.S. Bureau of Labor Statistics, 2017.

The data in Figure 3 show the percentage month-on-month employment change between January 2000 and September 2017. The unadjusted employment change shows considerable volatility, due to seasonal and academic employment. However, by adding a trend line showing the 12-month moving average, this volatility can be smoothed and the trends can be discerned. The 12-month moving average trend line shows that the Austin-Round Rock region suffered a prolonged period of job loss between 2001 and 2003, due to the downturn in the computer and telecommunications industries, in addition to the recessionary effects of the September 11, 2001 terrorist attacks. The region's economy recovered by early 2004 and enjoyed a period of sustained employment growth until 2008, when the national recession took hold. The job loss of the 2008-2009 Recession occurred over a briefer period than the previous recession and the recovery came quicker. Since early 2010, the Austin-Round Rock MSA has experienced another sustained period of employment growth similar to the mid-2000s, although more recent trends (2017) suggest this growth may be slowing.

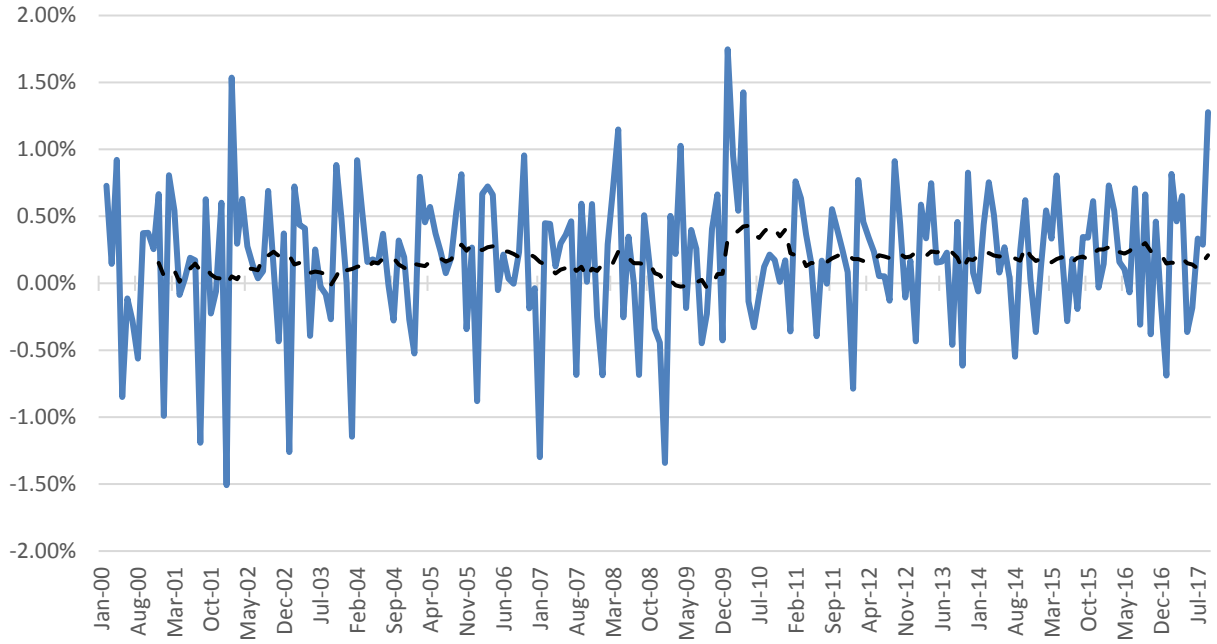
Figure 3: Month-on-Month Employment Change for Austin-Round Rock MSA, January 2000 to December 2013



Note: Figure based upon Quarterly Census of Employment and Wages (QCEW) data.
Source: Bureau of Labor Statistics, 2017.

Figure 4 shows the CES data over the same period for the San Antonio-New Braunfels MSA. The 12-month moving average trend line shows that the San Antonio region suffered a period of job growth stagnation more than job loss between 2001 and 2003, unlike the Austin-Round Rock MSA. The region's economy entered into a modest recovery by early 2004 and enjoyed a period of sustained employment growth between 2006 and 2008, when the national recession took hold. During the recession the San Antonio-New Braunfels MSA again experienced job stagnation growth rather than job loss, which was followed by a strong recovery during 2010 and 2011. Since early 2011, the San Antonio-Braunfels MSA has experienced a sustained of employment growth. Although the region's employment growth has been slightly less robust than the growth in the Austin-Round Rock MSA, it has been more consistent. Nonetheless, the 12-month moving average for the region's employment growth potentially suggests slowing job growth.

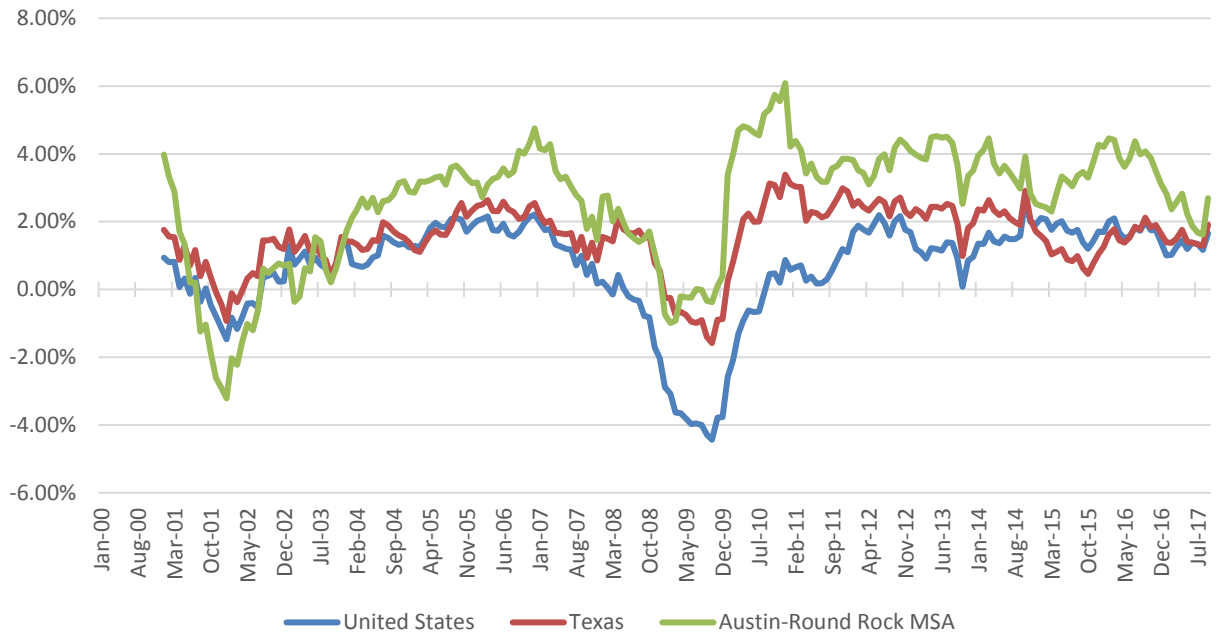
Figure 4: Month-on-Month Employment Change for San Antonio-New Braunfels MSA, January 2000 to September 2017



Note: Figure based upon Quarterly Census of Employment and Wages (QCEW) data.
Source: Bureau of Labor Statistics, 2017.

Figure 5 shows year-on-year employment change for the United States, Texas, and the Austin-Round Rock MSA. These data show that the recession, which began in 2001, had a more significant effect on the Austin-Round Rock region than it did on the United States or Texas economies. After recovering, the region's employment grew more quickly than did the nation or the state overall, for a four-year period between 2004 and 2008. The Austin-Round Rock MSA region even outperformed the U.S. economy during the period of labor force contraction, (as did the state of Texas), experiencing smaller proportional share of job losses and a quicker recovery. Since positive job growth returned in early-2010, the rate of job growth in the Austin-Round Rock MSA has outperformed the state and the nation. However, more recent trends show a convergence between local, state, and national employment growth rates. Whether this change is a long-term trend or a temporary pattern is yet to be determined.

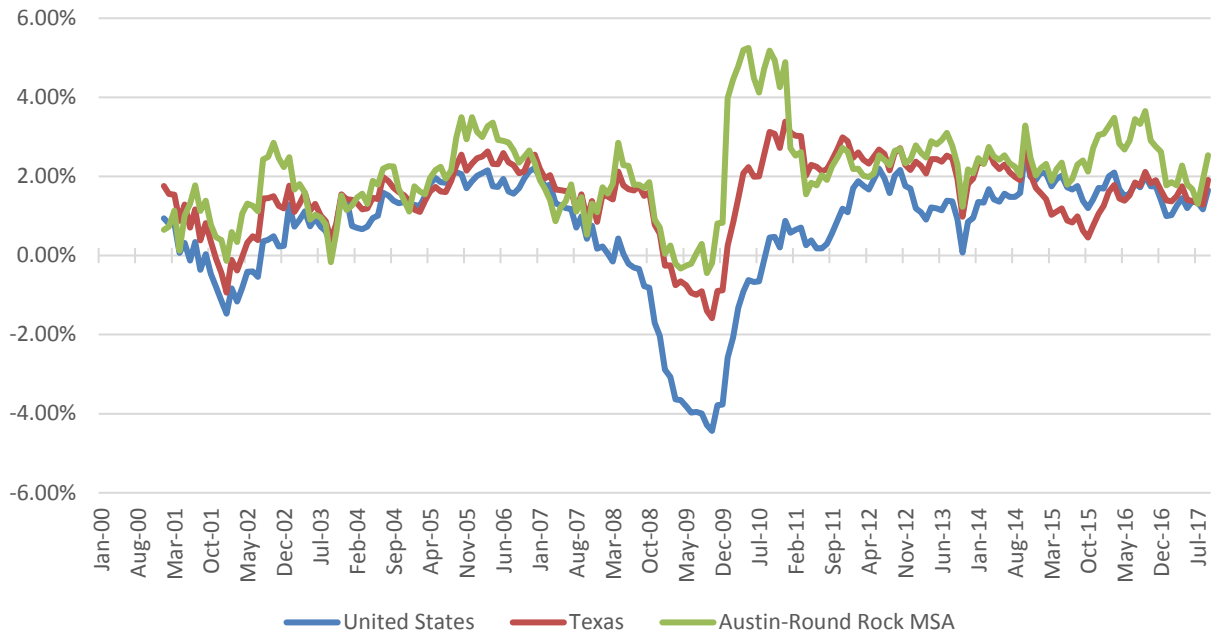
Figure 5: Year-on-Year Employment Change for the United States, Texas, and the Austin-Round Rock MSA, January 2000 to September 2017



Note: Figure based upon Quarterly Census of Employment and Wages (QCEW) data.
Source: Bureau of Labor Statistics, 2017.

Figure 6 shows the year-on-year employment change for the United States, Texas, and the San Antonio-New Braunfels MSA. These data again show that the San Antonio-New Braunfels MSA economy was less severely affected by the 2001 Recession than were the Texas and U.S. economies. Following its recovery, the region's employment grew strongly through the mid-2000s, similar to the overall state rate and more strongly than the nation. Like the Austin-Round Rock MSA's economy, the San Antonio-New Braunfels MSA's economy suffered a lower rate of employment loss and recovered from the 2008-2009 Recession more quickly than did the state and the nation. Since the recovery began, the region performed similarly to the Texas economy until 2015. During 2015 and 2016, the region began to grow at a much higher rate than the state and nation overall, which was likely due to oil and gas activity in the Eagle Ford shale play. Bexar County and surrounding counties were either a source of activity or a staging area for oil field services companies. During 2015, the price of oil dropped significantly, which ultimately led to many oil companies scaling back their activities or going out of business. These effects of these changes are evident on Figure 6. It is also important to note that despite the collapse in the energy industry, the region continues to have strong pace of growth that matches or exceeds the overall rate of employment growth for the state and nation.

Figure 6: Year-on-Year Employment Change for the United States, Texas, and the San Antonio-New Braunfels MSA, January 2000 to September 2017



Note: Figure based upon Quarterly Census of Employment and Wages (QCEW) data.
Source: Bureau of Labor Statistics, 2017.

For comparison purposes, Table 10 shows historic employment data for the four largest MSAs in Texas during the period between 2007 and 2013. The data show that the Austin-Round Rock MSA had a net employment increase of 195,138 jobs between 2010 and 2017, which is actually the third largest net increase among the four largest MSAs. However, the data also reveal that the Austin-Round Rock MSA had the fastest CAGR at 3.89 percent. The San Antonio-New Braunfels MSA ranked fourth, in terms of overall employment growth during this period and third highest rate of employment growth (2.82 percent).

Table 10: Total Employment in Largest Texas MSAs, 2010-2016

		TOTAL EMPLOYMENT		
Year	**Austin MSA**	**Dallas Fort Worth MSA**	**Houston MSA**	**San Antonio MSA**
2010	758,381	2,806,620	2,478,444	827,805
2011	782,423	2,874,730	2,543,721	842,408
2012	812,600	2,955,863	2,642,469	862,961
2013	845,787	3,058,414	2,738,665	888,703
2014	881,921	3,162,654	2,833,968	917,480
2015	923,098	3,277,116	2,888,114	948,103
2016	953,519	3,366,161	2,878,844	978,115
		TOTAL EMPLOYMENT CHANGE		
Year	**Austin MSA**	**Dallas Fort Worth MSA**	**Houston MSA**	**San Antonio MSA**
2010-2011	24,042	68,110	65,277	14,603
2011-2012	30,177	81,133	98,748	20,553
2012-2013	33,187	102,551	96,196	25,742
2013-2014	36,134	104,240	95,303	28,777
2015-2016	41,177	114,462	54,146	30,623
2016-2017	30,421	89,045	-9,270	30,012
2010-2017	**195,138**	**559,541**	**400,400**	**150,310**
		COMPOUNDED ANNUAL GROWTH RATE		
Year	**Austin MSA**	**Dallas Fort Worth MSA**	**Houston MSA**	**San Antonio MSA**
2010-2011	3.17%	2.43%	2.63%	1.76%
2011-2012	3.86%	2.82%	3.88%	2.44%
2012-2013	4.08%	3.47%	3.64%	2.98%
2013-2014	4.27%	3.41%	3.48%	3.24%
2015-2016	4.67%	3.62%	1.91%	3.34%
2016-2017	3.30%	2.72%	-0.32%	3.17%
2010-2017	**3.89%**	**3.08%**	**2.53%**	**2.82%**

Source: Bureau of Labor Statistics, 2017.

Figure 7 and Table 11 show the locations of selected major employers in the Austin region and their number of employees. Merck & Company was a notable new employer, which was drawn to the region because of the University of Texas at Austin's new Dell Medical School. It is anticiated that the new medical school, in combination with the region's strengths in computing, will draw many more employers in the biomedical research field. Geographically, a number of these employers are located near one of the CTTS facilities.

Table 11: Additions or Expansions of Workforce in Austin-Round Rock MSA for Selected Employers, YTD 2017

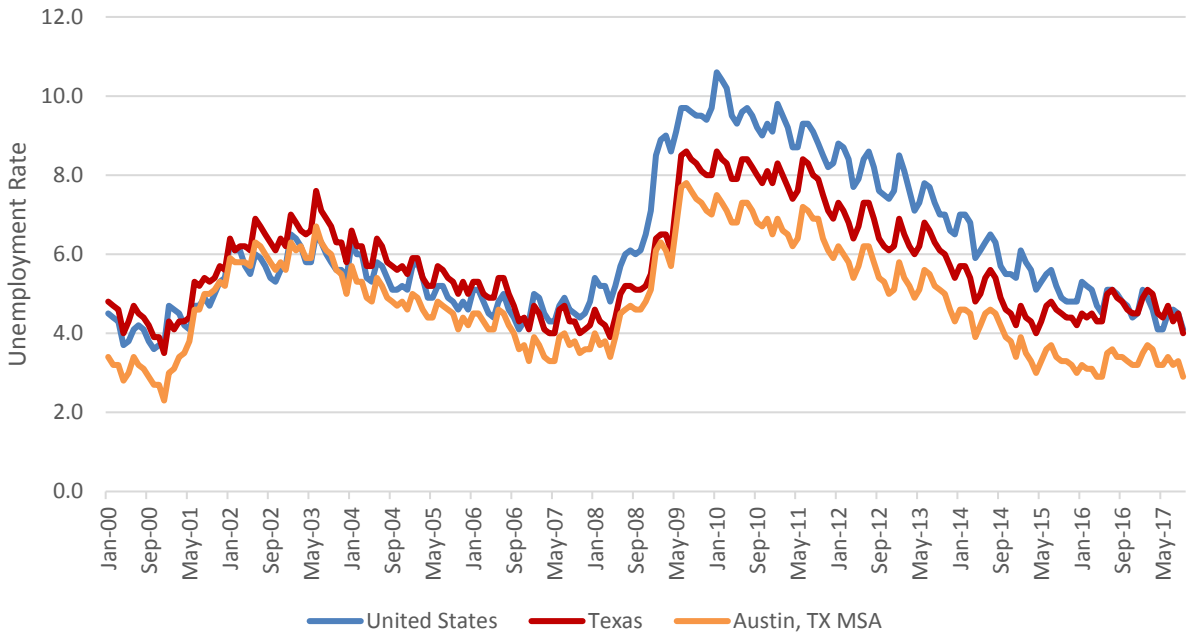
Map #	Employer	Type of Operation	Announced Jobs
1	Homeaway	Online vacation home rentals (Hdq.)	2,200
2	Facebook	Social networking service's online operations center (sales/marketing)	1,000
3	Seton Healthcare Family	Healthcare provider's innovation & call center	650
4	Merck & Company	Pharmaceutical company's IT innovation center	600
5	Main Street Hub	Social media solutions (Hdq.)	400
6	Republic National Distribution	Beverage distribution (Hdq.)	300
7	TG (formerly Texas Student Guaranteed Loan	Student financial aid nonprofit, including loan administration (Hdq.)	300
8	Yeti Coolers	Outdoor recreation cooler & accessors manufacturer	250
9	Opcity	Real estate agent and homebuyer matching service (Hdq.)	200
10	FloSports	Online broadcasting network (Hdq.)	175

Source: Greater Austin Chamber of Commerce, 2017.

Unemployment

Figure 7 shows the unemployment rates for the United States, Texas, and the Austin-Round Rock MSA. These data show the unemployment rate in the region has been below the overall unemployment rate in Texas during most of the period between January 2000 and September 2017. The Austin MSA experienced its lowest unemployment rate during December 2000, when it fell to 2.5 percent. During the recession that began in 2001, the regional unemployment rate peaked at 6.7 percent in June 2003. As the regional and national economy recovered and the employment expanded during the mid-2000s, the regional unemployment rate fell to less than 4.0 percent, before significantly increasing during 2008 and 2009. During the 2008-2009 Recession, the regional unemployment rate reached 7.4 percent in June 2009 but was not sustained for a prolonged period of time. Between 2011 and 2017, the regional unemployment rate consistently fell through 2015 and has remained relatively steady going forward. During September 2017, the region's unemployment rate was 2.9 percent.

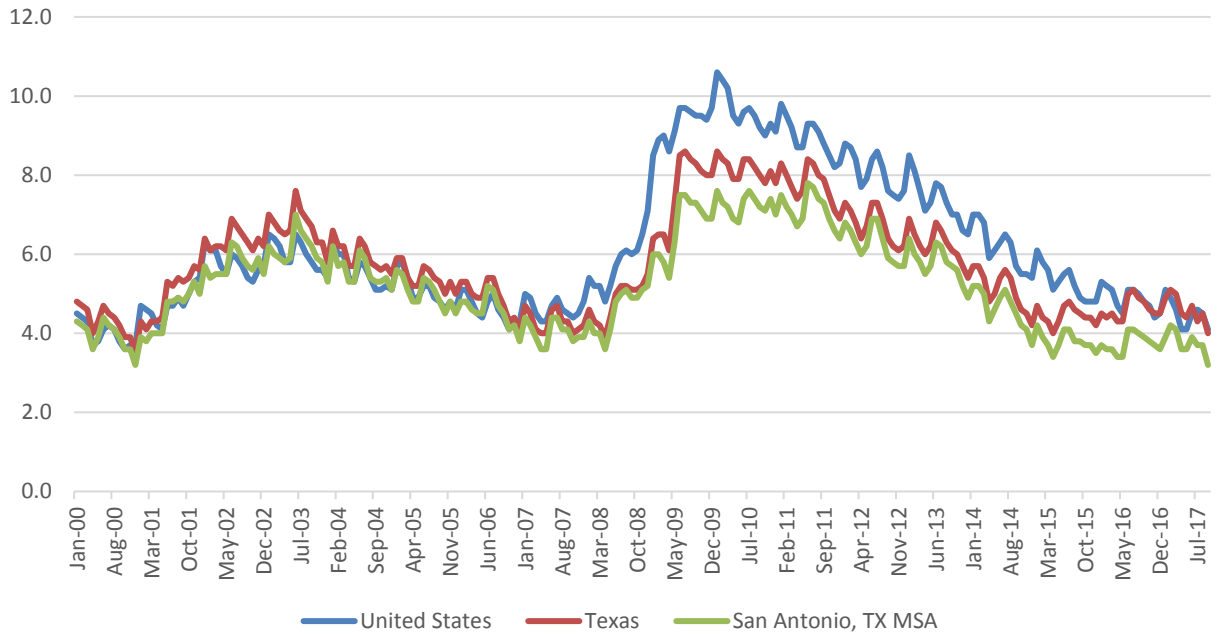
Figure 7: Unemployment Rate of Austin-Round Rock MSA, Texas, and the United States



Note: The unemployment rate data in Figure 7 are based upon seasonally unadjusted unemployment rates. The unadjusted figures were used to maintain consistency between the three geographies of the United States, Texas, and the Austin-Round Rock MSA. While seasonally adjusted data are available from the Texas Workforce Commission for the United States and Texas, they are not available for Texas's MSAs.
Source: Texas Workforce Commission, 2017.

Figure 8 shows the unemployment rates for the United States, Texas, and the San Antonio-New Braunfels MSA. These data show the unemployment rate in the region has been below the overall unemployment rate in Texas during most of the period between January 2000 and September 2017. The San Antonio-New Braunfels MSA experienced its lowest unemployment rate during December 2000, when it fell to 3.2 percent. During the recession that began in 2001, the regional unemployment rate peaked at 7.0 percent in June 2003. As the regional and national economy recovered and as employment expanded during the mid-2000s, the regional unemployment rate fell to 3.6 percent before increasing rapidly during 2008 and 2009. During the 2008-2009 Recession, the regional unemployment rate reached 7.2 percent in June and July 2009. Unemployment rates remained between 7.0 and 8.0 percent through 2011, peaking at 8.1 percent in June and July 2011. Like the Austin-Round Rock MSA, the San Antonio-New Braunfels MSA unemployment fell from mid-2012 through early-2015. Since then the unemployment rate has been relatively steady and was 3.2 percent during September 2017.

Figure 8: Unemployment Rate of San Antonio-New Braunfels MSA, Texas, and the United States



Note: The unemployment rate data in Figure 8 are based upon seasonally unadjusted unemployment rates. The unadjusted figures were used to maintain consistency between the three geographies of the United States, Texas, and the Austin MSA. While seasonally adjusted data are available from the Texas Workforce Commission for the United States and Texas, they are not available for Texas's MSAs.
Source: Texas Workforce Commission, 2017.

REAL ESTATE TRENDS

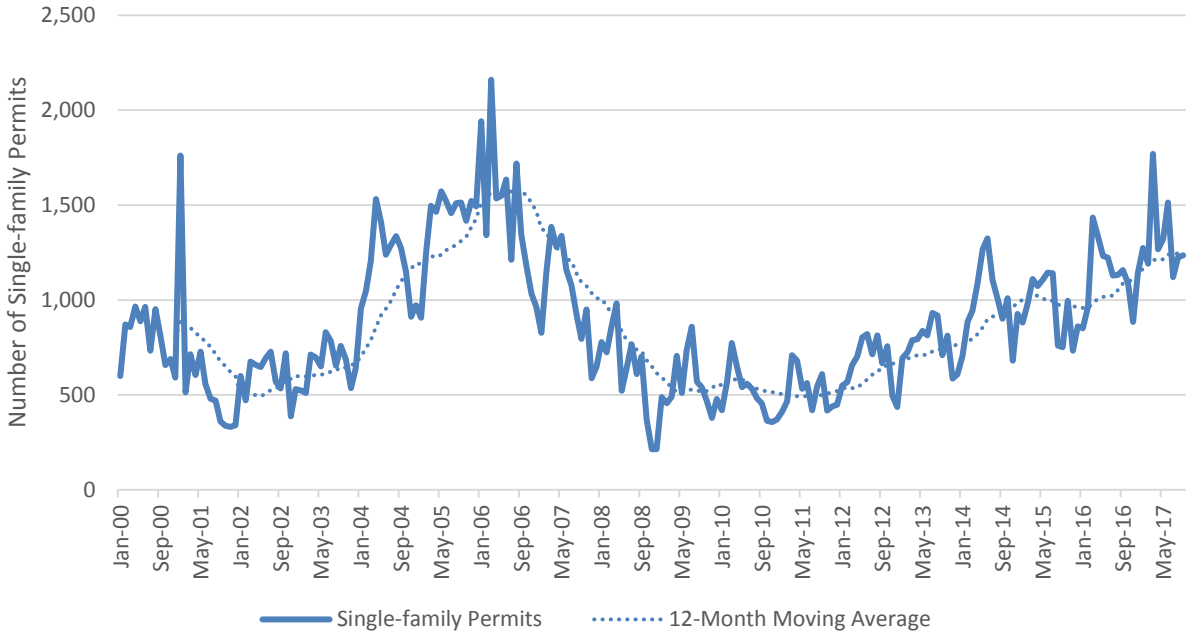
Since the 2008-2009 Recession, the housing market in both regions has shown consistent recovery with positive growth. Like almost every metropolitan area in the United States, the 2008-2009 Recession had a profound impact on regional housing markets, as well as commercial real estate. The near collapse of the nation's financial system and the severe curtailment of demand due to the subsequent recession led to a sharp reduction in the number of new single-family homes built after 2006. Multifamily construction was also severely impacted by the recession, although it later benefitted because fewer households were able to secure the financing to purchase new homes. Similarly, all aspects of commercial real estate were affected by the recession, either due to tight credit markets or financially stressed tenants. Fortunately, the nation's commercial real estate market did not experience the same collapse, as the residential market (a real and significant threat at the time), and has also recovered. However, other trends, such as telecommuting and online retail, are affecting demand for new commercial space within certain sectors.

Residential Trends

The U.S. Census Bureau's single-family building permit data from Real Estate Center at Texas A&M University are shown in Figure 10, which compares the number of monthly single-family

building permits issued in the Austin-Round Rock MSA. While an issued building permit does not guarantee that a structure was constructed (a certificate of occupancy would provide that proof), it does provide of gauge of builder interest that can be used to compare activity in a region over time. The data generally show what one would expect, which is that the monthly issuance of building permits in the Austin-Round Rock MSA grew during the "Housing Bubble", reaching a peak of more than 2,000 permits in mid-2006. Then the number of permits issued began to decline quickly, even taking into consideration seasonal influences. The local housing market reached its lowest level during early-2009, when only a couple hundred building permits were issued each month. Since then, the local housing markets has recovered with approximately 1,200 building permits issued each month during mid-2017. This figure, in combination with the number of issued permits for multifamily units, appears to roughly align with the region's current population growth.

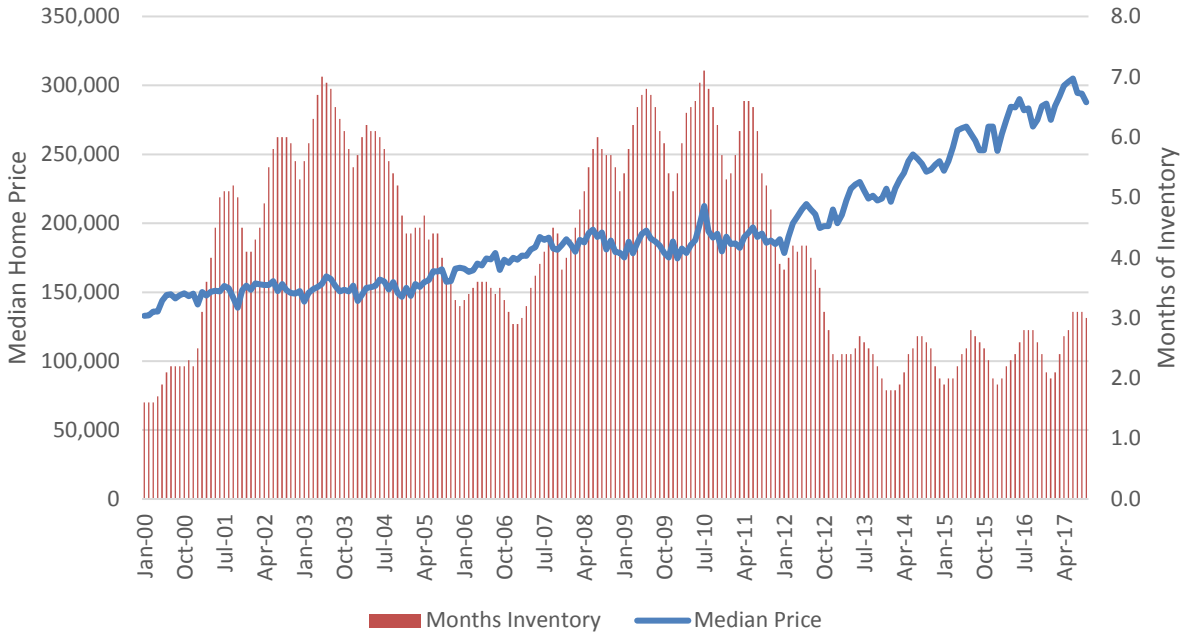
Figure 9: Single-Family Building Permits Issued in Austin-Round Rock MSA, January 2000 to January 2017



Note: MSA data based on 2013 CBSA definitions.
Source: Texas A&M Real Estate Center, 2017.

Figure 11 provides additional data showing the median home price for single-family homes and the months of inventory in the Austin-Round Rock MSA. These data show that median home prices in the region roughly doubled between 2000 and 2017, with most of the increase occurring between 2012 and 2017. The regional inventory of single-family homes was relatively consistent between late-2013 and September 2017, although there has been a modest uptick in the inventory of homes during 2017. Nonetheless, the housing inventory between 2012 and 2017 was well below historic levels.

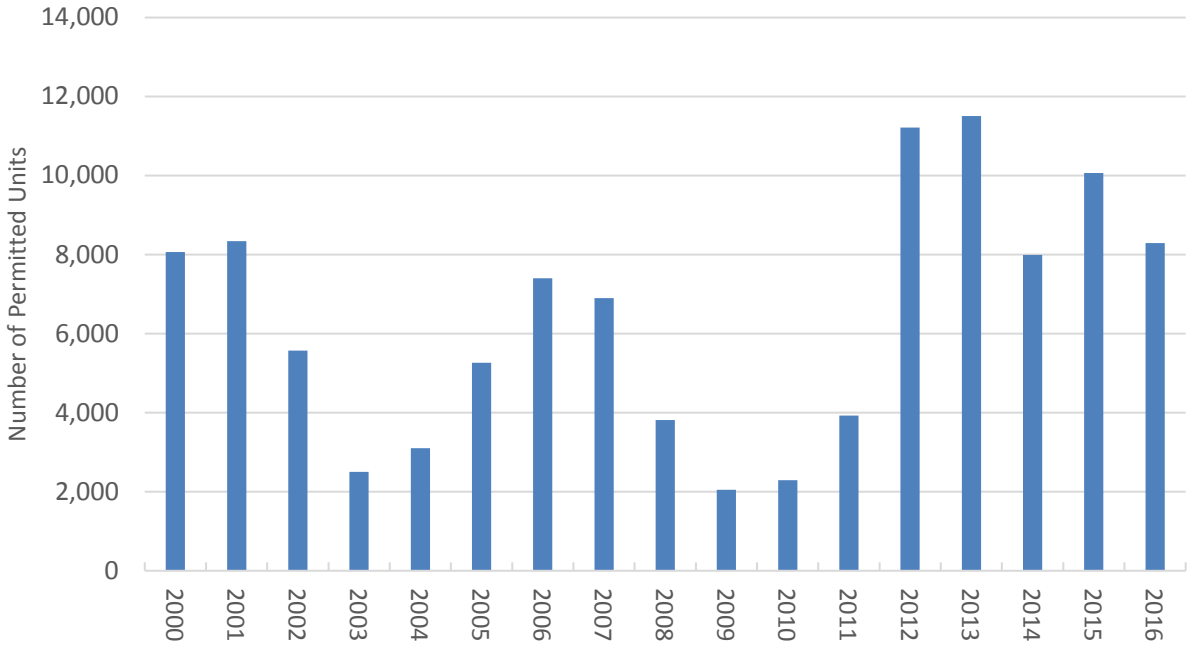
Figure 10: Median Price and Months of Inventory of Single-Family Homes in the Austin-Round Rock MSA, January 2000-September 2017



Source: Texas A&M Real Estate Center, 2017.

The number of permitted multifamily units in the Austin-Round Rock MSA has typically followed trends in the housing market, until the past few years. (See Figure 12) As would be expected, the number of multifamily permits was higher during the early-2000s with the technology-fueled expansion, fell with the 2001 Recession, and then rose again during the mid-2000s as a component of the Housing Bubble (at a slightly lower volume). The highest number of multifamily units were permitted during 2012 and 2013, when more than 11,000 multifamily units were permitted each year. Since then, the number of units permitted has been lower, but is still strong from a historical perspective.

Figure 11: Multifamily Units Permitted in the Austin-Round Rock, TX MSA, 2000-2016



Source: Texas A&M Real Estate Center, 2017.

Finally, Table 12 shows the market conditions for multifamily housing within the various submarkets in the Austin region during the second quarter of 2017. According to the real estate firm Marcus & Millichap, the region had an overall vacancy rate of 5.2 percent during the second quarter of 2017. During 2017, overall rents have increased by 3.5 percent to $1,225. It is anticipated that developers will deliver 11,800 units to the market during 2017. The data in Table 12 also show the lowest vacancy rate for multifamily was in in the North Central Austin submarket at 3.5 percent and the highest effective monthly rents were $2,022 in the downtown/university submarket.

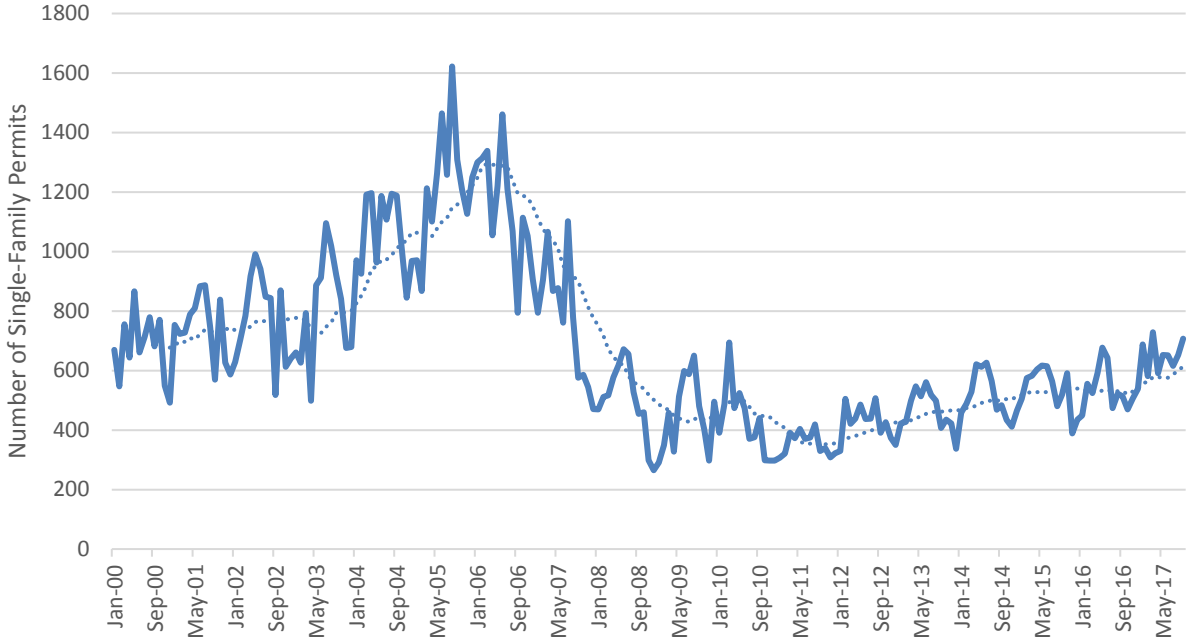
Table 12: Overview of the Austin Apartment Market during the Second Quarter 2017

RANK	SUBMARKET	VACANCY RATE	Y-O-Y BASIS POINT CHANGE	EFFECTIVE RENTS	Y-O-Y PERCENT CHANGE
1	North Central Austin	3.5%	30	$1,031	4.2%
2	Cedar Park	4.1%	-90	$1,154	-0.5%
3	South Austin	4.2%	20	$1,353	0.3%
4	San Marcos	4.5%	30	$1,314	10.6%
5	Downtown/University	4.6%	70	$2,202	4.2%
6	Pflugerville/Wells Branch	4.8%	-30	$1,080	0.2%
7	Far South Austin	5.2%	-20	$1,162	2.9%
8	Round Rock/Georgetown	5.4%	150	$1,096	0.6%
9	East Austin	7.0%	260	$1,266	12.6%
10	Southwest Austin	7.2%	160	$1,322	1.5%
	OVERALL METRO	5.2%	-90	$1,213	3.3%

Source: Marcus & Millichap, 2017.

Figure 13 shows historic, single-family building permit data for the San Antonio-New Braunfels MSA. Surprisingly, despite the significant amount of population growth in the region since 2010, the issuance of single-family building permits has only grown modestly, following the 2008-2009 Recession. At the height of building activity in 2005, more than 1,600 building permits were issued in a single month (August 2005), while during September 2017, less than half (approximately 700 building permits) were issued. Nonetheless, the number of building permits issued monthly has continued to trend upward, as the region's population continues to grow.

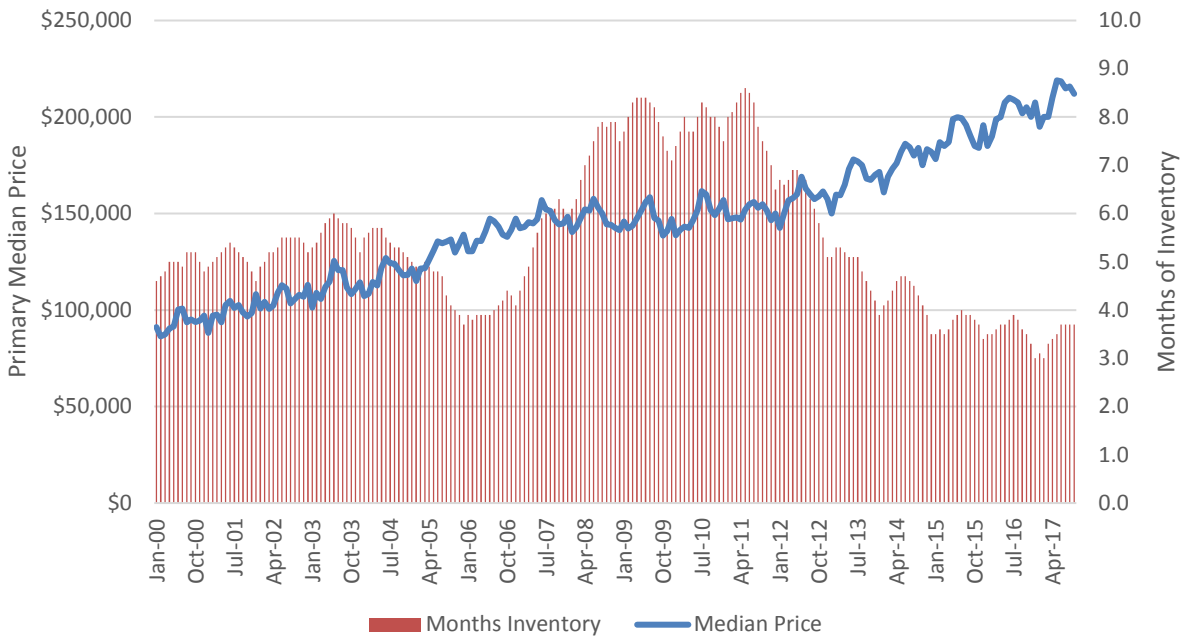
Figure 12: Single-Family Building Permits Issued in San Antonio MSA, January 2000 to September 2017



Source: Texas A&M Real Estate Center, 2017.

As in the Austin-Round Rock MSA, median home prices in the San Antonio-New Braunfels MSA have more than doubled between 2000 and 2017 (See Figure 14). During September 2017, the median home price in the region was $212,000, compared to $287,000 in the Austin-Round Rock MSA. The inventory of single-family homes in the San Antonio-New Braunfels MSA is also larger, but the amount of supply has shrunk significantly since 2011. During September 2017, the region had only a 3.7 month supply of single-family homes.

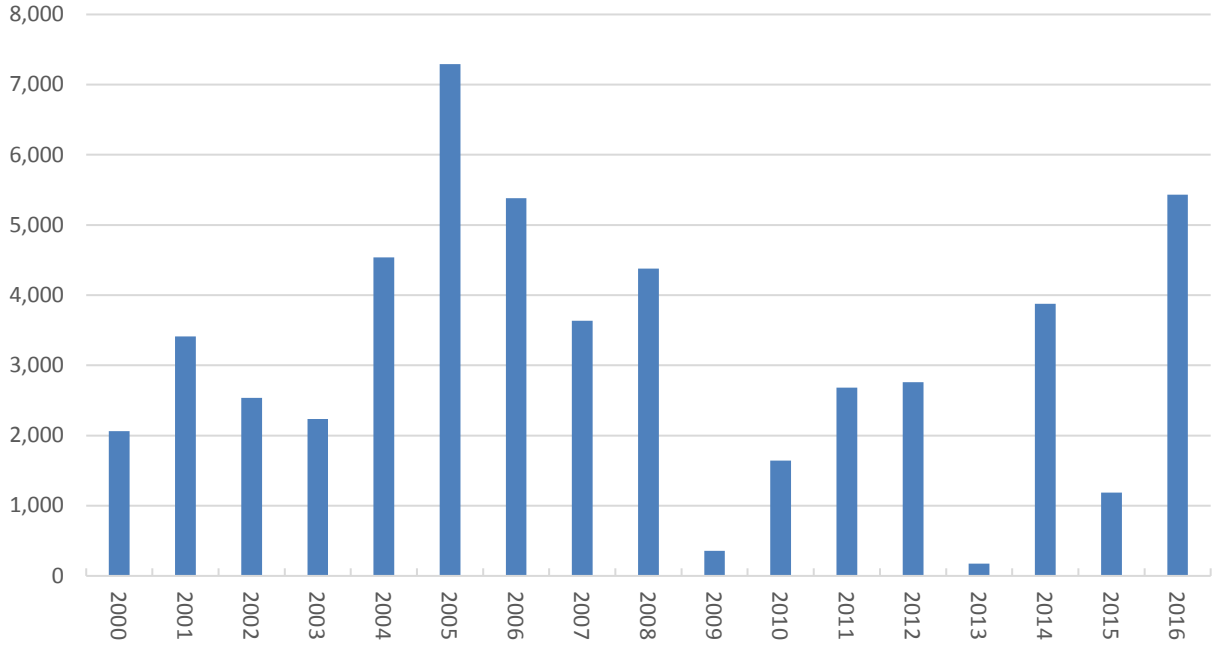
Figure 13: Median Price and Months of Inventory of Single-Family Homes in the San Antonio-New Braunfels MSA, January 2000-September 2017



Source: Texas A&M Real Estate Center, 2017.

Figure 15 shows the number of multifamily units permitted in the San Antonio-New Braunfels MSA between 2000 and 2016. Since the 2008-2009 Recession, the number of permitted multifamily units has grown, but the trend has not been consistent from year-to-year. In 2013, for example, fewer multifamily units were permitted than during 2009. The third worst year during this period was 2015, when only 1,186 units were permitted. However, the number jumped significantly during 2016, when 5,430 multifamily units were permitted.

Figure 14: Multifamily Units Permitted in the San Antonio-New Braunfels, TX MSA, 2000-2016



Source: Texas A&M Real Estate Center, 2017.

Table 13 provides recent market conditions for multifamily housing within the various submarkets in the San Antonio region during the second quarter of 2017. Marcus & Millichap estimated that the region had an overall vacancy rate of 5.8 percent during the second quarter of 2017. It anticipated that developers will deliver 8,200 units to the market during this year. Over the last year, effective rents have increased by 4.5 percent and the average effective rent for the region was $941. The data in Table 13 show the lowest vacancy rate for multifamily was in the West San Antonio submarket at 3.8 percent, while the submarket with the highest effective monthly rents was Far Northwest San Antonio at $1,176.

Table 13: Overview of the San Antonio Apartment Market during the Second Quarter 2017

RANK	SUBMARKET	VACANCY RATE	Y-O-Y BASIS POINT CHANGE	EFFECTIVE RENTS	Y-O-Y PERCENT CHANGE
1	West San Antonio	3.8%	-240	$728	3.3%
2	North Central San Antonio	3.8%	30	$960	3.6%
3	New Braunfels/Schertz/Universal City	4.4%	-100	$956	1.9%
4	Northwest San Antonio	5.2%	-140	$896	2.3%
5	Far West San Antonio	5.3%	50	$931	1.3%
6	Southwest San Antonio	5.6%	-90	$784	2.0%
7	Northeast San Antonio	6.1%	70	$828	2.9%
8	South San Antonio	6.2%	20	$790	4.8%
9	Far Northwest San Antonio	6.2%	-150	$1,176	-5.2%
10	Medical Center	6.4%	10	$881	1.8%
	Overall Metro	5.8%	-50	$941	2.1%

Source: Marcus & Millichap, 2017.

Office Trends

According to the real estate firm Transwestern, the Austin area office market had an overall vacancy rate of 9.7 percent during the second quarter of 2017 (See Table 14). In total, the Austin area market contained 68.3 million square feet of rentable space and at the end of the second quarter of 2017, the yield-to-date net absorption (the difference between the amount of newly leased space in the market and new constructed space or formerly leased space that has returned to the market) in the Austin area market was 1,863,305 square feet. Geographically, the largest concentrations of office space in the Austin market are in the Northwest & Far Northwest submarkets, the Central Business District, and the Southwest market. Austin's Central & West Central submarket had the highest occupancy rate at 95.4 percent and its Northeast & East submarket had the lowest occupancy rate in the region at 82.9 percent.

Table 14: Overview of the Austin Area Office Market during the Second Quarter 2017

SUBMARKET	TOTAL RENTABLE SF	TOTAL OCCUPANCY	YTD 2014 TOTAL NET ABSORPTION	NET RENTAL RATE PSF
Central Business District (CBD)	13,091,529	90.5%	422085	$35.85
Central & West Central	5,459,728	95.4%	57,543	$21.85
North	7,046,571	92.6%	368,020	$22.91
Northeast & East	6,048,882	82.9%	322,696	$20.62
Northwest & Far Northwest	17,045,220	90.6%	113,581	$22.00
Round Rock & Cedar Park	2,970,523	90.6%	113,104	$19.85
South	2,835,600	93.1%	6,630	$24.66
Southeast	2,394,577	87.7%	(37,952)	$16.53
Southwest	11,404,345	89.4%	497,598	$26.15
MARKET TOTAL	**68,296,975**	**90.3%**	**1,863,305**	**$25.14**

Note: Includes office buildings larger than 25,000 SF and excludes government, medical, user campuses, and office condos.
Source: Transwestern, 2017.

The San Antonio region's supply of office space is less than half the total rentable square footage of Austin's market (See Table 15). The region also has a higher overall vacancy rate at 18.8 percent, although (surprisingly) the net rental rate in San Antonio was not significantly lower than Austin at $21.70. The largest supply of the region's office space is located in the Northwest submarket (9,805,156 square feet), followed by the North Central submarket (7,956,136 square feet). San Antonio's Central Business District is the third largest submarket with 5,018,249 square feet of rentable spaced. Total net absorption during the second quarter of 2017 was 248,780 square feet.

Table 15: Overview of the San Antonio Area Office Market during the Second Quarter 2017

SUBMARKET	TOTAL RENTABLE SF	TOTAL AVAILABLE	2Q 2017 NET ABSORPTION	NET RENTAL RATE PSF
CBD	5,018,249	18.0%	29,024	$20.80
Midtown	921,471	8.6%	(7,316)	$29.85
North Central	7,956,136	17.7%	6,810	$22.91
Far North Central	3,093,355	17.3%	31,150	$28.75
Northwest	9,805,156	21.7%	137,531	$23.79
Northeast	1,953,421	14.6%	37,027	$19.52
Far West	826,086	15.4%	15,226	$27.68
South	557,145	27.8%	(672)	$16.64
New Braunfels	232,760	36.5%	--	$24.86
MARKET TOTAL	**30,363,779**	**18.8%**	**248,780**	**$21.70**

Source: Transwestern, 2017.

Industrial/Warehousing Trends

The Austin region has a sizeable amount of industrial/warehouse space totaling 48.5 million square feet during the first quarter of 2017, although a significant share is "flex space" which can also be converted into offices (See Table 16). The regional industrial/warehousing vacancy rate was 11.2 percent and the average net rent was $9.77 per square foot. During the first quarter of 2014, the region returned more than 450,000 square feet to the market (Transwestern, 2014).

Table 16: Overview of the Austin Industrial Market during the First Quarter 2014

SUBMARKET	INVENTORY SF	YTD NET ABSORPTION SF	TOTAL OCCUPANCY RATE	AVERAGE NET RENT
CBD & Central	655,300	(10,418)	91.7%	$12.14
Cedar Park & Far Northwest	2,637,737	34,162	90.8%	$10.80
East	3,535,517	261,804	83.3%	$9.24
North	11,433,026	(718,653)	88.6%	$10.01
Northeast	9,068,944	(167,262)	90.5%	$9.58
Northwest	1,740,220	11,496	95.1%	$10.31
Round Rock & Far Northeast	5,954,558	134,779	89.9%	$8.60
South	796,141	8,200	99.0%	$10.34
Southeast	11,889,786	(11,334)	86.9%	$9.84
Southwest	745,312	4,050	85.9%	$12.10
AUSTIN MARKET	**48,456,541**	**(453,176)**	**88.8%**	**$9.77**

Source: Transwestern, 2017.

The San Antonio industrial market had more than 45.2 million square feet of inventory during the third quarter of 2017 (See Table 17). The market was had a citywide availability rate of 12.5 percent or less than 2.0 million square feet of available space. During the third quarter 2017, 122,776 square feet of space was absorbed.

Table 17: Overview of the San Antonio Industrial Market during the Third Quarter 2017

MARKET	INVENTORY SF	TOTAL AVAILABILITY	3rd 2017 NET ABSORPTION	AVERAGE NET ASKING RENT
CBD	615,812	0.0%	0	N/A
North Central	6,041,988	6.9%	-1,469	$8.74
Northeast	24,953,128	15.1%	77,425	$5.11
Northwest	6,527,258	11.8%	13,331	$7.43
South	7,118,778	10.1%	33,489	$4.33
SAN ANTONIO MARKET	**45,256,964**	**12.5%**	**122,776**	**$5.57**

Source: CBRE, 2017.

Retail Trends

Transwestern estimated that the market for commercial retail space experienced moderate absorption during the third quarter 2017, with 300,440 square feet of space coming off the market (See Table 18). Overall, the region had almost 74.0 million square feet of retail space and the regional vacancy rate was 3.9 percent. The highest occupancy rates were in the following market subareas: the Austin CBD; south, southeast, southwest Travis County, and Hays County.

Table 18: Overview of the Austin Retail Market during Third Quarter 2017

MARKET	INVENTORY SF	TOTAL OCCUPANCY SF	YTD TOTAL NET ABSORPTION	AVERAGE NET RENT
Central Business District	1,820,166	98.0%	22,862	22.50
Central & West Central	7,314,845	95.1%	(67,180)	21.53
Cedar Park & Far Northwest	10,776,973	93.9%	290,557	20.70
East & Northeast	5,588,484	95.9%	58,499	20.65
Hays County	7,735,073	97.1%	(50,250)	23.58
North	6,599,219	96.5%	(20,786)	18.79
Northwest	4,828,677	96.1%	803	23.58
Round Rock & Far Northeast	9,468,716	94.9%	43,222	21.86
South & Southeast	11,840,302	97.3%	(75,962)	22.04
Southwest	7,989,945	97.8%	98,675	29.23
MARKET TOTAL	**73,962,400**	**96.1%**	**300,440**	**22.43**

Source: Transwestern, 2017.

Less detailed information was available for the San Antonio retail market. Most of retail space in the San Antonio market is located on the north side of the city and outside of the Central Business district. The vacancy rate for retail space during the second quarter of 2017 was 7.5 percent, with most of the retail space located in northern Bexar County (See Table 19).

Table 19: Overview of the San Antonio Retail Market during the Second Quarter 2017

MARKET	INVENTORY SF	DIRECT VACANT SF	YTD TOTAL NET ABSORPTION	AVERAGE NET RENT
Citywide	50,736,624	3,783,457	50,407	$16.46
Non-CBD/North	43,803,212	3,303,358	182,143	$16.20
CBD/South	6,933,412	480,099	(34,736)	$19.19

Note: Includes shopping centers totaling greater than 20,000 square feet.
Source: REOC San Antonio, 2017.

DEVELOPMENT PATTERNS IN THE PROJECT STUDY AREA

The sections below provide a brief overview of development patterns and projects in the CTTS study area. Organized by city, the narrative identifies various residential and commercial projects that are either: in the planning process; approved for construction; under construction; or recently completed. When available, information such as the number of lots in a subdivision,

units in a multifamily project, or square feet for commercial buildings is provided. The identification of the projects below reflects a "snapshot" view and should not be considered comprehensive, although the most significant projects in the study area have been identified.

Georgetown

The city of Georgetown's development pattern is currently concentrated in its west and northwest, as well as to the east and southeast towards SH 130. Among Georgetown's largest residential developments, the Sun City "active adult" community continues to expand. There are also a number of other parcels on the northwest side of Georgetown that are expected to be developed during the next 5 years. Along Williams Drive, the Deer Haven (70 lots), the Gardens at Verde Vista (149 lots), and the Lakeside (300 lots) subdivisions under construction. Further south, adjacent to Wolf Ranch's retail development, townhome and apartment projects are being planned, along with 209 single-family homes that have already started construction. The Water Oak subdivision, which lies adjacent to the CTTS study area on SH 29, has 1,500 acres available for development and will have up to 3,000 single-family units. Closer to SH 130, on the northeast corner of Rockride Lane and Sam Houston Boulevard, a 1,220-lot subdivision called Saddlecreek is being proposed, along with a 200-lot addition to the Pinnacle subdivision. Due east of the Pinnacle subdivision, on the west side of Maple Street, a 300-lot subdivision is also being planned. South of Georgetown, in an unincorporated area that is also due north of the city of Round Rock, another phase of the Teravista development continues to add a large number of single-family homes, as does the La Conterra subdivision.

A number of new multifamily developments are being planned, are under construction, or were recently completed in Georgetown, which are shown below in Table 20.

Table 20: Recent and Future Multifamily Projects in the City of Georgetown

APARTMENTS		
Name	**Total Number of Units**	**Status**
Carroll at Rivery Ranch	272	Under construction
HIllstone at Wolf Ranch	332	Completed
Kaia Pointe	102	Under construction
Live Oak Apartments	108	Under construction
Mansions of Georgetown	438	Completed
Merritt Heritage	244	Under construction
Retreat at Wolf Ranch	303	Completed
Retreat at Wolf Ranch Phase 2	259	Under construction
The Delaney at Georgetown Village	120	Completed
Third and Rock Court	12	Under construction
Villas of Georgetown	264	Proposed
TOWNHOMES		
Name	**Total Number of Units**	**Status**
Holly Street Townhomes	24	Completed
CONDOMINIUMS		
Name	**Total Number of Units**	**Status**
Gardens at Verde Vista	160	Completed
Gatlin Creek	70	Proposed
Old Mill Crossing	99	Completed

Source: Marczynski, 2017.

The most concentrated commercial construction has been at the Wolf Ranch development, which recently added a full-service Sheraton Hotel. Smaller commercial projects have occurred throughout the city, including new construction along the Williams Drive corridor and some site redevelopment in the downtown area. A new middle school was under construction in Georgetown at the southeast corner of Rockride Lane and SE Inner Loop.

Round Rock

Round Rock continues to be one of the primary recipients of suburban growth in the Austin region, although its rate of growth has slowed over the last decade, as other cities compete and as its supply of developable land diminishes. At present, there are a number of residential subdivision projects planned or underway, these include: the Freeman Tract, Avery North, Warner Ranch, and Kenney Fort. There will also be expansions of the Paloma and Sienna subdivisions, which fall within the jurisdiction of municipal utility districts (MUDs) and outside the City of Round Rock's boundaries. Table 21 identifies all the residential projects in the city of Round Rock that are either proposed, in review, approved, or under construction. Collectively, these projects will add thousands of new housing units to this portion of the CTTS study area.

Table 21: Ongoing Residential Construction Projects in the City of Round Rock, 2015-2017

SINGLE-FAMILY SUBDIVISIONS	
Development	**Total Number of Lots**
Freeman	228
Avery North/Vizcaya	1,192
Turtle Creek Phases 5 & 6	101
Warner Ranch	274
Meritage/GLO	194
Kenney Fort	202
Bodeman/HR 79	65
Madsen	285
Glen Ellyn Tract	194
Northfields Phases 1 & 2	194
Arden Park	118
DETACHED SINGLE-FAMILY COMMON LOT	
Development	**Total Number of Units**
Gardens at Mayfield Ranch	130
Mayfield Ranch	89
Sunrise Condos	100
Wallin Tract	100
Diamond Oaks	130
Cottages at Meadow Lake	33
DUPLEX	
Development	**Total Number of Units**
Turtle Creek Phase 8	N/A
Spring Street Townhomes	12
TOWNHOMES	
Development	**Total Number of Units**
Legends Village Condos	109
Cottages at Round Rock Town Center Phase 2	24
Turtle Creek Townhomes	28
University Village Townhomes	58
Wyoming Springs Townhomes/Rockwell Village Condos	58
Donnell Park Townhomes	149
MULTIFAMILY	
Development	**Total Number of Units**
Arrington Ridge	312
Waters at Sunrise	288
Avery Center South	238
Kenny Crossing	248
Holly Brook Ranch	336
Bartz II	296
Springs at Round Rock	260
University Village Apartments	292
Meadowlake Multifamily	254
SENIOR ASSISTED LIVING	
Development	**Total Number of Units**
Cedar Ridge Assisted Living	164
The Enclave at Round Rock	170
Sundara Assisted Living	32
Affinity Round Rock	170
Poets Walk	68

Note: Table provides the total number of lots or units in each development. The number of residential units constructed between 2015 and 2017 may be less than the total.

Source: City of Round Rock, 2016.

Various commercial projects were underway or proposed in Round Rock during the field visit. One of the most significant projects is the Kalahari Resort, which is still in the planning stages. It will be a 1,000-room hotel and waterpark with an African theme. The resort expects to hire 700 employees and will be located along US 79, east of Kenney Fort Road. Recently completed, the Scott & White Cancer Center is located on the northeast corner of University Boulevard and Mays Street in a four-story structure. One of the most active areas in Round Rock for new commercial development has been the La Frontera site at the northwest corner of SH 45 N and IH 35. Over the last two years, several projects have been completed there, including: a 91-room hotel and a 140-room hotel. Additionally, a 42,000 square foot college campus and 98,000 square foot office building were recently built. A former big box store was demolished and 102,000 square feet of retail strip was being constructed at the time of the field survey. Additional retail on this site (i.e. pad sites) is expected in the future. Developers have also started construction of a 95,000 square foot office building in July 2016. Further east, a mixed-use project with 1.0 million square feet called "The District" was recently announced. It will have Class-A office space, residential, hospitality, and retail uses and it will be located along SH 45 N and N. Greenlawn Boulevard.

Hutto

Located east of SH 130 in Williamson County, population growth in the city of Hutto has outpaced the surrounding area. Since the 2000 U.S. Census, when its population was 1,451 residents, the City of Hutto has grown approximately 1,542 percent to its estimated 2016 population of 23,832 residents. North of US 79, new development is anticipated in the Hutto Highlands subdivision (700 lots) and the Mager Meadows subdivision (200 lots). South of US 79, active residential developments include: Hutto Crossing (400 lots); the Park at Brush Creek, Glenwood; and the Riverwalk (400 lots) subdivisions. In the southeast quadrant of Hutto and south of County Road 499, 854 single-family homes are expected in the Meadows at Cottonwood Creek subdivision and 500 more single-family homes on an adjacent parcel. The Brooklands subdivision, which is south of FM 1660, is proposed to have 609 lots. Near this subdivision, an 80-unit multifamily senior complex is being proposed.

Although Hutto has grown to a sizeable population in a short period of time, commercial development has historically lagged, due to the lack of population density required to attract the interest of national chains and the city's proximity of extensive retail and services in nearby Round Rock. However, a large HEB grocery store and other strip commercial development was recently built at the northwest corner of SH 130 and Gattis School Road to serve the city and eastern Round Rock. The SH 79 corridor provides opportunities for new development, with easy access to SH 130. However, high-traffic retail development on the south side of SH 79 will probably be limited, due to the active Union Pacific track.

Pflugerville

The City of Pflugerville is viewed by many as an attractive location due its affordable housing and its relative proximity to Austin. This interest has extended to developers, who have been attracted to the SH 130 corridor. During the field survey, there was a strong pace of construction in many of the city's subdivisions. Table 22 provides an inventory of Pflugerville's

existing subdivisions and remaining lots to be developed or multifamily units or townhomes to be built. Developers have almost 11,000 housing units in active or approved projects for future construction.

Table 22: Subdivisions under Construction or Approved for Construction in the City of Pflugerville

Development	Total Units Built	Remaining Units
Avalon Subdivision	968	532
Blackhawk Subdivision	1,192	2,309
Blackhawk Far East	0	637
Branson Condominiums	3	130
Carmel Subdivision	0	2,317
Carrington Court Subdivision	83	50
Commerce Place Apartments	628	287
Commons at Heatherwilde/Pecan	0	1,250
Emerson Apartments	170	214
Falcon Pointe Subdivision	1,608	97
Highland Park Subdivision	1,131	141
Highlands Apartments	257	35
Huntington Park Subdivision	0	128
Kuemple Townshomes	0	18
Mansions at Stone Hill Apartments Phase 2	148	251
Paradise Cove Condominiums	0	17
Penley Park Subdivision	46	115
The Reserve at West Creek Subdivision	589	15
Sorento Subdivision	199	745
Senson Farms Condominiums	26	112
Verona Subdivision	87	237
Village on Legacy Subdivision	62	262
The Villages of Hidden Lake Subdivision	1,153	132
Vine Creek Subdivision	0	82
Walden Square	0	82
TOTAL	**8,350**	**10,915**

Source: City of Pflugerville, 2017.

Table 23 shows three new subdivisions that were under review with the City of Pflugerville's Planning Department. These three subdivisions would add 355 lots to the city's inventory.

Table 23: Subdivisions under Planning Review in the City of Pflugerville

Development	Total Number of Proposed Lots
Becker Farms Subdivision	83
Commons at Rowe Lane Subdivision	246
Maynard Subdivision	26
TOTAL	**355**

Source: City of Pflugerville, 2017.

Along with its robust residential market, Pflugerville is also experiencing considerable commercial development. Some of the city's more significant projects, currently under construction, include:

- An Aldi grocery store at the southeast corner of FM 685 and Pfennig Lane
- Heritage Lakes at Pflugerville – 90 independent living units, 52 senior cottages, 16 supported living units, 65 assisted living units, and 50 skilled nursing units
- A 530,000 square foot Living Spaces furniture store, southwest corner of SH 45 N and Heatherwilde Boulevard
- A Marriott Courtyard at the southwest corner of E. Pecan Boulevard and SH 130
- An elementary school on Hodde Lane, north of Cele Road.
- A high school on Weiss Road, south of E. Pflugerville Parkway
- Pflugerville Hospital, a 97,474 square foot Scott & White facility on the northeast corner of SH 130 and East Pflugerville Parkway.

Other projects that are still in the planning stages include: a Costco that is being proposed on the southeast corner of SH 130 and Kelly Lane; a medical and professional building that is proposed at the southwest corner of E. Pflugerville Parkway and FM 685; and an assisted living facility that is proposed at the northwest corner of Wells Branch Parkway and S. 10th Street.

<u>Manor</u>

Manor is a small city that lies due east of the city of Austin. During the mid-2000s, Manor was a growing suburb, but was impacted negatively by the 2008-2009 Recession. Since the recovery, Manor's growth has accelerated. As of June 2017, Manor had more than 8,000 lots in various phases of planning or construction. Ongoing or proposed residential projects include: Presidential Glen (360 lots); Presidential Heights (600 lots); Stonewater (350 lots); Stonewater North (270 lots); Shadow Glen (1,500 lots); Presidential Meadows (875 lots); Lagos (2,300 lots); the Village at Manor Commons (370 lots); and Sky Village (1,500 lots). Into the future, Manor is poised to be surrounded by more than 9,000 lots to the south in the proposed Indian Hills subdivision, Whisper Valley subdivision, and other projects.

Commercial development has been slow to follow residential growth in Manor. Its relative close proximity to retail and services in Austin, coupled with lower population densities, has historically resulted in little commercial development. Current commercial projects include the

construction of a new elementary school on the south side of the city along FM 973 and the New Tech Middle School along US 290 E. The Shadowview Lakeside Shopping Center at Lexington Street and US 290 E is now completed and is adding tenants. Restaurants and fast food restaurants are located there, along with a medical clinic and a cell phone store. Nearby, another medical clinic is being built.

Austin

Development in the city of Austin has generally been widespread, even reaching areas where growth has not been seen for some time. Historically, the city's eastern side has not attracted significant development, but attitudes have changed and middle-income and upper-middle income households' growing need for affordable housing (as well as gentrification that has attracted young professionals and higher-income households) have encouraged new development projects. Additionally, the linear form of the Austin metropolitan area means that many locations in eastern Travis County currently provide relatively quick commutes to central Austin, which are unavailable from any other direction without paying significantly more for housing. As a result, various residential development projects are planned or underway within the CTTS study area.

West of IH 35 from Travis County Line to US 183

In far North Austin, an important location for future development will be the Robinson Ranch, which is a 6,000-acre parcel. At present, its owners are mining limestone and are not opening sections of land for development. As a result, it is difficult to know when Robinson Ranch will be made available for significant residential and commercial construction. At the southeast corner of SH 45 N and Loop 1, the Preston Park and Travesia subdivisions are under construction. Additionally, the Mansions at Travesia apartments were recently completed, as were the Art at Bratton's Edge Apartments (76 units) and the Allegre Point Apartments (184 units) further south. Up to 450 more apartments are proposed on the same tract of land as Allegre Point. Continuing south, a multifamily project called Terraces at Scofield Ridge is under review on the southeast corner of Loop 1 and Grand Avenue Parkway. To the east, the Scofield Farm Meadows Condominiums (49 units) and the Walnut Park Apartments were under construction. At The Domain Development, 372 units were under construction for a project called Flatiron. Nearby on North Burnet Road, the Broadstone Burnet Apartments were under construction and on Braker Lane the North Burnet Gateway Apartments (423 units) were also being built.

Commercial development in this portion of the CTTS study area has been concentrated in The Domain development, which has just added two office buildings with 315,000 square feet of office space. Also at The Domain, a 310,000 square foot office space is under construction and its Rock Rose district has opened, which has added a large number of restaurants, bars, and stores. There has also been greater utilization of flex space and industrial space in the area bounded by Loop 1 and Metric Boulevard and Gracy Farms Lane and US 183. As office rents rise in Austin, a number of companies are utilizing cheaper flex space as office rather than renting traditional office buildings. This area has also become popular for microbreweries, which along with The Domain and Top Golf, are giving some needed cachet to a part of Austin

that has regularly been ignored. Another area with planned, ongoing, or recent commercial development are between Loop 1 and IH 35, south of SH 45 N. Most of the new development in this area is warehousing and industrial. Lastly, there has been infilling of vacant land between Lamar Boulevard to its intersection with IH 35, north of Walnut Creek.

East of IH 35 from Pflugerville to US 290

There are three large Municipal Utility Districts (MUD) or Planned Unit Developments (PUDs) in northeast Austin. The Northtown MUD is located due south of the city of Pflugerville. The developer has started construction and it is proposed to have 2,951 single-family units, 1,626 townhomes, 4,186 apartments, along with retail, office, industrial, and schools. Pioneer Crossing is located further south and oriented around Dessau Road. The Pioneer Crossing PUD is under construction and planned for 2,925 single-family homes. The Harris Branch PUD is located along Harris Branch Parkway and was originally proposed to have 3,787 single-family homes and 1,160 apartments. Over the past decade, construction in the Harris Branch PUD has occurred on an intermittent and limited basis. In addition to these large MUDs or PUDs, there are a number of smaller subdivisions that are proposed or under construction. The Fort Dessau subdivision is under construction and will have 86 condominiums, 50 duplex units, and 160 single-family homes. Nearby, the Harris Ridge Condominiums will have 108 units. A small infill subdivision along Yager Lane, called the Enclave of The Springs, was under construction during the field survey. Further east, the Entrada and Fossil Creek subdivisions have been approved for 822 lots and 933 lots, respectively, but there was no activity at the time of the field survey. Nearby, the Cantarra subdivision (1,126 lots) continues to build out. The Pioneer Hill subdivision on Dessau Road (671 lots and apartments) is under construction and, east along Parmer Lane near its intersection with SH 130, the Bellingham subdivision (629 lots) is under construction. There are two multifamily complexes being developed. One complex, called IO at Tech Ridge, was partially built, but stalled during the field survey. Another complex called Austin Waters was proposed and may now be under construction, along with an assisted living facility on Yager Lane that was also under construction.

Commercial development in this portion of the study area is dispersed throughout and occurs primarily on vacant parcels along major arterials or in commercial parks. The highest concentration of recent commercial development has been in the Parmer Business Park within the Tech Ridge development, which is located between Parmer Lane and Howard Lane. Recently, two buildings with approximately 192,000 square foot office buildings were built along McAllen Pass Drive. Four more buildings are under construction, one office building with 116,000 square feet of space and three more flexspace buildings totaling 350,000 square feet. Additionally, 3M will build its own 272,000 square foot office building in the same development (Anderson, 2017). In addition to these projects there are also plans to build additional office, flexspace/industrial, and retail buildings on other tracts within Tech Ridge. Business parks are also concentrated north and east of the intersection of US 183 and US 290 E. Within these business parks, new construction projects have consisted of both office and industrial/warehousing. Retail development in this part of the study area has primarily occurred as free-standing buildings and as small, strip shopping centers.

West of US 183 from US 290 to SH 71

Some of the major development projects within the urbanized core of Austin that are within or adjacent to the CTTS study area include the Mueller Airport redevelopment, Crestview Station, and the ACC Highland Center. Among these developments, the Mueller Airport redevelopment (which lies just outside the CTTS study area) is unquestionably the largest with approximately 4,900 single-family and multifamily units expected at full build out. Construction at the site has been underway for a number of years and is expected to continue for several more, as market conditions have accelerated the original timeline. The Crestview Station project is a transit-oriented-development built around a Capital Metro commuter rail station that is being constructed in phases. The project is a mixed-use development with retail, office, single-family homes, and multifamily units. Collectively, there will be 1,350 residential units when it is fully built out. The ACC Highland Center is a partial redevelopment of the existing Highland Mall and there are 1,250 multifamily units planned for a future phase of the project. The first phase of its multifamily construction is underway. The Mueller redevelopment, in particular, has been a catalyst for the area bordered by IH 35, US 183, Airport Boulevard, and US 290 E. In the last few years, home values in these neighborhoods have increased significantly, due to demand for central city proximity and a supply of renovated housing stock. However, to date, this trend has only led to a replacing of lower-income households with higher-income households and infill construction. There has been little densification of the neighborhood up to this point.

As land prices rise, particularly west of IH 35, developers are infilling vacant parcels and subdividing single-family lots in a piecemeal manner. They are also taking low-density commercial properties and building multi-story residential projects, typically with retail and office units on the bottom floor. Burnet Road and Lamar Boulevard are popular corridors for these types of projects, since there is an abundance of these low-density (in some cases dilapidated) retail properties that can be redeveloped into residential and commercial space with much higher rents.

Major commercial projects in central Austin include the Mueller Airport redevelopment, which is planned for 3.0 million square feet of commercial space and 790,000 square feet of retail development. A significant portion of this commercial space has already been built, including the Dell Children's Medical Center, The Thinkery (a children's museum), the Austin Independent School District's Performing Arts Center, various medical office buildings, and a large amount of strip center retail and big box retail. To some degree, the retail development at Mueller has absorbed much of the demand in the area and other commercial areas are not yet revitalizing, despite rapidly increasing household income and property values. The ACC Highland Center is the redevelopment of a portion of the existing Highland Mall into an Austin Community College campus. The low density of Highland Mall and surrounding properties coupled within rising land values suggests that redevelopment projects will be occurring in this area for some time.

East of US 183 from US 290 to SH 71

The pace of residential development in this portion of the CTTS study area is beginning to pick up, but is still slower than areas north of US 290 E. Between Loyola Lane and FM 969, the Trinity Meadows and the Loma Vista subdivisions have had modest amounts of new

construction. Building also continues in the Austin Colony subdivision along FM 969, east of SH 130. Along US 183, near its crossing of the Colorado River, the Knollwood on the Colorado River subdivision is platted for 257 single-family homes and the construction of its homes continues. Many of the subdivision projects in this area are planned and have not yet started. South of US 290 E and on the west side of FM 3177, the Parker Creek Ranch and the Loma Vista subdivisions are being proposed. The Indian Hills (1,522 multifamily units) and the Lariat B Ranch subdivision (981 lots) have been approved, but there has been no activity. The East Parke subdivision (124 lots) has been proposed at the northeast corner of US 183 and Loyola Lane. The right-of-ways for the streets have been cleared, but the project appears to have stalled. Further south, the Hornsby Glen subdivision has been approved for 538 lots. Along SH 71 and east of SH 71, Riverbend Landing (600 lots) and the Watersedge PUD with 1,254 single-family homes, 323 apartments, and 244 townhomes are proposed. On the south side of US 290 and north of Old Manor Road, the Terrace at Walnut Creek Apartments were under construction (329 units).

At the periphery of downtown Austin, redevelopment is occurring along Riverside Drive, east of IH 35. These new projects are mixed use residential/retail (unlike the buildings they are replacing) and they are redeveloping at higher densities and with much higher rents. Several projects grouped near Riverside Drive's intersection with IH 35 will collectively have 3,105 apartments, 7,746 square feet of office space; and 219,406 square feet of retail space. The redevelopment trend along the Riverside Drive corridor is expected to continue over the long-term, since there are many aged properties on large parcels that would become attractive as land prices increase. Further east in the Montopolis neighborhood, a number of smaller infill residential subdivisions are being proposed or constructed. Dwelling units in these subdivisions are typically single-family homes on small lots or townhomes or shared lot dwelling units. Some of the subdivisions include the Townhomes at Park Place, Riverside Homes, and Shire's Court.

A commercial park located at the southeast corner of SH 130 and US 290, called Parmer Center, is the location of a new beverage distributor, which has approximately 700 workers. It is the first business to locate in this park. Within this part of Far East Austin, there are several other large-scale projects have been proposed, but none have advanced to actual construction. At present, there is a commercial development proposed north of Decker Lake, along Lindell Lane, has been proposed. Nearby, the Wildhorse PUD is proposed to have more than 5,800 homes, almost 6.3 million square feet of commercial development, and an 800-room hotel. Between Loyola Lane and FM 969, a 45-acre warehouse and office development is proposed at the southwest corner of Decker Lane and Loyola Lane, but there has been no construction.

East of IH 35 and between Lady Bird Lake and SH 71, perhaps the highest concentration of new commercial development has been at the redeveloped properties along Lakeshore Drive and Riverside Drive, particularly on the ground floor of new apartment buildings. There has also been some new construction on the northeast corner of East Riverside Drive and East Ben White Boulevard, namely hotels serving the Austin-Bergstrom International Airport (ABIA)

South of US 71 to Buda

Areas south of US 71 and within the CTTS study area have generally experienced slower growth over the past decade than locations in northeastern Hays County or north of US 290 E in Travis County. However, there is renewed interest from developers, as they seek areas of Austin with affordable land. South of SH 71 and east of US 183, there has been relatively little residential construction, but there are several proposed developments. Along Ross Road and south of Pearce Lane, two subdivisions are being reviewed by the City of Austin, which are the Cactus Rose Mobile Home Park and one for stick-built homes. On the northeast corner of Ross Road and Elroy Road, a multifamily development has also been approved.

The most significant residential project underway (west of US 183) is Easton Park, which is proposed to have up to 10,000 housing units and other retail and commercial development. Easton Park is located between US 183 and Thaxton Road, south of FM 812. The first phase of the project is underway, but incentives for affordable housing were struck down by a court. It is not clear if this ruling will affect the viability of the project (Barragan, 2015 and Findell, 2016). To the north of Easton Park and along US 183, single-family homes in the Addison subdivision (500 lots and 225 apartments) are under construction. Development also continues in the Colorado Crossing subdivision (949 lots). Due west of Easton Park, construction is also underway on the Vista Point and the Springfield subdivisions (337 lots). To the south of Springfield, several tracts have also been approved for multifamily construction. Further west, on either side of Slaughter Lane, the Goodnight Ranch subdivision has started construction, which is proposed to have 1,192 single-family homes, 2,645 apartments, and 696 townhomes. Adjacent to Goodnight Ranch, the McKinney Heights subdivision (925 lots) is nearing its build out. Continuing south along Bradshaw Road, there is construction in the Bradshaw Crossing (921 lots) and Legends Way (289 lots) subdivisions. Several more subdivisions nearby are either approved for construction or under review by the City of Austin. The Vistas of Austin subdivision (669 lots) is approved and lies due east of Bradshaw Crossing. South and east of Legends Way subdivision are the proposed Bella Fortuna and Cascades at Onion Creek (467 lots and 250 multifamily units) subdivisions. On the west side of IH 35, south of Onion Creek is the Estancia Hill Country development which is planned for 385 single-family homes and 1,600 apartments and townhomes. Construction has started on its single-family homes.

South of SH 71 and east of US 183, new commercial development has been limited. The number of enplanements at ABIA continues to grow, which has required more employees to serve these passengers. There were also two hotels recently constructed on the airport property. To the south, the Circuit of the Americas motorsport and entertainment facility, built in 2012, continues to host Formula One races and other sporting events and concerts. However, the facility has not led to any meaningful redevelopment of adjacent rural land. One new and notable employer in this area has been the NLand Surf Park, which is a 14-acre artificial surfing lagoon with a small brewery. West of US 183 and south of SH 71, commercial development has been more active, particularly in the Met Center commercial park and other commercial parks located along Burleson Road and E Stassney Lane, where several large industrial tilt wall buildings were under construction during the field survey. On the west side of IH 35, south of Onion Creek is the Estancia Hill Country development, which is proposed to

have 1.9 million square feet of corporate office space, 1.5 million square feet of general office space, a hotel, and a hospital. Commercial construction at this development has not yet begun.

Buda

Located due south of Austin, in Hays County, Buda is expected to be the recipient of a significant volume of single-family residential development over the coming decades. Although Buda's historic center is located west of IH 35, recent residential development has been on both sides of the roadway. On the west side of IH 35, development is currently underway in the Garlic Creek, Elm Grove, the Whispering Hollow, Summer Pointe subdivisions. Several New subdivisions are being proposed along RR 967, which include: White Oak Preserve (245 lots); a subdivision north of Haleys Way Drive (400 lots); a subdivision north of Dodgen Trail (239 lots); and a subdivision west of Carpenter Elementary School (150 lots). To the east of IH 35, the largest residential project underway is the Sunfield development, which will be a mix of residential, industrial, and commercial land uses. The proposed 2030 build-out for Sunfield is 6,950 lots and several hundred single-family homes have already been built. Single-family construction also continues in the Stonefield, Stoneridge, and Meadow Park subdivisions. Additionally, a small subdivision with 127 lots is being proposed along Hillside Terrace Drive, between Goforth Road and FM 2001. There are multifamily projects proposed on the west side of IH 35 along Firecracker Road and at the southwest corner of Old Goforth Road and FM 2001 (250 to 300 units).

Outside of continued, piecemeal development within existing areas platted and zoned for commercial purposes, the primary commercial project proposed in the city is a hospital at the southwest corner of White Wing Trail and FM 2001.

Kyle

Kyle continues to be a rapidly growing Hays County suburb, located between Austin and San Marcos. Bisected by IH 35, new residential development is occurring on both sides of the roadway (See Table 24). On the west side of IH 35, construction continues in the Plum Creek development, where an additional 1,400 single-family dwelling units are planned for the second phase of the Plum Creek subdivision, as well as 170 new single-family homes within the first phase. Within existing subdivisions, there was single-family construction in the Creekside and Brooks Crossing subdivisions. Construction was starting on Phase 1 of Cypress Forest subdivision and to its north, along N. Old Stagecoach Road, Phases 1&2 of the Blanco River Ranch subdivision and Cypress Forrest Phase 2 (73 lots) are being proposed. Further south, in the Stagecoach Forest subdivision, 270 lots are planned at the southeast corner of S. Old Stagecoach Road and W. Center Street. Multifamily projects include the Fairways Landing (216 units) along Kohler's Crossing and the Oaks on Marketplace (255 units). On the east side of IH 35, there was ongoing construction in the Lakeside Crossing subdivision, Phase 1 of the Crosswinds subdivision is under construction with 233 lots, along with homes in the Bunton Creek Reserve (125 lots), Brookside, and Cool Springs (373 lots) subdivisions.

Table 24: Proposed or Active Subdivisions in the City of Kyle

Project	Total Number of Units	Status	Estimated Start
Anthem	2,200	In Design	2017
Ariza Apartments	349	In Review	2017
Blanco River Ranch	3,500	In Design	2017
BRI/McCoy	8,000	Concept	2020
Brooks R-3-3	300	Concept	2018
Brookside Phases 3&4	150	Under Construction	2017
Bunton Creek Reserve	355	In Review	2017
Cool Springs	372	Approved	2017
Creekside Village	280	Under Construction	2016
Crosswinds MUD	1,750	Under Construction	2017
Cypress Forest	337	Under Construction	2016
Hays Junction Apartments	207	Under Construction	2016
Intermandeco/Driskell	600	Concept	2018
Kyle Estates East (Walton)	2,500	Concept	2018
Kyle Estates West (Walton)	2,600	Concept	2018
La Salle MUD	10,000	Concept	2018
Lehman Tract	150	Concept	2020
Nance	9,000	Concept	2022
Oaks on Marketplace	254	Under Construction	2016
Pecan Woods	2,600	In Design	2018
Plum Creek Phase 2	1,404	In Review	2017
Plum Creek Vue Apartments	180	In Review	2017
Stagecoach Forest	270	In Review	2017
Sunset Hills	210	In Review	2017
Twin Creeks	400	Concept	2018
Woodlands Phases 3 & 4	300	Under Construction	2017

Source: City of Kyle, 2017.

Commercial development is scattered throughout the city, as stand-alone buildings or small strip retail centers. The construction of larger retail buildings has occurred primarily in the Village at Kyle and Kyle Marketplace shopping centers.

ASSESSMENT AND ADJUSTMENT OF THE POPULATION AND EMPLOYMENT CONTROL TOTALS

The first step of the socioeconomic data review was to assess the reasonableness of the population and employment control totals in the CAMPO model. Since traffic counts for the CTTS study were conducted during 2016, this became the travel demand model's base year. New 2016 population and employment control totals were developed for each county, using data from the U.S. Census Bureau, the U.S. Bureau of Labor Statistics, and the Texas Workforce Commission. With these data, each county's 2016 population and employment control totals were adjusted to either an agency estimate for that year or guided by them. The end result was that all ten counties had some adjustment to their base year population control total, typically to reflect the 2016 U.S. Census Bureau estimates, with Bexar County having its population adjusted by the largest amount (increased by 74,941 residents) compared to the 2014 CTTS

study[2] (See Table 25). Both Travis and Bexar counties had the largest upward adjustment to its 2016 employment control total with roughly 34,000 additional jobs, followed by Bexar County with 24,877 additional jobs. The development of the 2016 control totals were based upon data from the U.S. Bureau of Labor Statistics and the Texas Workforce Commission.

[2] The 2014 CTTS values for 2016 are based upon an interpolation between the study's 2013 base year and its 2020 forecast.

Table 25: Adjustments to 2016 Baseline County Population, Households, and Employment Control Totals

	2016 POPULATION			2016 HOUSEHOLDS			2016 EMPLOYMENT		
County	**2014 CTTS**	**2017 CTTS**	**Difference**	**2014 CTTS**	**2017 CTTS**	**Difference**	**2014 CTTS**	**2017 CTTS**	**Difference**
Travis	1,186,225	1,204,220	17,995	473,604	487,010	13,406	670,499	704,707	34,208
Williamson	508,564	526,718	18,154	186,120	192,132	6,012	151,847	156,834	4,987
Hays	194,981	205,074	10,093	70,964	72,452	1,488	59,867	63,683	3,816
Bastrop	80,007	81,710	1,703	29,568	28,976	-592	16,414	18,855	2,441
Burnet	N/A	45,182	--	N/A	17,868	--	N/A	13,184	--
Caldwell	40,617	39,848	-769	14,566	13,719	-847	8,628	8,579	-49
Bexar	1,853,755	1928696	74,941	670,786	702,521	31,735	807,680	841,664	33,984
Comal	126,516	134782	8,266	49,000	51,538	2,538	44,786	53,131	8,345
Guadalupe	153,196	155264	2,068	54,874	54,571	-303	33,475	38,631	5,156
Kendall	40,619	42542	1,923	15,571	16,328	757	13,171	14,873	1,702
Wilson	47,453	48481	1,028	16,824	17,193	369	7,407	7,636	229

Note: 2016 values from the 2014 CTTS are interpolated between the 2013 base year and the 2020 forecast. Burnet County was not included in the CAMPO travel demand model used for the 2014 CTTS study.

Table 26 shows the differences between the 2014 CTTS Update study's county population and employment forecast control totals and the adjusted county control totals for the 2017 CTTS Update study. During each forecast year in the 2017 CTTS update, the population control totals are higher than they were in the 2014 CTTS Update study, with the exception of the 2030 forecast for Wilson County. Overall, the forecasted control totals for households were higher for most years, excluding Guadalupe County in 2030 and 2040 and Wilson County in 2030. The household control total figures were not imposed from above but were the summed at the TAZ level. Additionally, CAMPO's assumptions about household size changed between the datasets. As a result, the revised number of households does not necessarily change in proportion with the population. The 2014 CTTS Update employment control totals were also higher than the 2012 CTTS Update study, due to more recent data that show stronger employment growth during the past few years. Bexar and Travis counties are the major source of the additional employment but most of the other counties contributed positively, as well. The notable exception is Caldwell County, which had lower employment for each forecast year and Bastrop County during 2040.

Table 26: Adjustments to Forecasted County Population and Employment Control Totals

	2020 POPULATION			2020 HOUSEHOLDS			2020 EMPLOYMENT		
County	**2014 CTTS**	**2016 CTTS**	**Difference**	**2014 CTTS**	**2016 CTTS**	**Difference**	**2014 CTTS**	**2016 CTTS**	**Difference**
Travis	1,273,336	1,314,093	40,757	507,727	533,615	25,888	717,497	762,715	45,218
Williamson	566,298	583,417	17,119	206,673	214,099	7,426	168,721	176,480	7,759
Hays	220,507	231,129	10,622	79,598	82,195	2,597	66,937	73,095	6,158
Bastrop	85,583	88,109	2,526	31,645	31,865	220	18,221	20,352	2,131
Burnet	N/A	46,683	--	N/A	18,452	--	N/A	14,880	--
Caldwell	42,471	43,480	1,009	15,260	15,304	44	9,511	9,285	-226
Bexar	1,957,968	2,045,074	87,106	707,980	743775	35,795	856,370	905194	48,824
Comal	138,646	147,364	8,718	53,751	56247	2,496	50,662	60328	9,666
Guadalupe	169,057	170,618	1,561	60,483	59875	-608	36,668	43281	6,613
Kendall	45,117	47,586	2,469	17,296	18258	962	14,517	16980	2,463
Wilson	50,898	51,684	786	18,046	18336	290	8,042	8342	300
	2030 POPULATION			**2030 HOUSEHOLDS**			**2030 EMPLOYMENT**		
County	**2014 CTTS**	**2016 CTTS**	**Difference**	**2014 CTTS**	**2016 CTTS**	**Difference**	**2014 CTTS**	**2016 CTTS**	**Difference**
Travis	1,474,365	1,563,432	89,067	586,277	631,851	45,574	839,247	883,257	44,010
Williamson	739,143	757,309	18,166	270,279	279,864	9,585	211,554	225,362	13,808
Hays	288,990	295,569	6,579	103,230	105,692	2,462	86,092	98,021	11,929
Bastrop	103,220	105,696	2,476	38,389	38,516	127	24,358	25,446	1,088
Burnet	N/A	51,639	--	N/A	20,384	--	N/A	18,135	--
Caldwell	48,235	50,339	2,104	17,393	17,609	216	12,300	11,517	-783
Bexar	2,196,665	2,351,596	154,931	793,624	852,345	58,721	982,096	1,060,224	78,128
Comal	168,731	183,147	14,416	65,515	69,425	3,910	67,780	82,300	14,520
Guadalupe	214,674	217,790	3,116	76,406	76,132	-274	45,225	56,050	10,825
Kendall	55,789	60,288	4,499	21,384	23,088	1,704	18,255	22,744	4,489
Wilson	60,663	60,348	-315	21,507	21,420	-87	9,592	10,154	562

Table 26: Adjustments to Forecasted County Population and Employment Control Totals (Continued)

	2040 POPULATION			2040 HOUSEHOLDS			2040 EMPLOYMENT		
County	**2014 CTTS**	**2016 CTTS**	**Difference**	**2014 CTTS**	**2016 CTTS**	**Difference**	**2014 CTTS**	**2016 CTTS**	**Difference**
Travis	1,669,612	1,801,138	131,526	661,446	723,506	62,060	962,917	991,374	28,457
Williamson	952,122	984,479	32,357	347,180	365,210	18,030	254,472	281,677	27,205
Hays	364,369	399,673	35,304	129,632	144,203	14,571	108,533	124,711	16,178
Bastrop	124,358	125,672	1,314	46,475	45,982	-493	33,126	32,732	-394
Burnet	N/A	55,412	--	N/A	21,858	--	N/A	22,099	--
Caldwell	55,111	57,616	2,505	19,938	20,153	215	15,958	14,561	-1,397
Bexar	2,471,362	2,678,541	207,179	892,021	968,310	76,289	1,116,034	1,231,801	115,767
Comal	197,279	225,827	28,548	76,873	85,245	8,372	88,534	107,492	18,958
Guadalupe	265,018	271,000	5,982	94,291	94,532	241	54,802	69,948	15,146
Kendall	66,740	73,221	6,481	25,581	28,019	2,438	22,642	29,053	6,411
Wilson	71,049	71,589	540	25,192	25,421	229	10,972	12,028	1,056

ASSESSMENT AND ADJUSTMENT OF ZONAL POPULATION AND EMPLOYMENT DATA

The project study area for the socioeconomic review consisted of a very large region that covered significant portions of eight counties, two MPO study areas, and more than 1,400 TAZs. The northern extent of the project study area was north of the city of Georgetown and it extended southward to the northeast quadrant of San Antonio, a distance of approximately 100 miles along IH 35. The width of the CTTS study varied, but was as wide as 15 or miles more in some locations. Since the 2014 CTTS study, CAMPO has updated the model's TAZ structure and its socioeconomic data. The result of these changes led the number of TAZs in the CAMPO portion of the CTTS study area to grow from 627 TAZs in the 2014 study to 894 TAZs in the 2017 study, even though the overall area remained the same. The changes to the geography caused some TAZs to be split into two or more new TAZs, while in other instances new TAZs were formed that crossed the boundaries of two or more of the original TAZs.

The base year for the 2017 CTTS study was 2016, so one of the first tasks was to update the base year population and employment data. To update the zonal population estimates, a visual housing count of new single-family and multifamily dwelling units was undertaken, by comparing 2010 and 2016 digital aerial photography in GIS. New residential development was delineated and the single-family units were counted. Dwelling unit counts for multifamily projects were derived from data provided by local governments, industry market research, company websites, or apartment locator websites. Along with assumptions of vacant housing absorption, the 2010-2016 housing unit count was multiplied by each TAZ's estimated persons per household and added to CAMPO's and AAMPO's 2010 population and households estimates to develop the 2016 base year population and household estimates for the entire project study area. Outside of the project study area, the populations of the TAZs were interpolated between the MPO's 2010 base year and the 2020 forecast year, then adjusted to subarea population control totals. In reconciling the zonal population estimates to the county subarea control totals, they also summed to the revised county control totals. The 2016 employment data were adjusted by assuming a portion of employment growth was absorbed into vacant commercial space or was added to firm rosters without requiring additional floor space. Additionally, new commercial developments were also identified using the digital aerial photography. Once these commercial facilities or schools were identified, 2013 firm-level employment data from the Texas Workforce Commission assisted with developing employment estimates or, if the employers were schools, data from the Texas Education Agency (TEA) were used. Using the TWC data and Google Maps, information from local chambers of commerce, periodicals, and other sources as a reference, along with professional judgment, the CAMPO TAZ employment data were assessed and adjusted as necessary. Finally, estimates of median household income in the study area were maintained from CAMPO's and AAMPO's revised 2010 estimates.

The assessment and adjustments to the zonal population and employment forecasts relied upon a variety of data sources, which included: the digital aerial photography, limited field surveys; zoning, future land use, and floodplain maps; and other planning reports and documents. The data collection for reviewing the forecasts also involved a large number of interviews with local planning officials across the study area. Table 27 provides a list of the XX

local governments who were interviewed. As with the baseline data, the forecasts for each TAZ were reviewed individually, drawing upon the aforementioned resources. The forecasts for all TAZ forecasts were reconciled to the forecasted population and employment control totals at the subarea and county levels to maintain consistency and reasonableness.

Table 27: Interviews with Local Governments in Southern Gateway Study Area

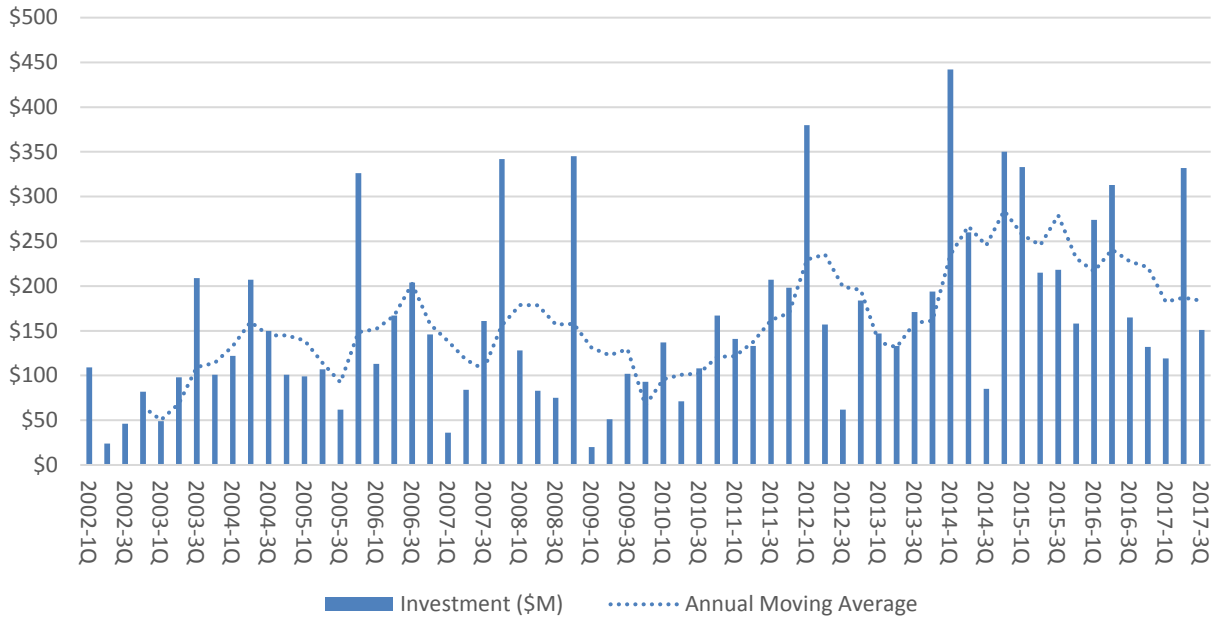
Jurisdiction	Lead Contact/Position	Date
City of Lockhart	Dan Gibson (City Planner)	
City of Round Rock		
Williamson County		
City of Georgetown		
City of Hutto		
City of Manor		
City of Kyle		
City of San Marcos		
City of Austin		
Travis County		
Caldwell County		
Guadalupe County		
City of Pflugerville		
City of Buda		
Hays County		
City of Live Oak		
City of Schertz		
City of Cedar Park		
City of Liberty Hill		
City of Leander		
City of Seguin		
City of Universal City		
City of Garden Ridge		
City of Selma		
City of Cibolo		
City New Braunfels		
City of San Antonio		

CONCLUSIONS

The overall trends in the CTTS study area continue to be positive, as they have been since the recovery from 2008-2009 Recession. There has been some dampening of employment growth in the AAMPO study area, which is likely due to declining oil and gas prices and the subsequent slowing of activity in the Eagle Ford shale play. However, the economy appears to be resilient and has absorbed the impact relatively well. The CAMPO region's economy (with the exception of Caldwell County) is not closely tied to the oil and gas industry and so the downturn has had relatively little effect. Nonetheless, employment growth in the Austin-Round Rock MSA has also shown some recent signs of hesitation, which could be the result of falling venture capital investment (See Figure 15) in the region and the consolidation of firms within technology

industries that have led to layoffs. It is not clear if the changes in recent months are part of a larger trend or if they reflect changes in a key industry that will be overcome in the near future.

Figure 15: Venture Capital Investment in the Austin Region, 1st Quarter 2002-3rd Quarter 2017



Source: PwC and Greater Austin Chamber of Commerce, 2017.

Regardless of any near term changes in the local economy, the rate of population and employment growth in the Austin-Round Rock MSA and the San Antonio-New Braunfels MSA are expected to continue to outperform the state and the nation. The Austin region's ability to attract a young and highly skilled labor force, a steady stream of industry relocations and expansions, and the region's ability to generate new firms appears to be self-sustaining, although the region's rapidly rising cost of living (namely housing) and traffic congestion are growing risks to the local economy. Most of the threats to the region's future growth will likely come as a consequence of issues at the national or global level. Domestic political instability, global insecurity, and the potential abandonment of the North American Free Trade Agreement (NAFTA) – as well as other trade agreements - are significant risks that, if realized, could tangibly, negatively, and meaningfully affect the state's economy and the local economies within the CTTS study area. Rising interest rates, inflation, and the impacts of climate change are all intermediate- to long-term issues that could impose future downstream impacts. The Austin region, like all regions in the nation, cannot avoid the potential impacts of these risks, it is relatively well-positioned to weather many of them, while remaining vulnerable to others.

New population and employment growth have been strong throughout most of the CTTS study area and development in the broader region and in the CTTS study area are expected to be favorable over the foreseeable future. In particular, the areas around Georgetown and Round

Rock, the eastern side of Pflugerville, northeastern Travis County, and northern Hays County have all performed well. There continues to be nascent activity on major projects in eastern Travis County and, if market conditions can persist for another 1 to 3 years, they will begin to influence regional growth patterns. Development in southeastern Travis County is likely to continue to lag over the near- to medium-term.

While population and employment growth have come relatively easy for the region, occasional downturns inform the populace (or at least some within it) that growth cannot be taken for granted. Water will remain an ongoing concern for the city, with the region suffering from a severe drought several years ago. Another limiting factor to development will be the ongoing, contradictory policies and positions among elected officials and senior bureaucrats that simultaneously encourage dense development, while occasionally campaigning against individual projects. These contradictions create uncertainty within the development community and likely discourage projects that would otherwise be viable and beneficial. On the positive side, the region's ability to attract young college graduates is, perhaps, the city's greatest asset. Although the city's existing industries are the primary contributors to the region's success, without their current access to a young, educated labor force, they would likely struggle to maintain their momentum. It is with this labor force that companies can grow and innovation is fostered within the region.

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