I-37 Corridor Study Report

I-69 to I-410

TxDOT Transportation Planning and Programming Division

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1. Introduction

South of Loop 1604

Interstate 37 (I-37) is located in southcentral Texas and extends between San Antonio and Corpus Christi for a length of 143 miles. It was first designated as a route between these two cities in 1959. Prior to this designation, the route between San Antonio included SH 9 from Corpus Christi to Three Rivers and US 281 from Three Rivers to San Antonio. Construction of this interstate began in the 1960s in the urban areas of Corpus Christi and San Antonio, and the segments in the rural areas were completed in the 1980s. The sections of SH 9 were removed as sections of I-37 were completed; however, no sections of US 281 were removed. SH 281 and I-37 share the same alignment at two different locations between south of San Antonio and Three Rivers.

This facility in Corpus Christi provides access to the downtown, Corpus Christi International Airport, and the Port of Corpus Christi. In San Antonio it provides access to the downtown, the River Walk, the Alamo, Brooks City-Base, and via US 281 to the San Antonio International Airport.[1]

I-37 is part of the National Highway System (NHS) and Interstate System. It is also included in the Strategic Highway Network (STRAHNET) which is the network identified for domestic operations by the U.S. Department of Defense and serves as a corridor for highway freight movement to and from Corpus Christi and the Brownsville-Harlingen-McAllen region.

I-37 is a vital regional corridor for hurricane evacuation, with two identified evacuation plans. The first is an Evacuation Contraflow Route plan that, when activated, reverses the I-37 southbound lanes to carry two lanes of northbound traffic. Traffic in these lanes may exit at US 59 and SH 359 along the corridor. The second plan for the corridor is the Hurricane Shoulder Evaculane. When this plan is in effect, generally the inside shoulder is utilized in the urban areas and the outside shoulder is used in the rural areas. For more information go to: http://www.txdot.gov/inside-txdot/division/traffic/safety/weather/hurricane-contraflow.html

[1] https://en.wikipedia.org/wiki/Interstate_37

Corridor Study Purpose

The purpose of the I-37 Corridor Study is to identify and prioritize potential projects for consideration in future TxDOT programming activities. Any project recommended as part of this study would be subject to further engineering and environmental study.

Study Goals and Objectives

The goal of this corridor study is to measure corridor performance to inform the development of near-term, mid-term, and long-term strategic solutions that are cost-effective and account for potential risks. This goal can be accomplished by following the process described below:

- Assess existing performance based on quantifiable performance measures
- Quantify needs based on a comparison of existing performance to performance objectives
- Identify solutions that can provide quantifiable benefits relative to the performance measures
- Prioritize solutions for future implementation, accounting for performance effectiveness and risk analysis findings

The objective of this study is to identify a recommended set of prioritized potential solutions for consideration in future construction programs, derived from a transparent, defensible, logical, and replicable process. The I-37 Corridor Study defines solutions and improvements for the corridor that are evaluated and ranked to determine which investments offer the greatest benefit to the corridor in terms of enhancing performance.

Corridor Overview and Location

This study includes the portion of I-37 from the interchange of I-37 and I-410 south of San Antonio to I-69 E in Corpus Christi, a distance of approximately 119 miles. The western limit of the study area generally parallels US 281 and the eastern limit follows US 181. A map of the study area is provided in **Figure 1**. The study corridor extends through five counties: Bexar, Atascosa, Live Oak, San Patricio, and Nueces and is located within the San Antonio and Corpus Christi TxDOT Districts.

1.1 Corridor Characteristics

This section describes the physical features of the I-37 corridor within the study area including main lanes, frontage roads, interchanges/intersections, bridges, freight, intelligent transportation systems, and other roadway characteristics such as right-of-way, typical sections, shoulder widths, number of lanes and speed limits, traffic volumes, and crashes.

South of US 281 split to Pleasanton

Main Lanes

The corridor is primarily a four-lane facility with two 12-foot lanes each direction. Near the city of Corpus Christi the facility widens to six lanes. Approaching San Antonio, the northbound side widens to three lanes near the U.S. 181 direct connector. I-37 is designated as a rural interstate facility throughout the corridor except at its approaches to the urbanized areas of San Antonio and Corpus Christi where it is classified as an urban interstate. The speed limit along the corridor is 75 miles per hour (mph), except in the vicinity of San Antonio where it drops to 70 mph.

Inside and outside shoulder widths vary along I-37. Outside of the urban areas, they generally range from nine feet to 16 feet on the outside shoulder and from three feet to eight feet on the inside shoulder. Within the urban areas, there are significant variations with the outside shoulders ranging from approximately three to twenty four feet and the inside shoulders ranging from three to sixteen feet. **Figure 2** shows the various shoulder widths. The widest inside and outside shoulder widths along the facility are located mainly in Live Oak County.

The median along the majority of the corridor is approximately 60 feet wide except near San Antonio. South of FM 1604, the median is approximately 360 feet and north of FM 1604 there is no median along I-37. More information on right-of-way (ROW) and typical sections is provided in the following sections.

I-37 at FM 99

Frontage Roads

Frontage roads along I-37 mainly serve to provide access and connectivity to various land parcels and thoroughfares along the corridor. Frontage roads are located along the majority of I-37 within the study area and are shown in **Figure 3**. However, there are sections in the northern half of the corridor where there are discontinuous frontage roads and there are sections with frontage roads on only one side of the main lanes. All frontage roads are two-way with the exception of those near Corpus Christi. All frontage roads have two lanes and the posted speed limit is 55 mph except just south of the northern limit near San Antonio where it has a posted speed limit of 50 mph.

Interchanges/Intersections

There are a total of 40 interchanges or intersections that connect to the I-37 corridor. Of these, seven have interchanges with I-37, two have traffic signals, and the remaining 31 connections are stop controlled. **Figure 4** shows the interchanges and intersections along the study corridor. **Table 1** lists the cross streets along the corridor, their functional class, number of lanes, average annual daily traffic (AADT), the type of interchange with I-37, type of ramp (parallel or taper), and type of ramp lighting (none, partial, or full).

Figure 1 – I-37 Study Area

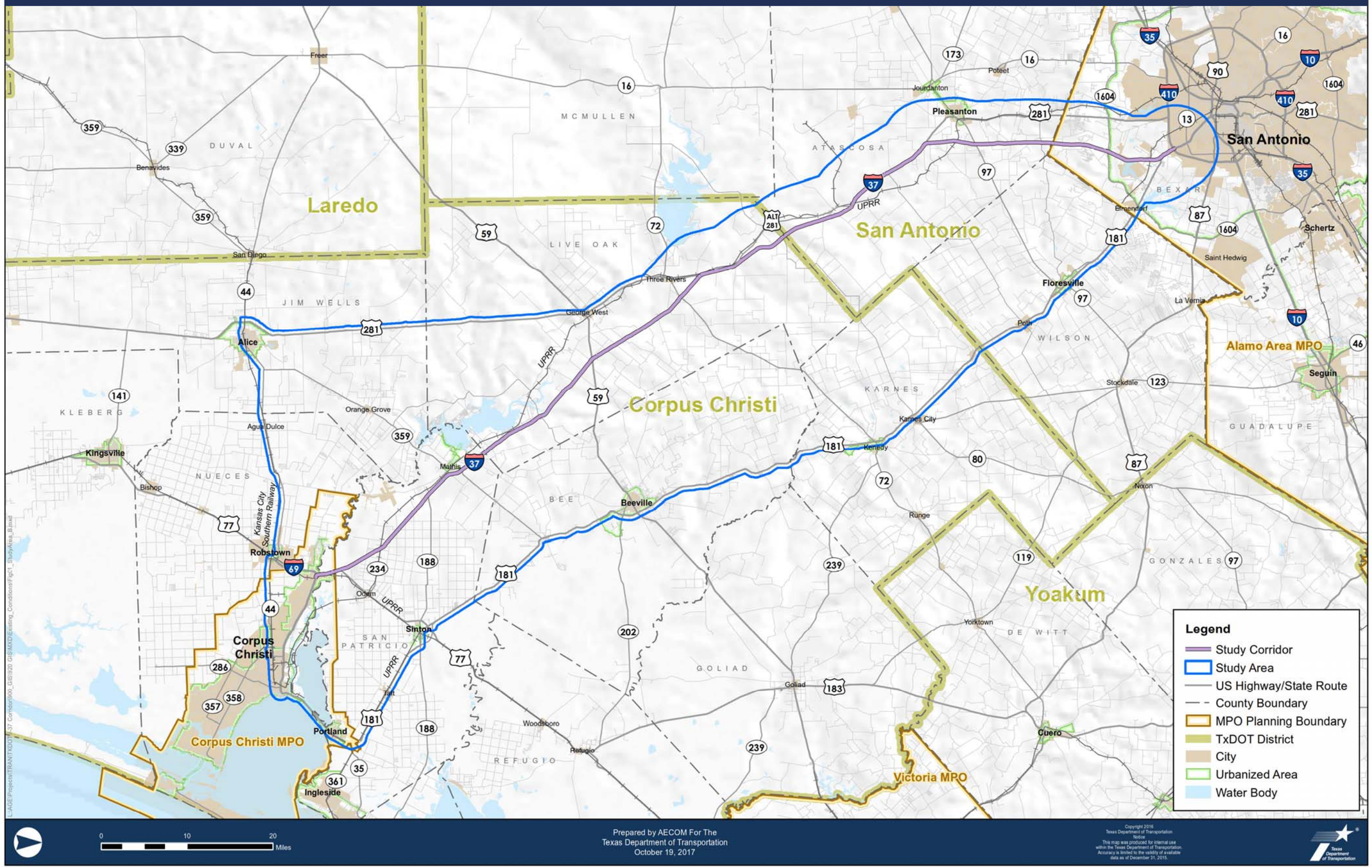


Figure 2 – I-37 Shoulder Widths

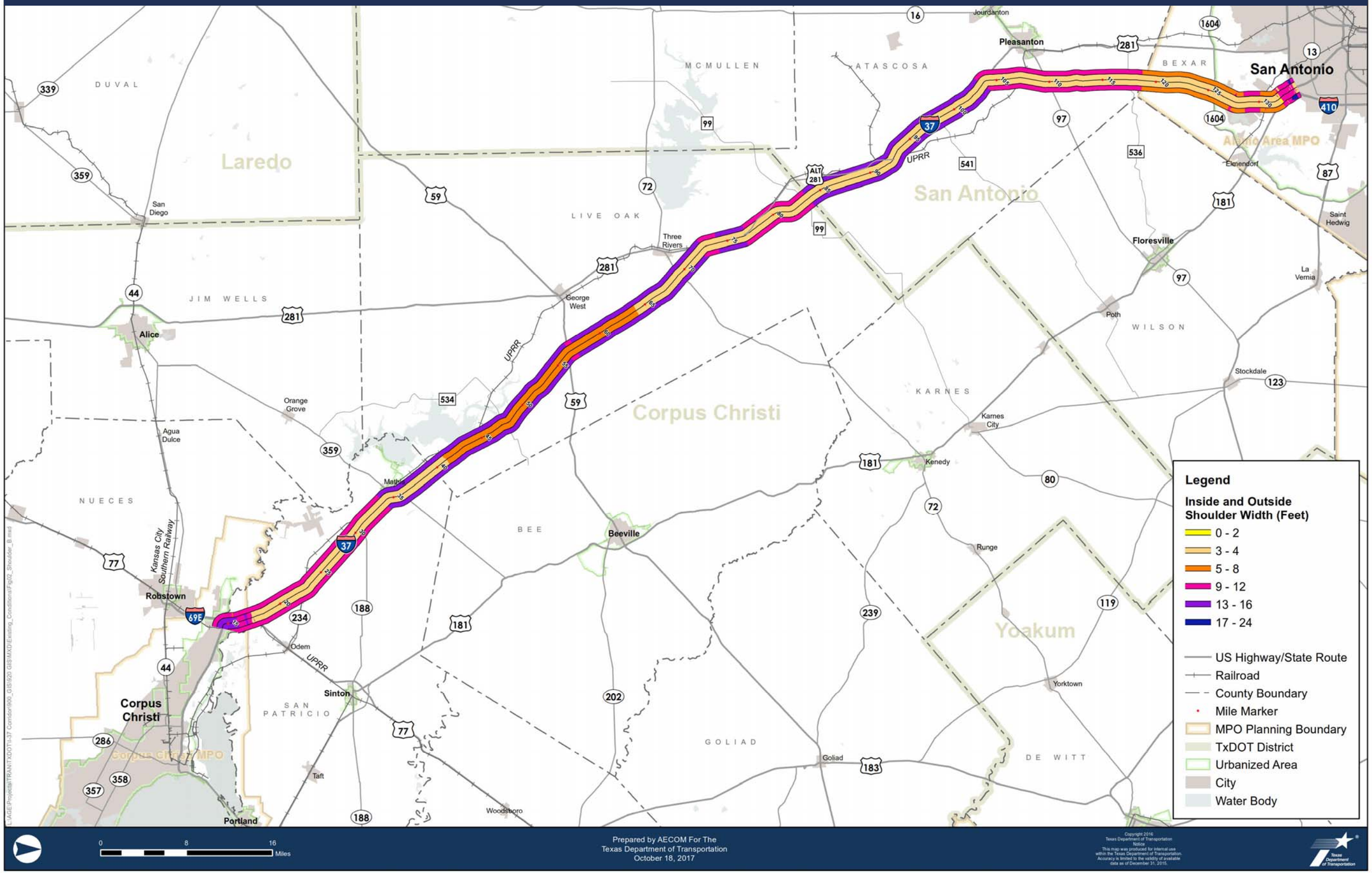


Figure 3 – Frontage Road Location

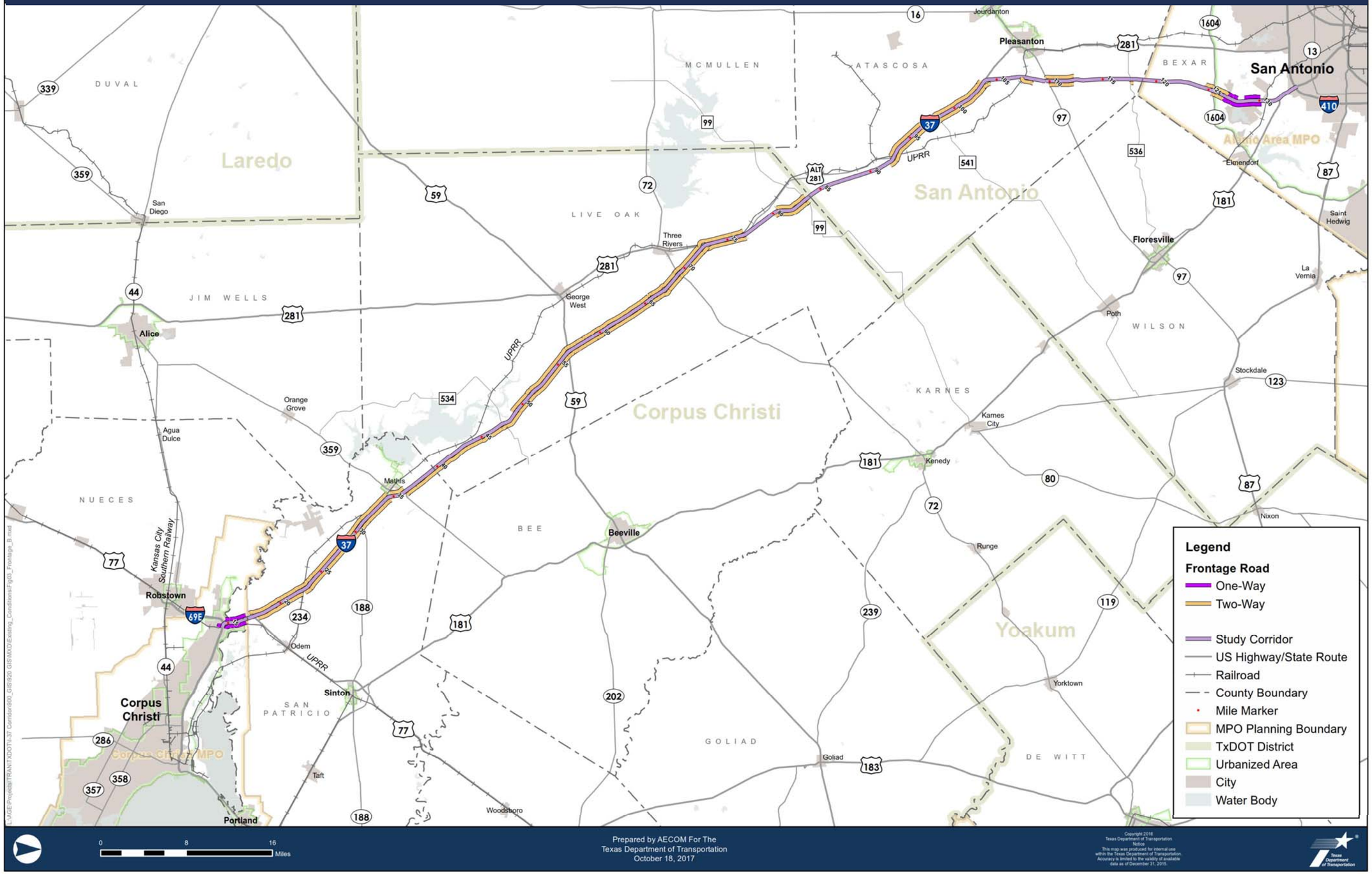


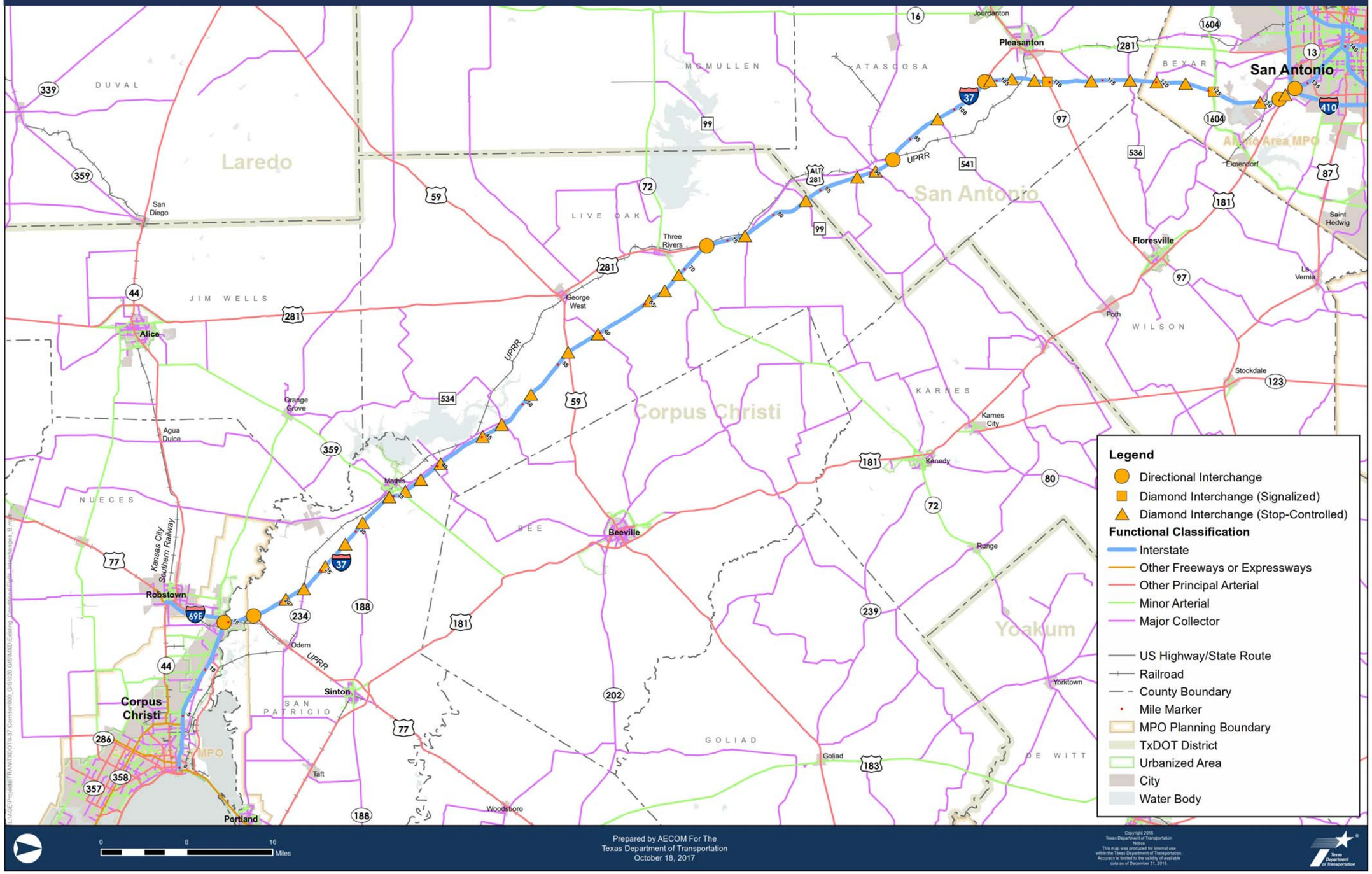
Table 1 – I-37 Interchanges

Cross Street	Functional Classification	Number of Lanes	Existing Average Daily Volume (vpd)	Type of Interchange	Type of Ramp	Lighting
I-69 E	Interstate	4	21,300	Directional Interchange	Parallel	Full
US 77	Principal Arterial	4	15,500	Directional Interchange	Parallel	Full
CR 188	Minor Collector	2	460	Diamond Interchange (Stop-Control)	Parallel	Partial
SH 234	Major Collector	2	1,100	Diamond Interchange (Stop-Control)	Taper	None
CR 1441	Local	2	N/A	Diamond Interchange (Stop-Control)	Taper	None
FM 630	Minor Collector	2	50	Diamond Interchange (Stop-Control)	Taper	None
SH 188	Minor Collector	2	1,900	Diamond Interchange (Stop-Control)	Taper	None
Spur 459	Minor Arterial	4	5,200	Diamond Interchange (Stop-Control)	Taper	None
SH 359	Minor Arterial	4	7,300	Diamond Interchange (Stop-Control)	Taper	Partial
FM 3377	Major Collector	2	290	Diamond Interchange (Stop-Control)	Taper	None
FM 888	Major Collector	2	670	Diamond Interchange (Stop-Control)	Taper	None
CR 350	Local	2	N/A	Diamond Interchange (Stop-Control)	Taper	None
FM 534	Major Collector	2	1,000	Diamond Interchange (Stop-Control)	Taper	None
CR 356	Local	2	60	Diamond Interchange (Stop-Control)	Taper	None
US 59	Principal Arterial	4	6,900	Diamond Interchange	Taper	None

Cross Street	Functional Classification	Number of Lanes	Existing Average Daily Volume (vpd)	Type of Interchange	Type of Ramp	Lighting
				(Stop-Control)		
FM 799	Major Collector	2	730	Diamond Interchange (Stop-Control)	Taper	None
FM 1358	Minor Collector	2	450	Diamond Interchange (Stop-Control)	Taper	None
CR 232	Local	2	250	Diamond Interchange (Stop-Control)	Taper	None
SH 72	Minor Arterial	4	10,300	Diamond Interchange (Stop-Control)	Taper	None
US 281	Principal Arterial	4	10,200	Directional Interchange	Parallel	Partial
US 281A	Major Collector	2	1,200	Diamond Interchange (Stop-Control)	Taper	None
FM 99	Major Collector	2	3,800	Diamond Interchange (Stop-Controlled)	Parallel	None
FM 1099	Major Collector	2	1,700	Diamond Interchange (Stop-Control)	Taper	None
FM 791	Major Collector	2	1,700	Diamond Interchange (Stop-Control)	N/A	None
US 281A	Major Collector	2	2,000	Directional Interchange	Taper	None
FM 541	Major Collector	2	700	Diamond Interchange (Stop-Control)	Taper	None
US 281	Principal Arterial	4	8,200	Directional Interchange	Parallel	None
Spur 199	Minor Collector	2	2,300	Diamond Interchange (Stop-Control)	Parallel	None
Coughran	Local	2	270	Diamond Interchange (Stop-Control)	Taper	None
Corgey	Local	2	680	Diamond Interchange (Stop-Control)	N/A	None

Cross Street	Functional Classification	Number of Lanes	Existing Average Daily Volume (vpd)	Type of Interchange	Type of Ramp	Lighting
SH 97	Principal Arterial	4	11,100	Diamond Interchange (Signalized)	Taper	None
Verdi	Major Collector	2	1,800	Diamond Interchange (Stop-Control)	Taper	None
FM 536	Major Collector	2	2,100	Diamond Interchange (Stop-Control)	Taper	None
Hardy	Local	2	440	Diamond Interchange (Stop-Control)	Taper	None
Waterwood	Local	2	2,500	Diamond Interchange (Stop-Control)	Taper	None
Loop 1604	Minor Arterial	2	9,200	Diamond Interchange (Signalized)	Taper	None
Southton	Local	2	3,100	Diamond Interchange (Stop-Control)	Taper	None
US 181	Principal Arterial	4	28,200	Directional Interchange	Parallel	Partial
Spur 122	Principal Arterial	2	3,900	Partial Diamond (Stop-Control)	Taper	None
I-410	Interstate	4	55,400	Directional Interchange	Parallel	Full

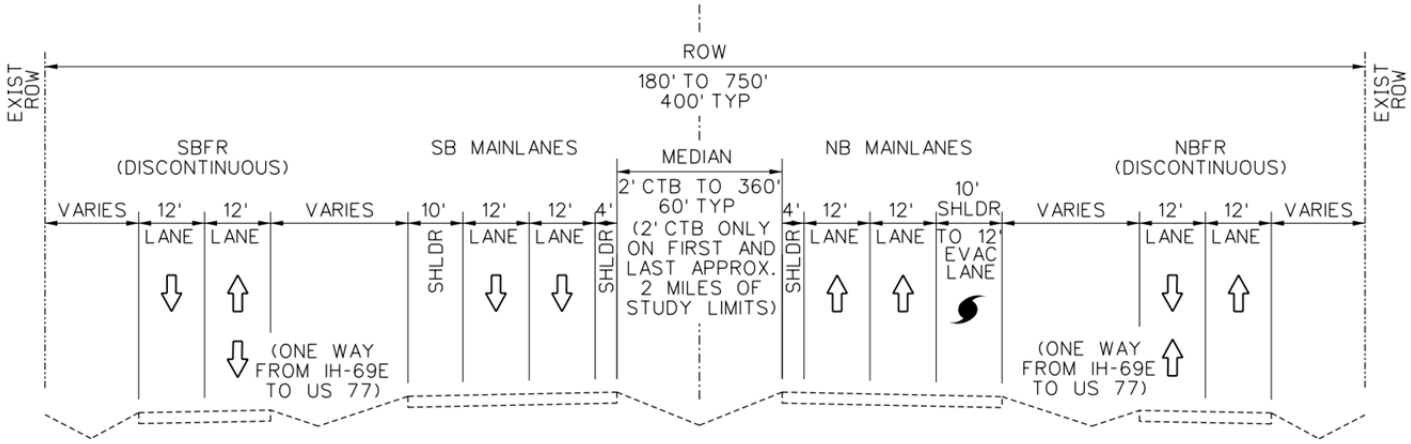
Figure 4 – Interchanges and Intersections



Right-of-Way/Typical Section

A typical section of the I-37 corridor is provided in **Figure 5**. I-37 is a four-lane divided highway. In the vicinity of San Antonio and Corpus Christi, the center median is reduced to a two-foot-wide concrete traffic barrier (CTB). Approximately two miles beyond the start and end points of the study area there is a 60-foot-wide median separating the mainlanes. There are discontinuous one-way and two-way northbound and southbound frontage roads. There is a 10-foot-wide outside shoulder and four-foot-wide inside shoulder along the southbound mainlanes. In the northbound direction there is a 12-foot-wide hurricane evacuation lane from the southern limit in Corpus Christi to Loop 410 in San Antonio. ROW along the corridor ranges from 180 feet to 750 feet in width, with a typical width of 400 feet. A map of ROW widths within the corridor is provided in **Figure 6**.

Figure 5 – I-37 Typical Section



Pavement Condition

The Pavement Management Information System (PMIS) data for 2015 was received from TxDOT. A review of this data shows that approximately 10% of the mainlane pavement has a Pavement Condition Score less than 70 with a majority of the locations occurring in the northbound lanes. In addition, approximately 30% of the frontage road pavement has a Condition Score less than 70 with the locations generally equally divided between the northbound and southbound frontage roads.

Bridges

Figure 7 provides the location of bridges along I-37. There are 143 bridges located within the study area. TxDOT produces the BRidge INventory, inSpection and Appraisal Program (BRINSAP) which was used for this study. Overall, there are 111 overpasses and 32 underpasses. The following are the general conclusions based on the summary table:

- Nine bridges have a sufficiency rating < 80.
- Eight bridges have a condition rating of 5 (deck, superstructure, substructure, or structural evaluation rating).
- One rating of 5 is related to deck condition, while one is related to superstructure condition, four are related to substructure condition, and two are related to structural evaluation rating.

- None of the bridges has a condition rating of 4 or less (deck, superstructure, substructure, or structural evaluation rating).
- Nine bridges are classified as functionally obsolete.
- Three underpass bridges provide < 16' vertical clearances

Freight

TxDOT conducted a study of freight needs in the State of Texas that was completed in 2015 (Texas Freight Mobility Plan). The Freight Mobility Plan designates I-37 as part of the Primary Freight Network within the state. The Freight Mobility Plan also concludes that approximately 75 percent of the primary freight network facilities are four-lane highways within the State, while the rest have six or more lanes.

Freight (truck) volumes along the study corridor are shown in **Figure 8**. As shown in this figure, the highest volumes of trucks are located on the approaches to the urbanized areas of San Antonio and Corpus Christi. The daily volumes are between 7,900 and 9,600 in the urbanized areas of the corridor and generally between 3,200 and 7,200 in the rural areas. Provided in **Figure 9** are freight features along the corridor. Truck parking facilities along, as well as within, 2½ miles of the I-37 corridor were identified using Google Earth. Google Earth was used to estimate the number of possible truck parking spaces within these facilities. There are 13 commercial gas stations/truck stops and two state-maintained rest areas with a total of 535 parking spaces along the 120 miles of the corridor. There are two weigh stations in the corridor located north of Three Rivers. Also included are airports, seaports, military bases, intermodal terminals, port-rail terminals, and rail-truck trans-shipment terminals. The Primary Freight Network, Secondary Freight Network, and Strategic Highway Network are shown to highlight designated freight routes in the study area.

Figure 6 – Right of Way Width

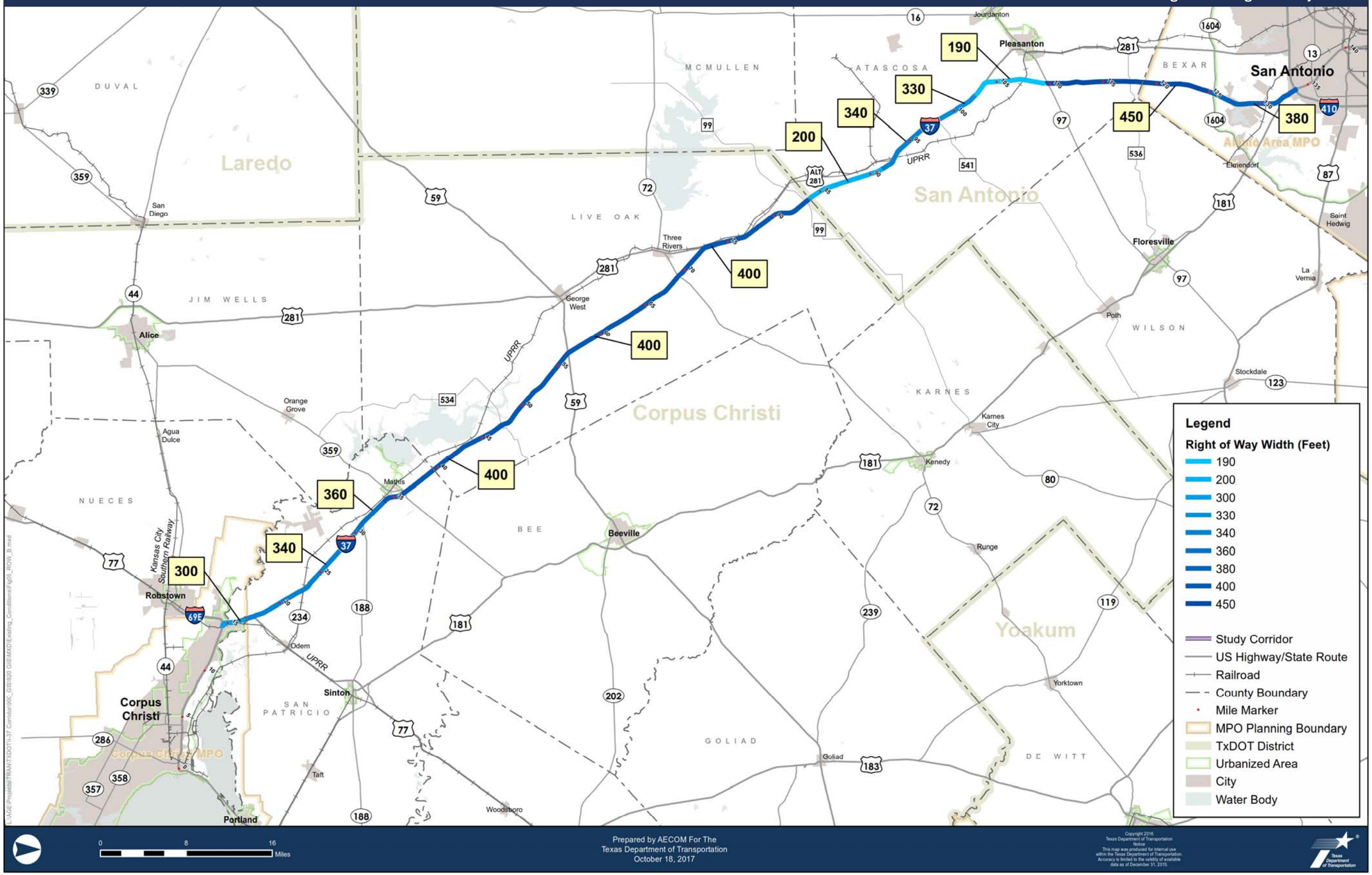


Figure 7 – I-37 Bridge Locations

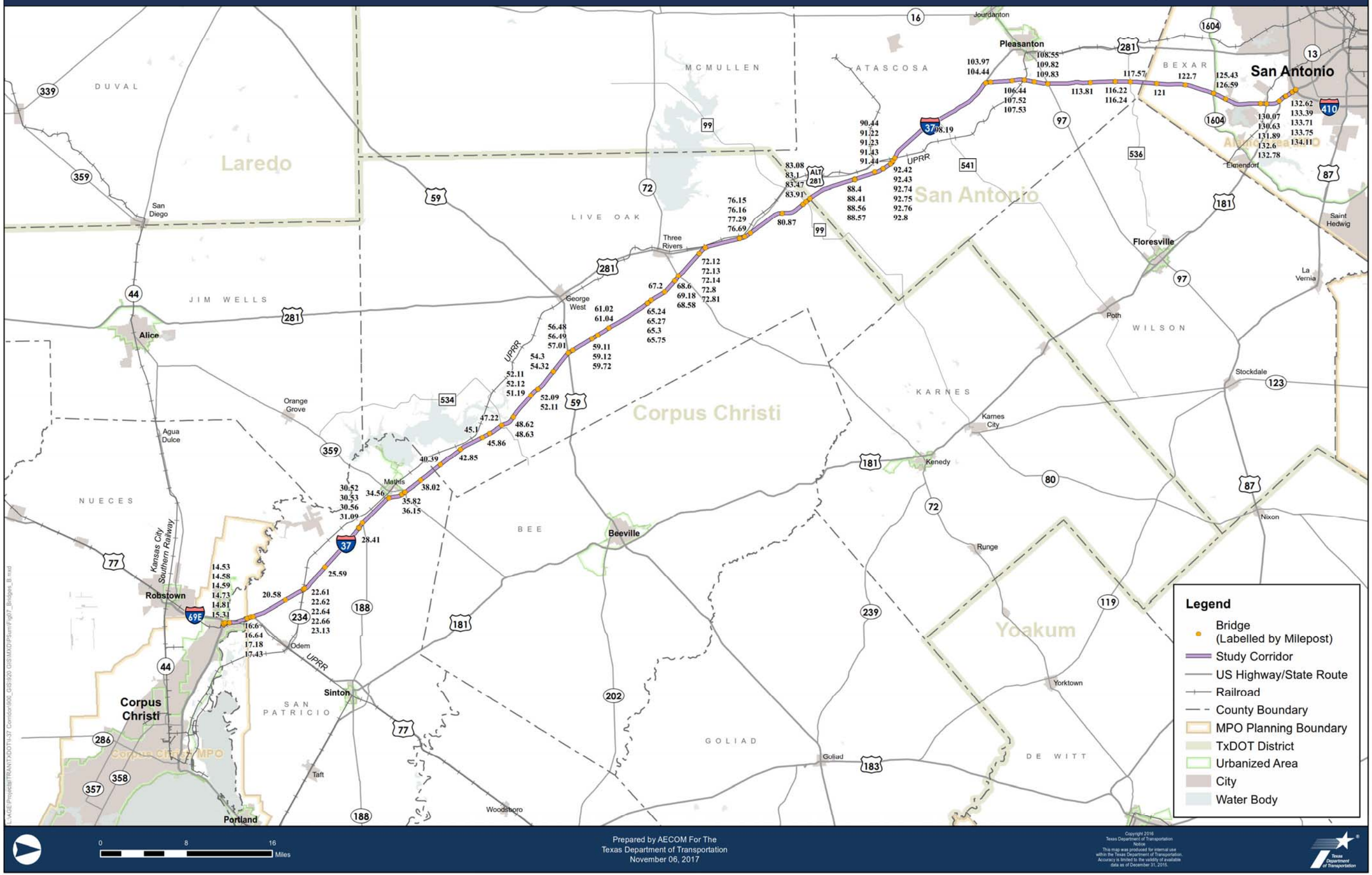


Figure 8 – I-37 Freight Volumes

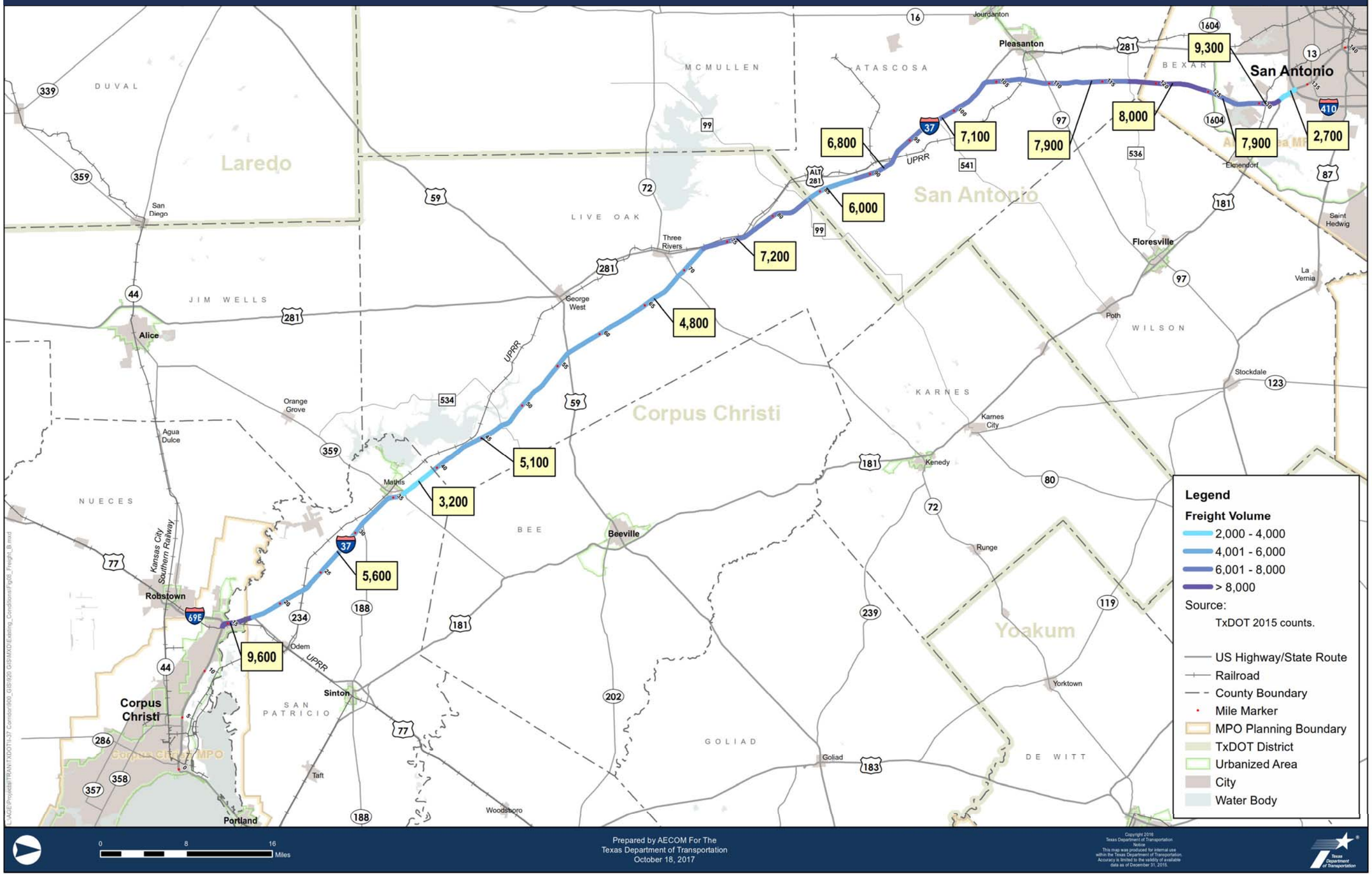
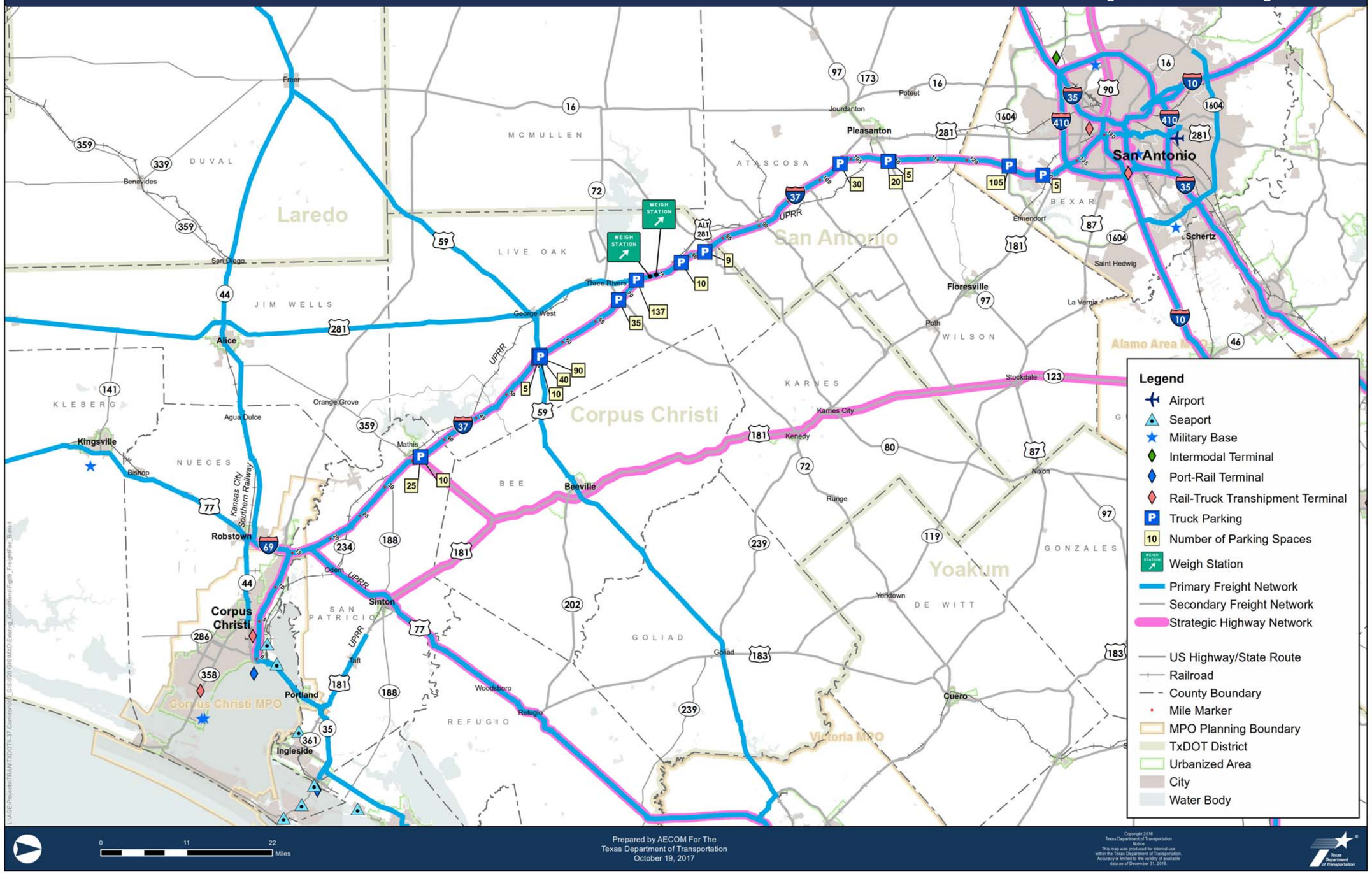


Figure 9 – I-37 2015 Freight Amenities



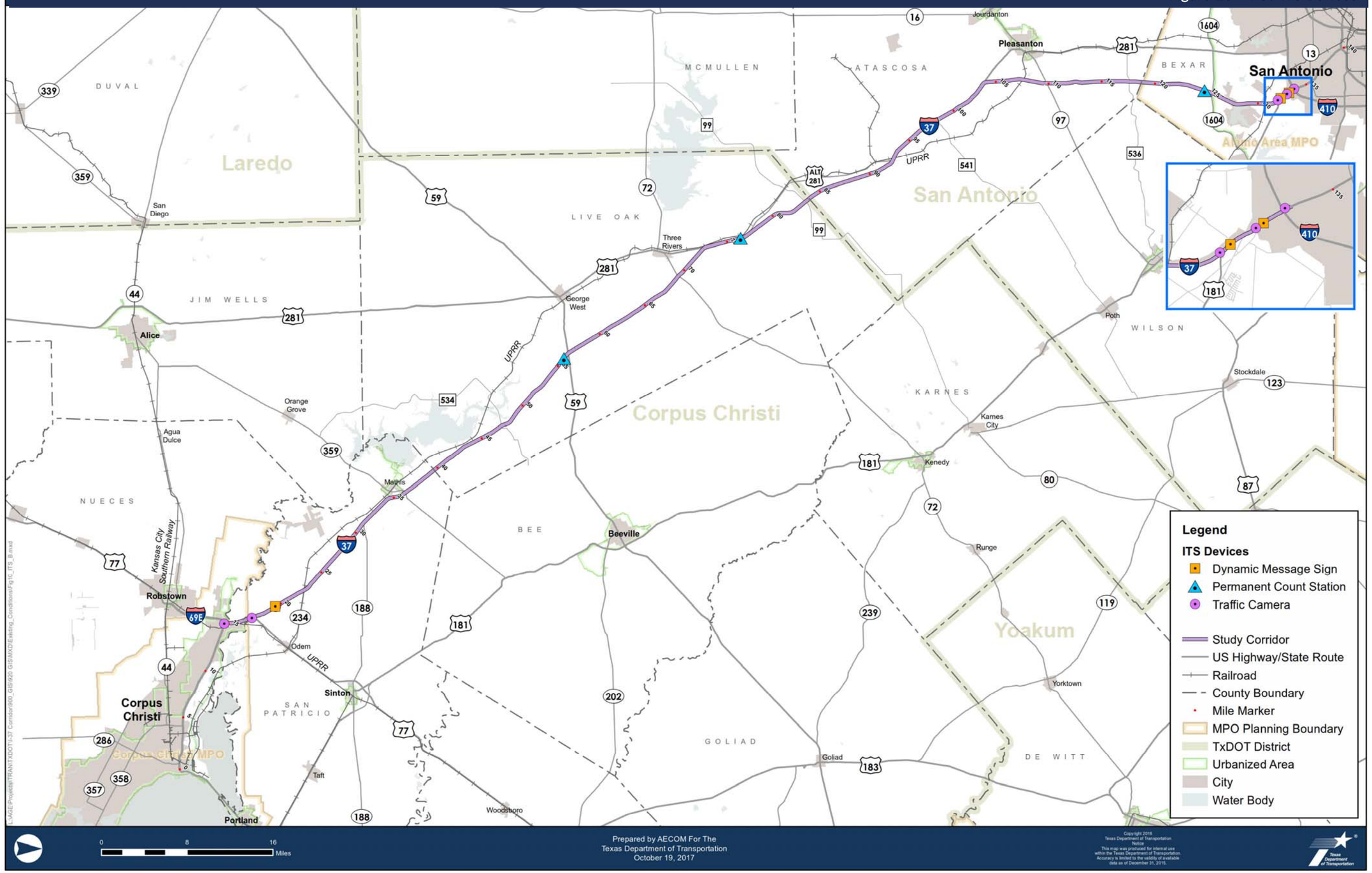
Intelligent Transportation Systems (ITS) Devices

Existing ITS devices are listed in **Table 2** and shown in **Figure 10**. ITS devices along the corridor include traffic cameras, dynamic message signs, and permanent count stations. The traffic cameras and dynamic message signs are located in the urban areas around San Antonio and Corpus Christi. Permanent count station 15S321 is located near San Antonio directly south of Loop 1604. Stations 149S232 and 149S54 are located near the middle of the corridor, north of Three Rivers and east of George West, respectively.

Table 2 – ITS Devices

ITS Type	Location
Traffic Camera	I-37 @ LP 410
Dynamic Message Sign	I-37 @ Old Corpus Christi Hwy
Traffic Camera	I-37 @ Salado Creek
Dynamic Message Sign	I-37 @ US 181
Traffic Camera	I-37 @ Hwy 181
Traffic Camera	I-37 @ US 77 Rest Area
Dynamic Message Sign	I-37 @ US 77 Rest Area
Traffic Camera	I-37 @ US 77 River Ridge
Traffic Camera	I-37 @ US 77 Calallen
Permanent Count Station	(ID: 15S321, AVC) (ID: 15A321, ATR)
Permanent Count Station	(ID: 149S232, Type: AVC/CVC)
Permanent Count Station	(ID: 149S54, Type: AVC/CVC)

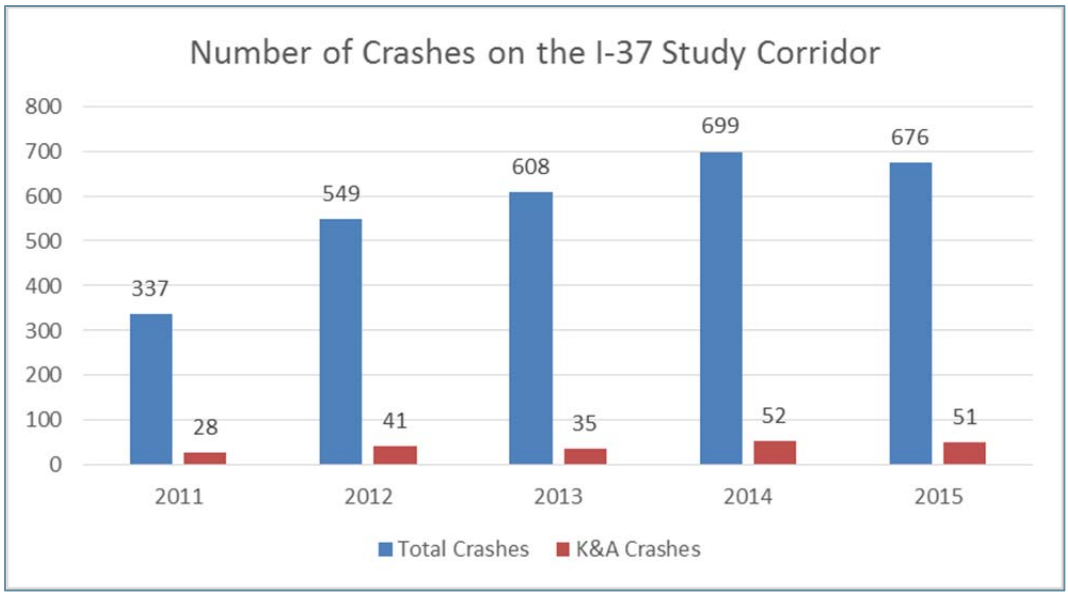
Figure 10 – I-37 ITS Devices



Crash Data

The crash data along I-37 was collected from TxDOT's Crash Records Information System (CRIS). The analysis period is five years from 2011 to 2015. Roadway components include main lanes, direct connectors, ramps, and frontage roads. **Figure 11** shows the numbers of total and K&A (fatal and incapacitating) crashes each year. There were 2,869 crashes on the corridor recorded between 2011 and 2015, and 207 (approximately seven percent) of them were K&A crashes. The highest number of crashes occurred in year 2014 - 699 total crashes with 52 K&A crashes. **Figure 12** shows the densities of the K&A crashes and the crash hot spots. As shown on this figure, there are primarily three locations where a high number of crashes occur. The first location is south of San Antonio at the intersection of I-37 and Loop 1604. The second area of high crashes is north of Campbellton where US 281A merges with I-37. The third location is north of Corpus Christi, approximately where SH 188 intersects I-37. The number of crashes along the remainder of the corridor is evenly distributed.

Figure 11 – I-37 Crashes



Mobility

Existing (2015) annual average traffic volumes (AADT) were obtained from TxDOT and are listed in **Table 3** and shown in **Figure 13**. As to be expected, the higher volumes of traffic on I-37 are approaching the urbanized areas of San Antonio and Corpus Christi, and range from 44,100 to 82,400. In the rural areas they range from 18,100 to 40,600. Also shown in this table is the capacity of the roadway by location and the number of lanes. The capacity was determined using the Highway Economic Requirements Systems (HERS). Volumes along the corridor are well below the facility's capacity. Table 3 also includes 2015 design hour volume factors (K Factor), directional distribution factors (D Factor), and truck volume percentages (T Factor) as provided by TxDOT.

Table 3 – 2015 Traffic Volumes

Nearest Cross Street	No. of Lanes	Existing AADT (vpd)	Daily Capacity (vpd)	K Factor	D Factor	T Factor
IH-69	6	64,300	118,300	15%	60%	15%
US 77	6	51,200	118,300	15%	60%	16%
SH 188	4	29,000	78,100	15%	60%	19%
SH 359	4	18,100	75,000	15%	60%	24%
FM 534	4	24,700	75,000	7%	58%	21%
SH 59	4	18,200	77,100	15%	60%	24%
FM 304	4	22,000	77,100	15%	60%	22%
SH 72	4	18,200	77,100	15%	60%	24%
US 281A	4	28,500	75,700	15%	60%	25%
FM 1099	4	19,800	75,100	15%	60%	30%
US 281	4	27,800	76,100	15%	60%	25%
SH 97	4	34,800	77,100	15%	60%	23%
SH 1604	4	40,600	77,100	9%	58%	22%
Southton Road	4	33,500	81,100	9%	58%	24%
US 181	4	44,100	81,100	9%	58%	21%
IH 410	4	82,400	81,100	9%	58%	3%

Figure 12 – Fatal and Incapacitating Crashes

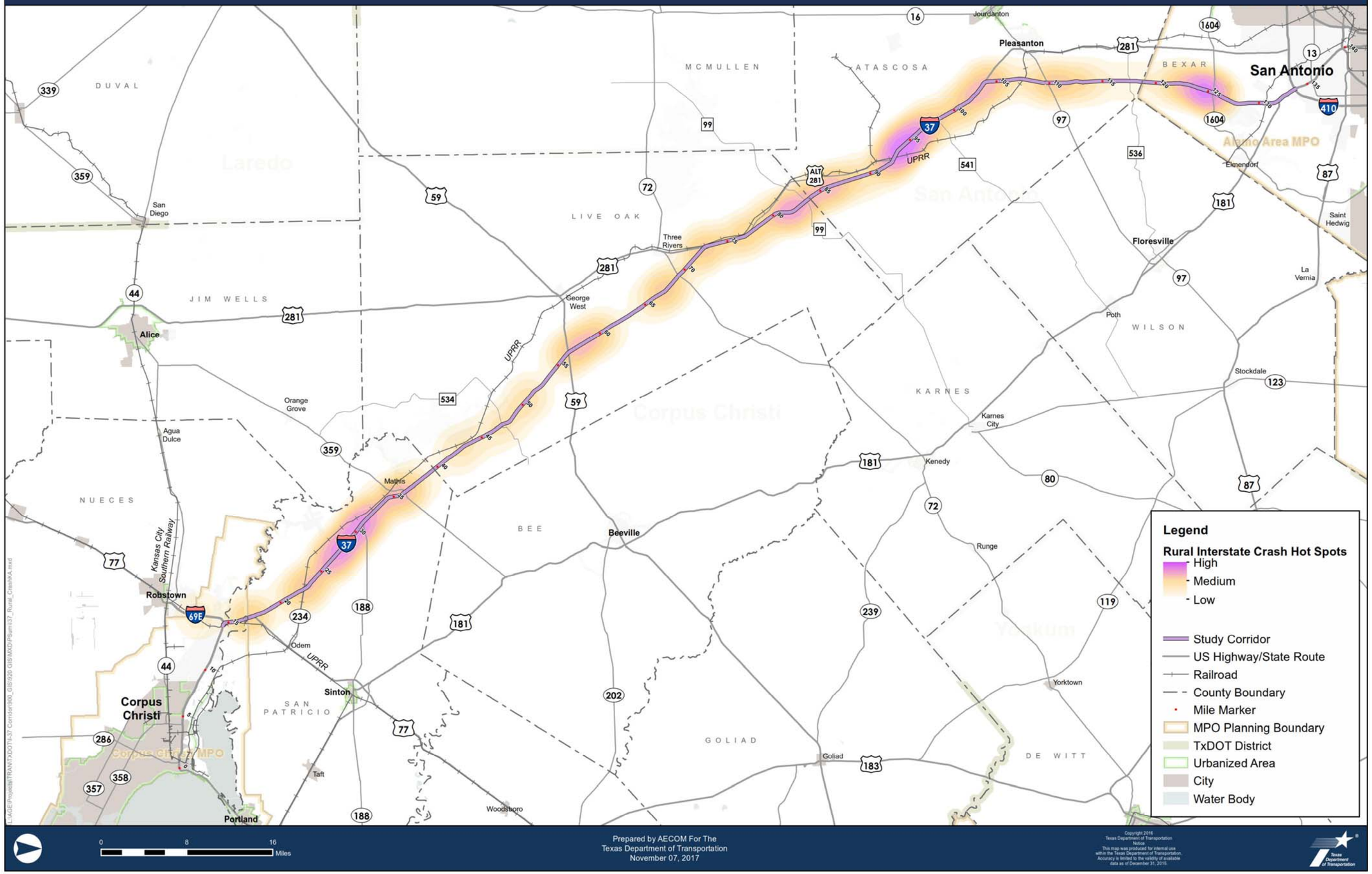


Figure 13 – I-37 2015 Daily Traffic Volumes

Population and Employment

Historic and existing population is shown in **Table 4**. As shown in this table, all five counties along the corridor had a low to moderate growth rate over the last few decades. In the northern portion of the corridor, Bexar County experienced the highest growth between 2010 and 2015 and the southern county of San Patricio experienced the lowest growth rate during this period. Existing population is shown in **Figure 14**. As shown on this figure, the highest population is in the northern portion of the corridor (Bexar County) followed by Nueces County in the southern portion.

Table 4 – Population Data

Year	Bexar	Atascosa	Live Oak	San Patricio	Nueces
1970	830,460	18,696	6,697	47,288	237,544
1980	988,971	25,055	9,606	58,013	268,215
1990	1,187,775	30,554	9,591	58,723	291,669
2000	1,398,834	38,805	12,233	67,333	313,673
2010	1,723,561	45,004	11,547	64,621	340,373
2015	1,897,753	48,435	12,229	67,357	359,715

Source: U.S. Census Population Estimates

Existing 2015 employment is shown in **Figure 15.** Comparable to the population figure, the highest employment is in Bexar County followed by Nueces County. For both population and employment the central part of the corridor has the lowest numbers.

Figure 14 – I-37 County Population Estimates

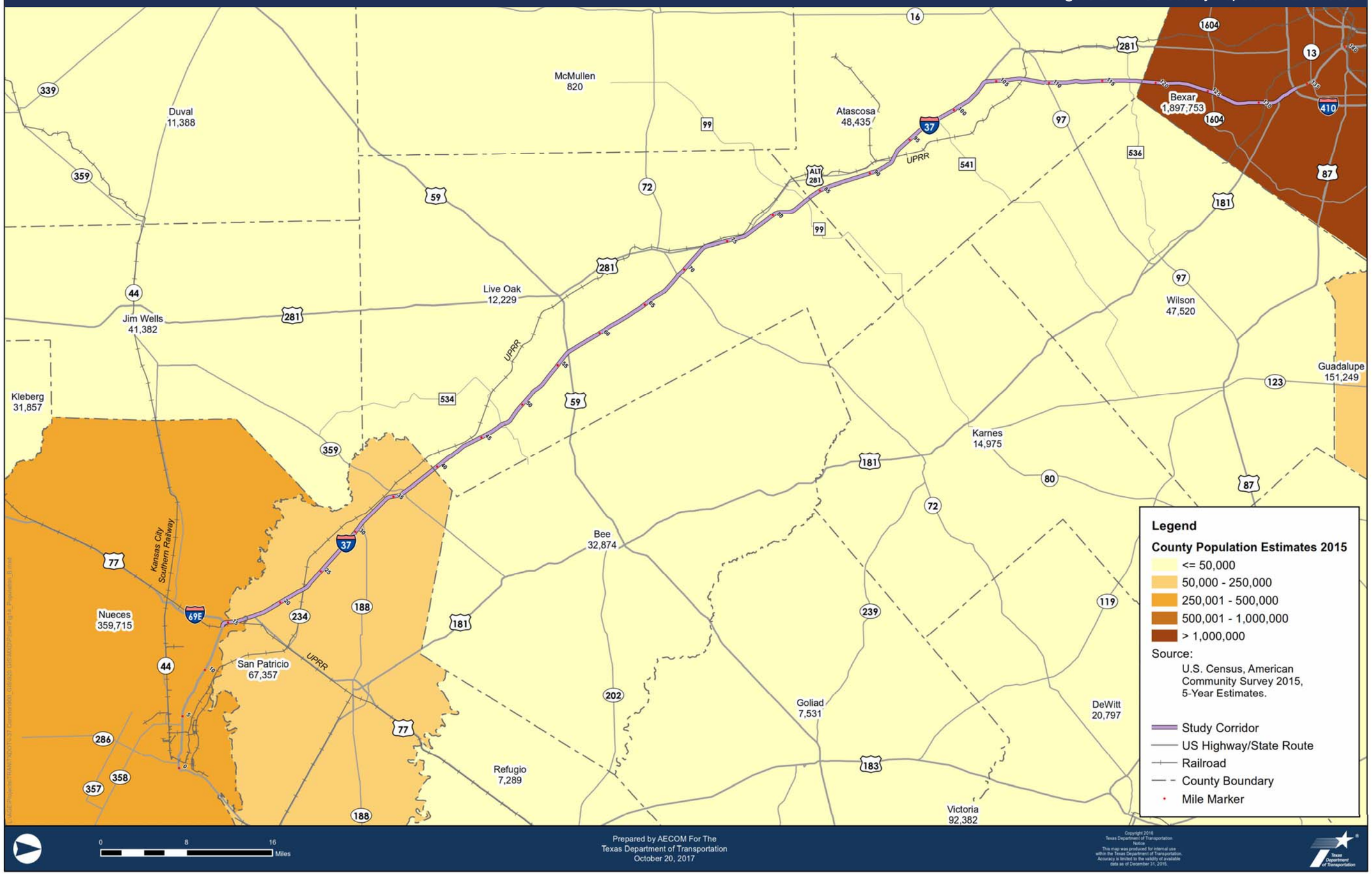
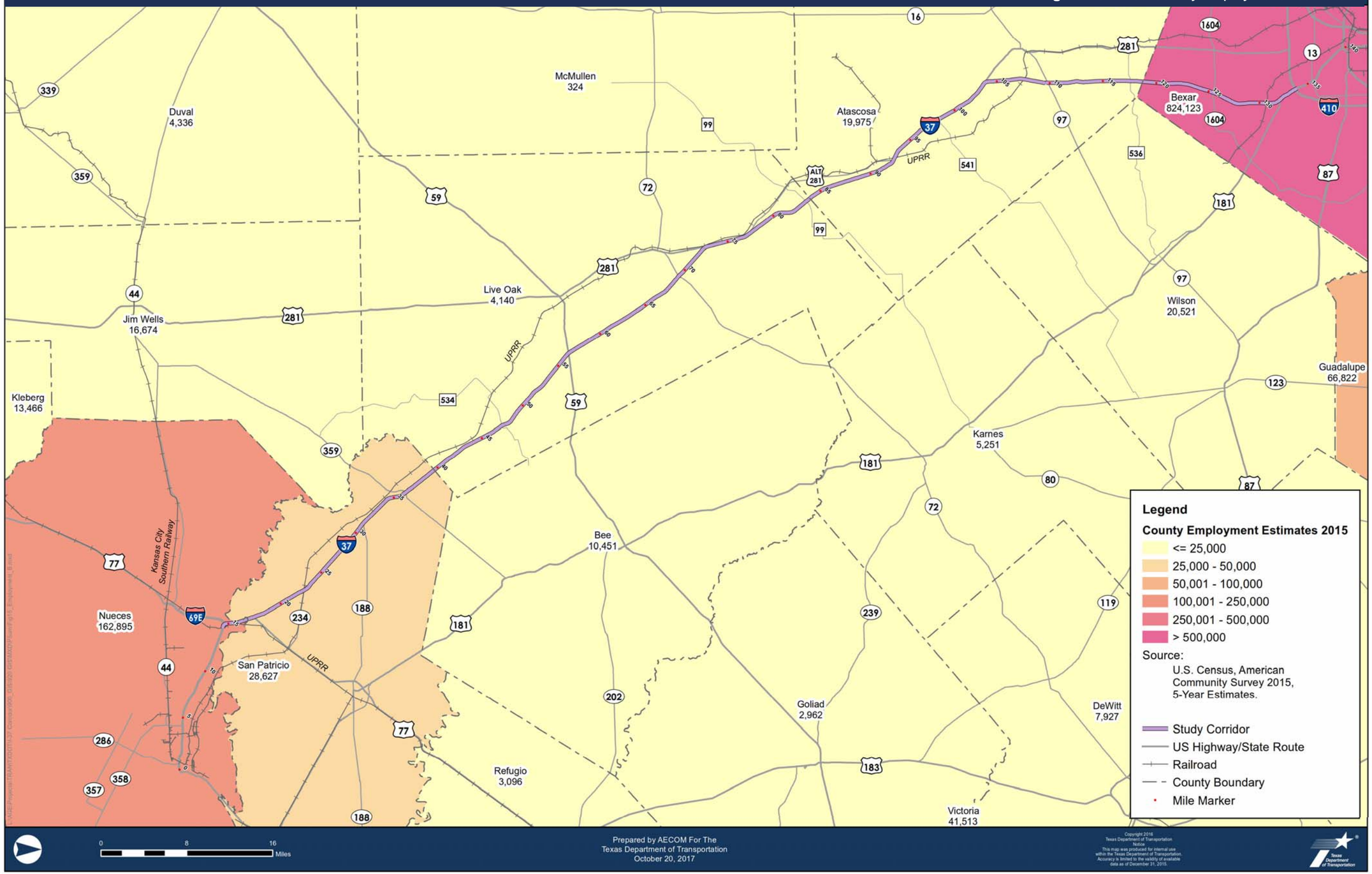


Figure 15 – I-37 County Employment Estimates



Environmental Constraints

Following the collection of environmental data for the I-37 Corridor Study area, the project team developed a series of environmental constraints maps to identify potentially sensitive resources that could affect the future engineering and environmental studies for improvements along the corridor. The environmental constraint data is presented on two sets of maps. The first set of maps displays United States Census Bureau (USCB) census geography boundaries, community facilities, archaeological sites and districts, historical sites and districts, cemeteries, railroads, streams and water bodies, wetlands, the 100-year flood zone, designated floodways, parks, conservation easements, mines/quarries, landfills, petroleum storage tanks, oil and gas wells, and water wells. The second set of maps displays existing land uses and prime farmland soils (as defined by the National Resources Conservation Services) outside of USCB-designated urban areas. Due to the length of the I-37 corridor within the study limits, both map sets are presented on 47 sheets that also show political boundaries and corridor segment breaks. The sheet index and the two maps sets are provided in **Appendix A**.

1.2 Corridor Segmentation

The I-37 corridor was divided into 14 planning segments, as shown in **Figure 16**, to allow for an appropriate level of detailed analysis, performance evaluation, and comparison between different segments of the corridor. The corridor segments are based on locations where the context changes due to differences in characterises such as terrain, traffic volumes, typical section, control sections, jurisdictional boundaries, or other relevant features.

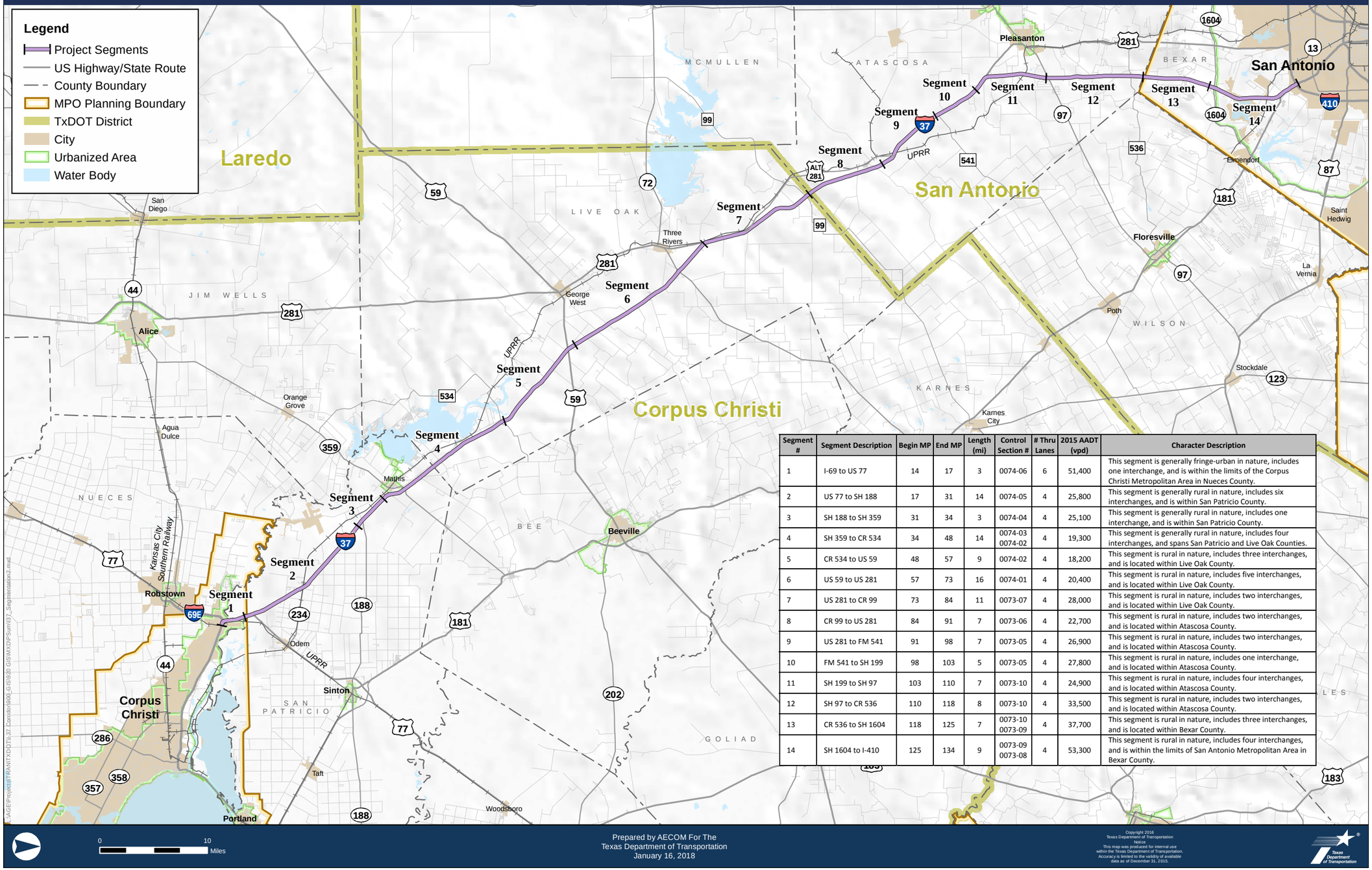
1.3 Stakeholder Outreach

Stakeholder input was an important component of the I-37 Corridor Study and therefore proactive stakeholder outreach activities were designed to enable TxDOT to identify and engage study area stakeholders with an interest in participating in the I-37 Corridor Study throughout the study process. These outreach activities were documented in the Public Involvement Plan developed for the study. They activities consisted of:

- Creation of a list of project stakeholders in the study area from San Antonio on the north to Corpus Christi on the south, and all towns in between;
- Development of a Public Involvement Plan describing the outreach activities and containing a timeline for conducting the activities;
- Distribution of an initial letter to all stakeholders to determine their interest in the I-37 Corridor Study;
- Development of two webinars for stakeholders (one held in August 2017 and a second held in October 2017). The format of these hour-long webinars consisted of a narrated PowerPoint presentation followed by a question and answer session. The first webinar was intended to gather input on the areas identified for improvement along the corridor and the second webinar was used to describe the results of the study and the proposed corridor improvements that had been identified. Both webinars were recorded and made available (along with the PowerPoint presentation) to the public via a YouTube link on the I-37 Corridor Study project page on the TxDOT website; and
- Use of a MetroQuest online survey following the first webinar. This webinar allowed stakeholders to prioritize the types of improvements they thought were most needed and to pinpoint specific geographic areas of concern at any point along the I-37 corridor and to add comments on these concerns.

More information regarding the stakeholder outreach in contained in **Appendix B.**

Figure 16 – Corridor Segmentation



Segment #	Segment Description	Begin MP	End MP	Length (mi)	Control Section #	# Thru Lanes	2015 AADT (vpd)	Character Description
1	I-69 to US 77	14	17	3	0074-06	6	51,400	This segment is generally fringe-urban in nature, includes one interchange, and is within the limits of the Corpus Christi Metropolitan Area in Nueces County.
2	US 77 to SH 188	17	31	14	0074-05	4	25,800	This segment is generally rural in nature, includes six interchanges, and is within San Patricio County.
3	SH 188 to SH 359	31	34	3	0074-04	4	25,100	This segment is generally rural in nature, includes one interchange, and is within San Patricio County.
4	SH 359 to CR 534	34	48	14	0074-03 0074-02	4	19,300	This segment is generally rural in nature, includes four interchanges, and spans San Patricio and Live Oak Counties.
5	CR 534 to US 59	48	57	9	0074-02	4	18,200	This segment is rural in nature, includes three interchanges, and is located within Live Oak County.
6	US 59 to US 281	57	73	16	0074-01	4	20,400	This segment is rural in nature, includes five interchanges, and is located within Live Oak County.
7	US 281 to CR 99	73	84	11	0073-07	4	28,000	This segment is rural in nature, includes two interchanges, and is located within Live Oak County.
8	CR 99 to US 281	84	91	7	0073-06	4	22,700	This segment is rural in nature, includes two interchanges, and is located within Atascosa County.
9	US 281 to FM 541	91	98	7	0073-05	4	26,900	This segment is rural in nature, includes two interchanges, and is located within Atascosa County.
10	FM 541 to SH 199	98	103	5	0073-05	4	27,800	This segment is rural in nature, includes one interchange, and is located within Atascosa County.
11	SH 199 to SH 97	103	110	7	0073-10	4	24,900	This segment is rural in nature, includes four interchanges, and is located within Atascosa County.
12	SH 97 to CR 536	110	118	8	0073-10	4	33,500	This segment is rural in nature, includes two interchanges, and is located within Atascosa County.
13	CR 536 to SH 1604	118	125	7	0073-10 0073-09	4	37,700	This segment is rural in nature, includes three interchanges, and is located within Bexar County.
14	SH 1604 to I-410	125	134	9	0073-09 0073-08	4	53,300	This segment is rural in nature, includes four interchanges, and is within the limits of San Antonio Metropolitan Area in Bexar County.

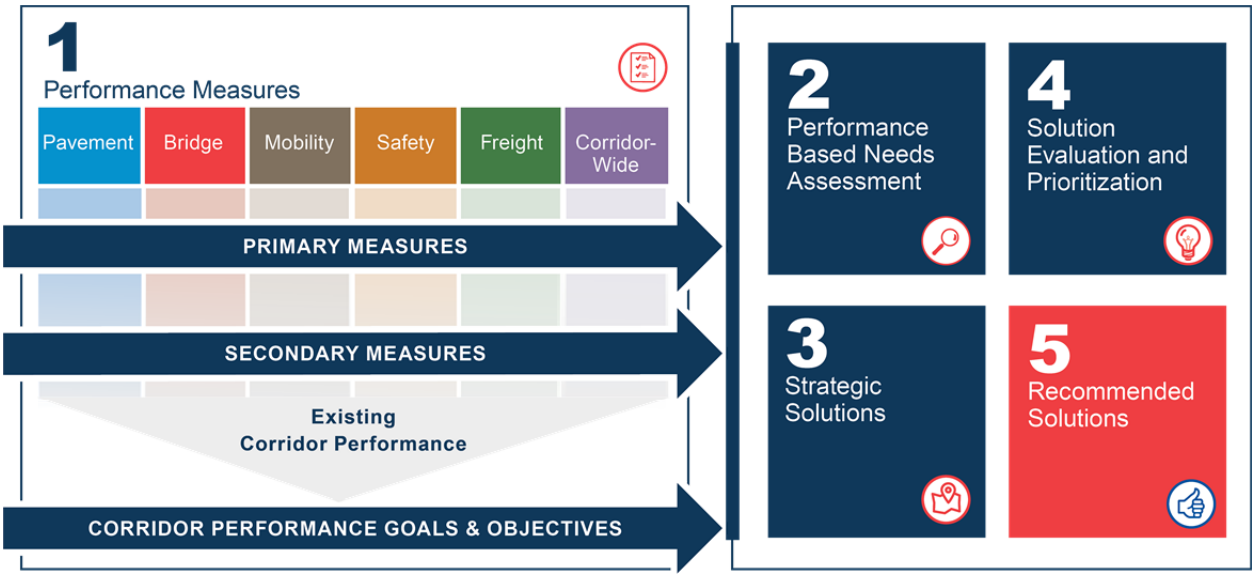
2. Corridor Performance

The objective of this study is to use a performance-based process to define baseline corridor performance, diagnose corridor needs and deficiencies, develop corridor solutions, and prioritize corridor investments. In support of this study objective, a framework for the performance-based process was developed through a collaborative process involving TxDOT and the project team. The performance framework illustrated in **Figure 17** illustrates five steps starting with defining baseline performance and resulting in a prioritized list of solutions for programming and/or further scoping.

These steps are as follows:

- Step 1 – Define Existing Corridor Performance: Each performance area was evaluated using a series of primary and secondary performance measures to understand how the corridor is currently operating.
- Step 2 – Define Performance Objectives: In coordination with TxDOT the corridor vision, goals, and performance objectives were established. The performance objectives established the desired corridor performance.
- Step 3 – Perform Performance Based Needs Assessment: The quantified difference between the performance objectives and the baseline corridor performance established the corridor needs. Each performance measure was converted to a None, Low, Medium, or High level of need to allow for comparison across performance areas and across segments. The performance-based needs identified locations that warrant further diagnostic investigation to define the contributing factors.
- Step 4 – Develop Strategic Solutions: Solutions were developed to address the identified needs from Step 3.
- Step 5 – Evaluate and Prioritize Solutions: The solutions were evaluated by measuring the potential benefit to the baseline performance and subsequent reduction in needs. The benefits (reduction in needs) for each solution were normalized by the costs of each solution to prioritize solutions along the corridor.

Figure 17 – Corridor Performance Framework



Six performance areas were defined to guide the performance-based corridor analyses including:

- Pavement performance
- Bridge performance
- Mobility performance
- Safety performance
- Freight performance
- Corridor-wide performance

These performance areas reflect a majority of the seven national performance goals as defined in *Moving Ahead for Progress in the 21st Century* (MAP-21), which are listed below:

- Safety
- Infrastructure condition
- Congestion reduction
- System reliability
- Freight movement and economic vitality
- Environmental sustainability
- Reduced project delivery delays

2.1 Corridor Performance Framework

Each performance area was organized with the identification of primary and secondary measures in an effort to quantify baseline corridor performance.

Portions of the I-37 corridor currently have frontage roads that parallel the I-37 mainlanes. While the focus of this study was the mainlanes, the performance of the frontage roads does contribute to the overall performance of the corridor. Therefore, in performance areas that have data for the frontage roads, the

frontage roads were included as part of the primary measure (Index) but were weighted to provide only a small influence on the overall score. The frontage roads are also contained in a secondary measure specific to the frontage roads to provide more detailed information regarding their performance.

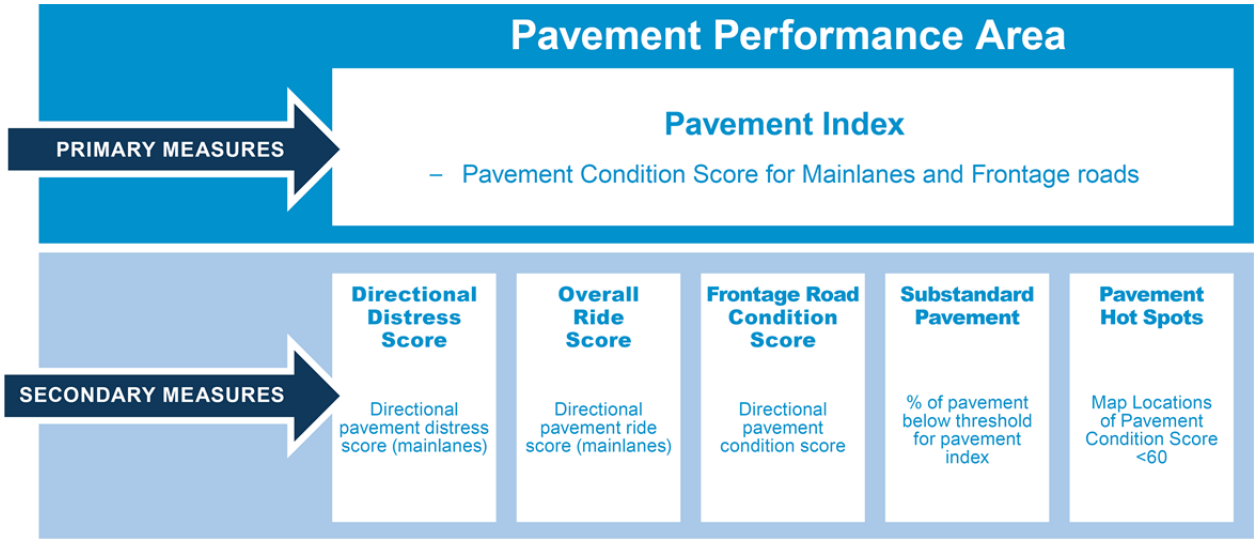
The following sections describe the organization for the segment-level analysis of each performance area: Pavement, Bridge, Mobility, Safety and Freight. Supplemental indicators were evaluated at a corridor-wide level.

2.2 Pavement Performance Area

The Pavement Performance Area consists of a primary measure (Pavement Index) and five secondary measures, as shown in **Figure 18**, to assess the condition of the existing pavement along the I-37 corridor.

All mainlane and frontage road pavement within the corridor that is contained within the Pavement Management Information System (PMIS) database maintained by TxDOT were included in the calculation of the Pavement Performance Area.

Figure 18 – Pavement Performance Area



Pavement Primary Measure

The Pavement Index was calculated based on the Pavement Condition Rating from PMIS. A segment-level Pavement Condition Rating was calculated for each direction of the mainlanes and each frontage road, as applicable. Following the calculation for each direction of the mainlanes and the frontage roads, the resulting segment Pavement Index score was calculated as a weighted average of the directional mainlanes scores and the frontage road scores with a heavier weight assigned to the mainlanes. The performance thresholds for the Pavement Index are as follows:

- Good > 80
- Fair 60 – 80
- Poor < 60

Pavement Secondary Measures

Five secondary measures were evaluated:

- Directional Distress Score
- Directional Ride Score
- Directional Frontage Road Condition Score
- Substandard Pavement
- Pavement Hotspots

Directional Distress Score

The mainlane directional Distress Scores from PMIS was used to calculated this secondary measure. The performance thresholds for the Directional Distress Score are as follows:

- Good > 80
- Fair 70 – 80
- Poor < 70

Directional Ride Score

The mainlane directional Ride Scores from PMIS was used to calculated this secondary measure. The performance thresholds for the Directional Ride Score are as follows:

- Good > 3.0
- Fair 2.0 – 3.0
- Poor < 2.0

Directional Frontage Road Condition Score

The Pavement Condition Scores for the Frontage Roads are reported under this secondary measure. The data and information from the Pavement Index was used to calculate this secondary measure. The rating thresholds are the same as the thresholds for the Pavement Index.

Substandard Pavement

The percentage of pavement rated below the "poor" threshold for Pavement Index (Pavement Condition Rating) was calculated for each segment. The performance thresholds for Substandard Conditions are as follows:

- Above Average Performance < 5%
- Average Performance 5% – 20%
- Below Average Performance > 20%

Pavement Hotspots

Pavement "hotspots" are identified where a given section of pavement has a Pavement Index rating below 60.

Pavement Performance

The Pavement Index and secondary performance measures were calculated for the I-37 corridor as described above. The pavement performance measures were calculated using the PMIS pavement condition data provided by TxDOT that was collected in 2015. The resulting scores are shown in **Table 5** and **Figure 18.** Maps

for all of the secondary performance measures are provided in **Appendix C** and performance data and calculations are provided in **Appendix D**.

Based on the results of this analysis, the following observations could be made:

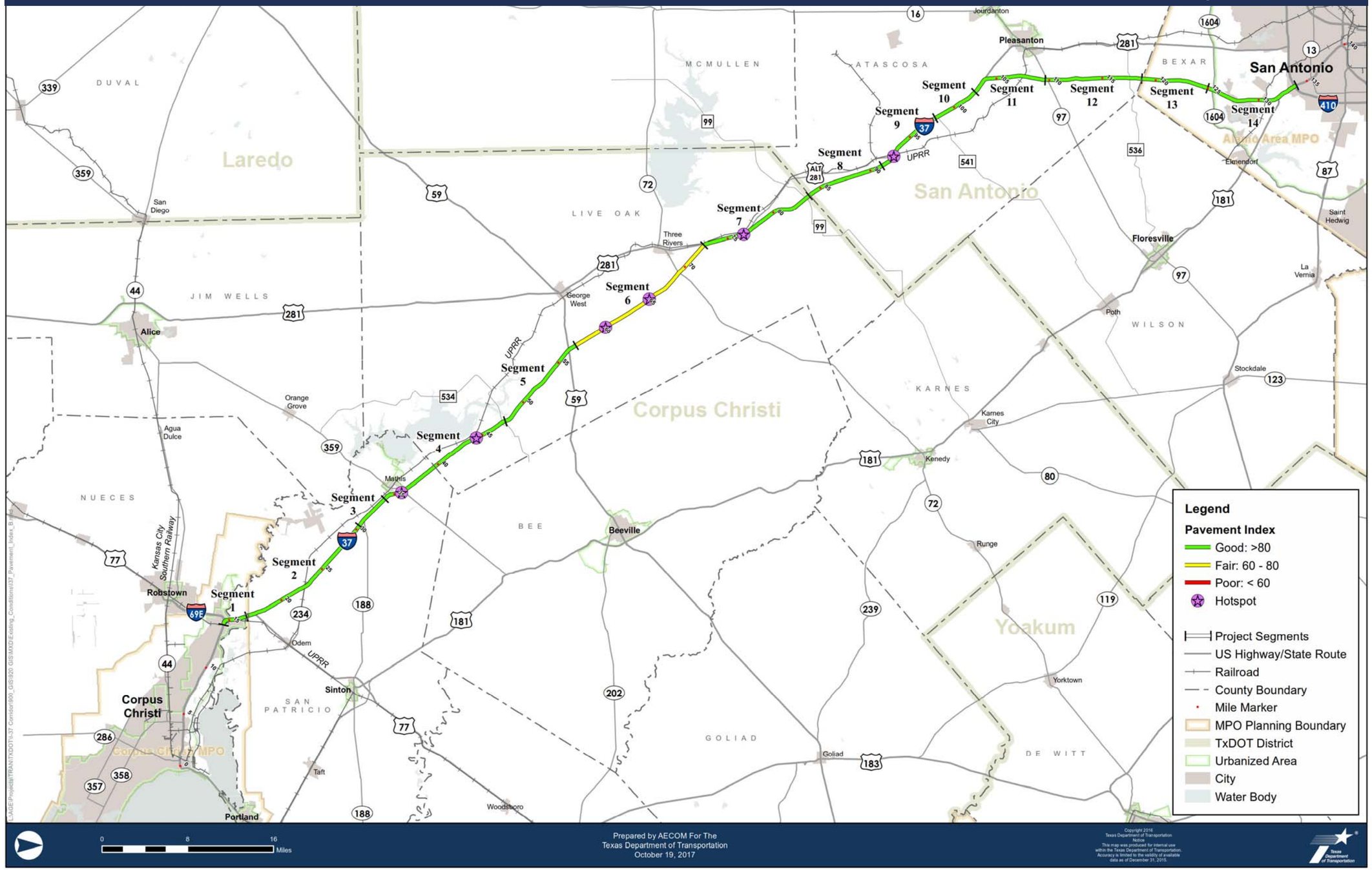
- A vast majority of the mainlane pavement can be classified as "Good" performance.
- Segments 4 – 7 have the lowest performance in the Pavement Index and have either "Fair" or "Poor" performance in the northbound Mainlane Distress Score secondary measure.
- On Segments 4 -7, the northbound mainlane pavement shows worse performance than the southbound mainlane pavement.
- The pavement on the frontage roads shows worse performance than the mainlane pavement, and has more pavement with a Condition Score < 60.
- On Segments 1, 2, 3, 10, 11, 12, and 14, all of the sub-standard pavement (Condition Score < 60) is located on the frontage roads.
- Pavement "hotspots" were identified on 14 miles of the mainlanes and 35 miles of frontage roads.

Table 5 – Pavement Performance

Seg. #	BMP	EMP	Length (miles)	Pavement Index	Mainlane Directional Distress Score		Mainlane Directional Ride Score		Frontage Rd Condition Score		Sub-Standard Pavement
					NB	SB	NB	SB	NB	SB	
1	14	17	3	94.73	93.20	96.30	3.96	3.94	92.69	95.95	1.5%
2	17	31	14	96.11	100.00	95.29	4.69	4.21	67.19	63.53	18.1%
3	31	34	3	97.22	100.00	97.83	4.67	4.82	59.17	67.50	25.0%
4	34	48	14	80.74	69.36	91.74	3.97	4.70	86.27	92.86	19.4%
5	48	57	9	82.91	70.78	93.61	4.21	4.50	95.78	98.83	4.3%
6	57	73	16	77.48	68.97	85.91	4.06	4.21	88.09	68.47	18.0%
7	73	84	11	80.77	79.79	82.71	4.20	3.97	80.08	63.16	16.3%
8	84	91	7	92.35	88.13	96.57	3.97	4.36	N/A	N/A	0.0%
9	91	98	7	93.90	88.36	99.93	4.02	4.35	82.52	98.39	9.7%
10	98	103	5	98.81	99.30	100.00	4.53	4.58	64.80	99.40	12.5%
11	103	110	7	95.76	93.36	100.00	4.19	4.26	79.33	75.36	3.4%
12	110	118	8	97.47	98.19	98.63	4.49	4.40	84.48	73.00	2.9%
13	118	125	7	99.66	99.90	100.00	4.74	4.54	N/A	88.00	0.0%
14	125	134	9	93.89	93.45	96.54	4.57	4.46	81.40	49.71	9.4%

Performance Scales					
Good/Above Average Performance	> 80	> 80	> 3.0	> 80	< 5%
Fair/Average Performance	60 - 80	70 – 80	2.0 – 3.0	60 - 80	5% - 20%
Poor/Below Average Performance	< 60	< 70	< 2.0	< 60	> 20%

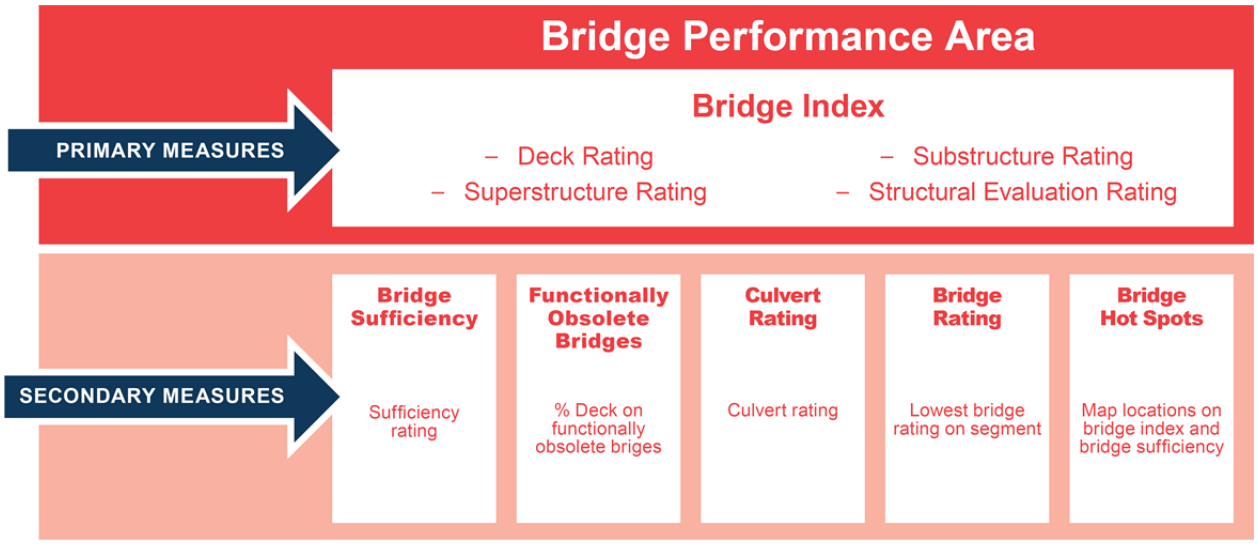
Figure 18 – Pavement Index



2.3 Bridge Performance Area

The Bridge Performance Area consists of a primary measure (Bridge Index) and five secondary measures, as shown in **Figure 19**, to assess the condition of the existing bridges along the I-37 corridor.

Figure 19 – Bridge Performance Area



All bridges within the corridor that are maintained by TxDOT were included in the calculation of the Bridge Performance Area including bridges on frontage roads and ramps. Culverts were also evaluated as a secondary measure.

Bridge Primary Measure

The Bridge Index was calculated based on the use of four bridge condition ratings from the TxDOT Bridge Database, also known as the Bridge Inventory, Inspection, and Appraisal Program (BRINSAP). The four ratings include the Deck Rating (item 58), Substructure Rating (item 60), Superstructure Rating (item 59), and Structural Evaluation Rating (item 67). The calculation of the Bridge Index used the lowest of these four ratings for each bridge.

The Bridge Index for each segment was calculated as a weighted average based on the deck area for each bridge using the lowest rating score for each bridge. The resulting Bridge Index was based on a 0 to 9 scale with 0 representing the lowest performance and 9 representing the highest performance. The performance thresholds for the Bridge Index are as follows:

- Good > 6.5
- Fair 5.0 – 6.5
- Poor < 5.0

Bridge Secondary Measures

Five secondary measures were evaluated:

- Bridge Sufficiency Rating
- Bridge Rating
- Culvert Ratings
- Functionally Obsolete Bridges
- Bridge Hotspots

Bridge Sufficiency Rating

The Sufficiency Rating is calculated by using numerous factors to obtain a numeric value which is indicative of bridge sufficiency to remain in service. The factors that contribute to the Sufficiency Rating include structural adequacy and safety, serviceability and functional obsolescence, and essentiality for public use.

Similar to the Bridge Index, the Bridge Sufficiency Rating was calculated as a weighted average (based on deck area) for each segment. The performance thresholds for the Bridge Sufficiency Rating are as follows:

- Good > 80
- Fair 50 – 80
- Poor < 50

Bridge Rating

The Bridge Rating simply identifies the lowest bridge rating on each segment. The performance thresholds for the Bridge Rating are as follows:

- Good > 6
- Fair 5 – 6
- Poor < 5

Culvert Rating

The Culvert Rating was based on the Culvert Rating (item 62) contained in BRINSAP. The Culvert Rating for each segment was calculated as a weighted average based on the length for each culvert. The performance thresholds for the Culvert Rating are as follows:

- Good > 6.5
- Fair 5.0 – 6.5
- Poor < 5.0

Functionally Obsolete Bridges

Functionally Obsolete means that the design of a bridge is no longer functionally adequate for its current use, such as a lack of shoulders or the inability to handle current traffic volumes. Functionally Obsolete does not directly relate to the structural adequacy.

The percentage of deck area on functionally obsolete bridges was calculated for each segment. The performance thresholds for the percentage of Functionally Obsolete Bridges along the corridor are as follows:

- Above Average Performance < 12%
- Average Performance 12% – 40%
- Below Average Performance > 40%

Bridge Hotspots

Bridge "hotspots" are identified where a given bridge has a bridge rating of 4 or lower or multiple ratings of 5, a Sufficiency Rating less than 50, or a culvert with a Culvert Rating less than 5.

Bridge Performance

The Bridge Index and secondary performance measures were calculated for the I-37 corridor as described above. The bridge performance measures were calculated using the BRINSAP bridge condition data provided by TxDOT based on the latest inspections. The resulting scores are shown in **Table 6** and **Figure 20**. Maps for all of the secondary performance measures are provided in **Appendix C** and performance data and calculations are provided in **Appendix D**.

Based on the results of this analysis, the following observations could be made:

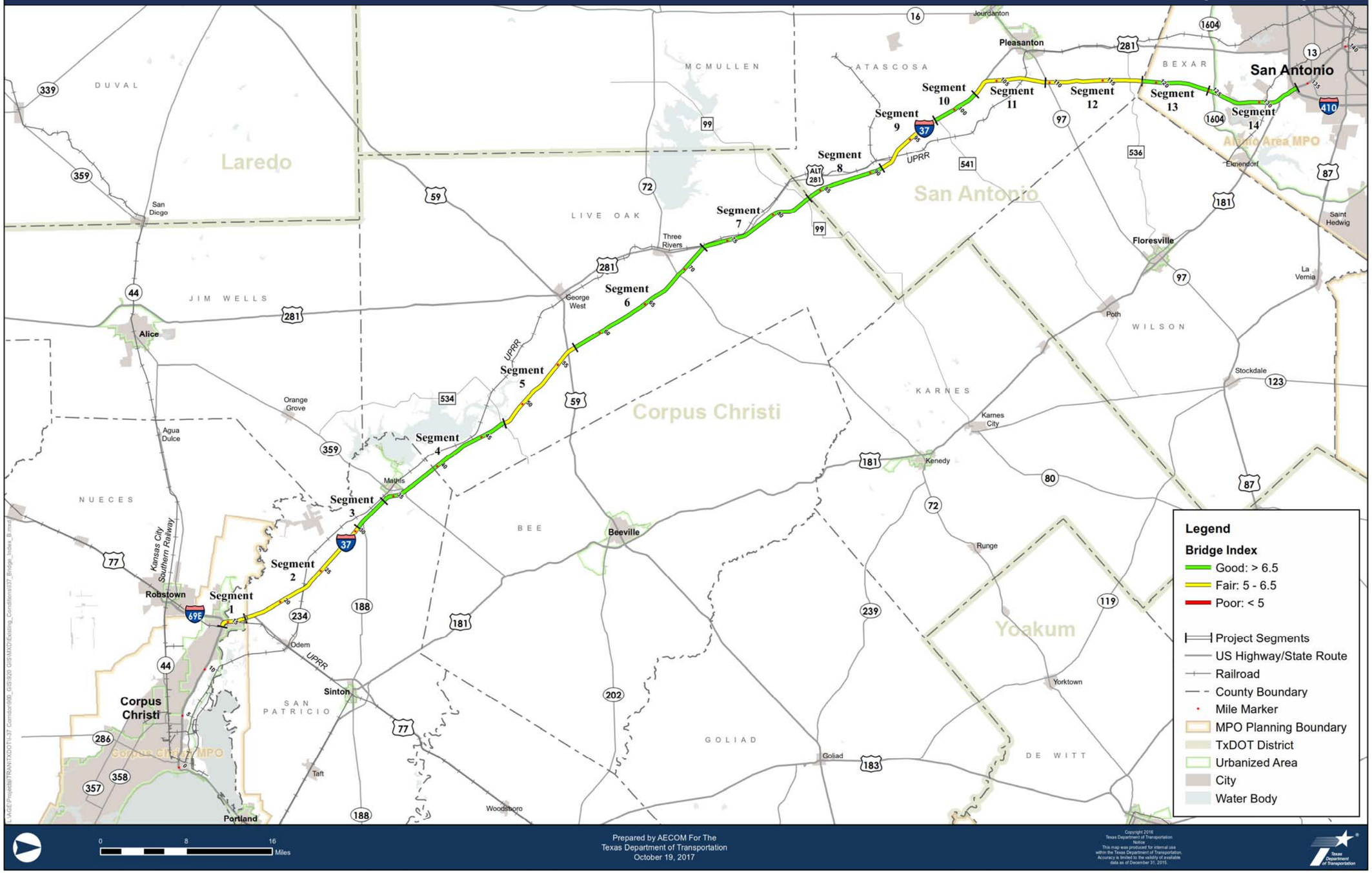
- All of the corridor segments either rate as "Good" or "Fair" performance in all bridge performance measures.
- Segments 1 and 11 have the lowest Bridge Index score and the lowest Sufficiency Rating.
- Eight bridges have a condition rating of 5 (deck, superstructure, substructure, or structural evaluation rating).
- None of the bridges has a condition rating of 4 or less (deck, superstructure, substructure, or structural evaluation rating).
- Segment 1 has five bridges that are classified as Functionally Obsolete.
- No bridge "hotspots" were identified.

Table 6 – Bridge Performance

Seg. #	BMP	EMP	Length (miles)	No. of Bridges in Segment	Bridge Index	Bridge Sufficiency	Bridge Rating	Culvert Rating	Funct. Obsolete Bridges
1	14	17	3	10	5.85	81.70	5	6.00	14.3%
2	17	31	14	14	6.10	90.09	5	6.53	8.0%
3	31	34	3	1	7.00	95.50	7	N/A	0.0%
4	34	48	14	15	6.58	91.01	6	6.51	5.3%
5	48	57	9	11	6.39	95.26	6	6.24	0.0%
6	57	73	16	23	6.74	92.80	5	6.43	0.0%
7	73	84	11	16	6.91	93.00	6	6.29	0.0%
8	84	91	7	7	6.57	96.27	5	6.74	0.0%
9	91	98	7	10	6.45	95.26	6	6.61	0.0%
10	98	103	5	2	7.00	95.80	7	N/A	0.0%
11	103	110	7	8	5.69	88.31	5	6.64	0.0%
12	110	118	8	4	6.23	97.04	6	6.79	0.0%
13	118	125	7	2	6.50	96.60	6	6.51	0.0%
14	125	134	9	20	6.56	94.87	6	6.19	0.0%

Performance Scales					
Good/Above Average Performance	> 6.5	> 80	> 6	> 6.5	< 12%
Fair/Average Performance	5 – 6.5	50 – 80	5 – 6	5 – 6.5	12% - 40%
Poor/Below Average Performance	< 5	< 50	< 5	< 5	> 40%

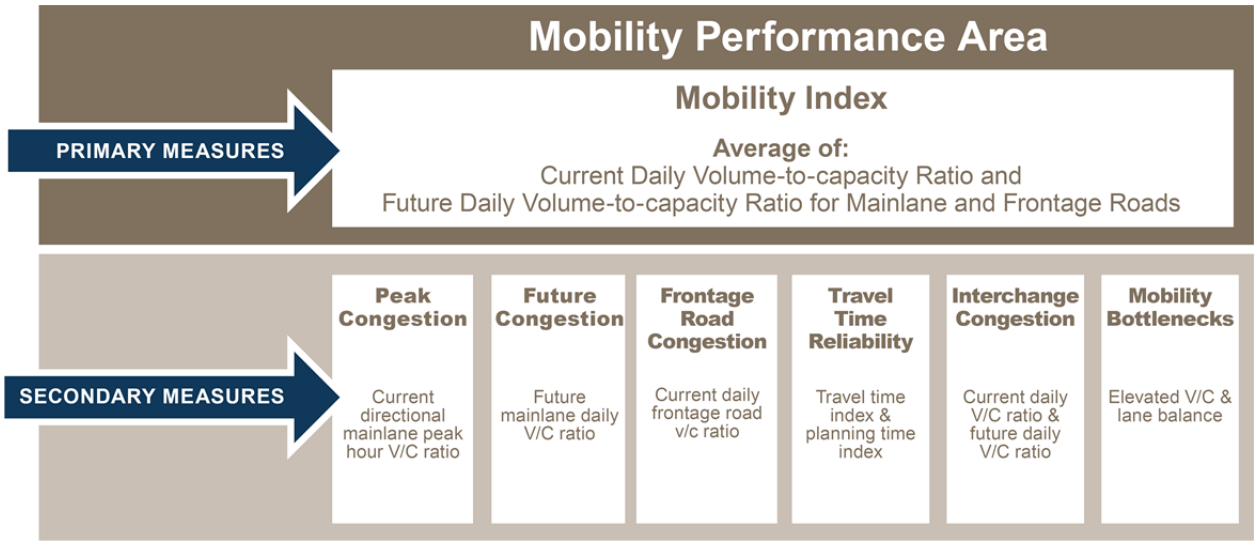
Figure 20 – Bridge Index



2.4 Mobility Performance Area

The Mobility Performance Area consists of a primary measure (Mobility Index) and multiple secondary measures, as shown in **Figure 21**, to assess levels and types of congestion that occur along the corridor using available data including annual average daily traffic (AADT), projected traffic volume growth from the Statewide Analysis Model (SAM), and travel time/speed.

Figure 21 – Mobility Performance Area



Mobility Primary Measure

The Mobility Index is an average of the current (2015) daily volume-to-capacity (V/C) ratio and the future (2040) daily V/C ratio for each segment of the corridor. The Primary Index includes both the mainlane V/C and frontage road V/C within each segment which results in a single segment value. The segment Mobility Index score is a weighted average of the mainlanes and frontage roads, with the score more heavily weighted toward the mainlane V/C.

This measure compares the AADT volume for a segment to the planning capacity of the segment as defined by the service volume for level of service E (LOS E). By using the average of the current and future year, this index will measure the level of daily congestion that could occur in approximately ten years (2025) if no capacity improvements are made to the corridor.

Existing Daily V/C Ratio

The existing V/C ratio for each segment was calculated using the 2015 AADT volume and dividing that value by the service volume for LOS E, as calculated using the Highway Economic Requirements System (HERS) procedures developed by the Federal Highway Administration (FHWA) for Estimating Highway Capacity.

The 2015 AADT was obtained from the Road-Highway Inventory Network (RHiNo) database maintained by TxDOT.

Future Daily V/C Ratio

The future V/C ratio for each segment was calculated using the 2040 AADT volume and dividing that value by the service volume for LOS E, as estimated using the HERS procedure mentioned above. The 2040 AADT volumes were generated as described in the attached memorandum (see Appendix E).

The Mobility Index is an average of the current (2015) daily volume-to-capacity (V/C) ratio and the future (2040) daily V/C ratio for each segment of the corridor. The scaling thresholds defined for the Mobility Index are based on Highway Capacity Manual (2000). The following thresholds will be used for all segments along the corridor due to their rural operating environment:

Rural Environments

- Good (LOS A-B) V/C ratio < 0.56
- Fair (LOS C) V/C ratio 0.56 - 0.76
- Poor (LOS D-F) V/C ratio > 0.76

Mobility Secondary Measures

Seven secondary measures were evaluated:

- Directional Existing Peak Hour V/C (mainlanes only)
- Future Daily V/C (mainlanes only)
- Frontage Road V/C
- Directional Travel Time Index (mainlane sonly)
- Directional Planning Time Index (mainlanes only)
- Interchange Congestion
- Mobility Bottlenecks

Directional Existing Peak Hour V/C

The peak hour V/C was calculated by dividing the mainlane directional design hour volume (DHV) by the directional mainlane capacity. The rating thresholds for the Peak Congestion secondary measure are the same as the thresholds defined for the Mobility Index.

Future Daily V/C

Future Congestion is defined as the future (2040) mainlane daily V/C ratio. This measure is the same value used in the calculation of the Mobility Index for the mainlanes.

The rating thresholds for the Future Congestion secondary measure are the same as the thresholds defined for the Mobility Index.

Frontage Road V/C

This secondary measure is based on the current (2015) daily volume-to-capacity (V/C) ratio and the future (2040) daily V/C ratio for the frontage roads along the corridor. The existing V/C ratio for each segment was calculated using the highest frontage road 2015 AADT volume and dividing that value by the frontage road service volumes for LOS E, as calculated using the HERS procedures. Only frontage roads with 2015 AADT data (from RHiNo) were included in this performance measure.

The rating thresholds for the Frontage Road V/C secondary measure are the same as the thresholds defined for the Mobility Index.

Directional Travel Time Index

The Travel Time Index (TTI) is the relationship of the posted speed limit to the mean peak hour speed. The TTI reflects the average increase in travel time during the peak hour due to recurring congestion. The higher the TTI value is, the more time is spent in traffic during peak times.

Observed mean speeds are available in the 2015 American Digital Cartography, Inc. HERE (formerly NAVTEQ) database. The free-flow speed is assumed to be the posted speed.

The following thresholds were applied to the TTI (for uninterrupted flow facilities):

- Good: < 1.15
- Fair: 1.15 - 1.33
- Poor: > 1.33

Directional Planning Time Index

The Planning Time Index (PTI) is the ratio of total travel time needed for 95% on-time arrival to free-flow travel time. The PTI includes the extra buffer time needed for on-time arrival while accounting for non-recurring delay. Non-recurring delay refers to unexpected or abnormal delay due to closures or restrictions resulting from circumstances such as crashes, inclement weather, and construction activities. The higher the PTI value, the more buffer time is needed to ensure on-time arrival.

Observed 5th percentile lowest speeds are available in the 2015 American Digital Cartography, Inc. HERE (formerly NAVTEQ) database. The free-flow speed is assumed to be the posted speed.

The following thresholds were applied to the PTI (for uninterrupted flow facilities):

- Good: < 1.30
- Fair: 1.30 - 1.50
- Poor: > 1.50

Interchange Congestion

This secondary measure was calculated for both the current (2015) daily volume-to-capacity (V/C) ratio and the future (2040) daily V/C ratio for the crossroad at each interchange along the corridor. This measure compares the average AADT volume for the crossroad at each interchange to the planning capacity of the crossroad as defined by the service volume for level of service E (LOS E). The capacity of each interchange was estimated by the HERS methodology.

The Interchange Congestion performance measure is reported as the weighted average V/C of all interchanges on each segment, weighted by the AADT at each interchange. Only interchanges with 2015 AADT data (from RHiNo) were included in this performance measure.

The rating thresholds for the Interchange Congestion secondary measure are the same as the thresholds defined for the Mobility Index.

Mobility Bottlenecks

The intent of this secondary measure is to identify mobility bottlenecks that may be causing performance issues at isolated locations that may not affect the segment-level V/C ratios. These locations were identified as follows:

- Interchanges that currently experience LOS 'E' or 'F' based on the Interchange Congestion performance measure
- Locations within segments that have an elevated existing V/C ratio due to traffic volume or travel lane variations (within the segment)
- Locations with short weaving distance, acceleration/deceleration length, etc.

Mobility Performance

The Mobility Index and secondary performance measures were calculated for the I-37 corridor as described above. The mobility performance measures were calculated using the 2015 and 2040 traffic volumes. The resulting scores are shown in **Table 7** and **Figure 22**. Maps for all secondary performance measures are provided in **Appendix C** and performance data and calculations are provide in **Appendix D**.

Based on the results of this analysis, the following observations could be made:

- The current (2015) mainlane traffic operations could generally be described as "Good" performance
- At the far north end of the corridor (segments 13 and 14), the mainlanes are anticipated to experience severe congestion by 2025.
- Future traffic growth along the corridor will cause five segments to show "Poor" mainlane performance by the year 2040 (segments 1, 7, and 12-14).
- All of the frontage roads currently show "Good" performance and in 2040 are expected to show either "Good" or "Fair" performance.
- Segments 5 and 14 currently show "Poor" performance in the Traffic Interchange secondary measure while segments 6 and 13 show "Fair" performance.
- By 2040, nine segments will show "Poor" or "Fair" performance in the Traffic Interchange secondary measure.
- Generally, the corridor appears to be fairly reliable as both the TTI and PTI scores show "Good" performance expect in segment 1 in the northbound direction of travel.
- Mobility "bottlenecks" were identified at:
    - Three traffic interchanges that have an existing V/C ratio > 0.76 (US 59, Southton Road, and Spur 122/Presa Street)
    - The far north end of the corridor (just south of I-410) currently carries 82,000 vpd which would result in an existing V/C ratio > 0.76
    - Two locations where entrance ramp lanes are dropped in a short distance (at US 77 and I-69)
    - Two high volume rural interchanges with taper-type ramps (US 77 and SH 97)

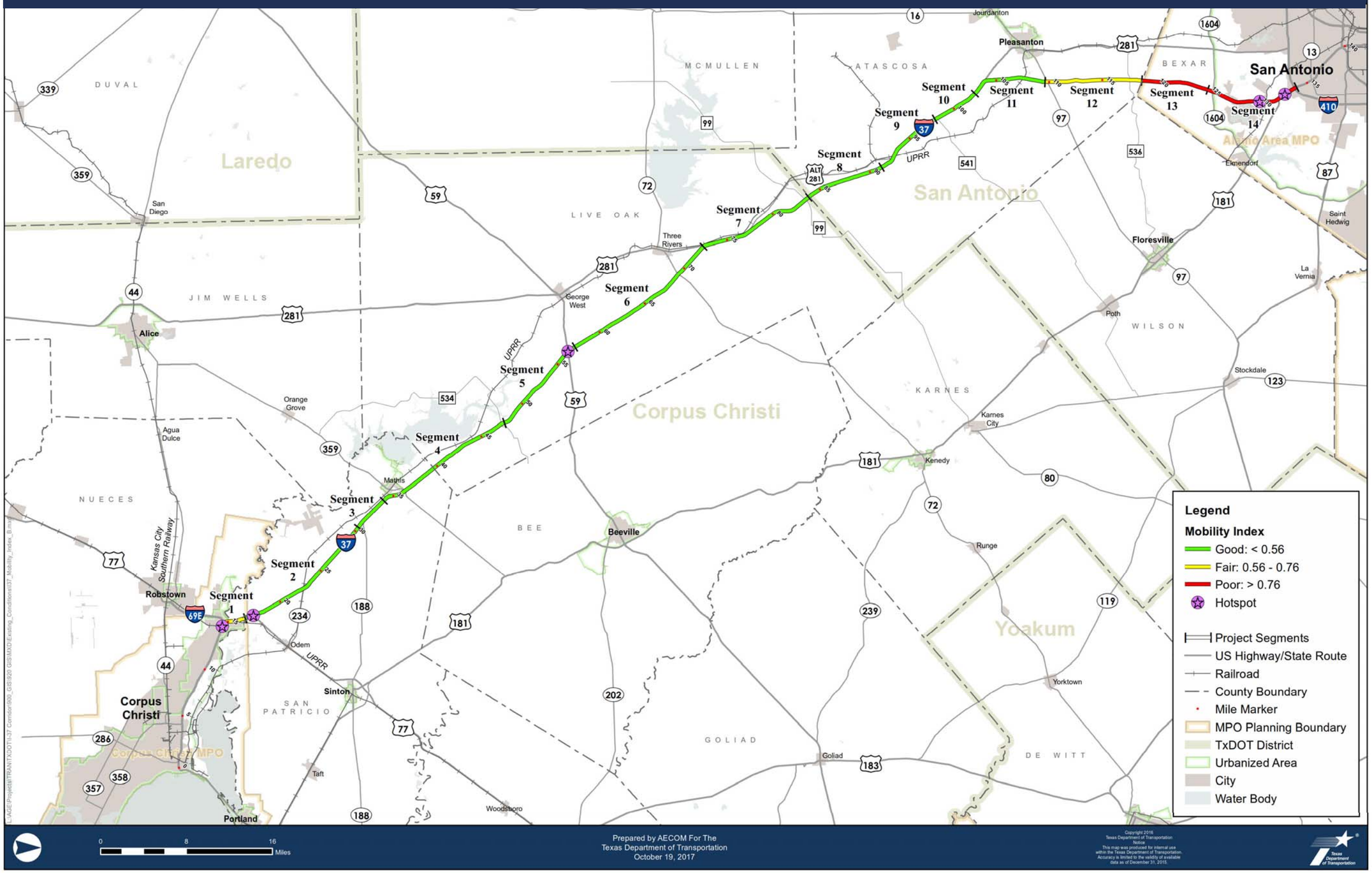
Table 7 – Mobility Performance

Segment #	BMP	EMP	Length (miles)	Mobility Index	2040 Mainlane V/C	Existing Mainlane Peak Hour V/C		Frontage Road V/C		Interchange V/C		Directional TTI (all vehicles)		Directional PTI (all vehicles)	
						NB	SB	2015	2040	2015	2040	NB	SB	NB	SB
1	14	17	3	0.61	0.85	0.62	0.67	0.05	0.09	N/A	N/A	1.14	1.12	1.38	1.25
2	17	31	14	0.47	0.64	0.45	0.49	0.01	0.02	0.17	0.34	1.10	1.09	1.22	1.22
3	31	34	3	0.46	0.63	0.43	0.49	0.04	0.07	0.42	0.81	1.09	1.10	1.22	1.23
4	34	48	14	0.37	0.53	0.31	0.37	0.02	0.04	0.39	0.80	1.08	1.10	1.21	1.19
5	48	57	9	0.35	0.50	0.33	0.36	0.02	0.04	0.92	1.92	1.07	1.10	1.19	1.23
6	57	73	16	0.39	0.55	0.38	0.38	0.04	0.08	0.61	1.28	1.08	1.10	1.21	1.22
7	73	84	11	0.55	0.77	0.53	0.51	0.09	0.20	0.23	0.48	1.09	1.10	1.19	1.20
8	84	91	7	0.46	0.62	0.43	0.41	N/A	N/A	0.50	1.04	1.09	1.10	1.20	1.20
9	91	98	7	0.52	0.74	0.52	0.50	0.01	0.01	N/A	N/A	1.09	1.09	1.20	1.19
10	98	103	5	0.54	0.76	0.53	0.51	0.08	0.17	0.22	0.46	1.09	1.09	1.20	1.18
11	103	110	7	0.48	0.68	0.46	0.46	0.11	0.22	0.28	0.59	1.10	1.10	1.24	1.21
12	110	118	8	0.67	0.97	0.62	0.62	0.04	0.10	0.54	1.19	1.10	1.08	1.25	1.19
13	118	125	7	0.77	1.07	0.41	0.43	0.30	0.66	0.63	1.39	1.10	1.10	1.19	1.22
14	125	134	9	0.99	1.40	0.52	0.52	0.27	0.59	0.84	1.86	1.07	1.09	1.24	1.26

N/A – traffic interchange or frontage road does not exist in segment

Performance Scales			
Good/Above Average Performance	< 0.56 (rural)	< 1.15	< 1.30
Fair/Average Performance	0.56 – 0.76 (rural)	1.15 – 1.33	1.30 – 1.50
Poor/Below Average Performance	> 0.76 (rural)	> 1.33	> 1.50

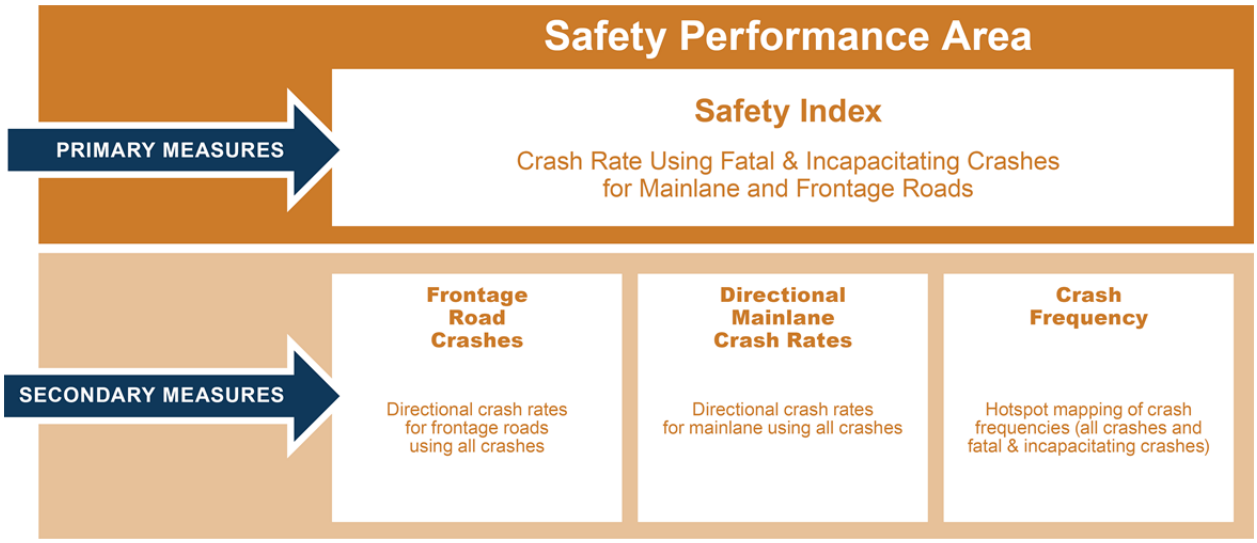
Figure 22 – Mobility Index



2.5 Safety Performance Area

The Safety Performance Area consists of a primary measure (Safety Index) and three secondary measures, as shown in **Figure 23**, to assess the crash rates and frequencies along the I-37 corridor.

Figure 23 – Safety Performance Area



Primary Measure

The Safety Index was calculated based on the data from the Crash Records Information System (CRIS) and only included fatal and incapacitating crashes (K&A crashes). A segment-level crash rate was calculated for each direction of the mainlanes and each frontage road, as applicable. The resulting Safety Index is a weighted average of the directional mainlane rates and the frontage road rates with a heavier weight assigned to the mainlanes. The performance thresholds for the Safety Index are based on the statewide K&A crash rates are as follows:

- Above Average Performance < 3.27
- Average Performance 3.27 – 4.91
- Below Average Performance > 4.91

Secondary Measures

Three secondary measures were evaluated:

- Directional Mainlane Crash Rates
- Frontage Road Crashes
- Crash Frequency

Directional Mainlane Crash Rates

All types of mainlane directional crashes (not just K&A) from CRIS were used to calculate the crash rates for this secondary measure.

The performance thresholds for the Directional Crash Rates are as follows:

- Above Average Performance < 51.78
- Average Performance 51.78 – 77.67
- Below Average Performance > 77.67

Frontage Road Crashes

All frontage road crashes from CRIS were used to calculate the crash rates for this secondary measure.

The performance thresholds for the Frontage Road Crashes are as follows:

- Above Average Performance < 97.93
- Average Performance 97.93 – 146.90
- Below Average Performance > 146.90

Crash Frequency

A "hotspot" analysis was conducted to identify elevated concentrations of both all crashes and fatal and incapacitating crashes along the study corridor. This process included the geo-spatial analysis of crashes on rural Interstates statewide to determine the mapping thresholds. The results of this analysis are shown in Appendix C.

Safety Performance

The Safety Index and secondary performance measures were calculated for the I-37 corridor as described above. The safety performance measures were calculated using the crash data from 2011 through 2015. The resulting scores are shown in Table 8 and Figure 24. Maps for all of the secondary performance measures are provided in Appendix C and performance data and calculations are provided in Appendix D.

Table 8 – Safety Performance

Seg. #	BMP	EMP	Length (miles)	Safety Index	Directional Mainlane Rates		Frontage Road Rates
					NB	SB	
1	14	17	3	4.46	76.69	111.49	118.16
2	17	31	14	3.47	32.83	34.35	189.96
3	31	34	3	6.25	46.66	49.57	208.57
4	34	48	14	3.11	41.27	44.50	120.16
5	48	57	9	4.53	65.67	44.89	513.35
6	57	73	16	3.48	34.53	33.19	146.43
7	73	84	11	3.05	27.03	27.75	73.22
8	84	91	7	4.14	43.43	43.43	N/A
9	91	98	7	6.66	68.77	52.45	80.15
10	98	103	5	2.25	47.30	26.81	149.61
11	103	110	7	2.70	52.86	39.64	29.71
12	110	118	8	2.22	35.16	46.60	146.98
13	118	125	7	2.37	21.19	22.44	0.00
14	125	134	9	2.52	56.62	53.20	27.89

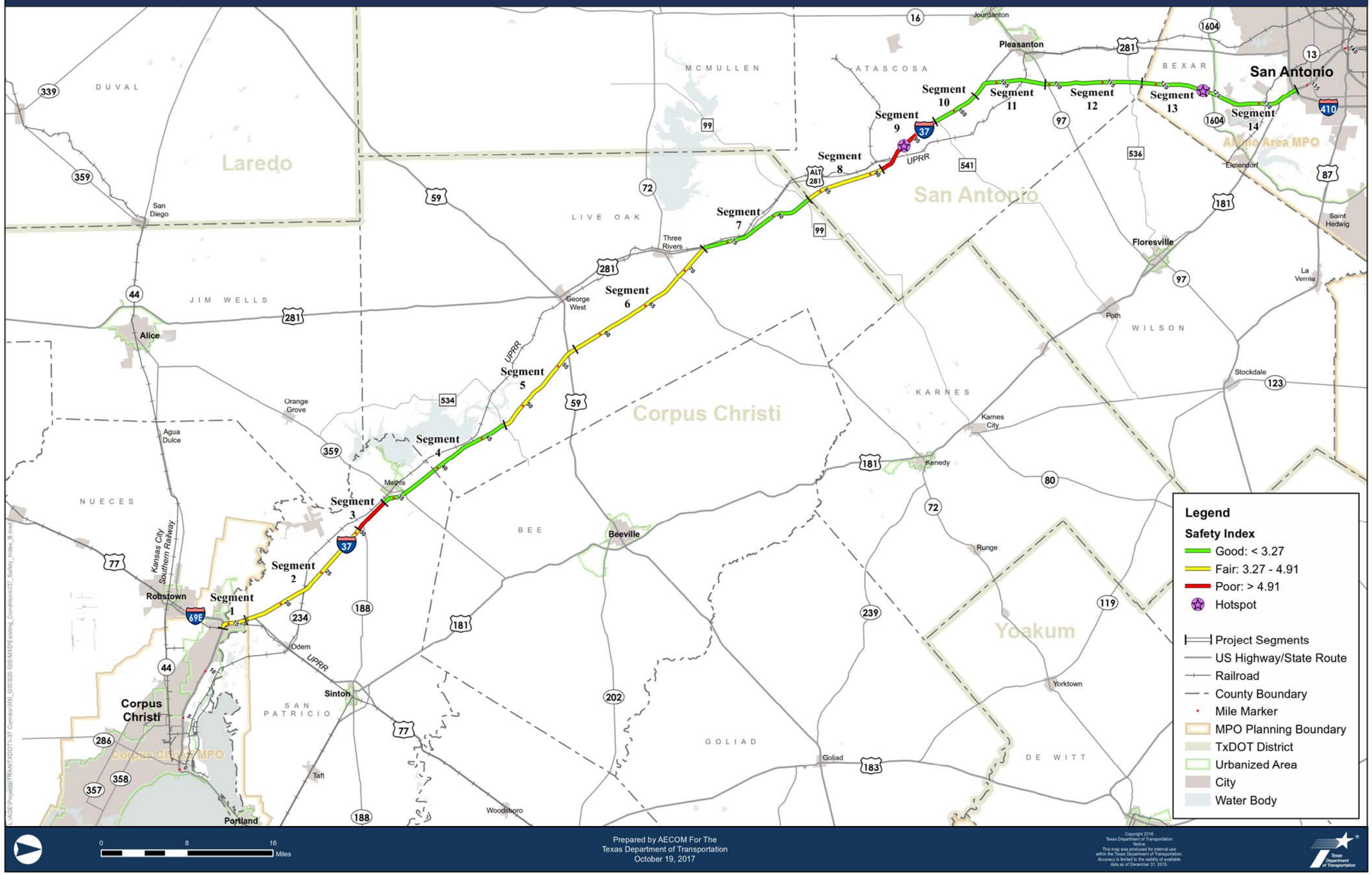
N/A –frontage road does not exist in segment

Performance Scales			
Good/Above Average Performance	< 3.27	< 51.78	< 97.93
Fair/Average Performance	3.27 – 4.91	51.78 – 77.67	97.93 – 146.90
Poor/Below Average Performance	> 4.91	> 77.67	> 146.90

Based on the results of this analysis, the following observations could be made:

- A majority of the corridor segments show either "Above Average" or "Average" performance in the Safety Index.
- All of the corridor segments show "Above Average" or "Average" performance in the Directional Mainlane secondary measure, except Segment 1 in the southbound direction.
- Segments 3 and 9 experience fatal and incapacitating crash rates that are above the statewide average for rural interstates.
- Five segments experience crash rates along the frontage roads that are above the statewide average for rural 2-lane highways.
- "Hotspots" for fatal and incapacitating crashes were identified near mileposts 93-95 and 124-125.

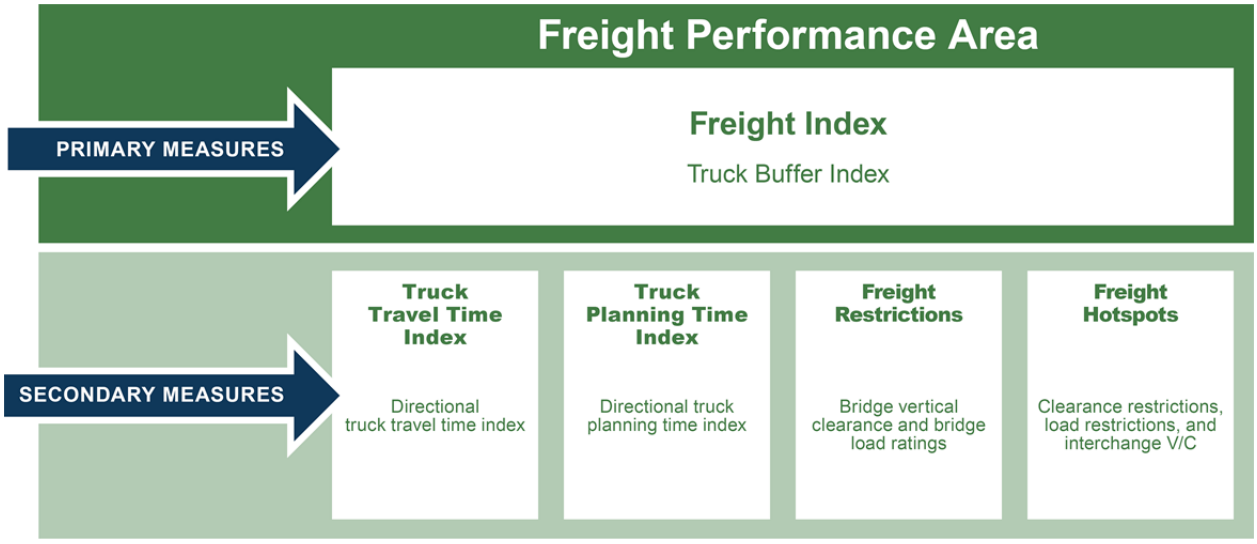
Figure 24 – Safety Index



2.6 Freight Performance Area

The Freight Performance Area consists of a single Freight Index and five secondary measures as illustrated in **Figure 25**. All measures relate to the reliability of truck travel as measured by observed truck travel speeds and delays in truck travel due to bottlenecks or physical restrictions to truck travel.

Figure 25 – Freight Performance Area



Primary Measure

The Fright Index is calculated as the Buffer Index for each segment of the corridor using speed data collected for truck traffic. The Buffer Index is the difference between the Planning Time Index (PTI) and the Travel Time Index (TTI) which provides an indication of the reliability of the corridor. This measure was calculated as a single number for each segment that represents the average Buffer Index for both directions of travel on the I-37 mainlanes. The following thresholds were defined for uninterrupted flow facilities:

Uninterrupted Flow Facilities

- Good: < 0.15
- Fair: 0.15 – 0.35
- Poor: > 0.35

Secondary Measures

Five secondary measures were evaluated:

- Directional Travel Time Index (TTI) (trucks only)
- Directional Planning Time Index (PTI) (trucks only)
- Bridge Vertical Clearance
- Bridge Load Ratings
- Freight Hotspots

Directional Travel Time Index (TTI) (trucks only)

The performance measure for recurring delay is the Directional Travel Time Index (TTI). The calculation for this performance measure is the same as described in the Mobility Index but only uses data collected for trucks.

The free-flow truck speed is assumed to be 65 mph or the posted speed, whichever is less. This upper limit of 65 mph accounts for governors that restrict truck speeds to no more than 65 mph, even when the speed limit may be higher.

For each corridor segment, the TTI was calculated for each direction of travel on the mainlanes. The scale for rating the Directional TTI (trucks only) is the same as defined in the Mobility Index:

Uninterrupted Flow Facilities

- Good: < 1.15
- Fair: 1.15 – 1.33
- Poor: > 1.33

Directional Planning Time Index (PTI) (trucks only)

The Planning Time Index (PTI) is the ratio of total truck travel time needed for 95% on-time arrival to free-flow travel time. As described in the Mobility Index, the PTI reflects the extra buffer time needed for on-time arrival while accounting for non-recurring delay.

For each corridor segment, the PTI was calculated for each direction of travel of the mainlanes. The threshold scale for rating the Directional PTI (trucks only) is the same as defined in the Mobility Index:

Uninterrupted Flow Facilities

- Good: < 1.30
- Fair: 1.30 – 1.50
- Poor: > 1.50

Bridge Vertical Clearance

This secondary measure uses the vertical clearance information from TxDOT's BRINSAP to identify locations with low vertical clearance. The minimum vertical clearance for all underpass structures, and overpass structures that are part of the Primary Freight Network, were determined for each segment. The performance thresholds for the Bridge Underpass Vertical Clearance are as follows:

- Good: > 16.5'
- Fair: 16.0' – 16.5'
- Poor: < 16.0'

Bridge Load Ratings

This secondary measure used the Bridge Posting rating (item 70) and the Operating Rating (item 64) from BRINSAP to identify bridges with load restrictions.

The performance thresholds for the Bridge Load Rating are as follows:

- Good: No bridges in segment have a posted load limit (all bridges coded as "5" in item 70)
- Fair: At least one bridge in segment has a posted load limit (item 70) which has an Operating Rating > HS10 but < HS20 (item 64), and Superstructure and Substructure Ratings > 5, and Deck Rating > 4
- Poor: At least one bridge in segment has
  - A posted load limit (item 70) that has an Operating Rating (item 64) < HS 10, or
  - A posted load limit (item 70) that has an Operating Rating ≥ HS10 but < HS20 (item 64), and has Superstructure or Substructure Rating < 5, or Deck Rating < 4

Freight Hotspots

Hotpots that could apply to all traffic, including freight, were identified under the Mobility Performance Area. The additional freight hotspot locations would include:

- Interchanges that currently experience LOS 'E' or 'F' based on the Interchange Congestion performance measure, and that have an elevated percentage of heavy vehicles (>15%), and that currently have more 1,000 AADT
- Mainlane underpass locations with a vertical clearance less than 16.0' and that do not have ramps so the restriction cannot be avoided
- Mainlane overpass locations with a vertical clearance less than 16.0' and that are part of the Primary Freight Network
- Mainlane bridge locations that would be rated as "Poor" in the Bridge Load Rating (as described above) performance measure.

Freight Performance

The Freight Index and secondary performance measures were calculated for the I-37 corridor as described above. The resulting scores are shown in **Table 9** and **Figure 26**. Maps for all of the secondary performance measures are provided in **Appendix C** and performance data and calculations are provided in **Appendix D**.

Table 9 – Freight Performance

Seg. #	BMP	EMP	Length (miles)	Freight Index	Directional TTI (trucks only)		Directional PTI (trucks only)		Bridge Load Ratings	Bridge Vertical Clearance
					NB	SB	NB	SB		
1	14	17	3	0.15	1.04	1.04	1.19	1.16	Good	16.33
2	17	31	14	0.11	1.02	1.02	1.11	1.13	Good	16.08
3	31	34	3	0.08	1.02	1.02	1.09	1.10	Good	16.75
4	34	48	14	0.07	1.02	1.02	1.09	1.07	Good	16.25
5	48	57	9	0.12	1.01	1.03	1.07	1.15	Good	16.17
6	57	73	16	0.08	1.02	1.03	1.09	1.11	Good	16.42
7	73	84	11	0.09	1.02	1.03	1.10	1.12	Good	16.50
8	84	91	7	0.10	1.02	1.03	1.08	1.13	Good	16.17
9	91	98	7	0.06	1.02	1.02	1.08	1.08	Good	No UP
10	98	103	5	0.06	1.02	1.02	1.08	1.08	Good	No UP
11	103	110	7	0.09	1.02	1.02	1.11	1.09	Good	15.83
12	110	118	8	0.07	1.02	1.01	1.09	1.05	Good	16.83
13	118	125	7	0.10	1.01	1.02	1.06	1.12	Good	16.33
14	125	134	9	0.19	1.04	1.05	1.18	1.24	Good	16.50

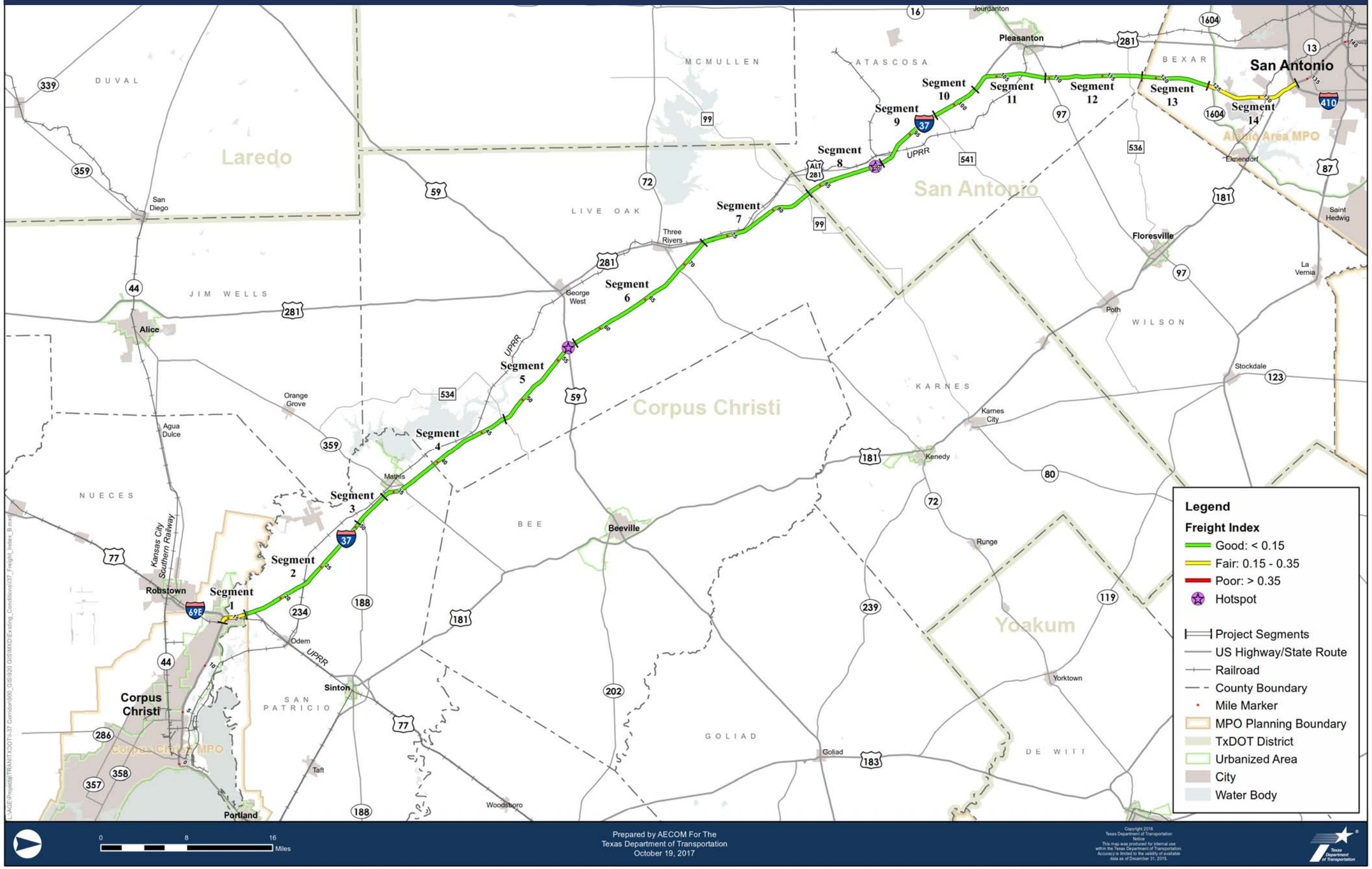
Performance Scales					
Good/Above Average Performance	< 0.15	< 1.15	< 1.30	*	> 16.5'
Fair/Average Performance	0.15 – 0.35	1.15 – 1.33	1.30 – 1.50	*	16.0' – 16.5'
Poor/Below Average Performance	> 0.35	> 1.33	> 1.50	*	< 16.0'

* Good = no bridges have a posted load limit (Operating Rating > HS 20)
Fair = At least one bridge has a posted load limit but condition ratings are 5 or above
Poor = At least one bridge has a posted load limit but condition ratings are below 5

Based on the results of this analysis, the following observations could be made:

- All of the corridor segments show "Good" performance in both the Travel Time Index (TTI; trucks only) and Planning Time Index (PTI; trucks only) secondary measures.
- Nearly all of the segments show "Good" performance in the Freight Index, except segments 1 and 14, which both show "Fair" performance.
- No bridges along the corridor are currently load posted (all have Operating Rating > HS 20).
- Freight "hotspots" due to elevated V/C were identified at the US 59 interchange.

Figure 26 – Freight Index



2.7 Corridor-Wide Performance Area

The preceding sections describe the performance-based results of the evaluation of the segment-based analysis along the I-37 corridor. However, several conditions do not lend themselves to segment-based analysis such as truck parking and the travel demand on parallel routes. In addition several elements were evaluated that do not represent the performance of the corridor, but rather a quantification of existing features (e.g. frontage roads). The factors described below were therefore evaluated under the Corridor-Wide Performance Area.

Truck Parking

Truck parking facilities adjacent to, and within 2½ miles of, the I-37 corridor were identified using the TruckMaster Fuel Finder online directory and Google Earth. Google Earth was also used to estimate the number of possible truck parking spaces within these facilities. There are 13 commercial gas stations/truck stops, 4 state-maintained picnic areas, and 2 state-maintained rest areas with a total of approximately 530 parking spaces along the 120 miles of the corridor.

The truck parking demand for the I-37 corridor was calculated based on the methodology outlined in the Virginia Truck Parking Study. This methodology estimates the parking demand based on the annual average daily traffic, percentage of trucks, corridor length, average speed, and average parking duration per hour of travel. The average parking duration is assumed to vary according to whether the trip is a long haul or short haul trip.

Assumptions for the percentages of long haul and short haul trips are based on a Pennsylvania truck parking study completed by the Pennsylvania State Transportation Advisory Committee. The study determined that trucks traveling on interstates were approximately 65% short haul and 35% long haul. Long haul trips are defined as having a distance of 200 miles or more.

The following three formulas were used to calculate the overall truck parking demand along the I-37 corridor:

1) Truck parking demand (short term) = [AADT x T% x (L/S)] x (daily truck stops (short-term) x 2.11%)
2) Truck parking demand (long term) = [AADT x T% x (L/S)] x (daily truck stops (long-term) x 45.35%)
3) Overall Truck Parking Demand = 0.65 x (Short-term truck parking demand) + 0.35 x (Long-term truck parking demand).

Where,

- AADT= Annual Average Daily Traffic (vpd)
- T% = Percentage of trucks on the roadway segment
- L = Length of the roadway segment (miles)
- S = Average speed of the roadway segment (mph)

The I-37 AADT, length, and percent trucks, and the results of the analysis are shown below.

AADT (vpd)	L (miles)	T (%)	Speed (mph)	Total Demand (#)	Available Parking (#)
29,000	120	23%	63	500	530

The following assumptions were used in this analysis:

- Percent of truck trips that are short-term trips = 65%
- Percent of truck trips that are long-term trips = 35%
- Average duration of short-term parking = 0.367 hours
- Average duration of long-term parking = 7.25 hours
- Average parking duration per hour of short-term travel = 0.083 hours
- Average parking duration per hour of long-term travel = 1.725 hours
- percentage of trucks parked for less
- Percentage of trucks parked for less than 3 hours during the peak parking period (3 am to 4 am) = 2.11% for short-term
- Percentage of trucks parked for more than 3 hours during the peak parking period (3 am to 4 am) = 45.35% for long-term.

Frontage Roads

TxDOT PMIS data and Google Maps were used to inventory the frontage roads along I-37. Below is a description of the existing frontage roads:

- Frontage roads exist along approximately 65% (78 miles) of the corridor.
- Along the northbound (eastern) side of I-37, frontage roads exist for approximately 70% of the corridor (85 miles).
- Along the southbound (western) side of I-37, frontage roads exist for approximately 60% of the corridor (71 miles).
- A vast majority of the existing frontage roads provide two-way operation, with the exceptions being at the far north and south ends of the corridor.

Access Control

Google Map aerials were used to identify locations where it appears that drivers are either exiting or entering the mainlanes where ramps do not currently exist. Along the northbound mainlanes, approximately 30 locations were identified with a majority appearing to be used to exit the mainlanes. Along the southbound mainlanes, approximately 15 locations were identified with an approximate 50/50 split between exiting and entering the mainlanes.

Parallel Route Travel Demand

The travel demand was reviewed at three locations along the corridor. At each location, a volume-to-capacity (V/C) ratio was calculated for the total demand and total capacity for the I-37, US 181, and US 281 corridors. For this assessment, the future (2040) demand was compared to the capacity to estimate a V/C ratio. The

capacity was estimated using the HERS methodology discussed under the Mobility performance area. The results of this analysis are shown below.

Location	2040 Volume				2040 Total Capacity (vpd)	2040 V/C ratio
	I-37 Volume (vpd)	US 281 Volume (vpd)	US 181 Volume (vpd)	Total Volume (vpd)		
South (near I-37 MP 20)	46,000	15,000	9,000	70,000	208,000	0.34
Middle (near I-37 MP 80)	57,000	3,000	14,000	74,000	156,000	0.47
North (near I-37 MP 120)	77,000	7,000	46,000	130,000	215,000	0.60

Floodplains

All 100-year flood elevations for stream and river crossings along I-37 within the study area were checked against the main lane roadway profiles as determined from the as-built plans. The initial screening involved comparison of the FEMA flood plain contours and elevations to the I-37 roadway profile. Differences in the vertical datum between the FEMA maps and the as-builts was accounted for. The majority of main lane crossing profiles were well above the 100-year flood plain; however, some crossing profiles appeared to be very close to the elevation indicated by the FEMA flood contours. Since the FEMA flood plain contours are approximate, crossing profiles that appeared close to the 100-year elevation were further reviewed using hydrologic data and calculations from the as-built drawings. Through this review, it was determined that the I-37 main lane profiles at the stream and river crossings within the study area are above the 100-year flood elevation with the exception of the Nueces River crossing in Segment 1 which has an approximate roadway elevation of 16 ft and a 100-year flood plain elevation of 21 ft. Also, the FEMA Nueces County Coastal Project Area map indicates that there are no Coastal Surge Influenced Areas within the I-37 study limits.

The results of the Corridor-Wide analysis are shown in Table 10.

Table 10 – Corridor-Wide Performance

Segment	Segment Length (miles)	Segment Mileposts (MP)	% of Frontage Roads on Segment		Parallel Route Travel Demand (V/C)	Number of Access Control Breaks (ramps/mile)	% of Parking Demand Served	Total Width of Floodplain Crossings (ft)
			NB	SB				
1	3	14-17	87%	70%	0.34	0.0	112%	8,000
2	14	17-31	96%	99%		0.4		0
3	3	31-34	100%	100%		0.0		0
4	14	34-48	90%	15%		0.2		0
5	9	48-57	100%	91%		0.1		0
6	16	57-73	100%	100%	0.47	0.3	118%	0
7	11	73-84	66%	63%		0.9		0
8	7	84-91	0%	0%		1.0		0
9	7	91-98	87%	80%		0.0		0
10	5	98-103	100%	100%	0.60	0.8	100%	0
11	7	103-110	34%	16%		0.4		0
12	8	110-118	31%	30%		0.4		0
13	7	118-125	0%	6%		0.1		0
14	9	125-134	52%	47%		0.4		0

Performance Scales					
Good/Above Average Performance	> 90%	< 0.56	< 0.10	> 95%	< 250'
Fair/Average Performance	40% –90%	0.56 – 0.76	0.10 – 0.50	50% - 95%	250' – 2500'
Poor/Below Average Performance	< 40%	> 0.76	> 0.50	< 50%	> 2500'

2.8 Corridor Performance Summary

Table 11 shows the ratings for each segment and a weighted average rating for each performance measure. Based on the results shown in Table 11, and described in the preceding sections, the following general observations could be made related to the performance of the I-37 corridor:

Pavement & Bridge

- The mainlane pavement generally shows "good" performance with the exception of 14 miles that show "poor" performance.
- The frontage road pavement generally shows "good" or "fair" performance with the exception of 35 miles that show "poor" performance.
- The bridges generally show "good" or "fair" performance.

Mobility & Freight

- The current (2015) mainlane traffic operations could generally be described as having "good" performance.
- At the far north end of the corridor (segments 13 and 14), the mainlanes are anticipated to experience severe congestion by 2025.
- Future traffic growth along the corridor will cause five segments to show "poor" mainlane performance by the year 2040 (segments 1, 7, and 12-14).
- Two segments (segments 5 and 14) currently show "poor" performance intraffic interchange operations.
- Future traffic growth along the corridor will cause eight segments to show "poor" performance in traffic interchange operation by the year 2040 (segments 3-6,8,12-14).
- Generally, the corridor appears to be fairly reliable (for general mobility as well as freight) as both the TTI and PTI scores show "good" performance.
- No bridges along the corridor are currently load posted (all have Operating Rating > HS 20).

Safety

- A majority of the corridor segments show either "above average" or "average" performance in safety performance.
- Segments 3 and 9 experience fatal and incapacitating crash rates that are above the statewide average for rural interstates.
- Five segments experience crash rates along the frontage roads that are above the statewide average for rural 2-lane highways.
- "Hotspots" for fatal and incapacitating crashes were identified near mileposts 93-95 and 124-125.

Corridor-Wide

- The estimated demand for truck parking generally matches the truck parking available along the corridor.
- Approximately 65% of the corridor has frontage roads.
- Of the existing frontage roads, nearly all provide two-way operation with the few exceptions being at the far north and south ends of the corridor.
- The frequency of access control breaks is higher in segments 7, 8, and 10.
- One location (in segment 1) encroaches into a designated floodplain.

Table 11 – Corridor Performance Summary

				Pavement Performance Area								Bridge Performance Area					Mobility Performance Area											
					Mainline Directional Distress Score		Mainline Directional Ride Score		Frontage Rd Condition Score										Existing Mainline Peak Hour V/C		Frontage Road V/C		Interchange V/C		Directional TTI (all vehicles)		Directional PTI (all vehicles)	
Segment	BMP	EMP	Length (miles)	Pavement Index	NB	SB	NB	SB	NB	SB	Sub-Standard Pavement	Bridge Index	Bridge Sufficiency	Bridge Rating	Culvert Rating	Func. Obsolete Bridges	Mobility Index	Mainline Future V/C	NB	SB	2015	2040	2015	2040	NB	SB	NB	SB
1	14	17	3	94.73	93.20	96.30	3.96	3.94	92.69	95.95	1.5%	5.85	81.70	5	6.00	14.3%	0.61	0.85	0.60	0.65	0.05	0.09	N/A	N/A	1.14	1.12	1.38	1.25
2	17	31	14	96.11	100.00	95.29	4.69	4.21	67.19	63.53	18.1%	6.10	90.09	5	6.53	8.0%	0.47	0.64	0.45	0.49	0.01	0.02	0.17	0.34	1.10	1.09	1.22	1.22
3	31	34	3	97.22	100.00	97.83	4.67	4.82	59.17	67.50	25.0%	7.00	95.50	7	N/A	0.0%	0.46	0.63	0.43	0.49	0.04	0.07	0.42	0.81	1.09	1.10	1.22	1.23
4	34	48	14	80.74	69.36	91.74	3.97	4.70	86.27	92.86	19.4%	6.58	91.01	6	6.51	5.3%	0.37	0.53	0.34	0.38	0.02	0.04	0.39	0.80	1.08	1.10	1.21	1.19
5	48	57	9	82.91	70.78	93.61	4.21	4.50	95.78	98.83	4.3%	6.39	95.26	6	6.24	0.0%	0.35	0.50	0.32	0.36	0.02	0.04	0.92	1.92	1.07	1.10	1.19	1.23
6	57	73	16	77.48	68.97	85.91	4.06	4.21	88.09	68.47	18.0%	6.74	92.80	5	6.43	0.0%	0.39	0.55	0.37	0.38	0.04	0.08	0.61	1.28	1.08	1.10	1.21	1.22
7	73	84	11	80.77	79.79	82.71	4.20	3.97	80.08	63.16	16.3%	6.91	93.00	6	6.29	0.0%	0.55	0.77	0.54	0.51	0.09	0.20	0.23	0.48	1.09	1.10	1.19	1.20
8	84	91	7	92.35	88.13	96.57	3.97	4.36	N/A	N/A	0.0%	6.57	96.27	5	6.74	0.0%	0.46	0.62	0.44	0.42	N/A	N/A	0.53	1.12	1.09	1.10	1.20	1.20
9	91	98	7	93.90	88.36	99.93	4.02	4.35	82.52	98.39	9.7%	6.45	95.26	6	6.61	0.0%	0.52	0.74	0.51	0.50	0.01	0.01	N/A	N/A	1.09	1.09	1.20	1.19
10	98	103	5	98.81	99.30	100.00	4.53	4.58	64.80	99.40	12.5%	7.00	95.80	7	N/A	0.0%	0.54	0.76	0.53	0.51	0.08	0.17	0.22	0.46	1.09	1.09	1.20	1.18
11	103	110	7	95.76	93.36	100.00	4.19	4.26	79.33	75.36	3.4%	5.69	88.31	5	6.64	0.0%	0.48	0.68	0.48	0.46	0.11	0.22	0.28	0.59	1.10	1.10	1.24	1.21
12	110	118	8	97.47	98.19	98.63	4.49	4.40	84.48	73.00	2.9%	6.23	97.04	6	6.79	0.0%	0.67	0.97	0.63	0.63	0.04	0.10	0.68	1.49	1.10	1.08	1.25	1.19
13	118	125	7	99.66	99.90	100.00	4.74	4.54	N/A	88.00	0.0%	6.50	96.60	6	6.51	0.0%	0.77	1.07	0.43	0.43	0.30	0.66	0.63	1.38	1.10	1.10	1.19	1.22
14	125	134	9	93.89	93.45	96.54	4.57	4.46	81.40	49.71	9.4%	6.56	94.87	6	6.19	0.0%	0.99	1.40	0.56	0.58	0.27	0.59	0.84	1.86	1.07	1.09	1.24	1.26
			120																									
			Corridor Averages	89.30	85.67	93.84	4.29	4.36	81.34	77.17	11.4%	6.48	93.14	5.68	6.47	1.9%	0.53	0.74	0.46	0.47	0.08	0.16	0.49	1.04	1.09	1.10	1.22	1.21
																											Uninterrupted Flow	
Good/Above Average Performance				> 80	> 80		> 3.0		> 80		< 5%	> 6.5	> 80	> 5	> 6.5	< 12%	< 0.56								< 1.15		< 1.30	
Fair/Average Performance				60 - 80	70 - 80		2.0 - 3.0		60 - 80		5% - 20%	5.0 - 6.5	50 - 80	5	5.0 - 6.5	12% - 40%	0.56 - 0.76								1.15 - 1.33		1.30 - 1.50	
Poor/Below Average Performance				< 60	< 70		< 2.0		< 60		> 20%	< 5.0	< 50	< 5	< 5.0	> 40 %	> 0.76								> 1.33		> 1.50	

Table 11 – Corridor Performance Summary – Continued

				Safety Performance Area				Freight Performance Area							Corridor-Wide Performance Area					
Segment	BMP	EMP	Length (miles)	Safety Index	Directional Mainline Rates NB	Directional Mainline Rates SB	Frontage Road Rate	Freight Index	Directional TTI (trucks only) NB	Directional TTI (trucks only) SB	Directional PTI (trucks only) NB	Directional PTI (trucks only) SB	Bridge Load Ratings	Bridge Vertical Clearance	% of Frontage Roads on Segment NB	% of Frontage Roads on Segment SB	Parallel Route Travel Demand (V/C)	Number of Access Control Breaks (ramps/mile)	% of Parking Demand Served	Total Width of Floodplain Crossings (ft)
1	14	17	3	4.46	76.69	111.49	118.16	0.15	1.04	1.04	1.19	1.16	Good	16.33	87%	70%		0.0		8,000
2	17	31	14	3.47	32.83	34.35	189.96	0.11	1.02	1.02	1.11	1.13	Good	16.08	96%	99%		0.4		0
3	31	34	3	6.25	46.66	49.57	208.57	0.08	1.02	1.02	1.09	1.10	Good	16.75	100%	100%	0.34	0.0	112%	0
4	34	48	14	3.11	41.27	44.50	120.16	0.07	1.02	1.02	1.09	1.07	Good	16.25	90%	15%		0.2		0
5	48	57	9	4.53	65.67	44.89	513.35	0.12	1.01	1.03	1.07	1.15	Good	16.17	100%	91%		0.1		0
6	57	73	16	3.48	34.53	33.19	146.43	0.08	1.02	1.03	1.09	1.11	Good	16.42	100%	100%		0.3		0
7	73	84	11	3.05	27.03	27.75	73.22	0.09	1.02	1.03	1.10	1.12	Good	16.50	66%	63%	0.47	0.9	118%	0
8	84	91	7	4.14	43.43	43.43	N/A	0.10	1.02	1.03	1.08	1.13	Good	16.17	0%	0%		1.0		0
9	91	98	7	6.66	68.77	52.45	80.15	0.06	1.02	1.02	1.08	1.08	Good	No UP	87%	80%		0.0		0
10	98	103	5	2.25	47.30	26.81	149.61	0.06	1.02	1.02	1.08	1.08	Good	No UP	100%	100%		0.8		0
11	103	110	7	2.70	52.86	39.64	29.71	0.09	1.02	1.02	1.11	1.09	Good	15.83	34%	16%		0.4		0
12	110	118	8	2.22	35.16	46.60	146.98	0.07	1.02	1.01	1.09	1.05	Good	16.83	31%	30%	0.60	0.4	100%	0
13	118	125	7	2.37	21.19	22.44	0.00	0.10	1.01	1.02	1.06	1.12	Good	16.33	0%	6%		0.1		0
14	125	134	9	2.52	56.62	53.20	27.89	0.19	1.04	1.05	1.18	1.24	Good	16.50	52%	47%		0.4		0
			120																	
			Corridor Averages	3.48	43.16	40.99	141.90	0.10	1.02	1.03	1.10	1.12	Good	16.32	77%	64%	0.46	0.38	110%	200
								Uninterrupted Flow												
Good/Above Average Performance				< 3.27	< 51.78		< 97.9	< 0.15	< 1.15		< 1.30		*	>16.5	> 90%		< 0.56	< 0.10	> 95%	< 250’
Fair/Average Performance				3.27-4.91	51.78 - 77.67		97.9-146.9	0.15-0.35	1.15 - 1.33		1.30 - 1.50		*	16.0-16.5	40% –90%		0.56 – 0.76	0.10 – 0.50	50% - 95%	250’ – 2500’
Poor/Below Average Performance				> 4.91	> 77.67		> 146.9	> 0.35	> 1.33		> 1.50		*	<16.0	< 40%		> 0.76	> 0.50	< 50%	> 2500’

* Good = no bridges have a posted load limit (Operating Rating > HS 20)
Fair = At least one bridge has a posted load limit but condition ratings are 5 or above
Poor = At least one bridge has a posted load limit but condition ratings are below 5

3. Needs Assessment

3.1 Corridor Objectives

High-level performance objectives for the I-37 Corridor are listed below and align with the TxDOT statewide goals listed in the *Texas Transportation Plan 2040*:

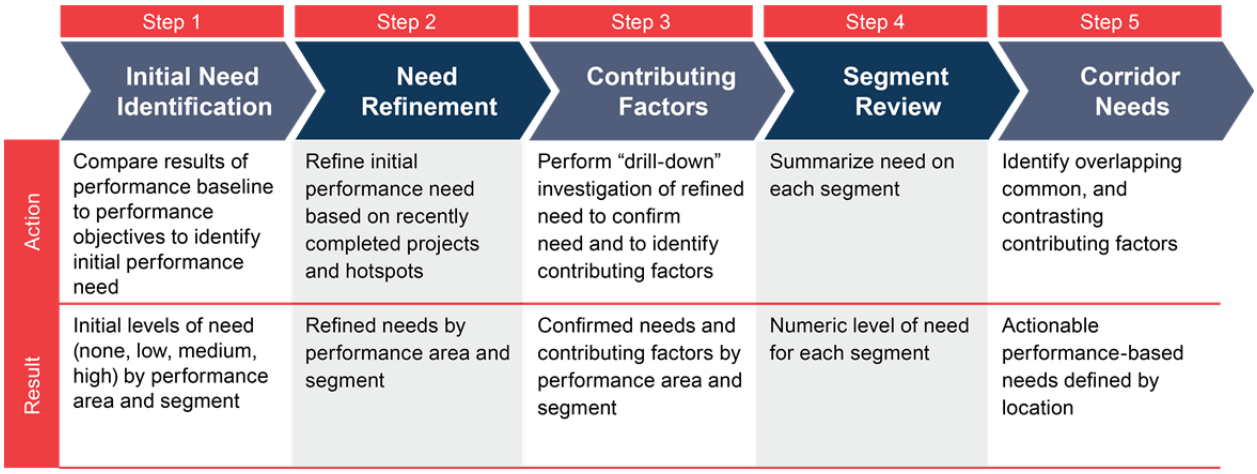
- Reduce current and future congestion
- Reduce delays from non-recurring events and incidents to enhance travel time reliability
- Reduce delays and restrictions to freight movements
- Reduce the number of structurally deficient bridges
- Maintain acceptable level of pavement ride quality
- Reduce fatal and serious injury crashes.

The performance measures and resulting needs are grouped by the six performance areas (Pavement, Bridge, Mobility, Safety, Freight, and Corridor-Wide). As part of the needs process described below, the performance areas that are importation to the corridor are identified as "Emphasis Areas". Coordination with the TxDOT San Antonio and Corpus Christi Districts led to the identification of the Safety, Mobility, and Freight performance areas as Emphasis Areas for the I-37 Corridor.

3.2 Needs Assessment Process

Following the evaluation of corridor performance in each of the five performance areas (Pavement, Bridge, Mobility, Safety, and Freight), performance scores for each corridor segment were converted to a universal level of need. This conversion is necessary because the performance score for each separate measure is not calculated on the same scale. The performance score for each measure was converted to a None, Low, Medium, or High level of need to allow for comparison across performance areas. The need identification and refinement process is illustrated in **Figure 27** below and described in the following sections.

Figure 27 – Needs Assessment Process



Step 1- Initial Need Identification

The first step in the needs assessment process links baseline (existing) corridor performance with performance objectives. In this step, the baseline corridor performance is compared to the performance objectives to provide a starting point for the identification of initial performance needs. This mathematical comparison results in an initial need rating of None, Low, Medium, or High for each primary and secondary performance measure. An illustrative example of this process is shown in **Figure 28**.

Figure 28 – Example Conversion from Performance to Needs

Performance Level	Initial Level of Need	Description
Good	None	All levels of Good
Good		
Good		
Fair	Low	Upper 2/3 of Fair
Fair		
Fair	Medium	Lower 1/3 of Fair and top 1/3 of Poor
Poor		
Poor	High	Lower 2/3 of Poor
Poor		

The performance score for each performance measure is converted to a numeric score (generally ranging from 0-4) representing the initial level of need (variance from performance objective) as follows:

- No need (all levels of 'Good' performance) results in a score < 0.5
- Low need (upper 2/3 of 'Fair' performance) results in a score from 0.5 – 1.5
- Medium need (lower 1/3 of 'Fair' performance and upper 1/3 of 'Poor' performance) results in a score from 1.5 – 2.5
- High need (lower 2/3 of 'Poor' performance) results in a score > 2.5.

The initial need scores for each performance measure are combined to produce a weighted initial need score for each segment. A weight of 1.0 is applied to the Performance Index need score and equal weights of 0.20 are applied to each secondary performance measure need score along the mainlanes. For directional secondary performance measures, each direction of travel receives a weight of 0.10. The secondary performance measure need scores are added to the need from the Primary Index to create a cumulative need score. With this approach, the resulting segment level of need is always equal to or higher than the Primary Index need score.

Step 2 - Need Refinement

In Step 2, the initial level of need for each segment is refined using the following information and engineering judgment.

- If an initial need is not identified, the existence of hot spots in the segment is justification for increasing the level of need from None to Low.
- Recently completed projects or projects under construction may be justification for lowering or eliminating a need.
- Programmed projects were not be used to lower the initial need because the project may not be implemented as planned. In addition, further investigations may suggest that changes in the scope of a programmed project may be warranted.

The resulting final need (potential increase, decrease, or no change from initial need) is carried forward for further evaluation in Step 3.

Step 3 - Contributing Factors

In Step 3, a more detailed review of the condition and performance data is conducted to identify contributing factors to the need. Typically, the same databases that are used to develop the baseline performance serve as the principal sources for the more detailed analysis.

In addition, other sources are considered to help identify the contributing factors, such as:

- Maintenance history or trends in historical data are used to help provide context for pavement and bridge history.
- Field observations from TxDOT district personnel could be used to provide additional information regarding a need that has been identified.
- Previous studies could be used to provide additional information regarding contributing factors to a need that has been identified.

Step 3 results in the identification of contributing factors to needs by segment (and milepost locations, if appropriate) that can be addressed to improve corridor performance.

Step 4 - Segment Review

In this step, the needs from Step 2 are used for each segment to numerically determine the level of need for each segment. A weight factor of 1.5 is applied to the performance areas that are identified as Emphasis Areas and a weighted average need is calculated for each segment. The resulting average need value can be used to compare needs across segments to determine the location of the highest needs.

Step 5 - Corridor Needs

In this step, the needs and contributing factors for each performance area are reviewed on a segment-by-segment basis to identify actionable needs and to facilitate the formation of solutions that address multiple performance areas and contributing factors. The intent of this process is to identify overlapping, common, and contrasting needs to help develop strategic solutions.

3.3 Corridor Needs Assessment

3.3.1 Pavement Performance Area Needs (Steps 1-3)

Step 1 - Initial Pavement Needs

The baseline performance scores for the I-37 corridor were used to determine the initial pavement needs. The PMIS pavement condition data collected in 2015 was used to calculate the performance.

Step 1 uses the scores for the Pavement Index primary performance measure and four secondary performance measures to determine the initial level of need by segment for each performance measure individually as well as for all performance measures combined.

The performance scores and initial levels of need for each pavement performance measure and for all pavement performance measures combined are contained in **Table 12.**

Step 2 - Pavement Need Refinement

Once the initial pavement needs for I-37 were established, they were then refined in Step 2 to more accurately reflect existing needs. An evaluation of pavement hot spots as well as relevant recently completed and under-construction projects was performed to determine if segment need levels required adjustment. The initial needs were then refined based on this assessment to determine the final need for each segment. The Step 2 process is described in more detail below and summarized in **Table 12**.

Pavement Hot Spots

There are five segments containing pavement failure hot spots on the mainlanes and 11 segments containing pavement failure hot spots along the frontage roads. The initial needs were adjusted on two segments to reflect the presence of hot spots.

Recently Completed and Under-Construction Projects

TxDOT provided information on potentially relevant recently completed and under-construction projects that were not previously reflected in the baseline performance data. This includes any projects completed or under construction after 2015 that have the potential to mitigate a pavement need on a corridor segment.

There are three segments containing recently completed projects which would supersede the pavement condition data, as shown in **Table 12**.

Step 3 - Pavement Contributing Factors

TxDOT provided pavement rehabilitation project data for the last 20 years. Each pavement rehabilitation project was assigned to one of four categories based on the assumed level of investment. This information was used to estimate the level of historical investment in each segment. Additional information regarding the pavement historical investments is contained in Appendix F.

For the Pavement Performance Area, no additional data is readily available so the contributing factors simply identify the specific locations of Needs, the level of historical investment, and any additional supporting information available from other sources. A summary of this information is shown in **Table 13** and the final Pavement needs are shown in **Figure 29**.

Table 12 – Pavement Needs

Segment	Segment Mileposts (MP)	Segment Length (miles)	Pavement Index		Mainlane Directional Ride				Mainlane Directional Distress				Frontage Rd Condition				% Sub-Standard Pavement		Initial Segment Pavement Need	Final Segment Pavement Need	Comments
					Performance Score		Level of Need		Performance Score		Level of Need		Performance Score		Level of Need						
			Performance Score	Level of Need	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	Performance Score	Level of Need			
1	14-17	3	94.73	None	3.96	3.94	None	None	93.20	96.30	None	None	92.69	95.95	None	None	1.46%	None	None	None	
2	17-31	14	96.11	None	4.69	4.21	None	None	100.00	95.29	None	None	67.19	63.53	Low	Medium	18.08%	Medium	Low	Low	
3	31-34	3	97.22	None	4.67	4.82	None	None	100.00	97.83	None	None	59.17	67.50	Medium	Low	25.00%	High	Low	Low	
4	34-48	14	80.74	None	3.97	4.70	None	None	69.36	91.74	Medium	None	86.27	92.86	None	None	19.44%	Medium	Low	None	Need reduced to 'None' due to previous projects
5	48-57	9	82.91	None	4.21	4.50	None	None	70.78	93.61	Medium	None	95.78	98.83	None	None	4.26%	None	Low	None	Need reduced to 'None' due to previous projects
6	57-73	16	77.48	Low	4.06	4.21	None	None	68.97	85.91	Medium	None	88.09	68.47	None	Low	17.97%	Medium	Low	Low	
7	73-84	11	80.77	None	4.20	3.97	None	None	79.79	82.71	Low	None	80.08	63.16	None	Medium	16.30%	Medium	Low	Low	
8	84-91	7	92.35	None	3.97	4.36	None	None	88.13	96.57	None	None	N/A	N/A	None	None	0.00%	None	None	None	
9	91-98	7	93.90	None	4.02	4.35	None	None	88.36	99.93	None	None	82.52	98.39	None	None	9.73%	Low	None	Low	Need increased due to mainlane 'hot spots'
10	98-103	5	98.81	None	4.53	4.58	None	None	99.30	100.00	None	None	64.80	99.40	Medium	None	12.50%	Low	None	Low	Need increased due to frontage road 'hot spots'
11	103-110	7	95.76	None	4.19	4.26	None	None	93.36	100.00	None	None	79.33	75.36	Low	Low	3.43%	None	None	None	
12	110-118	8	97.47	None	4.49	4.40	None	None	98.19	98.63	None	None	84.48	73.00	None	Low	2.87%	None	None	None	
13	118-125	7	99.66	None	4.74	4.54	None	None	99.90	100.00	None	None	N/A	88.00	None	None	0.00%	None	None	None	
14	125-134	9	93.89	None	4.57	4.46	None	None	93.45	96.54	None	None	81.40	49.71	None	High	9.42%	Low	None	None	

Level of Need	Performance Score Relation to Level of Need				
None	> 80.0	> 3.0	> 80.0	> 80.0	< 5%
Low	66.7 – 80.0	2.3 – 3.0	73.3 – 80.0	66.7 – 80.0	5% - 15%
Medium	53.3 – 66.7	1.7 – 2.3	66.7 – 73.3	53.3 – 66.7	15% - 25%
High	< 53.3	< 1.7	< 66.7	< 53.3	> 25%

Performance Measure	Weight Factor	% Distribution
Pavement Index	1.0	59%
Mainlane Ride	0.2	12%
Mainlane Distress	0.2	12%
Frontage Rd Condition	0.1	6%
% Sub-Standard Pavement	0.2	12%

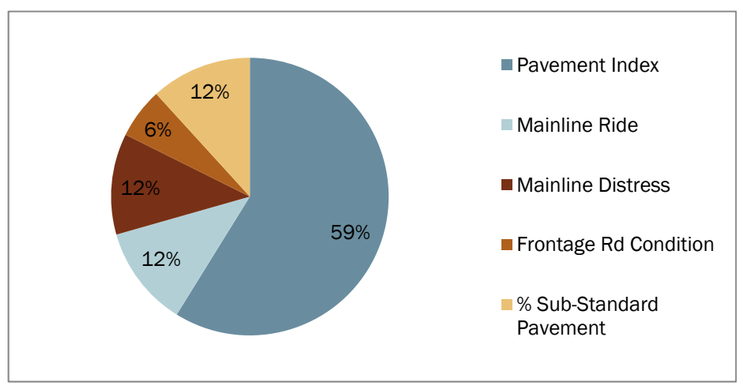
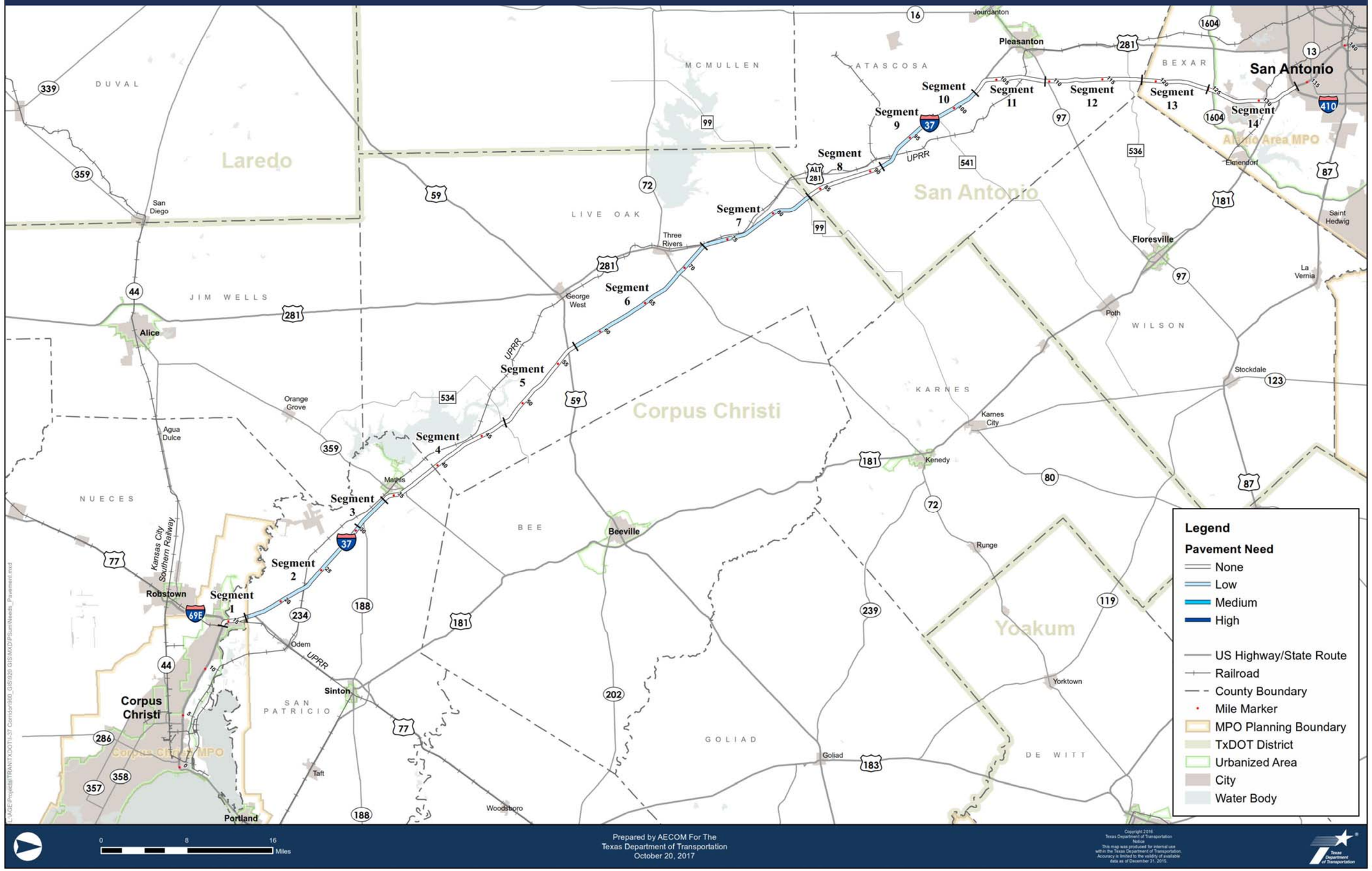


Table 13 – Pavement Contributing Factors

Segment	Segment Mileposts (MP)	Final Segment Pavement Need	Historical Investment		Contributing Factors and Comments
			Mainlane	Frontage Roads	
1	14-17	None	Medium	High	
2	17-31	Low	High	High	Failure hot spots on frontage roads
3	31-34	Low	High	High	Failure hot spots on frontage roads
4	34-48	None	Medium	Medium	
5	48-57	None	High	Medium	
6	57-73	Low	High	Low	Failure hot spots on frontage roads
7	73-84	Low	Medium	Low	Failure hot spots on mainlane and frontage roads
8	84-91	None	Low	Low	
9	91-98	Low	Low	Medium	Failure hot spots on mainlane and frontage roads
10	98-103	Low	Low	Medium	Failure hot spots on frontage roads
11	103-110	None	Medium	Low	
12	110-118	None	Medium	Low	
13	118-125	None	Low	Low	
14	125-134	None	Low	Low	

Figure 29 – Final Pavement Needs



3.3.2 Bridge Performance Area Needs (Steps 1-3)

Step 1 - Initial Bridge Needs

The baseline performance scores for the I-37 corridor were used to determine the initial bridge needs. The current BRINSAP data available in late 2016 was used to calculate the performance.

Step 1 uses the scores for the Bridge Index primary performance measure and four secondary performance measures to determine the initial level of need by segment for each performance measure individually as well as for all performance measures combined.

The performance scores and initial levels of need for each bridge performance measure and for all bridge performance measures combined are contained in **Table 14.**

Step 2 - Bridge Need Refinement

Once the initial bridge needs for I-37 were established, they were then refined in Step 2 to more accurately reflect existing needs. An evaluation of bridge hot spots as well as relevant recently completed and under-construction projects was performed to determine if segment need levels required adjustment. The initial needs were then refined based on this assessment to determine the final need for each segment. The Step 2 process is described in more detail below and summarized in **Table 14**.

Bridge Hot Spots

Five of the I-37 segments contain a bridge hot spot. All of these segments had an initial need identified in Step 1 so no adjustments were made.

Recently Completed and Under-Construction Projects

TxDOT provided information on potentially relevant recently completed and under-construction projects that were not previously reflected in the baseline performance data. This includes any projects completed or under construction after 2015 that have the potential to mitigate a bridge need on a corridor segment.

No recently completed projects that would supersede the bridge condition data have been completed, as shown in **Table 14**.

Step 3 - Bridge Contributing Factors

TxDOT provided historical bridge rating data for the last 20 years that was used to investigate historical trends for each bridge and is summarized in **Table 15** and **Appendix F**. A bridge is deemed to have a potential historical issue if any category rating (Deck, Superstructure, Substructure, or Evaluation) increases or decreases more than two times in the last 20 years, or has a sufficiency drop of more than 20 points in that same time frame. These characteristics would indicate that investments are repeatedly being made or ignored on that structure.

The current bridge ratings were reviewed to determine which rating (or ratings) were less than 6 (deck, superstructure, substructure, or structural evaluation rating). **Table 15** provides a summary of this information, identifies the bridges with potential historical issues, and provides any additional information related to the contributing factors. The final Bridge needs are shown in **Figure 30**.

Table 14 – Bridge Needs

Segment	Segment Length (miles)	Segment Mileposts (MP)	Number of Bridges in Segment	Bridge Index		Bridge Rating		Bridge Sufficiency		Culverts		% Functionally Obsolete Bridges		Initial Segment Bridge Need	Final Segment Bridge Need	Comments
				Performance Score	Level of Need	Performance Score	Level of Need	Performance Score	Level of Need	Performance Score	Level of Need	Performance Score	Level of Need			
1	3	14-17	10	5.85	Low	5	Low	81.70	None	6.00	Low	14.30%	Low	Medium	Medium	No changes from Initial Need to Final Need
2	14	17-31	14	6.10	Low	5	Low	90.09	None	6.53	None	8.0%	None	Low	Low	No changes from Initial Need to Final Need
3	3	31-34	1	7.00	None	7	None	95.50	None	N/A	None	0.0%	None	None	None	No changes from Initial Need to Final Need
4	14	34-48	15	6.58	None	6	None	91.01	None	6.51	None	5.3%	None	Low	Low	No changes from Initial Need to Final Need
5	9	48-57	11	6.39	Low	6	None	95.26	None	6.24	Low	0.0%	None	Low	Low	No changes from Initial Need to Final Need
6	16	57-73	23	6.74	None	5	Low	92.80	None	6.43	Low	0.0%	None	Low	Low	No changes from Initial Need to Final Need
7	11	73-84	16	6.91	None	6	None	93.00	None	6.29	Low	0.0%	None	None	None	No changes from Initial Need to Final Need
8	7	84-91	7	6.57	None	5	Low	96.27	None	6.74	None	0.0%	None	Low	Low	No changes from Initial Need to Final Need
9	7	91-98	10	6.45	Low	6	Low	95.26	None	6.61	None	0.0%	None	Low	Low	No changes from Initial Need to Final Need
10	5	98-103	2	7.00	None	7	None	95.80	None	N/A	None	0.0%	None	None	None	No changes from Initial Need to Final Need
11	7	103-110	8	5.69	Low	5	Low	88.31	None	6.64	None	0.0%	None	Medium	Medium	No changes from Initial Need to Final Need
12	8	110-118	4	6.23	Low	6	None	97.04	None	6.79	None	0.0%	None	Low	Low	No changes from Initial Need to Final Need
13	7	118-125	2	6.50	None	6	None	96.60	None	6.51	None	0.0%	None	Low	Low	No changes from Initial Need to Final Need
14	9	125-134	20	6.56	None	6	None	94.87	None	6.19	Low	0.0%	None	Low	Low	No changes from Initial Need to Final Need

Level of Need	Performance Score Relation to Level of Need				
None	> 6.5	> 5.5	> 80.0	> 6.5	< 12.0%
Low	5.5 – 6.5	4.8 – 5.5	60 – 80	5.5 – 6.5	12.0% - 30.7%
Medium	4.5 – 5.5	4.2 – 4.8	40 – 60	4.5 – 5.5	49.3% - 30.7%
High	< 4.5	< 4.2	< 40	< 4.5	> 49.3%

Performance Measure	Weight Factor	% Distribution
Bridge Index	1.0	59%
Bridge Rating	0.2	12%
Bridge Sufficiency	0.2	12%
Culverts	0.2	12%
% Functionally Obsolete Bridges	0.1	6%

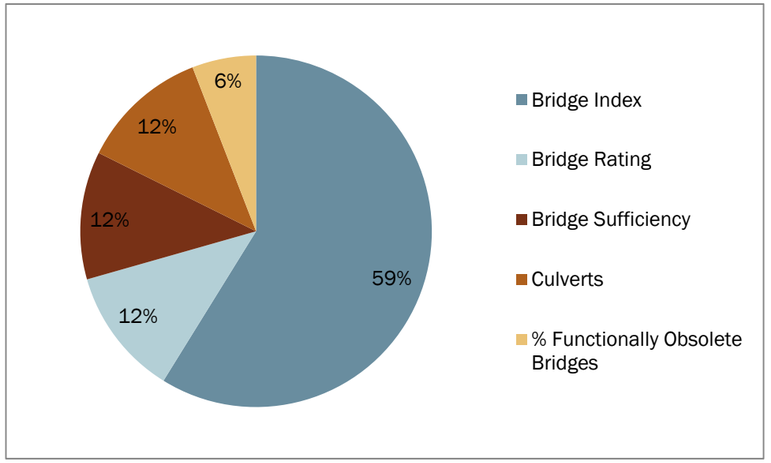
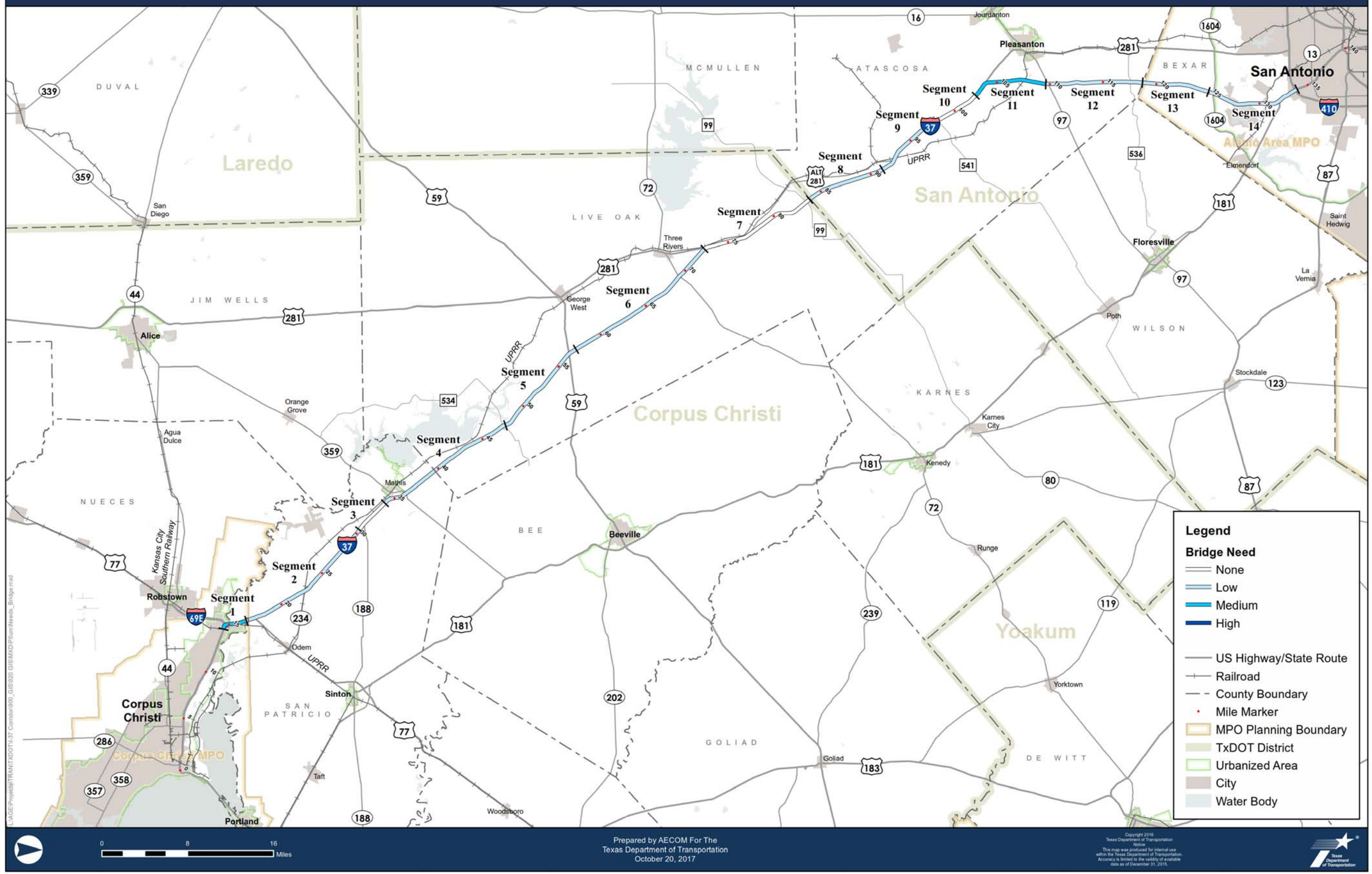


Table 15 – Bridge Contributing Factors

Segment	Segment Length (Miles)	Segment Mileposts (MP)	Number of Bridges in Segment	# Functionally Obsolete Bridges	Final Segment Bridge Need	Contributing Factors		
						Bridge	Current Ratings	Historical Review
1	3	14-17	10	5	Medium	Nueces River NB (#405048)(MP 16.64)	Evaluation Rating of 5	Sharpsburg Rd OP SB (#406197)(MP 15.31) Sharpsburg Rd OP NB (#406195)(MP 15.31)
2	14	17-31	14	2	Low	CR 1726/Cooper Rd UP (#405111)(MP 20.58)	Evaluation Rating of 5	Arroyo Nombre de Dios OP NB (#404118)(MP 30.52) FM 796 UP (#405108)(MP 23.12)
						IH 37 WFR UP (#405038)(MP 22.64)	Substructure rating of 5	
3	3	31-34	1	0	None	No bridges with current ratings less than 6		
4	14	34-48	15	1	Low	No bridges with current ratings less than 6		
5	9	48-57	11	0	Low	No bridges with current ratings less than 6		US 59 OP NB (#402148)(MP 56.48)
6	16	57-73	23	0	Low	Sulphur Creek EFR (#401033)(MP 65.30)	Deck rating of 5	Gamble Gully OP SB (#402145)(MP 57.01) Sulphur Creek OP WFR (#401177)(MP 65.27) SH 72 OP SB (#401184)(MP 69.18) SH 72 OP NB (#401185)(MP 69.18) SH 72 OP (#401184)(MP 69.18)
7	11	73-84	16	0	None	No bridges with current ratings less than 6		Brush Pen Hollow Creek OP SB (#307210)(MP 76.16) San Christoval Creek OP NB (#307215)(MP 77.29) Salt Branch Creek OP WFR (#307223)(MP 83.08)
8	7	84-91	7	0	Low	FM 791 UP (#306169)(MP 90.44)	Superstructure rating of 5	
9	7	91-98	10	1	Low	No bridges with current ratings less than 6		UPRR RR OP WFR (#305013)(MP 92.74)
10	5	98-103	2	0	None	No bridges with current ratings less than 6		
11	7	103-110	8	0	Medium	UPRR & Atascosa River OP NB (#310251)(MP 107.52)	Substructure rating of 5	Corgey Rd UP (#310250)(MP 108.55)
						UPRR & Atascosa River OP SB (#310252)(MP 107.53)	Substructure rating of 5	
						Corgey Rd UP (#310250)(MP 108.55)	Substructure rating of 5	
12	8	110-118	4	0	Low	No bridges with current ratings less than 6		
13	7	118-125	2	0	Low	No bridges with current ratings less than 6		
14	9	125-134	20	0	Low	No bridges with current ratings less than 6		

Figure 30 – Final Bridge Needs



3.3.3 Mobility Performance Area Needs (Steps 1-3)

Step 1 - Initial Mobility Needs

The baseline performance scores for the I-37 Corridor were used to determine the initial mobility needs. The mobility condition data used to calculate baseline performance was provided by TxDOT for 2015 for the existing traffic volumes and travel time data, and 2040 for future traffic volumes.

Step 1 uses the scores for the Mobility Index primary performance measure and six secondary performance measures to determine the initial level of need by segment for each performance measure individually as well as for all performance measures combined.

The performance scores and initial levels of need for each mobility performance measure and for all mobility performance measures combined are shown in Table 16.

Step 2 - Mobility Need Refinement

Once the initial mobility needs for the I-37 Corridor were established, they were then refined to more accurately reflect existing needs. An evaluation of hot spots/bottlenecks and relevant recently completed and under-construction projects was performed to determine if segment need levels required adjustment. The initial needs were then refined based on this assessment to determine the final need for each segment. The Step 2 process is described in more detail below and summarized in Table 16.

Mobility Hot Spots/Bottlenecks

Six of the I-37 segments contain a mobility hot spot. One segment need was adjusted to reflect the presence of a hot spot.

Recently Completed and Under-Construction Mobility Projects

TxDOT provided information on potentially relevant recently completed and under-construction projects that were not previously reflected in the baseline performance data. This includes any projects completed or under construction after 2015 that have the potential to mitigate a mobility need on a corridor segment. There were no recently completed projects along I-37 that changed the Mobility level of need, as shown in Table 16.

Step 3 - Mobility Contributing Factors

Step 3 identifies potential contributing factors to the performance needs calculated in Step 2. These contributing factors provide information on what types of improvements may help improve performance. Contributing factors include:

- Roadway variables
- Traffic variables
- Relevant freight-related existing infrastructure
- Non-actionable conditions

Roadway Variables

Roadway variables include functional classification, environmental type (e.g., urban, rural), terrain, number of lanes, speed limit, presence of auxiliary lanes, if a roadway is divided or non-divided, and how often passing is not allowed. These variables are described in more detail below:

- Functional classification indicates if a roadway is an interstate, state highway, or arterial. Capacity equations and parameters differ depending on a roadway's functional classification.
- Environmental type refers to how developed the land is adjacent to the roadway. Environmental types include urban, fringe urban, and rural. Capacity thresholds differ depending on the environmental type as higher congestion levels are more acceptable in urbanized areas than in rural areas.
- Terrain (described as level, rolling, or mountainous) indicates the general roadway grade, which influences how quickly vehicles can accelerate or decelerate or maintain a constant speed.
- The number of lanes in each direction indicates how many general-purpose through lanes exist.
- The speed limit indicates the posted speed limit.
- The presence of auxiliary lanes for turning, weaving, or passing can improve mobility performance by maintaining more consistent speeds in mainlane through lanes.
- A roadway is considered divided if it has a raised or depressed median separating the directions of traffic that cannot easily be traversed. A roadway with a painted paved median is considered a non-divided roadway. Dividing a roadway generally increases the roadway capacity.
- The presence of no-passing zones restricts the movement of vehicles around slower-moving vehicles.

Traffic Variables

Traffic variables include existing and future level of service (LOS), percent (%) trucks, and the buffer index (difference between PTI and TTI). The existing and future LOS, percentage of trucks, and buffer index can indicate how well a corridor is performing in terms of overall mobility and why certain segments of a corridor may be performing worse than others.

- Existing and Future LOS - the existing and future LOS provide a letter "grade" between "A" and "F" for mobility that is generally reflective of Existing and Future V/C calculations. LOS values of "A", "B", and "C" are generally considered highly acceptable. A LOS value of "D" is generally considered moderately acceptable. LOS values of "E" and "F" are generally considered unacceptable.
- Truck Traffic - the amount of truck traffic in a given segment of the corridor can be represented as a percentage of the overall total traffic volume for that specific segment. The truck volume on a corridor can impact overall mobility based on truck travel speed, corridor grades, required inspection points, and number of lanes.
- Buffer Index - the Buffer Index is calculated by subtracting the segment level TTI value (ratio of peak hour speed to free flow speed) from the segment level PTI value (95th percentile speed). The buffer index expresses the amount of extra time necessary to be on-time 95 percent of the time for any given trip. This calculation provides information on the reliability of a corridor.

Non-Actionable Conditions

Non-actionable conditions are features or characteristics that result in poor mobility performance that cannot be addressed through an engineered solution. An example could be a border patrol checkpoint that requires all vehicles to slow down or stop for inspection.

Mobility Needs Contributing Factors

Table 17 summarizes the potential contributing factors to Mobility needs on the I-37 Corridor while **Figure 31** shows the final Mobility needs. **Appendix F** contains diagrams showing the number of lanes and traffic volumes at locations along I-37 with elevated level of need.

Table 16 –Mobility Needs

Segment	Segment Mileposts	Segment Length (miles)	Environment Type	Facility Operation	Mobility Index		Future Daily V/C		Existing Peak Hour V/C				Frontage Road V/C				Directional TTI (all vehicles)			
					Performance Score	Level of Need	Performance Score	Level of Need	Performance Score		Level of Need		Performance Score		Level of Need		Performance Score		Level of Need	
									NB	SB	NB	SB	2015	2040	2015	2040	NB	SB	NB	SB
1	14-17	3	Rural	Uninterrupted	0.61	Low	0.85	High	0.36	0.39	None	None	0.05	0.11	None	None	1.14	1.12	None	None
2	17-31	14	Rural	Uninterrupted	0.47	None	0.64	Low	0.27	0.29	None	None	0.01	0.02	None	None	1.10	1.09	None	None
3	31-34	3	Rural	Uninterrupted	0.46	None	0.63	Low	0.26	0.29	None	None	0.04	0.08	None	None	1.09	1.10	None	None
4	34-48	14	Rural	Uninterrupted	0.37	None	0.53	None	0.27	0.31	None	None	0.02	0.05	None	None	1.08	1.10	None	None
5	48-57	9	Rural	Uninterrupted	0.35	None	0.50	None	0.26	0.29	None	None	0.02	0.04	None	None	1.07	1.10	None	None
6	57-73	16	Rural	Uninterrupted	0.39	None	0.55	None	0.29	0.30	None	None	0.04	0.09	None	None	1.08	1.10	None	None
7	73-84	11	Rural	Uninterrupted	0.55	None	0.77	Medium	0.43	0.41	None	None	0.10	0.22	None	None	1.09	1.10	None	None
8	84-91	7	Rural	Uninterrupted	0.46	None	0.62	Low	0.35	0.33	None	None	*No Data*	*No data*	N/A	N/A	1.09	1.10	None	None
9	91-98	7	Rural	Uninterrupted	0.52	None	0.74	Medium	0.41	0.40	None	None	0.01	0.02	None	None	1.09	1.09	None	None
10	98-103	5	Rural	Uninterrupted	0.54	None	0.76	Medium	0.43	0.41	None	None	0.09	0.19	None	None	1.09	1.09	None	None
11	103-110	7	Rural	Uninterrupted	0.48	None	0.68	Low	0.38	0.37	None	None	0.12	0.25	None	None	1.10	1.10	None	None
12	110-118	8	Rural	Uninterrupted	0.67	Low	0.97	High	0.50	0.50	None	None	0.05	0.11	None	None	1.10	1.08	None	None
13	118-125	7	Rural	Uninterrupted	0.77	Medium	1.07	High	0.41	0.41	None	None	0.33	0.74	None	Medium	1.10	1.10	None	None
14	125-134	9	Rural	Uninterrupted	0.99	High	1.40	High	0.56	0.58	None	Low	0.30	0.67	None	Low	1.07	1.09	None	None

Level of Need	Performance Score Relation to Level of Need				
None	< 0.56	< 0.56	< 0.56	< 0.56	< 1.15
Low	0.56 – 0.69	0.56 – 0.69	0.56 – 0.69	0.56 – 0.69	1.15 – 1.27
Medium	0.69 – 0.83	0.69 – 0.83	0.69 – 0.83	0.69 – 0.83	1.27 – 1.39
High	> 0.83	> 0.83	> 0.83	> 0.83	> 1.39

Table 16 – Mobility Needs – continued

Segment	Segment Mileposts	Segment Length (miles)	Environment Type	Facility Operation	Directional PTI (all vehicles)				Traffic Interchange V/C				Initial Segment Mobility Need	Final Segment Mobility Need	Comments
					Performance Score		Level of Need		Performance Score		Level of Need				
					NB	SB	NB	SB	2015	2040	2015	2040			
1	14-17	3	Rural	Uninterrupted	1.38	1.25	Low	None	No Data	No data	N/A	N/A	Medium	Medium	
2	17-31	14	Rural	Uninterrupted	1.22	1.22	None	None	0.17	0.34	None	None	None	Low	Increased Need from None to Low due to hotspots
3	31-34	3	Rural	Uninterrupted	1.22	1.23	None	None	0.42	0.81	None	Medium	None	None	
4	34-48	14	Rural	Uninterrupted	1.21	1.19	None	None	0.39	0.80	None	Medium	None	None	
5	48-57	9	Rural	Uninterrupted	1.19	1.23	None	None	0.92	1.92	High	High	Low	Low	
6	57-73	16	Rural	Uninterrupted	1.21	1.22	None	None	0.61	1.28	Low	High	Low	Low	
7	73-84	11	Rural	Uninterrupted	1.19	1.20	None	None	0.23	0.48	None	None	Low	Low	
8	84-91	7	Rural	Uninterrupted	1.20	1.20	None	None	0.53	1.12	None	High	Low	Low	
9	91-98	7	Rural	Uninterrupted	1.20	1.19	None	None	No Data	No Data	N/A	N/A	Low	Low	
10	98-103	5	Rural	Uninterrupted	1.20	1.18	None	None	0.22	0.46	None	None	Low	Low	
11	103-110	7	Rural	Uninterrupted	1.22	1.21	None	None	0.28	0.59	None	Low	None	None	
12	110-118	8	Rural	Uninterrupted	1.22	1.19	None	None	0.68	1.49	Low	High	High	High	
13	118-125	7	Rural	Uninterrupted	1.19	1.22	None	None	0.63	1.38	Low	High	High	High	
14	125-134	9	Rural	Uninterrupted	1.24	1.26	None	None	0.84	1.86	High	High	High	High	

Level of Need	Performance Score Relation to Level of Need	
None	< 1.30	< 0.56
Low	1.30 – 1.43	0.56 – 0.69
Medium	1.43 – 1.57	0.69 – 0.83
High	> 1.57	> 0.83

Performance Measure	Weight Factor	% Distribution
Mobility Index	1	45%
Future V/C	0.2	9%
Peak Hour V/C	0.2	9%
Frontage Rd V/C	0.2	9%
Travel Time Index	0.2	9%
Planning Time Index	0.2	9%
Interchange V/C	0.2	9%

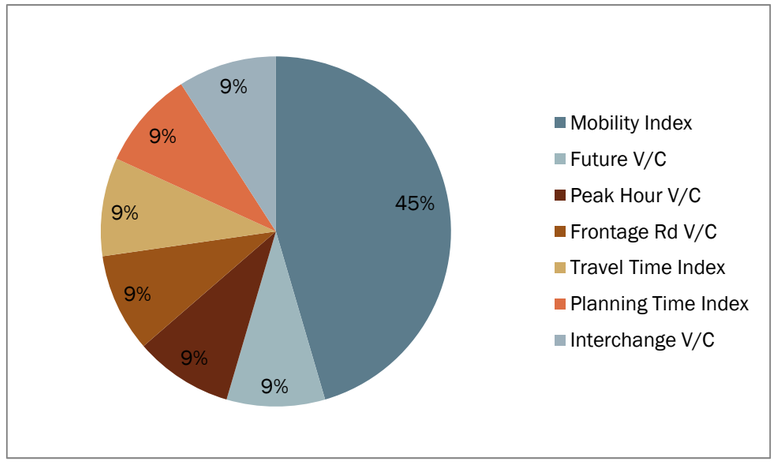
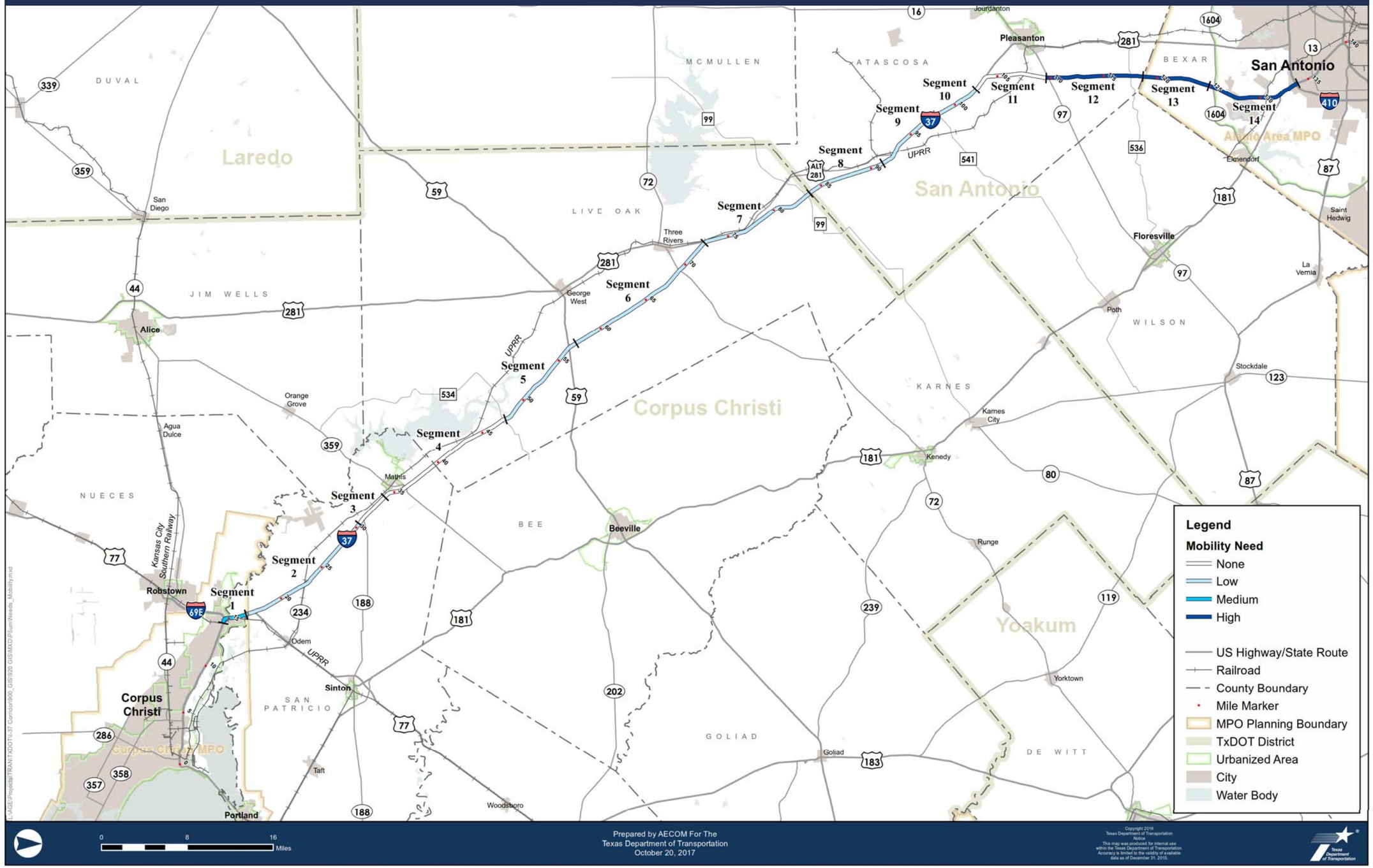


Table 17 – Mobility Contributing Factors

Segment	Segment Mileposts (MP)	Segment Length (miles)	Final Segment Mobility Need	Roadway Variables								Traffic Variables					Non-Actionable Conditions
				Functional Classification	Environmental Type (Urban/Rural)	Terrain	# of Lanes/ Direction	Speed Limit (mph)	Aux Lanes	Divided/ Non-Divided	% No Passing	Existing LOS	Future 2040 LOS	% Trucks	NB Buffer Index (PTI-TTI)	SB Buffer Index (PTI-TTI)	
1	14-17	3	Medium	Interstate	Rural	Level	3	75	Yes	Divided	0%	A/B	D-F	17%	0.24	0.13	None
2	17-31	14	Low	Interstate	Rural	Level	2	75	No	Divided	0%	A/B	C	20%	0.12	0.13	None
3	31-34	3	None	Interstate	Rural	Level	2	75	No	Divided	0%	A/B	C	21%	0.13	0.13	None
4	34-48	14	None	Interstate	Rural	Level	2	75	No	Divided	0%	A/B	A/B	23%	0.13	0.09	None
5	48-57	9	Low	Interstate	Rural	Level	2	75	No	Divided	0%	A/B	A/B	24%	0.12	0.13	None
6	57-73	16	Low	Interstate	Rural	Level	2	75	No	Divided	0%	A/B	A/B	22%	0.13	0.12	None
7	73-84	11	Low	Interstate	Rural	Level	2	75	No	Divided	0%	A/B	D-F	25%	0.10	0.10	None
8	84-91	7	Low	Interstate	Rural	Level	2	75	No	Divided	0%	A/B	C	28%	0.11	0.10	None
9	91-98	7	Low	Interstate	Rural	Level	2	75	No	Divided	0%	A/B	C	26%	0.11	0.10	None
10	98-103	5	Low	Interstate	Rural	Level	2	75	No	Divided	0%	A/B	C	25%	0.11	0.09	None
11	103-110	7	None	Interstate	Rural	Level	2	75	No	Divided	0%	A/B	C	27%	0.12	0.11	None
12	110-118	8	High	Interstate	Rural	Level	2	75	No	Divided	0%	A/B	D-F	23%	0.12	0.11	None
13	118-125	7	High	Interstate	Rural	Level	2	75	No	Divided	0%	A/B	D-F	22%	0.09	0.12	None
14	125-134	9	High	Interstate	Rural	Level	2.1	70	Yes	Divided	0%	C	D-F	16%	0.17	0.17	None

Segment	Segment Mileposts (MP)	Segment Length (miles)	Final Segment Mobility Need	Contributing Factors
1	14-17	3	Medium	Future projected travel demand exceeds capacity along mainlanes; hotspot/bottleneck at I-69 TI
2	17-31	14	Low	Hotspot/bottleneck at US-77 TI
3	31-34	3	None	
4	34-48	14	None	
5	48-57	9	Low	Hotspot/bottleneck at US-59 TI
6	57-73	16	Low	
7	73-84	11	Low	
8	84-91	7	Low	
9	91-98	7	Low	
10	98-103	5	Low	
11	103-110	7	None	
12	110-118	8	High	Future projected travel demand exceeds capacity along mainlanes and at interchanges; hotspot/bottleneck at SH-97 TI
13	118-125	7	High	Future projected travel demand exceeds capacity along mainlanes and at interchanges; hotspot/bottleneck at Waterwood Dr/Mathis Rd TI
14	125-134	9	High	Future projected travel demand exceeds capacity along mainlanes and at interchanges; hotspot/bottleneck at Southton Rd and Spur 122 TI's

Figure 31 – Final Mobility Needs



3.3.4 Safety Performance Area Needs (Steps 1-3)

Step 1 - Initial Safety Needs

The baseline performance scores for the I-37 Corridor were used to determine the initial safety needs. The performance scores are based on the CRIS data (provided by TxDOT) for the calendar years from 2011 through 2015.

Step 1 uses the scores for the Safety Index primary performance measure and two secondary performance measures to determine the initial level of need by segment for each performance measure individually as well as for all performance measures combined.

The performance scores and initial levels of need for each safety performance measure and for all safety performance measures combined are shown in **Table 18**.

Step 2 - Safety Need Refinement

Once the initial safety needs were established, they were then refined in Step 2 to more accurately reflect existing needs. An evaluation of crash hot spots as well as relevant recently completed and under-construction projects was performed to determine if segment need levels required adjustment. The initial needs were then refined based on this assessment to determine the final need for each segment. The Step 2 process is described in more detail below and summarized in **Table 18**.

Safety Hot Spots

There are two segments containing a safety hot spot. One safety hot spot is located within a segment that does not already have an identified initial need, so the need on this segment was adjusted to account for the hot spot.

Recently Completed and Under-Construction Projects

TxDOT provided information on potentially relevant, recently completed, and under-construction projects that were not previously reflected in the baseline performance data. This includes any projects completed or under construction that have the potential to mitigate a safety need on a corridor segment. There were no recently completed projects along I-37 that changed the Safety level of need, as shown in **Table 18**.

Step 3 - Safety Contributing Factors

Step 3 identifies potential contributing factors to the performance needs calculated in Step 2. These contributing factors provide information on what types of improvements may help improve performance. Crash frequencies for each possible crash type descriptor were summarized for each corridor segment with an elevated level of need (Medium or High) and each hot spot, and are contained in **Appendix F**. The crash type descriptors include the following components:

- First harmful event - collision with motor vehicle, overturning, collision with fixed object, etc.
- Manner of collision - single vehicle, angle, sideswipe, etc.
- Crash severity – fatal, incapacitating injury, possible injury, etc.
- Lighting condition – daylight, dawn, dark-lighted, dark-unlighted, etc.

- Surface condition – dry, wet, snow, etc.
- Weather condition – clear, rain, cloudy, etc.
- Direction of travel – northbound, southbound, etc.

Safety Needs Contributing Factors

Table 19 summarizes the likely contributing factors to Safety needs on the I-37 Corridor while Figure 32 shows the final Safety needs.

Table 18 – Safety Needs

Segment	Operating Environment	Segment Length (miles)	Segment Mileposts (MP)	Safety Index		Mainlane Directional				Frontage Roads		Initial Segment Safety Need	Final Segment Safety Need	Comments
						Performance Score		Level of Need						
				Performance Score	Level of Need	NB	SB	NB	SB	Performance Score	Level of Need			
1	Rural Interstate	3	14-17	4.46	Medium	76.69	111.49	Medium	High	118.16	Low	Medium	Medium	
2	Rural Interstate	14	17-31	3.47	Low	32.83	34.35	None	None	189.96	High	Low	Low	
3	Rural Interstate	3	31-34	6.25	High	46.66	49.57	None	None	208.57	High	High	High	
4	Rural Interstate	14	34-48	3.11	None	41.27	44.50	None	None	120.16	Low	None	None	
5	Rural Interstate	9	48-57	4.53	Medium	65.67	44.89	Low	None	513.35	High	High	High	
6	Rural Interstate	16	57-73	3.48	Low	34.53	33.19	None	None	146.43	Medium	Low	Low	
7	Rural Interstate	11	73-84	3.05	None	27.03	27.75	None	None	73.22	None	None	None	
8	Rural Interstate	7	84-91	4.14	Low	43.43	43.43	None	None	N/A	N/A	Low	Low	
9	Rural Interstate	7	91-98	6.66	High	68.77	52.45	Low	Low	80.15	None	High	High	
10	Rural Interstate	5	98-103	2.25	None	47.30	26.81	None	None	149.61	Medium	None	None	
11	Rural Interstate	7	103-110	2.70	None	52.86	39.64	Low	None	29.71	None	None	None	
12	Rural Interstate	8	110-118	2.22	None	35.16	46.60	None	None	146.98	Medium	None	None	
13	Rural Interstate	7	118-125	2.37	None	21.19	22.44	None	None	0.00	None	None	Low	Elevated Need from None to Low due to presence of hotspot
14	Rural Interstate	9	125-134	2.52	None	56.62	53.20	Low	Low	27.89	None	None	None	

Level of Need	Performance Score Relation to Level of Need		
None	< 3.27	< 51.78	< 97.90
Low	3.27 – 4.36	51.78 – 69.04	97.90 – 130.57
Medium	4.36 – 5.46	69.04 – 86.30	130.57 – 163.23
High	> 5.46	> 86.30	> 163.23

Performance Measure	Weight Factor	% Distribution
Safety Index	1.0	77%
Directional Mainlane Crashes	0.2	15%
Frontage Road Crashes	0.1	8%

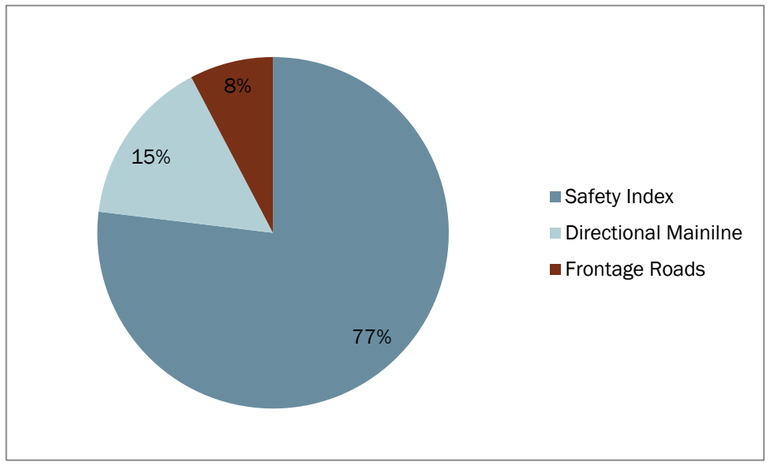
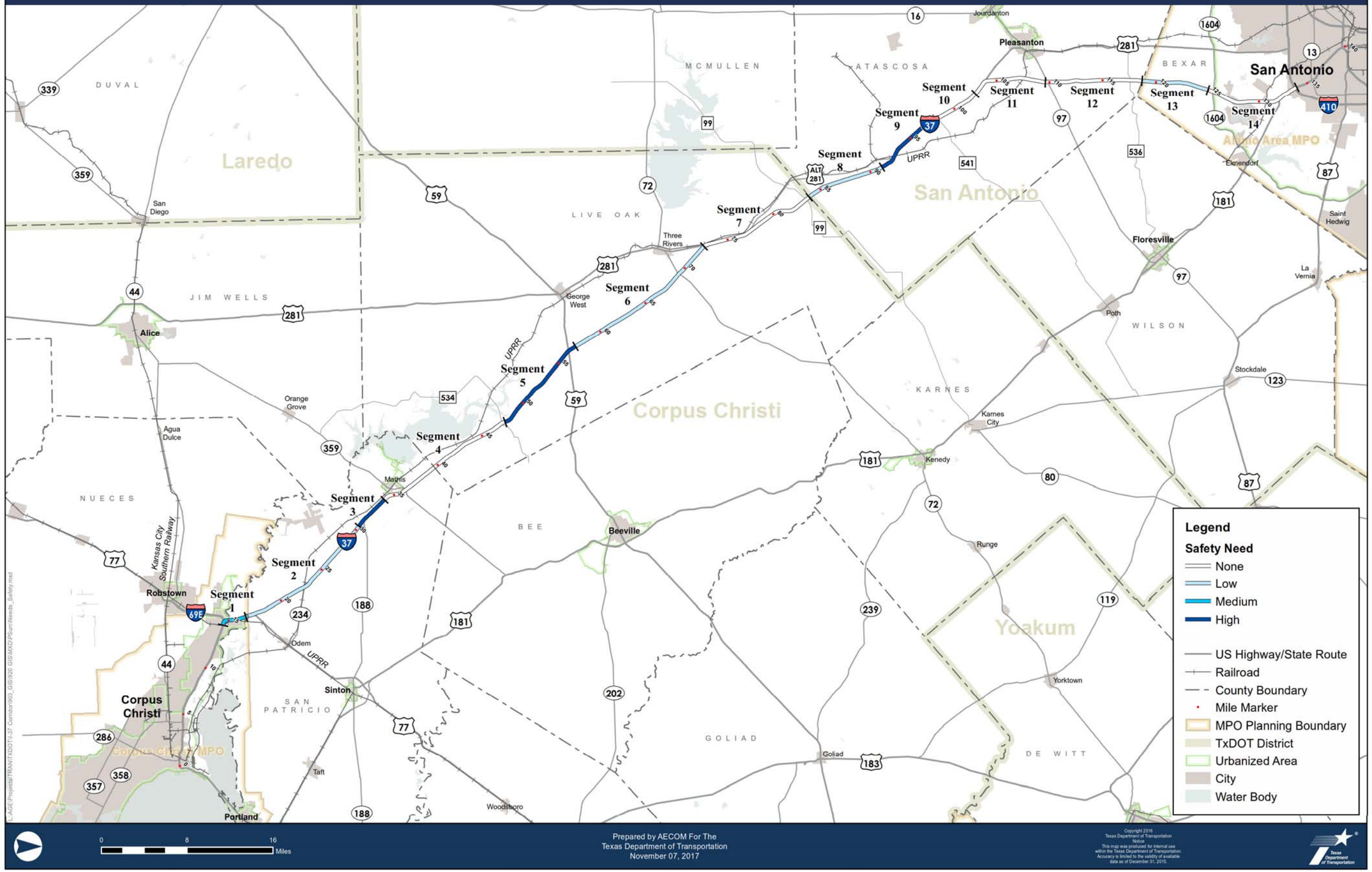


Table 19 – Safety Contributing Factors

Segment	Segment Mileposts (MP)	Segment Length (miles)	Final Segment Safety Need	Contributing Factors		
1	14-17	3	Medium	Contributing Factors: • 34% of all crashes and 25% of K&A crashes involve speeding on the mainlanes.	First Harmful Event Type: • 53% of all crashes involve collision with fixed object on the mainlanes.	Weather Condition: • 43% of all crashes occur in rain condition on the mainlanes.
2	17-31	14	Low	Contributing Factors: • 37% of all crashes and 42% of K&A crashes involve overturning on the mainlanes. • 22% of all crashes involve animal on road on the frontage road.	Light Condition: • 42% of K&A crashes occur in dark, unlighted condition on the mainlanes. • 33% of all crashes occur in dark, unlighted condition on frontage road.	First Harmful Event Type: • 43% of all crashes involve collision with fixed object and 50% of K&A crashes involve overturning on the mainlane. • 58% of all crashes involve collision with fixed object on the frontage road.
3	31-34	3	High	Contributing Factors: • 33% of K&A crashes involve under influence on the mainlanes. Light Condition: • 44% of all crashes and 56% of K&A crashes occur in dark, unlighted condition on the mainlanes.	First Harmful Event Type: • 29% of all crashes involve collision with fixed object on the frontage road.	Manner of Collision: • 14% of all crashes involve one motor vehicle – turning right and 14% of all crashes involve same direction – both going straight, rear end on the frontage road
4	34-48	14	None			
5	48-57	9	High	Contributing Factors: • 60% of K&A crashes involve driver physical condition, and 40% of the K&A crashes involve under influence on the mainlanes. • 32% of all crashes involve inattention/distraction and 24% of all crashes involve speeding on the frontage road.	Light Condition: • 36% of all crashes and 40% of K&A crashes occur in dark, unlighted condition on the mainlanes. Weather Condition: • 18% of all crashes occur in rain condition on the mainlanes.	
6	57-73	16	Low	Light Condition: • 53% of K&A crashes occur in dark, unlighted condition on the mainlanes.	Manner of Collision: • 11% of K&A crashes involve opposite direction - both going straight on the mainlanes	
7	73-84	11	None			
8	84-91	7	Low	Contributing Factors: • 58% of K&A crashes involve driver physical conditions and 25% of K&A crashes involve under influence on the mainlanes.	First Harmful Event: • 67% of K&A crashes involve overturning on the mainlanes.	
9	91-98	7	High	Overall Segment: Light Condition: • 38% of all crashes and 42% of K&A crashes occur in dark, unlighted condition on the mainlanes. First Harmful Event Type: • 50% of K&A crashes involve overturning on the mainlanes.	Hot spot MP 93-95: Contributing Factors: • 13% of K&A crashes involve under influence on the mainlanes. Light Condition: • 40% of all crashes and 27% of K&A crashes occur in dark, unlighted condition on the mainlanes.	
10	98-103	5	None			
11	103-110	7	None			
12	110-118	8	None			
13	118-125	7	Low	Overall Segment: Light Condition: • 67% of K&A crashes occur in dark, unlighted condition on the mainlanes.	Hot spot MP 124-125: Contributing Factors: • 52% of all crashes involve inattention/distraction and 13% of K&A crashes involve under influence on the mainlanes. Light Condition: • 38% of all crashes and 88% of K&A crashes occur in dark, unlighted condition on the mainlanes.	
14	125-134	9	None			

Figure 32 – Final Safety Needs



3.3.5 Freight Performance Area Needs (Steps 1-3)

Step 1 - Initial Freight Needs

The baseline performance scores for the I-37 Corridor were used to determine the initial freight needs. The performance scores are based on the 2015 HERE speed data and the BRINSAP bridge data.

Step 1 uses the scores for the Freight Index primary performance measure and four secondary performance measures to determine the initial level of need by segment for each performance measure individually as well as for all performance measures combined.

The performance scores and initial levels of need for each freight performance measure and for all freight performance measures combined are shown in **Table 20**.

Step 2 - Freight Need Refinement

Once the initial freight needs were established, they were then refined in Step 2 to more accurately reflect existing needs. An evaluation of hot spots as well as relevant recently completed and under-construction projects was performed to determine if segment need levels required adjustment. The initial needs were then refined based on this assessment to determine the final need for each segment. The Step 2 process is described in more detail below and summarized in **Table 20**.

Freight Hot Spots

There are three segments containing a freight hot spot. One freight hot spot is located within a segment that does not already have an identified initial need, so the need on this segment was adjusted to account for the hot spot.

Recently Completed and Under-Construction Projects

TxDOT provided information on potentially relevant, recently completed, and under-construction projects that were not previously reflected in the baseline performance data. This includes any projects completed or under construction that have the potential to mitigate a freight need on a corridor segment. There were no recently completed projects along I-37 that changed the Freight level of need, as shown in **Table 20**.

Step 3 - Freight Contributing Factors

Step 3 identifies potential contributing factors to the performance needs calculated in Step 2. These contributing factors provide information on what types of improvements may help improve performance. Contributing factors include:

- Roadway variables
- Traffic variables
- Relevant freight-related existing infrastructure
- Non-actionable conditions.

The contributing factors for the freight performance area are very similar to those for the mobility performance area. A detailed discussion of these factors was included in section 3.3.3.

Table 21 summarizes the potential contributing factors to Freight needs on the I-37 Corridor while **Figure 33** shows the final Freight needs.

Table 20 – Freight Needs

Segment	Facility Operations	Segment Mileposts (MP)	Segment Length (miles)	Freight Index		Directional TTI (trucks only)				Directional PTI (trucks only)				Bridge Load Rating		Bridge Clearance		Initial Segment Freight Need	Final Segment Freight Need	Comments
				Performance Score	Level of Need	Performance Score		Level of Need		Performance Score		Level of Need		Performance Score	Level of Need	Performance Score	Level of Need			
						NB	SB	NB	SB	NB	SB	NB	SB							
1	Uninterrupted	14-17	3	0.15	Low	1.04	1.04	None	None	1.19	1.16	None	None	Good	None	16.33	Low	Low	Low	
2	Uninterrupted	17-31	14	0.11	None	1.02	1.02	None	None	1.11	1.13	None	None	Good	None	16.08	Medium	Low	Low	
3	Uninterrupted	31-34	3	0.08	None	1.02	1.02	None	None	1.09	1.10	None	None	Good	None	16.75	None	None	None	
4	Uninterrupted	34-48	14	0.07	None	1.02	1.02	None	None	1.09	1.07	None	None	Good	None	16.25	Low	None	None	
5	Uninterrupted	48-57	9	0.12	None	1.01	1.03	None	None	1.07	1.15	None	None	Good	None	16.17	Low	Low	Low	
6	Uninterrupted	57-73	16	0.08	None	1.02	1.03	None	None	1.09	1.11	None	None	Good	None	16.42	Low	None	None	
7	Uninterrupted	73-84	11	0.09	None	1.02	1.03	None	None	1.10	1.12	None	None	Good	None	16.50	None	None	None	
8	Uninterrupted	84-91	7	0.10	None	1.02	1.03	None	None	1.08	1.13	None	None	Good	None	16.17	Low	None	Low	LiDar data shows lower clearance than BRINSAP at FM 791; Increased Need due to presence of hot spot
9	Uninterrupted	91-98	7	0.06	None	1.02	1.02	None	None	1.08	1.08	None	None	Good	None	No UP	None	None	None	
10	Uninterrupted	98-103	5	0.06	None	1.02	1.02	None	None	1.08	1.08	None	None	Good	None	No UP	None	None	None	
11	Uninterrupted	103-110	7	0.09	None	1.02	1.02	None	None	1.11	1.09	None	None	Good	None	15.83	High	Low	Low	
12	Uninterrupted	110-118	8	0.07	None	1.02	1.01	None	None	1.09	1.05	None	None	Good	None	16.83	None	None	None	
13	Uninterrupted	118-125	7	0.10	None	1.01	1.02	None	None	1.06	1.12	None	None	Good	None	16.33	Low	None	None	
14	Uninterrupted	125-134	9	0.19	Low	1.04	1.05	None	None	1.18	1.24	None	None	Good	None	16.50	None	Low	Low	

Level of Need	Performance Score Relation to Level of Need				
None	< 0.15	< 1.21	< 1.37	Good	> 16.50
Low	0.15 – 0.28	1.21 – 1.27	1.37 – 1.43	N/A	16.17 – 16.50
Medium	0.28 – 0.42	1.27 – 1.39	1.43 – 1.57	Fair	15.83 – 16.50
High	> 0.42	> 1.39	> 1.57	Poor	< 15.83

Performance Measure	Weight Factor	% Distribution
Freight Index	1.0	56%
Directional TTI (trucks only)	0.2	11%
Directional PTI (trucks only)	0.2	11%
Bridge Load Rating	0.2	11%
Bridge Clearance (feet)	0.2	11%

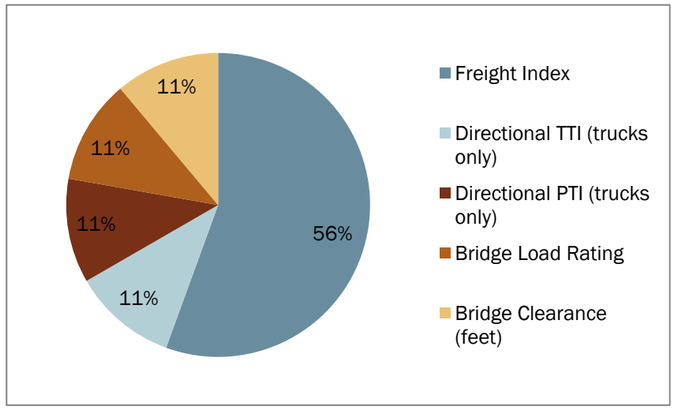
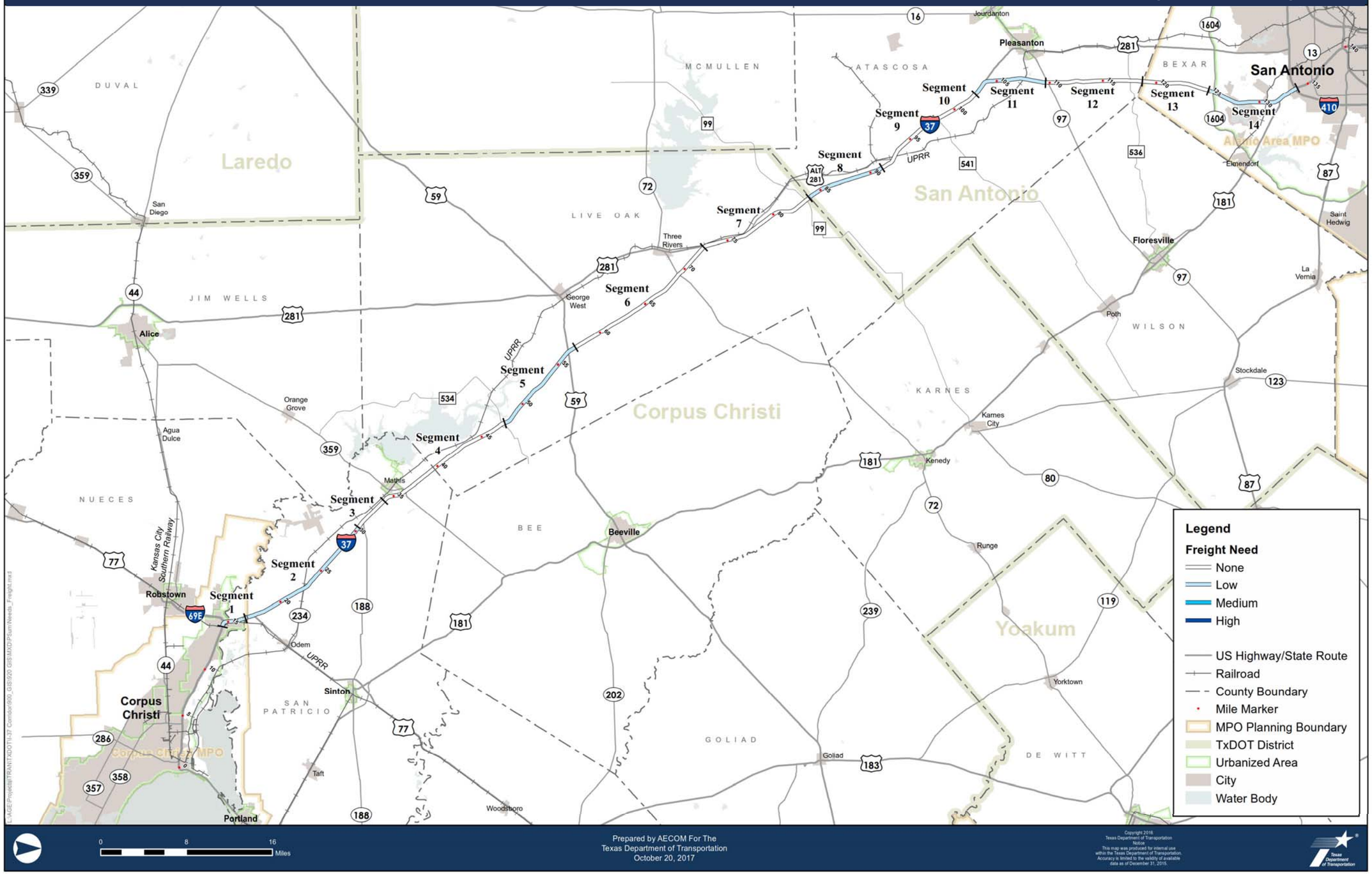


Table 21 – Freight Contributing Factors

Segment	Segment Mileposts (MP)	Segment Length (miles)	Final Segment Freight Need	Roadway Variables								Traffic Variables					Non-Actionable Conditions
				Functional Classification	Environmental Type (Urban/Rural)	Terrain	# of Lanes/ Direction	Speed Limit	Aux Lanes	Divided/ Non-Divided	% No Passing	Existing LOS	Future 2040 LOS	% Trucks	NB Truck Buffer Index (PTI-TTI)	SB Truck Buffer Index (PTI-TTI)	
1	14-17	3	Low	Interstate	Rural	Level	3	75	No	Divided	0%	A-B	D or Less	17%	0.15	0.12	None
2	17-31	14	Low	Interstate	Rural	Level	2	75	No	Divided	0%	A-B	C	20%	0.09	0.11	None
3	31-34	3	None	Interstate	Rural	Level	2	75	No	Divided	0%	A-B	C	21%	0.07	0.08	None
4	34-48	14	None	Interstate	Rural	Level	2	75	No	Divided	0%	A-B	A-B	23%	0.07	0.05	None
5	48-57	9	Low	Interstate	Rural	Level	2	75	No	Divided	0%	A-B	A-B	24%	0.06	0.12	None
6	57-73	16	None	Interstate	Rural	Level	2	75	No	Divided	0%	A-B	A-B	22%	0.07	0.08	None
7	73-84	11	None	Interstate	Rural	Level	2	75	No	Divided	0%	A-B	D or Less	25%	0.08	0.09	None
8	84-91	7	Low	Interstate	Rural	Level	2	75	No	Divided	0%	A-B	C	28%	0.06	0.10	None
9	91-98	7	None	Interstate	Rural	Level	2	75	No	Divided	0%	A-B	C	26%	0.06	0.06	None
10	98-103	5	None	Interstate	Rural	Level	2	75	No	Divided	0%	A-B	C	25%	0.06	0.06	None
11	103-110	7	Low	Interstate	Rural	Level	2	75	No	Divided	0%	A-B	C	27%	0.09	0.07	None
12	110-118	8	None	Interstate	Rural	Level	2	75	No	Divided	0%	A-B	D or Less	23%	0.07	0.04	None
13	118-125	7	None	Interstate	Rural	Level	2	75	No	Divided	0%	A-B	D or Less	22%	0.05	0.10	None
14	125-134	9	Low	Interstate	Rural	Level	2.1	70	No	Divided	0%	C	D or Less	16%	0.14	0.19	None

Segment	Segment Mileposts (MP)	Segment Length (miles)	Final Segment Freight Need	Contributing Factors
1	14-17	3	Low	NB Truck Buffer Index is slightly elevated meaning that this segment has frequent non-recurring delays
2	17-31	14	Low	
3	31-34	3	None	
4	34-48	14	None	
5	48-57	9	Low	SB Truck Buffer Index is slightly elevated meaning that this segment has frequent non-recurring delays; vertical clearance restriction at Hailey Ranch (CR 356) TI
6	57-73	16	None	
7	73-84	11	None	
8	84-91	7	Low	Vertical clearance restriction at FM 791
9	91-98	7	None	
10	98-103	5	None	
11	103-110	7	Low	Vertical clearance restriction at Coughran Rd TI and SH 97 TI
12	110-118	8	None	
13	118-125	7	None	
14	125-134	9	Low	SB Truck Buffer Index is slightly elevated meaning that this segment has frequent non-recurring delays

Figure 33 – Final Freight Needs



3.3.6 Corridor-Wide Performance Area Needs

The previous sections describe the needs analysis for the segments along the I-37 corridor. However, several conditions do not lend themselves to the segment-level analysis, including the following:

- Truck parking
- Frontage roads
- Access control breaks
- Parallel route travel demand
- Floodplains.

The needs analysis for these elements was conducted with a slightly different approach as the process only involved Step 1 and did not include Steps 2 or 3. The baseline performance scores for the I-37 Corridor were used to determine the corridor-wide needs. Step 1 uses the corridor-wide scores for the five performance measures to determine the level of need by segment for each performance measure individually as well as for all performance measures combined.

The performance scores and levels of need for each corridor-wide performance measure are shown in **Table 22**.

Table 22 – Corridor-Wide Needs

Segment	Segment Length (miles)	Segment Mileposts (MP)	% of Frontage Roads on Segment				Regional Travel Demand (V/C)		Number of Access Control Breaks		Truck Parking		Total Width of Floodplain Crossings (ft)		Corridor-Wide Need
			Performance Score		Level of Need		Performance Score	Level of Need	Performance Score	Level of Need	Performance Score	Level of Need	Performance Score	Level of Need	
			NB	SB	NB	SB									
1	3	14-17	87%	70%	Low	Medium	0.34	None	0.0	None	180	None	8,000	High	High
2	14	17-31	96%	99%	Low	Low		None	0.4	Medium		None	0	None	Medium
3	3	31-34	100%	100%	Low	Low		None	0.0	None		None	0	None	None
4	14	34-48	90%	15%	Low	High		None	0.2	Low		None	0	None	Medium
5	9	48-57	100%	91%	Low	Low		None	0.1	None		None	0	None	Low
6	16	57-73	100%	100%	Low	Low	0.47	None	0.3	Low	191	None	0	None	Low
7	11	73-84	66%	63%	Medium	Medium		None	0.9	High		None	0	None	High
8	7	84-91	0%	0%	High	High		None	1.0	High		None	0	None	High
9	7	91-98	87%	80%	Low	Low		None	0.0	None		None	0	None	Low
10	5	98-103	100%	100%	Low	Low	0.60	Low	0.8	High	165	None	0	None	High
11	7	103-110	34%	16%	High	High		Low	0.4	Medium		None	0	None	Medium
12	8	110-118	31%	30%	High	High		Low	0.4	Medium		None	0	None	Medium
13	7	118-125	0%	6%	High	High		Low	0.1	None		None	0	None	Medium
14	9	125-134	52%	47%	Medium	High		Low	0.4	Medium		None	0	None	Medium

Level of Need	Performance Score Relation to Level of Need				
None	100%	< 0.56	< 0.10	> 160	< 250
Low	75% – 100%	0.56 – 0.69	0.10 – 0.37	106 – 160	250 – 1750
Medium	50% – 75%	0.69 – 0.83	0.37 – 0.63	53 – 106	1750 – 3250
High	< 50%	> 0.83	> 0.63	< 53	> 3250

3.4 Needs Summary

Segment Review (Step 4)

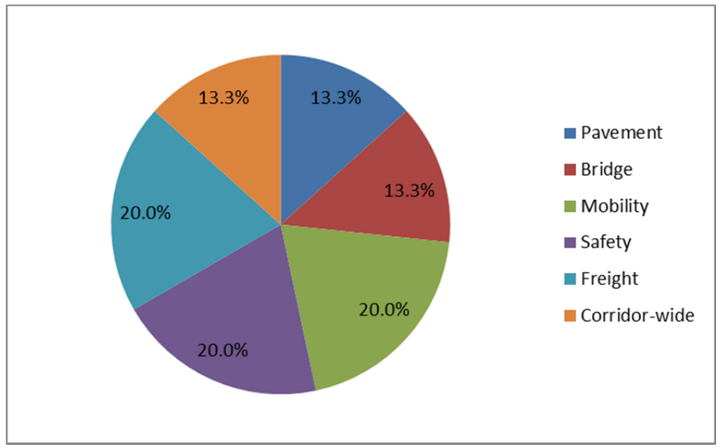
As part of Step 4, the final needs results for each segment were combined to determine the average numeric level of need for each segment along the I-37 Corridor. During coordination with the San Antonio and Corpus Christi Districts, the Mobility, Safety, and Freight Performance Areas were identified as Emphasis Areas. Therefore, a weighting factor of 1.50 was applied to those performance area need scores. A summary of the segment needs is shown in **Table 23** and along with the resulting average segment need. The average segment need is also shown in **Figure 34**. These results are intended for use in comparing the level of need across segments and across corridors.

Table 23 – Segment Needs Summary

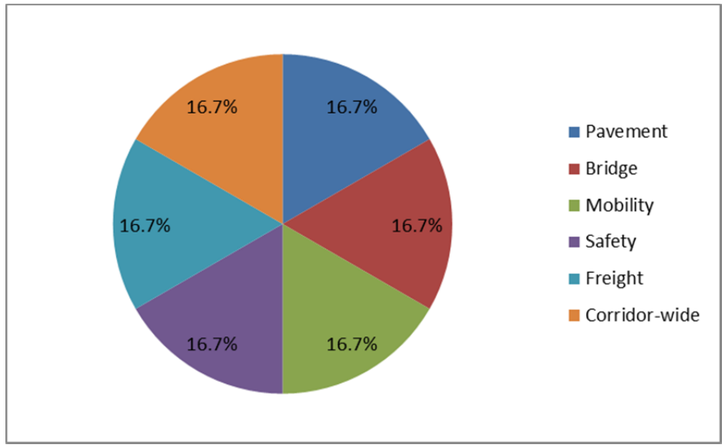
Performance Area	Segment & Milepost													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	MP 14-17	MP 17-31	MP 31-34	MP 34-48	MP 48-57	MP 57-73	MP 73-84	MP 84-91	MP 91-98	MP 98-103	MP 103-110	MP 110-118	MP 118-125	MP 125-134
Pavement	0.03	0.52	0.68	0.11	0.03	0.52	0.94	0.00	0.71	0.83	0.14	0.12	0.00	0.35
Bridge	1.75	1.27	0.00	0.53	0.76	0.62	0.23	0.73	0.63	0.00	1.65	0.81	0.60	0.60
Mobility *	1.62	0.73	0.45	0.29	1.41	0.77	0.85	0.70	0.60	0.74	0.37	2.95	3.88	6.66
Safety *	2.29	1.01	3.67	0.48	3.11	0.89	0.30	1.30	3.80	0.23	0.06	0.22	0.50	0.14
Freight *	0.70	0.55	0.00	0.25	0.57	0.15	0.15	0.92	0.00	0.00	0.55	0.00	0.33	0.90
Corridor-Wide	5.86	1.69	0.36	1.67	0.57	1.32	3.82	4.58	0.55	3.35	2.13	1.93	2.23	1.61
Weighted Average Need (0-3)	1.94	0.92	1.06	0.62	1.27	0.75	0.93	1.29	1.13	0.75	0.72	1.02	1.32	1.88
Unweighted Average Need (0-3)	2.04	0.96	0.86	0.56	1.08	0.71	1.05	1.37	1.05	0.86	0.82	1.01	1.26	1.71

Level of Need	Score
NONE	0 - 0.5
LOW	0.5 - 1.5
MEDIUM	1.5 - 2.5
HIGH	> 2.5

Weighted Average Need*

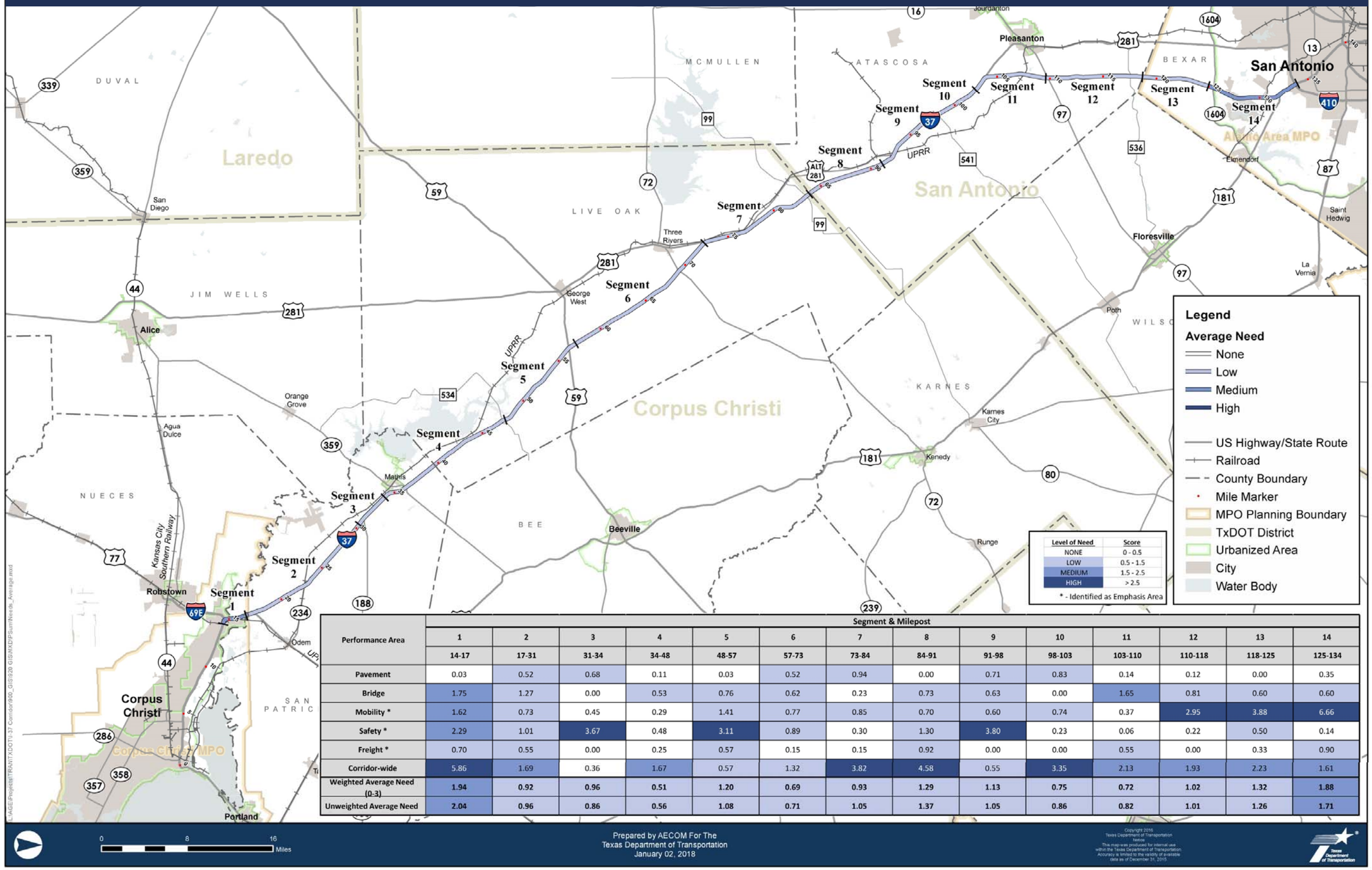


Unweighted Average Need



* Emphasis Areas are weighted by a factor of 1.5

Figure 34 – Average Segment Needs



Performance Area	Segment & Milepost													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	14-17	17-31	31-34	34-48	48-57	57-73	73-84	84-91	91-98	98-103	103-110	110-118	118-125	125-134
Pavement	0.03	0.52	0.68	0.11	0.03	0.52	0.94	0.00	0.71	0.83	0.14	0.12	0.00	0.35
Bridge	1.75	1.27	0.00	0.53	0.76	0.62	0.23	0.73	0.63	0.00	1.65	0.81	0.60	0.60
Mobility *	1.62	0.73	0.45	0.29	1.41	0.77	0.85	0.70	0.60	0.74	0.37	2.95	3.88	6.66
Safety *	2.29	1.01	3.67	0.48	3.11	0.89	0.30	1.30	3.80	0.23	0.06	0.22	0.50	0.14
Freight *	0.70	0.55	0.00	0.25	0.57	0.15	0.15	0.92	0.00	0.00	0.55	0.00	0.33	0.90
Corridor-wide	5.86	1.69	0.36	1.67	0.57	1.32	3.82	4.58	0.55	3.35	2.13	1.93	2.23	1.61
Weighted Average Need (0-3)	1.94	0.92	0.96	0.51	1.20	0.69	0.93	1.29	1.13	0.75	0.72	1.02	1.32	1.88
Unweighted Average Need	2.04	0.96	0.86	0.56	1.08	0.71	1.05	1.37	1.05	0.86	0.82	1.01	1.26	1.71

Corridor Review (Step 5)

Step 5 translates the performance-based needs into corridor needs that are "actionable." These needs can facilitate development of solutions (projects, initiatives, countermeasures, and programs) to improve corridor performance through strategic investments.

Pavement Needs

- Based on the segment-level analysis, Pavement needs were identified on approximately 45% of the corridor.
- All of segment-based Pavement needs were classified as Low need.
- Pavement hot spots were identified at:
  - Segment 7 southbound mainlanes MP 76 - 77
  - Segment 9 northbound mainlanes MP 92 - 94
  - A total of approximately 35 miles along the frontage roads in Segments 1 - 4, 6, 7, 9 – 12, and 14.

Bridge Needs

- Based on the segment-level analysis, Bridge needs were identified on approximately 85% of the corridor.
- Approximately 75% of the corridor has a Low Bridge need while the remaining 10% has an elevated level of need.
- Eight bridges along the corridor have been identified as a hot spot:
  - Nueces River (Str #40548) (MP 16.64)
  - CR 1726/Cooper Rd (Str #405111) (MP 20.58)
  - IH 37 WFR UP (Str #405038)(MP 22.64)
  - Sulphur Creek EFR (Str #401033)(MP 65.30)
  - FM 791 UP (Str #306169)(MP 90.44)
  - UPRR & Atascosa River OP NB (Str #310251)(MP 107.52)
  - UPRR & Atascosa River OP NB (Str #310251)(MP 107.52)
  - Corgey Rd UP (Str #310250)(MP 108.55).
- Fifteen bridges along the corridor were identified though the historical review process as having their ratings change more frequently than the corridor average:
  - Sharpsburg Rd OP SB (Str #406197)(MP 15.31)
  - Sharpsburg Rd OP NB (Str #406195)(MP 15.31)
  - Connector to US 77 NB UP (Str #405112)(MP 17.18)
  - Arroyo Nombre de Dios OP NB (Str #404118)(MP 30.52)
  - FM 796 UP (Str #405108)(MP 23.12)
  - US 59 OP NB (Str #402148)(MP 56.48)
  - Gamble Gully OP SB (Str #402145)(MP 57.01)
  - Sulphur Creek OP WFR (Str #401177)(MP 65.27)
  - SH 72 OP SB (Str #401184)(MP 69.18)
  - SH 72 OP NB (Str #401185)(MP 69.18)
  - Brush Pen Hollow Creek OP SB (Str #307210)(MP 76.16)
  - San Christoval Creek OP NB (Str #307215)(MP 77.29)
  - Salt Branch Creek OP WFR (Str #307223)(MP 83.08)
  - UPRR RR OP WFR (Str #305013)(MP 92.74)

  - Corgey Rd UP (Str #310250)(MP 108.55).
- One bridge along the corridor has been identified as a hot spot and was identified though the historical review process:
  - Corgey Rd UP (Str #310250)(MP 108.55).

Mobility Needs

- Based on the segment-level analysis, Mobility needs were identified on approximately 80% of the corridor.
- Approximately 60% of the corridor has a Low Mobility need while the remaining 20% has an elevated level of need.
- MP 14 – 17 (Segment 1) has an elevated level of need primarily related to future travel demand along the mainlanes in the Corpus Christi area.
- MP 110 – 134 (Segments 12 -14) has an elevated level of need primarily related to future travel demand along the mainlanes, and existing and future travel demand at several interchanges in the San Antonio area.
- The US 59 interchange (MP 56.5)(Segment 5) has been identified as a mobility bottleneck based on existing and future travel demand.

Safety Needs

- Based on the segment-level analysis, Safety needs were identified on approximately 50% of the corridor.
- Approximately 30% of the corridor has a Low Safety need while 20% has an elevated level of need.
- MP 14 – 17 (Segment 1) has an elevated level of need due to all crashes along the mainlanes, and crashes along the frontage roads.
- MP 31 – 34 (Segment 3) has an elevated level of need primarily related to fatal and incapacitating crashes along the mainlanes, and crashes along the frontage roads.
- MP 48 – 57 (Segment 5) has an elevated level of need primarily related to fatal and incapacitating crashes along the mainlanes, and crashes along the frontage roads.
- MP 91 – 98 (Segment 9) has an elevated level of need primarily related to fatal and incapacitating crashes along the mainlanes.
- A crash hot spot was identified at MP 124-125 along the mainlanes (Segment 13).

Freight Needs

- Based on the segment-level analysis, Freight needs were identified on approximately 40% of the corridor.
- All of segment-based Freight needs were classified as Low need.
- Freight bottlenecks were identified at the US 59, FM 791, Coughran Rd, and SH 97 interchanges.

Corridor-Wide Needs

- Segments 4, 7, 8, and 11 – 14 are missing significant sections of frontage roads.
- Segments 2, 7, 8, 10, 11, 12, and 14 have a high number of access control breaks.
- Segment 1 has 100-year floodplain that encroaches on I-37.

Overlapping Needs

This section identifies overlapping performance needs on I-37, which provide guidance for developing strategic solutions that address more than one performance area. Completing projects that address multiple needs may present the opportunity for more effectively improving overall performance. A summary of the overlapping needs that relate to locations with elevated levels of need is provided below.

- MP 14 - 17 (Segment 1) has elevated needs in the Bridge, Safety, Mobility and Corridor-Wide performance areas. The Bridge and Corridor-Wide needs are related to the Nueces River Bridge and the Mobility needs are related to future travel demand. The safety needs are related to crashes along the mainlanes.
- MP 17 – 31 (Segment 2) has elevated needs in the Corridor-Wide performance area, and has Pavement, Bridge, and Mobility hot spots. The Corridor-Wide needs are related to access control breaks. The pavement hot spot is located along the frontage roads, and the Mobility hot spot is related to the US 77 interchange. The Bridge hot spots are at the CR 1726/Cooper Road underpass and the SH 234 frontage road underpass.
- MP 31 - 34 (Segment 3) has an elevated need in Safety and has a Pavement hot spot. The Safety needs are primarily related to fatal and incapacitating crashes along the mainlanes, and crashes along the frontage roads. The Pavement hot spot is along the frontage road.
- MP 48 - 57 (Segment 5) has an elevated level of need in Safety and a Mobility hot spot. The Safety need is primarily related to fatal and incapacitating crashes along the mainlanes, and crashes along the frontage roads. The Mobility hot spot is at the US 59 interchange.
- MP 57 - 73 (Segment 6) has a Pavement hot spot and a Bridge hot spot. The Pavement hot spot is located along the frontage road and the Bridge hot spot is at the Sulphur Creek OP.
- MP 73 – 84 (Segment 7) has an elevated need in the Corridor-Wide performance area and has Pavement hot spots. The Pavement hot spots are located along the mainlanes and the frontage roads. The Corridor-Wide needs are related to the lack of frontage roads and to access control breaks.
- MP 84 - 91 (Segment 8) has an elevated need in the Corridor-Wide performance area, and has a Bridge hot spot and a Freight hot spot. Both hot spots are at the FM 791 UP bridge. The Corridor-Wide need is related to the lack of frontage roads, and the access control breaks.
- MP 91 - 98 (Segment 9) has elevated needs in Safety and has a Pavement hot spot. The Safety need is primarily related to fatal and incapacitating crashes along the mainlanes. The Pavement hot spot is located on the mainlanes.
- MP 98 - 103 (Segment 10) has an elevated Corridor-Wide need and a Pavement hot spot. The Corridor-Wide need is related to access control breaks and the Pavement hot spot is located along the frontage road.
- MP 103 – 110 (Segment 11) has elevated needs in the Bridge and the Corridor-Wide performance areas, and has Freight hot spots. The Bridge needs are related to the Atascosa River bridges and the Corgey Road bridge. The Freight hot spots are located at the SH97 and Coughran Road bridges. The Corridor-Wide needs are related to the lack of frontage roads and to access control breaks.
- MP 110 – 118 (Segment 12) has elevated needs in the Mobility and Corridor-Wide performance areas. The Mobility needs are related to future travel demand along the mainline and at interchanges while the Corridor-Wide needs are related to the lack of frontage roads and to access control breaks.
- MP 118 - 125 (Segment 13) has an elevated Mobility need and Corridor-Wide need, and has a Safety hot spot. The Mobility needs are primarily related to future travel demand along the mainlanes and at interchanges. The Safety hot spot is related to fatal and incapacitating crashes along the mainlanes. The Corridor-Wide needs are related to the lack of frontage roads.

- MP 125 – 134 (Segment 14) has elevated needs In the Mobility and Corridor-Wide performance areas. The Mobility needs are primarily related to future travel demand along the mainlanes and at interchanges. The Corridor-Wide needs are related to the lack of frontage roads and to access control breaks.

An objective of this corridor study is to identify strategic solutions (investments) that are performance-based to ensure that available funding resources are used to maximize the performance of the corridor. Addressing areas of Medium or High need will have the greatest effect on the corridor performance and will be the focus of the strategic solutions. Segments with Medium or High needs, and specific locations of hot spots are considered candidates for strategic solutions. Segments with lower levels of need or without identified hot spots are not considered candidates for strategic investment and are expected to be addressed through other TxDOT programming processes. The areas of the I-37 Corridor identified for potential strategic investments are shown in **Table 24 and Figure 35.**

3.5 Stakeholder Outreach

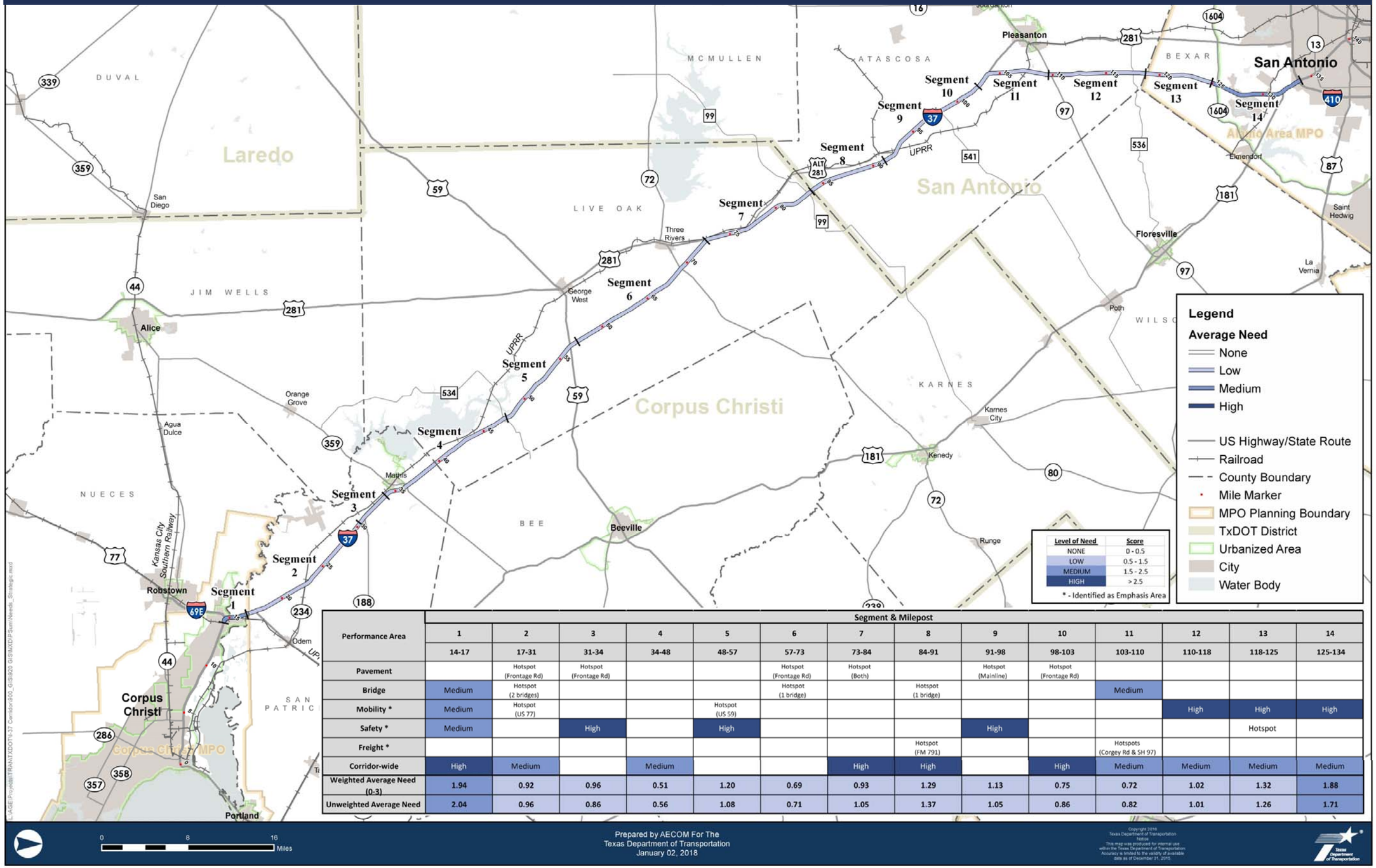
During the first I-37 Corridor Study webinar held on August 24, 2017, the participants had an opportunity to listen to the TxDOT project manager and AECOM project team members describe the background and need for the corridor study; explain the performance-based analysis process; and review the identified needs in the study area by segment of the corridor. In general the participants asked about the safety of the I-37 bridges, environmental impacts, the ability to provide feedback and to access information regarding whether segment data reflects local concerns, and if specific projects had already been identified. Project team members replied to all of these questions and encouraged the participants to complete an online survey (MetroQuest) to document their concerns and comments. The input received during the seminar was considered during the subsequent analysis and identification of potential corridor solutions. A copy of the webinar PowerPoint, along with the script and questions asked by participants may be found in Appendix B.

An online interactive survey was developed for the study using the MetroQuest platform. This survey was available on the I-37 project page at www.txdot.gov from the date of the webinar (August 24) until September 30, 2017. The survey was intended to extend the reach of the webinar by offering input opportunities to the entire stakeholder list whether or not an individual had participated in the webinar. Thirty-four people responded to the survey, which asked respondents to prioritize the performance measures used in the corridor study, identify concerns along the corridor by type and geographic location, and leave general comments. The results of this survey may be found in Appendix B.

Table 24 – Strategic Investment Areas

Performance Area	Segment & Milepost													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	MP 14-17	MP 17-31	MP 31-34	MP 34-48	MP 48-57	MP 57-73	MP 73-84	MP 84-91	MP 91-98	MP 98-103	MP 103-110	MP 110-118	MP 118-125	MP 125-134
Pavement		Hotspot (Frontage Rd)	Hotspot (Frontage Rd)			Hotspot (Frontage Rd)	Hotspot (Both)		Hotspot (Mainlanes)	Hotspot (Frontage Rd)				
Bridge	Medium	Hotspot (2 bridges)				Hotspot (1 bridge)		Hotspot (1 bridge)			Medium			
Mobility *	Medium	Hotspot (US 77)			Hotspot (US 59)		Hotspot (US 281)					High	High	High
Safety *	Medium		High		High				High				Hotspot	
Freight *								Hotspot (FM 791)						
Corridor-Wide	High	Medium		Medium			High	High		High	Medium	Medium	Medium	Medium
Average Need (0-3)	1.94	0.92	1.06	0.62	1.27	0.75	0.93	1.29	1.13	0.75	0.72	1.02	1.32	1.88

Figure 35 – Strategic Locations



Performance Area	Segment & Milepost													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	14-17	17-31	31-34	34-48	48-57	57-73	73-84	84-91	91-98	98-103	103-110	110-118	118-125	125-134
Pavement		Hotspot (Frontage Rd)	Hotspot (Frontage Rd)			Hotspot (Frontage Rd)	Hotspot (Both)		Hotspot (Mainline)	Hotspot (Frontage Rd)				
Bridge	Medium	Hotspot (2 bridges)				Hotspot (1 bridge)		Hotspot (1 bridge)			Medium			
Mobility *	Medium	Hotspot (US 77)			Hotspot (US 59)							High	High	High
Safety *	Medium		High		High				High				Hotspot	
Freight *								Hotspot (FM 791)			Hotspots (Corgey Rd & SH 97)			
Corridor-wide	High	Medium		Medium			High	High		High	Medium	Medium	Medium	Medium
Weighted Average Need (0-3)	1.94	0.92	0.96	0.51	1.20	0.69	0.93	1.29	1.13	0.75	0.72	1.02	1.32	1.88
Unweighted Average Need	2.04	0.96	0.86	0.56	1.08	0.71	1.05	1.37	1.05	0.86	0.82	1.01	1.26	1.71

4. Strategic Solutions

The needs assessment process can result in the identification of investment locations that already have a programmed project or are non-actionable (cannot be addressed by a TxDOT project). The potential investment locations were examined to determine if the needs in those locations require action. In some cases, needs that are identified do not advance to solution development and are screened out from further consideration because they have been or will be addressed through other measures, including:

- A project is already programmed to address this need.
- The need is a result of a Pavement or Bridge hot spot that does not show historical investment or rating issues; these hot spots will likely be addressed through other TxDOT programming means.
- The need is determined to be non-actionable (i.e., cannot be addressed through a TxDOT project).
- The conditions/characteristics of the location have changed since the performance data was collected that was used to identify the need.
- Other conditions as documented below.

Table 25 notes whether each potential strategic need advanced to solution development, and if not, the reason for screening the potential strategic need out of the process. Locations advancing to solutions development are marked with Yes (Y); locations not advancing are marked with No (N) and highlighted. This screening table provides specific information about the needs in each segment that will be considered for strategic investment. The table identifies the level of need – either Medium or High segment needs, or segments without Medium or High level of need that have a hot spot. Each area of need is assigned a location number in the screening table to help document and track locations considered for strategic investment.

4.1 Candidate Solutions

For each elevated need within a strategic investment area that is not screened out, a candidate solution was developed to address the identified need. Documented performance needs serve as the foundation for developing candidate solutions which are used to identify short-term and mid-term solutions through a performance-based process to address needs in one or more of the five performance areas of Pavement, Bridge, Mobility, Safety, and Freight.

Candidate solutions should include some or all of the following characteristics:

- Address elevated levels of need (High or Medium) and hot spots
- Address overlapping needs
- Reduce costly repetitive maintenance
- Provide measurable benefit.

A set of 32 candidate solutions are proposed to address the identified needs on the I-37 Corridor.

Table 26 identifies each strategic location that has been assigned a candidate solution with a number (e.g., CS 1, CS 2, etc.). Each candidate solution is comprised of one or more components to address the identified needs. The assigned candidate solution numbers are linked to the location number and provide tracking capability through the rest of the process.

Candidate solutions developed to address an elevated need in the Pavement or Bridge performance area include two options: rehabilitation or full replacement. These solutions are initially evaluated through a Life-Cycle Cost Analysis (LCCA) to provide insights into the cost-effectiveness of these options so a recommended approach can be identified. Candidate solutions developed to address an elevated need in the Mobility, Safety, or Freight performance areas are advanced directly to the Performance Effectiveness Evaluation. In some cases, there may be multiple solutions identified to address the same area of need.

Table 25 – Strategic Investment Area Screening

Segment # and MP	Level of Strategic Need						Location #	Type	Need Description	Advance (Y/N)	Screening Description
	Pavement	Bridge	Mobility	Safety	Freight	Corridor-Wide					
1 MP 14-17		Medium	Medium	Medium		High	L1	Bridge	Nueces River Bridge Northbound has a current Structural Evaluation Rating of 5	N	Was not identified as part of historical review
							L2	Mobility	Mobility Need primarily driven by Mainlane Future (2040) V/C due to projected future travel demand	Y	
							L3	Corridor-Wide	Floodplain at Nueces River exceeds roadway elevation	Y	
							L4	Safety	Mainlane crash rates exceed statewide average	Y	
2 MP 17-31	Hot Spot	Hot Spot	Hot Spot			Medium	L5	Bridge	CR1726/Cooper Rd UP Bridge has a current Structural Evaluation Rating of 5	N	Was not identified as part of historical review
							L6	Bridge	IH 37 West Frontage Rd UP Bridge has a current Substructure Rating of 5	N	Was not identified as part of historical review
							L7	Pavement	10 miles of pavement hot spots along frontage roads	Y	
							L8	Mobility	US 77 southbound entrance ramp and northbound exit ramp connections to I-37	Y	
							L9	Corridor-Wide	Elevated density of access control breaks	Y	
3 MP 31-34	Hot Spot			High			L10	Pavement	3 miles of pavement hot spots along frontage roads	Y	
							L11	Safety	Mainlane and Frontage Road crash rates exceed statewide average	Y	
4 MP 34-48						Medium	L12	Corridor-Wide	Lack of southbound frontage road	N	Existing parallel route approximately ¼ mile to the west
5 MP 48-57			Hot Spot	High			L13	Mobility	US 59 interchange along crossroad	Y	
							L14	Safety	Mainlane and Frontage Road crash rates exceed statewide average	Y	
6 MP 57-73	Hot Spot	Hot Spot					L15	Pavement	8 miles of pavement hot spots along frontage roads	N	Was not identified as part of historical review
							L16	Bridge	Sulphur Creek Bridge has a current Deck Rating of 5	N	Was not identified as part of historical review
7 MP 73-84	Hot Spot		Hot Spot			High	L17	Pavement	1 mile of pavement hot spots along mainlane and 6 miles along frontage road	N	Was not identified as part of historical review
							L18	Mobility	US 281 northbound entrance ramp and southbound exit ramp connections to I-37	Y	
							L19	Corridor-Wide	Elevated density of access control breaks	Y	
8 MP 84-91		Hot Spot			Hot Spot	High	L20	Bridge	FM791 UP has a current Superstructure Rating of 5	N	Was not identified as part of historical review
							L21	Freight	FM791 UP shows vertical clearance < 16'	Y	
							L22	Corridor-Wide	Lack of northbound and southbound frontage roads and elevated density of access control breaks	Y	

Eliminated from further consideration

Segment # and MP	Level of Strategic Need						Location #	Type	Need Description	Advance (Y/N)	Screening Description
	Pavement	Bridge	Mobility	Safety	Freight	Corridor-Wide					
9 MP 91-98	Hot Spot			High			L23	Pavement	1 mile of pavement hot spots along mainlanes and 2 miles along frontage road	N	Was not identified as part of historical review
							L24	Safety	Mainlane crash rate exceeds statewide average; Safety Hot Spot near MP 93-95	Y	
10 MP 98-103	Hot Spot					High	L25	Pavement	3 miles of pavement hot spots along frontage roads	N	Was not identified as part of historical review
							L26	Corridor-Wide	Elevated density of access control breaks	Y	
11 MP 103-110		Medium			Hot Spot	Medium	L27	Bridge	UPPR & Atascosa River Bridge Northbound has a current Substructure Rating of 5	N	Was not identified as part of historical review
							L28	Bridge	UPPR & Atascosa River Bridge Southbound has a current Substructure Rating of 5	N	Was not identified as part of historical review
							L29	Bridge	Corgey Road UP Bridge has a current Substructure Rating of 5 and was identified as part of the Historical Ratings Review	Y	
							L30	Freight	Coughran Road UP shows vertical clearance < 16'	Y	
							L31	Freight	SH 97 UP shows vertical clearance < 16'	Y	
							L32	Corridor-Wide	Lack of northbound and southbound frontage roads and elevated density of access control breaks	Y	
12 MP 110-118			High			Medium	L33	Mobility	Mobility Need primarily driven by Mainlane Future (2040) V/C and Traffic Interchange Future (2040) V/C due to projected future travel demand (at SH 97, FM 536, and Verdi Rd interchanges, and at SH 97 northbound entrance ramp and southbound exit ramp connections to I-37)	Y	
							L34	Corridor-Wide	Lack of northbound and southbound frontage roads and elevated density of access control breaks	Y	
13 MP 118-125			High	Hot Spot		Medium	L35	Mobility	Mobility Need primarily driven by Mainlane Future (2040) V/C and Traffic Interchange Future (2040) V/C due to projected future travel demand (at Waterwood Dr/Mathis Rd interchange)	Y	
							L36	Safety	Safety Hot Spot near MP 124-125	Y	
							L37	Corridor-Wide	Lack of northbound and southbound frontage roads	Y	
14 MP 125-134			High			Medium	L38	Mobility	Mobility Need primarily driven by Mainlane Existing and Future (2040) V/C, and Traffic Interchange Existing and Future (2040) V/C (at Southton Rd and Spur 122 interchanges)	Y	
							L39	Corridor-Wide	Elevated density of access control breaks and lack of northbound and southbound frontage roads	Y	
							L40	Mobility	Loop 1604 interchange	N	Improvements programmed in 2018

Eliminated from further consideration

Table 26 – Candidate Solutions

Candidate Solution #	Segment	Location #	Solution Milepost Location	Length	Candidate Solution Name	Option	Scope
1	1	L2, L3, L4, & L8	14 - 18	4	Corpus Christi Mobility Improvements	-	Widen mainlanes to add one lane in each direction from I-69 to US 77 Extend acceleration/merge length for NB entrance ramp from I-69 Extend acceleration/merge length for SB entrance ramp from US 77 Replace NB Nueces River Bridge and raise profile to remove from floodplain
2	2	L9	25 - 29	4	Corpus Christi Access	-	Construct NB & SB exit and entrance ramps to existing frontage roads near MP 25.5 & 28
3	3	L11	31 - 34	3	Mathis Safety Improvements	-	Install NB & SB mainlanes lane departure countermeasures MP 31 - 34 (rumble strips, striping, delineators, raised/reflective pavement markers, chevrons) Install median cable barrier MP 31 -34 Construct roundabouts at ramp/frontage roads intersections at SH 188 interchange Enhance signing (additional signs, larger signs, increased reflectivity) with warning beacons at SH 188 Interchange
4	5	L14	48 - 57	9	George West Safety Improvements	-	Install NB & SB mainlanes lane departure countermeasures MP 48 - 57 (rumble strips, striping, delineators, raised/reflective pavement markers, chevrons) Install NB & SB frontage road lane departure countermeasures MP 48 - 57 (rumble strips, striping, delineators, raised/reflective pavement markers, chevrons) Construct roundabouts at ramp/frontage roads intersections at 6 locations Install median cable barrier MP 52 -54
5		L13	56.5	-	US 59 Interchange Improvement	-	Construct moderate intersection improvements (additional turn lanes on approaches, physical channelization, striping, signing, signalization; no new through lanes)
6		L14	48 - 57	10	George West Lighting	-	Install safety lighting MP 48 - 49 Install safety lighting at CR 356 ramps, MP 51 -52 Install safety lighting at US 59 ramps, MP 55 - 57
7	7	L18	73 -73.5	0.5	Three Rivers Mobility Improvements	-	Extend acceleration/merge length for NB entrance ramp from US 281 Extend deceleration length for SB exit ramp to US 281
8		L19	80 - 81	1	Three Rivers Access	-	Construct NB & SB exit and entrance ramps at grade separation near MP 80.8
9	8	L21	90.4	-	FM 791 Freight Improvements	-	Replace FM 791 bridge to provide additional clearance
10		L22	90-91	1	Cambellton Access	-	Construct NB & SB exit and entrance ramps at grade separation near MP 90.5
11		L22	84 - 91	7	Cambellton Frontage	-	Construct northbound and southbound frontage roads

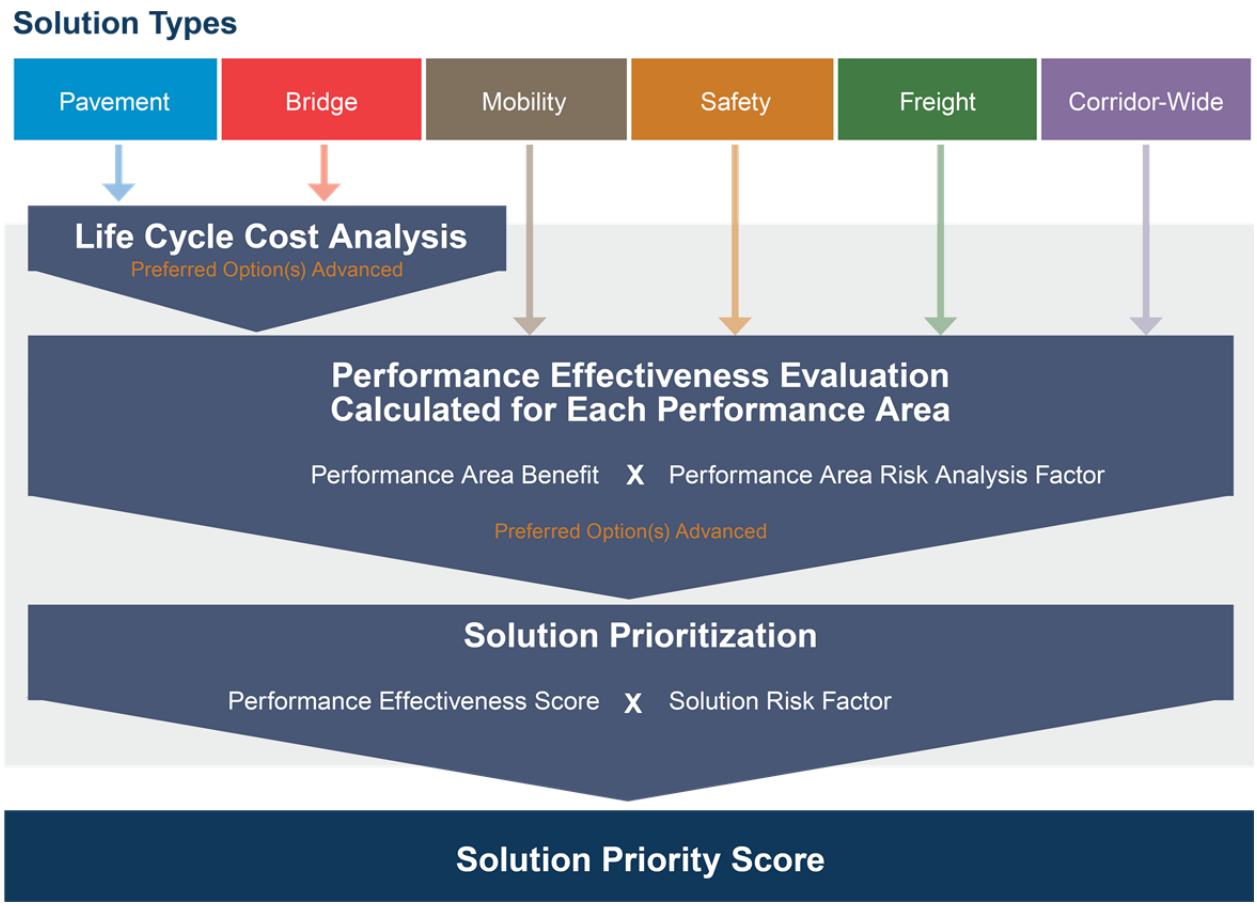
Candidate Solution #	Segment	Location #	Solution Milepost Location	Length	Candidate Solution Name	Option	Scope
12	9	L24	91 - 98	7	Cambellton Safety Improvements	-	Install NB & SB mainlanes lane departure countermeasures MP 91- 98 (rumble strips, striping, delineators, raised/reflective pavement markers, chevrons) Install safety lighting MP 91 - 98 Extend acceleration/merge length for NB entrance ramp from US 281A Install NB & SB roadway departure countermeasures MP 91 - 92 (shoulder rehabilitation, recovery area grading, guardrail, fixed object removal, crash attenuators)
13	10	L26	101.5-102.5	1	Pullin Drive Access		Construct NB exit and entrance ramps to existing frontage roads near MP 102
14	11	L29	108.6	-	Corgey Road Bridge	A	Repair/rehabilitate bridge
						B	Replace bridge
15		L30	106.4	-	Coughran Road Freight Improvements	-	Replace Coughran Road bridge to provide additional clearance
16		L31	109.8	-	SH 97 Freight Improvements	-	Replace SH 97 bridges to provide additional clearance
17		L32	103 - 110	7	South Pleasanton Frontage & Access	-	Construct NB & SB exit and entrance ramps to new frontage roads near MP 107.5 Construct northbound and southbound frontage roads
18	12	L33	109 - 118	9	Pleasanton Mobility Improvements	-	Widen mainlanes to add one lane in each direction from SH 97 to FM 536 Extend acceleration/merge length for NB entrance ramp from SH 97 Extend deceleration length for SB exit ramp to SH 97
19		L33	109.8	-	SH 97 Interchange Improvements	-	Construct moderate intersection improvements (additional turn lanes on approaches, physical channelization, striping, signing, signalization; no new through lanes)
20		L33	117.6	-	FM 536 Interchange Improvement	-	Construct minor intersection improvements (additional turn lanes on some approaches, striping, signing, signalization or signal upgrades; no new through lanes)
21		L33	114	-	Verdi Road Interchange Improvement	-	Construct minor intersection improvements (additional turn lanes on some approaches, striping, signing, signalization or signal upgrades; no new through lanes)
22		L34	110 - 118	8	North Pleasanton Frontage & Access	-	Construct SB exit and entrance ramps to new or existing frontage roads near MP 112 & 115.5 Construct northbound and southbound frontage roads
23	13	L36	117 - 125	7	Floresville Safety Improvements	-	Install continuous lighting from FM 536 to SH 1604
24		L35	118 - 125	7	Floresville Mobility Improvements	-	Widen mainlanes to add one lane in each direction from FM 536 to SH 1604
25		L35	122.7	-	Waterwood Dr/Mathis Rd Interchange Improvement	-	Construct minor intersection improvements (additional turn lanes on some approaches, striping, signing, signalization or signal upgrades; no new through lanes)
26		L37	118 - 125	7	Floresville Frontage	-	Construct northbound and southbound frontage roads
27	14	L38	125 - 134	9	San Antonio Mobility Improvements	-	Widen mainlanes to add one lane in each direction from SH 1604 to I-410

Candidate Solution #	Segment	Location #	Solution Milepost Location	Length	Candidate Solution Name	Option	Scope
28		L38	130	-	Southton Road Interchange Improvement	-	Construct minor intersection improvements (additional turn lanes on some approaches, striping, signing, signalization or signal upgrades; no new through lanes)
29		L39	130-133.5	3.5	San Antonio Frontage & Access	-	Construct SB exit ramp & NB entrance ramp to existing frontage roads near MP 127.5 Construct NB & SB frontage roads
30		L38	132.6	-	Spur 122 Interchange Improvement	-	Construct minor intersection improvements (additional turn lanes on some approaches, striping, signing, signalization or signal upgrade; no new through lanes)
31	2 & 3	L7 & L10	20 – 34	14	Corpus Christi Pavement	A	Repair/rehabilitate northbound and southbound frontage road pavement
						B	Replace northbound and southbound frontage road pavement

4.2 Solution Evaluation and Prioritization

Candidate solutions are evaluated using the following steps: LCCA (where applicable), Performance Effectiveness Evaluation, Solution Risk Analysis, and Candidate Solution Prioritization. The methodology and approach to this evaluation are shown in **Figure 36** and described below.

Figure 36 – Solution Evaluation Process



<u>Life-Cycle Cost Analysis</u>

All Pavement and Bridge candidate solutions have two options: rehabilitation/repair or reconstruction. These options are evaluated through an LCCA to determine the best approach for each location where a Pavement or Bridge solution is recommended. The LCCA can eliminate options from further consideration and identify which options should be carried forward for further evaluation.

When multiple independent candidate solutions are developed for Mobility, Safety, or Freight strategic investment areas, these candidate solution options advance directly to the Performance Effectiveness Evaluation without an LCCA.

Performance Effectiveness Evaluation

After completing the LCCA process, all remaining candidate solutions are evaluated based on their performance effectiveness. This process includes determining a Performance Effectiveness Score (PES) based on how much each solution impacts the existing performance and needs scores for each segment. This evaluation also includes a Performance Area Risk Analysis to help differentiate between similar solutions based on factors that are not directly addressed in the performance system.

Solution Risk Analysis

All candidate solutions advanced through the Performance Effectiveness Evaluation were also evaluated through a Solution Risk Analysis process. A solution risk probability and consequence analysis was conducted to develop a solution-level risk weighting factor. This risk analysis is a numeric scoring system to help address the risk of not implementing a solution based on the likelihood and severity of performance failure.

Candidate Solution Prioritization

The PES, weighted risk factor, and segment average need score are combined to create a prioritization score. The candidate solutions are ranked by prioritization score from highest to lowest. The highest prioritization score indicates the candidate solution that is recommended as the highest priority. Solutions that address multiple performance areas tend to score higher in this process.

4.3 Life-Cycle Cost Analysis

LCCA was conducted for any candidate solution that was developed as a result of a need in the Pavement or Bridge performance area. The intent of the LCCA is to determine which options warrant further investigation and eliminate options that would not be considered strategic.

LCCA is an economic analysis that compares cost streams over time and presents the results in a common measure - the present value of all future costs. The cost stream occurs over an analysis period that is long enough to provide a reasonably fair comparison among alternatives that may differ significantly in scale of improvement actions over shorter time periods. For both bridge and pavement LCCA, the costs are focused on agency (TxDOT) costs for corrective actions to meet the objective of keeping the bridge or pavement serviceable over a long period of time.

LCCA is performed to provide a more complete holistic perspective on asset performance and agency costs over the life of an investment stream. This approach helps TxDOT look beyond initial and short-term costs, which often dominate the considerations in transportation investment decision making and programming.

Bridge LCCA

For the bridge LCCA, three basic strategies were analyzed that differ in timing and scale of improvement actions to maintain the selected bridges, as described below:

- Bridge replacement (large upfront cost but small ongoing costs afterwards)

- Bridge rehabilitation until replacement (moderate upfront costs then small to moderate ongoing costs until replacement)
- On-going repairs until replacement (low upfront and ongoing costs until replacement).

The bridge LCCA model reviews the characteristics of the candidate bridges including bridge ratings and deterioration rates to develop the three improvement strategies (full replacement, rehabilitation until replacement, and repair until replacement). Each strategy consists of a set of corrective actions that contribute to keeping the bridge serviceable over the analysis period. Cost and effect of these improvement actions on the bridge condition are essential parts of the model. Other considerations in the model include bridge age, elevation, pier height, length-to-span ratio, skew angle, and substandard characteristics such as shoulders and vehicle clearance. The following assumptions are included in the bridge LCCA model:

- The bridge LCCA only addresses the structural condition of the bridge and does not address other issues or costs.
- The bridge will require replacement at the end of its 75-year service life regardless of current condition.
- The bridge elevation, pier height, skew angle, and length-to-span ratio can affect the replacement and rehabilitation costs.
- The current and historical ratings are used to estimate a rate of deterioration for each candidate bridge.
- Following bridge replacement, repairs will be needed every 20 years.
- Different bridge repair and rehabilitation strategies have different costs, expected service life, and benefit to the bridge rating.
- The net present value of future costs is discounted at 3% and all dollar amounts are in 2015 dollars.
- If the LCCA evaluation recommends rehabilitation or repair, the solution is not considered strategic and the rehabilitation or repair will be addressed by normal programming processes.
- Because this LCCA is conducted at a planning level, and due to the variabilities in costs and improvement strategies, the LCCA net present value results that are within 15% should be considered equally; in such a case, the solution should be carried forward as a strategic replacement project – more detailed scoping will confirm if replacement or rehabilitation is needed.

Based on the candidate solutions presented in Table 26, LCCA was conducted for one bridge project on the I-37 Corridor. A summary of this analysis is shown in Table 27. Appendix G contains additional information regarding the LCCA.

Pavement LCCA

The LCCA approach to pavement is very similar to the process used for bridges. For the pavement LCCA, three basic strategies are analyzed that differ in timing and scale of improvement actions to maintain the selected pavement, as described below:

- Pavement replacement (large upfront cost but small ongoing costs afterwards – could be replacement with asphalt or concrete pavement)
- Pavement major rehabilitation until replacement (moderate upfront costs then small to moderate ongoing costs until replacement)
- Pavement minor rehabilitation until replacement (low upfront and ongoing costs until replacement).

The pavement LCCA model reviews the characteristics of the candidate paving locations including the historical rehabilitation frequency to develop potential improvement strategies (full replacement, major rehabilitation until replacement, and minor rehabilitation until replacement, for either concrete or asphalt, as applicable). Each strategy consists of a set of corrective actions that contribute to keeping the pavement serviceable over the analysis period. The following assumptions are included in the pavement LCCA model:

- The pavement LCCA only addresses the condition of the pavement and does not address other issues or costs.
- The historical pavement rehabilitation frequencies at each location are used to estimate future rehabilitation frequencies.
- Different pavement replacement and rehabilitation strategies have different costs and expected service life.
- The net present value of future costs is discounted at 3% and all dollar amounts are in 2015 dollars.
- If the LCCA evaluation recommends rehabilitation or repair, the solution is not considered strategic and the rehabilitation will be addressed by normal programming processes.
- Because this LCCA is conducted at a planning level, and due to the variabilities in costs and improvement strategies, the LCCA net present value results that are within 15% should be considered equally; in such a case, the solution should be carried forward as a strategic replacement project – more detailed scoping will confirm if replacement or rehabilitation is needed.

Based on the candidate solutions presented in Table 26, LCCA was conducted for two pavement projects on the I-37 Corridor. A summary of this analysis is shown in **Table 27**. Appendix G contains additional information regarding the LCCA.

Table 27 - Life-Cycle Cost Analysis Results

Candidate Solution		14 – Corgey Rd Bridge	31 – Corpus Christi Pavement
Present Value at 3% Discount Rate	Repair	$540,000	$51,200,000
	Rehabilitation	$750,000	$51,100,000
	Replace	$1,160,000	$58,600,000
Value Compared to Lowest	Repair	1.0	1.0
	Rehabilitation	1.4	1.0
	Replace	2.1	1.5
Other Related Needs		None	None
Results		Replacement does not appear to be warranted; rehabilitation or repair through normal TxDOT programming	Replacement does not appear to be warranted; rehabilitation or repair through normal TxDOT programming

As shown in Table 27, the following conclusions were determined based on the LCCA:

- Repair or rehabilitation rather than replacement, appears to be warranted at the Corgey Road Bridge. Therefore, this solution will not be advanced for further evaluation.
- Repair or rehabilitation rather than replacement, appears to be warranted for the frontage road pavement between mileposts 20 and 34.

4.4 Performance Effectiveness Evaluation

The results of the Performance Effectiveness Evaluation are combined with the results of a Performance Area Risk Analysis to determine a Performance Effectiveness Score (PES). The objectives of the Performance Effectiveness Evaluation include:

- Measure the benefit to the performance system versus the cost of the solution.
- Include risk factors to help differentiate between similar solutions.
- Account for each performance area that is affected by the candidate solution.
- Account for emphasis areas identified for the corridor.

The Performance Effectiveness Evaluation includes the following steps:

- Estimate the post-solution performance for each of the five performance areas (Pavement, Bridge, Mobility, Safety, and Freight).
- Use the post-solution performance scores to calculate a post-solution level of need for each of the five performance areas.
- Compare the pre-solution level of need to the post-solution level of need to determine the reduction in level of need (potential solution benefit) for each of the five performance areas.
- Calculate performance area risk weighting factors for each of the five performance areas.
- Use the reduction in level of need (benefit) and risk weighting factors to calculate the PES.

Post-Solution Performance Estimation

For each performance area, a slightly different approach is used to estimate the post-solution performance. This process is based on the following assumptions:

- Pavement:
  - The Distress Score would increase (to 100 for replacement or 90 for rehabilitation).
  - The Ride Score would increase (to 5.0 for replacement or 4.5 for rehabilitation).
  - The Pavement Condition Score would increase (to 100 for replacement or 90 for rehabilitation.
- Bridge:
  - The structural ratings would increase (+1 for repair, +2 for rehabilitation, or increase to 8 for replacement).
  - The Sufficiency Rating would increase (+10 for repair, +20 for rehabilitation, or increase to 98 for replacement).
- Mobility:
  - Additional lanes would increase the capacity and therefore affect the Mobility Index and associated secondary measures.
  - Changes in the Mobility Index (due to increased capacity) would have a direct effect on the TTI secondary measure.
  - Changes in the Mobility Index (due to increased capacity) and Safety Index (due to crash reductions) would have a direct effect on the PTI secondary measure.

- Safety:
  - Crash modification factors were developed that would be applied to estimate the reduction in crashes (see Appendix H for additional information).
- Freight:
  - Changes in the Mobility Index (due to increased capacity) and Safety Index (due to crash reductions) would have a direct effect on the Freight Index and the TPTI secondary measure.
  - Changes in the Mobility Index (due to increased capacity) would have a direct effect on the TTTI secondary measure.

Performance Area Risk Analysis

The Performance Area Risk Analysis is intended to develop a numeric risk weighting factor for each of the six performance areas (Pavement, Bridge, Mobility, Safety, Freight and Corridor-Wide). This risk analysis addresses other considerations for each performance area that are not directly included in the performance system and could help differentiate between solutions with similar benefits. For example, the Pavement Risk Factor is based on factors such as the climate, daily traffic volumes, and the amount of truck traffic which would influence the rate of deterioration of the pavement. A risk weighting factor is calculated for each candidate solution based on the specific characteristics at the solution location. Additional information regarding the Performance Area Risk Factors is included in Appendix J.

Following the calculation of the reduction in level of need (benefit) and the Performance Area Risk Factors, these values are used to calculate the PES. In addition, the reduction in level of need in each emphasis area is also included in the PES.

Net Present Value Factor

The benefit (reduction in need) is measured as a one-time benefit. However, different types of solutions will have varying service lives during which the benefits will be obtained. For example, a preservation solution would likely have a shorter stream of benefits over time compared to a modernization or expansion solution. To address the varying lengths of benefit streams, each solution is classified as a 10-year, 20-year, 30-year, or 75-year benefit stream, or the net present value (NPV) factor (F_{NPV}). A 3% discount rate is used to calculate F_{NPV} for each classification of solution. The service lives and respective factors are described below:

- A 10-year service life is generally reflective of preservation solutions such as pavement and bridge preservation; these solutions would likely have a 10-year stream of benefits; for these solutions, a FNPV of 8.8 is used in the PES calculation.
- A 20-year service life is generally reflective of modernization/safety solutions that do not include new infrastructure (travel lanes); these solutions would likely have a 20-year stream of benefits; for these solutions, a FNPV of 15.3 is used in the PES calculation.
- A 30-year service life is generally reflective of expansion solutions or modernization/safety solutions that include new infrastructure (travel lanes); these solutions would likely have a 30-year stream of benefits; for these solutions, a FNPV of 20.2 is used in the PES calculation.
- A 75-year service life is used for bridge replacement solutions; these solutions would likely have a 75-year stream of benefits; for these solutions, a FNPV of 30.6 is used in the PES calculation.

Vehicle-Miles Travelled Factor

Another factor in assessing benefits is the number of travelers who would benefit from the implementation of the candidate solution. This factor varies between candidate solutions depending on the length of the solution and the magnitude of daily traffic volumes. Multiplying the solution length by the daily traffic volume results in vehicle-miles travelled (VMT), which provides a measure of the amount of traffic exposure that would receive the benefit of the proposed solution. The VMT is converted to a VMT factor (known as F_{VMT}), which is on a scale between 0 and 5, using the equation below:

$$F_{VMT} = 5 - (5 \times e^{VMT \times -0.0000139})$$

Performance Effectiveness Score

The PES is calculated using the following equation:

PES = ((Sum of all Risk Factored Segment-Level Benefit Scores + Sum of all Risk Factored Corridor-Level Benefit Scores) / Cost) x F_{VMT} x F_{NPV}

Where:

Risk Factored Segment-Level Benefit Score = Reduction in Segment-Level Need (benefit) x Performance Area Risk Weighting Factor x Emphasis Area Factor (calculated for each performance area)

Risk Factored Corridor-Level Benefit Score = Reduction in Corridor-Level Need x Performance Area Risk Factors x Emphasis Area Factor (calculated for each performance area)

Cost = estimated cost of candidate solution in millions of dollars (see Appendix I)

F_{VMT} = Factor between 0 and 5 to account for VMT at location of candidate solution based on existing (2015) daily volume and length of solution

F_{NPV} = Factor (ranging from 8.8 to 30.6 as previously described) to address anticipated longevity of service life (and duration of benefits) for each candidate solution

The resulting Performance Effectiveness Scores are shown in **Table 28**. Additional information regarding the calculation of the Performance Effectiveness Score is contained in Appendix K.

Table 28 - Performance Effectiveness Scores

Candidate Solution #	Segment #	Candidate Solution Name	Milepost Location	Cost ($ million)	Risk Factored Benefit Score						Total Factored Benefit Score	F_{VMT}	F_{NPV}	Performance Effectiveness Score
					Pavement	Bridge	Safety	Mobility	Freight	Corridor-Wide				
1	1	Corpus Christi Mobility	14-18	188.3	0.00	6.57	4.19	7.14	0.30	38.69	56.88	4.71	20.2	28.8
2	2	Corpus Christi Access	25-29	8.2	0.00	0.00	0.00	0.00	0.00	3.74	3.74	0.14	20.2	1.3
3	3	Mathis Safety	31-34	12.7	0.00	0.00	12.60	0.00	0.00	0.00	12.60	3.24	15.3	49.3
4	5	George West Safety	48-57	18.1	0.00	0.00	13.54	0.00	0.87	0.00	14.41	4.49	15.3	54.7
5	5	US 59 TI	56.5	1.7	0.00	0.00	1.20	2.46	0.00	0.00	3.67	0.46	20.2	19.9
6	5	George West Lighting	48-57	1.8	0.00	0.00	0.56	0.00	0.07	0.00	0.63	4.60	15.3	24.5
7	7	Three Rivers Mobility	73-73.5	0.9	0.00	0.00	0.00	1.32	0.00	0.00	1.32	0.88	20.2	26.3
8	7	Three River Access	80-81	4.1	0.00	0.00	0.00	0.00	0.00	2.48	2.48	0.07	20.2	0.8
9	8	FM 791 Freight	90.4	2.3	0.00	2.08	0.00	0.00	0.97	0.00	3.05	0.73	30.6	29.6
10	8	Cambellton Access	90-91	4.1	0.00	0.00	-0.13	0.00	0.00	12.04	11.91	0.07	20.2	4.1
11	8	Cambellton Frontage	84-91	63.1	0.00	1.09	0.00	0.00	0.00	2.07	3.17	0.88	20.2	0.9
12	9	Cambellton Safety	91-98	7.2	0.00	0.00	13.04	0.00	0.00	0.00	13.04	4.64	15.3	128.4
13	10	Pullin Dr Access	101.5-102.5	2.0	0.00	0.00	-0.01	0.00	0.00	4.49	4.48	0.03	20.2	1.6
15	11	Coughran Rd Freight	106.4	2.0	0.00	0.58	0.00	0.00	1.64	0.00	2.22	0.79	30.6	26.9
16	11	SH 97 Freight	109.8	5.1	0.00	1.14	0.00	0.00	1.15	0.00	2.29	0.79	30.6	10.9
17	11	South Pleasanton Frontage & Access	103-110	51.1	0.27	2.48	-0.04	0.00	0.00	1.63	4.34	0.88	20.2	1.5
18	12	Pleasanton Mobility	109-118	42.2	0.00	0.00	0.16	10.74	0.00	0.48	11.38	4.92	20.2	26.8
19	12	SH 97 TI	109.8	1.7	0.00	0.00	0.29	1.25	0.00	0.00	1.54	0.90	20.2	16.6
20	12	FM 536 TI	117.6	0.9	0.00	0.00	0.14	2.50	0.00	0.00	2.63	0.15	20.2	9.2
21	12	Verdi TI	114	0.9	0.00	0.00	0.03	1.02	0.00	0.00	1.05	0.17	20.2	4.2
22	12	North Pleasanton Frontage & Access	110-118	26.8	0.20	0.00	-0.02	0.00	0.00	2.48	2.66	1.00	20.2	2.0
23	13	Floresville Safety	117-125	5.6	0.00	0.00	0.66	0.00	0.50	0.00	1.16	4.87	15.3	15.4
24	13	Floresville Mobility	118-125	34.3	0.00	0.00	0.26	13.54	0.54	0.48	14.82	4.87	20.2	42.5
25	13	Mathis Rd TI	122.7	0.9	0.00	0.00	0.00	4.34	0.00	0.00	4.34	0.17	20.2	17.8
26	13	Floresville Frontage	118-125	23.4	0.00	0.00	0.00	0.00	0.00	2.11	2.11	0.88	20.2	1.6
27	14	San Antonio Mobility	125-134	74.0	0.00	0.00	0.46	17.40	0.20	0.48	18.55	4.99	20.2	25.3
28	14	Southton Rd TI	130	0.9	0.00	0.00	0.01	1.77	0.00	0.00	1.77	0.21	20.2	8.9
29	14	San Antonio Frontage & Access	130-133.5	30.1	0.45	1.00	-0.01	0.00	0.00	0.51	1.95	0.46	20.2	0.6
30	14	Spur 122 TI	132.6	0.9	0.00	0.00	0.00	0.86	0.00	0.00	0.86	0.26	20.2	5.4

4.5 Solution Risk Analysis

Following the calculation of the PES, an additional step is taken to develop the prioritized list of solutions. A solution risk probability and consequence analysis is conducted to develop a solution-level risk weighting factor. This risk analysis is a numeric scoring system to help address the risk of not implementing a solution based on the likelihood and severity of performance failure. The table below shows the risk matrix used to develop the risk weighting factors.

Risk Matrix

		Severity/Consequence				
		Insignificant	Minor	Significant	Major	Catastrophic
Frequency/Likelihood	Very Rare	Low	Low	Low	Moderate	Major
	Rare	Low	Low	Moderate	Major	Major
	Seldom	Low	Moderate	Moderate	Major	Severe
	Common	Moderate	Moderate	Major	Severe	Severe
	Frequent	Moderate	Major	Severe	Severe	Severe

Using the risk matrix shown above, numeric values were assigned to each category of frequency and severity. The higher the risk, the higher the numeric factor that was assigned. The risk weight for each area of the matrix was calculated by multiplying the severity factor times the frequency factor. These numeric factors are shown below.

Numeric Risk Matrix

			Severity/Consequence				
			Insignificant	Minor	Significant	Major	Catastrophic
		Weight	1.00	1.10	1.20	1.30	1.40
Frequency/Likelihood	Very Rare	1.00	1.00	1.10	1.20	1.30	1.40
	Rare	1.10	1.10	1.21	1.32	1.43	1.54
	Seldom	1.20	1.20	1.32	1.44	1.56	1.68
	Common	1.30	1.30	1.43	1.56	1.69	1.82
	Frequent	1.40	1.40	1.54	1.68	1.82	1.96

Using the values shown above, risk weighting factors were calculated for each of the following four risk categories: low, moderate, major, and severe. These values are simply the average of the values in the numeric risk matrix that fall within each category. The resulting average risk weighting factors are:

Low	Moderate	Major	Severe
1.14	1.36	1.51	1.78

The risk weighting factors listed above are assigned to the five performance areas as follows:

- Safety = 1.78
  - The Safety performance area quantifies the likelihood of fatal or incapacitating injury crashes; therefore, it is assigned the Severe (1.78) risk weighting factor.
- Bridge = 1.51
  - The Bridge performance area focuses on the structural adequacy of bridges; a bridge failure may result in crashes or traffic being detoured for long periods of time resulting in significant travel time increases; therefore, it is assigned the Major (1.51) risk weighting factor.
- Corridor-Wide = 1.51
  - This performance area focuses on frontage roads, access points, floodplains, truck parking, and regional travel demand. These factors generally overlap with the Mobility and Safety performance areas, so the Major (1.51) risk weighting factor was assigned.
- Mobility and Freight = 1.36
  - The Mobility and Freight performance areas focus on capacity and congestion; failure in either of these performance areas would result in increased travel times but would not have significant effect on safety (crashes) that would not already be addressed in the Safety performance area; therefore, they are assigned the Moderate (1.36) risk weighing factor.
- Pavement = 1.14
  - The Pavement performance area focuses on the ride quality of the pavement; failure in this performance area would likely be a spot location that would not dramatically affect drivers beyond what is already captured in the Safety performance area; therefore, it is assigned the Low (1.14) risk weighting factor.

The benefit in each performance area is calculated for each candidate solution as part of the Performance Effectiveness Evaluation. Using this information on benefits and the risk factors listed above, a weighted (based on benefit) solution-level numeric risk factor is calculated for each candidate solution. For example, a solution that has 50% of its benefit in Safety and 50% of its benefit in Mobility has a weighted risk factor of 1.57 (0.50 x 1.36 + 0.50 x 1.78 = 1.57).

4.6 Candidate Solution Prioritization

The Performance Effectiveness Score, weighted risk factor, and segment average need score were combined to create a prioritization score as follows:

Prioritization Score = PES x Weighted Risk Factor x Segment Average Need Score

Where:

PES = Performance Effectiveness Score as shown in ***Table 28***

Weighted Risk Factor = Weighted factor to address risk of not implementing a solution based on the likelihood and severity of the performance failure

Segment Average Need Score = Segment level need score as shown in ***Table 23.***

The candidate solutions were prioritized based on the calculation above as shown in **Table 29**. The highest prioritization score indicates the candidate solution that is recommended as the highest priority. Solutions that address multiple performance areas tend to score higher in this process. **Table 30** shows the ranking of the scores. Additional information regarding the prioritization scoring is contained in Appendix K.

Table 29 - Prioritization Scores

Candidate Solution #	Segment #	Solution Name	Milepost Location	Estimated Cost ($ million)	Performance Effectiveness Score	Weighted Risk Factor	Segment Average Need Score	Prioritization Score	Percentage Distribution of Benefit					
									Pavement	Bridge	Safety	Mobility	Freight	Corridor-Wide
1	1	Corpus Christi Mobility	14-18	188.3	28.8	1.51	1.94	84	0.0%	11.5%	7.4%	12.5%	0.5%	68.0%
2	2	Corpus Christi Access	25-29	8.2	1.3	1.51	0.92	2	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
3	3	Mathis Safety	31-34	12.7	49.3	1.78	1.06	93	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%
4	5	George West Safety	48-57	18.1	54.7	1.75	1.27	122	0.0%	0.0%	93.9%	0.0%	6.1%	0.0%
5	5	US 59 Interchange	56.5	1.7	19.9	1.50	1.27	38	0.0%	0.0%	32.8%	67.2%	0.0%	0.0%
6	5	George West Lighting	48-57	1.8	24.5	1.73	1.27	54	0.0%	0.0%	89.2%	0.0%	10.8%	0.0%
7	7	Three Rivers Mobility	73-73.5	0.9	26.3	1.36	0.93	33	0.0%	0.0%	0.3%	99.7%	0.0%	0.0%
8	7	Three River Access	80-81	4.1	0.8	1.51	0.93	1	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
9	8	FM 791 Freight	90.4	2.3	29.6	1.46	1.29	56	0.0%	68.3%	0.0%	0.0%	31.7%	0.0%
10	8	Cambellton Access	90-91	4.1	4.1	1.51	1.29	8	0.0%	0.0%	-1.1%	0.0%	0.0%	101.1%
11	8	Cambellton Frontage	84-91	63.1	0.9	1.51	1.29	2	0.0%	34.5%	0.0%	0.0%	0.0%	65.5%
12	9	Cambellton Safety	91-98	7.2	128.4	1.78	1.13	258	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%
13	10	Pullin Dr Access	101.5-102.5	2.0	1.6	1.51	0.75	2	0.0%	0.0%	-0.2%	0.0%	0.0%	100.2%
15	11	Coughran Rd Freight	106.4	2.0	26.9	1.40	0.72	27	0.0%	26.1%	0.0%	0.0%	73.9%	0.0%
16	11	SH 97 Freight	109.8	5.1	10.9	1.43	0.72	11	0.0%	49.9%	0.0%	0.0%	50.1%	0.0%
17	11	South Pleasanton Frontage & Access	103-110	51.1	1.5	1.48	0.72	2	6.1%	57.1%	-0.9%	0.0%	0.0%	37.6%
18	12	Pleasanton Mobility	109-118	42.2	26.8	1.37	1.02	38	0.0%	0.0%	1.4%	94.4%	0.0%	4.2%
19	12	SH 97 Interchange	109.8	1.7	16.6	1.44	1.02	24	0.0%	0.0%	18.9%	81.1%	0.0%	0.0%
20	12	FM 536 Interchange	117.6	0.9	9.2	1.38	1.02	13	0.0%	0.0%	5.2%	94.8%	0.0%	0.0%
21	12	Verdi Interchange	114	0.9	4.2	1.37	1.02	6	0.0%	0.0%	3.1%	96.9%	0.0%	0.0%
22	12	North Pleasanton Frontage & Access	110-118	26.8	2.0	1.48	1.02	3	7.5%	0.0%	-0.7%	0.0%	0.0%	93.2%
23	13	Floresville Safety	117-125	5.6	15.4	1.60	1.32	33	0.0%	0.0%	56.9%	0.0%	43.1%	0.0%
24	13	Floresville Mobility	118-125	34.3	42.5	1.37	1.32	77	0.0%	0.0%	1.8%	91.4%	3.6%	3.2%
25	13	Mathis Rd Interchange	122.7	0.9	17.8	1.36	1.32	32	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%
26	13	Floresville Frontage	118-125	23.4	1.6	1.51	1.32	3	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
27	14	San Antonio Mobility	125-134	74.0	25.3	1.37	1.88	65	0.0%	0.0%	2.5%	93.8%	1.1%	2.6%
28	14	Southton Rd Interchange	130	0.9	8.9	1.36	1.88	23	0.0%	0.0%	0.4%	99.6%	0.0%	0.0%
29	14	San Antonio Frontage & Access	130-133.5	30.1	0.6	1.42	1.88	2	23.0%	51.3%	-0.4%	0.0%	0.0%	26.1%
30	14	Spur 122 Interchange	132.6	0.9	5.4	1.36	1.88	14	0.0%	0.0%	0.5%	99.5%	0.0%	0.0%

Table 30 - Prioritization Ranking

Rank	Candidate Solution #	Segment #	Solution Name	Milepost Location	Estimated Cost ($ million)	Prioritization Score	TxDOT District*
1	12	9	Cambellton Safety	91-98	7.2	258.3	SA
2	4	5	George West Safety	48-57	18.1	121.8	CC
3	3	3	Mathis Safety	31-34	12.7	92.9	CC
4	1	1	Corpus Mobility	14-18	188.3	84.3	CC
5	24	13	Floresville Mobility	118-125	34.3	77.0	SA
6	27	14	San Antonio Mobility	125-134	74	65.3	SA
7	9	8	FM 791 Freight	90.4	2.3	55.8	SA
8	6	5	George West Lighting	48-57	1.8	53.9	CC
9	5	5	US 59 Interchange	56.5	1.7	37.8	CC
10	18	12	Pleasanton Mobility	109-118	42.2	37.5	SA
11	7	7	Three Rivers Mobility	73-73.5	0.9	33.3	CC
12	23	13	Floresville Safety	117-125	5.6	32.6	SA
13	25	13	Mathis Rd Interchange	122.7	0.9	32.0	SA
14	15	11	Coughran Rd Freight	106.4	2.0	27.1	SA
15	19	12	SH 97 Interchange	109.8	1.7	24.3	SA
16	28	14	Southton Rd Interchange	130	0.9	22.9	SA
17	30	14	Spur 122 Interchange	132.6	0.9	13.8	SA
18	20	12	FM 536 Interchange	117.6	0.9	13.0	SA
19	16	11	SH 97 Freight	109.8	5.1	11.3	SA
20	10	8	Camellton Access	90-91	4.1	7.9	SA
21	21	12	Verdi Interchange	114	0.9	5.9	SA
22	26	13	Floresville Frontage Rd	118-125	23.4	3.2	SA
23	22	12	North Pleasanton Frontage Rds	110-118	26.8	3.0	SA
24	13	10	Pullin Dr Access	101.5-102.5	2.0	1.8	SA
25	2	2	Corpus Access	25-29	8.2	1.8	CC
26	11	8	Cambellton Frontage Rds	84-91	63.1	1.7	SA
27	29	14	San Antonio Frontage Rds	130-133.5	30.1	1.6	SA
28	17	11	South Pleasanton Frontage Rds	103-110	51.1	1.6	SA
29	8	7	Three River Access	80-81	4.1	1.2	CC

* SA – San Antonio
* CC – Corpus Christi

4.7 Stakeholder Outreach

The second webinar, held on October 24, 2017, was used to present the proposed improvement solutions for the needs identified during the performance-based analysis of the I-37 corridor. The intent of this webinar was primarily informational rather than to gather input, although the participants were encouraged to ask questions during the webinar and to submit any additional comments to the TxDOT project manager after the webinar. One letter was received from the City of Corpus Christi (see Appendix B) with comments on specific corridor study findings. A copy of the webinar PowerPoint, script, and Q&A can be found in Appendix B.

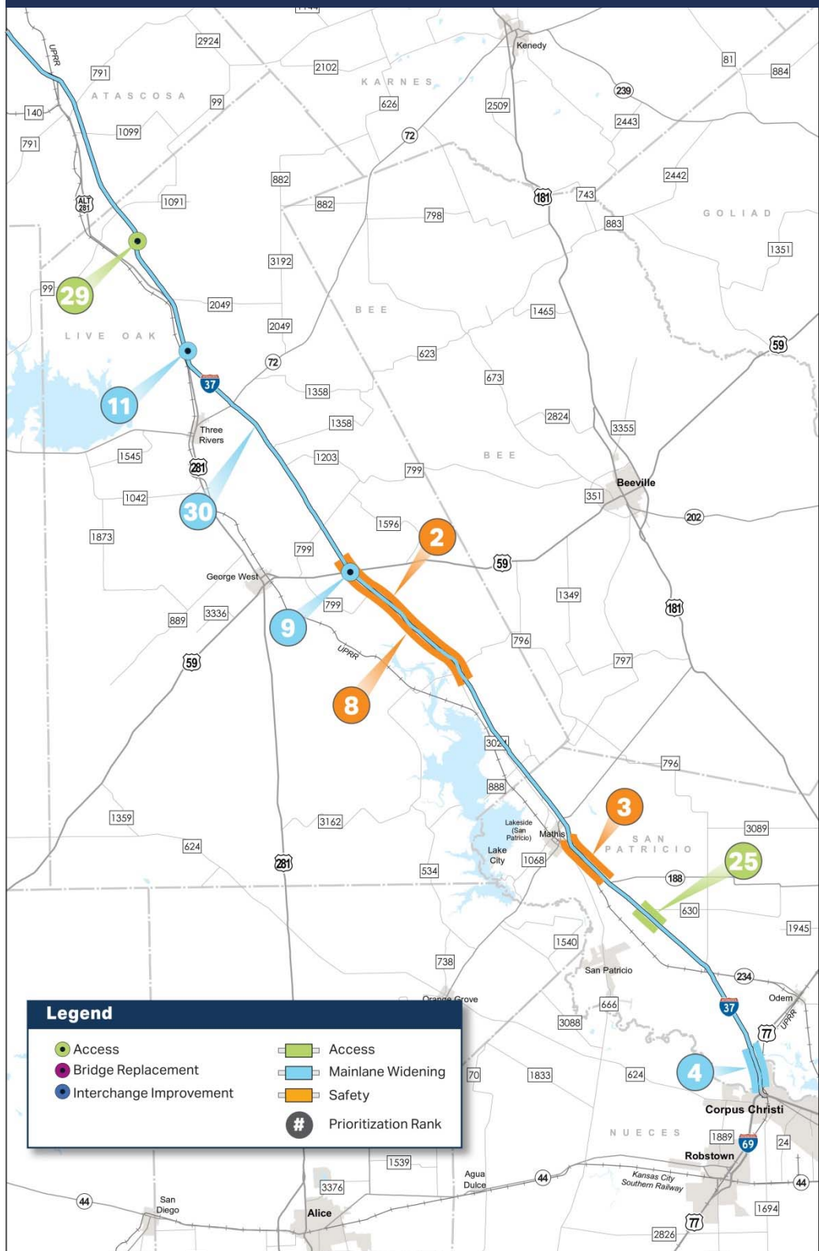
5. Summary of Corridor Recommendations

The rankings shown in Table 30 were used to classify the solutions for the I-37 Corridor as near-term (before year 2025) and mid-term (between year 2025 and 2035) priorities. The highest ranked solutions are anticipated to have the greatest effect on overall corridor performance. Long-term (after year 2035) priorities were generally developed based on TxDOT policies including widening the entire corridor to provide three mainlanes in each direction of travel, continuous frontage roads, and a minimum of 18.5 foot vertical clearance at underpass structures. **Figure 37** shows the solutions within the Corpus Christi District and **Figure 38** shows the solutions within the San Antonio District.

Since a 2040 horizon year was used in this study, and a 20-year planning horizon is typical to estimate future demand, it is possible that travel demand will increase more rapidly than anticipated, and the widening currently classified as long term may be warranted sooner.

The purpose of this study was to identify and prioritize potential projects for consideration in future TxDOT programming activities. Any project recommended as part of this study would be subject to further engineering and environmental study after it is selected to move forward in the programming process.

Figure 37 – Solutions Within the Corpus Christi District



Rank	Candidate Solution #	Solution Name and Location	Proposed Improvements	Estimated Cost (in millions)	Anticipated to Require New R/W	TxDOT District
Recommended Near-Term Solutions (Before 2025)						
2	4	George West Safety (MP 48-57)	• Construct NB & SB mainlane safety improvements • Construct NB & SB frontage road safety improvements • Construct roundabouts at ramp/frontage roads intersections	$18.1	●	Corpus Christi
3	3	Mathis Safety (MP 31-34)	• Construct NB & SB mainlane safety improvements • Construct roundabouts at ramp/frontage roads intersections at SH 188 interchange • Construct safety improvements at SH 188 Interchange	$12.7	●	Corpus Christi
4	1	Corpus Christi Mobility (MP 14-18)	• Widen mainlanes to add one lane in each direction from I-69 to US 77 • Replace Nueces River Bridges and raise profile to remove from floodplain	$188.3	●	Corpus Christi
8	6	George West Lighting (MP 48-57)	• Install safety lighting	$1.8		Corpus Christi
Recommended Mid-Term Solutions (2025 – 2035)						
9	5	US 59 TI (MP 56.5)	• Construct intersection improvements	$1.7		Corpus Christi
11	7	Three Rivers Mobility (MP 73-73.5)	• Extend acceleration/deceleration lengths for US 281 ramps	$0.9		Corpus Christi
25	2	Corpus Access (MP 25-29)	• Construct NB & SB exit and entrance ramps near MP 25.5 & 28	$8.2		Corpus Christi
29	8	Three River Access (MP 80-81)	• Construct NB & SB exit and entrance ramps near MP 80.8	$4.1		Corpus Christi
Recommended Long-Term Solutions (Beyond 2035)						
30	Separate project limits TBD		• Add one mainlane lane in each direction from US 77 to SH 97 (MP 17 -110)	N/A		Corpus Christi & San Antonio
31	N/A	N/A	• Construct frontage roads MP 16.5 - 17	N/A		Corpus Christi
32	N/A	N/A	• Construct SB frontage road MP 36 - 48	N/A		Corpus Christi
33	N/A	N/A	• Construct frontage roads MP 76.5 - 80	N/A		Corpus Christi
35	Separate project limits TBD		• Replace underpass bridges to provide 18.5' vertical clearance	N/A		Corpus Christi & San Antonio

All recommended improvements will require further engineering and environmental study. The cost estimates shown are planning-level estimates based on standardized unit prices for the purposes of conducting a comparative analysis and will require further refinement for future programming.

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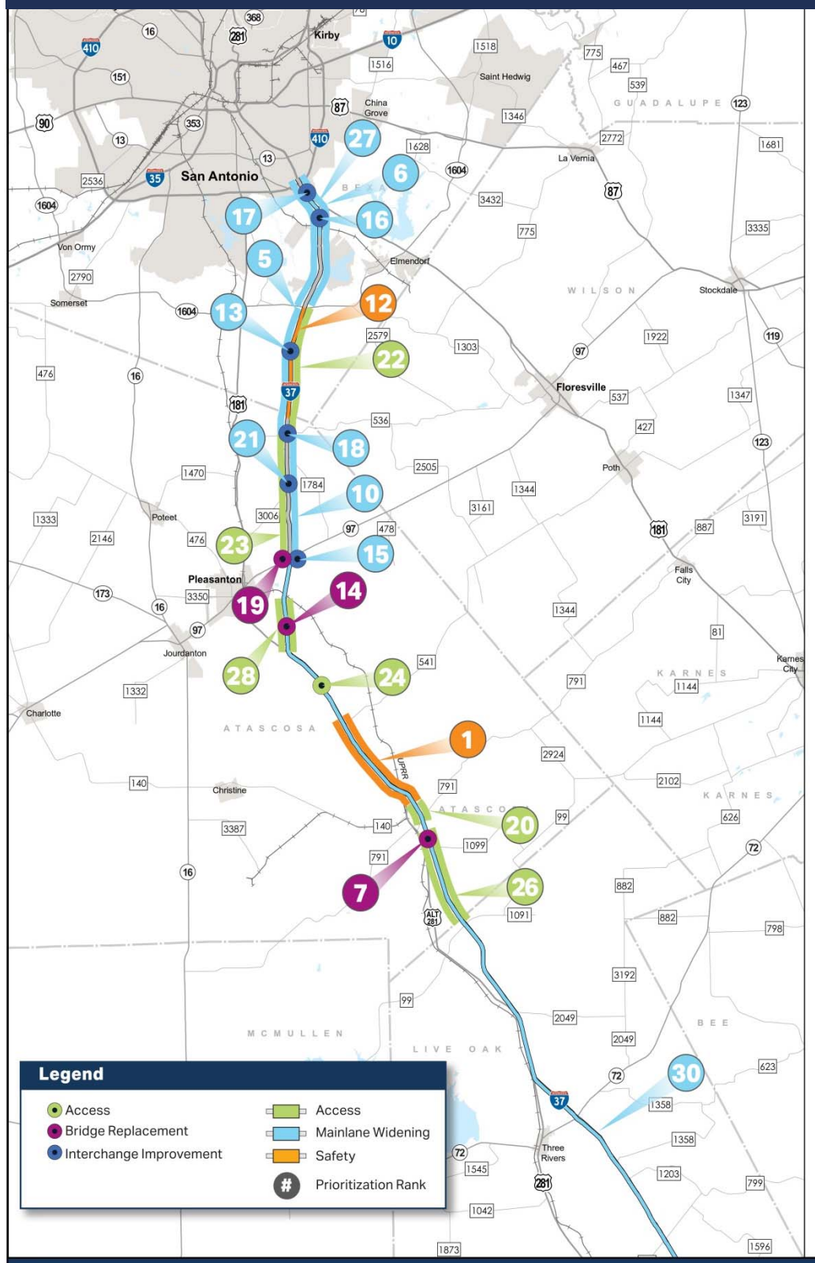
I-37 Prioritized Solutions for San Antonio District

Figure 38 – Solutions Within the San Antonio District



Rank	Candidate Solution #	Solution Name and Location	Proposed Improvements	Estimated Cost (in millions)	Anticipated to Require New R/W	TxDOT District
Recommended Near-Term Solutions (Before 2025)						
1	12	Cambellton Safety (MP 91-98)	• Construct NB & SB mainlane safety improvements • Install safety lighting • Extend acceleration length for NB entrance ramp from US 281A	$7.2		San Antonio
5	24	Floresville Mobility (MP 118-125)	• Widen mainlanes to add one lane in each direction from FM 536 to SH 1604	$34.3		San Antonio
6	27	San Antonio Mobility (MP 125-134)	• Widen mainlanes to add one lane in each direction from SH 1604 to I-410	$74.0		San Antonio
7	9	FM 791 Freight (MP 90.4)	• Replace FM 791 bridge to provide additional clearance	$2.3		San Antonio
Recommended Mid-Term Solutions (2025 – 2035)						
10	18	Pleasanton Mobility (MP 109-118)	• Add one mainlane lane in each direction from SH 97 to FM 536	$42.2		San Antonio
12	23	Floresville Safety (MP 117-125)	• Install continuous lighting from FM 536 to SH 1604	$5.6		San Antonio
13	25	Mathis Rd TI (MP 122.7)	• Construct intersection improvements	$0.9		San Antonio
14	15	Coughran Rd Freight (MP 106.4)	• Replace Coughran Road bridge to provide additional clearance	$2.0		San Antonio
15	19	SH 97 TI (MP 109.8)	• Construct intersection improvements	$1.7	●	San Antonio
16	28	Southton Rd TI (MP 130)	• Construct intersection improvements	$0.9	●	San Antonio
17	30	Spur 122 TI (MP 132.6)	• Construct intersection improvements	$0.9	●	San Antonio
18	20	FM 536 TI (MP 117.6)	• Construct intersection improvements	$0.9		San Antonio
19	16	SH 97 Freight (MP 109.8)	• Replace SH 97 bridges to provide additional clearance	$5.1		San Antonio
20	10	Cambellton Access (MP 90 -91)	• Construct NB & SB exit and entrance ramps at grade separation near MP 90.5	$4.1		San Antonio
21	21	Verdi TI (MP 114)	• Construct intersection improvements	$0.9		San Antonio
22	26	Floresville Frontage (MP 118-125)	• Construct northbound and southbound frontage roads	$23.4		San Antonio
23	22	North Pleasanton Frontage & Access (MP 110-118)	• Construct SB exit and entrance ramps to new or existing frontage roads near MP 112 & 115.5 • Construct northbound and southbound frontage roads	$26.8		San Antonio
24	13	Pullin Dr Access (MP 101.5-102.5)	• Construct NB exit and entrance ramps near MP 102	$2.0		San Antonio
26	11	Cambellton Frontage (MP 84-91)	• Construct northbound and southbound frontage roads	$63.1	●	San Antonio
27	29	San Antonio Frontage & Access (MP 130-133.5)	• Construct NB & SB frontage roads • Construct SB exit ramp and NB entrance ramp near MP 127.5	$30.1		San Antonio
28	17	South Pleasanton Frontage & Access (MP 103-110)	• Construct NB & SB exit and entrance ramps to new frontage roads near MP 107.5 • Construct northbound and southbound frontage roads	$51.1	●	San Antonio
Recommended Long-Term Solutions (Beyond 2035)						
30	Separate project limits TBD		• Add one mainlane lane in each direction from US 77 to SH 97 (MP 17 -110)	N/A		Corpus Christi & San Antonio
34	N/A	N/A	• Construct frontage roads MP 90 – 92	N/A		San Antonio
35	Separate project limits TBD		• Replace underpass bridges to provide 18.5' vertical clearance	N/A		Corpus Christi & San Antonio

All recommended improvements will require further engineering and environmental study. The cost estimates shown are planning-level estimates based on standardized unit prices for the purposes of conducting a comparative analysis and will require further refinement for future programming.

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