TTI: 5-9052

Making Every Day Count: Applying Data-Driven Safety Analyses in a TxDOT District

Technical Report 5-9052-01-R1

Cooperative Research Program

TEXAS A&M TRANSPORTATION INSTITUTE
COLLEGE STATION, TEXAS

in cooperation with the
Federal Highway Administration and the
Texas Department of Transportation
http://tti.tamu.edu/documents/5-9052-01-R1.pdf

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA/TX-20/5-9052-01-R1		

4. Title and Subtitle	5. Report Date
MAKING EVERY DAY COUNT: APPLYING DATA-DRIVEN SAFETY ANALYSES IN A TXDOT DISTRICT	Published: October 2020
	6. Performing Organization Code
7. Author(s) Robert Wunderlich, Karen Dixon, Lingtao Wu, Srinivas Geedipally, Bahar Dadashova, and Eva Shipp	8. Performing Organization Report No. Report 5-9052-01-R1
9. Performing Organization Name and Address Texas A&M Transportation Institute The Texas A&M University System College Station, Texas 77843-3135	10. Work Unit No. (TRAIS) 11. Contract or Grant No. Project 5-9052-01
12. Sponsoring Agency Name and Address Texas Department of Transportation Research and Technology Implementation Office 125 E. 11th Street Austin, Texas 78701-2483	13. Type of Report and Period Covered Implementation Report: Sept 2017–Aug 2019 14. Sponsoring Agency Code

15. Supplementary Notes

Project performed in cooperation with the Texas Department of Transportation and the Federal Highway Administration.

Project Title: A Data-Driven Safety Analysis (DDSA) Framework for the Beaumont District

URL: http://tti.tamu.edu/documents/5-9052-01-R1.pdf

16. Abstract

Using a data-driven approach to analyze safety issues and projects will help Texas Department of Transportation (TxDOT) districts to target safety investments with more confidence and reduce crashes on Texas highways. Many predictive and systemic analysis tools are now available that provide the means to quantify safety impacts in a similar way so that roadway capacity and operations, environmental impacts, drainage, and pavement life can be quantified. The Texas A&M Transportation Institute developed a logical, practical, and data-driven framework for integrating these tools into practice within the TxDOT Beaumont District. There are four basic elements to consider when building a data-driven framework. The first element is the description of traffic safety issues. The second is the identification of roadway segments and intersections where the greatest potential to reduce crashes exists and the development and evaluation of potential safety treatments. This identification includes the assessment of historic crash trends combined with the application of new but proven safety analysis methods. The source of this information was TxDOT's Crash Record Information System, maintained by TxDOT's Traffic Operations Division. The third element is quantifying the correlation of prevalent crash types with specific roadway features to allow the development and evaluation of systemic safety improvements. The fourth element is the integration of safety assessment directly into the project development process or overall process from the conceptual to the construction phase. The purpose of this effort is to identify ways to better integrate safety assessment into identifying safety projects and to build more safety into new construction, reconstruction, and maintenance activities. The framework is intended to be a model that can be adapted and utilized in other TxDOT districts to assist decision makers as they determine viable roadway safety investments.

17. Key Words	18. Distribution Statement
Data-Driven, Safety, Predictive Modeling	No restrictions. This document is available to the public through NTIS: National Technical Information Service Alexandria, Virginia http://www.ntis.gov

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	290	

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

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Project 5-9052-01
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Texas Department of Transportation
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Federal Highway Administration

Published: October 2020

TEXAS A&M TRANSPORTATION INSTITUTE
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DISCLAIMER

ACKNOWLEDGMENTS

This project was conducted in cooperation with TxDOT and FHWA. The authors thank the staff of the TxDOT Beaumont District, in particular Ted Clay, Operations Director, and Adam Jack, Transportation Planning and Development Director, for their help in conducting this project; the authors also acknowledge the support and guidance provided by both Wade Odell, Research Project Manager, and Kevin Peete, Project Portfolio Manager, of TxDOT's Research and Technology Implementation Division.

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Definition
3S	3-Leg Signalized Intersection
4S	4-Leg Signalized Intersection
A	Suspected Serious Injury Crash
AADT	Annual Average Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
ADT	Average Daily Traffic
B	Non-Incapacitating Injury Crash
B/C	Benefit/Cost
C	Possible Injury Crash
CMF	Crash Modification Factor
CRIS	Crash Record Information System
DDSA	Data-Driven Safety Analysis
DFI	Distance from Origin
EB	Empirical Bayes
FHWA	Federal Highway Administration
FI	Fatal or Injury (Crash)
FM	Farm to Market
HO	Head On
HSIP	Highway Safety Improvement Program
HSM	Highway Safety Manual
IH	Interstate Highway
K	Fatal Crash
NB	Negative Binomial
O	Property Damage Only Crash
OD	Opposite Direction
PDO	Property Damage Only
PMIS	Pavement Management Information System
PSL	Posted Speed Limit
R3US	Rural 3-Leg Unsignalized Intersection
R4US	Rural 4-Leg Unsignalized Intersection
R-Div. Multi	Rural Divided Multilane Roadway Segment

Acronym	Definition
R-Undiv. Multi	Rural Undivided Multilane Roadway Segment
RDM	Roadway Design Manual
RHiNO	Roadway Highway Inventory Network Offload
RI	Rural Interstate
RS	Rumble Strip
SH	State Highway
SPF	Safety Performance Function
SVROR	Single-Vehicle Run-Off-Road
TTI	Texas A&M Transportation Institute
TxDOT	Texas Department of Transportation
U3US	Urban 3-Leg Unsignalized Intersection
U3SG	Urban 3-Leg Signalized Intersection
U3ST	Urban 3-Leg Stop-Controlled Intersection
U4US	Urban 4-Leg Unsignalized Intersection
U-Undiv. Multi	Urban Undivided Multilane Roadway Segment
U-2 Lane	Urban Undivided Two-Lane Roadway Segment
UDM	Urban Divided Multilane Roadway (Non-Freeway/Expressway)
UI	Urban Interstate
VMT	Vehicle Miles Traveled
VPD	Vehicle Per Day

CHAPTER 1: INTRODUCTION

DATA-DRIVEN FRAMEWORKS

Many predictive and systemic analysis tools are now available that provide the means to quantify safety impacts in a similar way so that roadway capacity and operations, environmental impacts, drainage, and pavement life can be quantified. There are four basic elements to consider when building a data-driven framework:

- The description of crash trends, severities, prevalent crash types, causal factors, rural versus urban setting, roadway types, location along the roadway, and environmental factors to gain an understanding of the most significant characteristics of the crash issues within a district.
- The identification of roadway segments and intersections where the greatest potential to reduce crashes exists and the development and evaluation of potential safety treatments. This identification includes the assessment of historic crash trees combined with the application of new but proven safety analysis methods. The source of this information was the Texas Department of Transportation's (TxDOT's) Crash Record Information System, maintained by TxDOT's Traffic Operations Division.
- The quantification of the correlation of prevalent crash types with specific roadway features to allow the development and evaluation of systemic safety improvements.
- The integration of the safety assessment directly into the project development process or overall process from the conceptual to the construction phase.

The purpose of applying a data-driven framework is to identify ways to better integrate safety assessment into the project development process. The goal of using a data-driven framework is to identify the locations and types of projects that can improve safety and to evaluate already planned construction, reconstruction, and maintenance activities so that decision makers can best determine viable roadway safety investments and enable incorporation of safety analyses directly into the project development process.

A DATA-DRIVEN SAFETY ANALYSIS (DDSA) FRAMEWORK FOR THE BEAUMONT DISTRICT

As part of the Every Day Counts initiative, TxDOT embarked on a focused DDSA effort to assess ways to enhance ongoing initiatives that will help to reduce the number and severity of crashes in Texas. As a starting point and through Project 5-9052-01, "A Data-Driven Safety Analysis (DDSA) Framework for the Beaumont District," the Texas A&M Transportation Institute (TTI) conducted a pilot study to assess how evolving safety techniques can be embedded into common TxDOT activities. More specifically, TTI developed a process that integrated data-driven and evidence-based safety analysis into the design and operations of state roadways within the TxDOT Beaumont District. The project included the following tasks, with the relevant chapters in this report identified in parentheses:

1. Meet with Beaumont District staff.
2. Develop a final work plan.
3. Develop a crash profile for the Beaumont District (Chapter 2).
4. Identify areas of potential safety emphasis based on the crash profile (Chapter 3).
5. Identify potential analysis tools and determine the most appropriate for use in the Beaumont District (Chapter 4).
6. Apply systemic analyses to safety needs identified in developed crash profile (Chapter 5).
7. Develop a procedure for identifying roadways with potential for safety improvements (Chapter 6).
8. Use selected safety assessment tools to develop a prioritized list of potential projects (Chapter 7).
9. Identify existing TxDOT district projects coinciding with locations the greatest opportunity to reduce crashes exists (Chapter 8).
10. Develop a User Guide and training (Chapter 9).
11. Prepare a project report and monthly progress reports.

The framework and pilot project developed for the TxDOT Beaumont District is intended to be a model that can be adapted and utilized in other TxDOT districts. A separate document presents the User Guide and Excel Spreadsheet Tool.

CHAPTER 2: CRASH PROFILE FOR THE BEAUMONT DISTRCT

Many predictive and systemic analysis tools are now available that provide the means to quantify safety impacts in a manner similar to that used for evaluating roadway capacity and operations, environmental impacts, drainage, and pavement durability. Researchers from TTI are developing a logical and practical framework for integrating these tools into practice within the TxDOT Beaumont District.

There are three basic elements of the ongoing DDSA effort:

- Identification of roadway segments and intersections where the greatest potential to reduce crashes exists and the development and evaluation of potential safety treatments.
- Correlation of prevalent crash types with specific roadway features to allow the development and evaluation of systemic safety improvements.
- Integration of safety assessment directly into the project development process. The term *project development process* refers to the overall process that takes any project from the conceptual to the construction phase.

The framework for this DDSA effort has the added goal of creating a scalable process that can be adapted and utilized in other TxDOT districts. The goal of this effort is to develop tools that will assist decision makers as they determine viable roadway safety investments and develop strategies to incorporate them directly into the project development process

This chapter reports the analysis of crash profiles in the Beaumont District. The primary purpose of this task was to identify the major crash types and characteristics for the on-system roadways in the Beaumont District. TTI researchers developed a crash profile framework that provides:

- Descriptive statistics of on-system crashes for a 7-year period (2010 to 2016) associated with the Beaumont District.
- Crash trees showing the percentage of crashes and exposure (i.e., vehicle miles traveled).
- Crash density analyses on both Beaumont District and Texas on-system roadways.

The crash profile is organized into the following three sections:

- The documentation of the summary statistics of the on-system crashes in the Beaumont District includes a review of crash trends for a 7-year period, crash trees, severity level distribution, and crash distributions by varying conditions and collision types.
- The crash density analyses, including the introduction of the crash screening tool, incorporates a crash density analysis for Beaumont on-system roadways and a statewide crash density analysis of Texas.
- The summary of key findings is based on the results of the crash profile analysis for Texas and the Beaumont District.

CRASH DESCRIPTIVE STATISTICS

The TxDOT Beaumont District maintains 2,162 mi of on-system roadways. These roadways are divided into 3,524 segments, as presented in the TxDOT Roadway Highway Inventory Network Offload (RHiNO) (TxDOT, n.d.).

TxDOT's Crash Record Information System (CRIS) has a record of 39,888 Beaumont District on-system crashes associated with 586 deaths and 21,476 injuries from 2010 to 2016 (TxDOT Crash Data, n.d.). The number of fatalities over time should be compared to the vehicle miles traveled (VMT), which is an indicator of the exposure for a given period and is calculated as follows:

$$VMT = \frac{AADT \times Length \times 365}{10^6} \qquad \text{(Equation 1)}$$

Where:

- AADT represents the annual average daily traffic.
- Length represents the segment length in miles.

Research team members obtained the AADT and segment lengths from TxDOT's 2016 RHiNO database. Figure 1 depicts the annual crashes and VMT for Beaumont. As can be seen, the annual VMT remained relatively constant from 2010 to 2016. In contrast, crash numbers increased annually after 2013. Specifically, the number of crashes increased from 5,035 in 2013 to 7,450 in 2016. The average annual increase rate is around 14 percent from 2014–2016 (taking 2013 as the base year).

Figure 2 illustrates the annual number of fatal crashes and suspected serious injury crashes separately. Although the number of fatal crashes has been relatively stable, the suspected serious injury crashes in the last 3 years have increased. In all years except 2012, more than 200 suspected serious injury crashes occurred on Beaumont on-system roadways, and the number has continued to rise since 2014. On average, about 75 fatal crashes occur every year on the on-system roadways.

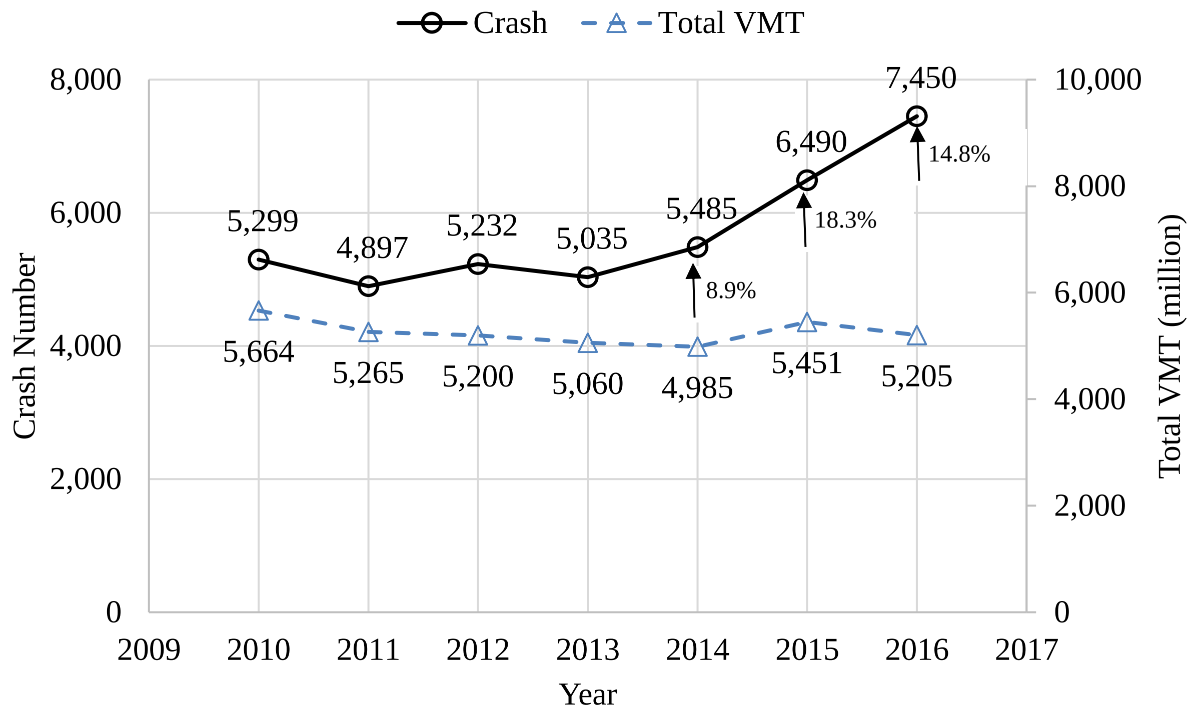


Figure 1. Annual Crash and VMT of Beaumont On-System Roadways.

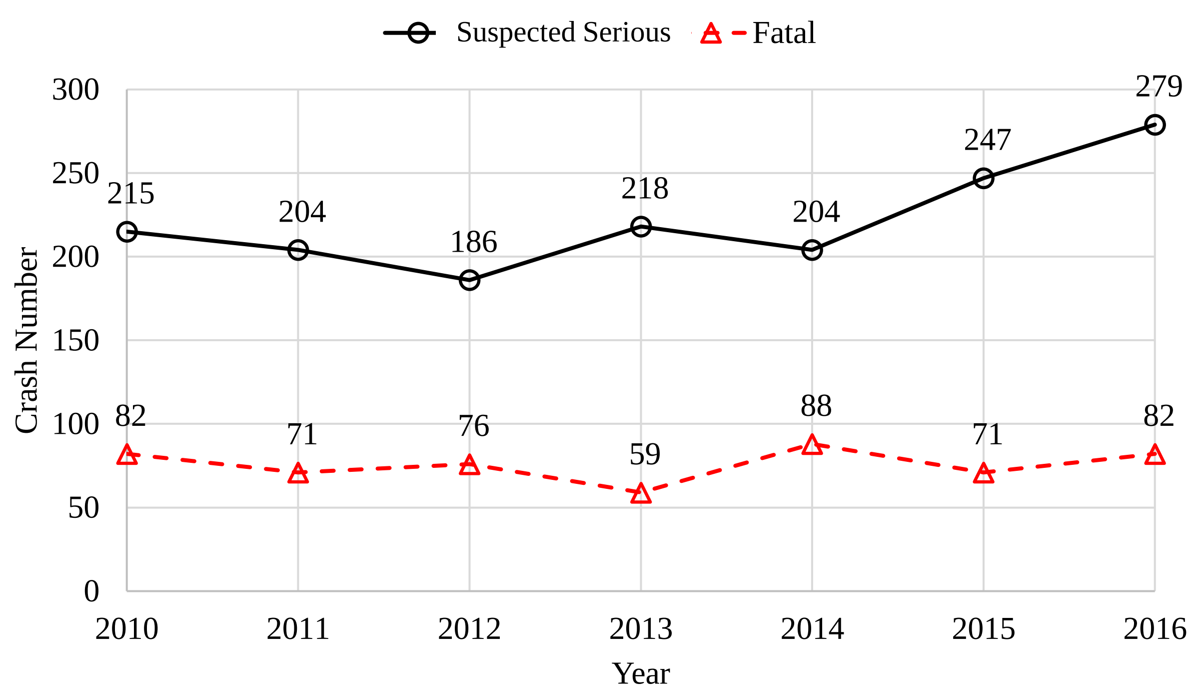


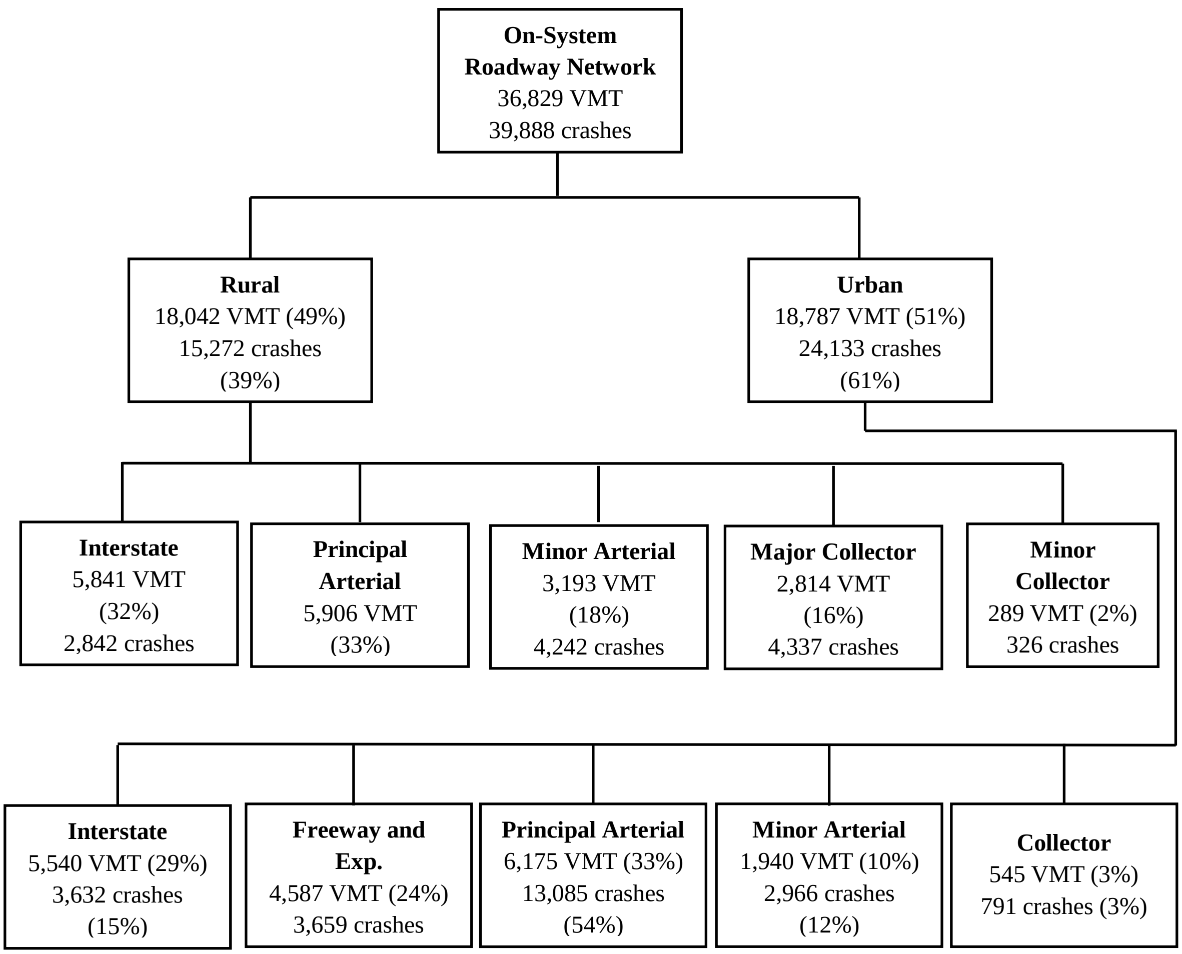
Figure 2. Annual Fatal Crashes and Suspected Serious Injury Crashes on Beaumont On-System Roadways.

Crash Trees

Crash trees help to visualize the distribution of the crashes based on a selected category. The research team developed two crash trees based on (1) roadway functional classification; and (2) highway system. RHiNO classifies the on-system roadways into the following categories of functional classes:

- Interstate, freeway, and expressway.
- Principal arterial.
- Minor arterial.
- Major collector.
- Minor collector.

To develop the crash trees, members of the research team utilized these functional classes for each area type—rural and urban. Figure 3 depicts a roadway functional classification-based tree of VMT and crashes.



Notes: VMT = vehicle miles traveled in a 7-year period (2010–2016), and the unit is in millions. There are 483 crashes with unknown rural or urban status.

Figure 3. Crash Tree Based on Roadway Functional System.

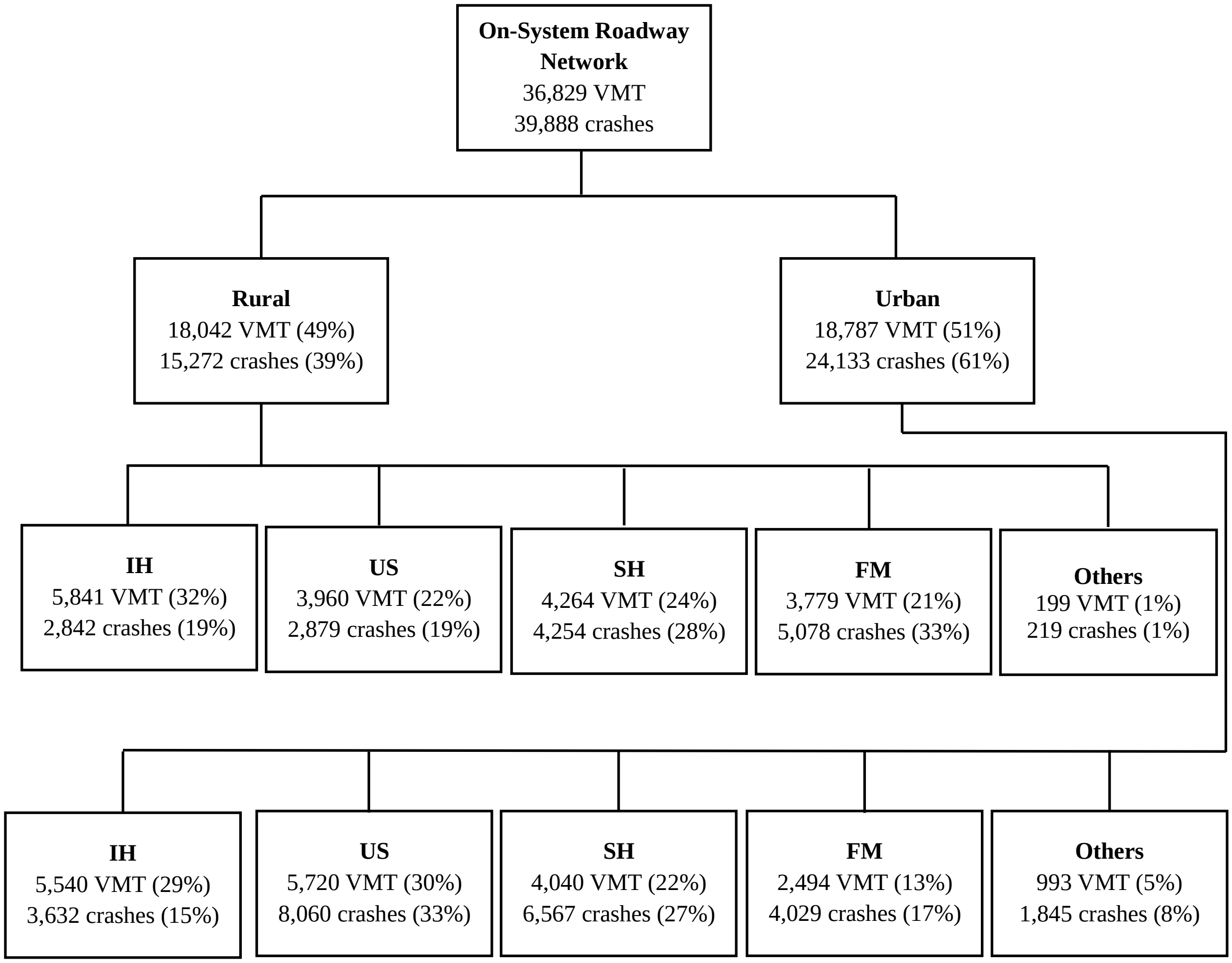
The amount of VMT on roadways in the rural areas account for 49 percent of the total on-system network, while the crashes that occurred in the rural areas account for 39 percent of all crashes. The amount of VMT on roadways in the urban areas account for 51 percent of the total on-system roadway network, while the crashes that occurred in the urban areas accounted for 61 percent of all crashes.

In the rural areas, crashes on minor arterials, major collectors, and minor collectors are overrepresented compared to the proportion of their VMT. The amount of VMT for these three classes of roadways accounts for 17.7, 15.6, and 1.6 percent, respectively. The crashes on these roadways account for 27.8, 28.4, and 2.1 percent, respectively.

In the urban areas, crashes on other principal arterials, minor arterials, and collectors are overrepresented. Their VMT account for 32.9, 10.3, and 2.9 percent, respectively. Crashes on the three roadways account for 54.2, 12.3, and 3.3 percent, respectively.

RHiNO classifies the highway system into state highways (SH), farm to market (FM) roads, interstate highways (IH), and U.S. (US) highways. Figure 4 depicts a crash tree with a structure based on the highway system. In the rural areas, SH and FM road crashes are overrepresented compared to the proportion of their VMT. The amount of VMT on SH and FM roads account for 23.6 and 20.9 percent of the total roadway network. The SH and FM road crashes account for 27.9 and 33.3 percent of the total numbers.

In urban areas, crashes on SH, FM, and other types of roadways are overrepresented. Their VMT account for 21.5, 13.3, and 5.3 percent of the total network, respectively. Crashes on these three road types account for 27.2, 16.7, and 7.6 percent of the total crashes, respectively.



Note: VMT = vehicle miles traveled in a 7-year period (2010–2016), and the unit is in millions; IH = Interstate, US = US Highway, SH = State Highway, FM = Farm to Market. There are 483 crashes with unknown rural or urban status.

Figure 4. Crash Tree Based on Highway System.

Severity Distribution

To explore the crash severities in Beaumont, researchers used the KABCO scale, where K and A represent fatal and suspected serious injury crashes (formerly incapactitating injury crashes), B refers to non-incapacitating injury crashes, C refers to possible injury crashes, and O refers to the property damage only (PDO) crashes. In Texas, a driver must report a PDO crash if the cost of the crash exceeds $1,000 in damages.

As indicated earlier, 39,888 crashes occurred on the on-system roadways in the Beaumont District from 2010 to 2016 and resulted in 529 fatal and 1,553 suspected serious injury crashes. These numbers represent 1.3 and 3.9 percent of the overall crashes. In addition to these numbers, there were 5,078 non-incapacitating injury crashes (12.7 percent), 6,888 possible injury crashes (17.3 percent), and 25,455 PDO crashes (63.8 percent). Figure 5 illustrates the trends of the VMT amount and number of crashes by severity level from 2010 to 2016, and Table 1 depicts the annual crash severity distributions. As can be observed, travel, as reflected by VMT remained relatively constant, but crashes have increased, especially in 2014, except for fatal crashes. Property damage crashes have increased the most since 2010, but non-fatal injury crashes have also risen significantly. These increases cannot be attributed to growth in travel.

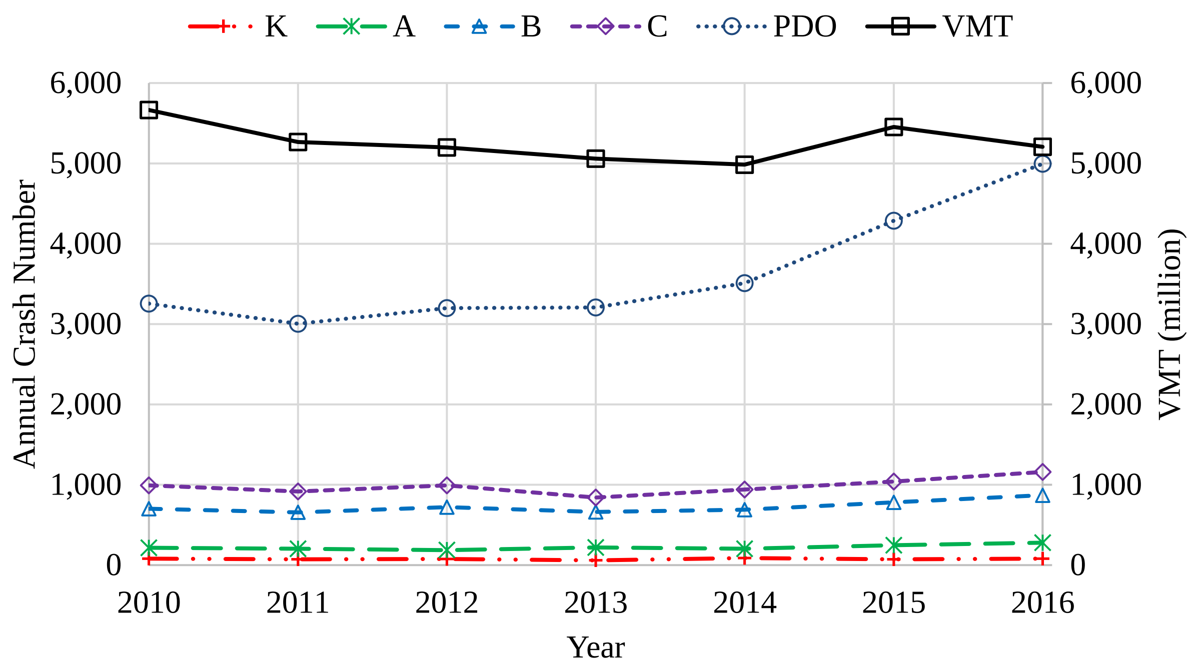


Figure 5. Annual VMT Amount and Crash Number by Severity, 2010–2016.

Table 1. Crash Severity Distributions (2010 and 2016).

Year	**Severity**							**VMT**
	K	**A**	**B**	**C**	**PDO**	**Unknown**	**All**	
2010	82	215	701	993	3,255	53	5,299	5,664
2016	82	279	870	1,159	4,994	66	7,450	5,205
Change in 2010–2016	0.0%	29.8%	24.1%	16.7%	53.4%	24.5%	40.6%	-8.1%

Note: VMT = vehicle miles traveled, in millions. The last row indicates the percent change of 2016 compared to 2010, e.g., "A" crashes in 2016 increased by 29.8 over 2010 "A" crashes.

Collision Type

Researchers categorized the collision types into six groups: single-vehicle run-off-road (SVROR), head-on (HO), rear-end, angle, sideswipe, and others. The identifications of SVROR and HO were consistent with their definitions in the Texas Strategic Highway Safety Plan (TxDOT, 2017). The rear-end, angle, and sideswipe crashes represent additional collision types represented by the collision ID in the crash records.

Figure 6 depicts the distribution of collision types. In the rural area, SVROR, HO, rear-end, angle, and sideswipe crashes account respectively for 38.2, 3.1, 26.1, 10.5, and 8.2 percent of the total rural on-system crashes. In urban areas, these collision types account for 14.6, 1.3, 42.3, 19.6, and 11.2 percent, respectively. In the rural areas, the proportions of SVROR and HO crashes are higher than they are in urban areas. The proportions of rear-end, angle, and sideswipe crashes are relatively higher in urban areas.

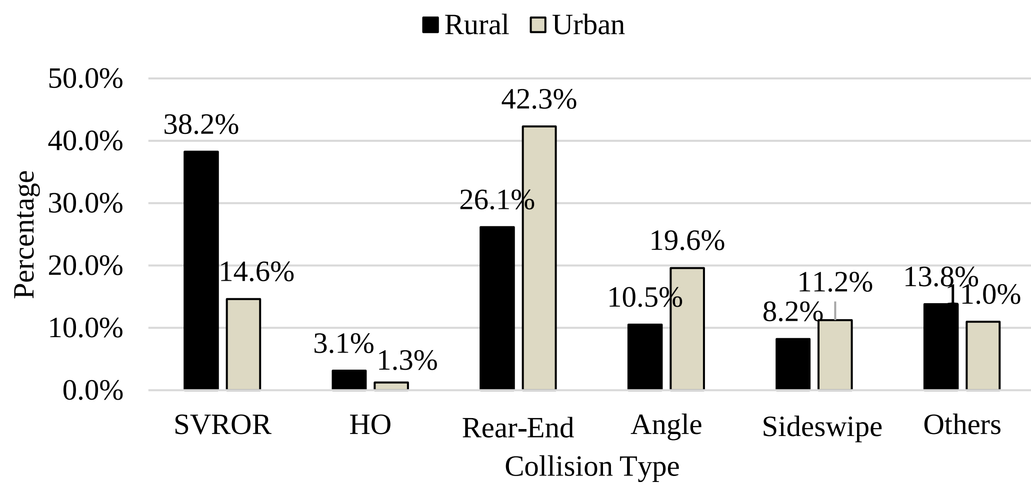


Figure 6. Distribution of Crashes by Collision Type.

First Harmful Event

The first harmful event describes the manner of collision and provides the information on what was struck. Vehicles can collide with stationary or moving objects or people (other motor vehicles, fixed objects, pedestrians, bicyclists, or animals) and/or strike the earth in an unintended manner, as is the case with overturn crashes.

Figure 7 shows the distribution of first harmful events. In rural areas, 52.3 percent of the harmful events involved collisions with other motor vehicles, 29.8 percent were collisions with fixed objects, and 7.9 percent of the crashes involved an overturning vehicle. In urban areas, the proportion of harmful events where the vehicle hit another motor vehicle represented 82.3 percent of the crashes, a value that reflects the greater density of traffic in urban areas and the greater chance of striking another vehicle. The proportions of fixed object crashes and overturned vehicles were 13.1 and 1.6 percent, respectively. Both occurrences are lower than in rural crashes. In rural areas, about 0.1 percent of the crashes involved a collision with a pedestrian or bicycle. In urban areas, this percentage was 0.9 percent.

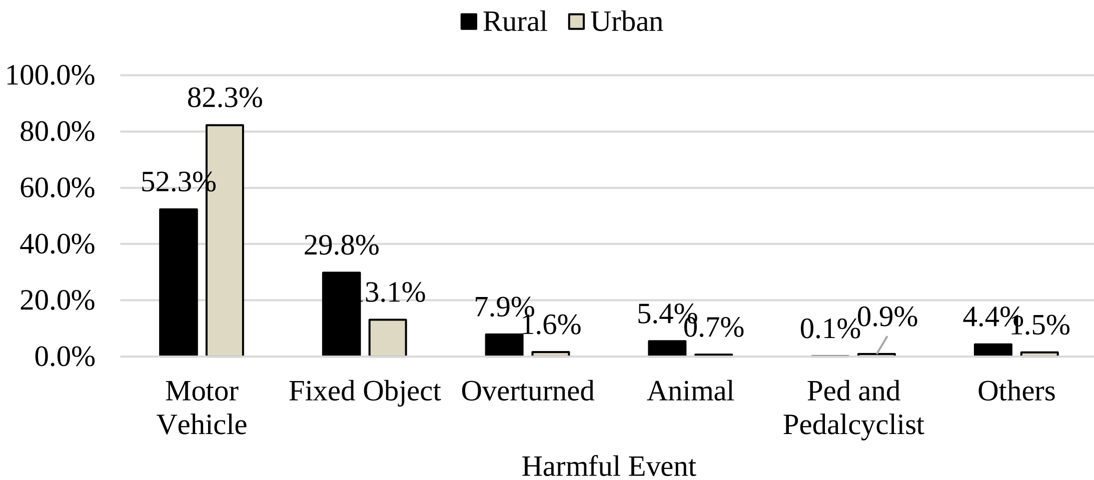


Figure 7. Distribution of Crashes by First Harmful Event.

Location along the Roadway

Crashes either occur at intersections or along roadway segments. Figure 8 shows the crash distribution based on crash proximity to the intersections. The proportion of intersection-related and driveway-related crashes is higher in urban areas than in rural areas. This observation is expected since the intersection density on rural highways is significantly smaller.

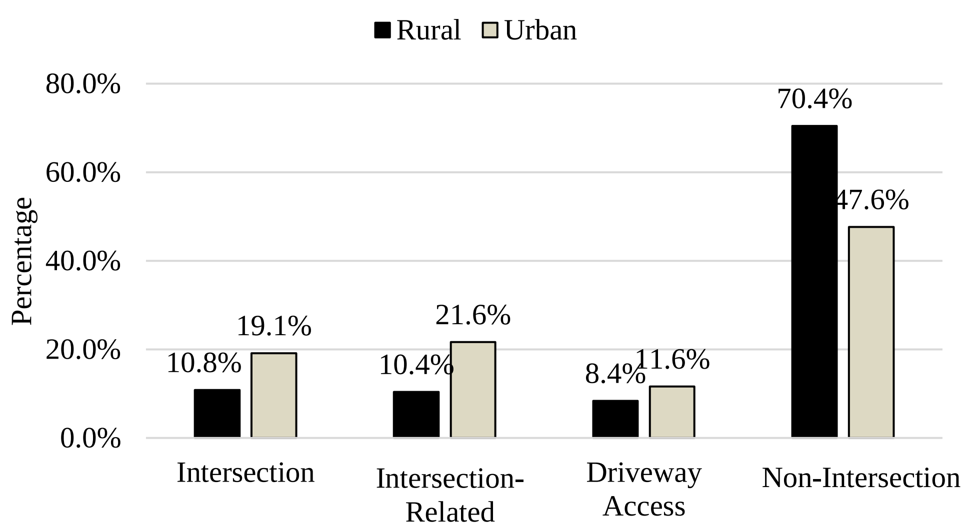


Figure 8. Distribution of Crashes by Intersection.

Roadway Alignment

Crashes can occur on straight or curved sections of roadway. As can be seen in Figure 9, most crashes occur on straight sections of roadway, which is expected since straight sections make up most of the roadway mileage. A higher percentage of urban crashes occur on straight, level sections of roadway than rural crashes and a higher percentage of rural crashes occur on level curves than in urban areas.

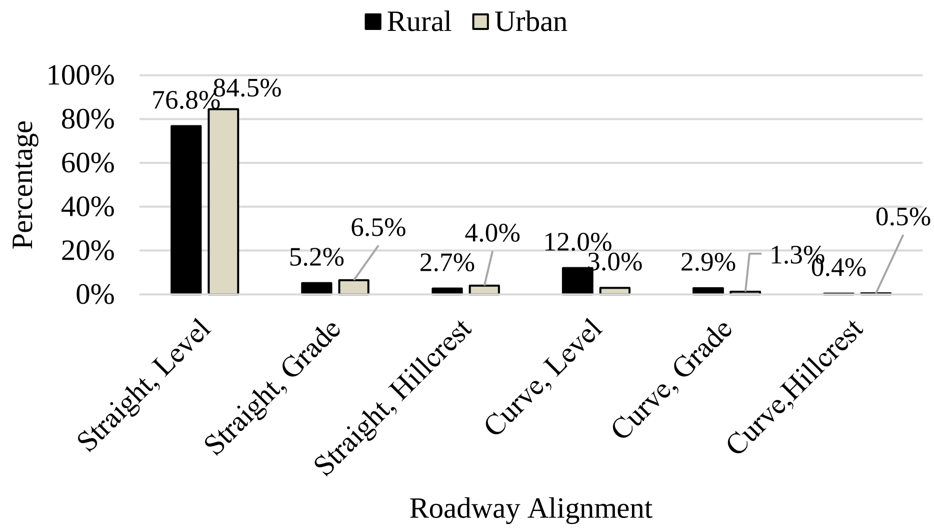


Figure 9. Distribution of Crashes by Roadway Alignment.

Lighting Condition

Figure 10 shows the distribution of lighting conditions associated with crashes. In rural areas, 63.4 percent of crashes occurred during daylight conditions compared to 73.3 percent of urban crashes. In general, a greater proportion of rural crashes occur in dark, unlit conditions than do urban crashes, while a greater proportion of urban crashes occur in dark but lit conditions, reflecting the higher degree of street lighting used in urban areas.

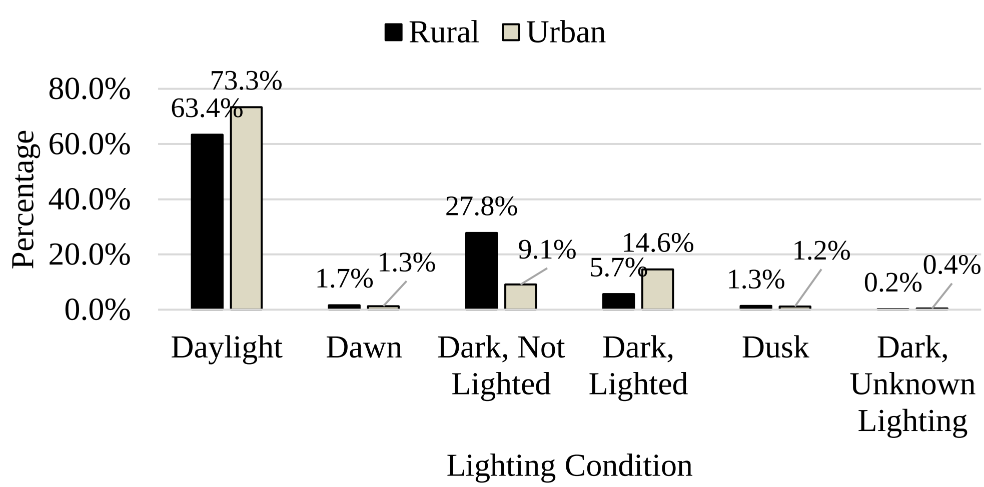


Figure 10. Distribution of Crashes by Lighting Condition.

Weather and Surface Condition

Figure 11 and Figure 12 illustrate the distribution of crashes by weather and surface conditions, respectively. The overall distributions of weather and surface conditions are quite similar for rural and urban areas. Approximately 13 percent of crashes occurred during rainy conditions, and about 18.4 percent of crashes occurred on wet surfaces.

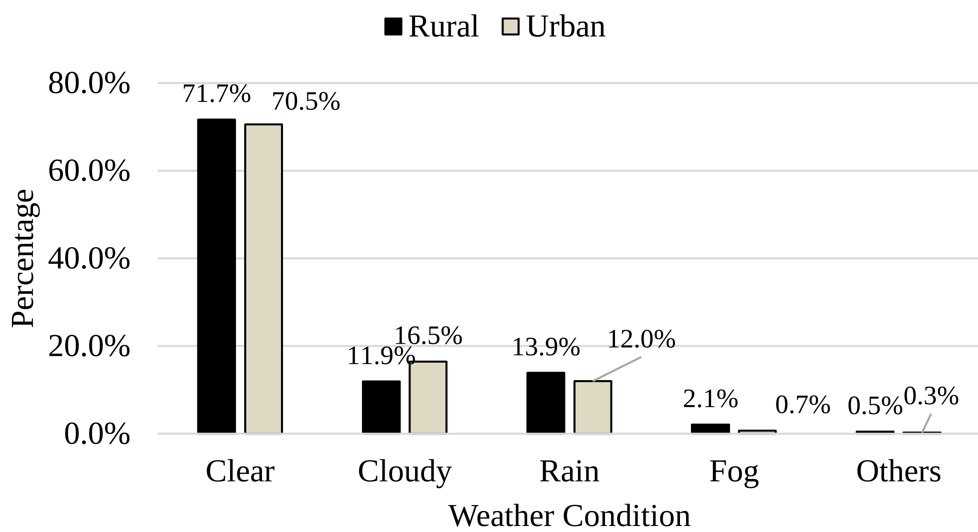


Figure 11. Distribution of Crashes by Weather Condition.

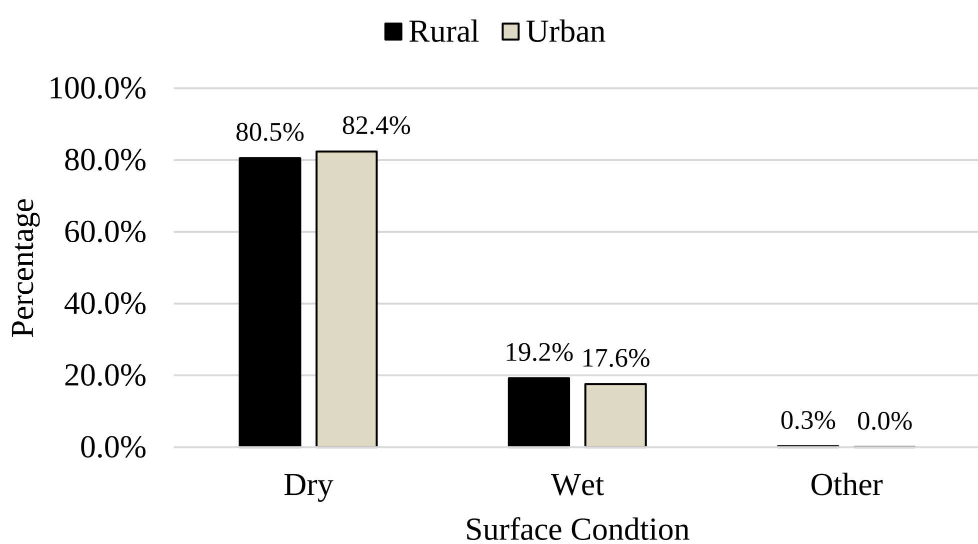


Figure 12. Distribution of Crashes by Surface Condition.

Section Summary

This section presented the crash descriptive statistics for the on-system roadways in the TxDOT Beaumont District. Crash statistics reveal that the annual crash numbers have been increasing rapidly in the most recent 3 years of statistics (i.e., 2014 to 2016), while the VMT has remained relatively stable. Crash trees show that crashes on lower classes of roadways (e.g., minor arterials, major collectors, minor collectors, SH, and FM roadways) are overrepresented compared to their respective VMT thresholds. Crashes in rural and urban areas have different characteristics in terms of severities and crash types. The rural and urban crash types also exhibit different crash location characteristics and external conditions.

CRASH DENSITY ANALYSIS

TTI has developed a Highway Safety Improvement Program (HSIP) Screening Tool for TxDOT. This tool helps to identify roadways where a higher opportunity for reducing crashes exists (Geedipally et al., 2017). This tool assigns the roadway segments to one of four risk categories—very high-risk, high-risk, moderate risk, and low risk based on the historical fatal and suspected serious injury crashes (i.e., KA crashes), roadway classification system, and the VMT.

In the HSIP Screening Tool, the researcher team members have identified eight roadway categories based on the functional classification:

- Rural:
  - Interstate and freeway and expressway.
  - Principal arterial.
  - Minor arterial and major collector.
  - Rural minor collector and rural local.
- Urban:
  - Interstate and freeway and expressway.
  - Principal arterial and minor arterial.
  - Minor collector and major collector.
  - Urban local.

Using the VMT data, the research team members further classified these roadway categories into high, moderate, and low volume categories, as shown in Table 2.

Table 2. Volume Groups for Crash Risk Assessment.

Roadway Category	Functional Classifications	Low Volume	Moderate Volume	High Volume
Group 1	• Rural Interstate • Rural Freeway and Expressway	<30,000	—	≥30,000
Group 2	• Rural Principal Arterial	<7,500	—	≥7,500
Group 3	• Rural Minor Arterial • Rural Major Collector	<400	400–3,000	≥3,000
Group 4	• Rural Minor Collector • Rural Local	<400	400–1,000	≥1,000
Group 5	• Urban Interstate • Urban Freeway and Expressway	<50,000	50,000–100,000	≥100,000
Group 6	• Urban Principal Arterial • Urban Minor arterial	<2,500	2500–15,000	≥15,000
Group 7	• Urban Minor Collector • Urban Major Collector	<1,000	1,000–5,000	≥5,000
Group 8	• Urban Local	All	—	—

Note: This table is adapted from Geedipally et al. (2017).
— indicates there are not enough roadways with the volume level.

Equation 2 shows the crash rate calculation derived by dividing the KA crash frequency by the VMT.

$$KA\ Crash\ Rate = \frac{KA\ Crash\ Frequency}{VMT} \qquad \text{(Equation 2)}$$

For the next step in the crash density analysis, the research team members compared the segments in the same roadway type and volume group to determine the threshold percentiles in order to assign the roadway segments to one of the four risk groups: low risk, moderate risk, high-risk and very high-risk. As an example, the threshold percentiles for the low-volume rural interstate segments were 20, 85, 95 and < 95 percent for low, moderate, high, and very high categories, respectively. Appendix A of this report summarizes the threshold values for each type of roadway segment. Table 3 summarizes the assessment of risk for a variety of roadway segment groups.

Table 3. Summary of Risk Assessments in the Beaumont District.

Area	Risk Level	VMT	Number of Total Crashes	Number of K Crashes	Number of A Crashes
Rural	Very High	177 (1.0% of rural)	691 (4.5% of rural)	20 (6.2% of rural)	69 (9.4% of rural)
	High	1,137 (6.3% of rural)	1,243 (8.2% of rural)	40 (12.5% of rural)	102 (13.9% of rural)
	Moderate	15,131 (83.9% of rural)	11,675 (76.7% of rural)	261 (81.3% of rural)	565 (76.8% of rural)
	Low	1,598 (8.9% of rural)	1,615 (10.6% of rural)	0 (0% of rural)	0 (0% of rural)
	Rural Total	**18,043 (49.0% of total)**	**15,224 (35.5% of total)**	**321 (58.3% of total)**	**736 (43.5% of total)**
Urban	Very High	179 (0.5% of urban)	1,088 (2.5% of urban)	8 (1.5% of urban)	58 (3.4% of urban)
	High	2,072 (5.6% of urban)	5,330 (12.4% of urban)	46 (8.3% of urban)	236 (14.0% of urban)
	Moderate	15,595 (42.3% of urban)	19,989 (46.6% of urban)	176 (31.9% of urban)	661 (39.1% of urban)
	Low	942 (2.6% of urban)	1,224 (2.9% of urban)	0 (0% of urban)	0 (0% of urban)
	Urban Total	**18,788 (51.0% of total)**	**27,631 (64.5% of total)**	**230 (41.7% of total)**	**955 (56.5% of total)**
Grand Total		**36,831**	**42,855**	**551**	**1,691**

Note: (a) Each intersection crash is included on all the segments associated with that intersection, and therefore the total number of crashes accounted for in the table is greater than the total number of crashes on state roadways; (b) K crashes = fatal crashes; and A crashes = suspected serious injury crashes.

To determine if crashes related to specific segment groups are overrepresented, research team members compared the percentage of crashes on each segment group to the percentage of VMT associated with the roads in that group. If the percentage of crashes is greater than the amount of the travel, then that group is considered overrepresented in the crash category. This is the case for all high- and very high-risk segments in both rural and urban areas. For example, segments in the first row of Table 3 were identified as having very high-risk levels in the rural areas. The amount of travel (VMT) on these segments account for one percent of rural VMT, but the crashes on these segments account for 4.5 percent of rural crashes. Therefore, the segments in this group are overrepresented in terms of crashes. This overrepresentation is also true for fatal and suspected serious injury crashes, whose percentage of rural "K" and "A" crashes are 6.2 and 9.4 percent, respectively. In contrast, segments with a moderate risk level account for 83.9 percent of the total VMT, but the number of crashes accounts for 76.7 percent of the rural crash total. Although the crash percentage on rural segments with low risk (10.6 percent) is higher than the proportion of VMT (8.9 percent) for those segments, fatal and suspected serious injury crashes are under-represented since none of these crash severity types occurred. Figure 13 illustrates the resulting TxDOT Beaumont District roadway risk map.

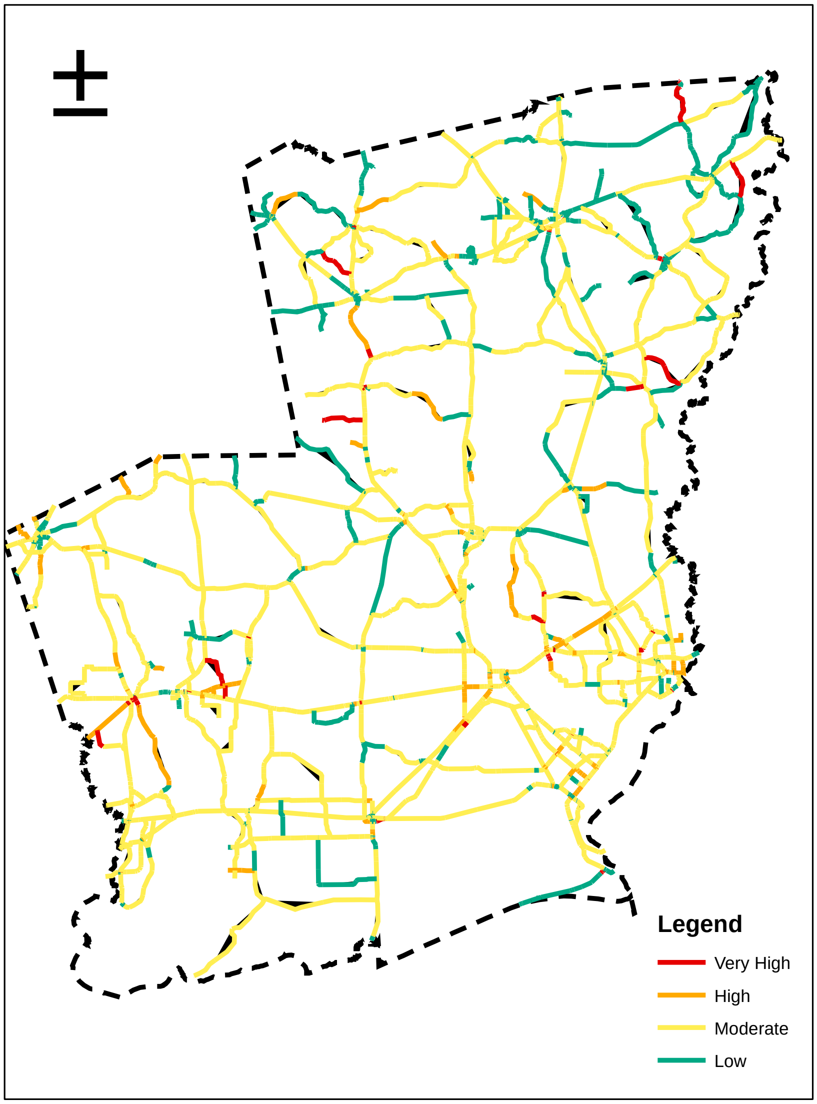


Figure 13. Roadway Risk Assessment Map in the Beaumont District.

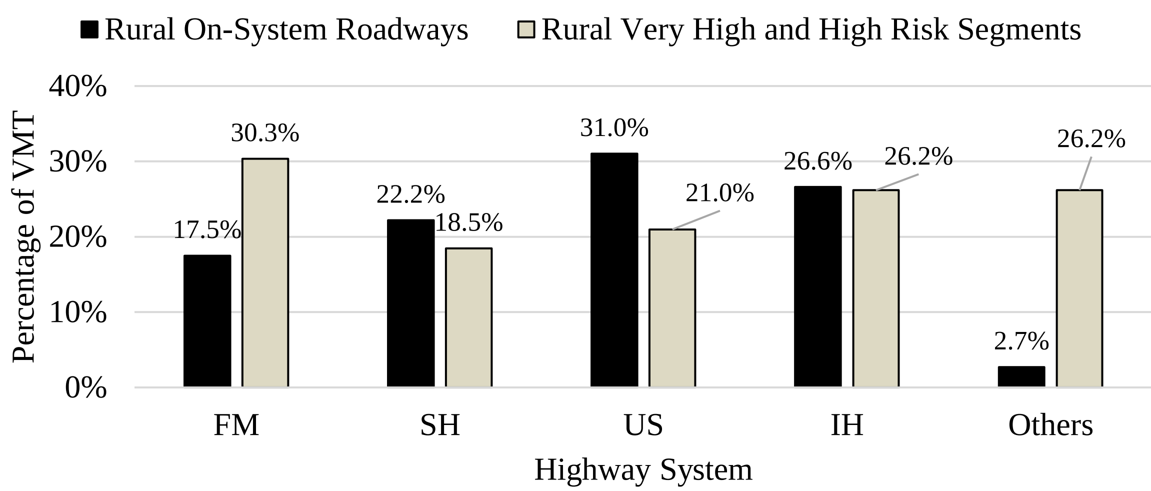
Higher Risk Segments in Texas

Higher risk segments refer to the segments in high- and very high-risk groups. Because crashes on the low risk segments were not serious, the descriptive analysis for Texas and Beaumont District focus on higher risk segments. Researchers have conducted an exploratory analysis to identify the recurring roadway characteristics of these segments:

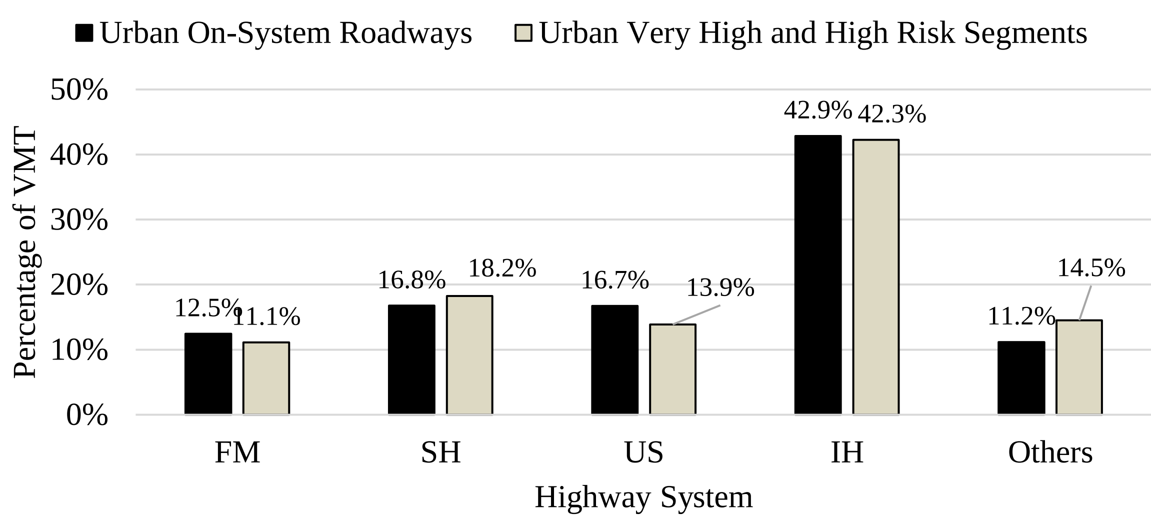
- Highway system.
- Lane width.
- Median type and width.
- Shoulder width of divided and undivided roadways.
- Posted speed limit (PSL).

Highway System

Figure 14 shows the VMT distributions by highway system for the on-system roadway network segments with very high- and high-risk levels in Texas.



(a) Rural Area



(b) Urban Area

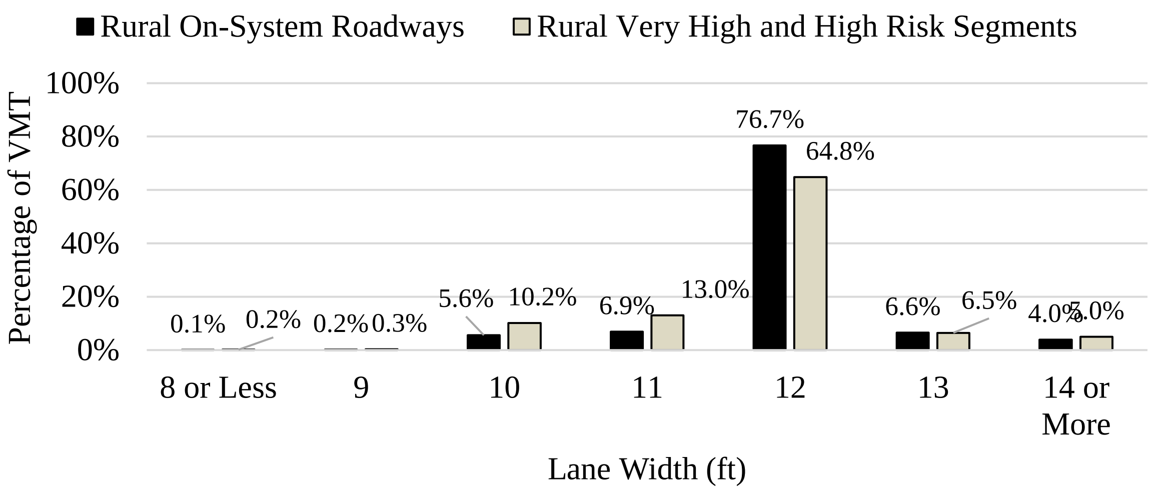
Figure 14. Distribution of VMT by Highway System (Texas).

In the rural areas (i.e., Figure 14a), FM roadways are overrepresented. Overrepresentation occurs when the proportion of total VMT carried by a roadway type is lower than the proportion of total VMT on high- and very high-risk segments carried by that roadway type. VMT can be classified as high- or very high-risk if it occurs on segments classified as such. Rural FM roadways carry 17.5 percent of the on-system VMT in Texas, but 30.3 percent of the high- and very high-risk VMT is carried on these roadways.

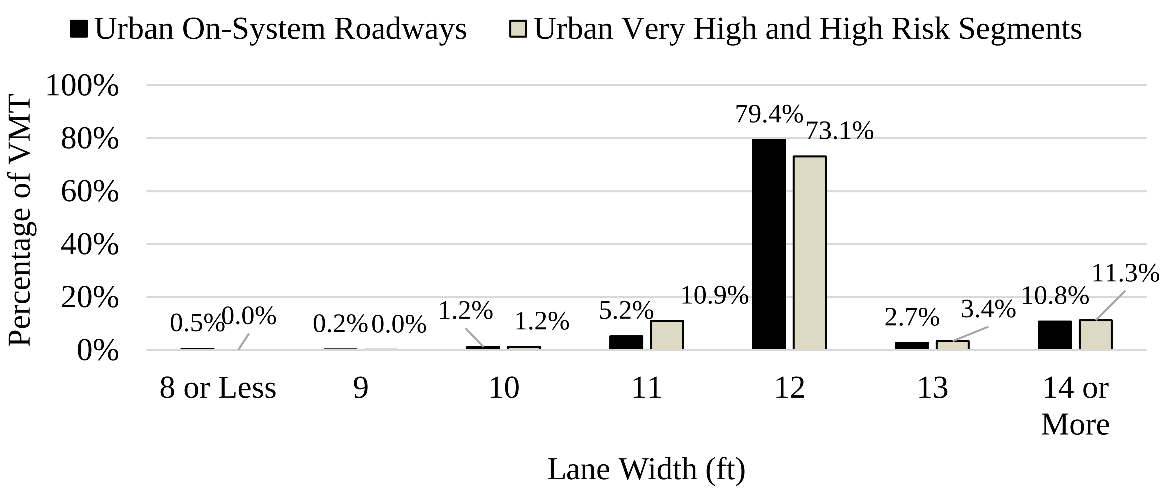
In urban areas, the distribution of crashes is nearly uniform. SH and other types of roadways are slightly overrepresented.

Lane Width

Figure 15 shows the VMT distributions by lane width. Due to highway design standards, 12 ft wide lanes are common for both rural and urban areas. In rural areas, 10 or 11 ft wide lanes are overrepresented in the very high- and high-risk segments. In urban areas, 11 and 13 ft wide lanes are overrepresented.



(a) Rural Area

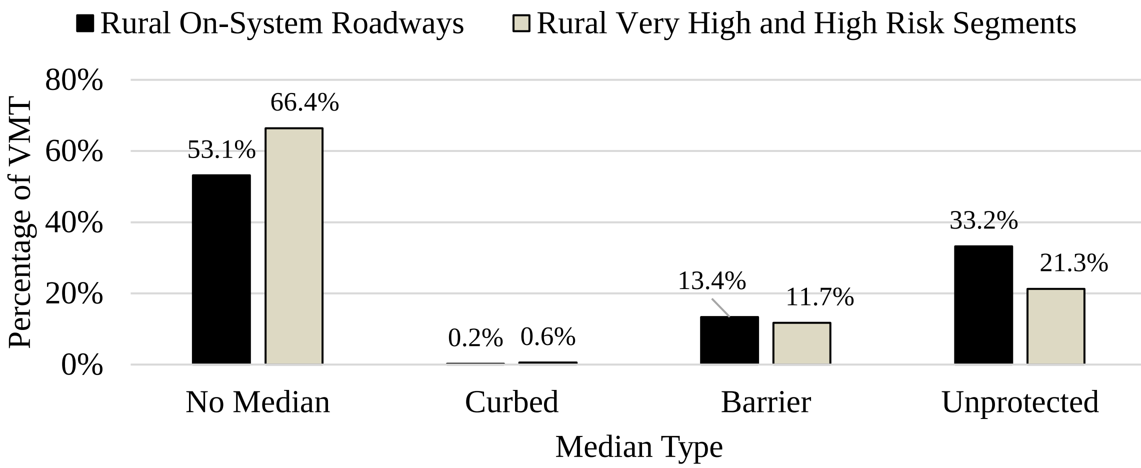


(b) Urban Area

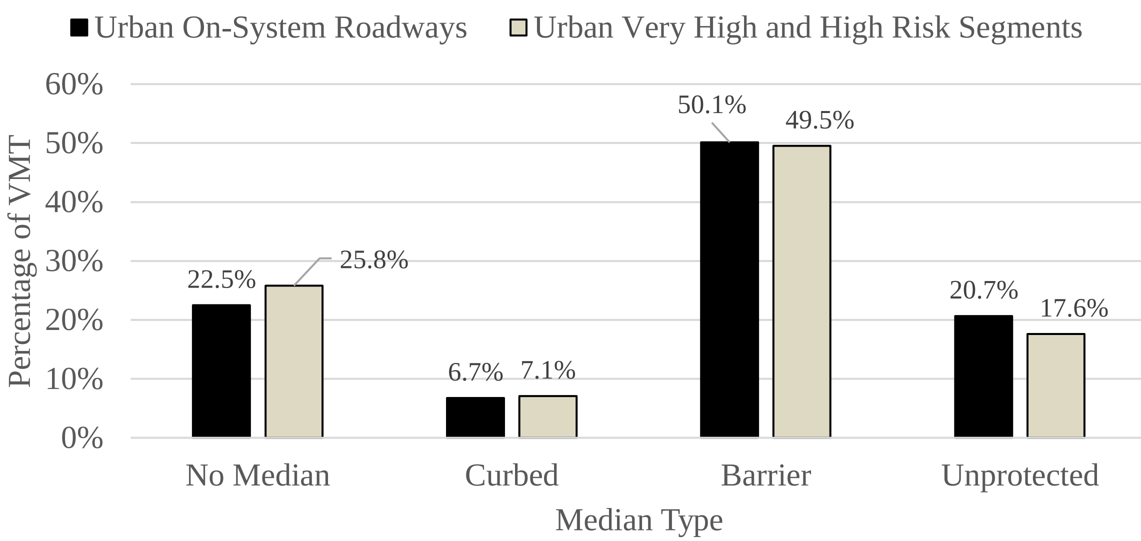
Figure 15. Distribution of VMT by Lane Width (Texas).

Median Type and Width

Figure 16 shows the VMT distributions, based on median type, for the very high- and high-risk segments. In rural areas, roadways without medians are overrepresented. In urban areas, roadways without median are slightly overrepresented



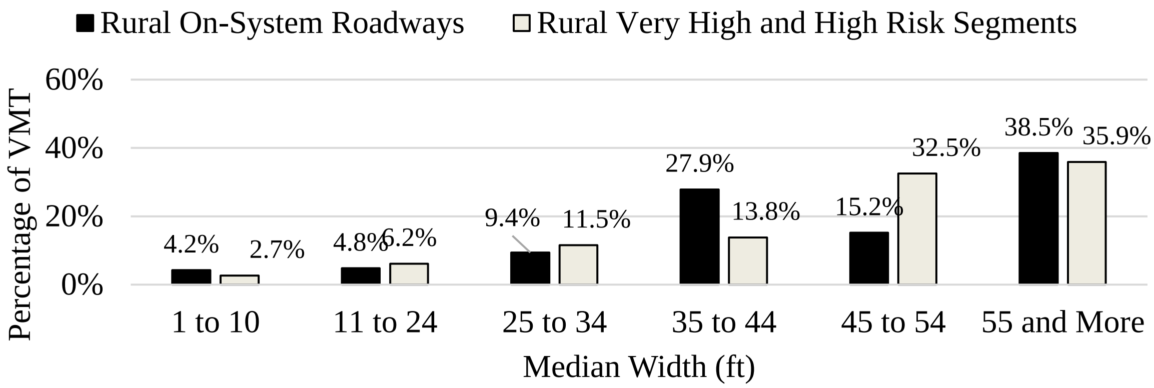
(a) Rural Area



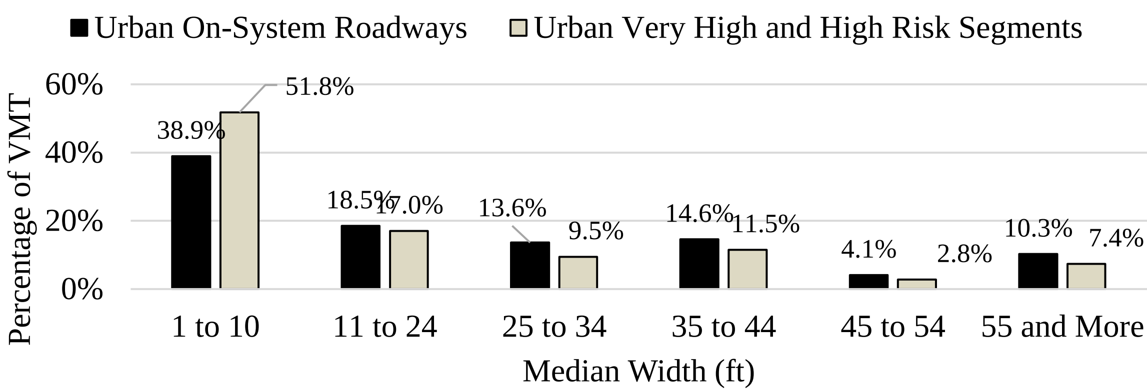
(b) Urban Area

Figure 16. Distribution of VMT by Median Type (Texas).

Figure 17 illustrates the distribution of VMT for the divided roadways based on the associated median width. Roadways with 45 to 54 ft wide medians are highly overrepresented in rural areas. In urban areas, roadways with a narrow median (i.e., 1 to 10 ft) are overrepresented for the very high- and high-risk segments.



(a) Rural Area



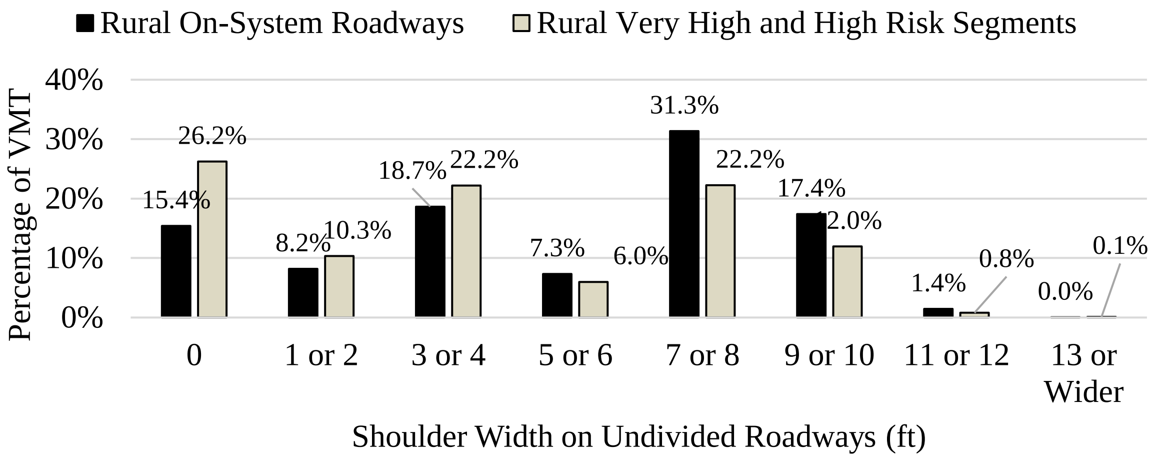
(b) Urban Area

Figure 17. Distribution of VMT by Median Width on Roadways with Medians (Texas).

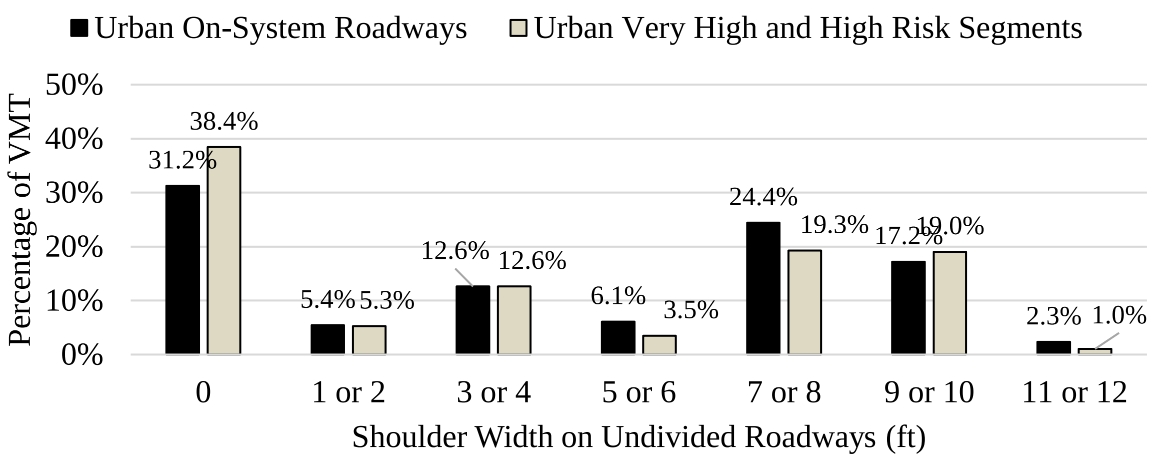
Shoulder Width (Undivided Roadways)

Undivided roadways typically have two shoulders (i.e., left shoulder and right shoulder), while divided roadways usually have four shoulders (i.e., two inside shoulders and two outside shoulders). The shoulder width in this document is defined as the average of left-side and right-side shoulder widths.

Figure 18 illustrates the distributions of VMT by shoulder width. Roadways without shoulders in both rural and the urban areas are overrepresented. In addition, roadways with narrow shoulders (i.e., 1 to 4 ft) in the rural areas are overrepresented.



(a) Rural Area



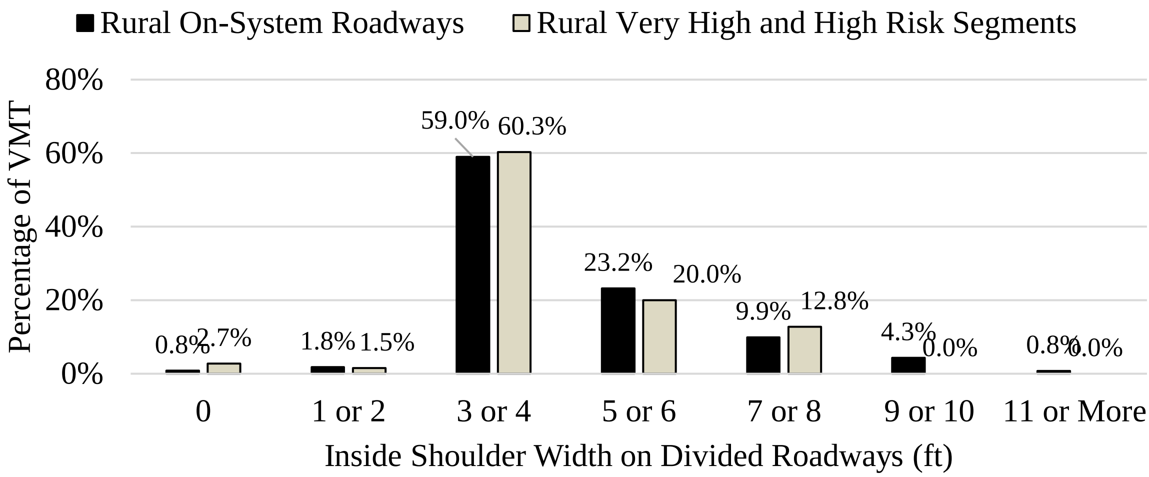
(b) Urban Area

Figure 18. Distribution of VMT by Shoulder Width (Texas Undivided Roadways).

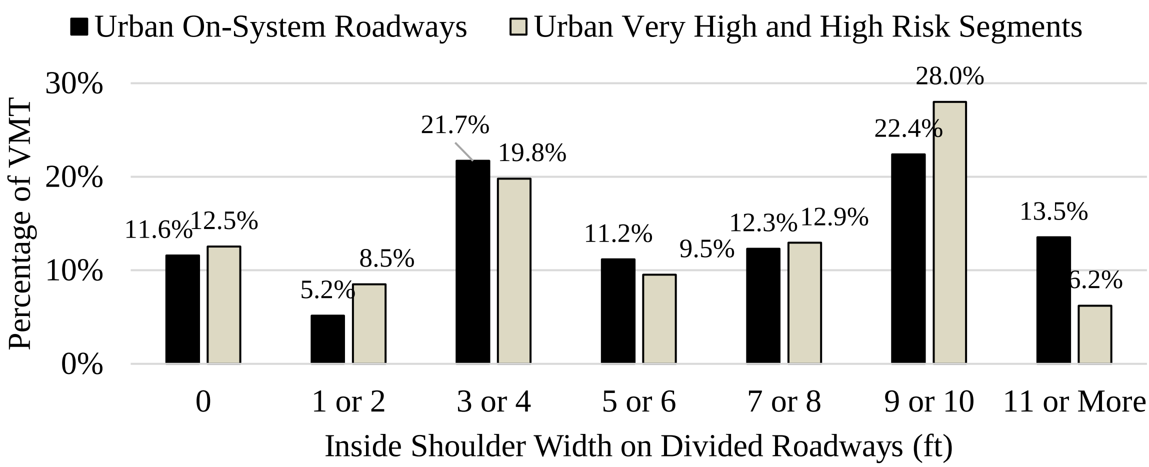
Shoulder Width (Divided Roadways)

The inside shoulder width of a divided segment, for the purposes of this review, is represented by the average of the two inside shoulders. Similarly, the outside shoulder width is represented by the average of the two outside shoulders. Figure 19 and Figure 20, respectively, depict the distributions of VMT by inside shoulder width and outside shoulder width on divided on-system roadways in Texas.

On rural divided roadways, distributions of inside shoulder are relatively uniform. As can be observed, the very high- and high-risk undivided rural roadways that do not have an inside shoulder are slightly overrepresented. As for urban divided roadways, segments with no inside shoulders or with narrow or 9–10 ft inside shoulders are overrepresented.



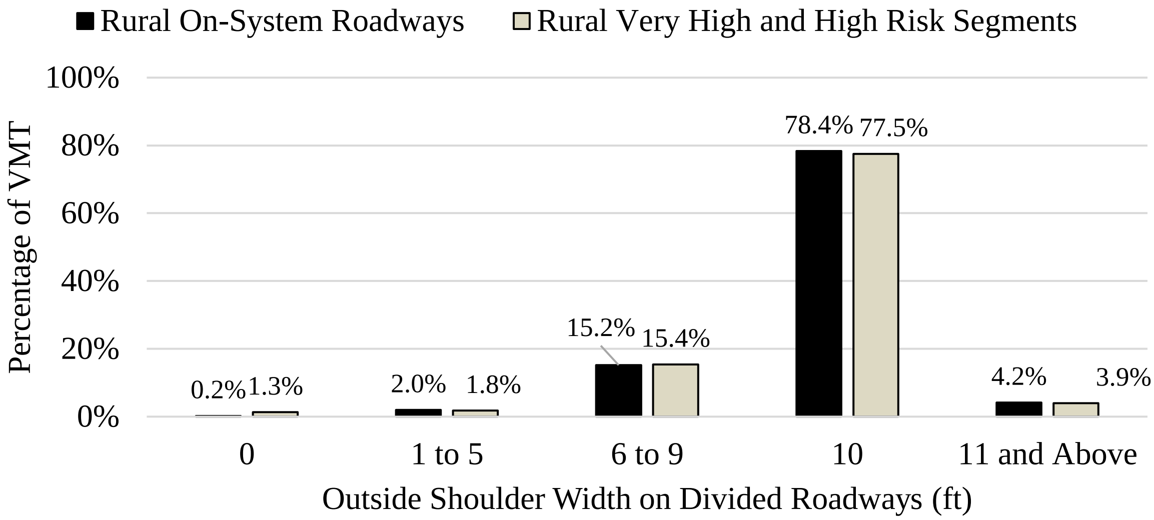
(a) Rural Area



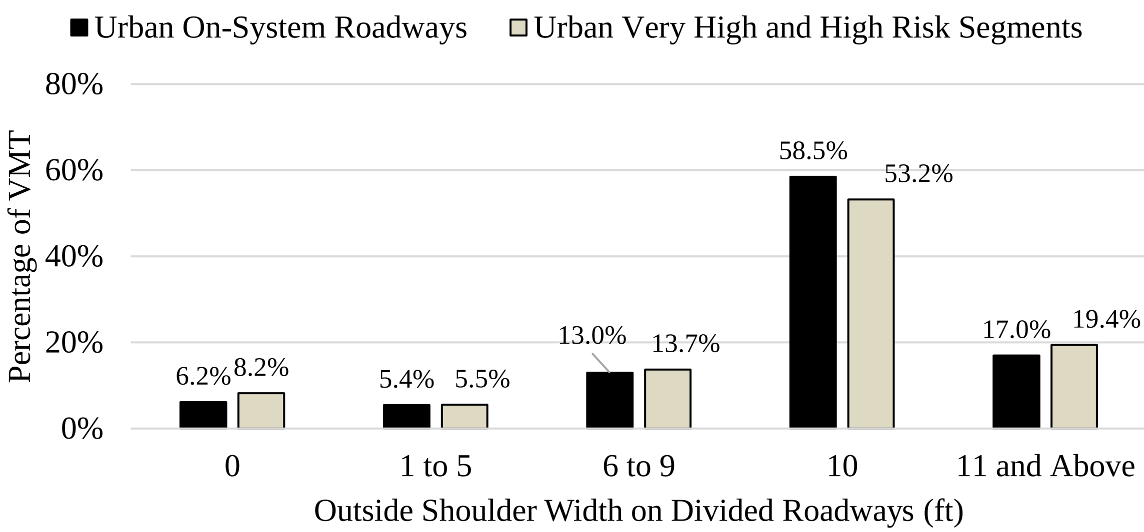
(b) Urban Area

Figure 19. Distribution of VMT by Inside Shoulder Width (Texas Divided Roadways).

There were no obvious associations between outside shoulder widths and crashes. As can be seen in Figure 20, the percentage of VMT and the crashes on the high- and very high-risk segments were similar.



(a) Rural Area

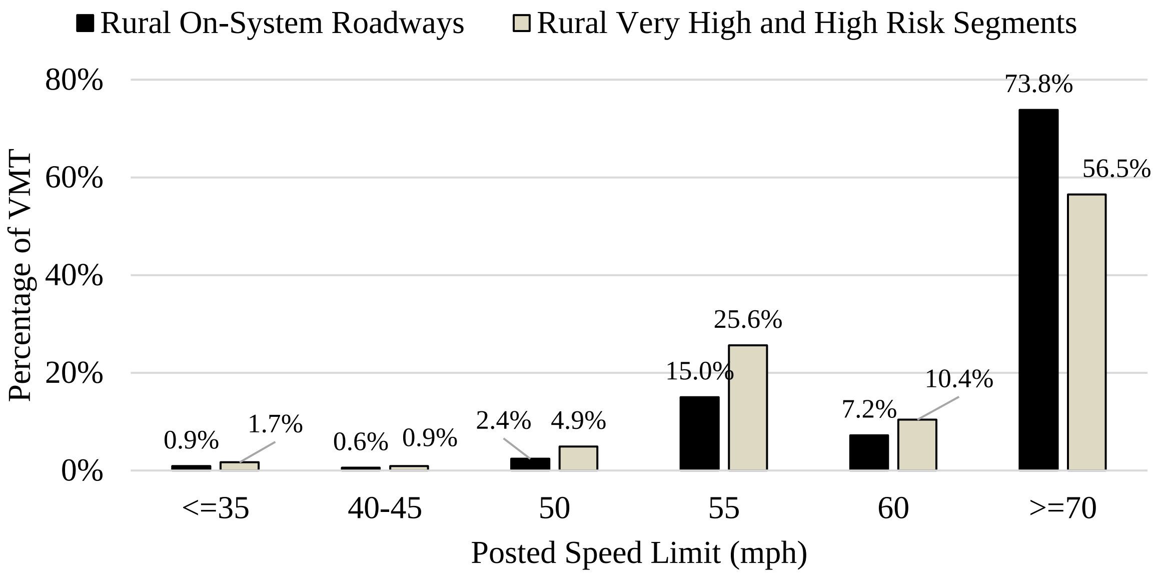


(b) Urban Area

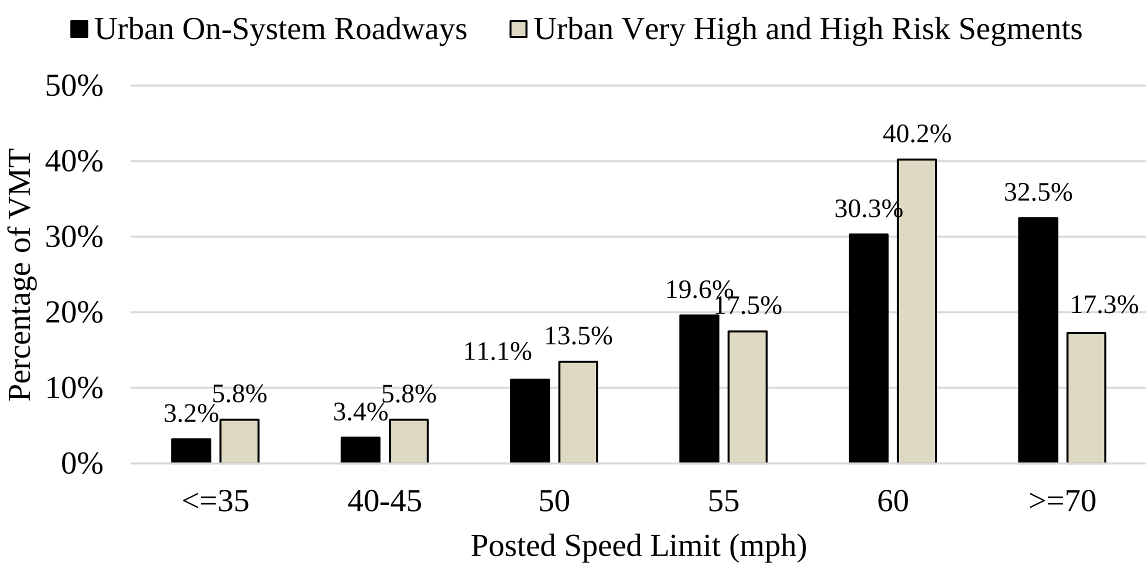
Figure 20. Distribution of VMT by Outside Shoulder Width (Texas Divided Roadways).

Posted Speed Limit

Figure 21b illustrates the distributions of VMT by PSL. In rural areas, the PSL on the very high- and high-risk roadways are primarily overrepresented on 50, 55 and 60 mph highways. In urban areas, roadways with a PSL of 60 mph or less than 50 mph are overrepresented in the very high- and high-risk segments.



(a) Rural Area



(b) Urban Area

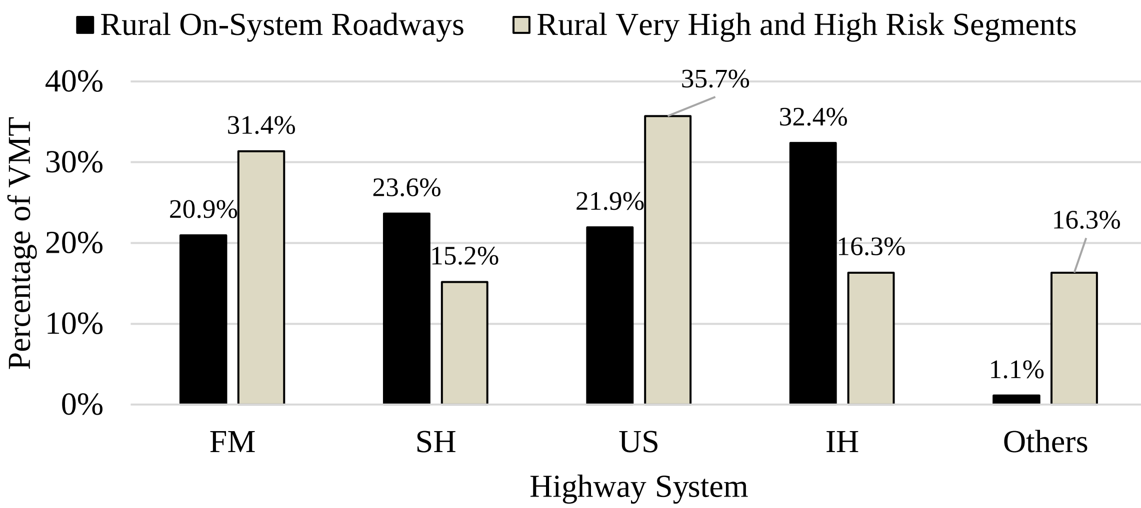
Figure 21. Distribution of VMT by Posted Speed Limit (Texas).

Higher-Risk Segments in Beaumont District

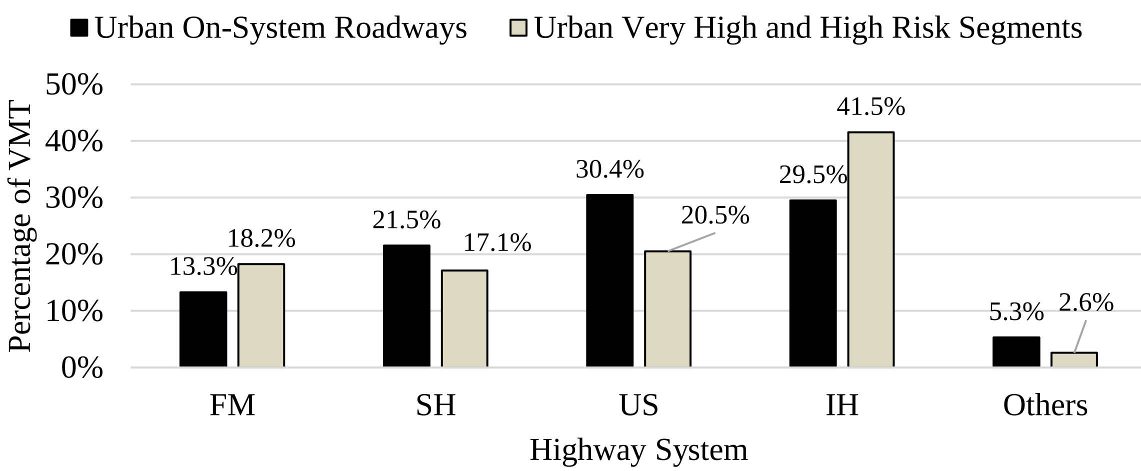
In the TxDOT Beaumont District, there are a total of 455 high- and very high-risk roadway segments. The total length of these segments is 198.1 mi (146.9 mi in rural areas and 51.2 mi in urban areas), and the total VMT is 3,564.4 million vehicle miles for 7 years (1,313.5 million in rural areas and 2,250.9 million in urban areas).

Highway System

Figure 22 depicts the VMT distributions by highway system type. Figure 22a and Figure 22b illustrate the distributions for rural and urban areas, respectively.



(a) Rural Area



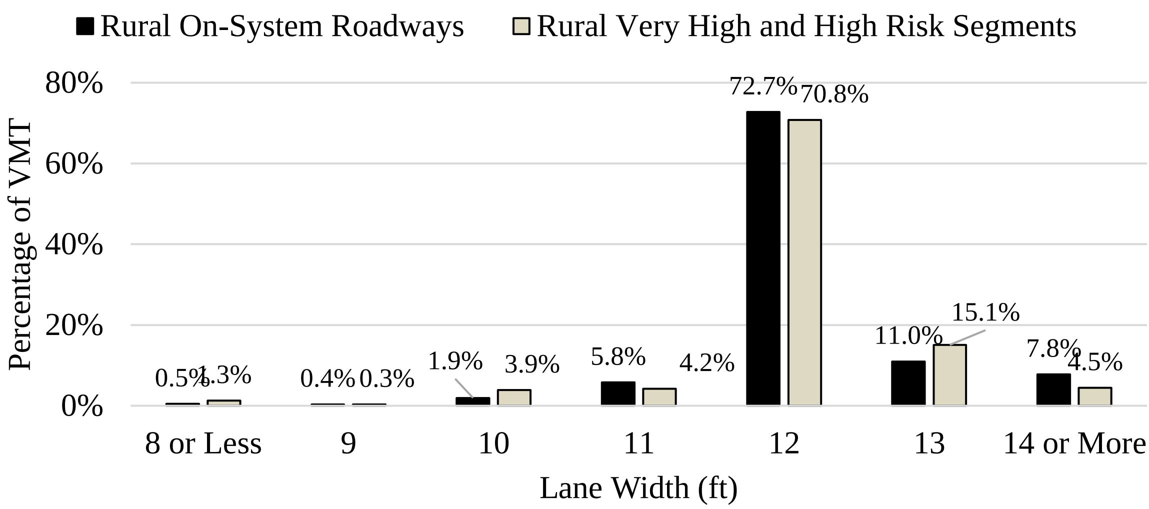
(b) Urban Area

Figure 22. Distribution of VMT by Highway System (Beaumont).

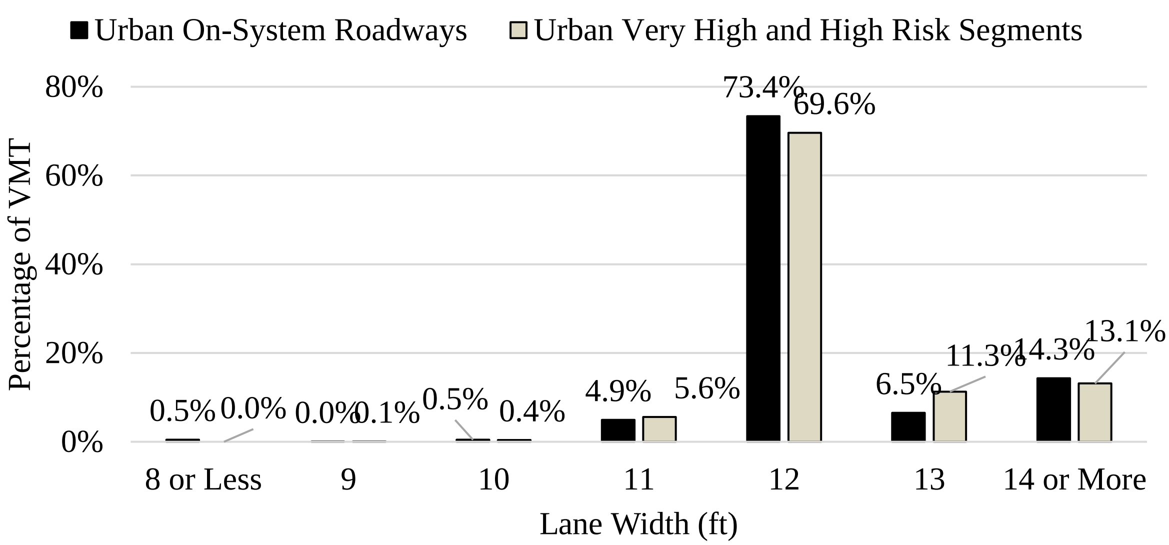
In rural areas, FM roadways and US highways are overrepresented. Rural FM roadways carry 21.1 percent of the on-system VMT, while 31.4 percent of the high- and very high-risk VMT is carried on these roadways. Similarly, US highways serve 22 percent of the total on-system VMT, with 35.4 percent of the high- and very high-risk VMT. In urban areas, FM and IH roadways are overrepresented in a similar manner.

Lane Width

Figure 23 shows the VMT distributions by lane width.



(a) Rural Area



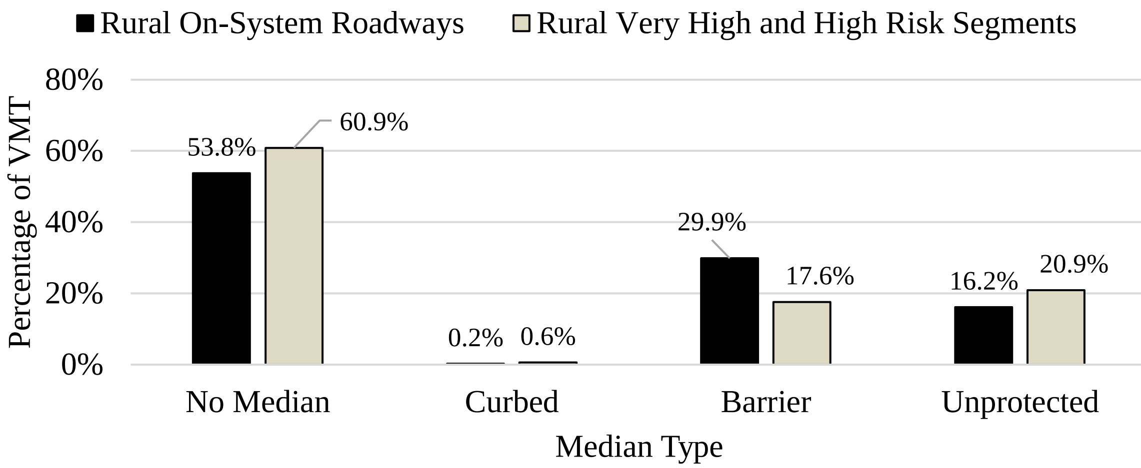
(b) Urban Area

Figure 23. Distribution of VMT by Lane Width (Beaumont).

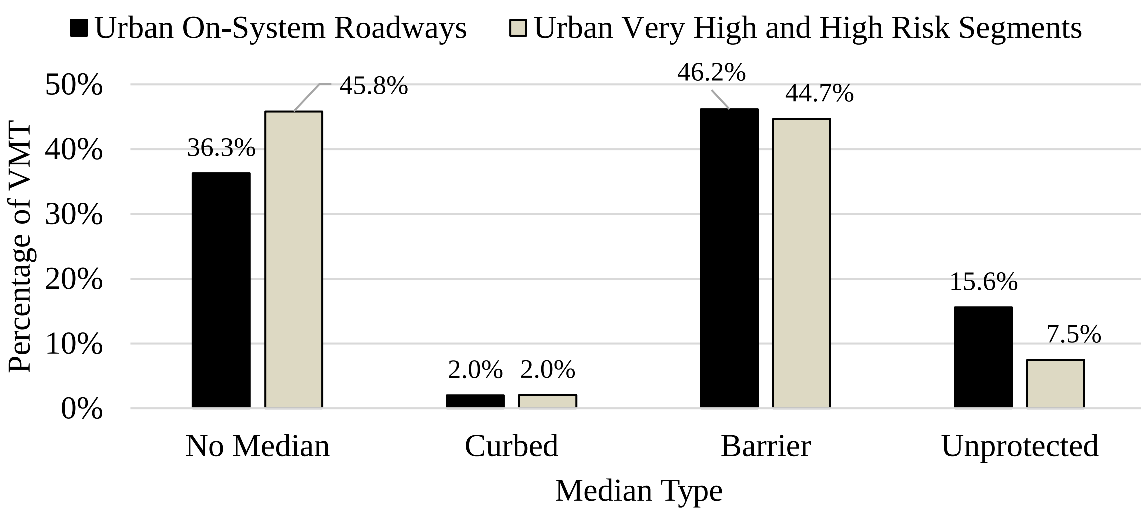
Figure 23a and Figure 23b illustrate the distributions in rural and urban areas, respectively. As previously noted, 12 ft wide lanes are common in both rural and urban areas. In rural areas, 8, 10, and 13 ft wide lanes are overrepresented in the very high- and high-risk segments. In urban areas, 11 and 13 ft wide lanes are overrepresented.

Median Type and Width

Figure 24 shows the VMT distributions by median type. In rural areas, roadways without a median or with an unprotected median are overrepresented, while in urban areas, segments without medians are overrepresented.



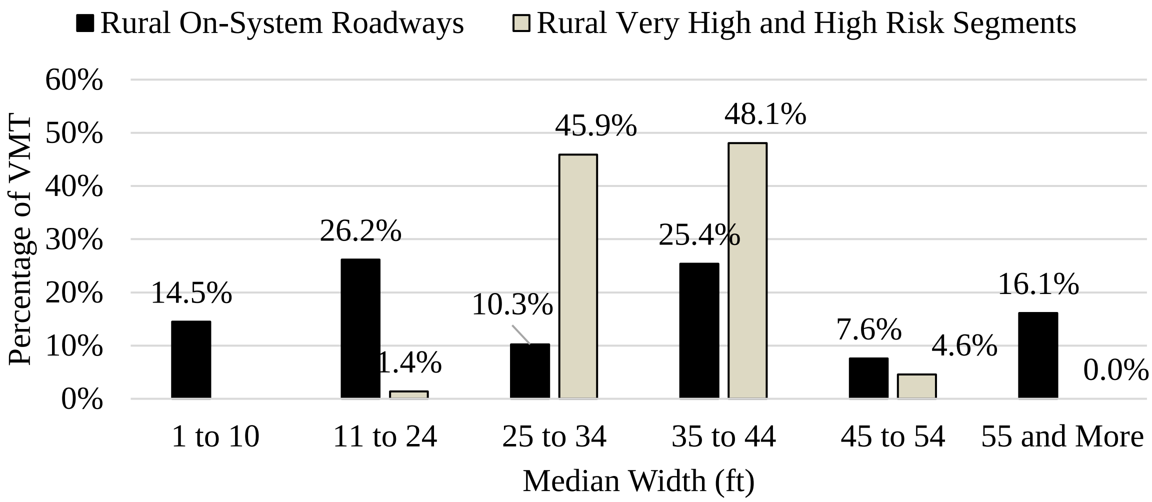
(a) Rural Area



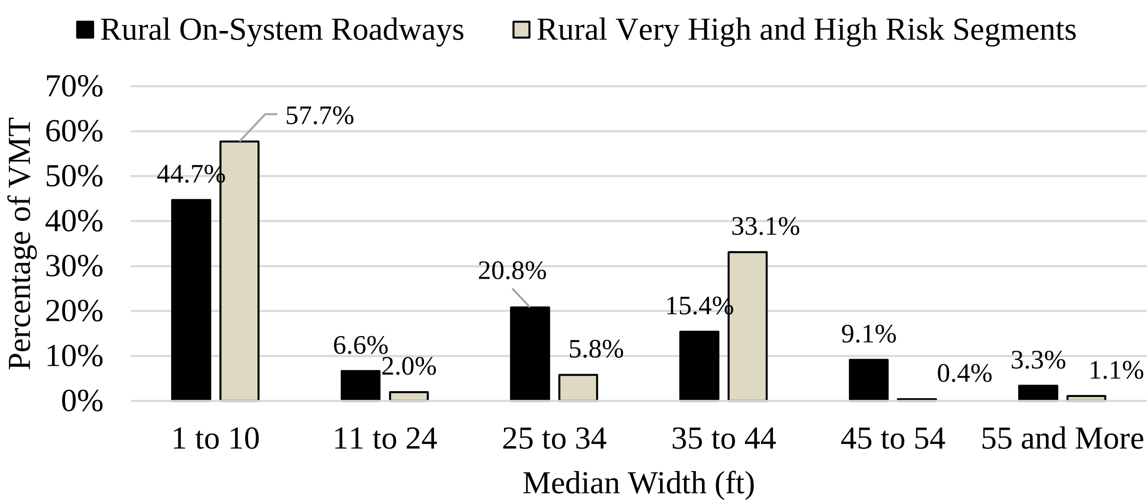
(b) Urban Area

Figure 24. Distribution of VMT by Median Type (Beaumont).

Figure 25 illustrates the distribution of VMT by median width. Note that Figure 25 only includes divided roadways, since undivided roadways, by definition, do not have a median. As can be seen, roadways with 35 to 54 ft wide medians are highly overrepresented in rural areas (Figure 25a). In urban areas (Figure 25b), roadways with 1 to 10 ft or 35 to 44 ft wide medians are overrepresented in the very high- and high-risk segments.



(a) Rural Area

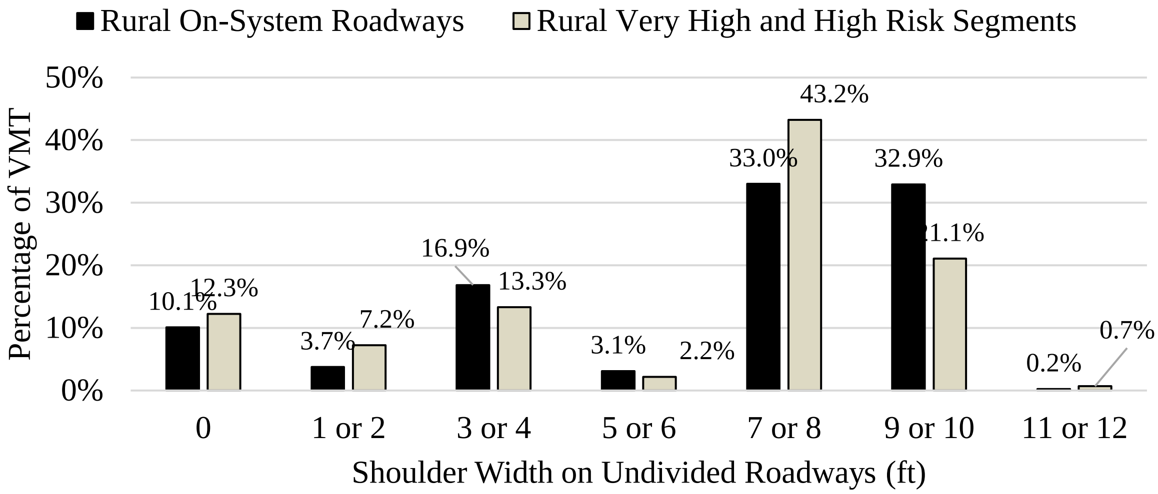


(b) Urban Area

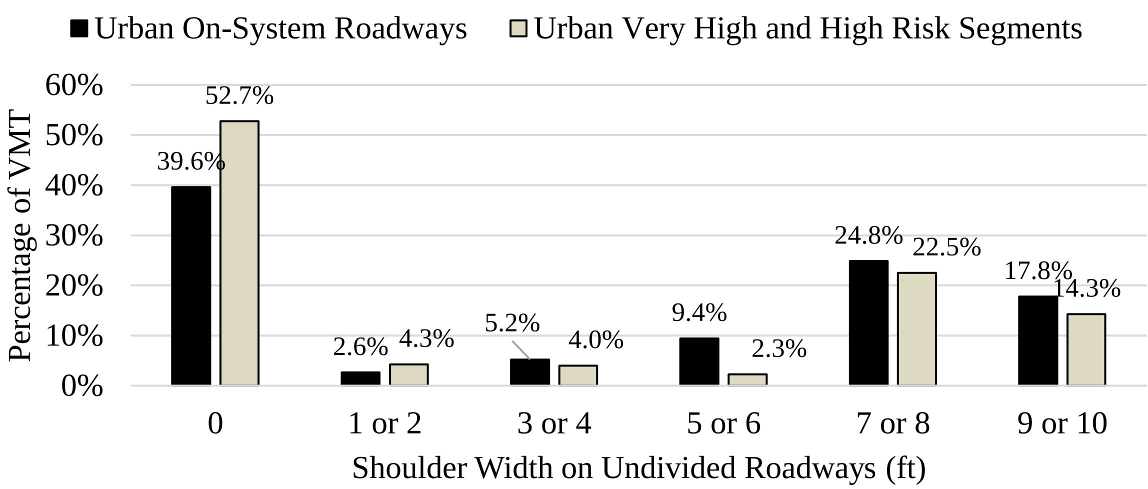
Figure 25. Distribution of VMT by Median Width on Roadways with Medians (Beaumont).

Shoulder Width (Undivided Roadways)

Figure 26 demonstrates the distributions of VMT by shoulder width. Roadways without shoulders or with 7 and 8 ft wide shoulders are overrepresented in rural areas. In urban areas, roadways without shoulders or with narrow shoulders (1 or 2 ft) are overrepresented.



(a) Rural Area

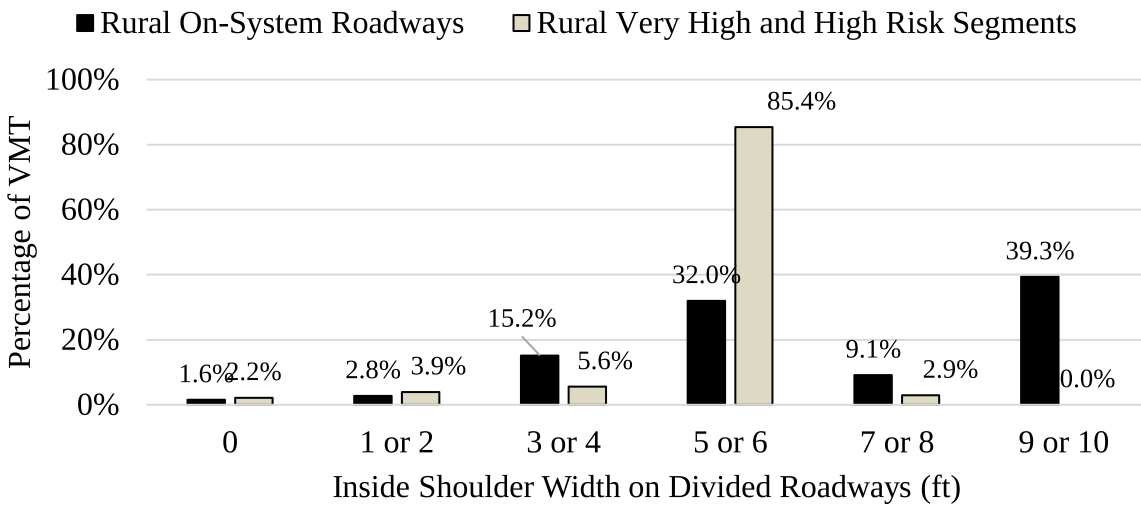


(b) Urban Area

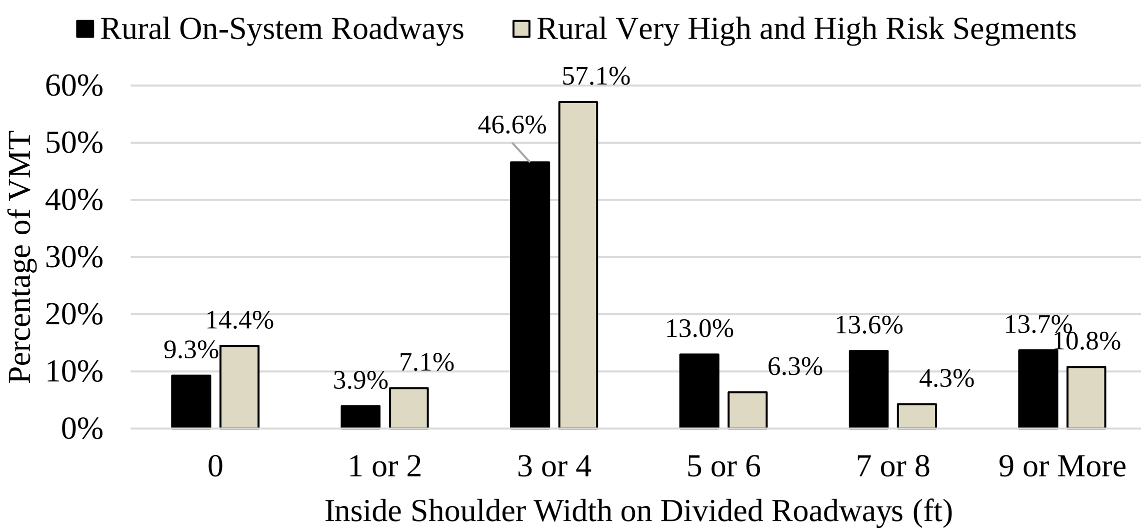
Figure 26. Distribution of VMT by Shoulder Width (Beaumont Undivided Roadways).

Shoulder Width (Divided Roadways)

Figure 27 and Figure 28, respectively, show the distributions of VMT by inside shoulder width and outside shoulder width.



(a) Rural Area

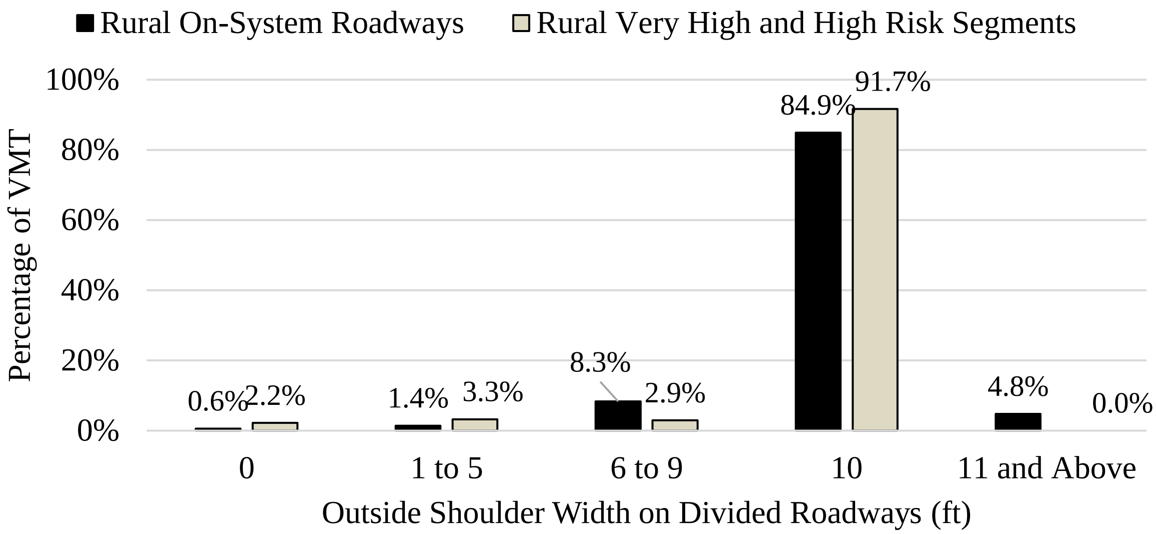


(b) Urban Area

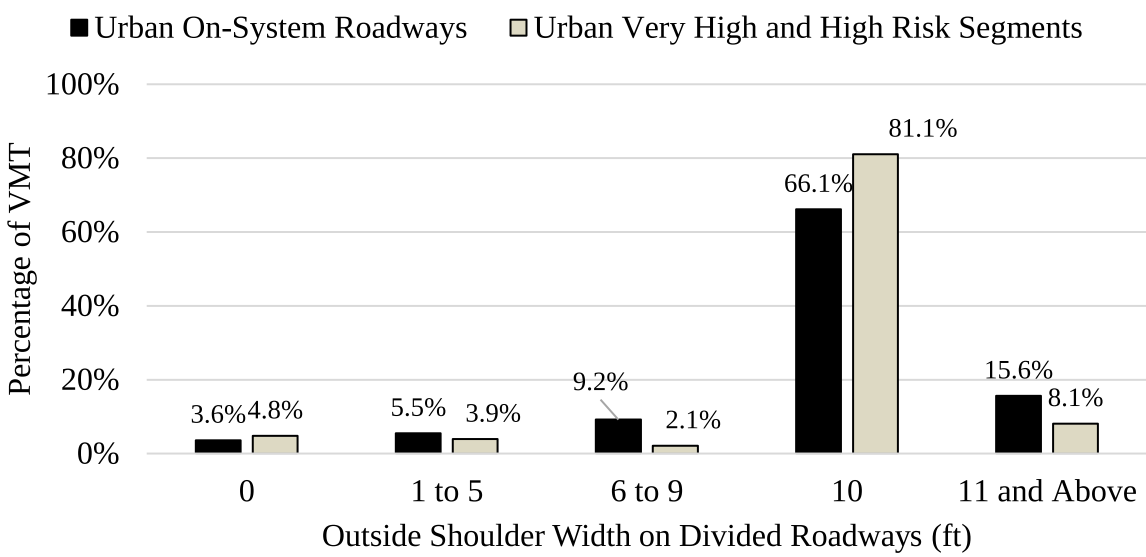
Figure 27. Distribution of VMT by Inside Shoulder Width (Beaumont Divided Roadways).

For rural divided roadways, segments with 5 and 6 ft wide inside shoulders are significantly overrepresented in the very high- and high-risk segments. Those without an inside shoulder or narrow inside shoulders (1 or 2 ft) are slightly overrepresented in the very high- and high-risk segments. In urban areas, segments with relatively narrow inside shoulders (no inside shoulder, or 1 to 4 ft inside shoulders) are overrepresented in the very high- and high-risk segments.

Most rural and urban divided roadways have 10 ft outside shoulders, but segments with 10 ft outside shoulders are still overrepresented in the very high- and high-risk segments.



(a) Rural Area

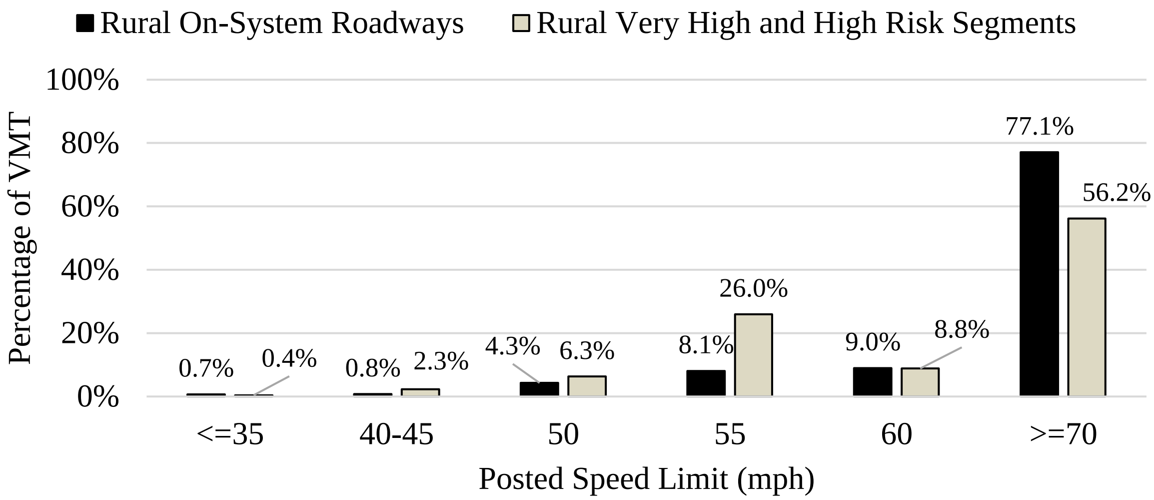


(b) Urban Area

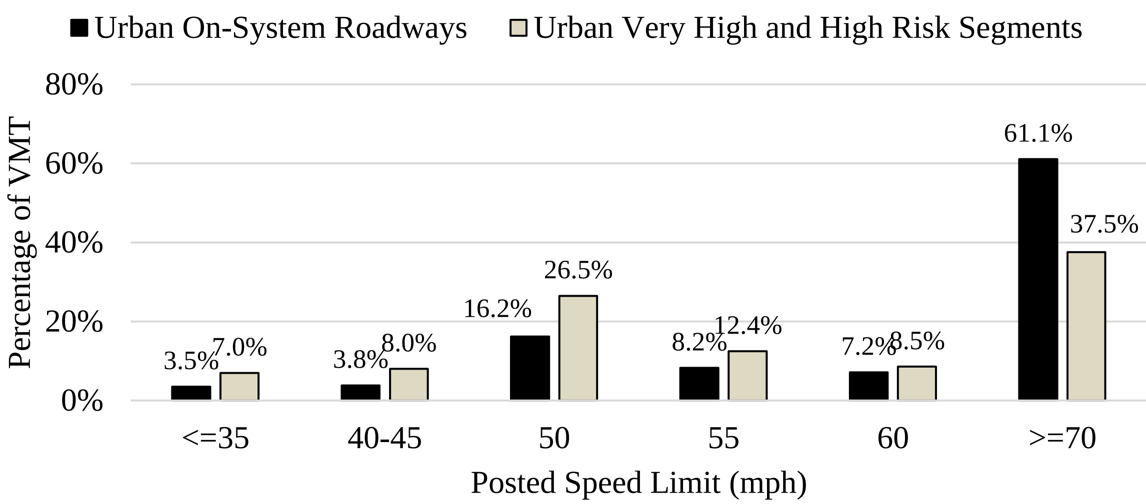
Figure 28. Distribution of VMT by Outside Shoulder Width (Beaumont Divided Roadways).

Posted Speed Limit

Figure 29 (a) and (b) illustrate the distributions of VMT by PSL. In rural areas, roadways with a PSL of 55 mph are highly overrepresented in the identified segments. In urban areas, roadways with relatively low PSL (i.e., 50 mph or lower) are overrepresented in the identified very high- and high-risk segments.



(a) Rural Area



(b) Urban Area

Figure 29. Distribution of VMT by Posted Speed Limit (Beaumont).

Section Summary

This section documents the summary statistics of very high- and high-risk segments in Beaumont District and Texas. First, the summary statistics show that some roadway features are overrepresented for the identified very high- and high-risk segments, indicating that these features may be potentially associated with the occurrence of fatal and suspected serious injury crashes. For example, rural undivided roadways with 7 or 8 ft shoulders are highly overrepresented in the very high- and high-risk segments for the TxDOT Beaumont District (see Figure 26a), which indicates that fatal and suspected serious injury crashes are more likely to occur on these types of roadways. It is important to note that the association here does not necessarily indicate a cause and effect relationship between crashes and shoulder width. As a result, one should not conclude that widening the shoulders of a roadway to 7 or 8 ft will increase crashes. There are likely other confounding factors. For example, the design of roadways with higher traffic volumes and higher speeds commonly incorporates wider shoulders. For these reasons, additional robust statistical analyses are recommended to capture the causal relationships between crashes and the roadway features.

Second, the roadway features that are overrepresented are not identical for the TxDOT Beaumont District when contrasted to those for the entire state of Texas. For instance, rural US roadways are overrepresented in the very high- and high-risk roadways in the Beaumont District. However, this is not the case for the entire state. Thus, rural US roadways in the Beaumont District need further attention in safety management. Tables 4 and 5 present a comparison of overrepresented roadway characteristics between the TxDOT Beaumont District and the entire state of Texas in rural and urban areas, respectively.

Table 4. Overrepresented Roadway Characteristics on Rural High- and Very High-Risk Segments.

Roadway Feature	Beaumont District	Texas
Highway System	FM, US	FM
Lane Width	8, 10, or 13 ft	10 or 11 ft
Median Type	No median, unprotected	No median
Median Width	35 to 44 ft	45 to 54 ft
Shoulder Width (Undivided Roadways)	No shoulder, 7 to 8 ft	No shoulder, 1 to 4 ft
Inside Shoulder (Divided Roadways)	5 to 6 ft	No overrepresentation
Outside Shoulder (Divided Roadways)	10 ft	No overrepresentation
Posted Speed Limit	55 mph	50 or 55 mph

Table 5. Overrepresented Roadway Characteristics on Urban High- and Very High-Risk Segments.

Roadway Feature	Beaumont District	Texas
Highway System	FM, IH	No overrepresentation
Lane Width	11, 13 ft	11, 13 ft
Median Type	No median	No overrepresentation
Median Width	1 to 10, 35 to 44 ft	1 to 10 ft
Shoulder Width (Undivided Roadways)	No shoulder, 1 to 2 ft	No shoulder
Inside Shoulder (Divided Roadways)	No inside shoulder, or 1 to 4 ft	Narrow inside shoulder (0, 1, or 2 ft), or 9 to 10 ft
Outside Shoulder (Divided Roadways)	10 ft	No overrepresentation
Posted Speed Limit	35 to 50 mph	50 or lower, 60 mph

CHAPTER SUMMARY

In order to identify the major crash types and characteristics for the on-system roadways in the Beaumont District, researchers developed a 7-year period crash profile. The crash profile includes two key aspects: crash descriptive statistics and crash density analysis.

The crash descriptive statistics reveal that the on-system annual crashes continued to increase over the last 3 years (2014–2016). The annual increase rate is about 14 percent since 2014, whereas the VMT values have remained at the same level. A DDSA for the Beaumont District is timely and necessary.

The crash trees show that crashes on lower classes of roadways (e.g., minor arterials, major collectors, minor collectors, SH, and FM roadways) are overrepresented compared to their respective VMT values. Crashes in rural and urban areas display different characteristics. In rural areas, SVROR and rear-end crashes are prevalent and account for 38.2 and 26.1 percent of the on-system rural crashes, respectively. In urban areas, intersection and intersection-related crashes account for 40.7 percent of the on-system urban crashes. Rear-end and angle crashes are the two most common collision types in urban areas.

The crash density analysis mainly focused on the very high- and high-risk segments commonly identified by the HSIP Screening Tool. The analysis suggests that certain roadway features are overrepresented in the very high- and high-risk segments and that some of these road characteristics may be potentially associated with the occurrence of crashes. In addition, researchers compared the crash density between the TxDOT Beaumont District and the entire Texas on-system roadway. This comparison demonstrated that the association between roadway features and crash densities are not identical when contrasting the Beaumont District to Texas.

These findings served as helpful indicators to inform the research team and help them define and refine key areas of potential safety emphasis, such as crash types or contributing factors, for later project tasks.

CHAPTER 3:
AREAS OF POTENTIAL SAFETY EMPHASIS

INTRODUCTION

The project team defined, and refined key areas of potential safety emphasis based on the crash profile development. The project team selected these areas of emphasis based on the examination of contributing factors, crash types, roadway elements, discussions with the district staff, and examination of high- and very high-risk segments in the district.

EMPHASIS AREAS

In Technical Memo 3, the research team documented the crash profile analysis for the TxDOT Beaumont District. Based on that report and discussions with the district staff, researchers identified potential emphasis areas. The crash profile and these emphasis areas concern on-system roadways only.

Roadway Departures

Roadway departure crashes are the single largest crash type in rural areas, making up nearly 40 percent of all crashes. The district also identified roadway widening as a priority for reducing these crashes. The project team recommended that the screening, analysis, and countermeasure efforts include this crash type.

Roadway Widening

Because TxDOT and the Beaumont District are emphasizing the widening of roadways to a desirable standard of 26 ft wide at locations with a roadway volume of more than 400 vehicles per day, the project team recommends that additional analysis of this crash countermeasure be included in this work effort. In particular, the project team recommends an examination of the volume threshold in terms of cost effectiveness. Just as every day counts, every dollar counts as well. This examination will be valuable in helping provide guidance on cost-effective safety funding. The thresholds proposed in the new American Association of State Highway and Transportation Officials (AASHTO) *Low Volume Roads* guide will be examined as part of this effort.

Intersections

Rear-end and angle crashes make up nearly 62 percent of urban crashes in the district. Rear-end crashes are the second-most prevalent crash type in rural areas. These crash types are associated with intersections, and the project team recommends intersections as an emphasis area. The project team is developing a GIS-based inventory of on-system intersections that will be used in this effort. The project team also recommends concentrating on signalized locations, which have been inventoried, and that the work include consideration of approach speed limits (as a surrogate for operating speed) since these are often correlated with rear-end collisions

Pedestrian Crashes

Pedestrian fatalities and injuries are increasing statewide at a faster rate than any other crash type, and the Beaumont staff identified the US 90 corridor west of downtown Beaumont as a corridor with pedestrian safety issues. The project team recommends an analysis of safety issues on this corridor to use as an example of applying DDSA.

Wet-Weather Crashes

The district staff identified a desire to prevent wet-weather crashes, particularly in areas prone to standing water or at superelevation transition locations where the road does not drain well. Additionally, the district staff indicated that they wish to be able to better identify road surfaces or areas where available friction is marginal. The project team will provide guidance related to existing and emerging tools for identifying and addressing wet-weather crashes.

Characteristics to Consider in Crash Analyses

Injury Severity

The project team recommends that fatal, serious injury and non-incapacitating injury (KAB) crashes be emphasized in these analyses. Fatal and serious injuries have the greatest impact on the citizens of the district, and serious and non-incapacitating injuries are the crash types experiencing the greatest increases. A-severity crashes have increased almost 30 percent from 2010 to 2016, while B-severity crashes have increased 24 percent.

Roadway Classification and Designation

Rural. In rural areas of the district, minor arterials and major collectors carry 33 percent of rural VMT, but 54 percent of rural crashes occur on these facilities. In rural areas, FM roadways are overrepresented in crash experiences, with 33 percent of rural crashes but only 21 percent of rural VMT.

Urban Areas. In urbanized areas, roadways classified as principle arterials are overrepresented with regard to crash experience. These roads carry 33 percent of VMT, but 54 percent of crashes occur on them. Roads designated as US highways, SH, and FM roads are somewhat overrepresented.

Lane Width

In rural areas, 8, 10, and 13 ft wide lanes are overrepresented in the very high- and high-risk segments. In urban areas, 11 and 13 ft wide lanes are overrepresented.

Median Type and Width

In rural areas, roadways without a median or with an unprotected median are overrepresented. In urban areas, segments without medians are overrepresented. Roadways with 35 to 54 ft wide medians are highly overrepresented in rural areas. In urban areas, roadways with 1 to 10 ft or 35 to 44 ft wide medians are overrepresented in the very high- and high-risk segments.

Shoulder Width (Undivided Roadways)

Undivided roadways without shoulders or with 7 and 8 ft wide shoulders are overrepresented in rural areas. In urban areas, undivided roadways without shoulders or with narrow shoulders (1 or 2 ft) are overrepresented.

For rural divided roadways, segments with 5 and 6 ft wide inside shoulders are significantly overrepresented in the very high- and high-risk segments. Those without an inside shoulder or narrow inside shoulders (1 or 2 ft) are slightly overrepresented in the very high- and high-risk segments. In urban areas, segments with relatively narrow inside shoulders (no inside shoulder, or 1 to 4 ft inside shoulders) are overrepresented in the very high- and high-risk segments.

Posted Speed Limit

In rural areas, roadways with a PSL of 55 mph are highly overrepresented in the identified segments. In urban areas, roadways with relatively low PSL (i.e., 50 mph or lower) are overrepresented for the identified very high- and high-risk segments

CHAPTER 4:
ANALYSIS TOOLS FOR USE IN THE BEAUMONT DISTRICT

INTRODUCTION

Based on the areas of potential emphasis and the exploratory work on crashes in the Beaumont District, appropriate analytical tools were identified and evaluated. The tools include predictive, systemic, and descriptive methods. The tools are described in the sections below.

SCREENING TOOLS

Predictive analyses can be used to screen the highway network to identify locations where the greatest potential for reducing crashes exists. Typically, statistical methods are used to develop equations that relate roadway type and volume with the number of crashes, and then this information is weighted with the number of observed crashes to develop an expected number of crashes on a corridor, on a corridor divided into segments and intersections, or for intersections themselves.

The project team developed an approach that allows district personnel to screen the state system for locations where crashes may be reduced, either through a safety-specific project (perhaps for a HSIP call) or by incorporating safety improvements into the project development process.

The project team developed a high-level screening tool for this purpose by exploring two approaches and selecting one based on the ability and accuracy to discern crash issues and the level of effort to perform the analyses. In this step, a corridor-based analysis that combines segments and intersections was compared to a more detailed approach that performs separate intersection and segment calculations. If it is possible to discern crash issues without doing a separate analysis, then the combined method may be preferred. However, if crash issues are obscured in a corridor-based approach, then the separate segment and intersection approach may be necessary. This analysis focused on the fidelity of the results contrasted to the level of effort for a large-scale analysis.

The project team examined two conditions. The first was rural two-lane highways, and the second urban multilane highways. In each case, several test corridors were identified, and both the corridor and separate analyses were conducted and compared. Based on the results of this comparison, an approach was selected. The research team believes that different approaches may be warranted depending on the roadway type. In urban conditions, it may be more important to separate intersections from segments because intersection crashes typically comprise a significant proportion of total crashes. On the other hand, in rural situations, segment-related crashes may be predominant and the need to perform intersection analyses less critical. For these two test conditions, network screening safety performance functions (SPFs) were developed for the corridor, segment, and intersection condition. Following this analysis, remaining network screening SPFs for other road configurations were only developed using the preferred approach (i.e., corridor only versus segment and intersection). As part of this assessment, the researchers also examined how segmenting corridors into separate sections for analysis may potentially bias the results if this segmentation varies dramatically from the site-specific segment and intersection segmentation configuration. The goal is to find a minimally biased approach that allows the district to discern crash issues with the minimum amount of effort.

Another aspect of network screening is the searching method for determination of candidate improvement locations. The project team assessed the optimal screening method and provided guidance relative to the most suitable approach. The researchers also compared these methods to the risk maps developed based on observed crashes to see if the risk maps offer a simpler method to discern crash issues or served as a first-level screening tool, with more sophisticated methods used on a smaller subset of the state system.

Predictive Safety Performance Functions for Signalized Intersections.

The research team developed statistical relationships between geometric and operational characteristics for the signalized intersections on state roadways (signals maintained by either the district or one of the three major cities) and the crashes that occurred at these signalized locations. These SPFs can be used to determine the potential for improvements to intersection safety. They can be used in conjunction with crash modification factors to analyze the effects of safety countermeasures.

Wet-Pavement Crash Diagnostic Tool

The project team compared the existing TxDOT Wet-Surface Crash Reduction program methods with a modified process that was informed by the research on TxDOT Project 0-6932. The Beaumont District experiences more rainfall than any other district in Texas. Monthly crash patterns were examined in terms of rainfall. The comparison determined if an enhanced process can be of benefit. This wet-pavement tool is systemic in nature, in that it used roadway and rainfall characteristics to identify locations with the potential for safety improvement.

Roadway Widening Analysis Tool

The project team developed a tool to aid in the identification and ranking of roadway segments narrower than 26 ft that are slated for widening projects. Volume thresholds were examined, and benefit/cost ratios were developed for various volume and crash rate scenarios. The applicability of a systemic safety analysis method was examined to determine if that approach yields the most benefits to the district.

CHAPTER 5: SYSTEMATIC ANALYSIS TO ADDRESS SAFETY NEEDS

A METHOD TO PRIORITIZE NARROW HIGHWAYS FOR WIDENING

All standard design manuals provide design values for the width of a traveled roadway based on traffic volumes. These values are different for roads with average daily traffic (ADT) less than 400 vehicles per day (vpd), defined as low-volume roads, when compared to roads with ADT of at least 400 vpd. Typically, states do not prioritize these low-volume roads for highway widening. It is not clear if the safety of low-volume roads is different from other roads. The objective described in this chapter was to develop a prioritization methodology for highway widening based on safety performance.

Background

The *Texas Manual on Uniform Traffic Control Devices* (TMUTCD, 2014) defines a low-volume road as a facility lying outside of built-up areas of cities, towns, and communities, and it shall have a traffic volume of less than 400 vpd. The road shall not be a freeway, an expressway, an interchange ramp, a freeway service road, a road on a designated state highway system, or a residential street in a neighborhood. In terms of highway classification, it shall be a variation of a conventional road or a special-purpose road. It can be classified as either paved or unpaved. A low-volume road typically serves land uses such as agricultural, recreational, resource management and development (e.g., mining, logging, or grazing) or functions as a local road in rural areas.

Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT ≤ 400 vpd) (AASHTO, 2001) defines very low-volume local roads as roads that are functionally classified as local roads and have ADT ≤ 400 vpd. It defines the following functional subclasses:

- Rural major access roads.
- Rural minor access roads.
- Rural industrial/commercial access roads.
- Rural agricultural access roads.
- Rural recreational/scenic roads.
- Rural resource recovery roads.
- Urban residential streets.
- Urban major access streets.
- Urban industrial/commercial access streets.

It defines low speed as ≤ 45 mph and high speed as > 45 mph. It also provides different guidelines for some design elements (particularly sight distance) based on the following volume ranges:

- ADT ≤ 100 vpd.
- 100 < ADT ≤ 250 vpd.
- 250 < ADT ≤ 400 vpd.

The AASHTO *Green Book* (AASHTO, 2011) suggests that a 12 ft lane width is desirable on both rural and urban highways, while a lane width of 11 ft or smaller can be acceptable in urban areas. Specific roads with unique characteristics, such as low-speed (less than 45 mph) and low-volume (typically, ADT $\leq$ 400 vpd) roads in rural and residential areas, allow a minimum lane width of 9 ft. The *Green Book* recommends a 10 ft shoulder width along high-speed and high-volume facilities. A 12 ft shoulder width is preferable for highways that experience a large number of heavy trucks. Generally, 6 to 8 ft shoulder widths are preferable for low-volume highways, but a 2 ft minimum shoulder width is considered a requirement. Table 6 presents the minimum width of lanes and shoulders on rural two-lane highways by functional class, design speed, and traffic volume documented in the *Green Book.*

AASHTO recommends that two-lane highways in rural areas should be designed with at least 9 ft for a lane width and 2 ft for a shoulder width. In other words, the pavement width should be at least 22 ft on rural two-lane highways. The threshold of 400 vpd appears to be an arbitrarily chosen value based on engineering judgment, and it is used to define different cross-sectional width requirements.

According to TxDOT’s *Roadway Design Manual* (RDM) (TxDOT, 2014), the minimum lane width should be 12 ft for high-speed facilities, such as freeways and rural arterials. For low-speed urban streets, an 11 ft or 12 ft lane width is generally recommended. Minimum lane and shoulder widths for two-lane rural highways vary according to volume and design speed.

Table 6. Lane and Shoulder Widths on Rural Two-Lane Highways (AASHTO, 2011).

Functional Class	Element	Design Speed (mph)	Minimum Width[1](ft) for Future ADT of:			
			<400	400–1,500	1,500–2,000	>2,000
Arterial	Lanes (ft)	40	11	11	11	12
		45	11	11	11	12
		50	11	11	12	12
		55	11	11	12	12
		60	12	12	12	12
		65	12	12	12	12
		70	12	12	12	12
		75	12	12	12	12
	Shoulders (ft)	All	4	6	6	8
Collector	Lanes (ft)	20	10[2]	10	11	12
		25	10[2]	10	11	12
		30	10[2]	10	11	12
		35	10[2]	11	11	12
		40	10[2]	11	11	12
		45	10	11	11	12
		50	10	11	11	12
		55	11	11	12	12
		60	11	11	12	12
		65	11	11	12	12
	Shoulders (ft)	All	2	5	6	8
Local	Lanes (ft)	15	9	10	10	11
		20	9	10	11	12
		25	9	10	11	12
		30	9	10	11	12
		35	9	10	11	12
		40	9	10	11	12
		45	10	11	11	12
		50	10	11	11	12
		55	11	11	12	12
		60	11	11	12	12
		65	11	11	12	12
	Shoulders (ft)	All	2	5	6	8

[1] On roadways to be reconstructed, an existing 22 ft traveled way may be retained where the alignment is satisfactory and there is no crash pattern suggesting the need for widening.
[2] A 9 ft minimum width may be used for roadways with design volumes under 250 vpd.

Table 7 presents the specific design criteria for rural two-lane highways in the RDM. Similar to the *Green Book*, TxDOT’s RDM adopts the 400 vpd threshold to define low-volume roads.

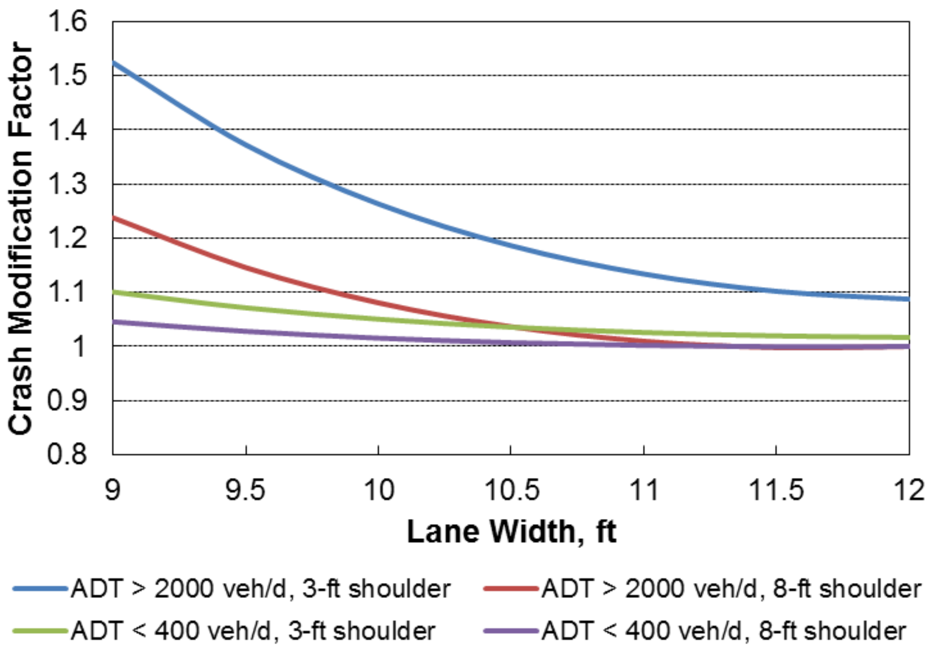
Table 7. Lane and Shoulder Widths on Texas Rural Two-Lane Highways (TxDOT, 2014).

Functional Class	Element	Design Speed (mph)	Minimum Width[1, 2] (ft) for future ADT of:			
			<400	400–1,500	1,500–2,000	>2,000
Arterial	Lanes (ft)	All	12	12	12	12
	Shoulders (ft)	All	4[3]	4[3] or 8[3]	8[3]	8–10[3]
Collector	Lanes (ft)	30	10	10	11	12
		35	10	10	11	12
		40	10	10	11	12
		45	10	10	11	12
		50	10	10	12	12
		55	10	10	12	12
		60	11	11	12	12
		65	11	11	12	12
		70	11	11	12	12
		75	11	12	12	12
		80	11	12	12	12
	Shoulders (ft)	All	2[4,5]	4[5]	8[5]	8–10[5]
Local[6]	Lanes (ft)	30	10	10	11	12
		35	10	10	11	12
		40	10	10	11	12
		45	10	10	11	12
		50	10	10	11	12
	Shoulders (ft)	All	2	4	4	8

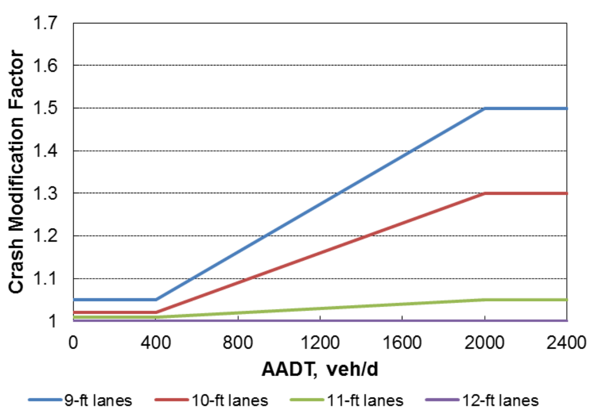
[1] Minimum surfacing width is 24 ft for all on-system state highway routes.
[2] On high riprapped fills through reservoirs, a minimum of two 12 ft lanes with 8 ft shoulders should be provided for roadway sections. For arterials with 2,000 or more ADT in reservoir areas, two 12 ft lanes with 10 ft shoulders should be used.
[3] On arterials, shoulders fully surfaced.
[4] On collectors, use minimum 4 ft shoulder width at locations where roadside barrier is used.
[5] For collectors, shoulders fully surfaced for 1,500 or more ADT. Shoulder surfacing not required but desirable even if partial width for collectors with lower volumes and all local roads.
[6] Applicable only to off-system routes that are not functionally classified at a higher classification.

According to the geometric design manuals, narrower lanes and shoulders can be used for lower-volume highways. However, extensive study has not been done on whether low-volume roads have a different safety performance (in terms of crash rates) than high-volume roads and whether it is cost effective to improve safety performance by widening highways with low volumes. There is evidence for the safety benefits of widening pavement on rural two-lane highways, in terms of crash frequency, but not focusing specifically on the distinction between low- and high-volume roads. For instance, crash modification factors (CMFs) for lane and shoulder widths on rural two-lane highways have been documented in TxDOT's *Roadway Safety Design Workbook*

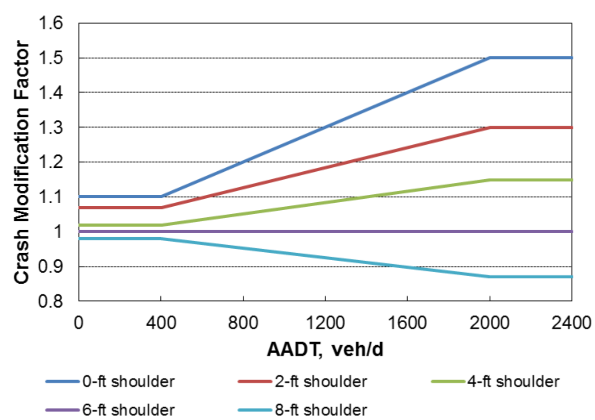
(Bonneson & Pratt, 2009) and the *Highway Safety Manual* (HSM) (AASHTO, 2010). These CMFs are shown graphically in Figure 30. Widening pavement (lane and/or shoulder) width reduces the occurrence of SVROR and opposite direction (OD) crashes, but the safety benefit of wider lanes and shoulders is greater for high-volume roads than low-volume roads. Note that the functional form of the combined lane and shoulder width CMF from the *Roadway Safety Design Workbook* has been adjusted such that the plotted CMF applies to overall crashes, while the lane and shoulder widths from the HSM apply only to SVROR, OD, and HO crashes.



a. Combined Lane and Shoulder Width CMF (Bonneson & Pratt, 2009)



b. Lane Width CMF (AASHTO, 2010)



c. Shoulder Width CMF (AASHTO, 2010)

Figure 30. Lane and Shoulder Width CMFs.

Data Analysis

This section covers data collection, crash rate calculation and comparison, and the cost effectiveness of highway widening with rumble strip installation for roads with different ADTs.

Data Collection

The primary focus of the data analysis was on two-lane rural highways. The information on roadway segments was extracted from the TxDOT RHiNo database for the year 2016. A roadway segment is a section of continuously traveled roadway that is not interrupted by a major intersection and consists of homogenous geometric and traffic control features. A roadway segment begins at the center of an intersection and ends at either the center of the next intersection or where there is a change from one homogeneous roadway segment to another homogenous roadway segment. Only state-maintained highways were considered in the analysis. The database was filtered to include mainlane roadway segments only (i.e., no frontage roads, ramps, etc.). The RHiNo database includes the length and traffic volumes for the last 10 years for each segment. Only the roadway segments that were at least 0.01 mile were considered. In addition, only roadway segments with traffic volumes up to 5000 vpd were considered because the primary focus was on low-volume roads. All the roadway segments were grouped into different categories based on their traffic volumes (0–99 vpd, 100–199 vpd, etc.)

After the roadway segments were identified, crashes were assigned to each individual roadway segment. Crash data for the years 2013 to 2017 were considered. TxDOT's CRIS maintains a statewide automated database for all reported motor vehicle traffic crashes. The data were filtered to include crashes occurring only on main lanes. Only those crashes that were coded as "TxDOT Reportable" were considered. A crash is defined as "TxDOT Reportable" if it occurs on a traffic way and results in an injury or property damage greater than $1,000.

Once the crash frequency on a roadway segment is identified, the crashes are subdivided by the severity of occurrence. The level of injury or property damage due to a crash is referred to as "crash severity." While a crash may cause a number of injuries of varying severity, the term crash severity refers to the most severe injury caused by a crash. Crash severity is often divided into five categories. The five crash severity levels are:

- K—Fatal injury: an injury that results in death.
- A—Suspected serious injury: any injury, other than a fatal injury, that prevents the injured person from walking, driving, or normally continuing the activities the person was capable of performing before the injury occurred.
- B—Non-incapacitating evident injury: any injury other than a fatal injury or an incapacitating injury that is evident to observers at the scene of the crash in which the injury occurred.
- C—Possible injury: any injury reported or claimed that is not a fatal injury, suspected serious injury, or non-incapacitating evident injury and that includes claim of injuries not evident.
- O—No injury/PDO.

In addition to crashes by severity, the number of crashes by collision type were identified. Mainly, SVROR and OD crashes were collected because pavement widening affects only these crash types.

Table 8 provides summary statistics for Texas data.

Table 8. Summary Statistics for Texas Data.

Variable	Narrow Roads (Paved Width < 24 ft)					Wider Roads (Paved Width ≥ 24 ft)				
	Min	Max	Avg	Std. dev	Total	Min	Max	Avg	Std. dev	Total
ADT (vpd)	10	16,881	756.2	1,028	—	17	34128	2506	2390	—
Paved Width (ft)	12.0	23.0	20.5	1.1	—	24.0	50.0	34.4	8.0	—
Segment Length (mile)	0.01	27.98	1.35	1.67	21,124	0.01	30.11	0.97	1.50	32,983
Total Crashes	0	72	1.3	3.1	21,046	0	177	2.3	4.8	78,721
KABC Crashes	0	34	0.5	1.4	8,272	0	50	0.8	1.9	28,728
Total SVROR+OD Crashes	0	63	1.0	2.5	14,842	0	71	1.4	3.2	48,752
KABC SVROR+OD Crashes	0	28	0.4	1.2	6,805	0	32	0.6	1.5	21,451

Note: — represents not applicable.

Table 9 summarizes mileage by highway system in Texas.

Table 9. Mileage by Highway System in Texas.

Highway System	Narrow Roads (Paved Width < 24 ft)	Wider Roads (Paved Width ≥ 24 ft)
BF	0.1	0.4
BI	0.0	37.8
BS	13.3	30.0
BU	8.4	80.5
FM	18,395.8	15,535.7
FS	26.2	8.3
PR	138.5	74.7
RE	2.3	77.1
RM	1,546.7	1,230.4
RR	—	6.6
RS	1.5	9,622.3
SH	832.3	124.6
SL	49.5	66.5
SS	35.3	159.7
US	74.2	5,928.7

Note: — represents not applicable.

Crash Rate

The number of crashes on any given roadway segment are due to a number of factors, but the length of the roadway segment and traffic volume (which combined are known as "exposure") have a great influence on the number of crashes. The roadway segments in this database are of differing lengths and traffic volumes. Therefore, it is desirable to know the crash rate in order to better understand the safety performance of each segment and to make comparisons between roadway segments.

The crash rate at each roadway segment was calculated by dividing the number of crashes by the product of length and traffic volume—in this case, the length in miles multiplied by the annual traffic volume (e.g., vehicle miles). The number of crashes relative to the number of vehicle miles is very small, so the rates are expressed per million vehicle miles to provide values that are more convenient to express and understand. Crash rates may be interpreted as the probability (based on past events—in this case, what occurred from 2013 to 2017) of being involved in a crash per instance of the exposure measure.

The crash rate for each roadway segment is calculated as:

$$Crash\ rate = \frac{Number\ of\ crashes \times 1{,}000{,}000}{Number\ of\ years \times Length \times 365 \times Average\ Daily\ Traffic} \quad \text{(Equation 3)}$$

The crash rates for each volume group in Texas are provided in Table 10. Only roadway segments that have a pavement width of less than 24 ft are considered. The rates are provided for all crashes, fatal and injury (i.e., KABC), SVROR+OD and SVROR+OD KABC crashes. It is evident from Table 10 that low-volume highways have slightly higher crash rates than high-volume highways.

Table 10. Crash Rates by Traffic Volume Range in Texas.

ADT (vpd)	Mileage	Total Crashes	Crashes per Mile				Crash Rate (crashes per million vehicle miles)			
			Total	KABC	SVROR+OD		Total	KABC	SVROR+OD	
					Total	KABC			Total	KABC
0–99	3,399	460	0.03	0.01	0.02	0.01	1.16	0.51	0.81	0.41
100–199	4,366	1,185	0.06	0.03	0.04	0.02	1.17	0.46	0.79	0.37
200–299	2,917	1,497	0.12	0.06	0.09	0.05	1.32	0.61	0.94	0.53
300–399	2,074	1,536	0.17	0.07	0.12	0.06	1.30	0.52	0.92	0.47
400–499	1,491	1,271	0.17	0.06	0.11	0.05	1.05	0.38	0.68	0.32
500–599	1,079	1,366	0.29	0.12	0.22	0.10	1.44	0.59	1.08	0.53
600–699	957	1,302	0.31	0.13	0.22	0.11	1.30	0.53	0.94	0.45
700–799	690	895	0.26	0.10	0.18	0.08	0.94	0.36	0.66	0.30
800–899	560	999	0.31	0.13	0.23	0.11	1.01	0.42	0.75	0.37
900–999	417	803	0.36	0.16	0.27	0.14	1.04	0.45	0.78	0.39

Table 10. Crash Rates by Traffic Volume Range in Texas (Continued).

ADT (vpd)	Mileage	Total Crashes	Crashes per Mile				Crash Rate (crashes per million vehicle miles)			
			Total	KABC	SVROR+OD		Total	KABC	SVROR+OD	
					Total	KABC			Total	KABC
1,000–1,099	358	781	0.44	0.20	0.35	0.17	1.16	0.52	0.91	0.45
1,100–1,199	336	759	0.43	0.17	0.33	0.13	1.04	0.40	0.79	0.32
1,200–1,299	254	626	0.55	0.21	0.42	0.18	1.20	0.45	0.93	0.39
1,300–1,399	201	522	0.50	0.17	0.35	0.14	1.01	0.35	0.72	0.29
1,400–1,499	167	411	0.48	0.23	0.31	0.18	0.91	0.43	0.60	0.35
1,500–1,599	176	479	0.63	0.18	0.48	0.14	1.12	0.32	0.85	0.24
1,600–1,699	161	364	0.41	0.12	0.27	0.10	0.69	0.20	0.44	0.17
1,700–1,799	108	349	0.79	0.25	0.57	0.23	1.25	0.39	0.89	0.35
1,800–1,899	171	497	0.70	0.27	0.45	0.19	1.04	0.41	0.67	0.29
1,900–1,999	91	251	0.57	0.21	0.36	0.18	0.80	0.29	0.50	0.25
>=2,000	1,152	4,698	0.87	0.29	0.59	0.23	0.82	0.28	0.57	0.22

Figure 31 shows the plot of total crashes per mile (Column 4 in Table 10) and ADT. Median ADT is used on the *x*-axis.

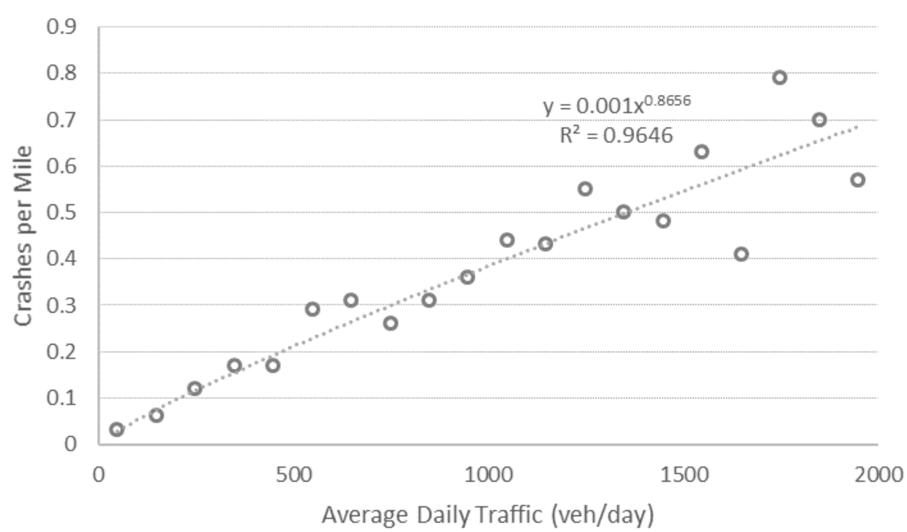


Figure 31. Total Crashes per Mile versus ADT.

Figure 32 shows the plot of SVROR+OD crashes per mile (Column 6 in Table 10) and ADT. Median ADT is used on the *x*-axis.

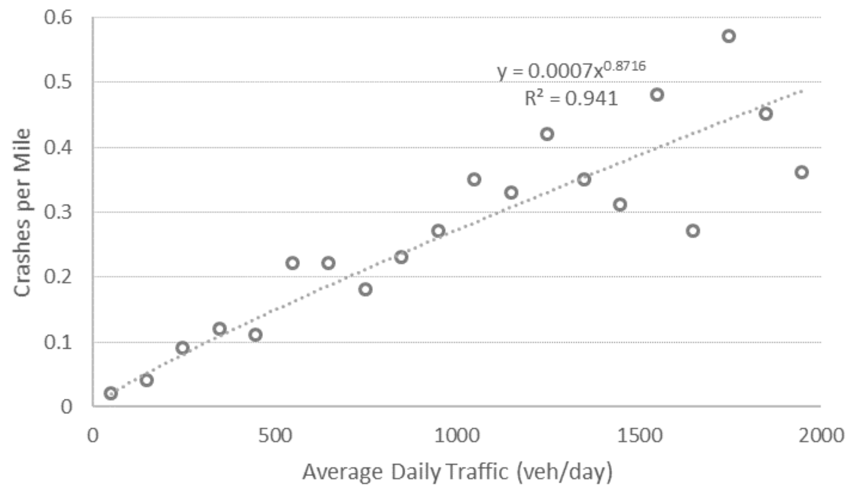


Figure 32. SVROR+OD Crashes per Mile versus ADT.

Safety Performance Functions

Using Texas data, SPFs were developed to capture the effect of ADT and paved width on total crashes occurring on rural two-lane highways in Texas. Initially, only segments less than 24 ft were considered (Model 1), and the results are shown in Table 11. As seen, the paved width variable is not significant at the 5-percent level, which means that, for a given ADT, the difference between various roadway segments becomes marginal when the paved width falls below 24 ft.

Table 11. Parameter Estimates for Model 1 (Target Segments Only—i.e., Paved Width < 24 ft).

Variable	Total Crashes			KABC Crashes			PDO Crashes		
	Est	**Std Err**	**Pr > |t|**	**Est**	**Std Err**	**Pr > |t|**	**Est**	**Std Err**	**Pr > |t|**
Intercept	-7.470	0.218	<0.0001	-8.426	0.297	<0.0001	-7.864	0.251	<0.0001
ADT	0.893	0.011	<0.0001	0.857	0.015	<0.0001	0.905	0.013	<0.0001
Paved Width	*0.014*	*0.011*	*0.183*	*0.027*	*0.015*	*0.068*	*0.003*	*0.012*	*0.811*
Dispersion	0.577	0.019	—	0.719	0.034	—	0.552	0.024	—

Notes: Italics mean not significant at 5% level.
— represents not applicable.

Table 12 provides the SPF when all roadway segments are included and paved width is used as a continuous variable (Model 2). Paved width is statistically significant at the 5-percent level. For every foot increase in paved width, it is expected that total crashes decrease by 1.5 percent. The effect is more notable on KABC crashes than on PDO crashes.

Table 12. Parameter Estimates for Model 2 (All Segments—Paved Width as a Continuous Variable).

Variable	Total Crashes			KABC Crashes			PDO Crashes		
	Est	**Std Err**	**Pr > |t|**	**Est**	**Std Err**	**Pr > |t|**	**Est**	**Std Err**	**Pr > |t|**
Intercept	-6.412	0.035	<0.0001	-7.168	0.048	<0.0001	-7.063	0.041	<0.0001
ADT	0.828	0.006	<0.0001	0.820	0.008	<0.0001	0.830	0.007	<0.0001
Paved Width	-0.015	0.001	<0.0001	-0.021	0.001	<0.0001	-0.010	0.001	<0.0001
Dispersion	0.437	0.008	—	0.467	0.013	—	0.439	0.009	—

Note: — represents not applicable.

Table 13 provides the SPF when paved width is used as an indicator variable to differentiate between narrow roads (width < 24 ft) and wider roads (width ≥ 24 ft) (Model 3). The results show that wider roads are safer than narrow roads. For the same traffic volume, wider roads may experience 7.5 percent fewer crashes than narrow roads on average. Interestingly, wider roads experience 14 percent fewer KABC crashes than narrow roads.

Table 13. Parameter Estimates Model 3 (All Segments—Paved Width as an Indicator Variable).

Variable	Total Crashes			KABC Crashes			PDO Crashes		
	Est	**Std Err**	**Pr > |t|**	**Est**	**Std Err**	**Pr > |t|**	**Est**	**Std Err**	**Pr > |t|**
Intercept	-6.401	0.036	<0.0001	-7.174	0.049	<0.0001	-7.044	0.042	<0.0001
ADT	0.772	0.005	<0.0001	0.748	0.007	<0.0001	0.787	0.006	<0.0001
Paved Width (=1 if ≥24ft, 0 otherwise)	-0.076	0.014	<0.0001	-0.149	0.019	<0.0001	-0.039	0.016	0.015
Dispersion	0.452	0.008	—	0.495	0.013	—	0.447	0.009	—

Note: — represents not applicable.

Pavement Widening and Rumble Strip Installation

TxDOT uses a 400-vpd threshold and only considers highways above that threshold to be eligible for pavement widening. TxDOT also prefers to install rumble strips immediately after highway widening when possible. Thus, when rumble strips are installed, the highways will benefit from the two treatments (widening and rumble strip installation). Wu et al. (2015) developed the safety effectiveness of highway widening by collision type. TTI researchers used the highway widening CMF and developed a composite CMF for SVROR and OD crashes. In addition, TTI researchers used the work of Kay et al. (2015), who developed the rumble strip CMFs by collision type, to develop a CMF for highway widening with rumble strips installed on SVROR+OD crashes. Table 14 provides the reduction in crashes by severity for both highway widening only and highway widening with rumble strips.

Table 14. Crash Reduction by Treatment Type.

Treatment	Percent Reduction[1]	Collision Type	Crash Severity	Roadway Type
Highway Widening	38.2 ± 7.9	ROR and HO	All	Two-lane rural highways; Conversion of highways with 18–22 ft paved width to 28 ft
Highway Widening with Rumble Strips	70 ± 4.0	ROR and HO	K Fatal	
	58 ± 5.4	ROR and HO	A Injury	
	72 ± 3.7	ROR and HO	B Injury	
	60 ± 5.2	ROR and HO	C Injury	
	56 ± 5.7	ROR and HO	PDO	

Note: [1] Percent reduction ± 95 percent confidence interval.

Based on current TxDOT estimates, the average cost is approximately $300,000 per centerline mile to widen a highway to 26 or 28 ft. The cost for installing rumble strips is $18,078 per mile of highway. Highway widening is expected to be effective in improving safety for 20 years, whereas rumble strips are expected to be effective for 5 years. Thus, when the two treatments are used, it is assumed that rumble strips are installed four times during the 20-year service life of the highway widening treatment. The total cost for the highway widening and rumble strips installation for one centerline mile is approximately $372,312 (i.e., $300,000 + 4 × $18,078). Changes in construction costs over time are not considered for simplicity of the calculation.

Finally, the return on investment is calculated using the average comprehensive crash costs in the FHWA Highway Safety BCA Guide and Tool (Harmon et al., 2018) that are provided in Table 15.

Table 15. Average Comprehensive Cost (Harmon et al. 2018).

Crash Severity	Cost
Fatal	$ 11,295,400
Suspected serious injury	$ 655,000
Non-incapacitating injury	$ 198,500
Possible injury	$ 125,600
PDO	$ 11,900

This annual monetary benefit associated with the crash reduction can be converted to the present value of project benefits over the service life (20 years) with the assumption of a 4 percent discount rate.

$$Present\ value\ of\ benefit = \frac{(1.0 + 0.04)^{20} - 1.0}{0.04 \times (1.0 + 0.04)^{20}} \times crash\ benefit/year \qquad \text{(Equation 4)}$$

The primary benefit of any safety treatment is reduction in crash frequency and/or severity. These reductions can be converted into monetary benefits, as described above. The reductions should be considered for the service life of the treatment. Table 16 and Table 17 provide details of the benefit-cost analysis for highway widening only and highway widening plus rumble strips. Expected crashes are estimated by considering the median ADT and the SVROR+OD total crash rate (last two columns in Table 10) for each row in the tables. Crashes by severity were then estimated using the proportions obtained from crash data collected on two-lane rural highways in Texas. Crash reductions by severity were calculated based on Table 14. These reductions are multiplied by the crash costs to estimate the value of crash reduction benefits. The sixth column provides the overall benefit for the service life of the treatment. For highway widening only, one can achieve more benefits than the cost (i.e., the benefit-to-cost ratio is greater than 1.00) when the volume is greater than 500 vpd. However, when rumble strips are installed with highway widening, then one can expect more benefits than the cost for traffic volumes of more than 200 vpd.

Table 16. Benefit-Cost Analysis for Highway Widening Only.

ADT	Crash rate	Median ADT	Expected crashes/yr /mile	Crash benefit/yr /mile[1]	Present value of 20-yr benefit[2]	Cost of widening	Benefit-to-cost (B/C) ratio
0–99	0.81	50	0.015	$2,638	$35,856	$300,000	0.12
100–199	0.79	150	0.043	$7,720	$104,913	$300,000	0.35
200–299	0.94	250	0.086	$15,309	$208,055	$300,000	0.69
300–399	0.92	350	0.118	$20,977	$285,080	$300,000	0.95
400–499	0.68	450	0.112	$19,934	$270,915	$300,000	0.90
500–599	1.08	550	0.217	$38,696	$525,893	$300,000	1.75
600–699	0.94	650	0.223	$39,804	$540,944	$300,000	1.80
700–799	0.66	750	0.181	$32,247	$438,244	$300,000	1.46
800–899	0.75	850	0.233	$41,530	$564,406	$300,000	1.88
900–999	0.78	950	0.270	$48,272	$656,039	$300,000	2.19
1,000–1,099	0.91	1,050	0.349	$62,246	$845,945	$300,000	2.82
1,100–1,199	0.79	1,150	0.332	$59,184	$804,334	$300,000	2.68
1,200–1,299	0.93	1,250	0.424	$75,731	$1,029,211	$300,000	3.43
1,300–1,399	0.72	1,350	0.355	$63,321	$860,553	$300,000	2.87
1,400–1,499	0.6	1,450	0.318	$56,676	$770,248	$300,000	2.57
1,500–1,599	0.85	1,550	0.481	$85,829	$1,166,439	$300,000	3.89
1,600–1,699	0.44	1,650	0.265	$47,295	$642,759	$300,000	2.14
1,700–1,799	0.89	1,750	0.568	$101,463	$1,378,921	$300,000	4.60
1,800–1,899	0.67	1,850	0.452	$80,747	$1,097,382	$300,000	3.66
1,900–1,999	0.5	1,950	0.356	$63,516	$863,209	$300,000	2.88
>=2,000	0.57	3,000	0.624	$111,398	$1,513,935	$300,000	5.05

Notes: [1] Reduction of crashes due to highway widening multiplied by crash costs.
[2] The service life of highway widening is 20 years.

Table 17. Benefit-Cost Analysis for Highway Widening with Rumble Strips.

ADT	Crash rate	Median ADT	Expected Crashes/yr /mile	Crash benefit/yr /mile[1]	Present value of 20-yr benefit[2]	Cost of widening	Benefit-to- cost (B/C) ratio
0–99	0.81	50	0.015	$4,689	$63,722	$372,312	0.17
100–199	0.79	150	0.043	$13,719	$186,446	$372,312	0.50
200–299	0.94	250	0.086	$27,206	$369,745	$372,312	0.99
300–399	0.92	350	0.118	$37,279	$506,629	$372,312	1.36
400–499	0.68	450	0.112	$35,426	$481,455	$372,312	1.29
500–599	1.08	550	0.217	$68,769	$934,589	$372,312	2.51
600–699	0.94	650	0.223	$70,737	$961,336	$372,312	2.58
700–799	0.66	750	0.181	$57,307	$778,824	$372,312	2.09
800–899	0.75	850	0.233	$73,805	$1,003,031	$372,312	2.69
900–999	0.78	950	0.270	$85,787	$1,165,876	$372,312	3.13
1,000–1,099	0.91	1,050	0.349	$110,620	$1,503,367	$372,312	4.04
1,100–1,199	0.79	1,150	0.332	$105,179	$1,429,418	$372,312	3.84
1,200–1,299	0.93	1,250	0.424	$134,585	$1,829,057	$372,312	4.91
1,300–1,399	0.72	1,350	0.355	$112,531	$1,529,327	$372,312	4.11
1,400–1,499	0.6	1,450	0.318	$100,722	$1,368,842	$372,312	3.68
1,500–1,599	0.85	1,550	0.481	$152,530	$2,072,931	$372,312	5.57
1,600–1,699	0.44	1,650	0.265	$84,051	$1,142,275	$372,312	3.07
1,700–1,799	0.89	1,750	0.568	$180,315	$2,450,543	$372,312	6.58
1,800–1,899	0.67	1,850	0.452	$143,500	$1,950,207	$372,312	5.24
1,900–1,999	0.5	1,950	0.356	$112,878	$1,534,047	$372,312	4.12
>=2,000	0.57	3,000	0.624	$197,970	$2,690,483	$372,312	7.23

Notes: [1] Reduction of crashes due to widening and rumble strip (RS) installation multiplied by crash costs.
[2] The service life of highway widening is 20 years.
[3] It includes cost of highway widening per mile and installation of rumble strips for four times because RS service life is 5 years.

PRIORITIZING THE WIDENING OF NARROW TWO-LANE ROADWAYS IN THE BEAUMONT DISTRICT

Background

The Beaumont District desires to widen roadways less than 24 ft to a minimum of 26 ft in order to meet one of the stated safety goals of the Texas Transportation Commission. This analysis provides a rationale for prioritizing segment widening. Table 18 and Note: — represents not applicable.

Table 19 provide details about the two-lane highways in the Beaumont District.

Table 18. Summary Statistics for Beaumont District Data.

Variable	Narrow Roads (Paved Width < 24 ft)					Wider Roads (Paved Width ≥ 24 ft)				
	Min	Max	Avg	Std. dev	Tot	Min	Max	Avg	Std. dev	Tot
ADT (vpd)	54	8,345	861.9	1,121	—	88	12,492	3,276	2,479	—
Paved Width (ft)	16.0	22.0	19.5	1.5	—	24	50	34.3	8.8	—
Segment Length (mile)	0.01	7.93	1.27	1.43	341	0.01	10.02	0.83	1.14	1,192
Total Crashes	0	17	1.4	2.5	365	0	56	3.0	5.1	4,341
KABC Crashes	0	9	0.6	1.2	154	0	30	1.1	2.2	1,601
Total SVROR+OD Crashes	0	14	1.0	1.9	257	0	48	1.9	3.7	2,799
KABC SVROR+OD Crashes	0	9	0.4	1.0	117	0	27	0.8	1.8	1,187

Note: — represents not applicable.

Table 19. Mileage by Highway System in Beaumont.

Highway System	Narrow Roads (Paved Width < 24 ft)	Wider Roads (Paved Width ≥ 24 ft)
BU	—	1.3
FM	318.8	641.4
PR	4.8	—
RE	—	56.6
RS	13.8	360.2
SH	1.4	4.3
SL	—	1.2
US	2.6	126.7

Note: — represents not applicable.

Results

We recommend that the Beaumont District prioritize roadway widening projects that provide the greatest safety benefit for dollar spent and avoid widening roadways with a benefit-cost ratio less than one. We analyzed two-lane roadways throughout the state of Texas to form this recommendation.

We calculated a benefit-to-cost (B/C) ratio based on the ADT of the roadway, the expected number and type of crashes reduced, and the cost of widening the roadway and installing rumble strips. Table 20 contains the results of this analysis. The table lists the rank order of priority according to the B/C ratio by ADT range (every 100 vpd). The fourth column lists the number of total miles in the Beaumont District in each category. Appendix B consists of a priority listing of these segments by highway designation, control section number, and beginning and ending distance from origin (DFO) points.

Table 20. Prioritization of Narrow Segments in Beaumont.

Rank Order Priority	Narrow Road ADT	B/C Ratio	Mileage
1	>=2,000	7.2	12
2	1,700–1,799	6.6	1
3	1,500–1,599	5.6	12
4	1,800–1,899	5.2	5
5	1,200–1,299	4.9	9
6	1,300–1,399	4.1	12
7	1,900–1,999	4.1	0.1
8	1,000–1,099	4	3
9	1,100–1,199	3.8	5
10	1,400–1,499	3.7	0
11	1,600–1,699	3.1	0
12	900–999	3.1	2
13	800–899	2.7	8
14	600–699	2.6	19
15	500–599	2.5	17
16	700–799	2.1	24
17	300–399	1.4	43
18	400–499	1.3	61
19	200–299	1.0	75
Not Recommended	100–199	0.5	30
	0–99	0.2	5

Recommendations

Based on these results, we recommend that narrow roadway segments with ADTs >= 2,000 vpd be widened first, followed by narrow roadway segments with ADTs between 1,700 and 1,799 vpd, and so forth. The analysis indicates that widenings are cost effective on roadways with ADTs greater than 200 vpd. The B/C ratio for roadways with less than 200 vpd is less than one, and therefore it is recommended that these roads not be widened unless there is a project scheduled for that roadway segment and the widening only adds a marginal cost to the project.

This discretion will allow only the marginal additional cost for widening to be included in the calculation if the rest of the roadway were being rehabilitated, for example. A spreadsheet tool has been developed that calculates B/C ratio for individual projects where actual costs can differ from assumed costs.

There are no narrow roadway segments in two of the ADT ranges. These categories are included so that priorities can be made if roadway segment volumes change and fall into those categories in the future.

Within each 100 vpd category, it is recommended that the roadway segments be prioritized by ADT, with the highest ADT segment widened first, and so on, and so forth. This process can be followed until funds allocated for widening for any given project cycle are exhausted and then repeated in subsequent cycles until all cost-effective projects have been completed.

These recommendations are based on the safety performance of two-lane roadway segments with a width of less than 24 ft within the entire Texas roadway network. All Texas two-lane roads were considered to provide an adequate and reliable sample for statistical analysis. Crashes occurring from 2013 to 2017 on these roadway segments were considered. A crash rate was calculated for each two-lane segment in Texas using the following formula, which considers the years of data, annual traffic, and segment length.

$$Crash\ rate = \frac{Number\ of\ crashes \times 1{,}000{,}000}{Number\ of\ years \times Length \times 365 \times Average\ Daily\ Traffic} \quad \text{(Equation 5)}$$

Figure 33 depicts the relationship between total crashes per mile and ADT. As ADT increases, the number of crashes increases. However, the crash risk per vehicle decreases as the ADT increases.

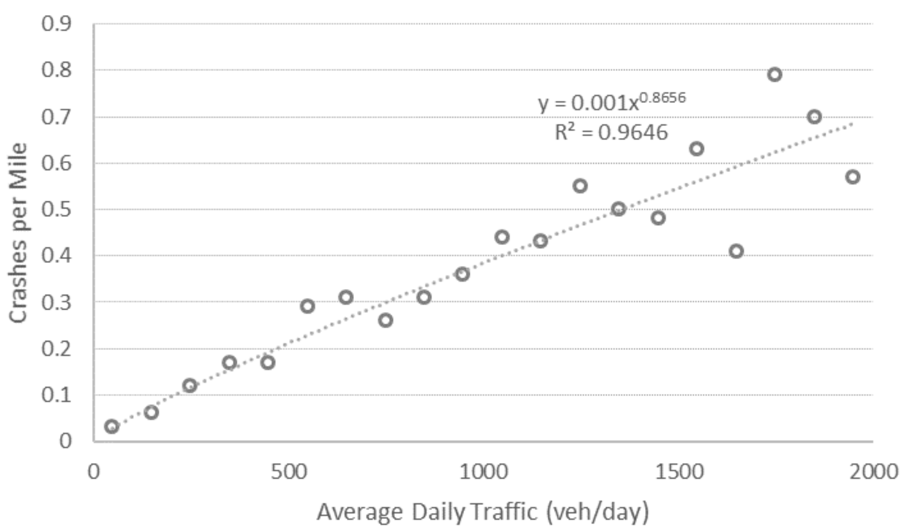


Figure 33. Total Crashes per Mile versus ADT.

To capture the influence of paved width on total crashes, we developed a statistical model to identify the relationship between ADT, paved width, and total injury (KABC) and PDO crashes. The analyses indicate that for roadways narrower than 24 ft, the width was found to not be a significant factor on the number of crashes, meaning that the important thing is whether the roadway is less than 24 ft or not as opposed to how much narrower the roadway is than 24 ft. It is also possible that the variability for the paved width in the data is too low for the model to capture the effect.

To address the above issue, segments greater than 24 ft wide were also included to capture the effect of paved width. The results showed that total crashes decrease by 1.5 percent for every foot increase. In general, roads with a width >24 ft experience 7.5 percent fewer total crashes and 14 percent fewer injury crashes than roads less than 24 ft wide.

The crash rates developed from the Texas data were used to calculate the expected number of crashes in each ADT range. Crash reductions from widening and rumble strip installation were calculated based on the research by Wu et al. (2015) and Kay et al. (2015). Widening and rumble strips reduce run-off-the-road and OD crashes, and this was considered in the analysis. These crash reductions were assigned dollar values and compared to the cost of construction. Both were calculated over the life of the project.

This analysis assumes widening to 26 or 28 ft and includes rumble strips as part of the project. The assumed cost for widening is $300,000 per mile and the assumed cost for rumble strip installation is $18,000 per mile. A 20-year project life is assumed with the rumble strips requiring reinstallation every 5 years, or four times over the life of the project. Crash reduction benefits are based on comprehensive cost of crashes from an FHWA report on crash costs.

The value of crashes reduced are based on the values shown in Table 21, taken from Harmon et al. (2018).

Table 21. Average Comprehensive Cost.

Crash Severity	Cost
Fatal	$11,295,400
Suspected serious injury	$655,000
Non-incapacitating injury	$198,500
Possible injury	$125,600
PDO	$11,900

PRIORITIZATION USING A SYSTEMIC APPROACH TO REDUCE WET-WEATHER CRASHES ON HORIZONTAL CURVES

Background

Of all the districts, the Beaumont District has the highest precipitation rate in the state. Table 22 shows the annual average precipitation by county in the Beaumont District. The last row of Table 22 provides the statewide average. The district has almost double the rainfall of the state average.

Table 22. Annual Average Precipitation (in.) by County.

County	Annual Avg. Precipitation (in.) 1971–2000 NOAA Normal	Annual Avg. Precipitation (in.) 1981–2010 NOAA Normal
Chambers	54.08	57.11
Hardin	56.50	61.70
Jasper	60.57	54.75
Jefferson	59.89	60.42
Liberty	60.52	59.92
Newton	54.90	57.45
Orange	59.00	59.13
Tyler	54.79	56.18
Statewide	31.39	32.13

The application of pavement-related treatments at appropriate horizontal curve locations in the district has the potential to improve driver performance and reduce the number of crashes, particularly wet-surface crashes that are experienced on horizontal curves. These treatments must be implemented judiciously due to their cost and consideration of wet-weather exposure. However, they have the potential to improve safety at a lower cost than geometric improvements like curve straightening. They also can be more effective than control-device treatments like installing delineators or chevrons. A prioritization method is needed to select projects carefully so that funds are spent where they will yield the greatest benefit in terms of crashes reduced and injuries and fatalities prevented.

Wet Weather and Safety

Weather acts through visibility impairments, precipitation, high winds, and temperature extremes that affect driver capabilities, vehicle performance (i.e., traction, stability, and maneuverability), pavement friction, and roadway infrastructure. These impacts can increase crash risk and severity. Several studies have been conducted on driver behavior and crashes during rainfall or snowfall. Examination of free-flow speeds on curved highway sections in rural New York State illustrated that drivers did not reduce speeds sufficiently on curves during wet-pavement conditions (Neuman et al. 2003). The investigators concluded that drivers did not recognize that pavement friction is lower on wet pavement than on dry pavement.

In a study of crashes during and after rain events in Calgary and Edmonton, Canada (Lamm et al. 1990), investigators concluded that crash risk during rainfall was 70 percent higher than crash risk under clear, dry conditions. In an assessment of weather and seasonal effects on highway crashes in California (Andrey and Yagar, 1993), weather was found to be a major factor. On very wet days, crash frequency was twice the rate of dry days. Using data from the United States and Israel, researchers analyzed crash risk during rainy weather (Satterthwaite, 1976). They learned that crash injury risk was two to three times higher than in dry conditions. Researchers also reported that crash risk was greater when rain followed a period of dry weather.

Jackson and Sharif (2016) used fatal crash data and geospatial data to examine the temporal and spatial distribution of rain-related fatal crashes in Texas from 1982 to 2011. The data obtained from the Fatality Analysis and Reporting System was used to identify spatial clustering patterns of rain-related fatal crashes and their correlation with rainfall and to compare them to spatial patterns of other crashes. Their study results suggest that rain is a contributor to crashes in a few counties but at less than 95 percent confidence in some of the counties with greater precipitation. The authors recommended that these counties should be the focus of further research and detailed analysis to identify underlying contributing factors to crashes.

Objective

Currently, crashes occurring on a horizontal curve are examined and sites with an overrepresentation of wet-weather crashes are prioritized for pavement-related treatments. Given that wet-weather crashes are rare and random, selecting sites just based on observed crashes may yield inaccurate results. This study proposes a new method based on a systemic approach. The systemic approach is a complementary technique that supplements the site-specific analysis approach. It focuses on identifying high-risk roadway characteristics rather than only high-risk locations. Systemic safety improvement is a proactive approach because it focuses on high-risk roadway features, not specific locations.

Regression Analysis

Before prioritizing locations, it is important to understand which factors influence crashes on two-lane horizontal curves in rural areas. Researchers developed regression models to identify the significant factors in the occurrence of crashes on horizontal curves. The database assembled for developing the regression models consisted of all crashes on two-lane horizontal curves in Texas. The horizontal curve information was extracted from the Texas Reference Marker System Geometrics (Geo-Hini) database for 2012. The Geo-Hini database contains geometrics for all curves on all highways in the state. Each curve is given a unique curve identifier number, and the beginning and ending milepoints of each curve are located through a given reference marker and curve length from that marker. Only normal curves (i.e., curves that deflect at a constant rate and do not have spiral transitions) that are $\geq$ 0.1 miles in length were considered in this analysis.

The horizontal curve database was combined with TxDOT's RHiNo database using the control section numbers and milepoints. Variables extracted from the RHiNo database included ADT, truck percentage, shoulder widths, lane width, median width, and number of lanes. Only those sites that have at least 400 vpd were considered in the development of regression models.

Pavement data were obtained from the Texas Pavement Management Information System (PMIS) for the years 2012 to 2016. Specifically, the following quantities were extracted:

- Skid score (or skid number).

- Condition score.
- Distress score.
- Ride score.
- International roughness index.

These quantities provide insight into friction supply and general pavement condition. The curves of interest were located in the PMIS database using reference markers and displacements.

Researchers retrieved crash data for the years 2012–2016 from the CRIS database. These data consisted of information describing date and location of the crash, severity, and weather conditions. Since it is widely recognized that PDO crash counts vary widely on a regional basis due to a significant variation in the reporting threshold, only those crashes associated with injury or fatality were considered in this analysis. The following four crash severity levels were used: fatal (K), suspected serious injury (A), non-incapacitating injury (B), and possible injury (C).

Once the crash and road-related data were collected for each horizontal curve, the data were combined using control section number and milepoints. Table 23 provides the parameter estimates for two-lane curves for wet-weather and dry-weather crashes.

Table 23. Parameter Estimation for Two-Lane Curves.

Variable	**Wet-Weather Crashes**		**Dry-Weather Crashes**	
	Estimate	**Std. err.**	**Estimate**	**Std. err.**
Intercept	−10.686	0.472	−7.686	0.168
LN (ADT)	0.881	0.049	0.767	0.019
Curve Radius	0.579	0.118	0.444	0.039
Lane Width	—	—	−0.043	0.017
Shoulder Width	-0.029	0.014	−0.043	0.006
Skid Number	−0.034	0.003	*−0.001*	*0.001*
Annual Prec.	0.035	0.004	0.011	0.002
Over-Dispersion	0.317	0.051	0.869	0.057
AIC	6,286		27,355	

Note: Italics mean the variable is not statistically significant at the 5% level.

The annual wet-weather crash frequency for horizontal curves on two-lane highways can be estimated by the following equation:

$$N_p = L \times y \times e^{-10.686} \times F^{0.881} \times CMF_R \times CMF_{SW} \times CMF_{SK} \times CMF_{AP} \quad \text{(Equation 6)}$$

with:

$$CMF_R = 1 + 0.579(0.147V)^4 \frac{(1.47V)^2}{32.2R^2}$$

$$CMF_{SW} = e^{-0.029(SW-8)}$$

$$CMF_{SK} = e^{-0.034(SK-40)}$$

$$CMF_{AP} = e^{0.035(AP-30)}$$

Where:

N_p	=	predicted number of crashes per year per mile for curves on two-lane highways.
CMF_R	=	horizontal curve radius crash modification factor.
CMF_{LW}	=	lane width crash modification factor.
CMF_{SW}	=	shoulder width crash modification factor.
CMF_{SN}	=	skid number crash modification factor.
CMF_{AP}	=	annual precipitation crash modification factor.
R	=	curve radius, ft.
V	=	regulatory speed limit, mph.
LW	=	lane width, ft.
SW	=	shoulder width, ft.
SK	=	skid number.
AP	=	annual precipitation rate, in.

The coefficient for annual precipitation shows that the Beaumont District may experience about three times (i.e., $e^{0.035(60-30)} = 2.86$) the average number of wet-weather crashes in the state. A higher skid number has a positive safety effect on wet-weather crashes, and it is not statistically significant at the 5 percent level for dry-weather crashes. Figure 34 shows the change in crashes with respect to the change in the skid number. The analysis results show that the horizontal curves in the Beaumont District benefit more from pavement-related treatments than do other districts.

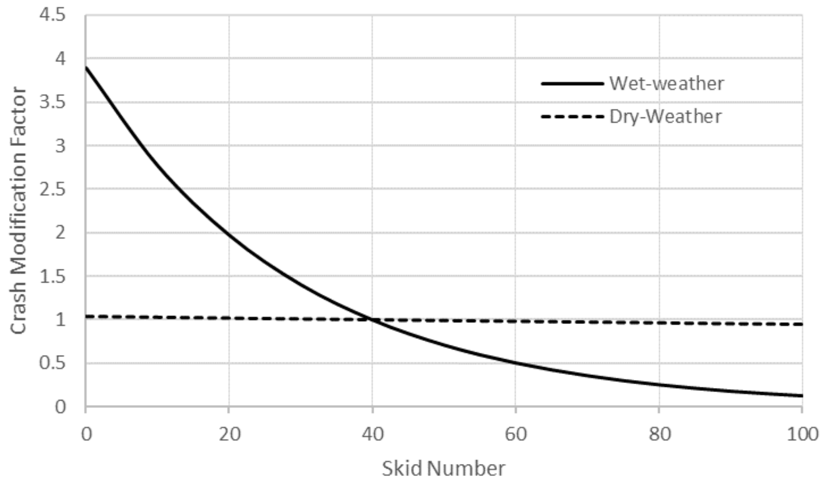


Figure 34. Skid Number CMF.

Systemic Approach

Unlike other more frequent crashes, such as roadway departures, wet-weather crashes are significantly affected by the random nature of the crash process. Scattered crashes make it much more difficult to efficiently predict or estimate the locations where these crash types will occur. It is even more problematic to prioritize horizontal curves to improve wet-weather safety. Thus, in short, transportation agencies will continue to experience difficulties when using traditional approaches to implement countermeasures for reducing wet-weather crashes. Since systemic improvements focus on high-risk roadway features rather than specific locations, it is possible to use the roadway characteristics that are associated with wet-weather crashes to estimate which locations are most likely to experience these crashes.

The advantages of a systemic approach are noteworthy. A systemic approach needs less data once the process is established, and since sites are selected proactively, it will help in reducing future crashes.

It is important to point out that a systemic approach does not replace the traditional site analysis but instead complements it. While a systemic approach suggests safety treatments based upon roadway system characteristics, the more traditional site analysis suggests safety countermeasures based on operator crash cause and type.

The FHWA developed a tool for systemic safety project selection based on the current practices for identifying roadway safety problems and developing the HSIP. The FHWA Systemic Tool provides a step-by-step process for conducting a roadway system safety evaluation. It involves three basic elements: (a) Element 1—the systemic safety planning process; (b) Element 2—a framework for balancing systemic and traditional safety investments; and (c) Element 3—an evaluation of a systemic safety program. The framework of the FHWA Systemic Tool is shown in Figure 35. This study's focus is on Element 1.

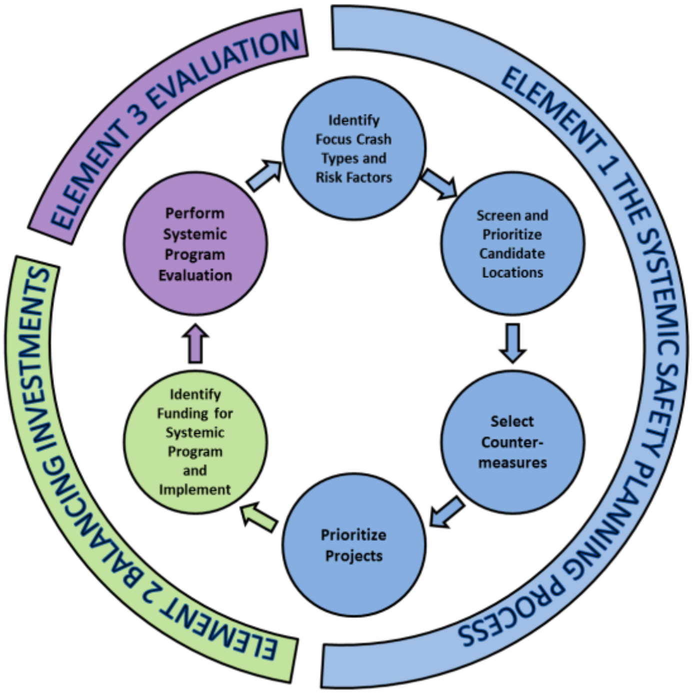


Figure 35. Framework of the FHWA Systemic Tool (Preston et al. 2013).

Evaluate Risk Factors

This task evaluates the risk factors for wet-weather crashes on two-lane horizontal curves. To accomplish this task, TTI researchers used the same data that were used for the regression analysis.

Average Daily Traffic

Figure 36 shows the proportion of wet-weather crashes and horizontal curve mileage as a function of ADT. The horizontal curves with more than 3000 vpd have an overrepresentation of wet-weather crash occurrence.

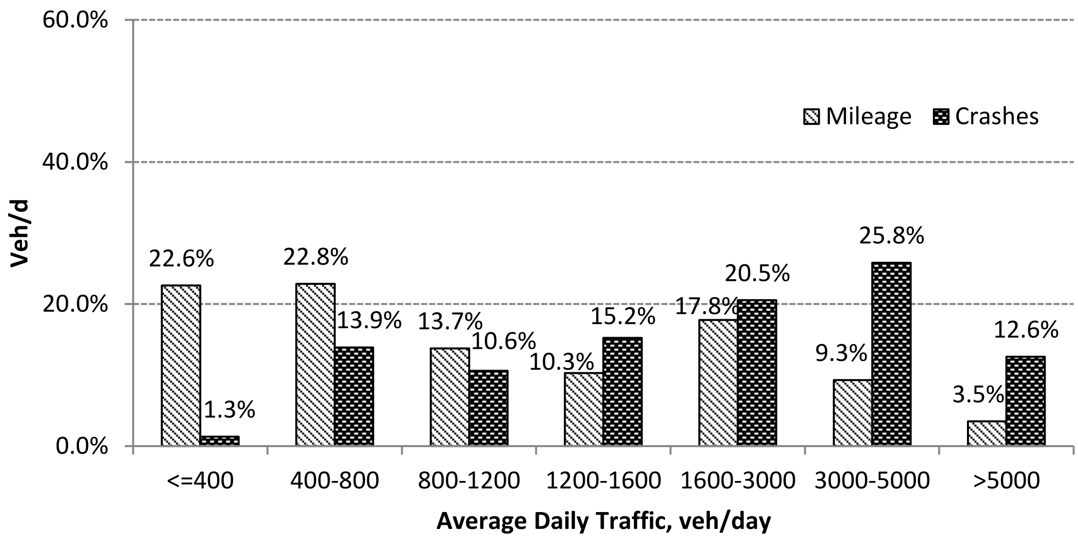


Figure 36. Proportion of Mileage and Wet Crashes by ADT.

Posted Speed Limit

Figure 37 shows the proportion of wet-weather crashes and horizontal curve mileage as a function of PSL. The horizontal curves with a PSL of 55 mph and 75 mph have an overrepresentation of wet-weather crash occurrence.

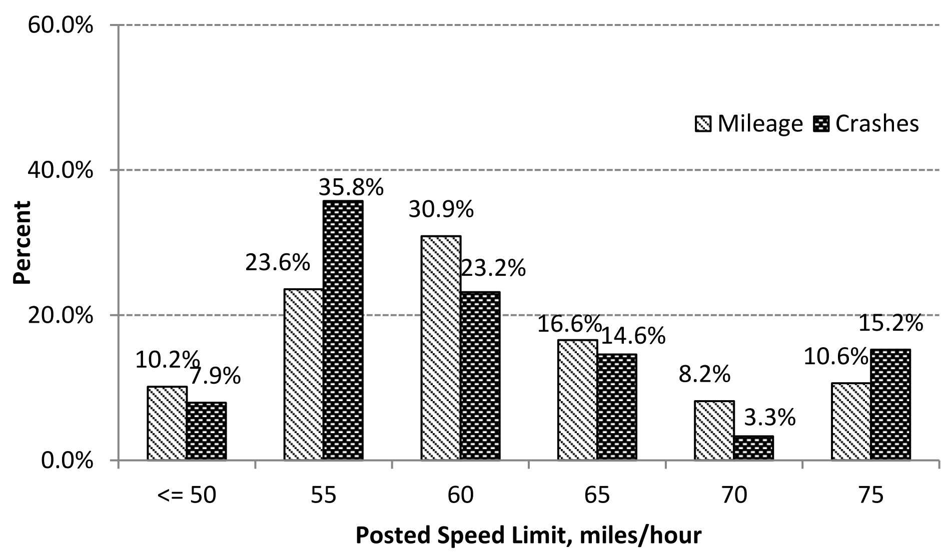


Figure 37. Proportion of Mileage and Wet Crashes by Speed Limit.

Skid Number

Figure 38 shows the proportion of wet-weather crashes and horizontal curve mileage as a function of skid number. The horizontal curves with a skid number of less than 50 have an overrepresentation of wet-weather crash occurrence.

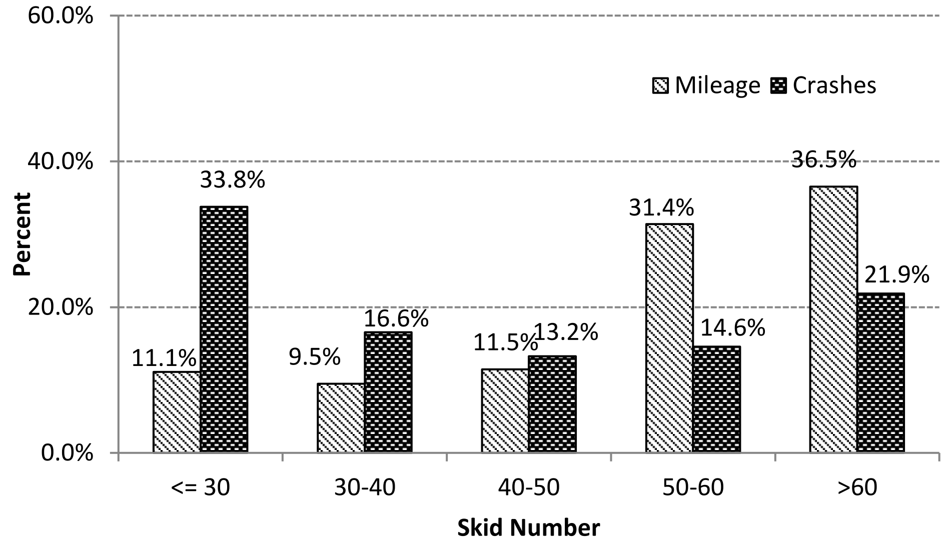


Figure 38. Proportion of Mileage and Wet Crashes by Skid Number.

Precipitation

Figure 39 shows the proportion of wet-weather crashes and horizontal curve mileage as a function of annual precipitation. The horizontal curves with annual precipitation between 59 and 60 inches have an overrepresentation of wet-weather crash occurrence.

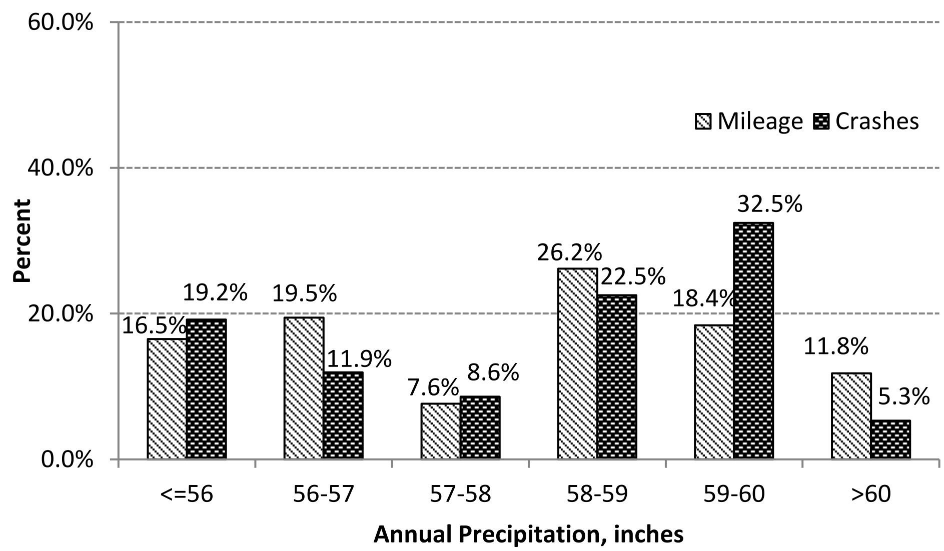


Figure 39. Proportion of Mileage and Wet Crashes by Precipitation.

Truck Percentage

Figure 40 shows the proportion of wet-weather crashes and horizontal curve mileage as a function of truck percentage. The horizontal curves with a truck volume proportion of less than 20 percent have an overrepresentation of wet-weather crash occurrence.

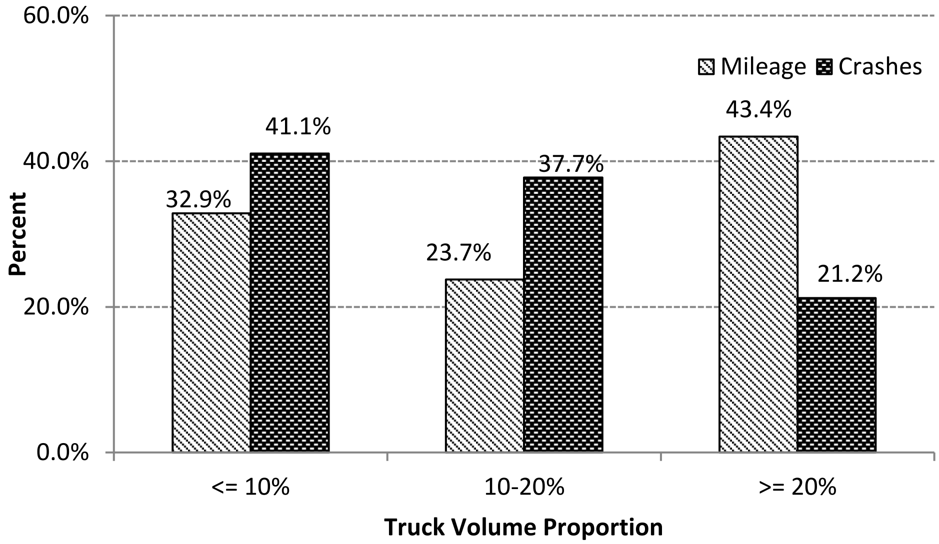


Figure 40. Proportion of Mileage and Wet Crashes by Truck Percentage.

Shoulder Width

Figure 41 shows the proportion of wet-weather crashes and horizontal curve mileage as a function of average shoulder width. The horizontal curves with a shoulder width of 2 or 3 ft have an overrepresentation of wet-weather crash occurrence.

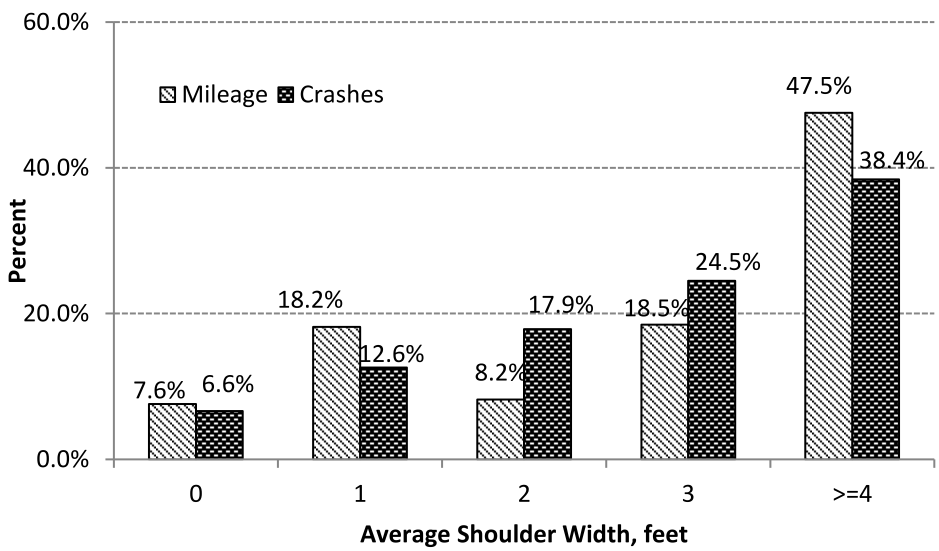


Figure 41. Proportion of Mileage and Wet Crashes by Shoulder Width.

Curve Radius

Figure 42 shows the proportion of wet-weather crashes and horizontal curve mileage as a function of curve radius. Sharper horizontal curves (i.e., curves with radius less than 1,000 ft) have an overrepresentation of wet-weather crash occurrence.

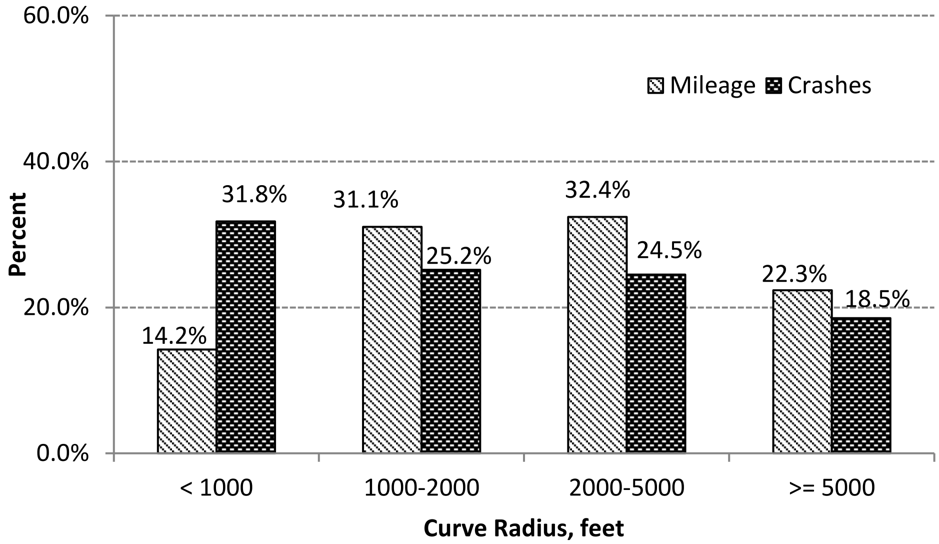


Figure 42. Proportion of Mileage and Wet Crashes by Curve Radius.

Conduct Risk Assessment

In the risk assessment, sites are prioritized using risk factor weights. Risk factor weights are calculated using the wet-weather crashes and the crash overrepresentation of each element. The total risk factor weight is the sum of all risk factor weights of a horizontal curve for each element evaluated. Table 24 provides the weights based on the proportion of crash overrepresentation and crash total when compared to roadway mileage.

Table 24. Risk Factor Weight Criteria.

Category	Weight (points)										
	0	1	2	3	4	5	6	7	8	9	10
Crash Total	≥ 0% and < 10%	≥ 10 and < 20%	≥ 20 and < 30%	≥ 30 and < 40%	≥ 40 and < 50%	≥ 50 and < 60%	≥ 60 and < 70%	≥ 70 and < 80%	≥ 80 and < 90%	≥ 90 and < 100%	100%
Crash Overrepresentation	0%	> 0% and < 2%	≥ 2% and < 3%	≥ 3% and < 4%	≥ 4% and < 5%	≥ 5% and < 6%	≥ 6% and < 7%	≥ 7% and < 8%	≥ 8% and < 9%	≥ 9% and < 10%	≥ 10% and ≤ 100%
Crash Under-Representation	0%	> 0% and < 2%	≥ 2% and < 3%	≥ 3% and < 4%	≥ 4% and < 5%	≥ 5% and < 6%	≥ 6% and < 7%	≥ 7% and < 8%	≥ 8% and < 9%	≥ 9% and < 10%	≥ 10% and ≤ 100%

Based on the weights provided in Table 24, the total weight for a particular risk factor can be calculated using the following equation.

$$W_t = 10 + CT + CO - CU \qquad \text{(Equation 7)}$$

Where:

- W_t = total weight.
- CT = weight based on crash total.
- CO = weight based on crash overrepresentation.
- CU = weight based on crash under-representation.

Table 25 summarizes the results of risk factor prioritization related to wet-weather crashes on two-lane rural horizontal curves.

Table 25. Wet-Weather Crash Risk Factor Prioritization Results.

Risk Factor		Weight (points)
Traffic Volume (veh/day)	≤400	0
	400–800	1
	800–1,200	8
	1,200–1,600	15
	1,600–3,000	14
	3,000–5,000	22
	>5,000	20
Posted Speed Limit (miles/hour)	≤50	8
	55	23
	60	5
	65	9
	70	6
	75	15
Skid Number	≤30	23
	30–40	18
	40–50	12
	50–60	1
	>60	2
Annual Precipitation (inches)	≤56	13
	56–57	4
	57–58	11
	58–59	9
	59–60	23
	>60	4
Truck Percentage (%)	≤10	22
	10–20	23
	>20	2
Shoulder Width (feet)	0	9
	1	6
	2	20
	3	18
	≥4	4
Curve Radius (feet)	<1,000	23
	1,000–2,000	7
	2,000–5,000	5
	≥5,000	8

Based on Table 25, every horizontal curve in the Beaumont District was assigned a weight as a function of risk characteristics. The total weights were categorized into five categories and the wet-weather crash rate was calculated. Table 26 provides the crash rate by the weights. As illustrated below, horizontal curves with larger weights have higher crash rates.

Table 26. Crash Rate for Horizontal Curves in Beaumont Based on Risk Factor Weights.

Total Weight (points)	Number of Curves	Total Wet Crashes	Average Crash Rate
≤50	538	9	0.09
50–75	661	25	0.18
75–100	475	59	0.67
100–125	218	34	0.34
>125	57	24	0.96

Recommendations

We recommend that the Beaumont District prioritize horizontal curves for pavement treatments that have the greatest potential for wet-weather crash occurrence. Appendix B consists of a priority listing of horizontal curves with risk factor weights greater than 125 in the Beaumont District by highway designation, control section number, and beginning and ending DFO points.

CHAPTER 6: PROCEDURE FOR IDENTIFYING ROADWAYS WITH POTENTIAL FOR SAFETY IMPROVEMENTS

INTRODUCTION

Previously in the project, researchers from TTI developed a crash profile, identified areas of potential safety emphasis based on the crash profile, and determined the most appropriate analysis tools for use in the Beaumont District. This chapter describes the development of a procedure for identifying roadways and intersections with the potential for safety improvement. Specifically, this document presents the technique TTI researchers proposed for preparing an intersection database, the development of SPFs, and the network screening method.

The organization of this chapter is as follows:

- A brief introduction to predictive methods used in the HSM is provided with a discussion of the statistical approach for developing SPFs.
- A section on data preparation and SPF development for normal segments is provided. This section also presents the detailed modeling process on rural two-lane highways.
- A documentation of intersection types, intersection crash data, and the technique TTI researchers developed for preparing the intersection safety data is provided. This section also provides the SPF modeling results for 3-leg unsignalized intersections in rural areas.
- A discussion of the network screening method is provided in which roadway segments and intersections are ranked separately based on safety measures. This section also lists top segments and intersections with the potential for safety improvements using the network screening method.
- Appendix C presents the modeling results for roadway segments on all other facility types and SPF modeling results for all intersections by different types and crash severity levels.

HIGHWAY SAFETY MANUAL PREDICTIVE METHODS

In the first edition of the HSM, SPFs are used for predictive safety analysis. An SPF is a statistical model used to estimate the long-term crash frequency (of total crashes, crash types, or crash severities) of a roadway entity (i.e., an intersection or roadway segment). SPFs are based on the *ceteris paribus* principle, i.e., all else being equal, the changes in crash frequency and severity will depend on traffic exposure (i.e., segment length and traffic volume for normal segments, and major and minor road AADT for intersections).

For the SPFs, the number of crashes occurring at an entity (i.e., a segment or an intersection) during a certain period (typically 1 year) is assumed to follow a negative binomial distribution. The probability mass function of the negative binomial distribution is defined as

$$f(y|N,\sigma) = \frac{\Gamma(y + {}^{1}/_{\sigma})}{\Gamma(y+1)\Gamma({}^{1}/_{\sigma})}\left(\frac{\sigma N}{1+\sigma N}\right)^{y}\left(\frac{1}{1+\sigma N}\right)^{{}^{1}/_{\sigma}} \quad \text{(Equation 8)}$$

Where:

- y = response variable, that is, the number of crashes occurring at a segment or an intersection during a certain period.
- N = mean of the response variable.
- σ = over-dispersion parameter.

For segments, assuming that the mean of the crash number is associated with roadway features (i.e., traffic volume, segment length, and roadway characteristics), the relationship between the two is shown by the following equation:

$$N = L \times \exp(\beta_0 + \beta_{ADT} \times \log(ADT) + \sum_{j=1}^{p} \beta_j \times x_j) \qquad \text{(Equation 9)}$$

Where:

- L = segment length.
- ADT = average daily traffic.
- x_j = roadway characteristics (e.g., lane width, shoulder width, truck percentage).
- β_0, β_{ADT}, β_j = unknown parameters.

In addition, assume that the over-dispersion parameter σ of the negative binomial distribution is related to the length of a segment with the following equation.

$$\sigma = \frac{\exp(\beta_\sigma)}{L} \qquad \text{(Equation 10)}$$

Where:

- β_σ = unknown parameter for over-dispersion parameter.

Thus, the over-dispersion parameter is disproportional to the segment length. In other words, as the length of a segment increases, the number of crashes becomes relatively less dispersed. This is consistent with the first edition of HSM *(AASHTO 2010)* (see Equation 10-7 on Page 10-16 of HSM). Note that the dispersion parameter $\theta = 1/\sigma$.

The intersection SPFs, on the other hand, only depend on the traffic volume of major and minor streets. Intersection SPFs have the following functional form:

$$N_i = e^{\beta_0} \times (Major\ ADT_i)^{\beta_1} \times (Minor\ AADT_i)^{\beta_2} \qquad \text{(Equation 11)}$$

Where:

- N_i = predicted crash number at the intersection i.
- $Major\ ADT_i$ = major road ADT at the intersection i.

- $Minor\ ADT_1$ = major road ADT at the intersection i.
- β_0 = intercept coefficient.
- β_1 and $\beta_2 =$ ADT coefficients.

DEVELOPMENT OF SPF FOR SEGMENTS

This section first describes the crash and traffic data on normal segments in the Beaumont District and then documents the modeling results of the SPFs. Since different types of roadways are usually designed with different standards, their safety performance may not remain at the same level. While developing SPFs, the research team categorized roadway facilities into eight types: (1) rural two-lane, (2) rural multiple-lane undivided; (3) rural multiple-lane divided, non-freeway; (4) rural interstates and freeways; (5) urban two-lane, (6) urban multiple-lane undivided; (7) urban multiple-lane divided, non-freeway; and (8) urban interstates and expressways. The detailed description in this chapter mainly focuses on rural two-lane highways. The data preparation and SPF development for other facility types followed a similar procedure, and the results are documented in Appendix C.

Developing the Roadway Database for the Beaumont District

In total, there are 3,749 segments of rural two-lane undivided highway in the Beaumont District. The research team removed about 200 segments with outliers or obvious errors in the data. In addition, 1,414 segments were very short (i.e., less than 0.1 miles). Manual checking using Google Earth revealed that these segments are typically located at boundaries (e.g., two counties), or close to an intersection. In some cases, roadway geometric features or traffic volume changed, and thus a segment was split into shorter ones in the RHiNO database. The research team attempted to combine the shorter segments with adjacent segments. However, there are geometric and traffic changes (e.g., number of lanes, roadway width, ADT) between these segments. This makes segment combination difficult. To make the SPF modeling more reliable and accurate, segments shorter than 0.1 miles were excluded from the analysis. In addition, previous studies pointed out that longer segments (typically greater than 2 miles) may lead to inaccurate parameter estimates (see HSM Chapter 10). To address this problem, the research team split segments that are longer than 2 miles into shorter segments. Finally, 2,068 segments were used to develop the SPFs. The total length of the 2,068 segments is 1,471.0 miles. Over the 3-year (2016–2018) period, 2,810 crashes occurred on these roadways. Of the crashes, 212 were fatal or suspected serious (KA) crashes, and 910 were fatal or injury (FI, or KABC) crashes. The summary statistics for the roadway segments, traffic (i.e., ADT), and crash numbers are shown in Table 27. It is worth noting that the research team used the 2017 RHiNO database, which is the latest available to the researchers. In the database, a few segments have missing ADT values in some of the study years, and the 2018 ADT data was not available by the date of the present analysis. To overcome this problem, the research team assumed that the roadways had the same ADT in 2018 as in 2017. Segments with missing ADT were removed from the analysis.

Table 27. Summary Statistics of Roadway Segments on Rural Two-Lane Highways.

Variable	Min	Max	Mean	SD
Segment Length (mi)	0.100	2.000	0.70	0.54
ADT (vpd)	102	13,087	2,836.3	2,376.32
Lane Width (ft)*	9	14	11.9	1.0
Shoulder Width (ft)	0	10	5.5	3.46
Annual Number of Crashes	0	11	0.5	0.91
Annual Number of KA Crashes	0	3	0.04	0.21
Annual Number of FI Crashes	0	4	0.16	0.46

Notes: SD = standard deviation; KA = fatal and suspected serious; FI = fatal and injury; * A few segments have 14 or 15 ft lanes. They were corrected based on the measurements on Google Earth. The total sample size is 5,620 segments * year.

Modeling Results

Total crashes, KA crashes, and FI crashes were analyzed using the negative binomial model separately. The modeling results are presented in Table 28. As can be seen, all the estimated parameters (i.e., intercept, ADT, shoulder width, and a parameter for over-dispersion) except lane width are statistically significant at the 99.9 percent level for total and FI crashes. Only the parameter for ADT is statistically significant at the 99.9 percent level for KA crashes. This is probably due to the relatively small number of KA crashes in the database (i.e., the mean is 0.04; please see Table 27).

Table 28. Modeling Results (Rural Two-Lane Undivided Highways).

Variable	Estimate	S.E.	p-Value	Significance Level
Total Crashes				
Intercept—β_0	-7.2321	0.3714	<0.001	99.9%
log(ADT)—β_{ADT}	0.9778	0.0345	<0.001	99.9%
Lane Width—β_1	-0.0399	0.0283	0.1587	Not Sig.
Shoulder Width—β_2	-0.0500	0.0086	<0.001	99.9%
Parameter for Over-Disp.—β_σ	-1.4417	0.1390	<0.001	99.9%
AIC	8,535.5			
KA Crashes				
Intercept—β_0	-9.8862	1.2489	<0.001	99.9%
log(ADT)—β_{ADT}	0.8375	0.1145	<0.001	99.9%
Lane Width—β_1	0.0491	0.0960	0.6091	Not Sig.
Shoulder Width (ft)—β_2	-0.0153	0.0286	0.5944	Not Sig.
Parameter for Over-Disp.—β_σ	0.1557	0.4627	0.7365	Not Sig.
AIC	1,602.3			
FI Crashes				
Intercept—β_0	-7.9248	0.5837	<0.001	99.9%
log(ADT)—β_{ADT}	0.9502	0.0538	<0.001	99.9%
Lane Width—β_1	-0.0471	0.0444	0.2894	Not Sig.
Shoulder Width (ft)—β_2	-0.0542	0.0134	<0.001	99.9%
Parameter for Over-Disp.—β_σ	-1.4044	0.3599	<0.001	99.9%
AIC	4,570.6			

Notes: S.E. = standard error; Not Sig. = not applicable/not statistically significant; AIC = the Akaike information criterion; Over-Disp. = over-dispersion parameter.

For rural two-lane undivided highways, the SPFs for total crashes, KA, and FI crashes are shown in the following equations:

$$\mu_{Total\ crash} = 0.0007 \times L \times ADT^{0.9778} \times e^{-0.0399 \times LW - 0.0500 \times SW} \quad \text{(Equation 12)}$$

$$\sigma_{Total\ crash} = \frac{e^{-1.4417}}{L} = \frac{0.2365}{L} \quad \text{(Equation 13)}$$

$$\mu_{KA\ crash} = 5.09 \times 10^{5} \times L \times ADT^{0.8375} \times e^{0.0491 \times LW - 0.0153 \times SW} \quad \text{(Equation 14)}$$

$$\sigma_{KA\ crash} = \frac{e^{0.1557}}{L} = \frac{1.1684}{L} \quad \text{(Equation 15)}$$

$$\mu_{FI\ crash} = 0.0004 \times L \times ADT^{0.9502} \times e^{-0.0471 \times LW - 0.0542 \times SW} \quad \text{(Equation 16)}$$

$$\sigma_{FI\ crash} = \frac{e^{-1.4044}}{L} = \frac{0.2455}{L} \quad \text{(Equation 17)}$$

Where:

- $\mu_{Total\ crash}$, $\mu_{KA\ crash}$, $\mu_{FI\ crash}$ = predicted number of total, KA, and FI crashes, respectively, per year.
- ADT = average daily traffic.
- L = segment length (mi).
- SW = average of left and right side shoulders (ft).
- LW = lane width (ft).
- $\sigma_{Total\ crash}$, $\sigma_{KA\ crash}$, $\sigma_{FI\ crash}$ = over-dispersion parameter for total, KA, and FI crashes, respectively.

In the following empirical Bayes (EB) analysis, the expected number of crashes of a segment can be calculated as:

$$EB = w \times \mu + (1 - w) \times Y \quad \text{(Equation 18)}$$

Where:

- Y = observed number of target crashes (e.g., total, KA, or FI) in a period.
- μ = predicted number of target crashes in the same period.
- w = weight factor.
- EB = expected number of target crashes in the same period.
- β_σ = unknown parameter for over-dispersion parameter.
- L = segment length (mi).

The weight factor is a function of the dispersion parameter and predicted number of crashes, as shown in the following equation:

$$w = 1/(1 + \mu \times e^{\beta_\sigma}/L) \quad \text{(Equation 19)}$$

The SPF curves for rural two-lane highways are plotted in Figure 43.

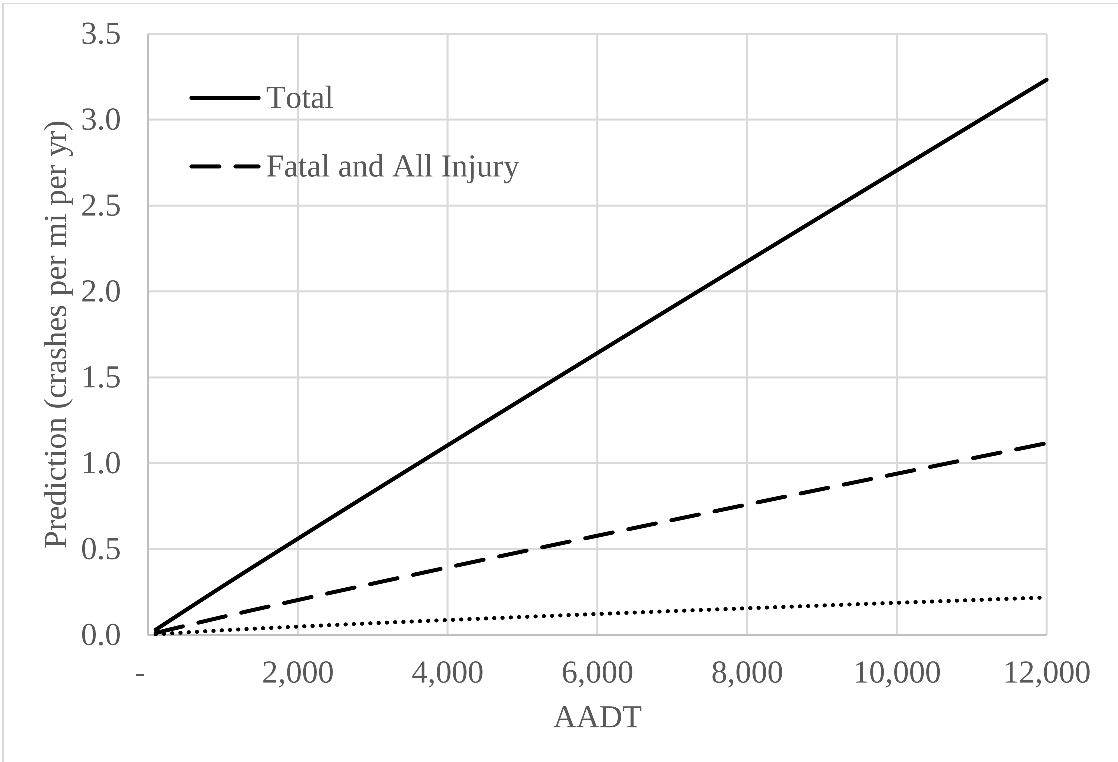


Figure 43. SPF Curves on Rural Two-Lane Highways.

The TTI researchers applied the same method and steps for other types of roadways, and the summary statistics and modeling results for them are presented in Appendix C.

Conclusions

In this chapter, the TTI researchers developed SPFs for normal segments on eight types of roadway facilities. For each of the facility types, the research team developed SPFs for three levels of crash severity: total crashes, FI crashes, and fatal and suspected serious injury (KA) crashes. The results on rural two-lane highways are discussed in this chapter, and the results for other types of roadways are documented in Appendix C. The SPFs for segments as well as SPF curves are documented in Appendix C.

DEVELOPING SPF FOR INTERSECTIONS

Developing Intersection Database for the Beaumont District

An intersection database should include the intersection characteristics (intersection type, major and minor road AADT, control type, number of legs, etc.) and the crash data. For this project, TTI researchers developed an intersection layer using the Geographic Information Systems tools and data from the 2017 RHiNO database. TTI researchers identified 4,491 on-system and 15,000 off-system intersections (Figure 44).

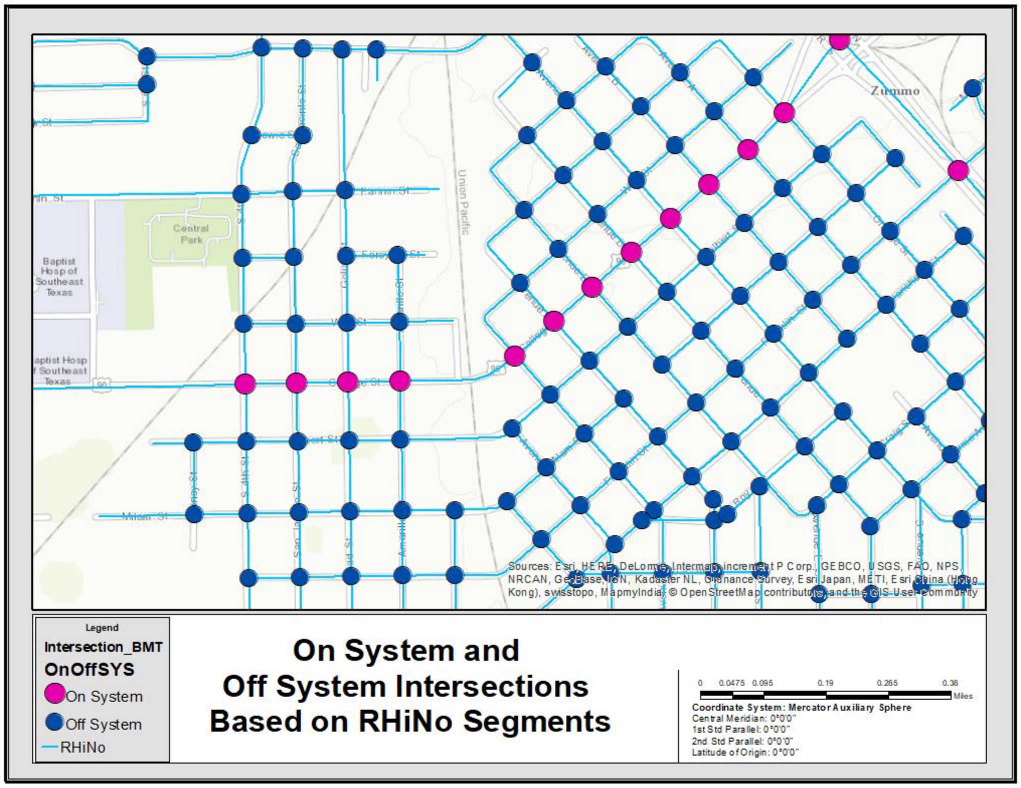


Figure 44. Highway Intersection Network Example.

Intersection Types

TTI researchers established a list of intersection types based on area type, the number of approaches, and traffic control type. In this project, TTI researchers classified intersections into several categories based on the following characteristics:

- Area type:
  - Rural.
  - Urban.
- The number of approaches:
  - 3 legs.
  - 4 legs.
- Traffic control type:
  - Signalized.
  - Unsignalized.

The location information of signalized intersections came from two sources: (1) TxDOT Beaumont District office provided it for those locations in rural areas and maintained by the district; and (2) three cities (Beaumont, Baytown, and Port Arthur) provided the signalized intersections on the on-system roadways within each city's boundary. Thus, all on-system signalized intersection information was available to the researchers. It is assumed that all other on-system intersections are unsignalized. Due to the relatively small number of signalized intersections in the Beaumont District, TTI researchers combined the rural and urban signalized intersections together. Considering the geometric and operation differences between 3-leg and 4-leg signalized intersections, the two types of intersections were analyzed separately. In total, there are six categories of intersections, as shown in Table 29.

Table 29. Intersection Facility Types and Designations.

Traffic Control Type	Number of Approaches	Designations	
		Rural Intersection	Urban Intersection
Unsignalized	3 Legs	R3US	U3US
	4 Legs	R4US	U4US
Signalized	3 Legs	3S	
	4 Legs	4S	

In addition, frontage-roadway-related intersections were excluded from the analyses, since the crash locations on frontage roadways are not precisely recorded in the CRIS database. The research team also removed non-isolated intersections to eliminate the interaction effect while developing intersection SPFs. A non-isolated intersection is defined as one that has another intersection within 250 ft of it.

Intersection Crash Data

TTI researchers integrated the intersection database with the CRIS crash database (2016–2018) by applying a 250 ft buffer to each intersection and summing up the crashes that fell within the buffer zone. Researchers identified 6,523 intersection-related crashes (KABCO), out of which 283 crashes were fatal and suspected serious injury (KA) crashes. Table 30 depicts the number of intersections per intersection type together with the number of total and FI crashes per intersection type.

Table 30. Intersection-Related Crashes (2016–2018).

Intersection Type	Number of Intersections	Total Crashes (KABCO)	Fatal and Injury Crashes (KABC, or FI)	Fatal and Serious Injury Crashes (KA)
R3US	1,348	870	317	87
R4US	216	338	132	25
U3US	651	1,918	616	81
U4US	220	992	317	32
3S	58	908	282	26
4S	80	1,497	423	32
Grand Total	**2,573**	**6,523**	**2,087**	**698**

Table 31 shows descriptive statistics of traffic volumes (AADT) for both major and minor roads as well as total and FI crashes per intersection facility type.

Table 31. Descriptive Statistics for the Intersection Safety Database.

Variable	Sample Size (Inter. * Yr.)	Min.	Max	Mean	SD
R3US, 1,348 Intersections					
Annual Total Crash	4,031	0	7	0.22	0.58
Annual FI Crash	4,031	0	4	0.08	0.31
Annual KA Crash	4,031	0	2	0.02	0.15
Major ADT	4,031	102	14,678	3,288.35	3,111.64
Minor ADT	4,031	101	1,930	222.00	233.86
R4US, 216 Intersections					
Variable	**Sample Size (Inter. * Yr.)**	**Min.**	**Max**	**Mean**	**SD**
Annual Total Crash	648	0	7	0.52	0.99
Annual FI Crash	648	0	4	0.20	0.53
Annual KA Crash	648	0	2	0.04	0.20
Major ADT	648	131	14,086	4,739.25	4,003.50
Minor ADT	648	101	1,846	274.99	315.95
U3US, 651 Intersections					
Variable	**Sample Size (Inter. * Yr.)**	**Min.**	**Max**	**Mean**	**SD**
Annual Total Crash	1,951	0	23	0.98	1.65
Annual FI Crash	1,951	0	8	0.32	0.71
Annual KA Crash	1,951	0	2	0.04	0.21
Major ADT	1,951	444	35,825	10,968.58	7,950.92
Minor ADT	1,951	103	2,979	477.58	399.49
U4US, 220 Intersections					
Variable	**Sample Size (Inter. * Yr.)**	**Min.**	**Max**	**Mean**	**SD**
Annual Total Crash	658	0	14	1.51	2.18
Annual FI Crash	658	0	6	0.48	0.88
Annual KA Crash	658	0	1	0.05	0.22
Major ADT	658	361	42,482	11,735.31	9,102.60
Minor ADT	658	118	2,293	452.62	377.78

Table 31. Descriptive Statistics for the Intersection Safety Database (Continued).

3S, 58 Intersections					
Variable	**Sample Size (Inter. * Yr.)**	**Min.**	**Max**	**Mean**	**SD**
Annual Total Crash	174	0	32	5.22	5.72
Annual FI Crash	174	0	17	1.62	2.37
Annual KA Crash	174	0	3	0.15	0.47
Major ADT	174	723	35,825	15,571.98	8,255.81
Minor ADT	174	161	13,640	3,556.64	3,187.22
4S, 80 Intersections					
Variable	**Sample Size (Inter. * Yr.)**	**Min.**	**Max**	**Mean**	**SD**
Annual Total Crash	236	0	30	6.34	5.38
Annual FI Crash	236	0	10	1.79	1.94
Annual KA Crash	236	0	3	0.14	0.44
Major ADT	236	388	35,825	13,669.09	8,388.88
Minor ADT	236	184	8,425	2,053.76	2,107.40

Developing Intersection SPFs

TTI researchers developed SPFs for each type of the intersections using a negative binomial regression model. Table 32 depicts the modeling results for total (KABCO), FI (KI), and fatal and serious injury (KA) crashes for R3USs. As can be observed, estimates of all the variables (i.e., intercept, major road AADT, minor road AADT, and dispersion parameter) are statistically significant at the 95.0 percent level or above, except the dispersion parameter for the KA crashes, which is mainly due to the low sample size of KA crashes (i.e., 87 in 3 years).

Table 32. Modeling Results for Intersection Crashes (R3US).

Variable	R3US			
	Estimate	**SD**	**p-Value**	**Level**
Total (KABCO) Crashes				
Intercept (β_0)	-11.4475	0.5177	<0.001	99.9%
Major ADT (β_{Maj_ADT})	1.0194	0.0459	<0.001	99.9%
Minor ADT (β_{Min_ADT})	0.3192	0.0526	<0.001	99.9%
Dispersion (θ)	1.6216	0.1610	<0.001	99.9%
FI (KABC) Crashes				
Intercept (β_0)	-12.0482	0.7859	<0.001	99.9%
Major ADT (β_{Maj_ADT})	0.9523	0.0701	<0.001	99.9%
Minor ADT (β_{Min_ADT})	0.3376	0.0781	<0.001	99.9%
Dispersion (θ)	1.3097	0.2446	<0.001	99.9%
KA Crashes				
Intercept (β_0)	-12.9201	1.8544	<0.001	99.9%
Major ADT (β_{Maj_ADT})	0.7783	0.1668	<0.001	99.9%
Minor ADT (β_{Min_ADT})	0.4181	0.1816	0.0213	95.0%
Dispersion (θ)	1.4101	1.7722	0.4344	Not significant

The functional forms of these SPFs are as follows:

SPF of R3US for <u>total crashes</u> (R3US-KABCO):

$$\mu_{\text{R3US-KABCO}} = 1.33 \times 10^{-5} \times Maj\_ADT^{0.8067} \times Min\_ADT^{0.5970} \quad \text{(Equation 20)}$$

The dispersion parameter $\theta = 1.1687$.

SPF of R3US for <u>FI crashes</u> (R3US-KABC):

$$\mu_{\text{R3US-KABC}} = 2.63 \times 10^{-6} \times Maj\_ADT^{0.8280} \times Min\_ADT^{0.6750} \quad \text{(Equation 21)}$$

The dispersion parameter $\theta = 1.2915$.

SPF of R3US for <u>fatal and serious injury crashes</u> (R3US-KA):

$$\mu_{\text{R3US-KA}} = 1.22 \times 10^{-6} \times Maj\_ADT^{0.6580} \times Min\_ADT^{0.8299} \quad \text{(Equation 22)}$$

The dispersion parameter $\theta = 0.7461$.

Where:

- $\mu_{R3US-KABCO}$ is the estimated number of total crashes per year.
- $\mu_{R3US-KABC}$ is the estimated number of FI crashes per year.
- $\mu_{R3US-KA}$ is the estimated number of fatal and seriously injury crashes per year.
- Maj_ADT is the annual ADT volume of the major intersecting road.
- Min_ADT is the annual ADT volume of the minor intersecting road.

For an intersection, the expected number of crashes can be calculated as:

$$EB = w \times \mu + (1 - w) \times Y \qquad \text{(Equation 23)}$$

Where:

- Y = observed number of target crashes (e.g., total, KA, or FI) at the intersection in a period.
- μ = predicted number of target crashes at the intersection in the same period.
- w = weight factor.
- EB = expected number of target crashes in the same period.

The weight factor is a function of the dispersion parameter and predicted number of crashes, as shown in the following equation:

$$w = 1/(1 + \mu/\theta) \qquad \text{(Equation 24)}$$

The SPF curve for total crashes at R3USs is shown in Figure 45.

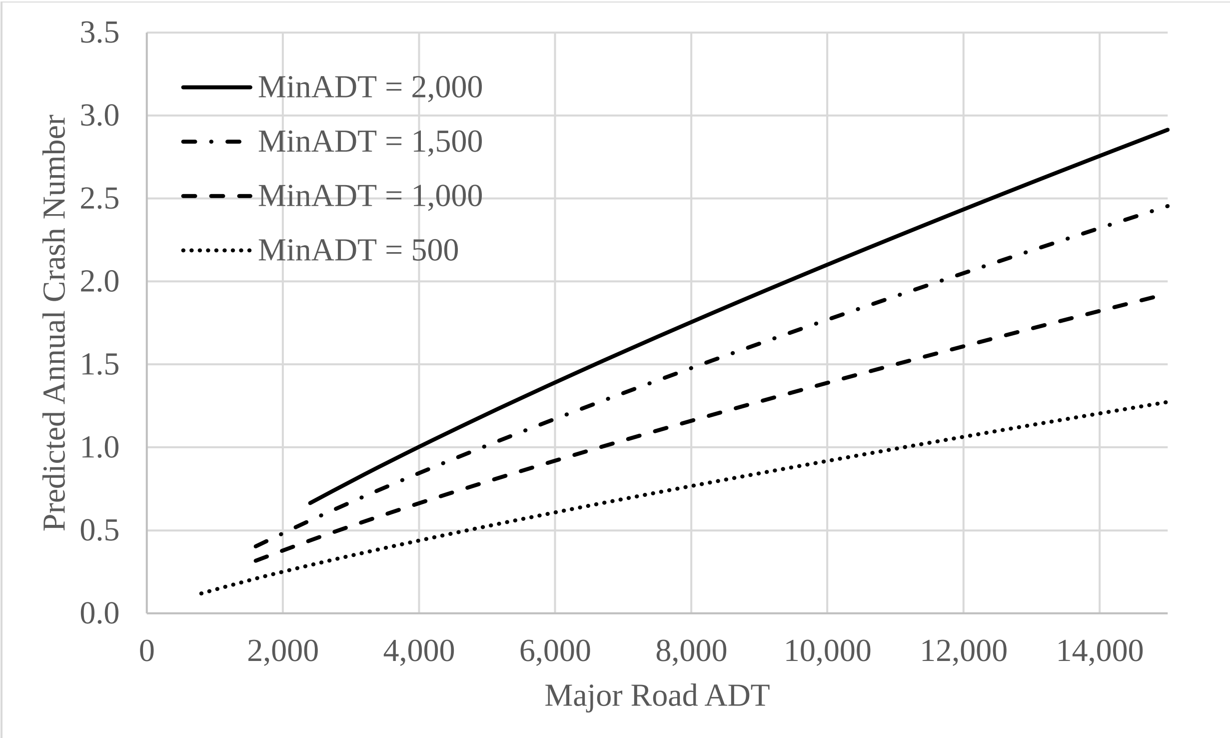


Figure 45. SPF Curve for Total Crashes at R3USs.

The data and modeling results for other types of intersections are documented in Appendix C. The SPFs for intersections and SPF curves (total crash) are documented in Appendix C.

NETWORK SCREENING

In this section, TTI researchers present the results of the separate network screening of segments and intersections. It is worth noting that both segments and intersections were categorized into different types, as shown below.

- Segment facility types:
  - Rural:
    - Rural divided multilane.
    - Rural undivided multilane.
    - Rural undivided two-lane.
    - Rural interstate.
  - Urban:
    - Urban divided multilane.
    - Urban undivided multilane.
    - Urban undivided two-lane.
    - Urban interstate.
- Intersection facility types:
  - Rural intersections:
    - 3-leg unsignalized.
    - 4-leg unsignalized.

- Urban intersections:
  - 3-leg unsignalized.
  - 4-leg unsignalized.
- 3-leg signalized (both rural and urban).
- 4-leg signalized (both rural and urban).

According to the HSM, network screening entails the five-step process listed below for identifying the sites with high potential for improvement:

1. Establish focus by identifying the crash type and severity of interest.
2. Establish a reference population by using a roadway network element (e.g., intersection type).
3. Use performance measures to evaluate the potential to reduce crash severity at the site.
4. Rank the sites based on their potential for improvement.
5. Evaluate the results.

Network Screening Focus

In this project, the focus of network screening was to reduce the number of total (KABCO) crashes, but the procedure can be applied to other types of crashes (e.g., FI or KA).

Reference Population

Reference population refers to the type of facility. TTI researchers conducted network screening of eight roadway segment facility types (see Table 33) and six intersection facility types.

Table 33. Roadway Segment Population and Crashes (2016–2018).

Facility Type	Number of Segments	Sum of Total Crashes (KABCO)
Rural Divided Multilane	159	641
Rural Undivided Multilane	147	211
Rural Undivided Two-Lane	2,068	2,689
Rural Interstate	56	2,212
Urban Divided Multilane	143	1,119
Urban Undivided Multilane	249	1,516
Urban Undivided Two-Lane	339	717
Urban Interstate	154	5,122
Grand Total	**3,315**	**14,227**

Performance Measures

TTI researchers conducted network screening of roadway segments and intersections using expected crash frequency with EB adjustment performance.

Ranking Segments

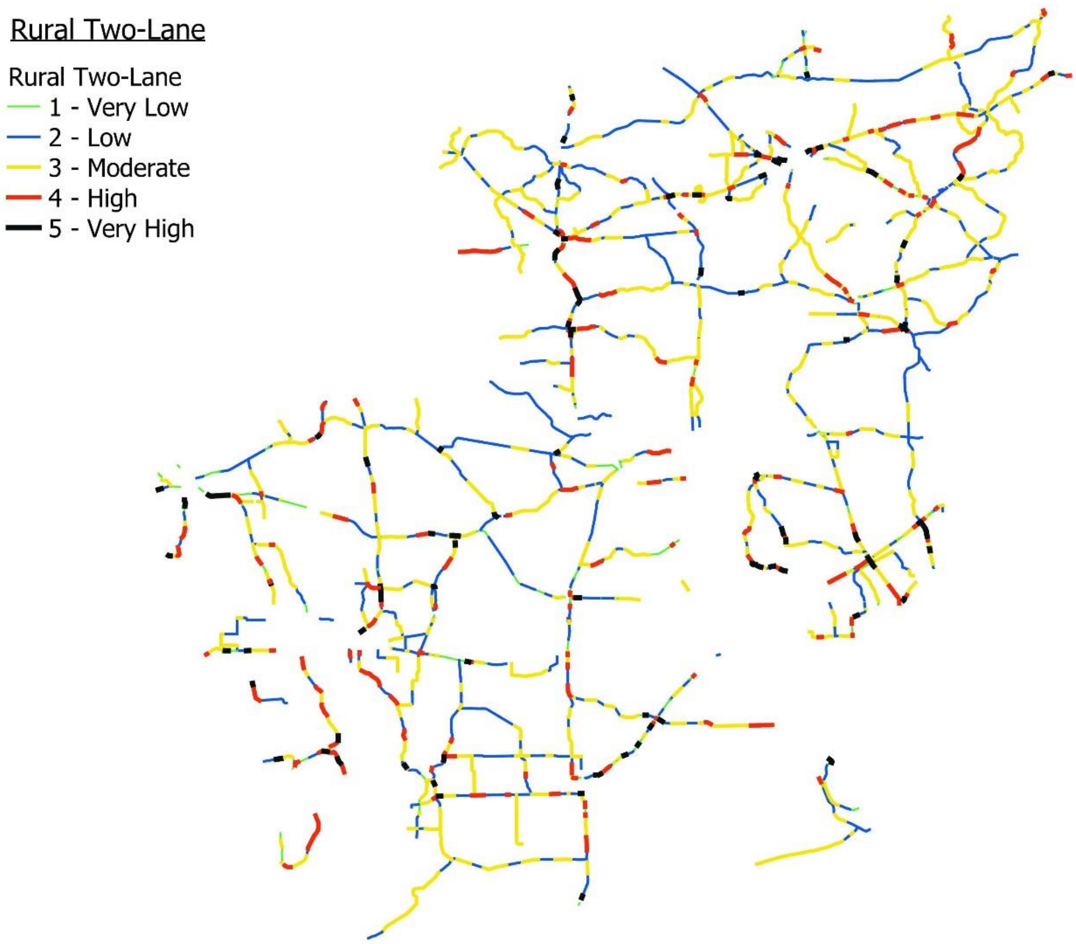
With the SPFs documented in the previous section, the research team calculated the predicted and expected numbers of crashes for each segment. The EB estimate represents the long-term expected number of crashes for a site (a segment or an intersection), while the prediction is the average number of crashes at similar sites. To rank the sites and identify those with a higher crash risk, the research team calculated the ratio between the expected and predicted number of crashes, as shown below:

$$Ratio = \frac{EB}{\mu} \quad \text{(Equation 25)}$$

Where:

- *Ratio* = ratio between expected and predicted number of crashes, which is used for ranking sites.
- *EB* = expected number of crashes (i.e., EB estimate).
- μ = predicted number of crashes.

The higher the ratio one segment has, the higher the potential that site could be improved compared to similar segments. Table 34 lists sample segments with a higher potential for safety improvements (i.e., higher ratio) on rural two-lane highways. The research team further divided the potential into five levels: very high (greatest potential), high, moderate, low, and very low (lowest potential). Each accounts for 5 percent, 10 percent, 30 percent, 40 percent, and 15 percent, respectively, of all the segments. Figure 46 illustrates the map of total crashes on rural two-lane highways in the Beaumont District.



Interactive Segment Map: http://people.tamu.edu/~wulingtao/BMT_Segment_Map/
(Username: tti; Password: safety)

Figure 46. Map of Rural Two-Lane Highways in Beaumont District.

Table 34. Sample of Segments with Higher Potential to Safety Improvements on Rural Two-Lane Highways.

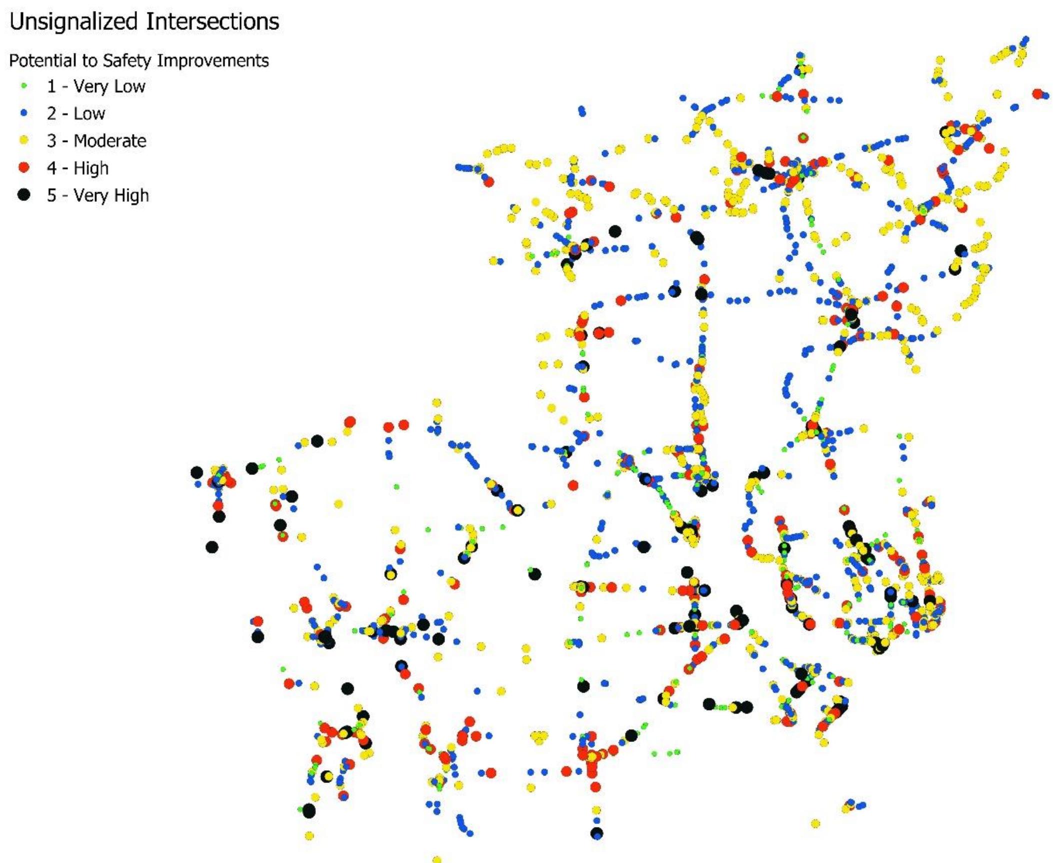
Cnty. Name	Rd. Name	Con-Sec	From DFO	To DFO	L (mi)	ADT	LW	SW	Obs.	Pred.	Exp.	Ratio	Potential
Orange	SH0062	0243-03	17.241	17.617	0.376	11,914	14	10	16	2.74	7.59	2.77	Very High
Tyler	US0069	0200-07	272.255	272.444	0.189	10,239	13	8	8	1.36	3.74	2.74	Very High
Tyler	US0190	0213-07	532.62	532.783	0.163	7,249	12	8	5	0.87	2.08	2.38	Very High
Liberty	SH0105	0593-01	93.993	94.096	0.103	7,276	13	9	3	0.51	1.2	2.37	Very High
Tyler	US0069	0200-08	279.128	279.412	0.284	7,013	13	9	8	1.35	3.12	2.32	Very High
Jasper	SH0063	0244-02	29.654	29.948	0.294	4,728	14	8	7	0.96	2.2	2.3	Very High
Jasper	FM1004	1274-01	6.515	6.626	0.111	774	11	1	2	0.1	0.22	2.26	Very High
Newton	SH0063	0214-03	62.075	62.185	0.11	1,143	12	2	2	0.13	0.28	2.17	Very High
Hardin	SH0105	1096-01	121.644	121.785	0.141	5,467	12	10	3	0.52	1.09	2.1	Very High
Chambers	FM0565	1024-01	3.451	3.811	0.36	10,960	11	3	13	3.86	8.02	2.08	Very High

Table 34. Sample of Segments with Higher Potential to Safety Improvements on Rural Two-Lane Highways (Continued).

Cnty. Name	Rd. Name	Con-Sec	From DFO	To DFO	L (mi)	ADT	LW	SW	Obs.	Pred.	Exp.	Ratio	Potential
Jasper	FM0776	0214-05	1.083	1.292	0.209	539	12	1	3	0.13	0.25	2.04	Very High
Orange	FM1131	0784-04	12.108	12.563	0.455	972	11	1	7	0.5	1.03	2.04	Very High
Newton	SH0087	0305-03	121.823	122.111	0.288	2,918	12	9	5	0.6	1.23	2.04	Very High
Liberty	FM1413	1421-01	0	0.15	0.15	3,561	11	3	3	0.54	1.09	2.03	Very High
Chambers	FM1942	1812-02	10.132	10.298	0.166	11,644	7	7	6	1.82	3.69	2.03	Very High
Liberty	SH0321	0593-01	17.373	17.525	0.152	5,557	14	9	3	0.56	1.11	1.98	Very High
Liberty	FM0787	0813-01	15.728	15.847	0.119	2,204	11	3	2	0.27	0.52	1.97	Very High

Notes: Cnty. Name = County Name; Rd. name = Roadway Name; Con-Section = Control Section Number; From DFO is the start DFO of the segment; To DFO is the end DFO of the segment; L = length of segment, in mile; ADT = average daily traffic; LW = Lane Width, in feet; SW is the average width of left and right shoulders, in feet; Obs. = observed crash count (2016-2018); Pred. = Predicted (2016-2018); Exp. = Expected (2016-2018); Ratio is the ratio between the expected to the predicted number of crashes. Potential is the level of potential to safety improvements.

The network screening of intersections followed the same procedure as that of segments. The researchers used the ratio between expected number of crashes and predicted number of crashes to rank the intersections within each facility type. Figure 47 shows the map of potential for safety improvements of unsignalized intersections in the Beaumont District.



Interactive Intersection Map: http://people.tamu.edu/~wulingtao/BMT_Intersection_Map/
(Username: tti; Password: safety)

Figure 47. Heat Map (Total Crashes) of Unsignalized Intersections in Beaumont District.

Table 35 lists sample unsignalized intersections with a higher potential for safety improvements (i.e., higher ratio).

Table 35. Sample of Unsignalized Intersections with Higher Potential to Safety Improvements.

Cnty. Name	Major Rd.	Minor Rd.	Minor Rd. Con-Sec	Legs	Obs.	Pred.	Exp.	Ratio	Potential
Jefferson	FM0365	LS0000	LT21-91	3	54	8.269	37.057	4.481	Very High
Jasper	US0096	CR0000	AA07-66	3	14	1.497	5.297	3.538	Very High
Hardin	FM0770	CR0000	AA03-01	3	10	0.432	1.48	3.426	Very High
Jefferson	FM0365	LS0000	LT20-92	3	23	4.537	13.479	2.971	Very High
Jefferson	FM0365	LS0000	LT19-70	3	23	4.537	13.453	2.965	Very High
Jefferson	SH0087	LS0000	LT18-33	4	20	4.678	12.875	2.752	Very High
Jefferson	SS0380	LS0000	LC46-40	4	25	6.519	17.802	2.731	Very High
Orange	SH0073	LS0000	LD14-29	4	30	8.438	22.865	2.71	Very High
Liberty	US0090	LS0000	LP14-33	3	18	3.773	9.987	2.647	Very High
Liberty	FM0160	FM2830	2887-01	3	9	1.264	3.313	2.621	Very High
Jefferson	US0090	LS0000	LC56-61	4	23	6.378	16.426	2.575	Very High
Jefferson	FM0364	LS0000	LC51-62	3	14	2.713	6.755	2.49	Very High
Liberty	US0090	LS0000	LG51-30	4	19	5.256	12.927	2.459	Very High
Newton	SH0062	CR0000	AA50-88	3	7	0.803	1.953	2.432	Very High
Jefferson	FC0000	LS0000	LC40-90	4	19	5.433	13.212	2.432	Very High
Jasper	US0096	CR0000	AA05-97	4	11	2.364	5.672	2.399	Very High
Liberty	FM1960	LS0000	LG50-01	3	12	2.364	5.639	2.385	Very High
Liberty	US0090	LS0000	LG51-20	3	18	4.725	11.25	2.381	Very High
Jefferson	US0090	LS0000	LC40-79	3	20	5.688	13.387	2.354	Very High
Orange	SH0087	LS0000	LR94-74	4	21	6.577	15.388	2.34	Very High

Notes: Cnty. Name = County Name; Major Rd. = Major Road; Minor Rd. = Minor Road; Minor Rd. Con-Sec is the control section number of the minor road. Legs is the number of legs; Obs. = observed crash count (2016–2018); Pred. = Predicted (2016–2018); Exp. = Expected (2016–2018); Ratio is the ratio between the expected to the predicted number of crashes. Potential is the level of potential to safety improvements.

CHAPTER 7: APPLICATION OF SAFETY ASSESSMENT TOOLS AND A PRIORITIZED LIST OF POTENTIAL PROJECTS

INTRODUCTION

Previously in the project, the researchers developed procedures for identifying roadways and intersections with the potential for safety improvement. This chapter focuses on applying the procedure to identify on-system roadway segments and intersections that may merit further examination for crash issues. This procedure is commonly referred to as network screening. Specifically, this chapter presents the following ranked lists:

- Rural two-lane, multilane divided, multilane undivided, and freeway segments.
- Urban two-lane, multilane divided, multilane undivided, and freeway segments.
- Rural and urban, 3-leg and 4-leg, signalized and unsignalized, intersections.

The organization of this chapter is as follows:

- Initially, the chapter presents a method used to screen rural and urban roadway segments using the segment SPFs developed earlier in the project.
- The chapter next describes the method used to screen rural and urban intersections using the intersection SPFs developed earlier in the project.
- The chapter documents the preliminary identification of the 50 segments, regardless of classification, with the greatest potential for safety improvement.
- The chapter documents the preliminary identification of the 50 intersections, regardless of classification, with the greatest potential for safety improvement.

Appendix D presents the preliminary identification of the segments with very high and high potential for safety improvements in each segment category and the intersections with very high and high potential for safety improvement in each intersection category.

IDENTIFICATION OF ROADWAY SEGMENTS WITH THE GREATEST POTENTIAL FOR SAFETY IMPROVEMENT

Each segment of on-system roadways was evaluated for the potential for safety improvements by applying the appropriate SPF to calculate the predicted number of crashes for each segment and using that in conjunction with the observed number of crashes to determine the expected numbers of crashes for each segment, which represents the long-term expected number of crashes for a segment. The prediction is the average number of crashes of similar segments. To rank the sites and identify those with the greatest potential for safety improvements, the research team calculated the ratio between the expected and predicted number of crashes within each segment grouping:

$$Potential\ for\ Safety\ Improvement = \frac{Expected\ Crashes}{Predicted\ Crashes} \qquad \text{(Equation 26)}$$

Where:

- *Potential for Safety Improvement* = ratio between expected and predicted number of crashes. A ratio is used because the segments are of different lengths and volumes, and a ratio allows a direct comparison between segments.
- *Expected Crashes* = expected number of crashes, based on an EB estimate considering predicted and observed crashes.
- *Predicted Crashes* = predicted number of crashes based on traffic volume and roadway characteristics.

As the ratio between expected crashes and predicted increases, the potential for improving safety (when compared to similar segments) also increases. The research team preliminarily divided segments into five levels: very high, high, moderate, low, and very low. The top 5 percent of the segments with the highest ratios in each facility type are designated as having a very high potential for safety improvements, and the top 5 to 15 percent of the segments are identified as having high potential for safety improvement. Segments with very high or high levels are those that need to be considered for safety improvement, since they show a relatively higher expectation of crashes compared to similar segments. The remaining three levels are 15 percent to 45 percent (i.e., moderate), 45 percent to 85 percent (i.e., low), and 85 percent to 100 percent (i.e., very low), respectively.

The researchers classified roadway segment groupings as follows:

- Rural:
  - Undivided two-lane.
  - Undivided multilane.
  - Divided multilane.
  - Interstate.
- Urban:
  - Undivided two-lane.
  - Undivided multilane.
  - Divided multilane.
  - Interstate and freeway.

IDENTIFICATION OF INTERSECTIONS WITH THE GREATEST POTENTIAL FOR SAFETY IMPROVEMENT

Each on-system intersection was evaluated for the potential for safety improvements. The evaluation included applying the appropriate SPF to calculate the predicted number of crashes for each intersection and using that in conjunction with the observed number of crashes to determine the expected number of crashes at each intersection, which represents the long-term expected number of crashes for an intersection. The prediction is the average number of crashes for similar intersections. To rank the sites and identify those sites with the greatest potential for safety improvements, the research team calculated the ratio between the expected and predicted number of crashes within each intersection grouping.

$$Potential\ for\ Safety\ Improvement = \frac{Expected\ Crashes}{Predicted\ Crashes} \quad \text{(Equation 27)}$$

Where:

- *Potential for Safety Improvement* = the ratio between expected and predicted number of crashes, which is used for ranking intersections.
- *Expected* = expected number of crashes, based on an EB estimate considering predicted and observed crashes.
- *Predicted* = predicted number of crashes based on the entering the amount of traffic volume.

The higher the ratio between the expected crashes and predicted, the higher the potential for improving safety as compared to similar segments. The research team divided the potential into five levels: very high, high, moderate, low, and very low. The top 5 percent of intersections with the greatest difference for each facility type (i.e., intersection category) are labeled as having a very high potential for safety improvements, and the top 5 to 15 percent of the intersections are identified as having high potential for safety improvement. The remaining three levels are 15 percent to 45 percent (i.e., moderate), 45 percent to 85 percent (i.e., low), and 85 percent to 100 percent (i.e., very low), respectively.

The researchers classified intersections into eight categories based on the following characteristics:

- Area type:
    - Rural.
    - Urban.
- The number of approaches:
    - 3 legs.
    - 4 legs.
- Traffic control type:
    - Signalized.
    - Unsignalized.

In total, there are six groups of intersections:

- R3US.
- R4US.
- U3US.
- U4US.
- 3S.
- 4S.

ROADWAY SEGMENTS WITH THE GREATEST POTENTIAL FOR SAFETY IMPROVEMENTS

Table 36 lists the 50 roadway segments in the Beaumont District identified as having the greatest potential for safety improvement regardless of segment category. Appendix D consists of the segments with very high and high potential for safety improvements for each roadway segment category.

Table 36. The 50 Beaumont Districts On-System Roadway Segments with the Greatest Potential for Safety Improvement.

Highway Name and Number		Control and Section Number	From DFO	To DFO	Length (feet)	AADT	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking	Roadway Type
US	69	0200-11	322.292	322.429	723.36	32,958	93	5.82	70.04	12.04	Very High	U-Interstate/Fwy
SH	82	2367-01	3.265	3.421	823.68	4,501	13	0.13	1.51	11.52	Very High	U-Undiv. Multi
US	96	0065-01	75.534	75.816	1,488.96	10,527	45	3.44	29.94	8.72	Very High	U-Undiv. Multi
SH	347	0667-01	5.018	5.3	1,488.96	12,337	35	3.67	24.17	6.58	Very High	U-Undiv. Multi
SH	12	0499-03	3.888	4.06	908.16	8,539	14	1.03	6.34	6.15	Very High	U-2 Lane
BU	90	0028-15	6.934	7.052	623.04	5,576	13	1.4	7.95	5.67	Very High	U-Div. Multi
SH	146	0389-02	73.441	73.556	607.2	32,809	57	9.47	52.21	5.51	Very High	U-Div. Multi
US	69	0200-16	342.875	342.995	633.6	43,415	55	9.51	50.29	5.29	Very High	U-Div. Multi
US	190	0213-08	560.296	560.415	628.32	9,808	8	0.87	4.58	5.28	Very High	U-Undiv. Multi
SH	87	0305-07	158.036	158.145	575.52	14,264	10	1.61	7.32	4.54	Very High	U-Undiv. Multi
SH	347	0667-01	11.16	11.335	924	12,394	26	4.78	20.63	4.31	Very High	U-Div. Multi
SH	73	0306-01	41.784	41.998	1,129.92	28,626	32	6.05	25.62	4.24	Very High	U-Div. Multi
SH	146	0389-02	73.556	73.749	1,019.04	32,809	38	7.95	33.67	4.24	Very High	U-Undiv. Multi
SH	347	0667-01	9.427	9.536	575.52	21,323	16	3.33	13.65	4.11	Very High	U-Undiv. Multi
SH	146	0388-03	50.373	50.49	617.76	8,608	11	2.03	7.86	3.86	Very High	U-Div. Multi
US	69	0200-14	327.891	328.366	2508	64,216	224	52.95	203.5	3.84	Very High	U-Interstate/Fwy
SH	321	0593-01	22.437	22.66	1,177.44	10,909	14	2.23	8.53	3.83	Very High	U-2 Lane
SH	87	0306-03	175.191	175.477	1,510.08	24,900	30	6.13	22.9	3.74	Very High	U-Div. Multi
US	96	0065-05	123.195	123.309	601.92	16,188	7	1.13	4.18	3.7	Very High	U-Div. Multi
SH	82	0508-05	1.955	2.102	776.16	15,371	11	2.39	8.83	3.69	Very High	U-Undiv. Multi
SH	62	0243-04	24.663	24.846	966.24	24,497	21	4.95	17.73	3.58	Very High	U-Undiv. Multi
US	69	0200-11	321.915	322.292	1,990.56	32,958	70	15.61	55.41	3.55	Very High	U-Interstate/Fwy
SH	124	0368-01	23.64	23.799	839.52	7,510	10	1.25	4.36	3.48	Very High	R-Div. Multi
US	190	0213-08	558.359	558.548	997.92	19,769	18	3.92	13.65	3.48	High	U-Div. Multi
SH	87	0306-01	161.179	161.384	1,082.4	15,770	24	6.19	20.68	3.34	Very High	U-Undiv. Multi
US	90	0028-04	694.766	694.917	797.28	17,772	21	5.42	17.75	3.28	High	U-Div. Multi
SH	73	0508-04	24.348	24.536	992.64	17,054	20	5.16	16.16	3.13	High	U-Div. Multi
FM	365	0932-01	32.047	32.222	924	31,493	33	9.59	29.62	3.09	High	U-Div. Multi

Table 36. The 50 Beaumont Districts On-System Roadway Segments with the Greatest Potential for Safety Improvement (Continued).

Highway Name and Number		Control and Section Number	From DFO	To DFO	Length (feet)	AADT	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking	Roadway Type
SH	347	0667-01	6.308	6.417	575.52	17,464	11	2.97	8.97	3.02	High	U-Div. Multi
US	69	0200-16	344.887	345.078	1,008.48	15,209	21	6.14	18.36	2.99	Very High	U-Undiv. Multi
BU	90	0028-15	4.151	4.275	654.72	12,162	6	1.44	4.3	2.98	Very High	U-Undiv. Multi
US	90	0028-03	687.627	687.9	1,441.44	15,684	19	5.15	15.28	2.97	Very High	U-Undiv. Multi
SH	327	0602-01	6.555	6.671	612.48	9,720	5	0.98	2.88	2.96	High	U-Div. Multi
BU	90	0028-15	1.484	1.788	1,605.12	12,791	22	6.07	17.89	2.95	High	U-Undiv. Multi
SH	347	0667-01	9.822	10.316	2,608.32	22,609	54	16.2	47.34	2.92	High	U-Undiv. Multi
SH	146	0389-02	73.104	73.315	1,114.08	28,186	10	1.67	4.83	2.9	Very High	R-Undiv. Multi
SL	227	0388-05	2.052	2.153	533.28	7,380	4	0.86	2.43	2.81	Very High	U-2 Lane
SH	105	0338-12	89.237	89.539	1,594.56	8,111	10	1.9	5.33	2.8	Very High	U-2 Lane
US	96	0065-05	122.941	123.195	1,341.12	15,870	11	2.46	6.83	2.78	High	U-Div. Multi
FM	565	1024-01	12.335	12.437	538.56	4,904	4	0.85	2.35	2.78	High	U-Div. Multi
SH	62	0243-03	17.241	17.617	1,985.28	11,914	16	2.74	7.59	2.77	Very High	R-2 Lane
FM	105	0689-02	31.64	31.837	1,040.16	6,386	5	0.71	1.98	2.77	Very High	U-2 Lane
US	69	0200-07	272.255	272.444	997.92	10,239	8	1.36	3.74	2.74	Very High	R-2 Lane
US	69	0200-16	343.16	343.264	549.12	24,750	12	3.81	10.34	2.72	High	U-Div. Multi
FM	365	0932-01	28.288	28.601	1,652.64	4,709	7	0.85	2.3	2.71	Very High	U-2 Lane
SH	62	0243-04	24.389	24.496	564.96	14,665	5	0.99	2.68	2.7	Very High	R-Undiv. Multi
SS	380	0065-08	1.676	1.927	1,325.28	30,502	55	19.2	51.15	2.66	High	U-Div. Multi
SH	99	3187-02	180.318	180.443	660	3,512	4	0.89	2.33	2.63	Very High	U-2 Lane
FM	365	0932-01	31.679	31.806	670.56	17,476	6	1.6	4.14	2.59	High	U-Div. Multi
FM	105	0883-02	17.773	17.957	971.52	8,096	4	0.77	1.99	2.58	High	U-Undiv. Multi

INTERSECTIONS WITH THE GREATEST POTENTIAL FOR SAFETY IMPROVEMENTS

Table 37 lists the 50 intersections in the Beaumont District identified preliminarily as having the greatest potential for safety improvement regardless of category. Appendix D contains the lists of intersections with very high and high potential for safety improvements for each intersection category

Table 37. The 50 Beaumont District On-System Intersections with the Greatest Potential for Safety Improvement.

Lat. & Long.	Type	Major Road Name	Minor Road Name (Con-Sec)	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
(29.9471, -93.9933)	U-3Leg Unsig.	FM0365	LS0000 (LT21-91)	54	8.269	37.057	4.481	Very High
(30.4409, -93.9697)	R-3Leg Unsig.	US0096	CR0000 (AA07-66)	14	1.497	5.297	3.538	Very High
(30.1945, -94.624)	R-3Leg Unsig.	FM0770	CR0000 (AA03-01)	10	0.432	1.48	3.426	Very High
(29.9138, -93.9494)	3Leg Sig.	US0069	FC0000 (C017-04)	84	23.603	73.714	3.123	Very High
(29.9418, -93.9983)	U-3Leg Unsig.	FM0365	LS0000 (LT20-92)	23	4.537	13.479	2.971	Very High
(29.9448, -93.9954)	U-3Leg Unsig.	FM0365	LS0000 (LT19-70)	23	4.537	13.453	2.965	Very High
(29.9045, -93.9235)	U-4Leg Unsig.	SH0087	LS0000 (LT18-33)	20	4.678	12.875	2.752	Very High
(30.0939, -94.1113)	U-4Leg Unsig.	SS0380	LS0000 (LC46-40)	25	6.519	17.802	2.731	Very High
(30.03, -93.8368)	U-4Leg Unsig.	SH0073	LS0000 (LD14-29)	30	8.438	22.865	2.71	Very High
(30.2555, -94.2165)	3Leg Sig.	US0069	LS0000 (LP74-46)	44	13.268	35.756	2.695	Very High
(30.0578, -94.7704)	U-3Leg Unsig.	US0090	LS0000 (LP14-33)	18	3.773	9.987	2.647	Very High
(30.0689, -94.7007)	R-3Leg Unsig.	FM0160	FM2830 (2887-01)	9	1.264	3.313	2.621	Very High
(30.0661, -94.1999)	U-4Leg Unsig.	US0090	LS0000 (LC56-61)	23	6.378	16.426	2.575	Very High
(29.9514, -93.9892)	3Leg Sig.	FM0365	LS0000 (LT19-22)	72	25.569	64.599	2.526	Very High
(30.1363, -94.1905)	U-3Leg Unsig.	FM0364	LS0000 (LC51-62)	14	2.713	6.755	2.49	Very High
(30.0459, -94.8871)	U-4Leg Unsig.	US0090	LS0000 (LG51-30)	19	5.256	12.927	2.459	Very High
(30.2433, -93.8956)	R-3Leg Unsig.	SH0062	CR0000 (AA50-88)	7	0.803	1.953	2.432	Very High
(30.071, -94.1072)	U-4Leg Unsig.	FC0000	LS0000 (LC40-90)	19	5.433	13.212	2.432	Very High
(30.5924, -93.9167)	R-4Leg Unsig.	US0096	CR0000 (AA05-97)	11	2.364	5.672	2.399	Very High
(30.0463, -94.8926)	U-3Leg Unsig.	FM1960	LS0000 (LG50-01)	12	2.364	5.639	2.385	Very High
(30.0473, -94.8852)	U-3Leg Unsig.	US0090	LS0000 (LG51-20)	18	4.725	11.25	2.381	Very High
(30.0674, -94.1874)	U-3Leg Unsig.	US0090	LS0000 (LC40-79)	20	5.688	13.387	2.354	Very High
(30.1135, -93.7474)	U-4Leg Unsig.	SH0087	LS0000 (LR94-74)	21	6.577	15.388	2.34	Very High
(30.0343, -93.8489)	U-3Leg Unsig.	FM1442	LS0000 (LD14-53)	13	2.98	6.777	2.274	Very High
(30.2538, -94.1978)	4Leg Sig.	US0096	LS0000 (LP75-38)	54	19.556	43.929	2.246	Very High

Lat. & Long.	Type	Major Road Name	Minor Road Name (Con-Sec)	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
(29.7158, -94.9158)	R-3Leg Unsig.	FM1405	CR0000 (AA04-15)	6	0.768	1.719	2.238	Very High
(30.9243, -94.0696)	R-4Leg Unsig.	SH0063	CR0000 (AA01-10)	7	0.982	2.165	2.205	Very High
(30.0697, -93.9744)	R-3Leg Unsig.	FM0105	CR0000 (AA03-76)	6	0.871	1.904	2.186	Very High
(30.1641, -94.7621)	R-3Leg Unsig.	FM0834	FM0834 (1146-02)	5	0.421	0.92	2.185	Very High
(30.0681, -94.143)	4Leg Sig.	US0090	LS0000 (LZ53-28)	18	6.841	14.848	2.17	Very High
(29.9089, -93.9194)	U-4Leg Unsig.	SH0087	LS0000 (LZ11-36)	15	4.678	10.029	2.144	Very High
(30.1397, -94.4004)	R-4Leg Unsig.	SH0105	LS0000 (LW63-81)	9	2.019	4.325	2.142	Very High
(30.3384, -95.0869)	U-4Leg Unsig.	FM1010	LS0000 (LE44-59)	6	0.641	1.36	2.122	Very High
(30.91, -93.9952)	U-3Leg Unsig.	US0096	LS0000 (LN43-00)	11	2.717	5.696	2.096	Very High
(29.9142, -93.9145)	U-3Leg Unsig.	SH0087	LS0000 (LT22-02)	12	3.09	6.465	2.092	Very High
(30.3338, -95.0604)	3Leg Sig.	SH0321	SH0105 (0338-12)	37	15.315	31.81	2.077	High
(29.8672, -94.8443)	R-3Leg Unsig.	FM0565	LS0000 (LR86-98)	6	1.155	2.355	2.039	Very High
(30.0679, -94.1555)	4Leg Sig.	US0090	FC0000 (B007-12)	25	10.916	22.213	2.035	Very High
(30.0949, -94.1115)	U-4Leg Unsig.	SS0380	LS0000 (LC49-21)	22	8.744	17.723	2.027	Very High
(30.1334, -94.1713)	U-3Leg Unsig.	SH0105	LS0000 (LC42-92)	17	5.994	11.996	2.001	Very High
(30.1179, -94.0091)	U-3Leg Unsig.	FM0105	LS0000 (LY08-35)	9	2.071	4.129	1.994	Very High
(29.8963, -94.8142)	R-3Leg Unsig.	FM1409	CR0000 (AA04-02)	6	1.266	2.522	1.992	Very High
(30.9076, -94.0297)	U-4Leg Unsig.	SH0063	FM0777 (1109-01)	14	5.034	10.006	1.988	High
(29.9241, -93.9168)	U-3Leg Unsig.	SH0347	LS0000 (LT21-59)	11	3.196	6.316	1.976	Very High
(30.0435, -94.8843)	U-3Leg Unsig.	FM1409	LS0000 (LG50-86)	7	1.22	2.403	1.97	Very High
(30.9085, -94.0017)	U-4Leg Unsig.	US0190	LS0000 (LN43-50)	17	6.573	12.949	1.97	High
(30.0458, -95.0124)	R-4Leg Unsig.	FM1960	CR0000 (AA06-12)	10	3.198	6.292	1.967	Very High
(30.2395, -94.1956)	U-3Leg Unsig.	US0096	LS0000 (LP74-70)	15	5.276	10.35	1.962	Very High
(30.4191, -94.1822)	U-4Leg Unsig.	FM0092	CR0000 (AA08-44)	10	3.059	5.999	1.961	High
(30.0244, -93.8426)	U-3Leg Unsig.	SH0073	LS0000 (LD15-17)	19	7.378	14.38	1.949	Very High

CHAPTER 8: EXISTING TXDOT DISTRICT PROJECTS COINCIDING WITH LOCATIONS HAVING THE GREATEST OPPORTUNITY TO REDUCE CRASHES

INTRODUCTION

The purpose of this chapter is to identify projects already under development in the Beaumont District to assess opportunities to reduce crashes. The Beaumont District staff identified seven existing projects that have such opportunities. The Beaumont staff also wished to review a section of US 90 that has experienced pedestrian safety issues. The TxDOT Project Tracker website was used to compile a map and list of existing Beaumont District projects that coincide with the roadway segments identified previously in the project that have high and very high potential for safety improvements. The researchers have also plotted the intersections with high or very high potential for safety improvements on the existing projects. This chapter is organized as follows:

- The chapter describes the existing projects identified by the Beaumont staff and the crash profile for each project. Any segments or intersections with high or very high potential for safety improvement within the project limits are also identified.
- The chapter next describes the section of US 90 with pedestrian safety issues.
- The chapter documents the coincidence of segments with high and very high potential for safety improvement with existing district projects and identifies intersections within the existing project limits that have the greatest potential for safety improvements.

Appendix E provides a list of potential pedestrian countermeasures, the existing Beaumont District projects that include segments with high and very high potential for safety improvements, and the existing Beaumont District projects that include intersections with high and very high potential for safety improvements.

EXISTING PROJECTS IDENTIFIED BY THE BEAUMONT STAFF WITH POTENTIAL FOR SAFETY IMPROVEMENTS

The Beaumont District staff identified seven existing projects that they believe provide the greatest opportunity for safety improvements. These projects are:

1. US 69 interchange at SH 73 (Jefferson County).
2. IH 10 from 0.54 mi east of FM 3247 to Sabine River Bridge (Orange County).
3. IH 10 at the Hollywood Overpass east to 7th Street (Jefferson County).
4. IH 10 from CR 131 (Walden Road) to US 90 (Jefferson County).
5. US 69 from 0.1 mi south of Black Creek to Hardin County Line (Tyler County).
6. US 69 from Tyler County Line to 0.75 mi south of FM 1003 (Hardin County).
7. SH 105 from 0.1 mi east of SH 326 to Pine Island Bayou.

The following sections provide descriptions of the projects based on field observations, a crash profile, and any segments or intersections with high or very high potential for safety improvements. The ratio of expected to predicted crashes is provided for the high and very high potential segments. This ratio provides a comparison of the crashes expected (based on crash history for the segment and segments with similar characteristics) in any given year to the level of crashes predicted based on the volume of traffic for that kind of facility. A ratio of 2, for example, indicates that twice as many crashes as the average prediction of traffic crashes for similar facilities with the same level of traffic are expected on an annual basis. Similarly, intersection safety was evaluated by comparing the ratio of the number of expected crashes to the number predicted for intersections with the same kind of control and traffic volumes on the major and minor roads.

Project 1: US 69 Interchange at SH 73 (Jefferson County)

CSJ: 0200-16-020
Letting Date: May 2020
Work Description: Improve interchange
Project Length: 0.582 miles

Site Observation

The current configuration has a cloverleaf with short weaves and short entrances. This section of road currently has high peak hour volumes with queuing. In many locations along the interchange, the median barrier shows frequent evidence of impacts. The roadside area is marshy, and the cable barrier, where present, displays crash damage and merits evaluation. The freeway section of US 69 changes abruptly beyond the interchange into an arterial roadway with a signalized intersection. This intersection is rated with very high potential for safety improvements.

Proposed improvements will separate the low-speed and high-speed flow by modifying the current cloverleaf so that it functions more like a free-flow Y-interchange for high-speed vehicles to and from US 69. The low-speed traffic will then be shifted to the frontage road. This creative solution (proposed by the district staff) can be expected to reduce injury crashes that occur due to speed differentials on southbound US 69.

Crash Profile

There were 403 total crashes in the 5 years from 2014 to 2018. Crashes increased from 69 in 2014 to 108 in 2016 and then declined to the mid-sixties in 2017 and 2018.

- Mainlanes: 286—71 percent.
- Ramps and connectors: 112—28 percent.
- Service/frontage roads: 5—1 percent.

In general, these crashes did not result in serious injuries or fatalities (1 fatal crash and 15 suspected serious injury crashes), and 64 percent of the crashes were non-injury. These fatal and suspected serious injury crashes were predominately single-vehicle crashes. The less serious injury and non-injury crashes were split between same direction crashes (55 to 60 percent) and single-vehicle crashes (34 to 40 percent). Most of the less serious and non-injury crashes occurred during daylight (58 to 66 percent), and speed was cited as a contributing factor in 41 percent of crashes.

This project includes two segments rated with high or very high potential for safety improvements:

US 69 0200-16-020: Highway Improvement			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
342.875	342.995	5.29	Very High
343.160	343.264	2.72	High

An adjacent project (US 69 0200-16-018: Improve Traffic Signals) includes an intersection identified as having high potential for safety improvement: The at-grade intersection of US 69 and 39th Street (see Figure 48) is in close proximity to the interchange (approximately 1,000 ft south of the entrance and exit ramps to and from SH 73).

Figure 48. Intersection of US 60 and 30th Street.

Another adjacent project (SH 73 0508-04-164: Overlay Existing Roadway) includes a segment identified as having very high potential for safety improvement. The segment is located on SH 73 (DFO begins at 28.615, and ends at 28.908) right to the east of the project (see Figure 49).

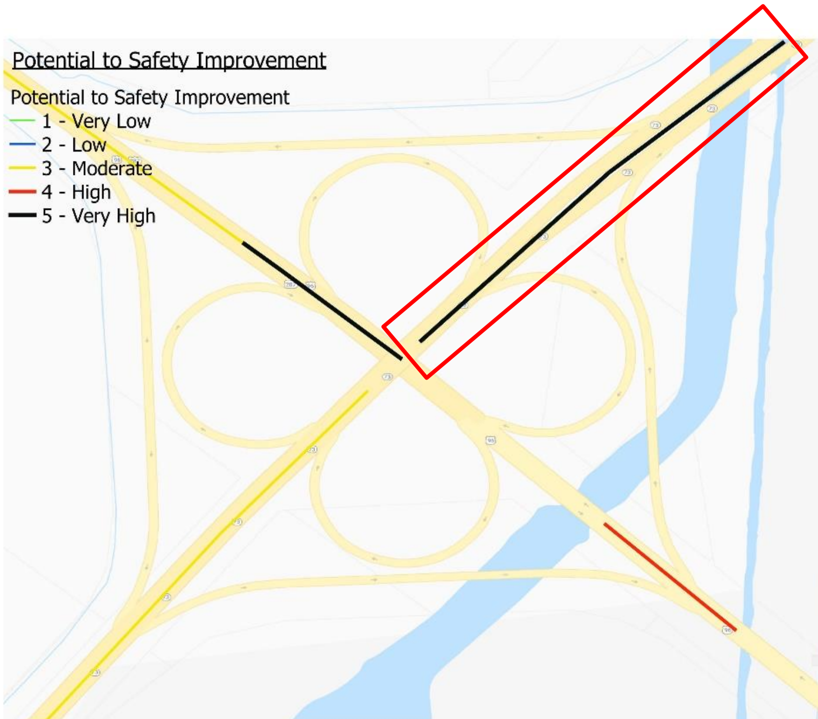


Figure 49. Segment Having Very High Potential For Safety Improvements to the East of the Project.

Project 2: IH 10 from 0.54 mi East of FM 3247 to Sabine River Bridge (Orange County)

CSJ: 0028-14-091
Letting Date: June 2020
Work Description: Widen existing mainlanes from four to six lanes

Site Observation

This is the Texas section of IH 10 that ends at the state line (at the Sabine River Bridge). The overall section is primarily four lanes, but active construction is underway to widen existing bridges in preparation for the future project. Primarily, this bridge project is focused on the median region of the existing road. The pavement condition for the active travel lanes is poor. The adjacent land appears to primarily be swamp, so the proposed widening will likely include a roadside barrier to prevent roadway departure crashes into the swamp. Most of the crashes have been into a barrier or were same direction; however, the frontage road has experienced some wrong-direction crashes.

One item to note is that due to the age of this facility, the on-ramp and off-ramp configurations are very abrupt, and merging visibility can be a challenge. Suggested enhancements as the project construction evolves should consider ways to improve the ramp configurations as well as widen the shoulders so that stranded vehicles will be able to stop between the active travel lanes and barrier without blocking the active travel lanes.

Crash Profile

This segment experienced 827 crashes from 2014 to 2018. Crashes increased each year. There was an 80 percent increase in crashes from 2014 to 2015. Since then, crashes have been increasing at an average rate of about 8 percent per year. There have been seven fatal crashes on this segment, five on the mainlanes and two on the service/frontage roads. Most (77 percent) of the crashes resulted in no injuries.

- Mainlane crashes: 648 (78 percent).
- Ramps and connectors: 24 (3 percent).
- Service/frontage roads: 155 (19 percent).

Mainlane Crashes

The fatal crashes tended to occur in darkness (80 percent), and all involved a single motor vehicle. The suspected serious injury crashes were more likely to involve vehicles traveling in the same direction (64 percent) and to occur in darkness (57 percent); these characteristics were less pronounced than in the fatal crashes. Some 79 percent of mainlane crashes resulted in no injuries, and these crashes tended to occur during daylight (70 percent) between vehicles traveling the same direction (70 percent). About 22 percent of the mainlane crashes involved vehicles hitting something other than another vehicle, and in these cases, most (62 percent) hit a guardrail.

This project includes two sections rated with high potential for safety improvements:

IH 10 0028-14-091: Widen Road—Add Lanes			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
876.170	877.097	1.58	High
877.886	878.527	1.31	High

Service/Frontage Road Crashes

Intersection crashes along the frontage road comprised slightly more than half (54 percent) of all crashes, and 21 percent of injury crashes were angle crashes. Approximately 35 percent of all service/frontage road crashes involved a roadway or lane departure. Most crashes occurred during daylight, although injury crashes had a greater tendency to occur during darkness.

The intersection of the WB service/frontage road and Meeks Drive (just west of the US 87 interchange) includes the WB IH 10 exit loop ramp and features complex geometry and traffic movements (see Figure 50).

Figure 50. IH 10 Service Frontage Road Intersection with Meeks Dr. and WB IH 10 Exit Ramp.

Project 3: IH 10 at the Hollywood Overpass East to 7th Street (Jefferson County)

CSJ: 0028-13-135
Letting Date: April 2021
Work Description: Widen freeway to six lanes and reconstruct interchange

Site Observation

This project will extend the existing six-lane section through the study area. To do this, the interchange will be reconstructed. The frontage roads currently are not continuous.

There appears to be a sizeable homeless population located near the interchange. Because the frontage road is not continuous, pedestrians walk along the freeway at this location. The creation of continuous frontage roads should help mitigate this crash type. If possible, it would be advisable to connect the frontage road during the initial project phases so that pedestrians do not get stranded between vehicles and barriers. The proposed design will also position IH 10 on a structure and the frontage road will be at grade.

Crash Profile

Over 1000 crashes occurred in the 5 years from 2014 to 2018. Crashes steadily increased from 2014 to 2016, from 153 to 245, but fell in 2017 to 183 and increased to 213 in 2018.

- Mainlane crashes: 531 (53 percent).
- Connector/flyover and ramp crashes: 76 (7 percent).
- Service/frontage roads: 404 (40 percent).
- Approximately 70 percent of crashes occurred without an injury; 3 percent resulted in a suspected serious injury or fatality.

Mainlane, Flyover and Ramp Crashes

Sixty-three percent of mainlane, flyover, and ramp crashes had no injuries. Non-injury and low severity crashes tended to occur between vehicles traveling in the same direction during daylight. Both fatal crashes involved a single vehicle traveling at night.

This project includes one segment rated with high potential for safety improvement:

IH 10 0028-13-135: Widen Freeway to Six Main Lanes And Reconstruct Interchange			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
850.706	851.056	1.79	High

Frontage Road

Frontage road crashes comprised a substantial portion of total crashes (40 percent). Approximately, 56 percent were non-injury. Injury crashes were primarily angle (47 percent) and same direction (41 percent) crashes, which indicates that frontage road intersection safety should be evaluated carefully. Daylight was the predominate lighting condition regardless of severity.

An eastbound/northbound entrance ramp is located at the frontage road intersection, and traffic movements are complex (see Figure 51).

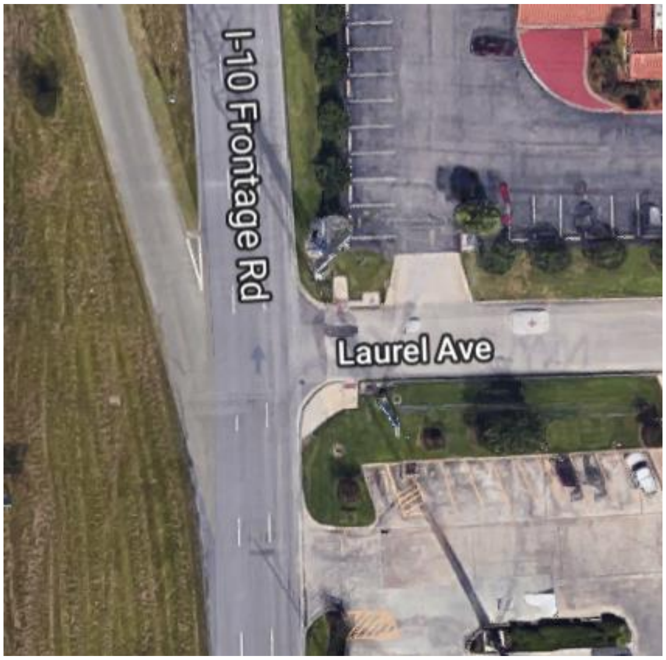


Figure 51. EB/NB IH 10 Service/Frontage Road and Laurel Ave.

Project 4: IH 10 from CR 131 (Walden Road) to US 90 (Jefferson County)

CSJ: 0739-02-140
Letting Date: April 2021
Work Description: Widen freeway from four to six lanes

Site Observation

This project will extend the existing 6-lane section through the study area with potential impacts to the interchange with US 69. Non-continuous frontage roads in this area present challenges to circulation and navigation in the area. The project presents an opportunity to provide continuous frontage roads.

Crash Profile

Over 900 crashes occurred from 2014 to 2018 in this segment. Crashes in 2016 and 2017 were about 165, but the following 3 years experienced around 200 crashes each year. Only crashes along IH 10 were included in this profile.

- Mainlane crashes: 585 (62 percent).
- Flyover/connectors and ramps: 83 (9 percent).
- Service/frontage: 269 (29 percent).

In contrast to Project 3 on IH 10 to the north, this project has less frontage road crashes. All three fatalities during the study period occurred on the mainlanes. All involved a single motor vehicle. Of the three fatalities, two occurred at night. Segments north and south of US 69/96 were identified as having high potential for crash reductions.

Mainlane, Flyover and Ramp Crashes

Approximately, 67 percent were non-injury crashes. Suspected serious injury and fatal crashes tended to involve 1 motor vehicle, and dark conditions are overrepresented. The lower severity and non-injury crashes tend to involve 2 vehicles traveling in the same direction during the day, although dark conditions are also somewhat overrepresented. Speed-related factors are most often cited as contributing factors, followed by failure to drive in a single lane or unsafe lane changes.

This project includes one section rated with high potential for safety improvements:

IH 10 0739-02-140: Widen Freeway from Four to Six Lanes			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
848.512	849.189	1.62	High

Additionally, US 69 has one segment near this interchange with IH 10 identified as having very high potential for safety improvement.

US 69 0200-14-078: Install High Mast Lighting			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
327.891	328.366	3.84	Very High

Service/Frontage Road Crashes

Approximately 73 percent of crashes involved no injuries. These incidents were overwhelmingly same-direction crashes between two vehicles that occurred in daylight. Of the crashes, 12 percent were angle crashes. The majority of injury crashes (60 percent) were between cars traveling in the same direction but also included single-vehicle crashes (22 percent) and angle (15 percent) crashes.

The intersection of the WB/SB frontage road and the at-grade section of Washington Boulevard features a fairly high degree of skew angle (see Figure 52).

Figure 52. WB/SB IH 10 Service/Frontage Road Intersection with Washington Boulevard.

Project 5: US 69 from 0.1 mi South of Black Creek to Hardin County Line (Tyler County)

CSJ: 0200-08-049
Letting Date: May 2020
Work Description: Construct new location four-lanes divided facility

Site Observation

This site is located next to the Hardin County section of US 69 (see Project #6). This location is currently a two-lane undivided highway. Elevated crash locations appear to occur primarily at existing intersections, with the two highest number of crashes occurring from DFO 282.56 to 282.74 and from 283.80 to 289.90. The concentrated crashes occurred at FM 1943 and at CR 4755.

This location is to be converted to a four-lane divided highway. The corridor is located next to wooded areas, so clear zone may be challenging, particularly since some of the roadway is adjacent to the Big Thicket Preserve.

Crash Profile

During the 5 years from 2014 to 2018, 87 crashes occurred. The crashes consistently varied from 14 to 20 each year. No fatal crashes were recorded during this period. Almost 60 percent of the crashes were without injury. Of the 35 injury crashes, 37 percent involved a single vehicle, 29 percent involved vehicles traveling in the same direction, and 26 percent involved traveling in ODs. Angle crashes accounted for 9 percent of crashes.

In 18 of the injury crashes (51 percent), the vehicles struck an object other than another vehicle. In those crashes, 22 percent involved an overturned vehicle, 17 percent involved hitting a tree or some other type of vegetation, 11 percent involved hitting a highway sign, and another 11 percent involved hitting a guardrail.

The majority (61 percent) of non-injury crashes involved a single vehicle. Half the crashes involved lane or road departures. Older drivers were involved in 18 percent of all crashes, and 26 percent of injury crashes. The factors cited as contributing to crashes were speed, failure to drive in a single lane, and fatigue or sleep.

This project includes eight segments rated with high or very high potential for safety improvements:

US 69 0200-08-049: Construct New Location, Four-Lane Divided Facility			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
281.795	282.005	1.35	High
282.190	282.342	1.57	Very High
283.145	283.263	1.24	High
283.566	283.723	1.49	Very High
283.723	283.950	1.25	High
286.683	286.797	1.25	High
286.797	287.200	1.32	High
287.632	288.587	1.17	High

This project includes three intersections rated with high or very high potential for safety improvements:

US 69 0200-08-049: Construct New Location, Four-Lane Divided Facility			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2408	US0069 @ FM2827	1.42	Very High
2460	US0069 @ CR4473	1.26	High
2379	US0069 @ CR1515	1.54	High

Project 6: US 69 from Tyler County Line to 0.75 mi South of FM 1003 (Hardin County)

CSJ: 0200-09-069
Letting Date: May 2021
Work Description: Construct new location four-lanes divided facility

Site Observation

This site is located south of the Tyler County section of US 69 (see Project #5). This location currently transitions from a four-lane facility to a two-lane road. The proposed effort is to modify the road to a four-lane divided highway. Currently, the highest crash locations are from milepoint 291.21 to 291.58. Elevated crashes appear to occur near the intersection with Oilfield Road at the southern end of the corridor. This location is next to heavily wooded areas and will require considerable tree removal to achieve required clear zone.

Crash Profile

Sixty-five crashes occurred in the 5-year period from 2014 to 2018. Crashes per year peaked at 22 in 2017. One fatal OD crash was recorded. No injuries were reported in 57 percent of crashes. Twenty-seven injury crashes were recorded. One-third of the crashes involved one vehicle, 26 percent involved vehicles traveling in the same direction, and 19 percent involved vehicles traveling in the OD. Approximately 70 percent occurred during daylight conditions, 63 percent involved a vehicle striking an object other than another vehicle, 24 percent involved an overturned vehicle, 18 percent involved hitting a tree or other vegetation, and 12 percent involved hitting a highway sign.

Non-injury crashes consisted of 49 percent single-vehicle crashes, 38 percent were between two vehicles traveling in the same direction, and 11 percent were angle crashes.

Some 42 percent of crashes involved a lane or roadway departure, 20 percent were intersection-related, but only 57 percent occurred during the day. The most frequently cited contributing factors were speed, failure to drive in a single lane, and fatigue or sleep.

This project includes no segments rated with high or very high potential for safety improvements. One intersection is rated with high potential for safety improvements:

US 69 0200-09-069: Construct New Location, Four-Lane Divided Facility			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
557	US0069 @ NEUSHAFER	1.23	High

Project 7: SH 105 from 0.1 mi East of SH 326 to Pine Island Bayou

CSJ: 0339-04-036
Letting Date: May 2021
Work Description: Widen to four lanes with center turn lane

Site Observation

Currently, this facility is a two-lane undivided highway with wide shoulders. Based on crash data, it appears that approximately 54 percent of the crashes occur between vehicles traveling in the same direction, while around 21 percent of the crashes are run-off-road collisions. The road is generally flat and straight, with elevated crashes near the center of the corridor where development has occurred. The proposal is to widen and add a center turn lane. Due to the same direction crashes, the turn lane is expected to move left-turning vehicles out of high-speed traffic.

Note that an option might be to have a median with periodic turn lanes so that the number of conflict points can be managed as roadside development increases.

Crash Profile

This segment experienced 123 crashes during the 5 years from 2014 to 2018. One fatal crash was recorded, while 64 percent of crashes had no injuries. Almost 60 percent involved vehicles traveling in the same direction. Another 25 percent involved a single vehicle, while 10 percent were OD crashes. A large majority (75 percent) occurred during daylight hours.

Injury crashes comprised 38 percent of the all crashes. Over half (55 percent) involved vehicles traveling in the same direction. Single-vehicle crashes comprised 18 percent of the total injury crashes. Vehicles traveling in ODs were involved in 13 percent of the crashes, and 10 percent were angle crashes.

Of the crashes, 35 percent were related to intersections, but the crashes were more likely to be rear-end than angular in nature. Another 21 percent of crashes involved roadway or lane departures.

Driver inattention and failure to control speed were the most cited contributing factors.

This project includes two sections rated with high or very high potential for safety improvements:

SH 105 0339-04-036: Widen to Four Lanes with Ctl			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
138.373	138.590	1.19	High
138.590	138.953	1.58	Very High

Five intersections on this project are rated as having high or very potential for safety improvements:

SH 105 0339-04-036: Widen to Four Lanes with Ctl			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
501	SH0105 @ RYAN	1.28	High
506	SH0105 @ VAGLICA	1.19	High
4295	SH0105 @ MITCHELL	1.44	Very High
4297	SH0105 @ NEVADA	1.18	High
4299	SH0105 @ SCANNON	2.14	Very High

US 90 from IH 10 to South Major Drive Pedestrian Safety Issues

During meetings with the researchers, the Beaumont staff identified pedestrian safety issues on US 90 from IH 10 to South Major Drive.

Site Observation

US 90 is a six-lane roadway. Left turns are accommodated via a continuous turn lane through most of the corridor. A short segment from Denton Drive to IH 10 includes a median with left-turn bays. Very few sections have sidewalks or other pedestrian accommodation. A few intersections are signalized, but they are widely spaced at irregular intervals. None appear to have separate pedestrian signals. The speed limit is 35 mph for a short (approximately 600 ft) segment near IH 10, then 45 mph to South 23rd Street, and then 50 mph for the rest of the corridor going west.

The corridor is almost fully developed, primarily with small- to medium-sized retail, service, and restaurant businesses, and driveway density is high. The Beaumont Municipal Athletic Complex is located along the corridor, as are several apartment complexes. Single-family residential areas are located behind the businesses in some sections. The Beaumont Transit System operates a route on US 90 from IH 10 to Dowlen Street from 6:30 AM to 9:30 PM.

There have been nine pedestrian crashes in the 5 years from 2014 to 2018, five of which resulted in fatalities. The other three resulted in non-incapacitating injuries. Only one crash was reported as intersection-related. The largest concentration of crashes is in the segment from just east of Dowlen Road to just west of Pinchback Road. The Timbers Edge Apartments are located on the south side of US 90 in this area. Two crashes occurred near South Major Drive.

All of the fatal crashes occurred in dark conditions. Of the four less severe crashes, three occurred during the day.

A list of potential pedestrian safety countermeasures is listed in Appendix E. In addition, the district may wish to investigate a new countermeasure developed in Michigan—known as the pedestrian gateway treatment—with in-street pedestrian crossing signs (R1-6). This treatment is a low-cost AASHTO innovation initiative that places R1-6 crossing signs on the lane lines and edgelines (note: edgeline placement may require FHWA permission to experiment). Also, this treatment may not yet have been used on a six-lane roadway.

The Michigan guidelines and research can be found at https://tinyurl.com/yydvddnr.

EXISTING BEAUMONT DISTRICT PROJECTS THAT INCLUDE ROADWAY SEGMENTS AND INTERSECTIONS WITH THE GREATEST POTENTIAL FOR SAFETY IMPROVEMENTS

This section presents segments and intersections identified as having potential for safety improvements because they have above average crash experiences and coincide with projects under development in the Beaumont District included in the TxDOT Project Tracker. The segment information is provided first, followed by the intersection locations.

Existing Beaumont District Projects with Segments with High and Very High Potential for Safety Improvements

The TxDOT projects that include segments identified as having high and very high potential for safety improvements are shown in Figure 53. A list of these projects with the limits of the segments are included in Appendix E. These segments were identified in Technical Memo 8, and the ranking is based on the ratio of expected to predicted crashes in that segment. The projects provide an opportunity to study the crash patterns and trends in these segments to determine if appropriate countermeasures can be included in the projects to help mitigate any crash issues.

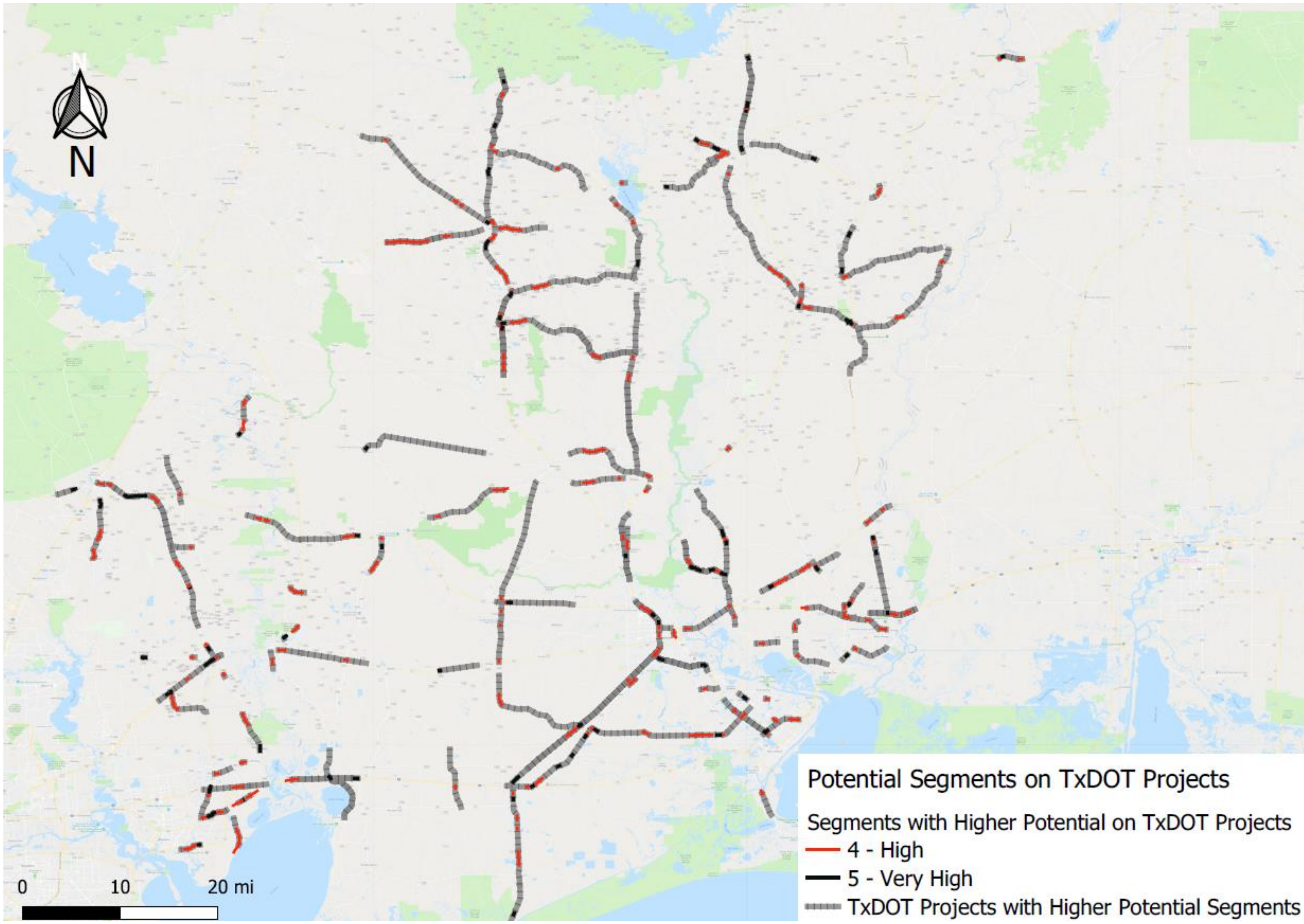


Figure 53. Map of Existing Beaumont Projects That Include Segments with High and Very High Potential for Safety Improvement.

Existing Beaumont District Projects with Intersections That Have Potential for Safety Improvements

Figure 54 provides a graphical depiction of the intersections with a high or very high potential for safety improvements overlaid on existing TxDOT projects. These intersections were identified in Technical Memo 8, and the ranking is based on the ratio between the number of expected and predicted crashes in the category of intersection. The projects provide an opportunity to study the crash patterns and trends at these intersections to determine if appropriate countermeasures can be included in the projects to help mitigate any crash issues. Appendix E lists the TxDOT projects that include intersections identified with high or very high potential for safety improvements in the Beaumont District.

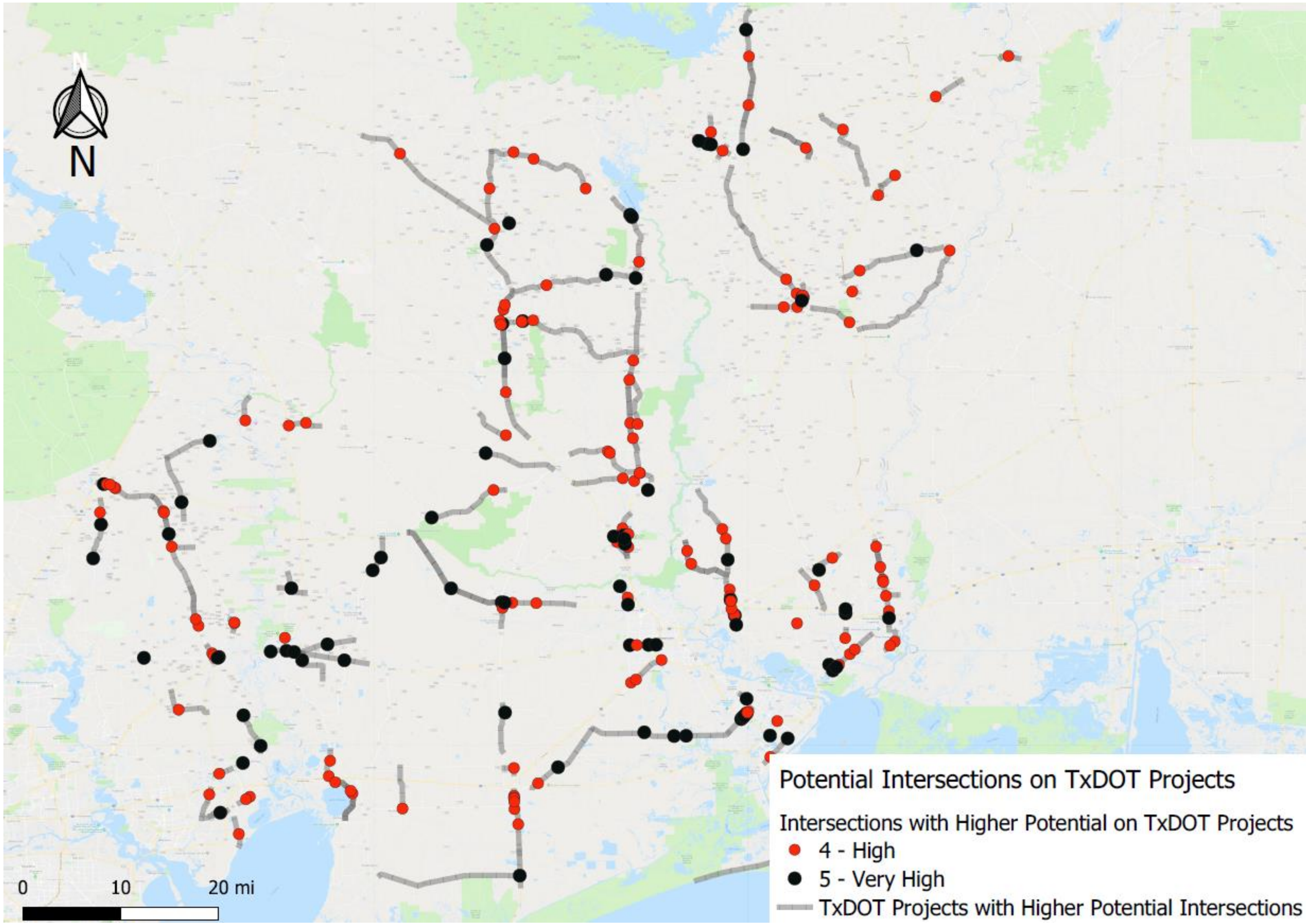


Figure 54. Map of Existing Beaumont District Projects That Include Intersections with High and Very High Potential for Safety Improvements.

CHAPTER 9: APPLYING THE RESEARCH RESULTS

The research conducted in this project is aimed at providing practical information that any TxDOT district can use to identify roadway segments and intersections with high potential for safety improvements, implement systemic safety programs, and integrate safety into project development. In order to transfer this research to TxDOT staff, TTI prepared a User Guide and a Safety Spreadsheet Toolkit and conducted training for the Beaumont District staff on how to apply these concepts.

USER GUIDE

- The User Guide covers the four basic elements of DDSA:
  - Describing crash issues.
  - Screening the roadway network to identify locations with potential for safety improvement.
  - Prioritizing targeted categories of safety improvements.
  - Integrating safety into the development.

Describing Crash Issues

The User Guide provides examples of five different crash visualization techniques (listed below) that can provide insight into crash issues within the district. Examples are provided of each technique along with information on what to look for and how to interpret them.

- Crash trend graphs.
- Indexed trend graphs.
- Crash trees.
- Proportional bar graphs.
- Comparison bar graphs.

Network Screening

The User Guide explains how the potential for safety improvement is measured and how benchmarks for intersections and roadway segments were established. The need for a database that allows the separation of these two types of locations is explained. Examples of determining the potential for safety improvement at an intersection and segment are provided, and the User Guide's appendices include the benchmarks for six categories of intersections and eight categories of roadway segments. Intersections are classified by the number of approach legs, the type of traffic control, and the location (urban or rural) within the district.

Prioritizing Targeted Categories of Safety Improvements

The User Guide provides information to aid in the selection of roadways for widening based on safety benefits and provides systemic prioritization based on a computation of the risk factors associated with the location's characteristics rather than the crash experience at that location. This type of analysis is particularly applicable to crashes that are not concentrated at locations but spread across the network. By targeting locations that possess a high degree of risk factors, crashes can be avoided at locations likely to experience them in the future if improvements are not made.

The User Guide provides the values for risk factors associated with the following:

- Pedestrian safety along segments and at signalized intersections.
- Wet-weather crashes on two-lane highway curves.
- Crossover crashes on multilane divided highways.
- Horizontal curve crashes.

Integrating Safety into the Project Development Process

The User Guide provides a framework for applying suitable assessment methods to help inform, justify, and defend safety-based decisions. The framework is primarily focused on the following project development phases:

- Planning and scoping.
- Alternatives identification and analysis.
- Preliminary design.
- Final design.

SAFETY SPREADSHEET TOOLKIT

TTI also developed a spreadsheet-based toolkit that performs the computations for the following analyses:

- Quantification of the potential for safety improvement (including graphical visualizations) for the following:
    - Roadway segments.
    - Intersections.
- Cost/benefit ratio for widening narrow two-lane roadways.
- Risk factor score for pedestrian safety for the following:
    - Roadway segments.
    - Intersections.
- Risk factor score for wet-weather crashes on two-lane highway curves.
- Risk factor score for crossover crashes on multilane divided highways.
- Risk factor score for horizontal curve crashes on two-lane highway curves.

TRAINING

TTI prepared instructional materials to train the Beaumont District staff in the application of the methods and techniques included in the User Guide and Safety Spreadsheet Toolkit.

A training workshop was scheduled to be held at the Beaumont District Office on August 8–9, 2019. Participants included analysts, designers, and district managers. Participants received a copy of the User’s Guide and the Safety Spreadsheet Toolkit.

APPENDIX A: CRASH RATE BY FUNCTIONAL SYSTEM AND VOLUME GROUPS

Table A1. Crash Rate by Functional System and Volume Groups.

#	Functional Classifications	Risk Level	Low Volume		Moderate Volume		High Volume	
			Percentile	Crash rate	Percentile	Crash rate	Percentile	Crash rate
1	Rural Interstate; Rural Other Freeway and Expressway	Low	<20%	<0.006			<22%	<0.004
		Moderate	20%–85%	0.006–0.057			22%–85%	0.004–0.039
		High	85%–95%	0.057–0.09			85%–95%	0.039–0.068
		Very High	>95%	>0.09			>95%	>0.068
2	Rural Other Principal Arterial	Low	<50%	<0.008			<36%	<0.002
		Moderate	50%–85%	0.008–0.167			36%–85%	0.002–0.112
		High	85%–95%	0.167–0.44			85%–95%	0.112–0.242
		Very High	>95%	>0.44			>95%	>0.242
3	Rural Minor Arterial; Rural Major Collector	Low	<70%	<0.04	<46%	<0.01	<37%	<0.006
		Moderate	70%–85%	0.04–0.50	46%–85%	0.01–0.294	37%–85%	0.006–0.162
		High	85%–95%	0.50–1.15	85%–95%	0.294– 0.588	85%–95%	0.162– 0.35
		Very High	>95%	>1.15	>95%	>0.588	>95%	>0.35
4	Rural Minor Collector; Rural Local	Low	<75%	<0.045	<44%	<0.019	<47%	<0.01
		Moderate	75%–85%	0.045–0.308	44%–85%	0.019–0.293	47%–85%	0.01–0.19
		High	85%–95%	0.308–0.874	85%–95%	0.293– 0.52	85%–95%	0.19– 0.36
		Very High	>95%	>0.874	>95%	>0.52	>95%	>0.36
5	Urban Interstate; Urban Other Freeway and Expressway	Low	<39%	<0.002	<28%	<0.001	<21%	<0.001
		Moderate	39%–85%	0.002–0.079	28%–85%	0.001–0.048	21%–85%	0.001–0.037
		High	85%–95%	0.079–0.162	85%–95%	0.048–0.102	85%–95%	0.037–0.063
		Very High	>95%	>0.162	>95%	>0.102	>95%	>0.063
6	Urban Other Principal Arterial; Urban Minor Arterial	Low	<64%	<0.04	<40%	<0.006	<20%	<0.004
		Moderate	64%–85%	0.04–0.494	40%–85%	0.006–0.239	20%–85%	0.004–0.166
		High	85%–95%	0.494–1.60	85%–95%	0.239–0.541	85%–95%	0.166–0.309
		Very High	>95%	>1.60	>95%	>0.541	>95%	>0.309
7	Urban Major Collector; Urban Minor Collector	Low	<77%	<0.132	<55%	<0.02	<36%	<0.01
		Moderate	77%–85%	0.132–0.52	55%–85%	0.02–0.37	36%–85%	0.01–0.195
		High	85%–95%	0.52–2.28	85%–95%	0.37–0.94	85%–95%	0.195–0.34
		Very High	>95%	>2.28	>95%	>0.94	>95%	>0.34
8	Urban Local	Low	<92%	<0.8				
		Moderate	—	—				
		High	92%–95%	0.8–0.9				
		Very High	>95%	>0.9				

Note: A blank cell means that the corresponding level does not exist.

APPENDIX B: BEAUMONT NARROW SEGMENTS SORTED BY PRIORITY RANDING FOR WIDENING

Table B1. Beaumont Narrow Segments Sorted by Priority Ranking for Widening.

HWY	CSEC	FRM_ DFO	TO_ DFO	LEN_ SEC	ADT 2016	ADT 2015	ADT 2014	ADT2 013	Paved Width	Priority
FM0252	78501	1.077	1.128	0.051	4,441	3,210	4,381	3,042	20	1
FM0252	78501	1.128	2.162	1.034	4,441	3,210	4,381	3,042	20	1
FM0256	87703	18.187	18.758	0.571	2,035	2,027	1,916	2,284	20	1
FM0365	93202	13.105	13.295	0.19	3,009	2,453	2,685	2,582	20	1
FM1008	95201	8.231	8.944	0.713	3,624	3,578	2,222	3,023	17	1
FM1008	95201	8.944	10.248	1.304	3,624	3,578	2,222	3,023	17	1
FM1008	95201	10.248	11.387	1.139	3,624	3,578	2,222	3,023	17	1
FM1130	128401	7.375	8.242	0.867	2,795	2,426	2,717	2,374	22	1
FM1413	142101	0	0.139	0.139	3,722	3,353	2,966	2,866	17	1
FM1413	142101	0.139	0.169	0.03	3,722	3,353	2,966	2,866	17	1
FM1413	142101	0.169	2.313	2.144	3,722	3,353	2,966	2,866	17	1
FM2090	191203	14.389	14.559	0.17	4,184	3,027	2,570	2,570	20	1
SL0207	38910	0	0.011	0.011	2,076	2,610	2,187	2,463	22	1
SL0207	38910	0.686	0.893	0.207	6,762	7,783	7,211	7,135	22	1
SL0207	38910	0.893	1.031	0.138	6,762	7,783	7,211	7,135	22	1
SL0207	38910	1.031	1.533	0.502	6,600	7,692	6,495	6,739	22	1
US0069	20009	299.838	300.389	0.551	8,551	8,021	8,364	8,443	22	1
US0190	21308	545.356	545.642	0.286	3,974	3,157	4,037	4,972	22	1
US0190	21308	545.642	545.946	0.304	3,974	3,157	4,037	4,972	22	1
US0190	21308	545.946	547.373	1.427	3,974	3,157	4,037	4,972	22	1
FM0160	78701	6.944	7.678	0.734	1,809	1,960	1,811	1,386	16	2
FM0686	106701	9.213	10.433	1.22	1,589	1,581	1,541	1,579	20	3
FM1004	94703	15.176	16.646	1.47	1,694	1,414	1,594	1,585	20	3
FM1130	128401	4.548	4.751	0.203	1,790	1,428	1,696	1,334	22	3
FM1130	128401	4.751	4.995	0.244	1,790	1,428	1,696	1,334	22	3
FM1130	128401	4.995	5.238	0.243	1,790	1,428	1,696	1,334	22	3
FM1130	128401	5.238	6.451	1.213	1,790	1,428	1,696	1,334	22	3
FM1130	128401	6.451	7.375	0.924	1,790	1,428	1,696	1,334	22	3
SH0061	24201	0	0.667	0.667	1,896	1,357	1,424	1,516	20	3
SH0061	24201	0.667	1.017	0.35	1,896	1,357	1,424	1,516	20	3
SH0061	24201	1.017	2.006	0.989	1,896	1,357	1,424	1,516	20	3
SH0061	24201	2.006	2.41	0.404	1,896	1,357	1,424	1,516	20	3
SH0061	24201	2.41	2.86	0.45	1,896	1,357	1,424	1,516	20	3
SH0061	24201	2.86	3.52	0.66	1,896	1,357	1,424	1,516	20	3

HWY	CSEC	FRM_ DFO	TO_ DFO	LEN_ SEC	ADT 2016	ADT 2015	ADT 2014	ADT2 013	Paved Width	Priority
SH0061	24201	3.52	4.855	1.335	1,896	1,357	1,424	1,516	20	3
SH0061	24201	4.855	5.248	0.393	1,896	1,357	1,424	1,516	20	3
SH0061	24201	5.248	5.32	0.072	1,896	1,357	1,424	1,516	17	3
SH0061	24202	5.32	5.941	0.621	1,896	1,357	1,424	1,516	17	3
SH0087	30406	90.718	90.843	0.125	1,237	1,538	1,493	1,762	18	3
SH0087	30406	90.843	90.964	0.121	1,237	1,538	1,493	1,762	18	3
FM0105	88302	21.558	22.778	1.22	1,862	2,088	1,734	1,692	22	4
FM0105	88302	22.778	24.876	2.098	1,909	1,995	1,734	1,692	22	4
FM1663	36805	14.59	16.13	1.54	1,794	1,856	1,910	1,979	20	4
FM1663	36805	16.13	16.193	0.063	1,794	1,856	1,910	1,979	20	4
FM1406	132401	0	0.088	0.088	1,429	905	1,255	1,398	22	5
FM1406	132401	0.088	2.704	2.616	1,429	905	1,255	1,398	22	5
FM1413	142101	2.313	2.559	0.246	1,667	1,467	1,082	920	17	5
FM1413	142101	2.559	4.599	2.04	1,667	1,467	1,082	920	17	5
FM1416	62704	10.466	14.715	4.249	2,839	531	688	827	20	5
FM1943	182802	7.31	7.444	0.134	1,266	1,120	1,232	1,214	20	5
FM1406	132401	2.704	5.434	2.73	1,317	1,244	1,221	1,534	22	6
FM1943	182801	10.85	11.26	0.41	1,389	1,020	1,558	1,556	20	6
FM1943	182801	11.26	11.358	0.098	1,389	1,020	1,558	1,556	20	6
FM1943	182801	11.358	14.702	3.344	1,389	1,020	1,558	1,556	20	6
SH0061	24202	5.941	7.214	1.273	1,467	959	1,424	1,424	17	6
SH0061	24202	7.214	7.706	0.492	1,467	959	1,424	1,424	17	6
SH0061	24202	7.706	8.018	0.312	1,467	959	1,424	1,424	17	6
SH0061	24202	8.018	8.531	0.513	1,467	959	1,424	1,424	17	6
SH0061	24202	8.531	9.986	1.455	1,467	959	1,424	1,424	17	6
SH0087	30406	93.212	93.705	0.493	1,221	1,318	1,400	1,634	22	6
SH0087	30406	94.625	95.515	0.89	1,221	1,318	1,400	1,634	22	6
FM1131	78403	1.536	1.658	0.122	2,136	1,846	1,944	1,958	20	7
FM2800	283401	0.74	2.954	2.214	887	1,041	1,145	1,157	20	8
FM2800	283401	2.954	3.671	0.717	887	1,041	1,145	1,157	20	8
FM0365	93202	8.706	11.003	2.297	1,411	1,018	1,247	1,110	20	9
FM0365	93202	11.003	13.105	2.102	1,411	1,018	1,247	1,110	20	9
SH0063	21403	63.616	63.776	0.16	1,241	1,205	1,040	1,043	20	9
FM1008	95301	0	2.14	2.14	1,096	964	845	936	20	12
FM1746	158501	8.317	8.348	0.031	921	836	870	1,010	20	12
FM1013	78503	33.956	34.442	0.486	883	758	835	835	19	13
FM1013	78503	34.442	34.595	0.153	883	758	835	835	19	13
FM1416	62704	0	0.271	0.271	687	626	961	1,254	18	13
FM1663	146401	13.596	13.633	0.037	936	741	816	817	20	13
FM1663	146401	13.633	13.686	0.053	936	741	816	817	20	13

HWY	CSEC	FRM_ DFO	TO_ DFO	LEN_ SEC	ADT 2016	ADT 2015	ADT 2014	ADT2 013	Paved Width	Priority
FM1663	146401	13.686	14.59	0.904	936	741	816	817	20	13
FM2041	194601	0	0.723	0.723	859	769	826	892	20	13
FM2354	224202	6.712	7.561	0.849	852	938	817	896	20	13
FM2799	24408	5.037	5.094	0.057	854	776	906	976	22	13
FM2830	288701	0	4.038	4.038	770	848	915	765	20	13
FM2830	288701	4.038	4.725	0.687	770	848	915	765	20	13
FM2830	288701	4.725	4.744	0.019	770	848	915	765	20	13
FM0256	87704	3.902	4.709	0.807	611	570	687	673	20	14
FM0256	87704	4.709	5.91	1.201	611	570	687	673	20	14
FM0686	106701	2.363	5.318	2.955	628	709	622	611	16	14
FM0777	110901	5.26	5.378	0.118	724	631	803	636	18	14
FM0777	110901	5.378	6.215	0.837	724	631	803	636	18	14
FM0777	110901	6.215	6.551	0.336	724	631	803	636	18	14
FM1416	62704	0.271	1.575	1.304	522	534	852	865	18	14
FM1416	62704	1.575	1.835	0.26	522	534	852	865	20	14
FM1416	62704	1.835	2.63	0.795	522	534	852	865	18	14
FM1416	62704	2.63	4.171	1.541	522	534	852	865	18	14
FM1663	146401	10.665	13.596	2.931	739	539	659	509	20	14
FM1943	182801	14.702	17.968	3.266	630	516	657	726	20	14
FM2830	288702	5.072	6.723	1.651	627	689	638	647	20	14
SL0149	6414	1.587	2.107	0.52	836	495	429	804	20	14
FM0777	110901	9.551	12.428	2.877	526	523	572	639	18	15
FM1003	81102	4.985	5.236	0.251	606	575	487	583	18	15
FM1003	81102	5.236	5.378	0.142	689	557	474	564	18	15
FM1003	81102	6.06	6.449	0.389	689	557	474	564	18	15
FM1003	81102	7.124	7.262	0.138	689	557	474	564	18	15
FM1410	142002	10.45	12.652	2.202	703	456	472	592	20	15
FM1410	142002	12.652	12.684	0.032	703	456	472	592	20	15
FM1943	182802	3.425	3.723	0.298	544	481	510	592	20	15
FM1943	182802	3.723	4.734	1.011	544	481	510	592	20	15
FM1943	182802	4.734	7.31	2.576	544	481	510	592	20	15
FM2460	194901	0	2.965	2.965	578	480	536	688	20	15
FM2992	304301	0	3.83	3.83	516	458	593	706	20	15
FM0777	21311	0	2.068	2.068	726	642	808	732	18	16
FM1004	94703	6.956	7.094	0.138	808	694	717	826	20	16
FM1004	94703	7.094	11.415	4.321	808	694	717	826	20	16
FM1004	94703	11.415	11.697	0.282	808	694	717	826	20	16
FM1004	94703	11.697	15.176	3.479	808	694	717	826	20	16
FM1008	95201	2.14	6.215	4.075	843	772	660	705	20	16
FM1008	95201	6.215	8.231	2.016	843	772	660	705	17	16

HWY	CSEC	FRM_ DFO	TO_ DFO	LEN_ SEC	ADT 2016	ADT 2015	ADT 2014	ADT2 013	Paved Width	Priority
FM1745	158401	7.249	7.633	0.384	756	749	686	968	18	16
FM2938	24305	0	2.21	2.21	682	679	777	840	20	16
FM2992	304301	3.83	6.74	2.91	720	669	772	867	20	16
SH0087	30406	88.698	90.555	1.857	542	838	775	751	20	16
SH0087	30406	90.555	90.718	0.163	542	838	775	751	20	16
FM0253	94702	9.598	9.621	0.023	544	485	280	280	20	17
FM0256	87704	7.688	7.737	0.049	260	293	344	352	20	17
FM0256	87704	10.843	10.898	0.055	260	293	344	352	20	17
FM0256	87703	10.898	13.387	2.489	369	227	417	457	20	17
FM1009	60103	7.315	7.701	0.386	347	379	244	244	16	17
FM1408	141901	0	2.02	2.02	409	318	372	374	18	17
FM1414	130001	0	0.293	0.293	413	281	392	358	18	17
FM1415	30408	1.217	1.693	0.476	262	285	397	424	18	17
FM1632	278201	3.509	5.177	1.668	322	323	342	303	20	17
FM1663	146401	2.973	6.173	3.2	432	265	314	328	20	17
FM1663	146401	6.173	8.173	2	432	265	314	328	20	17
FM1724	158001	0	0.039	0.039	509	286	333	340	18	17
FM1724	158001	0.039	1.332	1.293	509	286	333	340	18	17
FM1724	158001	1.332	1.521	0.189	509	286	333	340	20	17
FM1745	158402	4.217	6.009	1.792	209	311	359	331	20	17
FM1745	158402	6.009	6.418	0.409	209	311	359	331	20	17
FM1745	158402	6.418	6.477	0.059	209	311	359	331	20	17
FM1745	158402	6.477	6.98	0.503	209	311	359	331	20	17
FM1745	158401	7.633	7.669	0.036	326	328	311	563	18	17
FM1745	158401	7.672	7.872	0.2	326	328	311	563	18	17
FM1745	158401	7.872	11.994	4.122	326	328	311	563	18	17
FM1745	158401	11.994	12.087	0.093	326	328	311	563	20	17
FM1745	158401	15.368	17.459	2.091	377	285	311	411	20	17
FM1745	158401	17.459	20.556	3.097	377	285	311	411	20	17
FM1745	158401	20.556	20.612	0.056	377	285	311	411	20	17
FM1745	158401	20.612	20.929	0.317	377	285	311	411	20	17
FM1941	158002	0	0.026	0.026	185	253	339	445	20	17
FM1941	158002	0.026	4.012	3.986	185	253	339	445	20	17
FM2936	295101	0.909	1.769	0.86	410	299	357	340	20	17
FM2936	295101	1.769	1.786	0.017	410	299	357	340	20	17
FM2936	295101	1.786	3.41	1.624	410	299	357	340	20	17
FM2937	295201	4.508	4.621	0.113	396	394	401	316	20	17
FM2937	295201	4.621	4.906	0.285	396	394	401	316	20	17
FM2937	295201	4.906	5.803	0.897	396	394	401	316	20	17
FM2937	295201	5.803	5.815	0.012	396	394	401	316	20	17

HWY	CSEC	FRM_ DFO	TO_ DFO	LEN_ SEC	ADT 2016	ADT 2015	ADT 2014	ADT2 013	Paved Width	Priority
FM2939	295302	0	3.793	3.793	293	371	307	402	20	17
FM3065	309201	0	0.387	0.387	289	384	405	375	20	17
FM3065	309201	0.39	0.591	0.201	289	384	405	375	20	17
FM3065	309201	0.591	4.411	3.82	289	384	405	375	20	17
FM0256	87703	13.387	17.827	4.44	377	427	464	594	20	18
FM0256	87703	17.828	18.013	0.185	377	427	464	594	20	18
FM0256	87703	18.013	18.085	0.072	377	427	464	594	20	18
FM0256	87703	18.085	18.187	0.102	377	427	464	594	20	18
FM0834	114603	0	1.234	1.234	468	427	384	393	18	18
FM0943	119402	19.146	19.694	0.548	435	560	508	458	20	18
FM0943	119402	19.694	27.346	7.652	435	560	508	458	20	18
FM1003	81102	7.262	8.954	1.692	525	401	338	433	18	18
FM1003	81102	9.529	9.709	0.18	525	401	338	433	18	18
FM1410	142001	0	0.212	0.212	452	444	444	458	18	18
FM1410	142001	0.212	1.212	1	452	444	444	458	20	18
FM1410	142001	1.212	2.621	1.409	452	444	444	458	18	18
FM1410	142001	2.621	8.371	5.75	452	444	444	458	20	18
FM1410	142002	8.373	10.45	2.077	583	331	367	367	20	18
FM1410	142002	12.684	12.711	0.027	378	399	367	500	20	18
FM1410	142002	12.711	15.465	2.754	378	399	367	500	20	18
FM1410	142002	15.465	15.49	0.025	378	399	367	500	20	18
FM1414	130001	10.321	15.699	5.378	374	398	458	375	18	18
FM1416	62704	4.171	4.331	0.16	367	322	524	569	18	18
FM1416	62704	4.331	5.552	1.221	367	322	524	569	20	18
FM1416	62704	5.552	10.466	4.914	367	322	524	569	20	18
FM1663	146401	0	2.973	2.973	540	419	470	481	20	18
FM1663	146401	8.173	10.665	2.492	631	419	493	343	20	18
FM1746	158501	8.348	13.684	5.336	446	373	421	449	20	18
FM1746	158501	13.684	13.74	0.056	446	373	421	449	20	18
FM2626	261801	11.789	11.805	0.016	305	468	508	613	20	18
FM2827	288902	0	0.012	0.012	482	404	486	488	20	18
FM2827	288902	0.012	0.242	0.23	482	404	486	488	20	18
FM2827	288902	0.242	0.503	0.261	482	404	486	488	20	18
FM2827	288902	0.503	5.128	4.625	482	404	486	488	20	18
FM2827	288902	5.128	5.54	0.412	482	404	486	488	20	18
FM2827	288902	5.54	5.554	0.014	482	404	486	488	20	18
FM2937	295201	0	3.139	3.139	333	456	431	400	20	18
FM0160	78701	7.679	10.603	2.924	252	204	401	216	16	19
FM0253	94702	9.625	11.028	1.403	326	286	280	280	20	19
FM0254	94801	0	0.76	0.76	301	223	316	264	16	19

HWY	CSEC	FRM_ DFO	TO_ DFO	LEN_ SEC	ADT 2016	ADT 2015	ADT 2014	ADT2 013	Paved Width	Priority
FM0256	87704	0	3.215	3.215	267	283	266	216	16	19
FM0256	87704	3.215	3.547	0.332	267	283	266	216	16	19
FM0420	81101	0	2.93	2.93	278	318	261	310	18	19
FM0420	81101	2.93	3.853	0.923	278	318	261	310	18	19
FM0777	21311	2.068	5.26	3.192	271	245	267	276	18	19
FM0777	110901	6.551	6.789	0.238	164	173	552	155	18	19
FM0777	110901	6.789	9.551	2.762	164	173	552	155	18	19
FM1009	60104	0	0.076	0.076	272	235	291	286	22	19
FM1009	60104	0.076	1.525	1.449	272	235	291	291	22	19
FM1009	60104	1.525	1.977	0.452	272	235	291	291	16	19
FM1009	60104	1.977	5.282	3.305	272	235	291	291	16	19
FM1009	60103	5.282	7.315	2.033	233	212	244	244	16	19
FM1414	130001	0.293	1.598	1.305	228	209	256	291	18	19
FM1414	130001	1.598	2.047	0.449	228	209	256	291	20	19
FM1414	130001	2.047	3.141	1.094	228	209	256	291	18	19
FM1414	130001	3.141	3.619	0.478	228	209	256	291	20	19
FM1414	130001	3.619	3.68	0.061	228	209	256	291	20	19
FM1724	158001	1.521	2.146	0.625	239	195	212	158	20	19
FM1724	158001	2.146	4.911	2.765	239	195	212	158	18	19
FM1738	194802	0	0.752	0.752	185	276	360	360	20	19
FM1738	194802	0.752	0.957	0.205	185	276	360	360	20	19
FM1738	194802	0.957	2.32	1.363	185	276	360	360	20	19
FM1738	194802	2.32	3.426	1.106	185	276	360	360	20	19
FM1738	194802	3.426	3.627	0.201	185	276	360	360	20	19
FM1738	194802	3.627	4.279	0.652	185	276	360	360	20	19
FM1747	24407	0.19	0.63	0.44	228	166	278	294	22	19
FM1747	24407	0.63	2.671	2.041	228	166	278	294	22	19
FM1941	158002	4.012	5.831	1.819	81	193	255	283	20	19
FM1941	158002	5.831	6.436	0.605	81	193	255	283	20	19
FM1985	24206	0	7.926	7.926	329	227	226	343	22	19
FM1985	24206	7.926	14.785	6.859	349	205	205	335	22	19
FM1985	24206	14.785	14.796	0.011	349	205	205	335	22	19
FM2097	227101	0	1.477	1.477	166	304	188	279	20	19
FM2097	227101	1.477	3.467	1.99	166	304	188	279	20	19
FM2460	194901	2.965	6.164	3.199	246	276	305	311	20	19
FM2798	277803	6.514	8.939	2.425	241	260	323	304	20	19
FM2936	295101	0	0.908	0.908	244	205	244	195	20	19
FM2937	295201	3.139	4.005	0.866	255	276	273	240	20	19
FM2937	295201	4.005	4.358	0.353	255	276	273	240	20	19
FM2937	295201	4.358	4.508	0.15	255	276	273	240	20	19

HWY	CSEC	FRM_ DFO	TO_ DFO	LEN_ SEC	ADT 2016	ADT 2015	ADT 2014	ADT2 013	Paved Width	Priority
FM3065	309201	4.411	6.903	2.492	213	217	260	279	20	19
PR0048	298901	0	2.651	2.651	147	90	159	517	20	19
PR0048	298902	0	0.718	0.718	144	102	181	666	20	19
PR0048	298902	0.718	1.005	0.287	144	102	181	666	20	19
PR0048	298902	1.005	1.363	0.358	144	102	181	666	20	19
PR0048	298902	1.363	1.837	0.474	144	102	181	666	20	19
FM0254	94801	0.76	0.798	0.038	163	103	143	151	16	NR
FM0254	94801	0.798	2.695	1.897	163	103	143	151	16	NR
FM1014	123801	0	0.848	0.848	89	87	95	97	18	NR
FM1014	123801	0.848	1.034	0.186	89	87	95	97	18	NR
FM1014	123801	1.034	1.183	0.149	45	58	58	56	18	NR
FM1408	141901	2.02	5.348	3.328	224	162	214	149	18	NR
FM1414	130001	3.68	4.556	0.876	103	92	82	95	20	NR
FM1415	30408	0	0.504	0.504	102	107	201	147	20	NR
FM1415	30408	0.504	0.732	0.228	102	107	201	147	20	NR
FM1415	30408	0.732	0.782	0.05	102	107	201	147	18	NR
FM1415	30408	0.782	1.132	0.35	105	155	257	167	18	NR
FM1415	30408	1.132	1.217	0.085	105	155	257	167	18	NR
FM1632	278201	0	1.207	1.207	166	139	191	188	20	NR
FM1632	278201	1.207	2.12	0.913	207	171	204	210	20	NR
FM1632	278201	2.12	3.509	1.389	207	171	204	210	20	NR
FM1745	158401	12.087	12.109	0.022	184	99	113	273	20	NR
FM1745	158401	12.109	15.368	3.259	184	99	113	273	20	NR
FM1941	158002	6.436	10.901	4.465	43	110	322	171	20	NR
FM1941	158002	10.901	13.577	2.676	43	110	322	171	18	NR
FM1943	182802	0	3.38	3.38	105	146	153	141	20	NR
FM1943	182802	3.38	3.425	0.045	105	146	153	141	20	NR
FM2799	277901	0	1.722	1.722	121	188	140	206	20	NR
FM2800	283401	0	0.74	0.74	86	78	132	109	20	NR
FM2938	24305	2.21	3.51	1.3	172	144	170	176	20	NR
FM2991	304201	0	0.056	0.056	117	82	126	113	20	NR
FM2991	304201	0.056	2.024	1.968	117	82	126	113	20	NR
FM2991	304201	2.024	4.99	2.966	86	93	55	63	20	NR
PR0069	30706	0	0.283	0.283	13	252	48	218	22	NR
SH0087	30702	204.695	204.728	0.033	185	138	232	222	22	NR

Table B2. Horizontal Curves in Beaumont by Priority Ranking for Pavement Treatments.

CURVE _ID	CON SEC	HWY SYS	HWY NUM	CUR_BE G_DFO	CUR_EN D_DFO	CUR LEN	RAD	Avg ADT	Wet Crashes	Points
37096	158202	FM	1725	17.822	17.85	0.028	520.9	3106	0	156
37098	158202	FM	1725	18.304	18.423	0.119	520.9	3106	0	156
37100	158202	FM	1725	18.994	19.145	0.151	520.9	3060	5	156
37101	158202	FM	1725	19.555	19.653	0.098	520.9	3060	6	156
37102	158202	FM	1725	19.904	19.942	0.038	520.9	3060	0	156
41150	145903	FM	2025	13.769	13.83	0.061	881.5	6188.8	0	154
41151	145903	FM	2025	14.029	14.134	0.105	818.5	6188.8	0	154
41152	145903	FM	2025	14.321	14.388	0.067	954.9	6188.8	0	154
37099	158202	FM	1725	18.462	18.617	0.155	520.9	2513.4	2	149
21929	109603	FM	770	39.922	40.163	0.241	818.5	1005.8	0	143
37103	158202	FM	1725	20.047	20.085	0.038	5729	3060	0	141
37097	158202	FM	1725	18.049	18.101	0.052	1909.8	3106	0	140
37104	158202	FM	1725	20.273	20.33	0.057	1909.8	3060	0	140
27154	94703	FM	1004	21.07	21.182	0.112	674.1	3123.2	3	136
27155	94703	FM	1004	21.357	21.457	0.1	716.2	3123.2	1	136
28977	78404	FM	1131	15.81	15.857	0.047	716.2	4214.6	0	135
32906	76202	FM	1409	11.142	11.179	0.037	954.9	3303.8	0	135
32909	76202	FM	1409	11.566	11.622	0.056	573	3303.8	0	135
39905	181202	FM	1942	10.56	10.616	0.056	818.5	10623	0	135
17586	102302	FM	563	3.683	3.724	0.041	5729	2931	0	131
17655	102401	FM	565	6.428	6.47	0.042	636.6	3838	0	131
17657	102401	FM	565	6.598	6.647	0.049	636.6	3838	1	131
17658	102401	FM	565	6.829	6.879	0.05	716.2	3838	0	131
27300	106101	FM	1010	3.808	3.918	0.11	1909.8	4922.2	0	130
21925	109603	FM	770	36.598	36.848	0.25	818.5	1005.8	0	129
21926	109603	FM	770	37.042	37.282	0.24	818.5	1005.8	0	129
27400	123701	FM	1013	2.868	2.977	0.109	954.9	1307.6	0	129
27401	123701	FM	1013	3.076	3.154	0.078	573	1307.6	0	129
27402	123701	FM	1013	3.575	3.596	0.021	716.2	1307.6	0	129
27403	123701	FM	1013	3.855	3.891	0.036	573	1307.6	1	129
27405	123701	FM	1013	4.357	4.41	0.053	954.9	1307.6	0	129
27408	123701	FM	1013	4.924	4.97	0.046	573	1307.6	0	129
27434	123701	FM	1013	11.34	11.383	0.043	954.9	1548.2	0	129
27436	123701	FM	1013	11.817	11.853	0.036	818.5	1548.2	0	129
27320	106101	FM	1010	9.078	9.266	0.188	573	2313.2	0	129
17640	102401	FM	565	0.72	0.777	0.057	573	7577.6	0	129
17642	102401	FM	565	3.227	3.29	0.063	520.9	10580	3	129
32894	76202	FM	1409	6.328	6.352	0.024	573	3303.8	0	129
21928	109603	FM	770	39.706	39.768	0.062	5729	1005.8	1	128

21931	109603	FM	770	40.735	40.939	0.204	22909	1005.8	0	128
21932	109603	FM	770	41.013	41.073	0.06	22909	1005.8	0	128
29006	128501	FM	1136	3.061	3.216	0.155	5729	1978.6	0	128
29010	128501	FM	1136	4.672	4.688	0.016	5729	1978.6	0	128
27252	95201	FM	1008	10.446	10.521	0.075	5729	3089.4	0	128
27303	106101	FM	1010	5.064	5.099	0.035	573	2313.2	0	128
27306	106101	FM	1010	5.618	5.673	0.055	818.5	2313.2	0	128
27307	106101	FM	1010	5.751	5.829	0.078	716.2	2313.2	0	128
27311	106101	FM	1010	6.56	6.62	0.06	954.9	2313.2	0	128
27313	106101	FM	1010	6.966	7.003	0.037	573	2313.2	0	128
27317	106101	FM	1010	7.602	7.643	0.041	954.9	2313.2	0	128
21934	109603	FM	770	41.411	41.455	0.044	1909.8	1005.8	0	127
29004	128501	FM	1136	2.062	2.145	0.083	1432.4	1978.6	0	127
29007	128501	FM	1136	3.326	3.402	0.076	1145.9	1978.6	0	127
27253	95201	FM	1008	10.795	10.916	0.121	1909.8	3089.4	0	127
27254	95201	FM	1008	11.266	11.403	0.137	1909.8	3089.4	0	127
27319	106101	FM	1010	8.093	8.171	0.078	573	2313.2	1	127
22291	81301	FM	787	19.048	19.133	0.085	916.7	1791.6	0	126

APPENDIX C: SPF MODELING RESULTS FOR SEGMENTS AND INTERSECTIONS

SPF MODELING RESULTS FOR SEGMENTS

The research team followed the same procedure for developing SPFs on rural two-lane highways, and analyzed the data on other roadways. The results are shown below.

Some of the figures in this section refer to incapactitating injuries. During the course of conducting this project, TxDOT changed the term from incapactitating injuries to suspected serious injuries. Therefore, both of these terms refer to the same injury severity, which is also denoted with an "A" when the KABCO scale is used.

Rural Divided Multilane Roadway (Non-Freeway)

Table C1. Summary Statistics (Divided Multilane Roadway, Non-Freeway).

Variable	Sample Size	Min.	Max.	Mean	SD
Segment Length (mi)	441	0.101	1.923	0.6	0.54
ADT (vpd)	441	2,186	28,766	11,658.7	4,807.73
Lane Width (ft)	441	10	16	12.5	1.1
Outside Shoulder Width (ft)	441	0	10	8.6	2.22
Inside Shoulder Width (ft)	441	0	10	4.8	2.18
Median Width (ft)	441	10	300	57.8	35.71
No. Lanes	441	4	6	4.1	0.4
Annual Number of Total Crashes	441	0	18	1.4	1.99
Annual Number of KA Crashes	441	0	2	0.1	0.32
Annual Number of FI Crashes	441	0	5	0.4	0.8

Table C2. Modeling Results (Divided Multilane Roadway, Non-Freeway).

Variable	Estimate	S.E.	p-Value	Significance Level
Total Crashes				
Intercept—β_0	-6.4566	2.0029	0.0013	95%
log(ADT)—β_{ADT}	0.7376	0.1452	<0.001	99.9%
Lane Width—β_1	0.2097	0.0567	<0.001	99.9%
Outside Shoulder Width—β_2	-0.0309	0.0380	0.4157	Not Sig.
Inside Shoulder Width—β_3	0.0873	0.0307	0.0044	95%
Median Width—β_4	0.0001	0.0017	0.9533	Not Sig.
No. Lanes—β_5	-0.6038	0.2412	0.0123	95%
Parameter for Over-Disp.—β_σ	-1.5565	0.2142	<0.001	99.9%
AIC	1,273.5			
KA Crashes				
Intercept—β_0	2.6252	0.2877	<0.001	99.9%
log(ADT)—β_{ADT}	1.0890	0.4405	0.0134	95%
Lane Width—β_1	0.0576	0.1590	0.7172	Not Sig.
Outside Shoulder Width—β_2	-0.2050	0.0981	0.0368	95%
Inside Shoulder Width—β_3	0.2779	0.0967	0.0041	95%
Median Width—β_4	0.0002	0.0057	0.9742	Not Sig.
No. Lanes—β_5	-3.7725	1.1559	0.0011	95%
Parameter for Over-Disp.—β_σ	-9.0519	0.0000	<0.001	99.9%
AIC	267.5			
FI Crashes				
Intercept—β_0	1.0284	0.1427	<0.001	99.9%
log(ADT)—β_{ADT}	1.0977	0.2204	<0.001	99.9%
Lane Width—β_1	0.1940	0.0791	0.0142	95%
Outside Shoulder Width—β_2	-0.0748	0.0547	0.1719	Not Sig.
Inside Shoulder Width—β_3	0.1226	0.0473	0.0095	95%
Median Width—β_4	0.0001	0.0027	0.9632	Not Sig.
No. Lanes—β_5	-3.5133	0.5756	<0.001	99.9%
Parameter for Over-Disp.—β_σ	-2.1271	0.7994	0.0078	95%
AIC	704.7			

Rural Undivided Multilane Roadway

Table C3. Summary Statistics (Rural Undivided Multilane).

Variable	Sample Size	Min.	Max.	Mean	SD
Segment Length (mi)	384	0.102	1.854	0.4	0.36
Ave. ADT (vpd)	384	416	28,392	8,540.9	5,074.12
Lane Width (ft)	384	11	16	14	1.82
Outside Shoulder Width (ft)	384	0	15	7	3.89
No. Lanes	384	3	5	4.0	0.28
Annual Number of Total Crashes	384	0	8	0.5	1
Annual Number of KA Crashes	384	0	1	<0.01	0.11
Annual Number of FI Crashes	384	0	4	0.1	0.43

Table C4. Modeling Results (Rural Undivided Multilane).

Variable	Estimate	S.E.	p-Value	Significance Level
Total Crashes				
Intercept—β_0	-5.2097	1.7265	0.0025	95%
log(ADT)—β_{ADT}	0.5110	0.2145	0.0172	95%
Lane Width—β_1	0.1277	0.0846	0.1311	Not Sig.
Outside Shoulder Width—β_2	0.0481	0.0298	0.1067	Not Sig.
Median Width—β_3	-0.3596	0.4173	0.3889	Not Sig.
No. Lanes—β_4	-1.4544	0.3499	<0.001	99.9%
Parameter for Over-Disp.—β_σ	-5.2097	1.7265	0.0025	95%
AIC	465.5			
KA Crashes*				
Intercept—β_0	-19.1272	14.4798	0.1865	Not Sig.
log(ADT)—β_{ADT}	-0.3067	1.2205	0.8016	Not Sig.
Lane Width—β_1	3.9370	NA	NA	Not Sig.
Outside Shoulder Width—β_2	0.4524	0.2106	0.0317	95%
Median Width—β_3	-11.6498	0.3145	< 0.001	99.9%
No. Lanes—β_4	-8.2049	95.6729	0.9317	Not Sig.
Parameter for Over-Disp.—β_σ	-19.1272	14.4798	0.1865	Not Sig.
AIC	53.1			
FI Crashes				
Intercept—β_0	-5.4139	2.7025	0.0451	95%
log(ADT)—β_{ADT}	0.6784	0.4078	0.0962	90%
Lane Width—β_1	0.2121	0.1742	0.2234	Not Sig.
Outside Shoulder Width—β_2	0.0819	0.0592	0.1670	Not Sig.
Median Width—β_3	-1.4096	0.7667	0.0660	90%
No. Lanes—β_4	-2.7349	2.8802	0.3423	Not Sig.
Parameter for Over-Disp.—β_σ	-5.4139	2.7025	0.0451	95%
AIC	293.9			

Note: * indicates that the model is not reliable mainly due to low sample size.

Urban Undivided Two-Lane Roadway

Table C5. Summary Statistics (Urban Undivided Two-Lane).

Variable	Sample Size	Min.	Max.	Mean	SD
Segment Length (mi)	894	0	10	0.70	1.24
Ave. ADT (vpd)	894	0	2	0.10	0.25
Lane Width (ft)	894	0	4	0.20	0.59
Outside Shoulder Width (ft)	894	0.101	1.547	0.40	0.32
Annual Number of Total Crashes	894	221	23,400	5,869.6	3,582.40
Annual Number of KA Crashes	894	9	16	12	1.04
Annual Number of FI Crashes	894	0	11	6.2	3.31

Table C6. Modeling Results (Urban Undivided Two-Lane).

Variable	Estimate	S.E.	p-Value	Significance Level
Total Crashes				
Intercept—β_0	-10.4483	1.0115	<0.001	99.9%
log(ADT)—β_{ADT}	1.1379	0.1043	<0.001	99.9%
Lane Width—β_1	0.1168	0.0576	0.0427	95%
Outside Shoulder Width—β_2	-0.0561	0.0182	0.0020	95%
Parameter for Over-Disp.—β_σ	-1.0637	0.1714	<0.001	99.9%
AIC	1,738.5			
KA Crashes				
Intercept—β_0	-13.1745	2.9723	<0.001	99.9%
log(ADT)—β_{ADT}	1.2415	0.3032	<0.001	99.9%
Lane Width—β_1	0.0396	0.1596	0.8042	Not Sig.
Outside Shoulder Width—β_2	-0.0176	0.0537	0.7435	Not Sig.
Parameter for Over-Disp.—β_σ	-0.8700	1.0986	0.4284	Not Sig.
AIC	352.6			
FI Crashes				
Intercept—β_0	-10.5940	1.4951	<0.001	99.9%
log(ADT)—β_{ADT}	1.0668	0.1530	<0.001	99.9%
Lane Width—β_1	0.0774	0.0833	0.3528	Not Sig.
Outside Shoulder Width—β_2	-0.0222	0.0277	0.4223	Not Sig.
Parameter for Over-Disp.—β_σ	-0.9260	0.3325	0.0054	95%
AIC	956.7			

Urban Divided Multilane Roadway (Non-Freeway)

Table C7. Summary Statistics (Urban Divided Multilane Roadway, Non-Freeway).

Variable	Sample Size	Min.	Max.	Mean	SD
Segment Length (mi)	402	0.100	1.508	0.3	0.27
Ave. ADT (vpd)	402	3,204	46,744	18,018.6	9,107.52
Lane Width (ft)	402	10	16	12.6	1.01
Outside Shoulder Width (ft)	402	0	10	6.9	3.87
Inside Shoulder Width (ft)	402	0	10	3.7	2.74
Median Width	402	1	200	46.7	40
No. Lanes	402	3	6	4.4	0.69
Annual Number of Total Crashes	402	0	34	2.5	4.15
Annual Number of KA Crashes	402	0	2	0.1	0.31
Annual Number of FI Crashes	402	0	17	0.8	1.59

Table C8. Modeling Results (Urban Divided Multilane Roadway, Non-Freeway).

Variable	Estimate	S.E.	p-Value	Significance Level
Total Crashes				
Intercept—β_0	-7.4235	1.2917	<0.001	99.9%
log(ADT)—β_{ADT}	1.1579	0.1118	<0.001	99.9%
Lane Width—β_1	-0.0401	0.0559	0.4725	Not Sig.
Outside Shoulder Width—β_2	-0.0626	0.0209	0.0027	95%
Inside Shoulder Width—β_3	-0.1259	0.0300	<0.001	99.9%
Median Width— β_4	0.0017	0.0019	0.3654	Not Sig.
No. Lanes—β_5	-0.1432	0.1132	0.2057	Not Sig.
Parameter for Over-Disp.—β_σ	-1.1255	0.1096	<0.001	99.9%
AIC	1,610.5			
KA Crashes*				
Intercept—β_0	-10.7456	2.6850	< 0.001	99.9%
log(ADT)—β_{ADT}	0.7952	0.3608	0.0275	95%
Lane Width—β_1	0.0550	0.0942	0.5590	Not Sig.
Outside Shoulder Width—β_2	0.0193	0.0490	0.6940	Not Sig.
Inside Shoulder Width—β_3	0.1950	0.2309	0.3985	Not Sig.
Median Width—β_4	-0.7861	0.8445	0.3520	Not Sig.
No. Lanes—β_5	-10.7456	2.6850	< 0.001	99.9%
Parameter for Over-Disp.—β_σ	0.7952	0.3608	0.0275	95%
AIC	367.6			
FI Crashes				
Intercept—β_0	-7.8646	1.8413	<0.001	99.9%
log(ADT)—β_{ADT}	1.1605	0.1552	<0.001	99.9%
Lane Width—β_1	-0.0727	0.0784	0.3541	Not Sig.
Outside Shoulder Width—β_2	-0.0504	0.0276	0.0681	90%
Inside Shoulder Width—β_3	-0.1371	0.0405	<0.001	99.9%
Median Width—β_4	0.0034	0.0025	0.1627	Not Sig.
No. Lanes—β_5	-0.2441	0.1486	0.1005	Not Sig.
Parameter for Over-Disp.—β_σ	-0.9718	0.1851	<0.001	99.9%
AIC	950.1			

Note: * indicates that the model is not reliable mainly due to low sample size.

Urban Undivided Multilane Roadway

Table C9. Summary Statistics (Urban Undivided Multilane).

Variable	Sample Size	Min.	Max.	Mean	SD
Segment Length (mi)	621	0	42	2.2	4.19
Ave. ADT (vpd)	621	0	3	0.1	0.35
Lane Width (ft)	621	0	14	0.7	1.47
Outside Shoulder Width (ft)	621	0.100	1.856	0.4	0.3
No. Lanes	621	1,669	42,482	14,956.8	8,167.18
Annual Number of Total Crashes	621	10	16	13.4	2.03
Annual Number of KA Crashes	621	0	16	3.4	3.86
Annual Number of FI Crashes	621	3	6	4.3	0.72

Table C10. Modeling Results (Urban Undivided Multilane).

Variable	Estimate	S.E.	p-Value	Significance Level
Total Crashes				
Intercept—β_0	-12.3641	1.0518	<0.001	99.9%
log(ADT)—β_{ADT}	1.2276	0.1422	<0.001	99.9%
Lane Width—β_1	0.1273	0.0364	<0.001	99.9%
Outside Shoulder Width—β_2	-0.0617	0.0183	<0.001	99.9%
No. Lanes —β_3	0.1532	0.0854	0.0730	90%
Parameter for Over-Disp.—β_σ	-0.8370	0.1005	<0.001	99.9%
AIC	2,101.6			
KA Crashes*				
Intercept—β_0	-10.7456	2.6850	< 0.001	99.9%
log(ADT)—β_{ADT}	0.7952	0.3608	0.0275	95%
Lane Width—β_1	0.0550	0.0942	0.5590	Not Sig.
Outside Shoulder Width—β_2	0.0193	0.0490	0.6940	Not Sig.
No. Lanes —β_3	0.1950	0.2309	0.3985	Not Sig.
Parameter for Over-Disp.—β_σ	-0.7861	0.8445	0.3520	Not Sig.
AIC	367.6			
FI Crashes				
Intercept—β_0	-10.8974	1.2542	<0.001	99.9%
log(ADT)—β_{ADT}	0.9552	0.1685	<0.001	99.9%
Lane Width—β_1	0.0940	0.0432	0.0296	95%
Outside Shoulder Width—β_2	-0.0334	0.0227	0.1412	Not Sig.
No. Lanes —β_3	0.2551	0.1028	0.0131	95%
Parameter for Over-Disp.—β_σ	-1.0048	0.1783	<0.001	99.9%
AIC	1,286.5			

Note: * indicates that the model is not reliable mainly due to low sample size.

Rural Interstates and Freeways

Table C11. Summary Statistics (Rural Interstate and Freeway).

Variable	Sample Size	Min.	Max.	Mean	SD
Segment Length (mi)	156	0.116	1.959	0.9	0.56
ADT (vpd)	156	41,641	58,789	50,507.7	5,299.46
Inside Shoulder Width (ft)	156	12	14	12.1	0.44
Median Width (ft)	156	10	24	11.6	4.17
No. Lanes	156	2	10	7.7	2.63
Annual Number of Total Crashes	156	0	64	12.5	10.49
Annual Number of KA Crashes	156	0	4	0.5	0.82
Annual Number of FI Crashes	156	0	12	3.1	2.89

Table C12. Modeling Results (Rural Interstate and Freeway).

Variable	Estimate	S.E.	p-Value	Significance Level
Total Crashes *				
Intercept - β_0	-0.5652	5.3397	0.9157	Not Sig.
log(ADT) - β_{ADT}	0.1609	0.4422	0.7159	Not Sig.
Inside Shoulder Width - β_1	0.2432	0.1200	0.0427	95%
Median Width - β_2	-0.0493	0.0215	0.0219	95%
No. Lanes - β_3	-0.1772	0.0681	0.0093	95%
Parameter for Over-Disp. - β_σ	-0.0093	0.0064	0.1430	Not Sig.
AIC	938.1			
KA Crashes *				
Intercept - β_0	7.1659	17.8181	0.6876	Not Sig.
log(ADT) - β_{ADT}	-0.0357	1.4201	0.9799	Not Sig.
Inside Shoulder Width - β_1	-0.6457	0.5185	< 0.001	99.9%
Median Width - β_2	-1.3473	0.1779	< 0.001	99.9%
No. Lanes - β_3	-0.1526	0.2023	0.4506	Not Sig.
Parameter for Over-Disp. - β_σ	0.0040	0.0214	0.8505	Not Sig.
AIC	277.7			
FI Crashes				
Intercept - β_0	-10.1931	7.3825	0.1674	Not Sig.
log(ADT) - β_{ADT}	1.0473	0.6046	0.0832	90%
Inside Shoulder Width - β_1	0.1982	0.1555	0.2025	Not Sig.
Median Width - β_2	-0.0528	0.0298	0.0761	90%
No. Lanes - β_3	-0.0747	0.0892	0.4029	Not Sig.
Parameter for Over-Disp. - β_σ	-0.0144	0.0090	0.1102	Not Sig.
AIC	597.2			

Note: * indicates that the model is not reliable mainly due to low sample size.

Urban Interstates and Freeways

Table C13. Summary Statistics (Urban Interstates and Freeways).

Variable	Sample Size	Min.	Max.	Mean	SD
Segment Length (mi)	462	0.101	1.942	0.5	0.35
Ave. ADT (vpd)	462	15,989	113,416	53,298.0	22,307.30
Lane Width (ft)	462	12	16	12.4	0.87
Outside Shoulder Width (ft)	462	5	22	10.5	3.37
Inside Shoulder Width (ft)	462	0	10	5.4	2.66
Median Width (ft)	462	4	99	22	16.15
No. Lanes	462	4	14	4.8	1.63
Annual Number of Total Crashes	462	0	92	11.1	14.2
Annual Number of KA Crashes	462	0	4	0.3	0.71
Annual Number of FI Crashes	462	0	34	3.2	4.44

Table C14. Modeling Results (Urban Interstates and Freeways).

Variable	Estimate	S.E.	p-Value	Significance Level
Total Crashes				
Intercept—β_0	-11.9249	1.2366	<0.001	99.9%
log(ADT)—β_{ADT}	1.5332	0.1139	<0.001	99.9%
Lane Width—β_1	-0.0499	0.0510	0.3279	Not Sig.
Outside Shoulder Width—β_2	0.0173	0.0138	0.2084	Not Sig.
Inside Shoulder Width—β_3	-0.1107	0.0171	<0.001	99.9%
Median Width—β_4	-0.0060	0.0024	0.0137	95%
No. Lanes—β_5	-0.0871	0.0295	0.0031	95%
Parameter for Over-Disp.—β_σ	-1.6213	0.0824	<0.001	99.9%
AIC	2,860.5			
KA Crashes				
Intercept—β_0	-11.3411	3.1311	<0.001	99.9%
log(ADT)—β_{ADT}	1.1115	0.2947	<0.001	99.9%
Lane Width—β_1	-0.0785	0.1114	0.4808	Not Sig.
Outside Shoulder Width—β_2	0.0173	0.0352	0.6226	Not Sig.
Inside Shoulder Width—β_3	-0.1039	0.0411	0.0116	95%
Median Width—β_4	0.0034	0.0061	0.5744	Not Sig.
No. Lanes—β_5	0.0536	0.0561	0.3401	Not Sig.
Parameter for Over-Disp.—β_σ	-1.7848	0.7033	0.0112	95%
AIC	655.4			
FI Crashes				
Intercept—β_0	-12.3561	1.4538	<0.001	99.9%
log(ADT)—β_{ADT}	1.4731	0.1363	<0.001	99.9%
Lane Width—β_1	-0.0526	0.0569	0.3555	Not Sig.
Outside Shoulder Width—β_2	0.0047	0.0174	0.7883	Not Sig.
Inside Shoulder Width—β_3	-0.1426	0.0202	<0.001	99.9%
Median Width—β_4	-0.0033	0.0029	0.2565	Not Sig.
No. Lanes—β_5	-0.0619	0.0326	0.0576	90%
Parameter for Over-Disp.—β_σ	-1.6754	0.1234	<0.001	99.9%
AIC	1,909.5			

SEGMENT SPFS AND PLOTS

Table C15. List of Segment SPFs.

Facility Type	Severity	SPF	Dispersion Parameter (θ)	Weight
Rural Divided Multilane	All	$\mu = 0.0016 \times L \times ADT^{0.7376} \times e^{0.2097\times LW-0.0309\times OSW+0.0873\times ISW+0.0001\times MW-0.6038\times NL}$	$L/0.2109$	$\frac{1}{1+\mu\times 0.2109/L}$
	FI	$\mu = 2.7966 \times L \times ADT^{1.0977} \times e^{0.1940\times LW-0.0748\times OSW+0.1226\times ISW+0.0001\times MW-3.5133\times NL}$	$L/0.1192$	$\frac{1}{1+\mu\times 0.1192/L}$
	KA	$\mu = 13.807 \times L \times ADT^{1.0890} \times e^{0.0576\times LW-0.2050\times OSW+0.2779\times ISW+0.0002\times MW-3.7725\times NL}$	$L/0.00012$	$\frac{1}{1+\mu\times 0.00012/L}$
Rural Undivided Multilane	All	$\mu = 0.0055 \times L \times ADT^{0.5110} \times e^{0.1277\times LW+0.0481\times SW-0.3596\times NL}$	$L/0.2335$	$\frac{1}{1+\mu\times 0.2335/L}$
	FI	$\mu = 0.00445 \times L \times ADT^{0.6784} \times e^{0.2121\times LW+0.0819\times SW-1.4096\times NL}$	$L/0.0649$*	$\frac{1}{1+\mu\times 0.0649/L}$
	KA*	$\mu = 4.93 \times 10^{-9} \times L \times ADT^{-0.3067} \times e^{3.9370\times LW+0.4524\times SW-11.6498\times NL}$	$L/0.0003$	$\frac{1}{1+\mu\times 0.0003/L}$
Rural Two-Lane	All	$\mu = 0.0007 \times L \times ADT^{0.9778} \times e^{-0.0399\times LW-0.0500\times SW}$	$L/0.2365$	$\frac{1}{1+\mu\times 0.2365/L}$
	FI	$\mu = 0.0004 \times L \times ADT^{0.9502} \times e^{-0.0471\times LW-0.0542\times SW}$	$L/0.2455$	$\frac{1}{1+\mu\times 0.2455/L}$
	KA	$\mu = 5.09 \times 10^{-5} \times L \times ADT^{0.8375} \times e^{0.0491\times LW-0.0153\times SW}$	$L/1.1684$*	$\frac{1}{1+\mu\times 1.1684/L}$
Rural Interstate & Freeway	All*	$\mu = 0.5683 \times L \times ADT^{0.1609} \times e^{0.2432\times LW-0.0493\times OSW-0.1772\times ISW-0.0093\times MW+0.1250\times NL}$	$L/0.1202$	$\frac{1}{1+\mu\times 0.1202/L}$
	FI	$\mu = 0.0004 \times L \times ADT^{1.0473} \times e^{0.1982\times LW-0.0528\times OSW-0.0747\times ISW-0.0144\times MW-0.1634\times NL}$	$L/0.9110$	$\frac{1}{1+\mu\times 0.9110/L}$
	KA*	$\mu = 1294.5 \times L \times ADT^{-0.0357} \times e^{-0.6457\times LW-1.3473\times OSW-0.1526\times ISW+0.0040\times MW+0.3506\times NL}$	$L/(1.95 \times 10^{9})$	$\frac{1}{1+\mu\times 1.95\times 10^{9}}$

Facility Type	Severity	SPF	Dispersion Parameter (θ)	Weight
Urban Divided Multilane	All	$\mu = 0.0006 \times L \times ADT^{1.1579} \times e^{-0.0401 \times LW - 0.0626 \times OSW - 0.1259 \times ISW + 0.0017 \times MW - 0.1432 \times NL}$	$L/0.3245$	$\frac{1}{1 + \mu \times 0.3245/L}$
	FI	$\mu = 0.0004 \times L \times ADT^{1.1605} \times e^{-0.0727 \times LW - 0.0504 \times OSW - 0.1371 \times ISW + 0.0034 \times MW - 0.2441 \times NL}$	$L/0.3784$	$\frac{1}{1 + \mu \times 0.3784/L}$
	KA*	$\mu = 3.61 \times 10^{-6} \times L \times ADT^{1.2940} \times e^{0.2136 \times LW - 0.0107 \times OSW - 0.0877 \times ISW + 0.0066 \times MW - 0.3885 \times NL}$	$L/0.0018$	$\frac{1}{1 + \mu \times 0.0018/L}$
Urban Undivided Multilane	All	$\mu = 4.30 \times 10^{-6} \times L \times ADT^{1.2276} \times e^{0.1273 \times LW - 0.0617 \times SW + 0.1532 \times NL}$	$L/0.4330$	$\frac{1}{1 + \mu \times 0.4330/L}$
	FI	$\mu = 1.85 \times 10^{-5} \times L \times ADT^{0.9552} \times e^{0.0940 \times LW - 0.0334 \times SW + 0.2551 \times NL}$	$L/0.3661$	$\frac{1}{1 + \mu \times 0.3662/L}$
	KA*	$\mu = 2.15 \times 10^{-5} \times L \times ADT^{0.7952} \times e^{0.0550 \times LW + 0.0193 \times SW + 0.1950 \times NL}$	$L/0.4556$	$\frac{1}{1 + \mu \times 0.4556/L}$
Urban Two-Lane	All	$\mu = 2.90 \times 10^{-5} \times L \times ADT^{1.1379} \times e^{0.1168 \times LW - 0.0561 \times SW}$	$L/0.3452$	$\frac{1}{1 + \mu \times 0.3452/L}$
	FI	$\mu = 2.51 \times 10^{-5} \times L \times ADT^{1.0668} \times e^{0.0774 \times LW - 0.0222 \times SW}$	$L/0.3961$	$\frac{1}{1 + \mu \times 0.3961/L}$
	KA	$\mu = 1.90 \times 10^{-6} \times L \times ADT^{1.2415} \times e^{0.0396 \times LW - 0.0176 \times SW}$	$L/0.4190*$	$\frac{1}{1 + \mu \times 0.4190/L}$
Urban Interstate & Expressway	All	$\mu = 6.62 \times 10^{-6} \times L \times ADT^{1.5332} \times e^{-0.0499 \times LW + 0.0173 \times OSW - 0.1107 \times ISW - 0.0060 \times MW - 0.0871 \times NL}$	$L/0.1976$	$\frac{1}{1 + \mu \times 0.1976/L}$
	FI	$\mu = 4.30 \times 10^{-6} \times L \times ADT^{1.4731} \times e^{-0.0526 \times LW + 0.0047 \times OSW - 0.1426 \times ISW - 0.0033 \times MW - 0.0619 \times NL}$	$L/0.1872$	$\frac{1}{1 + \mu \times 0.1872/L}$
	KA	$\mu = 1.19 \times 10^{-5} \times L \times ADT^{1.1115} \times e^{-0.0785 \times LW + 0.0173 \times OSW - 0.1039 \times ISW + 0.0034 \times MW + 0.0536 \times NL}$	$L/0.1678$	$\frac{1}{1 + \mu \times 0.1678/L}$

Note: * indicates that the model is not reliable mainly due to low sample size.

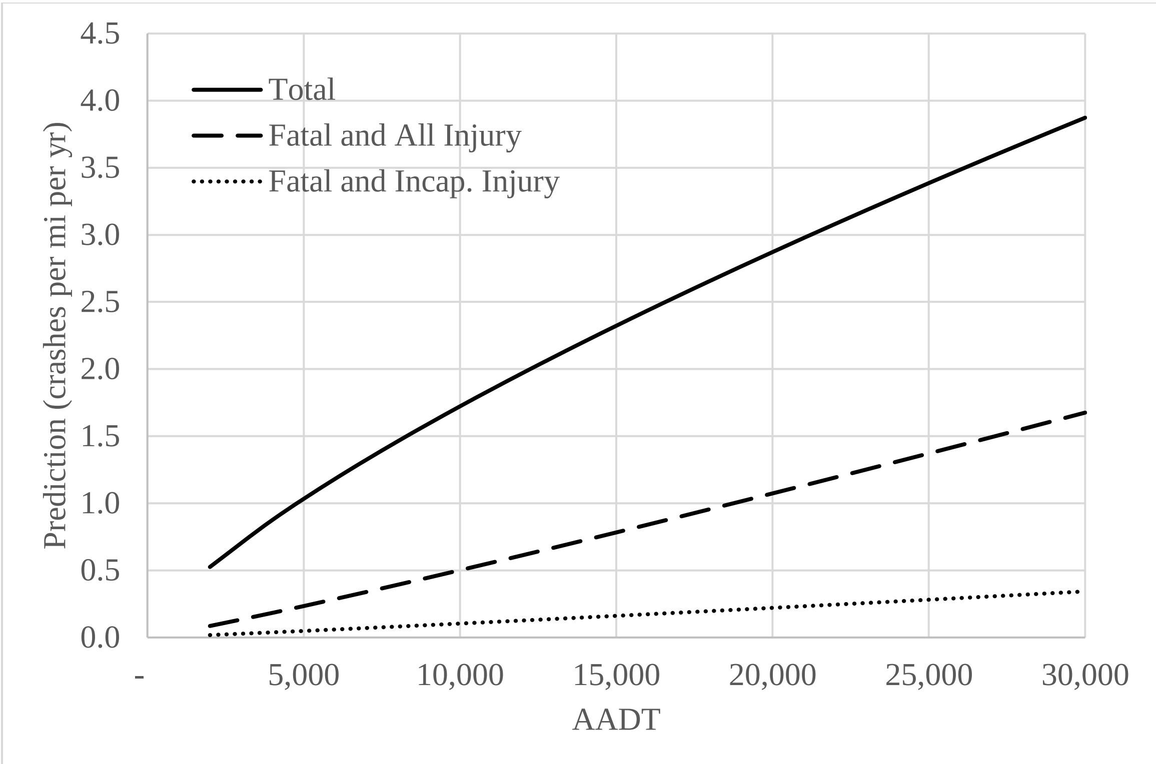


Figure C1. SPF Curves on Rural Divided Multilane Highways.

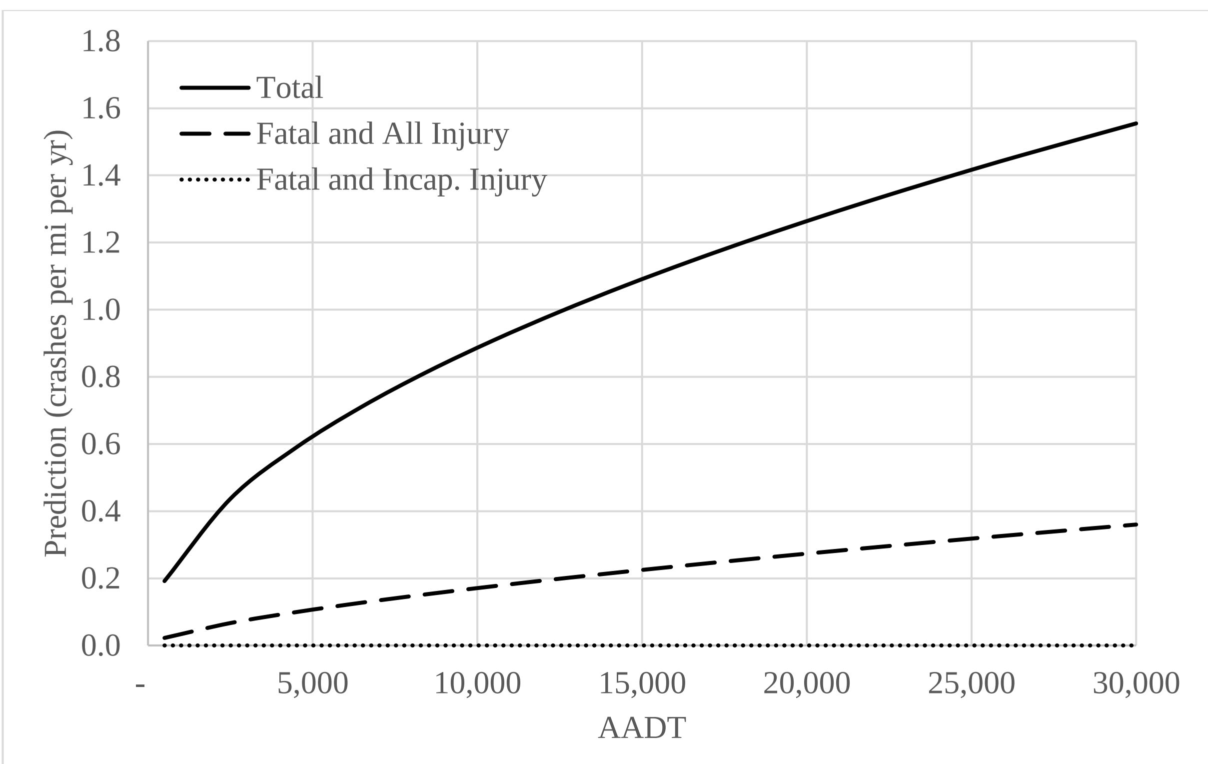


Figure C2. SPF Curves on Rural Undivided Multilane Highways.

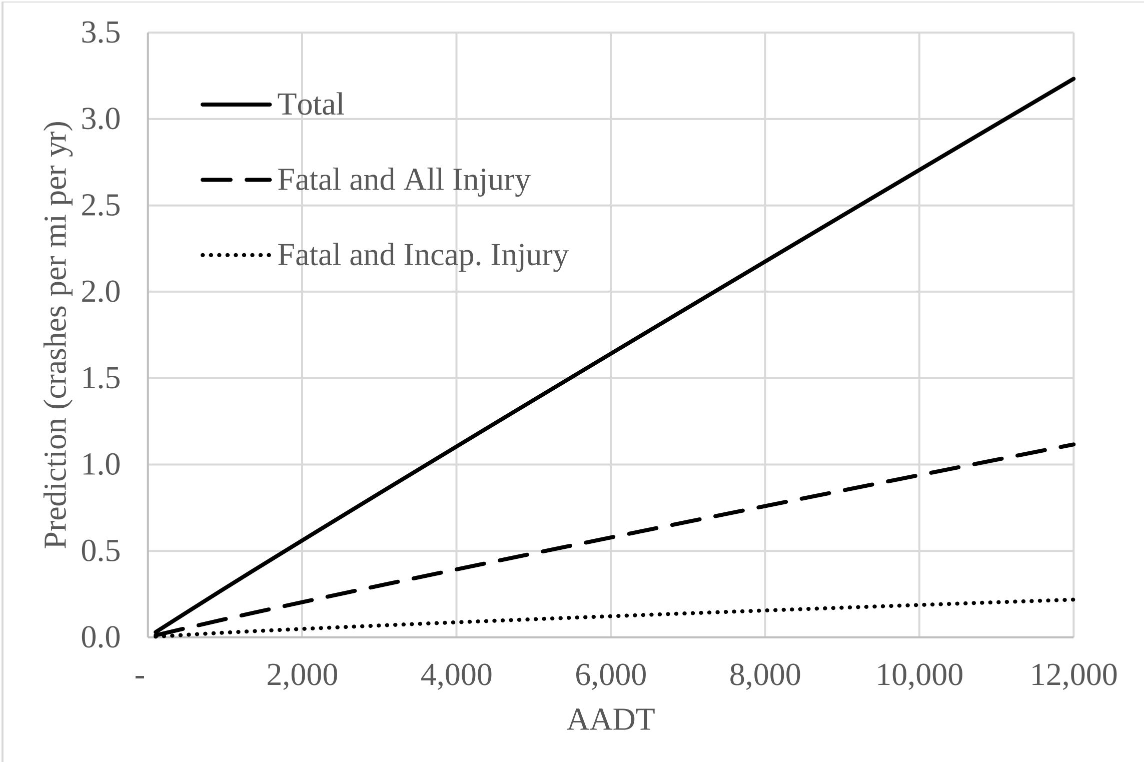


Figure C3. SPF Curves on Rural Two-Lane Highways.

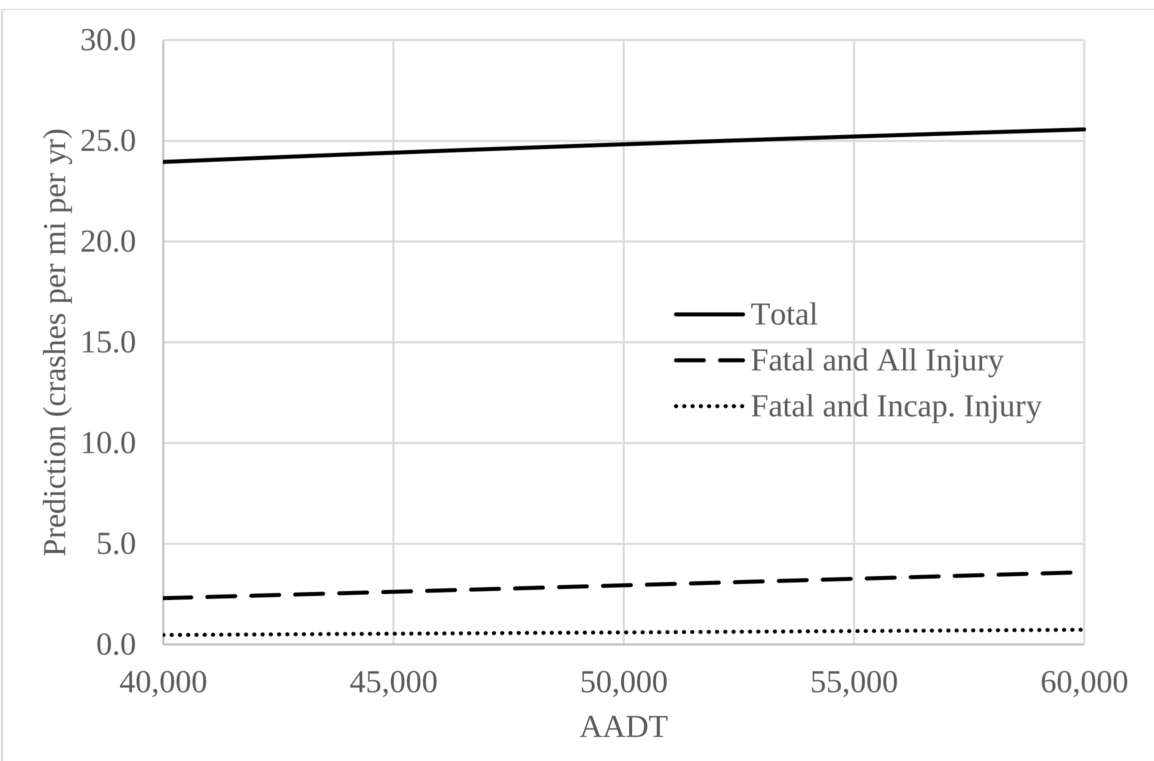


Figure C4. SPF Curves on Rural Freeways.

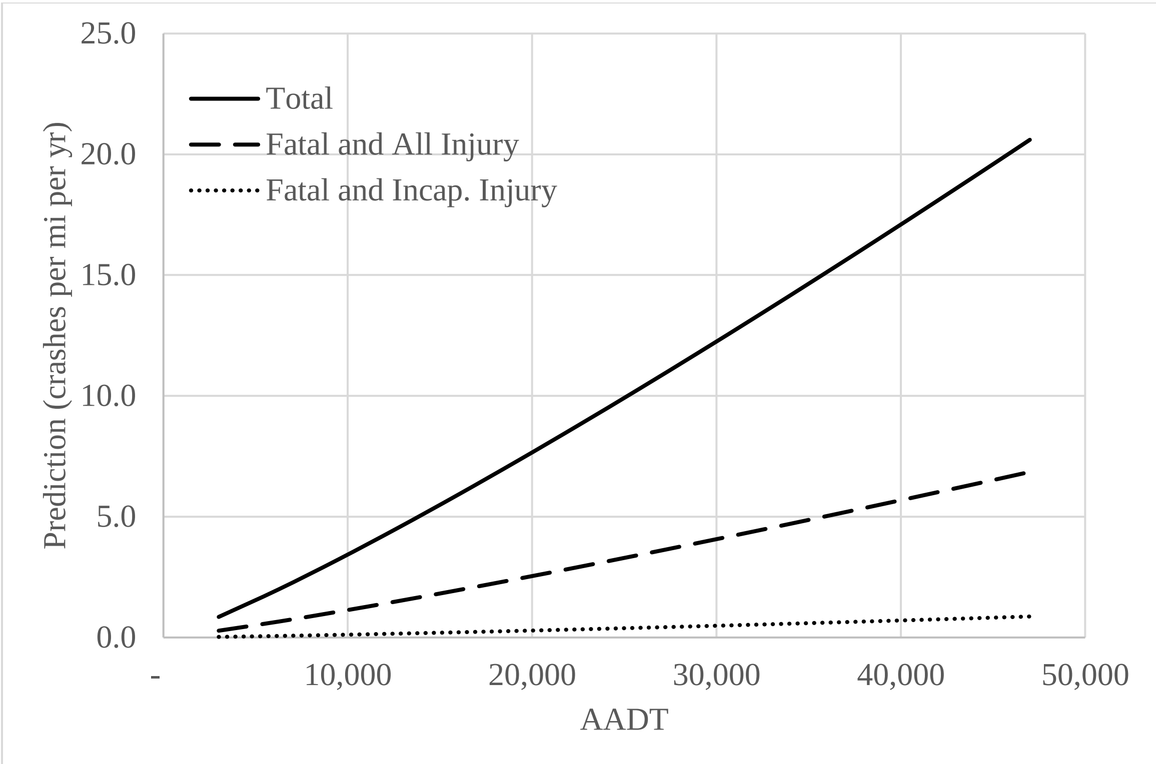


Figure C5. SPF Curves on Urban Divided Multilane Highways.

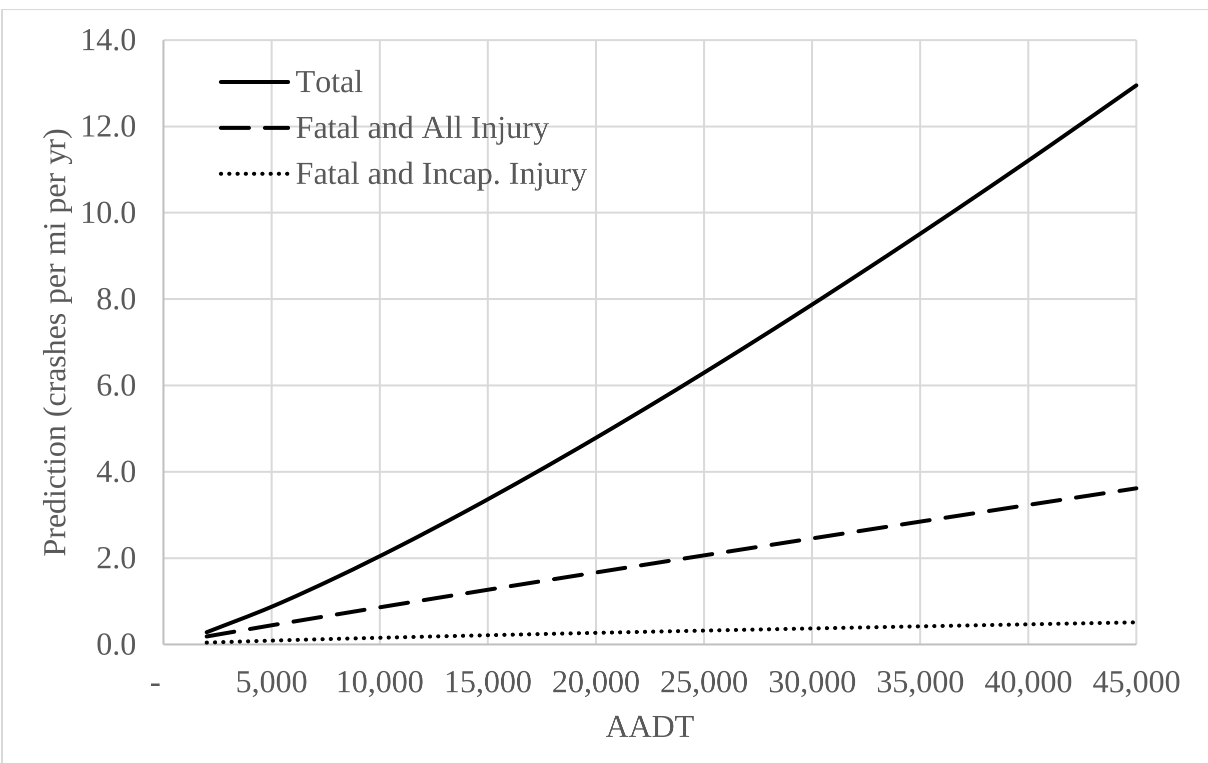


Figure C6. SPF Curves on Urban Undivided Multilane Highways.

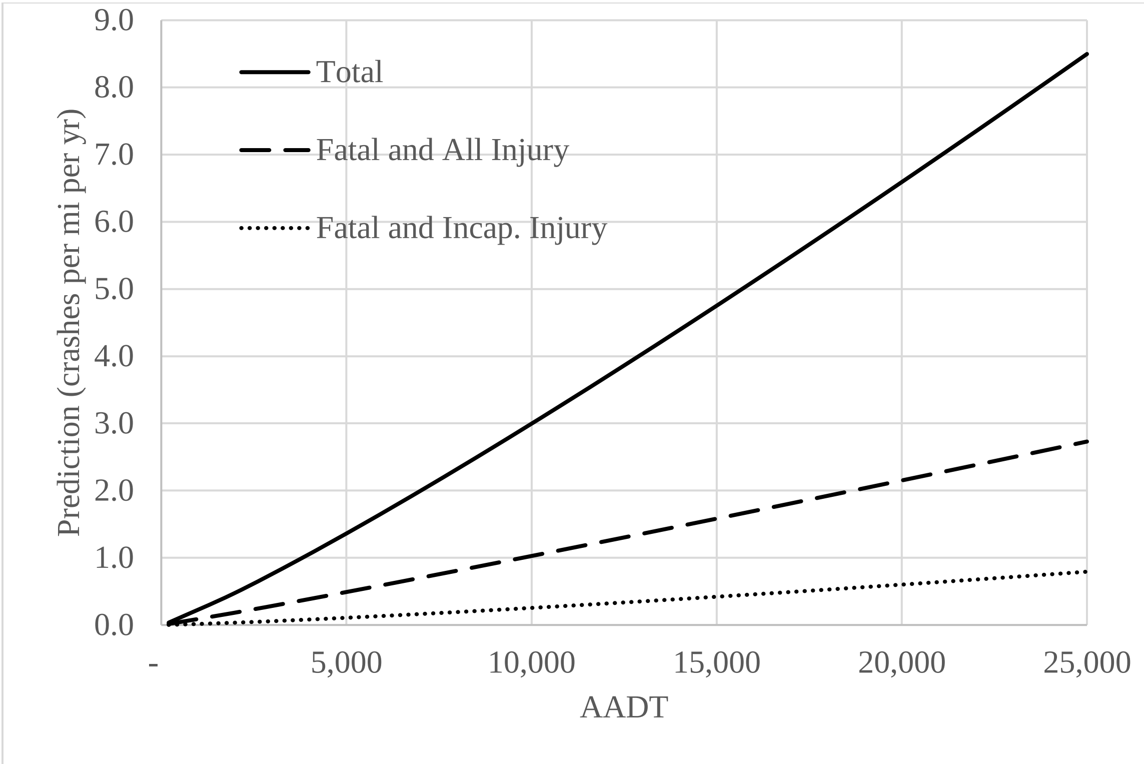


Figure C7. SPF Curves on Urban Two-Lane Highways.

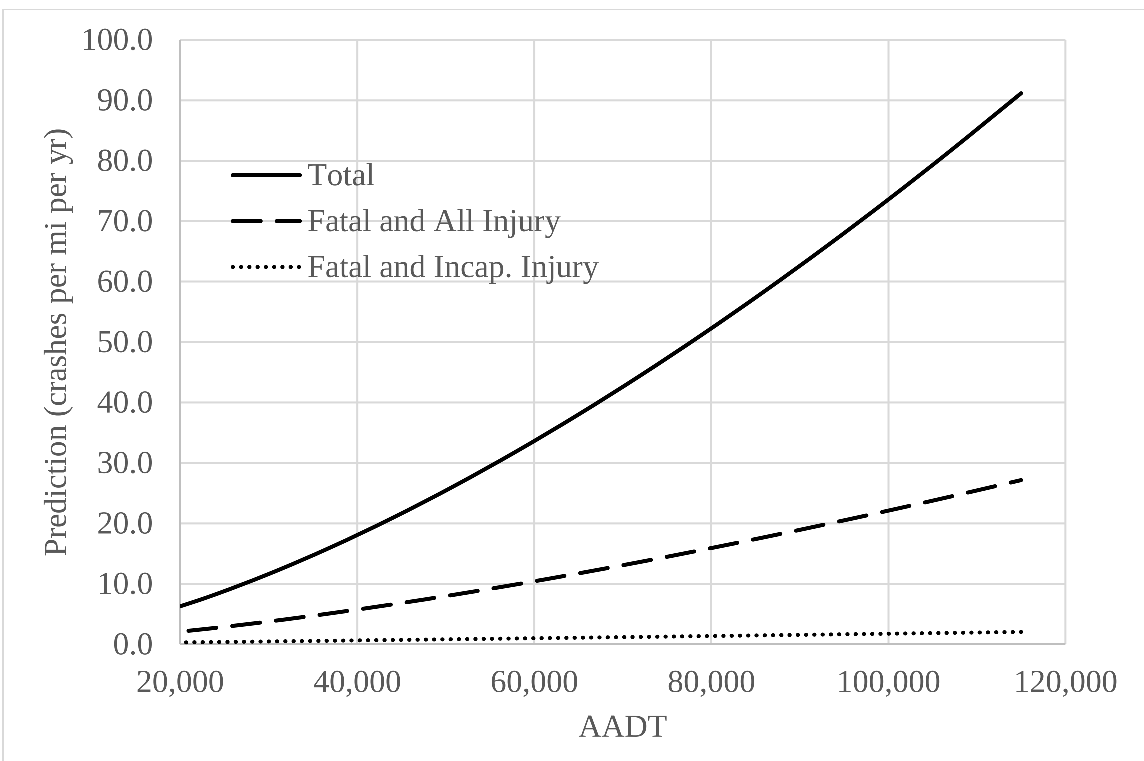


Figure C8. SPF Curves on Urban Freeways.

SPF MODELING RESULTS FOR INTERSECTIONS

Rural 3-Leg Unsignalized Intersections

Table C16. Summary Statistics (R3US).

Variable	Sample Size (Int. Yr.)	Min.	Max.	Mean	SD
Minor Road ADT (vpd)	4,031	102	14,678	3,288.35	3,111.64
Minor Road ADT (vpd)	4,031	101	1,930	222.00	233.86
Annual Number of Total Crashes	4,031	0	7	0.22	0.58
Annual Number of FI Crashes	4,031	0	4	0.08	0.31
Annual Number of KA Crashes	4,031	0	2	0.02	0.15

Table C17. Modeling Results for Intersection Crashes (R3US).

Variable	Estimate	SD	p-Value	Level
Total (KABCO) Crashes				
Intercept (β_0)	-11.2253	0.4448	<0.001	99.9%
Major ADT (β_{Maj_ADT})	0.8067	0.0479	<0.001	99.9%
Minor ADT (β_{Min_ADT})	0.5970	0.0502	<0.001	99.9%
Dispersion (θ)	1.1687	0.1836	<0.001	99.9%
FI (KABC) Crashes				
Intercept (β_0)	-12.8495	0.6898	<0.001	99.9%
Major ADT (β_{Maj_ADT})	0.8270	0.0761	<0.001	99.9%
Minor ADT (β_{Min_ADT})	0.6750	0.0716	<0.001	99.9%
Dispersion (θ)	1.2915	0.4948	0.0090	99.0%
KA Crashes				
Intercept (β_0)	-13.6128	1.2083	<0.001	99.9%
Major ADT (β_{Maj_ADT})	0.6580	0.1376	<0.001	99.9%
Minor ADT (β_{Min_ADT})	0.8299	0.1289	<0.001	99.9%
Dispersion (θ)	0.7461	0.6170	0.2287	Not Significant

Rural 4-Leg Unsignalized Intersections

Table C18. Summary Statistics (R4US).

Variable	Sample Size (Int. Yr.)	Min.	Max.	Mean	SD
Minor Road ADT (vpd)	648	131	14,086	4,739.25	4,003.50
Minor Road ADT (vpd)	648	101	1,846	274.99	315.95
Annual Number of Total Crashes	648	0	7	0.52	0.99
Annual Number of FI Crashes	648	0	4	0.20	0.53
Annual Number of KA Crashes	648	0	2	0.04	0.20

Table C19. Modeling Results for Intersection Crashes (R4US).

Variable	Estimate	SD	p-Value	Level
Total (KABCO) Crashes				
Intercept (β_0)	-9.8950	0.8945	<0.001	99.9%
Major ADT (β_{Maj_ADT})	0.7516	0.0831	<0.001	99.9%
Minor ADT (β_{Min_ADT})	0.5464	0.0817	<0.001	99.9%
Dispersion (θ)	1.3437	0.3124	<0.001	99.9%
FI (KABC) Crashes				
Intercept (β_0)	-10.5250	1.3251	<0.001	99.9%
Major ADT (β_{Maj_ADT})	0.7444	0.1236	<0.001	99.9%
Minor ADT (β_{Min_ADT})	0.5003	0.1172	<0.001	99.9%
Dispersion (θ)	1.0950	0.4625	0.0178	95.0%
KA Crashes				
Intercept (β_0)	-9.4624	2.5207	<0.001	99.9%
Major ADT (β_{Maj_ADT})	0.5284	0.2364	0.0254	95.0%
Minor ADT (β_{Min_ADT})	0.3419	0.2446	0.1622	Not Significant
Dispersion (θ)	1.7213	4.8547	0.7360	Not Significant

Urban 3-Leg Unsignalized Intersections

Table C20. Summary Statistics (U3US).

Variable	Sample Size	Min.	Max.	Mean	SD
Minor Road ADT (vpd)	1,951	444	35,825	10,968.58	7,950.92
Minor Road ADT (vpd)	1,951	103	2,979	477.58	399.49
Annual Number of Total Crashes	1,951	0	23	0.98	1.65
Annual Number of FI Crashes	1,951	0	8	0.32	0.71
Annual Number of KA Crashes	1,951	0	2	0.04	0.21

Table C21. Modeling Results for Intersection Crashes (U3US).

Variable	Estimate	SD	p-Value	Level
Total (KABCO) Crashes				
Intercept (β_0)	-11.4475	0.5177	<0.001	99.9%
Major ADT (β_{Maj_ADT})	1.0194	0.0459	<0.001	99.9%
Minor ADT (β_{Min_ADT})	0.3192	0.0526	<0.001	99.9%
Dispersion (θ)	1.6216	0.1610	<0.001	99.9%
FI (KABC) Crashes				
Intercept (β_0)	-12.0482	0.7859	<0.001	99.9%
Major ADT (β_{Maj_ADT})	0.9523	0.0701	<0.001	99.9%
Minor ADT (β_{Min_ADT})	0.3376	0.0781	<0.001	99.9%
Dispersion (θ)	1.3097	0.2446	<0.001	99.9%
*KA Crashes**				
Intercept (β_0)	-12.9201	1.8544	<0.001	99.9%
Major ADT (β_{Maj_ADT})	0.7783	0.1668	<0.001	99.9%
Minor ADT (β_{Min_ADT})	0.4181	0.1816	0.0213	95.0%
Dispersion (θ)	1.4101	1.7722	0.4344	Not Significant

Note: * indicates that the model is not reliable mainly due to low sample size.

Urban 4-Leg Unsignalized Intersections

Table C22. Summary Statistics (U4US).

Variable	Sample Size	Min.	Max.	Mean	SD
Minor Road ADT (vpd)	658	361	42,482	11,735.31	9,102.60
Minor Road ADT (vpd)	658	118	2,293	452.62	377.78
Annual Number of Total Crashes	658	0	14	1.51	2.18
Annual Number of FI Crashes	658	0	6	0.48	0.88
Annual Number of KA Crashes	658	0	1	0.05	0.22

Table C23. Modeling Results for Intersection Crashes (U3US).

Variable	Estimate	SD	p-Value	Level
Total (KABCO) Crashes				
Intercept (β_0)	-8.7838	0.7896	<0.001	99.9%
Major ADT (β_{Maj_ADT})	0.6778	0.0610	<0.001	99.9%
Minor ADT (β_{Min_ADT})	0.4820	0.0834	<0.001	99.9%
Dispersion (θ)	1.3901	0.1840	<0.001	99.9%
FI (KABC) Crashes				
Intercept (β_0)	-9.4405	1.1230	<0.001	99.9%
Major ADT (β_{Maj_ADT})	0.6511	0.0876	<0.001	99.9%
Minor ADT (β_{Min_ADT})	0.4471	0.1157	<0.001	99.9%
Dispersion (θ)	1.3211	0.3358	<0.001	99.9%
*KA Crashes**				
Intercept (β_0)	-8.5915	2.9536	0.0036	99.0%
Major ADT (β_{Maj_ADT})	0.5807	0.2309	0.0119	95.0%
Minor ADT (β_{Min_ADT})	0.0339	0.3262	0.9172	Not Sig.
Dispersion (θ)	968.5992	12018.6762	0.9413	Not Sig.

Note: * indicates that the model is not reliable mainly due to low sample size.

3-Leg Signalized Intersections

Table C24. Summary Statistics (3S).

Variable	Sample Size	Min.	Max.	Mean	SD
Minor Road ADT (vpd)	174	723	35,825	15,571.98	8,255.81
Minor Road ADT (vpd)	174	161	13,640	3,556.64	3,187.22
Annual Number of Total Crashes	174	0	32	5.22	5.72
Annual Number of FI Crashes	174	0	17	1.62	2.37
Annual Number of KA Crashes	174	0	3	0.15	0.47

Table C25. Modeling Results for Intersection Crashes (3S).

Variable	Estimate	SD	p-Value	Level
Total (KABCO) Crashes				
Intercept (β_0)	-5.1108	0.4448	<0.001	99.9%
Major ADT (β_{Maj_ADT})	0.5247	0.0479	<0.001	99.9%
Minor ADT (β_{Min_ADT})	0.2182	0.0502	<0.001	99.9%
Dispersion (θ)	1.6159	0.1836	<0.001	99.9%
FI (KABC) Crashes				
Intercept (β_0)	-7.8253	0.6898	<0.001	99.9%
Major ADT (β_{Maj_ADT})	0.6483	0.0761	<0.001	99.9%
Minor ADT (β_{Min_ADT})	0.2623	0.0716	0.0021	99.0%
Dispersion (θ)	1.2011	0.4948	<0.001	99.9%
*KA Crashes**				
Intercept (β_0)	-7.2237	1.2083	0.0891	90.0%
Major ADT (β_{Maj_ADT})	0.3971	0.1376	0.3509	Not Sig.
Minor ADT (β_{Min_ADT})	0.1936	0.1289	0.3667	Not Sig.
Dispersion (θ)	0.3793	0.6170	0.1243	Not Sig.

Note: * indicates that the model is not reliable mainly due to low sample size.

4-Leg Signalized Intersections

Table C26. Summary Statistics (4S).

Variable	Sample Size	Min.	Max.	Mean	SD
Minor Road ADT (vpd)	236	388	35,825	13,669.09	8,388.88
Minor Road ADT (vpd)	236	184	8,425	2,053.76	2,107.40
Annual Number of Total Crashes	236	0	30	6.34	5.38
Annual Number of FI Crashes	236	0	10	1.79	1.94
Annual Number of KA Crashes	236	0	3	0.14	0.44

Table C27. Modeling Results for Intersection Crashes (4S).

Variable	Estimate	SD	p-Value	Level
Total (KABCO) Crashes				
Intercept (β_0)	-2.6490	0.8945	<0.001	99.9%
Major ADT (β_{Maj_ADT})	0.3354	0.0831	<0.001	99.9%
Minor ADT (β_{Min_ADT})	0.1851	0.0817	<0.001	99.9%
Dispersion (θ)	2.6931	0.3124	<0.001	99.9%
FI (KABC) Crashes				
Intercept (β_0)	-2.9572	1.3251	<0.001	99.9%
Major ADT (β_{Maj_ADT})	0.2574	0.1236	0.0025	99.0%
Minor ADT (β_{Min_ADT})	0.1570	0.1172	0.0107	95.0%
Dispersion (θ)	2.0975	0.4625	<0.001	99.9%
*KA Crashes**				
Intercept (β_0)	-7.6271	2.5207	0.0111	95.0%
Major ADT (β_{Maj_ADT})	0.4553	0.2364	0.1406	Not Sig.
Minor ADT (β_{Min_ADT})	0.1857	0.2446	0.3316	Not Sig.
Dispersion (θ)	0.3741	4.8547	0.0920	90.0%

Note: * indicates that the model is not reliable mainly due to low sample size.

INTERSECTION SPFS AND PLOTS

Table C28. List of Intersection SPFs.

Facility Type	Severity	SPF	Dispersion Parameter (θ)	Weight
Unsignalized				
Rural 3-Leg	All	$\mu = 1.33 \times 10^{-5} \times Maj\_ADT^{0.8067} \times Min\_ADT^{0.5970}$	1.1687	$\frac{1}{1 + \mu/1.1687}$
	FI	$\mu = 2.63 \times 10^{-6} \times Maj\_ADT^{0.8270} \times Min\_ADT^{0.6750}$	1.2915	$\frac{1}{1 + \mu/1.2915}$
	KA	$\mu = 1.22 \times 10^{-6} \times Maj\_ADT^{0.6580} \times Min\_ADT^{0.8299}$	0.7461*	$\frac{1}{1 + \mu/0.7461}$
Rural 4-Leg	All	$\mu = 5.04 \times 10^{-5} \times Maj\_ADT^{0.7516} \times Min\_ADT^{0.5464}$	1.3437	$\frac{1}{1 + \mu/1.3437}$
	FI	$\mu = 2.69 \times 10^{-5} \times Maj\_ADT^{0.7444} \times Min\_ADT^{0.5003}$	1.0950	$\frac{1}{1 + \mu/1.0950}$
	KA*	$\mu = 7.77 \times 10^{-5} \times Maj\_ADT^{0.5284} \times Min\_ADT^{0.3419}$	1.7213	$\frac{1}{1 + \mu/1.7213}$
Urban 3-Leg	All	$\mu = 1.07 \times 10^{-5} \times Maj\_ADT^{1.0194} \times Min\_ADT^{0.3192}$	1.6216	$\frac{1}{1 + \mu/1.6216}$
	FI	$\mu = 5.86 \times 10^{-6} \times Maj\_ADT^{0.9523} \times Min\_ADT^{0.3376}$	1.3097	$\frac{1}{1 + \mu/1.3097}$
	KA	$\mu = 2.45 \times 10^{-6} \times Maj\_ADT^{0.7783} \times Min\_ADT^{0.4181}$	1.4101*	$\frac{1}{1 + \mu/1.4101}$
Urban 4-Leg	All	$\mu = 1.53 \times 10^{-4} \times Maj\_ADT^{0.6778} \times Min\_ADT^{0.4820}$	1.3901	$\frac{1}{1 + \mu/1.3901}$
	FI	$\mu = 7.94 \times 10^{-5} \times Maj\_ADT^{0.6511} \times Min\_ADT^{0.4471}$	1.3211	$\frac{1}{1 + \mu/1.3211}$

Facility Type	Severity	SPF	Dispersion Parameter (θ)	Weight
	KA*	$\mu = 1.86 \times 10^{-4} \times Maj\_ADT^{0.5807} \times Min\_ADT^{0.0339}$ *	968.6 *	$\frac{1}{1 + \mu/968.6}$
Signalized				
3-Leg	All	$\mu = 6.03 \times 10^{-3} \times Maj\_ADT^{0.5247} \times Min\_ADT^{0.2182}$	1.6159	$\frac{1}{1 + \mu/1.6159}$
	FI	$\mu = 3.99 \times 10^{-4} \times Maj\_ADT^{0.6483} \times Min\_ADT^{0.2623}$	1.2011	$\frac{1}{1 + \mu/1.2011}$
	KA*	$\mu = 7.29 \times 10^{-4} \times Maj\_ADT^{0.3971} \times Min\_ADT^{0.1936}$	0.3793	$\frac{1}{1 + \mu/0.3793}$
4-Leg	All	$\mu = 7.07 \times 10^{-2} \times Maj\_ADT^{0.3354} \times Min\_ADT^{0.1851}$	2.6931	$\frac{1}{1 + \mu/2.6931}$
	FI	$\mu = 5.20 \times 10^{-2} \times Maj\_ADT^{0.2574} \times Min\_ADT^{0.1570}$	2.0975	$\frac{1}{1 + \mu/2.0975}$
	KA*	$\mu = 4.87 \times 10^{-4} \times Maj\_ADT^{0.4553} \times Min\_ADT^{0.1857}$	0.3741	$\frac{1}{1 + \mu/0.3741}$

Note: * indicates that the model is not reliable mainly due to low sample size.

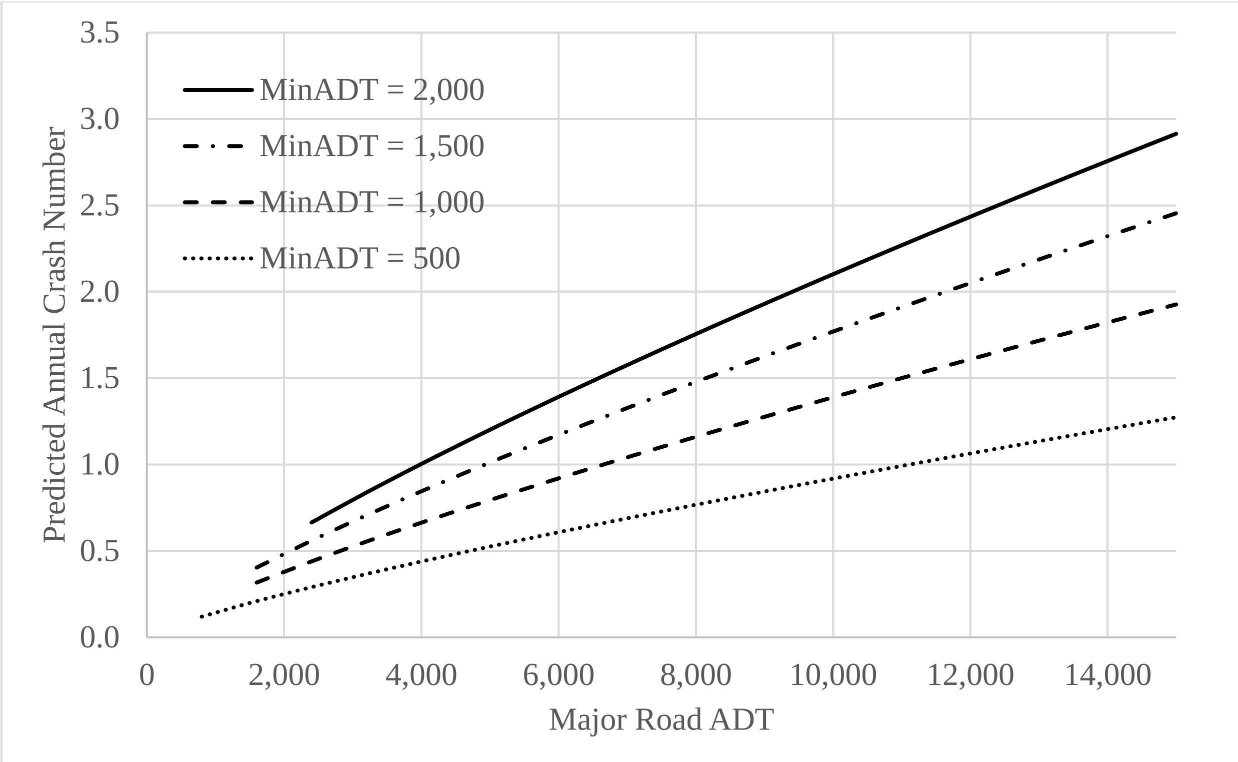


Figure C9. SPF Curve for Total Crashes at R3USs.

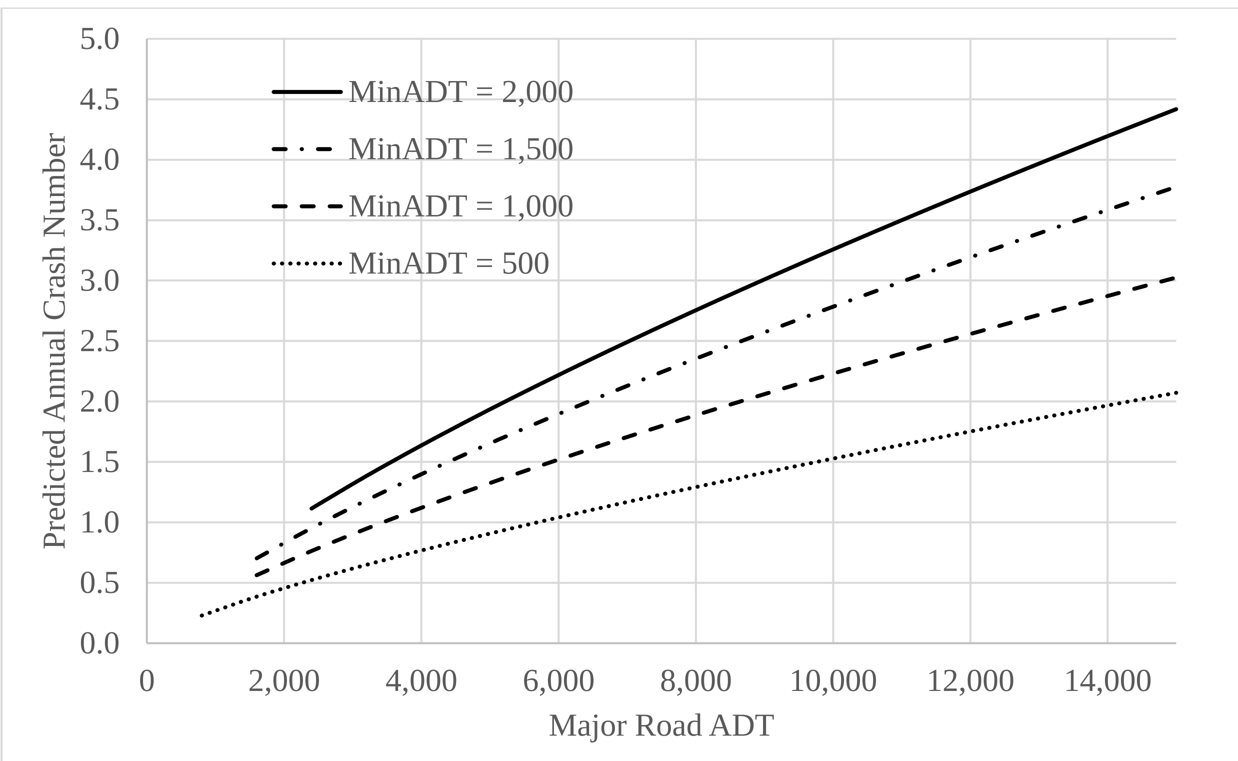


Figure C10. SPF Curve for Total Crashes at Rural 4-Leg Unsignalized Intersections.

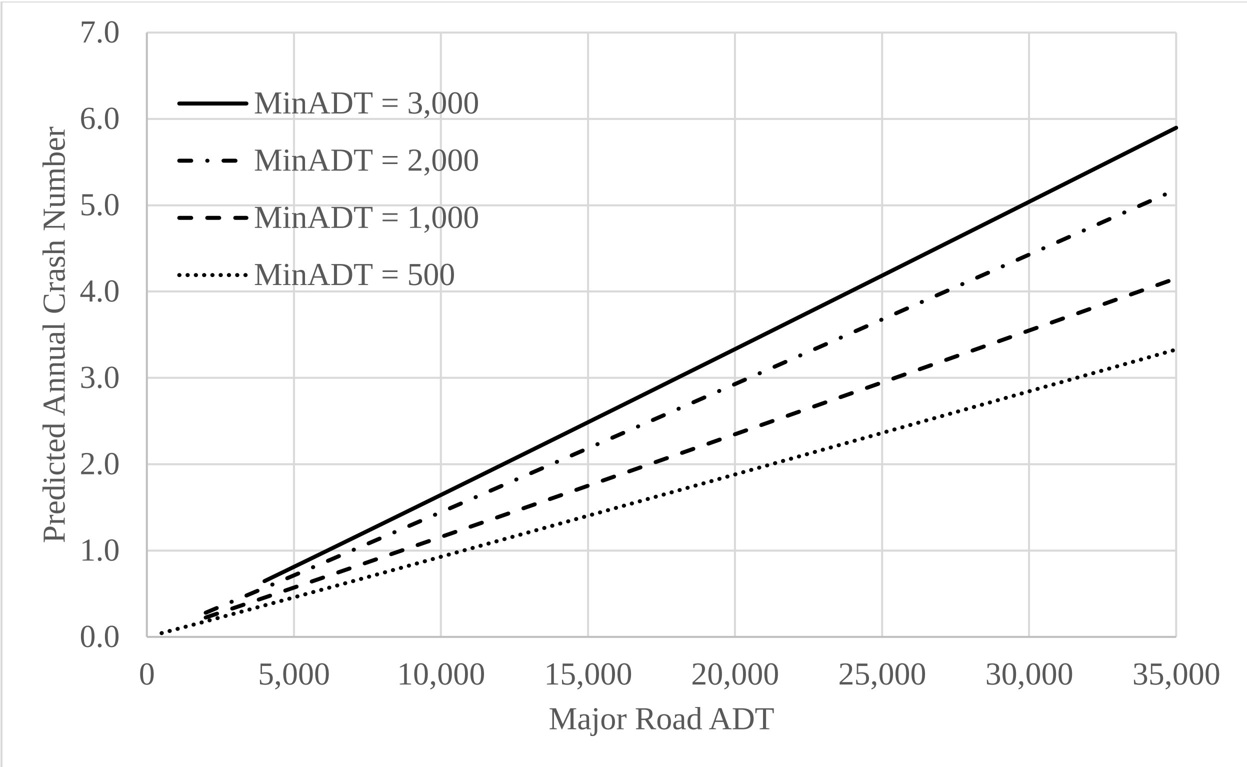


Figure C11. SPF Curve for Total Crashes at Urban 3-Leg Unsignalized Intersections.

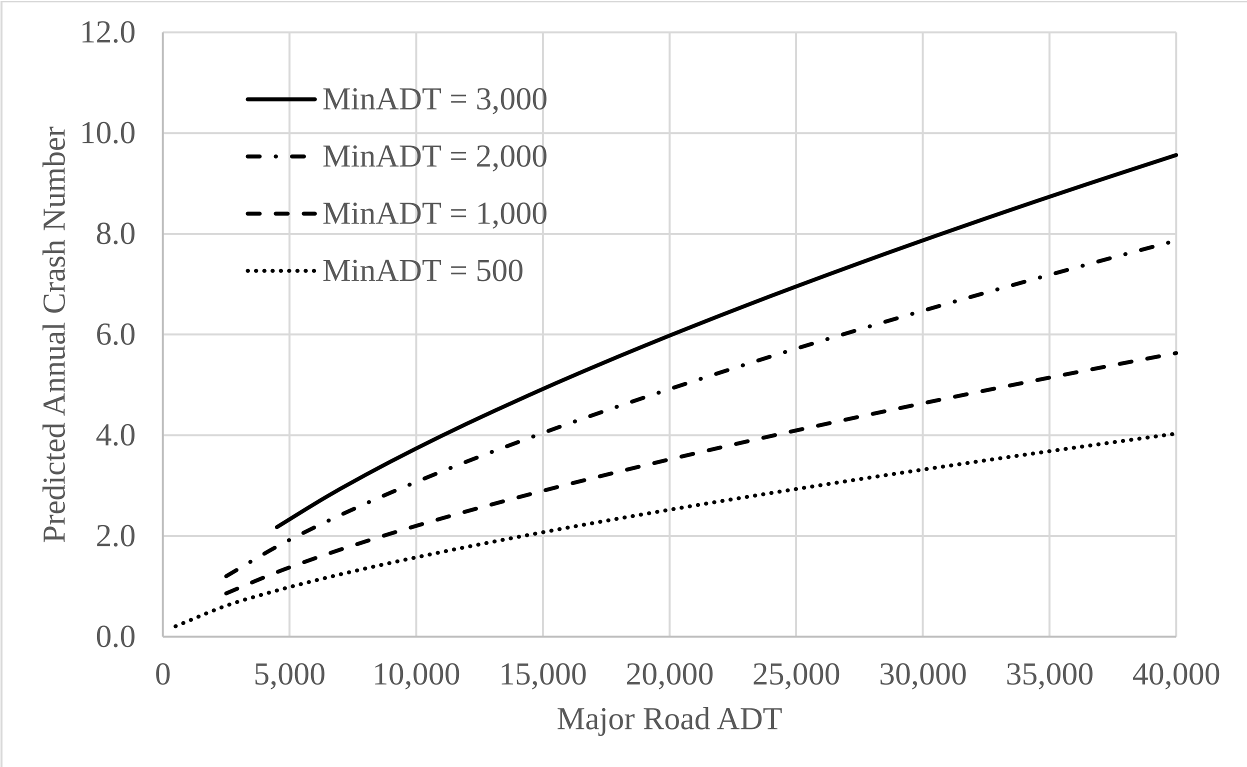


Figure C12. SPF Curve for Total Crashes at Urban 4-Leg Unsignalized Intersections.

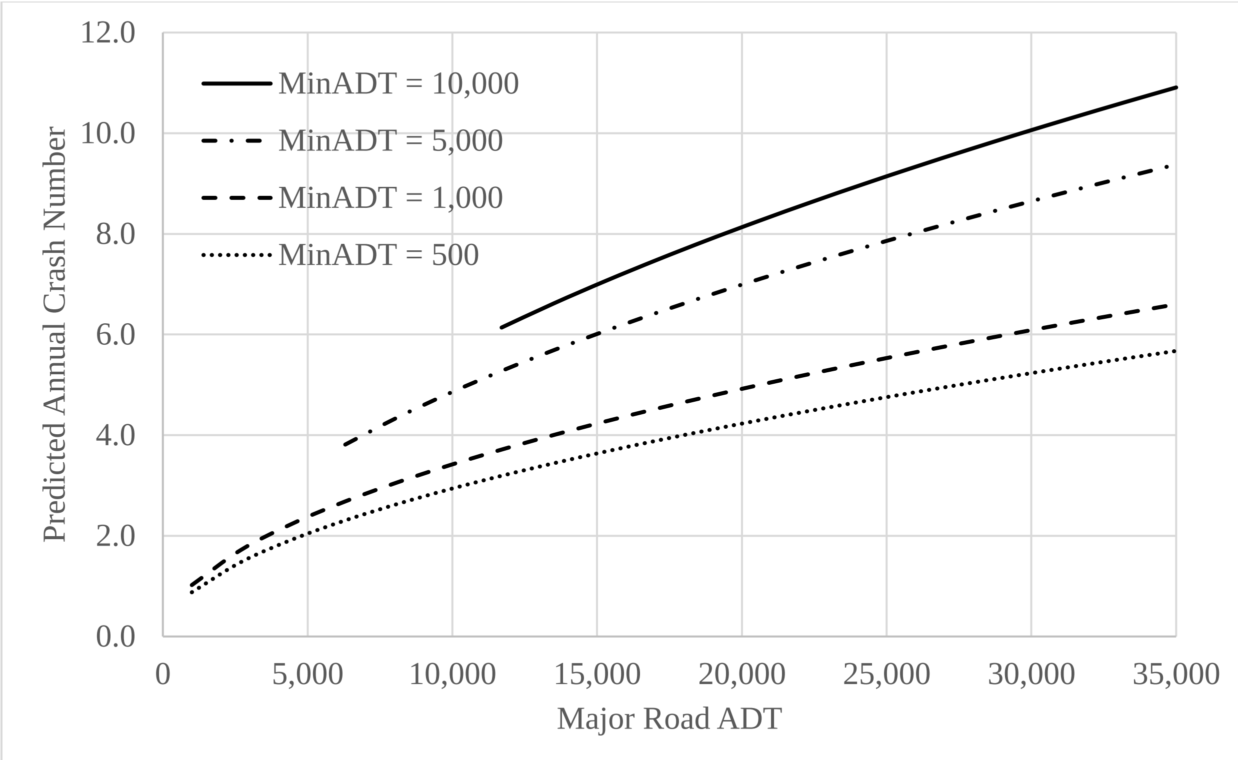


Figure C13. SPF Curve for Total Crashes at 3-Leg Signalized Intersections.

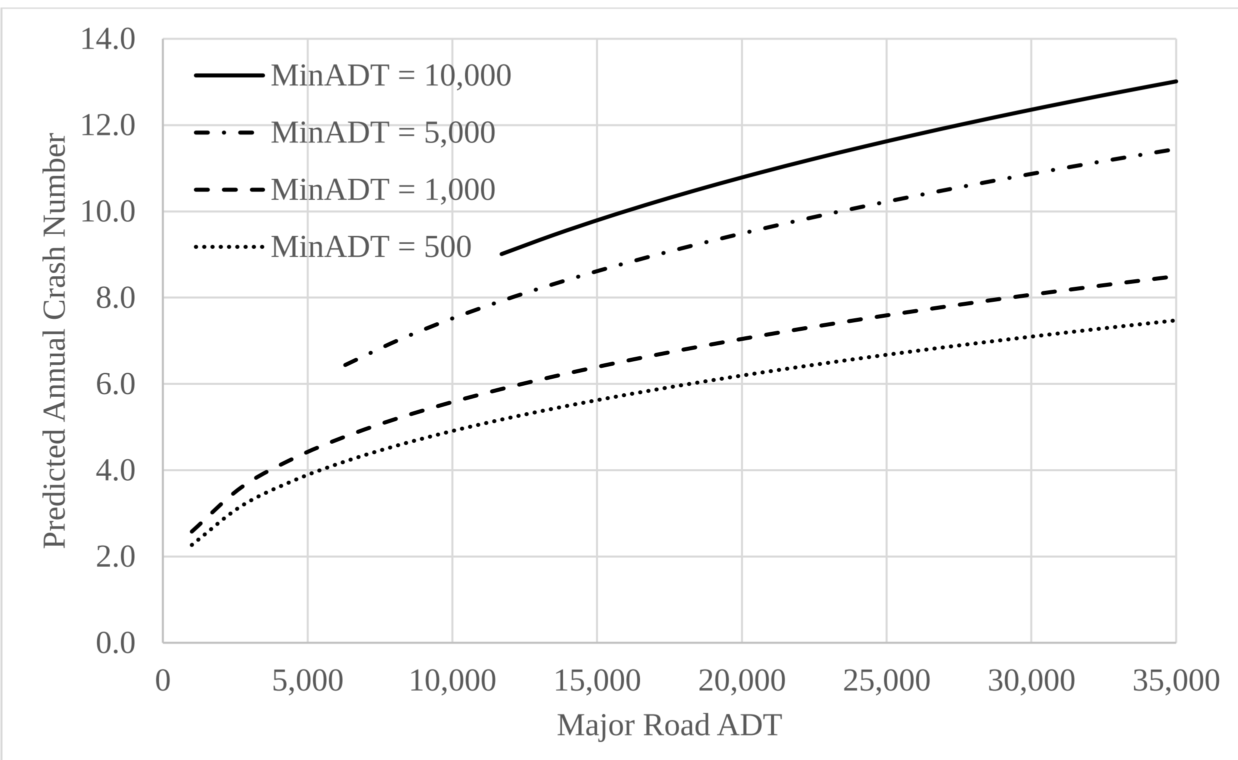


Figure C14. SPF Curve for Total Crashes at 4-Leg Signalized Intersections.

APPENDIX D: ROADWAY SEGMENTS AND INTERSECTION WITH VERY HIGH AND HIGH POTENTIAL FOR SAFETY IMPROVEMENT

ROADWAY SEGMENTS WITH VERY HIGH AND HIGH POTENTIAL FOR SAFETY IMPROVEMENT BY SEGMENT CATEGORY

Table D1. Rural Multilane Divided Roadway Segments with Very High Potential for Safety Improvement.

Highway Name and Number		Control and Section Number	From DFO	To DFO	Length (feet)	AADT	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
SH	124	0368-01	23.64	23.799	839.5	7,510	10	1.25	4.36	3.48	Very High
US	96	0064-08	70.895	71.221	1,721.3	7,271	11	1.53	3.91	2.57	Very High
US	90	0028-03	686.866	687.625	4,007.5	15,684	33	6.45	16.39	2.54	Very High
US	90	0028-05	711.414	711.531	617.8	7,286	2	0.06	0.13	2.14	Very High
US	90	0028-03	681.657	681.759	538.6	16,899	3	0.73	1.49	2.04	Very High
US	90	0028-06	721.387	721.583	1,034.9	9,451	5	1.12	2.24	1.99	Very High
SH	124	0368-01	22.298	22.647	1,842.7	10,730	11	3.58	6.63	1.85	Very High
SH	124	0368-01	22.175	22.298	649.4	10,730	2	0.32	0.59	1.83	Very High

Table D2. Rural Multilane Divided Roadway Segments with High Potential for Safety Improvement.

Highway Name and Number		Control and Section Number	From DFO	To DFO	Length (feet)	AADT	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
SH	73	0508-03	2.136	2.283	776.2	9,690	3	0.76	1.38	1.81	High
FM	1663	0368-05	16.333	16.613	1,478.4	9,615	7	2.56	4.28	1.68	High
US	90	0028-03	684.405	684.568	860.6	16,899	4	1.46	2.45	1.67	High
US	90	0028-06	721.159	721.387	1,203.8	9,451	4	1.31	2.09	1.6	High
US	96	0065-05	120.388	120.944	2,935.7	17,269	17	8.47	12.88	1.52	High
US	69	0200-10	304.32	304.472	802.6	11,591	2	0.58	0.88	1.52	High
SH	63	0244-02	18.122	18.231	575.5	3,413	1	0.15	0.22	1.49	High
FM	1405	1024-02	4.623	4.724	533.3	6,611	1	0.22	0.33	1.48	High
US	96	0065-05	120.049	120.358	1,631.5	17,269	7	3.5	5.05	1.44	High
SH	63	0244-02	17.991	18.122	691.7	2,611	1	0.14	0.21	1.44	High
US	190	0244-04	573.792	573.919	670.6	3,361	1	0.12	0.17	1.43	High
US	90	0028-05	710.953	711.414	2,434.1	7,286	3	0.24	0.34	1.41	High
SH	124	0368-01	22.942	23.145	1,071.8	11,263	4	2.16	2.96	1.37	High
SH	146	0389-01	68.036	68.263	1,198.6	12,894	3	1.33	1.82	1.37	High
US	96	0065-04	113.968	114.207	1,261.9	12,822	3	1.4	1.87	1.33	High
US	96	0065-05	124.527	124.823	1,562.9	12,372	5	2.75	3.62	1.32	High

Table D3. Rural Interstate Segments with Very High Potential for Safety Improvement.

Highway Name and Number		Control and Section Number	From DFO	To DFO	Length (feet)	AADT	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
IH	10	0739-01	827.637	828.463	4,361.3	42,269	141	76.96	127.49	1.66	Very High
IH	10	0508-02	811.271	811.588	1,673.8	50,415	22	10.23	16.86	1.65	Very High
IH	10	0739-02	837.036	837.284	1,309.4	42,712	19	10.93	16.08	1.47	Very High

Table D4. Rural Interstate Segments with High Potential for Safety Improvement.

Highway Name and Number		Control and Section Number	From DFO	To DFO	Length (feet)	AADT	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
IH	10	0028-11	867.02	867.646	3,305.3	57,698	52	30.9	44.91	1.45	High
IH	10	0508-02	803.171	803.685	2,713.9	55,480	24	13.46	18.87	1.4	High
IH	10	0508-02	804.312	805.471	6,119.5	55,480	72	44.94	61.38	1.37	High
IH	10	0508-02	802.338	802.52	961.0	55,480	13	8.3	11.33	1.37	High
IH	10	0028-14	877.886	878.527	3,384.5	53,069	90	64.7	84.97	1.31	High
IH	10	0739-02	833.626	835.331	9,002.4	42,712	103	75.12	92.92	1.24	High

Table D5. Rural Two-Lane Roadway Segments with Very High Potential for Safety Improvement.

Highway Name and Number		Control and Section Number	From DFO	To DFO	Length (feet)	AADT	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
SH	62	0243-03	17.241	17.617	1,985.3	11,914	16	2.74	7.59	2.77	Very High
US	69	0200-07	272.255	272.444	997.9	10,239	8	1.36	3.74	2.74	Very High
US	190	0213-07	532.62	532.783	860.6	7,249	5	0.87	2.08	2.38	Very High
SH	105	0593-01	93.993	94.096	543.8	7,276	3	0.51	1.2	2.37	Very High
US	69	0200-08	279.128	279.412	1,499.5	7,013	8	1.35	3.12	2.32	Very High
SH	63	0244-02	29.654	29.948	1,552.3	4,728	7	0.96	2.2	2.3	Very High
FM	1004	1274-01	6.515	6.626	586.1	774	2	0.1	0.22	2.26	Very High
SH	63	0214-03	62.075	62.185	580.8	1,143	2	0.13	0.28	2.17	Very High
SH	105	1096-01	121.644	121.785	744.5	5,467	3	0.52	1.09	2.1	Very High
FM	565	1024-01	3.451	3.811	1,900.8	10,960	13	3.86	8.02	2.08	Very High
FM	776	0214-05	1.083	1.292	1,103.5	539	3	0.13	0.25	2.04	Very High
FM	1131	0784-04	12.108	12.563	2,402.4	972	7	0.5	1.03	2.04	Very High
SH	87	0305-03	121.823	122.111	1,520.6	2,918	5	0.6	1.23	2.04	Very High
FM	1413	1421-01	0	0.15	792.0	3,561	3	0.54	1.09	2.03	Very High
FM	1942	1812-02	10.132	10.298	876.5	11,644	6	1.82	3.69	2.03	Very High
SH	321	0593-01	17.373	17.525	802.6	5,557	3	0.56	1.11	1.98	Very High
FM	787	0813-01	15.728	15.847	628.3	2,204	2	0.27	0.52	1.97	Very High
FM	563	1023-01	17.109	17.24	691.7	3,743	2	0.41	0.77	1.87	Very High
SH	124	0368-02	20.085	20.223	728.6	3,025	2	0.29	0.52	1.8	Very High
US	190	0244-04	567.979	568.268	1,525.9	3,192	4	0.65	1.16	1.78	Very High
US	190	0213-08	555.305	555.438	702.2	4,631	2	0.42	0.74	1.76	Very High
SH	82	2367-01	3.971	4.448	2,518.6	4,501	7	1.45	2.51	1.73	Very High
FM	2799	0244-08	4.839	5.027	992.6	785	2	0.16	0.27	1.69	Very High
SH	87	0305-06	149.14	149.261	638.9	6,761	2	0.55	0.93	1.69	Very High
SH	63	0244-02	29.948	30.172	1,182.7	4,728	3	0.73	1.23	1.68	Very High

BS	105	0338-05	0	0.322	1,700.2	7,021	6	1.92	3.22	1.68	Very High
SH	124	0368-02	14.522	14.689	881.8	4,170	2	0.47	0.79	1.67	Very High
SH	105	1096-01	121.803	121.938	712.8	5,467	2	0.5	0.83	1.67	Very High
SH	62	0243-03	17.924	18.218	1,552.3	8,459	5	1.53	2.54	1.66	Very High
SH	87	0305-06	147.509	148.409	4,752.0	6,761	14	4.08	6.69	1.64	Very High
FM	1010	1061-01	2.167	2.984	4,313.8	5,686	12	3.45	5.59	1.62	Very High
FM	2090	1912-03	14.383	14.56	934.6	4,889	3	0.99	1.6	1.62	Very High
SH	61	0242-03	16.432	16.633	1,061.3	1,912	2	0.29	0.47	1.61	Very High
SH	87	0304-06	100.405	100.614	1,103.5	1,986	2	0.27	0.44	1.6	Very High
SH	87	0305-03	121.423	121.823	2,112.0	2,038	4	0.59	0.94	1.6	Very High
SH	63	0244-02	27.568	27.735	881.8	3,414	2	0.41	0.65	1.59	Very High
SH	62	0243-03	17.002	17.241	1,261.9	9,413	4	1.38	2.2	1.59	Very High
US	69	0200-04	252.404	252.505	533.3	2,422	1	0.17	0.27	1.59	Very High
FM	1003	0811-02	4.36	4.475	607.2	849	1	0.08	0.12	1.59	Very High
SH	105	0339-04	138.59	138.953	1,916.6	8,901	6	2.15	3.4	1.58	Very High
SH	146	0388-03	48.638	48.935	1,568.2	9,660	5	1.8	2.83	1.58	Very High
US	69	0200-08	282.19	282.342	802.6	5,834	2	0.6	0.95	1.57	Very High
FM	1960	1685-04	39.472	39.812	1,795.2	7,674	5	1.74	2.73	1.56	Very High
FM	1442	1284-01	6.687	6.899	1,119.4	6,769	3	0.96	1.5	1.56	Very High
FM	82	1583-02	9.953	10.343	2,059.2	1,004	3	0.45	0.69	1.55	Very High
FM	787	0813-02	41.504	41.848	1,816.3	1,230	3	0.43	0.66	1.54	Very High
FM	565	1024-01	5.51	5.646	718.1	4,813	2	0.65	1.01	1.54	Very High
SH	146	0388-03	42.562	42.802	1,267.2	6,267	3	0.93	1.42	1.53	Very High
FM	92	0703-01	12.994	13.398	2,133.1	1,854	4	0.85	1.3	1.53	Very High
SH	87	0305-01	110.932	111.277	1,821.6	2,239	3	0.51	0.78	1.53	Very High
SH	105	0951-01	119.008	119.179	902.9	4,453	2	0.52	0.78	1.52	Very High
US	69	0200-05	257.777	257.999	1,172.2	2,531	2	0.39	0.59	1.52	Very High
US	190	0213-08	555.438	555.616	939.8	4,631	2	0.56	0.85	1.51	Very High
FM	565	1024-01	5.792	6.081	1,525.9	4,813	4	1.39	2.1	1.51	Very High
US	69	0200-06	263.111	263.797	3,622.1	3,742	7	1.76	2.65	1.5	Very High
SH	65	0368-01	0.275	0.519	1,288.3	1,102	2	0.28	0.41	1.5	Very High

FM	105	0710-01	0.197	0.367	897.6	8,549	3	1.28	1.92	1.5	Very High
FM	1406	0368-06	12.662	12.777	607.2	1,982	1	0.19	0.29	1.49	Very High
FM	105	0710-01	7.555	8.13	3,036.0	3,951	6	1.64	2.44	1.49	Very High
SH	61	0242-03	12.315	12.709	2,080.3	2,988	4	1.08	1.61	1.49	Very High
SH	124	0368-02	11.954	12.14	982.1	4,087	2	0.52	0.77	1.49	Very High
SH	146	0388-03	43.298	43.449	797.3	7,971	2	0.74	1.11	1.49	Very High
US	69	0200-08	283.566	283.723	829.0	6,584	2	0.7	1.04	1.49	Very High
FM	365	0932-02	13.937	14.038	533.3	2,858	1	0.24	0.36	1.48	Very High
SH	105	0593-01	94.341	96.1	9,287.5	7,276	24	9.09	13.48	1.48	Very High
SH	87	0305-07	150.8	151.034	1,235.5	6,909	3	1.09	1.61	1.47	Very High
SH	105	0951-02	121.277	121.473	1,034.9	4,696	2	0.62	0.91	1.46	Very High
US	287	0341-04	677.763	677.897	707.5	2,248	1	0.21	0.3	1.46	Very High
FM	2799	0244-09	7.397	7.942	2,877.6	1,589	4	0.61	0.89	1.45	Very High
US	190	0213-07	545.073	545.471	2,101.4	4,198	4	1.15	1.68	1.45	Very High
FM	770	1096-01	18.787	19.011	1,182.7	2,709	2	0.49	0.71	1.45	Very High
US	69	0200-07	278.339	278.717	1,995.8	7,577	5	1.93	2.81	1.45	Very High
SH	63	0214-01	35.366	35.621	1,346.4	1,817	2	0.33	0.47	1.45	Very High
FM	1013	1237-01	17.919	18.06	744.5	904	1	0.14	0.2	1.44	Very High
FM	1131	0784-04	14.353	14.62	1,409.8	4,738	3	0.94	1.36	1.44	Very High
FM	365	0932-01	15.625	15.933	1,626.2	3,994	3	0.92	1.32	1.43	Very High
FM	1131	0784-04	12.947	13.219	1,436.2	3,467	3	1.05	1.5	1.43	Very High
FM	1409	0762-02	11.614	12.151	2,835.4	3,597	5	1.45	2.07	1.43	Very High
SH	62	0243-02	13.898	14.533	3,352.8	5,849	7	2.65	3.76	1.42	Very High
US	190	0244-03	567.453	567.69	1,251.4	3,113	2	0.49	0.69	1.42	Very High
SH	12	0499-02	16.008	16.116	570.2	4,187	1	0.31	0.43	1.42	Very High
FM	563	1023-01	17.24	17.367	670.6	3,743	1	0.32	0.45	1.41	Very High
US	190	0213-08	547.859	548.295	2,302.1	4,605	5	1.64	2.32	1.41	Very High
US	96	0064-08	64.862	65.026	865.9	4,629	2	0.68	0.96	1.41	Very High
US	69	0200-07	277.737	278.287	2,904.0	7,577	7	2.96	4.16	1.41	Very High
SH	65	0368-01	15.347	15.493	770.9	1,303	1	0.2	0.28	1.41	Very High
FM	834	1146-01	8.873	8.988	607.2	2,178	1	0.26	0.37	1.41	Very High

FM	1131	0784-04	15.599	15.999	2,112.0	4,738	4	1.41	2	1.41	Very High
SH	87	0305-06	148.586	148.759	913.4	6,761	2	0.78	1.1	1.41	Very High
SH	124	0368-02	16.494	16.699	1,082.4	4,170	2	0.58	0.82	1.41	Very High
US	69	0200-07	272.842	273.107	1,399.2	10,239	4	1.91	2.69	1.4	Very High
SH	146	0388-03	43.994	44.167	913.4	7,694	2	0.84	1.17	1.4	Very High
SH	146	0388-02	26.971	27.524	2,919.8	2,019	4	0.94	1.31	1.4	Very High
FM	1943	1828-01	8.032	8.261	1,209.1	2,419	2	0.6	0.83	1.4	Very High
SH	124	0367-01	37.261	37.455	1,024.3	3,779	2	0.5	0.7	1.4	Very High
FM	105	0710-02	8.964	9.164	1,056.0	4,796	2	0.69	0.97	1.4	Very High
US	90	0028-05	706.781	706.954	913.4	7,286	2	0.84	1.16	1.39	Very High
FM	1078	1286-01	0.497	0.66	860.6	4,800	2	0.86	1.2	1.39	Very High
FM	777	1109-01	6.69	6.872	961.0	145	1	0.03	0.04	1.39	Very High
FM	1293	1947-01	0.118	0.264	770.9	1,295	1	0.19	0.26	1.39	Very High
FM	105	0710-01	0	0.197	1,040.2	8,549	3	1.48	2.06	1.39	Very High
FM	1960	0762-01	41.751	41.972	1,166.9	8,656	3	1.28	1.77	1.39	Very High
FM	1942	1812-02	9.827	10.132	1,610.4	11,644	6	3.24	4.51	1.39	Very High
SH	87	0305-02	115.406	115.69	1,499.5	2,239	2	0.46	0.64	1.39	Very High

Table D6. Rural Two-Lane Roadway Segments with High Potential for Safety Improvement.

Highway Name and Number		Control and Section Number	From DFO	To DFO	Length (feet)	AADT	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
FM	252	0785-01	2.641	2.756	607.2	4,227	1	0.34	0.48	1.39	High
US	190	0213-07	544.755	544.985	1,214.4	4,061	2	0.65	0.89	1.38	High
SH	87	0304-06	93.04	93.685	3,405.6	1,196	4	0.68	0.94	1.38	High
FM	82	1583-01	5.286	5.991	3,722.4	1,397	5	1.12	1.54	1.38	High
SH	87	0305-01	107.074	107.203	681.1	2,648	1	0.22	0.31	1.38	High
FM	770	1096-01	17.874	17.996	644.2	3,174	1	0.29	0.4	1.37	High
SH	63	0214-02	50.742	51.1	1,890.2	1,136	2	0.42	0.58	1.37	High
SH	63	0214-03	61.689	61.995	1,615.7	1,143	2	0.36	0.5	1.37	High
SH	12	0499-03	4.39	5.88	7,867.2	8,539	19	8.48	11.62	1.37	High
SH	326	0601-01	19.893	19.993	528.0	5,868	1	0.39	0.54	1.36	High
SL	207	0389-10	0.899	1.031	697.0	7,065	2	1.02	1.38	1.36	High
US	190	0213-06	522.809	524.245	7,587.4	3,675	11	3.58	4.88	1.36	High
SH	12	0499-03	4.06	4.386	1,721.3	8,539	4	1.86	2.53	1.36	High
FM	365	0932-01	25.524	26.059	2,824.8	4,709	5	1.88	2.56	1.36	High
US	287	0341-04	677.966	678.121	818.4	2,857	1	0.3	0.41	1.36	High
FM	2246	2120-01	8.544	9.238	3,664.3	2,485	5	1.31	1.76	1.35	High
US	69	0200-08	281.795	282.005	1,108.8	5,834	2	0.83	1.12	1.35	High
FM	2518	2381-01	4.449	4.584	712.8	2,051	1	0.28	0.38	1.35	High
FM	92	0703-02	26.546	27.137	3,120.5	4,248	5	1.79	2.41	1.35	High
US	69	0200-08	278.852	279.128	1,457.3	7,013	3	1.31	1.77	1.35	High
FM	1130	1284-01	1.548	1.675	670.6	2,265	1	0.32	0.43	1.35	High
SH	12	0499-02	15.849	15.967	623.0	5,260	1	0.42	0.56	1.34	High
FM	105	0710-01	8.331	8.819	2,576.6	3,951	4	1.39	1.87	1.34	High
FM	105	0710-01	8.836	8.96	654.7	3,951	1	0.35	0.47	1.34	High
US	190	0244-04	572.814	572.949	712.8	3,192	1	0.31	0.41	1.34	High

SH	105	0951-01	108.837	108.959	644.2	4,744	1	0.39	0.52	1.33	High
FM	1008	0953-01	1.954	2.136	961.0	1,122	1	0.19	0.26	1.33	High
US	190	0244-04	569.65	570.346	3,674.9	3,192	5	1.58	2.09	1.33	High
US	69	0200-06	269.355	269.487	697.0	5,386	1	0.35	0.46	1.33	High
FM	365	0932-01	26.498	27.751	6,615.8	4,709	11	4.41	5.84	1.33	High
FM	2246	2120-01	1.948	2.097	786.7	2,485	1	0.28	0.37	1.32	High
FM	363	0627-03	4.437	4.811	1,974.7	1,012	2	0.38	0.49	1.32	High
FM	1406	1324-02	10.219	10.5	1,483.7	2,637	2	0.62	0.82	1.32	High
US	69	0200-08	286.797	287.2	2,127.8	6,557	4	1.79	2.36	1.32	High
FM	421	0813-03	11.261	11.377	612.5	3,240	1	0.38	0.5	1.32	High
US	190	0244-04	574.31	574.444	707.5	3,361	1	0.33	0.43	1.31	High
SH	327	0602-01	1.087	2.173	5,739.4	3,912	8	2.88	3.77	1.31	High
SH	321	0593-01	17.237	17.35	596.6	5,557	1	0.42	0.55	1.31	High
SH	105	0951-01	108.959	109.202	1,283.0	4,744	2	0.78	1.02	1.31	High
FM	1131	0784-04	14.658	15.599	4,968.5	4,738	8	3.33	4.34	1.3	High
SH	124	0368-02	11.544	11.691	776.2	4,087	1	0.41	0.53	1.3	High
SH	12	0499-02	15.3	15.53	1,214.4	5,260	2	0.82	1.06	1.3	High
FM	256	0703-03	26.249	26.478	1,209.1	378	1	0.1	0.13	1.3	High
US	287	0341-04	674.417	674.601	971.5	2,248	1	0.28	0.37	1.3	High
SH	146	0388-03	46.897	47.817	4,857.6	8,618	10	4.98	6.48	1.3	High
FM	834	1146-01	11.335	11.506	902.9	1,467	1	0.26	0.34	1.29	High
US	90	0028-05	707.05	707.25	1,056.0	7,286	2	0.97	1.25	1.29	High
SH	63	0214-02	42.281	42.638	1,885.0	1,136	2	0.42	0.54	1.29	High
FM	565	1024-01	2.937	3.451	2,713.9	10,960	9	5.52	7.13	1.29	High
SH	87	0305-06	147.404	147.509	554.4	6,761	1	0.48	0.61	1.29	High
SH	326	0601-01	16.658	16.917	1,367.5	4,846	2	0.86	1.1	1.28	High
FM	1960	0762-01	44.371	44.643	1,436.2	8,656	3	1.57	2.01	1.28	High
FM	2354	2242-02	10.04	10.708	3,527.0	866	3	0.48	0.61	1.28	High
SH	63	0214-01	38.357	38.542	976.8	1,764	1	0.34	0.43	1.28	High
FM	565	1024-01	0.071	0.369	1,573.4	7,960	4	2.34	2.99	1.28	High
FM	565	1024-01	6.081	7.317	6,526.1	4,813	12	5.93	7.58	1.28	High

SH	63	0244-02	28.142	28.971	4,377.1	5,362	7	3.18	4.07	1.28	High
FM	692	1300-02	0	0.479	2,529.1	789	2	0.29	0.37	1.28	High
US	69	0200-05	253.974	254.338	1,921.9	2,531	2	0.64	0.81	1.27	High
FM	2684	0388-04	0.954	1.453	2,634.7	708	2	0.3	0.39	1.27	High
FM	1663	1464-01	0	0.47	2,481.6	561	2	0.27	0.35	1.27	High
SH	65	0368-01	7.544	7.751	1,093.0	1,102	1	0.23	0.3	1.27	High
FM	692	1300-02	9.22	9.5	1,478.4	471	1	0.15	0.19	1.27	High
FM	418	0784-01	5.065	5.673	3,210.2	3,271	4	1.5	1.89	1.26	High
FM	1416	0627-04	1.632	1.891	1,367.5	513	1	0.14	0.17	1.26	High
SH	12	0499-02	18.48	18.588	570.2	2,336	1	0.17	0.22	1.26	High
SH	61	0242-03	11.812	12.176	1,921.9	1,765	2	0.63	0.79	1.26	High
US	69	0200-08	286.683	286.797	601.9	6,557	1	0.51	0.63	1.25	High
FM	105	0883-02	23.083	23.428	1,821.6	1,920	2	0.71	0.89	1.25	High
SH	105	0951-01	107.962	108.369	2,149.0	4,744	3	1.3	1.63	1.25	High
SH	12	0499-03	8.457	8.657	1,056.0	8,091	2	1.08	1.35	1.25	High
US	69	0200-08	283.723	283.95	1,198.6	6,584	2	1.01	1.27	1.25	High
US	190	0213-06	522.301	522.774	2,497.4	3,675	3	1.18	1.47	1.24	High
FM	770	1096-02	32.916	33.09	918.7	2,063	1	0.38	0.48	1.24	High
FM	2354	2242-02	4.231	5.425	6,304.3	866	5	1.07	1.33	1.24	High
FM	253	0947-01	2.895	3.112	1,145.8	1,404	1	0.33	0.41	1.24	High
FM	565	1024-01	3.874	4.986	5,871.4	4,813	10	5.34	6.62	1.24	High
FM	563	1023-02	3.965	4.396	2,275.7	3,338	3	1.34	1.66	1.24	High
US	69	0200-08	283.145	283.263	623.0	6,584	1	0.53	0.65	1.24	High
SH	124	0368-02	18.806	20.085	6,753.1	3,025	7	2.64	3.24	1.23	High
SH	63	0214-01	41.154	41.327	913.4	1,321	1	0.24	0.29	1.23	High
FM	1010	1061-01	8.192	9.35	6,114.2	3,940	9	4.61	5.66	1.23	High
FM	1413	1421-01	0.162	1.238	5,681.3	3,561	8	3.85	4.74	1.23	High
SH	62	0243-02	13.524	13.894	1,953.6	5,849	3	1.55	1.9	1.23	High
FM	1013	1237-01	2.554	3.918	7,207.2	1,253	6	1.76	2.15	1.23	High
FM	365	0932-02	1.138	1.472	1,763.5	2,143	2	0.81	1	1.23	High
SH	327	0602-01	4.691	4.823	697.0	5,195	1	0.5	0.61	1.23	High

FM	1131	0784-04	11.158	12.096	4,952.6	972	4	1.04	1.28	1.23	High
FM	92	0703-01	24.374	24.516	749.8	4,048	1	0.43	0.53	1.23	High
FM	105	0710-01	0.367	0.889	2,756.2	8,007	6	3.67	4.5	1.22	High
FM	1746	1585-01	1.14	2.28	6,019.2	1,299	5	1.61	1.97	1.22	High
SH	63	0214-02	45.06	45.929	4,588.3	1,136	4	1.03	1.25	1.22	High
SH	62	0243-04	23.228	23.559	1,747.7	7,928	3	1.72	2.1	1.22	High
SH	63	0214-03	60.987	61.689	3,706.6	1,143	3	0.83	1.02	1.22	High
FM	1409	0762-02	1.122	2.019	4,736.2	5,706	7	3.81	4.6	1.21	High
FM	1960	1685-04	37.204	37.31	559.7	7,674	1	0.63	0.75	1.21	High
FM	365	0932-01	20.63	21.199	3,004.3	4,709	4	2	2.43	1.21	High
FM	1013	1275-01	30.245	30.473	1,203.8	1,534	1	0.36	0.43	1.21	High
SH	65	0368-01	2.593	3.833	6,552.5	1,102	5	1.41	1.71	1.21	High
SH	124	0367-01	27.189	27.337	781.4	3,871	1	0.39	0.47	1.21	High
FM	365	0932-01	15.211	15.442	1,219.7	6,012	2	1.14	1.38	1.21	High
FM	563	1023-02	1.164	1.322	834.2	4,234	1	0.5	0.6	1.21	High
US	69	0200-07	271.556	272.255	3,690.7	10,239	8	5.05	6.13	1.21	High
FM	1131	0784-03	7.432	8.192	4,012.8	850	3	0.74	0.9	1.21	High
SH	87	0304-06	94.381	96.166	9,424.8	1,196	7	1.82	2.2	1.21	High
SH	326	0601-02	24.125	24.275	792.0	4,768	1	0.48	0.58	1.21	High
SH	321	0593-01	6.14	6.966	4,361.3	8,215	8	4.81	5.81	1.21	High
SH	63	0214-02	47.987	48.543	2,935.7	1,136	2	0.66	0.79	1.21	High
FM	1013	1237-01	2.317	2.554	1,251.4	1,253	1	0.31	0.37	1.21	High
FM	776	0214-05	1.309	1.92	3,226.1	539	2	0.37	0.44	1.2	High
FM	1409	0762-02	4.971	5.664	3,659.0	3,597	4	1.87	2.25	1.2	High
FM	787	0813-01	14.769	14.992	1,177.4	2,204	1	0.38	0.45	1.2	High
FM	1943	1828-01	19.365	20.263	4,741.4	611	3	0.61	0.73	1.2	High
SH	61	0242-03	18.3	18.52	1,161.6	2,168	1	0.35	0.42	1.2	High
SH	124	0368-03	4.262	4.386	654.7	6,789	1	0.56	0.68	1.2	High
FM	2354	2242-02	5.444	6.826	7,297.0	866	5	1.24	1.49	1.2	High
SH	63	0214-02	43.278	44.02	3,917.8	1,136	3	0.88	1.05	1.2	High
SH	146	0388-02	19.593	20.028	2,296.8	2,252	2	0.65	0.78	1.2	High

FM	252	0785-01	17.605	17.885	1,478.4	1,110	1	0.33	0.39	1.2	High
FM	2800	2834-01	0.738	1.849	5,866.1	900	4	1.02	1.23	1.2	High
FM	256	0703-03	19.194	19.437	1,283.0	1,052	1	0.28	0.34	1.2	High
FM	1003	0811-02	6.434	6.756	1,700.2	645	1	0.16	0.19	1.19	High
FM	1663	1464-01	0.488	1.134	3,410.9	561	2	0.37	0.45	1.19	High
SH	105	0339-04	138.373	138.59	1,145.8	8,901	2	1.29	1.53	1.19	High
FM	2610	2591-02	5.652	6.238	3,094.1	778	2	0.5	0.59	1.19	High
SH	12	0499-03	7.448	8.457	5,327.5	8,091	9	5.45	6.51	1.19	High
SH	62	0243-03	21.141	22.907	9,324.5	8,459	16	9.77	11.66	1.19	High
FM	92	0703-01	5.399	5.641	1,277.8	1,847	1	0.31	0.37	1.19	High
SH	146	0388-02	30.159	30.916	3,997.0	2,019	3	1.05	1.25	1.19	High
FM	1078	1286-01	0.66	1.205	2,877.6	2,346	3	1.43	1.7	1.19	High
SH	87	0305-03	122.111	122.313	1,066.6	2,918	1	0.42	0.5	1.19	High
SH	63	0214-03	63.851	64.09	1,261.9	1,143	1	0.31	0.37	1.19	High
FM	563	1023-02	4.396	6.217	9,614.9	3,338	11	5.64	6.71	1.19	High
FM	1007	1276-01	4.4	4.654	1,341.1	1,306	1	0.34	0.4	1.19	High
FM	770	1096-01	20.844	22.051	6,373.0	2,709	6	2.62	3.12	1.19	High
SH	321	0593-01	14.145	14.876	3,859.7	5,557	5	2.9	3.41	1.18	High
FM	1409	0762-03	12.568	13.258	3,643.2	6,228	5	2.89	3.41	1.18	High
SH	63	0214-02	44.02	44.326	1,615.7	1,136	1	0.36	0.43	1.18	High
FM	1413	1421-01	1.238	2.314	5,681.3	3,561	7	3.85	4.52	1.18	High
SH	124	0367-01	25.78	26.269	2,581.9	4,766	3	1.57	1.85	1.18	High
FM	2354	2242-02	2.503	4.231	9,123.8	4,383	13	7.57	8.97	1.18	High
FM	1410	1420-02	12.826	13.172	1,826.9	330	1	0.12	0.14	1.18	High
FM	1409	0762-02	2.019	2.291	1,436.2	5,706	2	1.15	1.37	1.18	High
FM	365	0932-01	26.059	26.37	1,642.1	4,709	2	1.09	1.29	1.18	High
US	190	0213-07	536.103	536.639	2,830.1	3,686	3	1.48	1.75	1.18	High
SH	63	0244-02	18.231	19.026	4,197.6	3,413	4	1.96	2.31	1.18	High
US	190	0244-04	571.562	571.961	2,106.7	3,192	2	0.9	1.07	1.18	High
US	69	0200-06	269.487	269.674	987.4	5,386	1	0.49	0.58	1.18	High
FM	1416	0627-04	9.658	10.445	4,155.4	366	2	0.3	0.35	1.17	High

FM	770	1096-01	11.134	11.382	1,309.4	2,211	1	0.42	0.49	1.17	High
FM	1010	1061-01	6.918	8.121	6,357.1	3,940	8	4.8	5.6	1.17	High
SH	65	0368-01	0	0.275	1,452.0	1,102	1	0.31	0.37	1.17	High
FM	834	1146-02	1.233	1.962	3,849.1	1,060	3	0.88	1.03	1.17	High
SH	61	0242-03	9.972	10.207	1,240.8	1,765	1	0.41	0.47	1.17	High
FM	1007	1276-01	6.086	6.433	1,832.2	375	1	0.15	0.18	1.17	High
FM	421	0813-03	1.363	2.375	5,343.4	1,485	4	1.54	1.8	1.17	High
FM	563	1023-02	8.183	9.202	5,380.3	2,656	5	2.52	2.95	1.17	High
FM	1004	1274-02	0.456	2.254	9,493.4	535	5	1.11	1.3	1.17	High
SH	65	0368-01	12.247	13.039	4,181.8	1,303	3	1.06	1.24	1.17	High
SH	326	0601-01	18.284	18.424	739.2	5,868	1	0.59	0.69	1.17	High
US	69	0200-06	269.716	269.874	834.2	5,386	1	0.56	0.66	1.17	High
FM	1406	1324-02	8.507	9.53	5,401.4	2,055	5	2.36	2.77	1.17	High
US	69	0200-08	287.632	288.587	5,042.4	6,507	7	4.21	4.93	1.17	High
SH	146	0388-03	44.167	44.845	3,579.8	7,694	5	3.28	3.79	1.16	High
FM	1943	1828-01	8.9	10.485	8,368.8	1,354	6	2.34	2.72	1.16	High
FM	563	1023-02	12.651	13.667	5,364.5	2,656	5	2.37	2.74	1.16	High
FM	563	1023-02	3.527	3.707	950.4	3,338	1	0.56	0.65	1.16	High
FM	92	0703-01	8.083	8.334	1,325.3	1,504	1	0.43	0.5	1.16	High
FM	787	0813-01	16.371	17.465	5,776.3	2,204	5	2.45	2.83	1.16	High
US	90	0028-04	701.638	701.92	1,489.0	7,330	2	1.23	1.43	1.16	High
US	190	0213-08	548.381	548.683	1,594.6	4,605	2	1.14	1.32	1.16	High
SL	505	0305-10	2.306	2.644	1,784.6	914	1	0.28	0.32	1.16	High
SH	62	0243-01	12.763	13.368	3,194.4	5,578	4	2.41	2.8	1.16	High
FM	770	1096-01	2.91	4.391	7,819.7	1,761	6	2.82	3.24	1.15	High
SH	87	0304-06	98.66	100.325	8,791.2	1,442	5	1.6	1.84	1.15	High
FM	1746	1585-01	0	1.14	6,019.2	1,299	4	1.61	1.85	1.15	High
SH	12	0499-02	16.272	16.663	2,064.5	4,187	2	1.11	1.27	1.15	High
US	69	0200-07	275.534	277.107	8,310.7	7,795	13	8.7	10.01	1.15	High
SH	61	0242-03	14.518	14.798	1,478.4	2,399	1	0.45	0.52	1.15	High
FM	252	0785-01	13.332	15.073	9,192.5	659	5	1.22	1.41	1.15	High

US	190	0213-08	546.789	546.964	924.0	4,198	1	0.6	0.69	1.15	High
SH	87	0304-06	96.17	96.812	3,389.8	1,196	2	0.65	0.75	1.15	High
US	287	0341-04	673.589	673.944	1,874.4	1,583	1	0.39	0.45	1.15	High
US	69	0200-07	277.252	277.725	2,497.4	8,045	4	2.7	3.11	1.15	High
SH	87	0305-07	149.589	149.744	818.4	6,255	1	0.63	0.72	1.15	High
FM	418	0784-01	3.478	5.065	8,379.4	3,271	7	3.91	4.44	1.14	High
SH	87	0304-05	79.196	80.624	7,545.1	673	4	1	1.14	1.14	High
FM	1409	0762-02	8.774	10.194	7,497.6	3,597	7	3.84	4.39	1.14	High
US	190	0213-06	521.519	522.3	4,123.7	3,675	4	1.95	2.22	1.14	High
FM	2246	2120-01	2.103	2.37	1,409.8	2,485	1	0.5	0.57	1.14	High
FM	365	0932-02	3.712	5.039	7,006.6	2,143	6	3.22	3.67	1.14	High
SH	124	0367-01	29.981	31.566	8,368.8	3,707	7	3.99	4.56	1.14	High
SH	63	0214-02	51.424	52.12	3,674.9	1,134	2	0.82	0.94	1.14	High
SH	105	0951-01	116.321	117.665	7,096.3	4,453	7	4.05	4.62	1.14	High
SH	105	0951-01	96.718	96.859	744.5	7,276	1	0.69	0.78	1.14	High
SH	63	0214-01	34.74	35.046	1,615.7	1,470	1	0.31	0.35	1.14	High
FM	1442	1284-01	7.448	8.024	3,041.3	6,769	4	2.61	2.98	1.14	High
SL	505	0305-10	2.644	2.995	1,853.3	914	1	0.32	0.37	1.14	High
FM	105	0710-01	8.13	8.331	1,061.3	3,951	1	0.57	0.65	1.14	High
FM	834	1146-02	2.009	2.664	3,458.4	1,060	2	0.79	0.9	1.14	High
US	190	0213-08	551.658	552.027	1,948.3	4,631	2	1.17	1.34	1.14	High
US	69	0200-07	278.717	278.85	702.2	7,577	1	0.68	0.77	1.14	High
FM	1442	1284-01	9.356	9.506	792.0	6,395	1	0.64	0.74	1.14	High
US	69	0200-07	271.229	271.536	1,621.0	10,239	3	2.22	2.51	1.13	High
FM	2799	0244-08	2.69	3.764	5,676.0	785	3	0.93	1.05	1.13	High
US	190	0213-06	524.245	525.682	7,587.4	3,675	7	3.58	4.07	1.13	High
SH	87	0307-01	184.768	185.249	2,539.7	3,379	2	1.11	1.25	1.13	High

Table D7. Rural Multilane Undivided Roadway Segments with Very High Potential for Safety Improvement.

Highway Name and Number		Control and Section Number	From DFO	To DFO	Length (feet)	AADT	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
SH	146	0389-02	73.104	73.315	1,114.1	28,186	10	1.67	4.83	2.9	Very High
SH	62	0243-04	24.389	24.496	565.0	14,665	5	0.99	2.68	2.7	Very High
US	96	0065-03	99.279	99.494	1,135.2	8,969	6	1.02	2.37	2.31	Very High
US	96	0065-03	99.026	99.279	1,335.8	10,990	7	1.34	3.04	2.28	Very High
SH	62	0243-03	17.726	17.859	702.2	8,459	3	0.43	0.95	2.2	Very High
US	96	0065-03	95.413	95.565	802.6	11,938	3	0.84	1.49	1.77	Very High
US	96	0064-08	70.455	70.639	971.5	5,204	3	0.84	1.41	1.67	Very High
US	96	0064-08	70.254	70.445	1,008.5	5,204	3	0.88	1.44	1.64	Very High

Table D8. Rural Multilane Undivided Roadway Segments with High Potential for Safety Improvement.

Highway Name and Number		Control and Section Number	From DFO	To DFO	Length (feet)	AADT	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
US	96	0065-02	88.998	89.247	1,314.7	6,704	3	0.71	1.12	1.59	High
US	96	0064-08	70.639	70.893	1,341.1	7,271	4	1.38	2.19	1.58	High
US	287	0341-04	663.485	663.595	580.8	2,298	1	0.13	0.2	1.57	High
US	96	0065-03	94.63	94.999	1,948.3	12,496	6	2.08	3.26	1.56	High
US	190	0213-06	527.348	527.924	3,041.3	3,920	6	1.19	1.85	1.56	High
SH	62	0243-04	24.147	24.389	1,277.8	14,665	5	2.25	3.41	1.52	High
US	96	0065-03	94.999	95.229	1,214.4	12,496	3	1.3	1.82	1.4	High
US	96	0065-02	92.971	93.17	1,050.7	8,321	2	0.71	0.99	1.4	High
US	96	0065-03	109.783	110.011	1,203.8	12,660	3	1.3	1.82	1.4	High
SH	87	0305-01	105.382	105.576	1,024.3	2,091	1	0.14	0.18	1.33	High
US	69	0200-05	260.345	260.541	1,034.9	2,531	1	0.19	0.25	1.3	High
US	96	0065-03	96.59	96.89	1,584.0	10,990	3	1.58	2.02	1.27	High
US	96	0065-01	77.832	78.029	1,040.2	7,299	1	0.28	0.35	1.26	High
BU	96	0065-14	4.233	4.365	697.0	12,209	1	0.47	0.59	1.25	High

Table D9. Urban Multilane Divided Roadway Segments with Very High Potential for Safety Improvement.

Highway Name and Number		Control and Section Number	From DFO	To DFO	Length (feet)	AADT	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
BU	90	0028-15	6.934	7.052	623.0	5,576	13	1.4	7.95	5.67	Very High
SH	146	0389-02	73.441	73.556	607.2	32,809	57	9.47	52.21	5.51	Very High
US	69	0200-16	342.875	342.995	633.6	43,415	55	9.51	50.29	5.29	Very High
SH	347	0667-01	11.16	11.335	924.0	12,394	26	4.78	20.63	4.31	Very High
SH	73	0306-01	41.784	41.998	1,129.9	28,626	32	6.05	25.62	4.24	Very High
SH	146	0388-03	50.373	50.49	617.8	8,608	11	2.03	7.86	3.86	Very High
SH	87	0306-03	175.191	175.477	1,510.1	24,900	30	6.13	22.9	3.74	Very High
US	96	0065-05	123.195	123.309	601.9	16,188	7	1.13	4.18	3.7	Very High

Table D10. Urban Multilane Divided Roadway Segments with High Potential for Safety Improvement.

Highway Name and Number		Control and Section Number	From DFO	To DFO	Length (feet)	AADT	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
US	190	0213-08	558.359	558.548	997.9	19,769	18	3.92	13.65	3.48	High
US	90	0028-04	694.766	694.917	797.3	17,772	21	5.42	17.75	3.28	High
SH	73	0508-04	24.348	24.536	992.6	17,054	20	5.16	16.16	3.13	High
FM	365	0932-01	32.047	32.222	924.0	31,493	33	9.59	29.62	3.09	High
SH	347	0667-01	6.308	6.417	575.5	17,464	11	2.97	8.97	3.02	High
SH	327	0602-01	6.555	6.671	612.5	9,720	5	0.98	2.88	2.96	High
US	96	0065-05	122.941	123.195	1,341.1	15,870	11	2.46	6.83	2.78	High
FM	565	1024-01	12.335	12.437	538.6	4,904	4	0.85	2.35	2.78	High
US	69	0200-16	343.16	343.264	549.1	24,750	12	3.81	10.34	2.72	High
SS	380	0065-08	1.676	1.927	1,325.3	30,502	55	19.2	51.15	2.66	High
FM	365	0932-01	31.679	31.806	670.6	17,476	6	1.6	4.14	2.59	High
SH	347	0667-01	9.536	9.655	628.3	21,323	17	5.93	15.27	2.57	High
US	96	0065-05	122.811	122.941	686.4	15,870	5	1.26	3.17	2.52	High
SH	327	0602-01	7.458	7.719	1,378.1	9,646	6	1.49	3.19	2.14	High

Table D11. Urban Interstate Segments with Very High Potential for Safety Improvement.

Highway Name and Number		Control and Section Number	From DFO	To DFO	Length (feet)	AADT	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
US	69	0200-11	322.292	322.429	723.4	32,958	93	5.82	70.04	12.04	Very High
US	69	0200-14	327.891	328.366	2,508.0	64,216	224	52.95	203.5	3.84	Very High
US	69	0200-11	321.915	322.292	1,990.6	32,958	70	15.61	55.41	3.55	Very High
US	69	0200-11	323.332	323.475	755.0	80,192	61	23.73	57.88	2.44	Very High
SH	73	0508-04	28.615	28.908	1,547.0	46,948	49	19.29	43.41	2.25	Very High
US	69	0065-06	314.416	314.553	723.4	39,574	20	8.01	17.53	2.19	Very High
US	59	0177-03	259.345	259.489	760.3	29,464	10	3.43	7.44	2.17	Very High
US	69	0200-14	332.516	332.864	1,837.4	53,413	65	29.26	59.48	2.03	Very High

Table D12. Urban Interstate Segments with High Potential for Safety Improvement.

Highway Name and Number		Control and Section Number	From DFO	To DFO	Length (feet)	AADT	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
IH	10	0739-02	844.303	844.421	623.0	43,482	13	5.84	11.3	1.93	High
SH	73	0508-04	32.795	32.924	681.1	24,151	7	2.76	5.21	1.89	High
US	69	0200-14	327.271	327.459	992.6	64,216	41	20.96	38.6	1.84	High
US	69	0200-11	321.553	321.915	1,911.4	32,958	32	14.99	27.44	1.83	High
IH	10	0028-13	850.706	851.056	1,848.0	107,162	89	47.3	84.78	1.79	High
US	69	0200-11	323.475	324.081	3,199.7	73,897	162	88.72	155.12	1.75	High
IH	10	0508-02	798.801	799.858	5,581.0	65,645	119	61.83	106.98	1.73	High
US	69	0200-11	320.715	321.479	4,033.9	32,958	62	31.63	53.85	1.7	High
SH	73	0508-04	31.562	32.567	5,306.4	24,151	51	23.9	40.62	1.7	High
IH	10	0739-02	848.512	849.189	3,574.6	112,598	251	151.06	244.64	1.62	High
IH	10	0028-11	860.427	860.588	850.1	56,131	15	8.36	13.49	1.61	High
IH	10	0028-11	871.601	872.1	2,634.7	46,044	40	22.22	35.48	1.6	High
US	69	0200-15	338.838	339.117	1,473.1	43,655	35	20.37	32.44	1.59	High
IH	10	0028-14	876.17	877.097	4,894.6	57,548	122	71.79	113.74	1.58	High
IH	10	0028-09	854.272	854.667	2,085.6	79,712	66	41.01	62.81	1.53	High

Table D13. Urban Two-Lane Roadway Segments with Very High Potential for Safety Improvement.

Highway Name and Number		Control and Section Number	From DFO	To DFO	Length (feet)	AADT	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
SH	12	0499-03	3.888	4.06	908.2	8,539	14	1.03	6.34	6.15	Very High
SH	321	0593-01	22.437	22.66	1,177.4	10,909	14	2.23	8.53	3.83	Very High
SL	227	0388-05	2.052	2.153	533.3	7,380	4	0.86	2.43	2.81	Very High
SH	105	0338-12	89.237	89.539	1,594.6	8,111	10	1.9	5.33	2.8	Very High
FM	105	0689-02	31.64	31.837	1,040.2	6,386	5	0.71	1.98	2.77	Very High
FM	365	0932-01	28.288	28.601	1,652.6	4,709	7	0.85	2.3	2.71	Very High
SH	99	3187-02	180.318	180.443	660.0	3,512	4	0.89	2.33	2.63	Very High
FM	565	1024-01	10.504	10.639	712.8	4,904	3	0.57	1.35	2.38	Very High
FM	105	0883-02	26.748	27.015	1,409.8	3,550	5	0.87	2.01	2.3	Very High
FM	563	1023-02	0.936	1.164	1,203.8	4,234	4	0.69	1.55	2.25	Very High
SH	321	0593-01	24.945	25.143	1,045.4	14,080	8	2.65	5.91	2.23	Very High
FM	1405	1024-02	0	0.105	554.4	5,613	2	0.39	0.86	2.21	Very High
SL	227	0388-05	0.69	1.043	1,863.8	9,732	9	2.46	5.37	2.18	Very High
FM	3247	2701-02	6.045	6.173	675.8	8,522	3	0.86	1.79	2.08	Very High
FM	421	0813-03	12.181	12.33	786.7	3,240	2	0.39	0.77	1.97	Very High
FM	1010	1061-01	0.205	0.516	1,642.1	1,068	3	0.26	0.51	1.95	Very High
FM	565	1024-01	13.851	14.652	4,229.3	7,764	22	8.49	15.92	1.87	Very High

Table D14. Urban Two-Lane Roadway Segments with High Potential for Safety Improvement.

Highway Name and Number		Control and Section Number	From DFO	To DFO	Length (feet)	AADT	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
SH	321	0593-01	0.169	0.522	1,863.8	12,529	10	4.12	7.63	1.85	High
SL	227	0388-05	0.401	0.69	1,525.9	9,732	7	2.68	4.9	1.83	High
US	190	0213-08	557.186	557.854	3,527.0	6,633	11	3.57	6.43	1.8	High
FM	1132	0784-05	1.91	2.082	908.2	3,567	2	0.43	0.75	1.75	High
FM	563	1023-02	0	0.273	1,441.4	4,234	3	0.82	1.4	1.7	High
SH	99	3187-02	181.836	182.073	1,251.4	12,181	5	2.13	3.61	1.69	High
FM	105	0689-02	31.84	32.05	1,108.8	5,237	3	1.07	1.78	1.67	High
FM	1442	2562-01	11.093	11.276	966.2	9,143	3	1.19	1.96	1.65	High
FM	105	0883-02	20.113	20.446	1,758.2	3,191	3	0.91	1.41	1.55	High
FM	565	1024-01	13.016	13.851	4,408.8	7,764	17	8.85	13.33	1.51	High
FM	565	1024-01	8.681	10.004	6,985.4	3,701	12	4.04	6.1	1.51	High
FM	565	1024-01	15.191	15.388	1,040.2	11,043	4	2.09	3.13	1.5	High
FM	105	0883-02	19.307	19.67	1,916.6	3,191	3	0.99	1.48	1.48	High
FM	565	1024-01	14.688	15.191	2,655.8	11,043	10	5.33	7.89	1.48	High
SH	99	3187-02	181.434	181.836	2,122.6	12,181	7	3.61	5.34	1.48	High
FM	105	0883-02	27.015	28.248	6,510.2	3,550	11	4.03	5.95	1.47	High
SH	82	2367-01	3.493	3.971	2,523.8	4,501	4	1.39	2.01	1.45	High
FM	3513	0065-15	1.47	2.368	4,741.4	4,352	7	2.8	3.91	1.4	High
FM	365	0932-01	28.601	28.969	1,943.0	8,607	4	1.98	2.76	1.39	High
FM	3247	2701-02	5.3	5.597	1,568.2	6,793	3	1.37	1.91	1.39	High
FM	418	0784-01	11.418	11.801	2,022.2	6,148	4	1.99	2.75	1.38	High
FM	408	0883-02	1.111	1.909	4,213.4	3,311	6	2.55	3.45	1.35	High
SH	321	0593-01	24.423	24.945	2,756.2	14,080	11	6.98	9.42	1.35	High
FM	1409	0762-02	0.422	0.958	2,830.1	6,088	5	2.45	3.3	1.35	High
SH	321	0593-01	24.202	24.325	649.4	10,909	2	1.23	1.64	1.34	High

SH	99	3187-02	180.745	181.434	3,637.9	12,181	10	6.19	8.16	1.32	High
FM	1132	0784-05	0	0.956	5,047.7	2,941	5	1.91	2.5	1.31	High
SH	63	0244-02	30.499	31.114	3,247.2	4,728	5	2.66	3.47	1.31	High
SH	124	0368-03	3.65	4.238	3,104.6	5,057	4	1.94	2.51	1.29	High
FM	565	1024-01	10.639	11.65	5,338.1	4,904	8	4.25	5.49	1.29	High
SH	321	0593-01	1.029	1.429	2,112.0	12,529	7	4.67	6.01	1.29	High
FM	1130	1284-01	8.379	8.809	2,270.4	2,749	2	0.83	1.05	1.26	High
FM	105	0689-02	30.753	31.635	4,657.0	6,386	6	3.2	4.02	1.26	High
FM	3514	3579-01	0.312	0.553	1,272.5	2,528	1	0.36	0.46	1.26	High

Table D15. Urban Multilane Undivided Roadway Segments with Very High Potential for Safety Improvement.

Highway Name and Number		Control and Section Number	From DFO	To DFO	Length (feet)	AADT	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
SH	82	2367-01	3.265	3.421	823.7	4,501	13	0.13	1.51	11.52	Very High
US	96	0065-01	75.534	75.816	1,489.0	10,527	45	3.44	29.94	8.72	Very High
SH	347	0667-01	5.018	5.3	1,489.0	12,337	35	3.67	24.17	6.58	Very High
US	190	0213-08	560.296	560.415	628.3	9,808	8	0.87	4.58	5.28	Very High
SH	87	0305-07	158.036	158.145	575.5	14,264	10	1.61	7.32	4.54	Very High
SH	146	0389-02	73.556	73.749	1,019.0	32,809	38	7.95	33.67	4.24	Very High
SH	347	0667-01	9.427	9.536	575.5	21,323	16	3.33	13.65	4.11	Very High
SH	82	0508-05	1.955	2.102	776.2	15,371	11	2.39	8.83	3.69	Very High
SH	62	0243-04	24.663	24.846	966.2	24,497	21	4.95	17.73	3.58	Very High
SH	87	0306-01	161.179	161.384	1,082.4	15,770	24	6.19	20.68	3.34	Very High
US	69	0200-16	344.887	345.078	1,008.5	15,209	21	6.14	18.36	2.99	Very High
BU	90	0028-15	4.151	4.275	654.7	12,162	6	1.44	4.3	2.98	Very High
US	90	0028-03	687.627	687.9	1,441.4	15,684	19	5.15	15.28	2.97	Very High

Table D16. Urban Multilane Undivided Roadway Segments with High Potential for Safety Improvement.

Highway Name and Number		Control and Section Number	From DFO	To DFO	Length (feet)	AADT	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
BU	90	0028-15	1.484	1.788	1,605.1	12,791	22	6.07	17.89	2.95	High
SH	347	0667-01	9.822	10.316	2,608.3	22,609	54	16.2	47.34	2.92	High
FM	105	0883-02	17.773	17.957	971.5	8,096	4	0.77	1.99	2.58	High
SS	93	1075-01	0	0.285	1,504.8	8,374	8	1.91	4.91	2.57	High
US	96	0065-05	131.146	131.51	1,921.9	30,057	38	13.44	34.13	2.54	High
SH	146	0389-02	74.05	74.258	1,098.2	32,809	23	8.57	20.91	2.44	High
SH	82	2367-01	3.104	3.265	850.1	4,501	2	0.33	0.78	2.37	High
SH	87	0028-15	160.601	160.89	1,525.9	20,673	17	6.44	14.6	2.27	High
FM	366	0667-02	5.483	5.622	733.9	10,458	3	0.79	1.78	2.25	High
FM	366	0667-02	3.255	3.463	1,098.2	13,793	5	1.66	3.45	2.08	High
FM	1006	0882-02	0	0.23	1,214.4	5,784	4	1.04	2.16	2.08	High
US	90	0028-04	695.14	695.446	1,615.7	17,772	23	10.06	20.57	2.05	High
SS	215	0508-06	1.185	1.322	723.4	9,396	3	0.99	2.02	2.04	High
SH	87	0028-15	160.314	160.601	1,515.4	20,673	15	6.39	12.94	2.03	High
SH	347	0667-01	8.947	9.427	2,534.4	21,323	33	14.64	29.61	2.02	High
SS	215	0508-06	0.999	1.148	786.7	9,396	3	1.08	2.08	1.93	High
FM	105	0710-02	16.482	16.63	781.4	26,761	15	7.55	14.1	1.87	High
SS	380	0065-08	0.296	1.194	4,741.4	29,675	96	48.71	90.64	1.86	High
SH	82	0508-05	2.149	2.357	1,098.2	15,371	7	3.38	6.01	1.78	High
FM	366	0667-02	4.834	4.966	697.0	10,458	2	0.75	1.31	1.75	High
US	190	0213-08	559.787	560.111	1,710.7	9,808	9	4.19	7.31	1.74	High
BU	90	0028-15	4.275	4.646	1,958.9	9,153	7	3.05	5.24	1.72	High
US	90	0028-03	688.142	688.319	934.6	23,810	10	5.58	9.2	1.65	High
SH	146	0389-01	58.768	58.885	617.8	15,505	3	1.5	2.47	1.65	High
FM	1008	0952-01	16.951	17.217	1,404.5	5,389	3	1.1	1.82	1.64	High

INTERSECTIONS WITH VERY HIGH AND HIGH POTENTIAL FOR SAFETY IMPROVEMENT BY INTERSECTION CATEGORY

Table D17. Rural 3 Leg Unsignalized Intersections with Very High Potential for Safety Improvement.

Lat. & Long.	Major Road Name	Minor Road Name (Con-Sec)	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
(30.4409, -93.9697)	US0096	CR0000 (AA07-66)	14	1.497	5.297	3.538	Very High
(30.1945, -94.624)	FM0770	CR0000 (AA03-01)	10	0.432	1.48	3.426	Very High
(30.0689, -94.7007)	FM0160	FM2830 (2887-01)	9	1.264	3.313	2.621	Very High
(30.2433, -93.8956)	SH0062	CR0000 (AA50-88)	7	0.803	1.953	2.432	Very High
(29.7158, -94.9158)	FM1405	CR0000 (AA04-15)	6	0.768	1.719	2.238	Very High
(30.0697, -93.9744)	FM0105	CR0000 (AA03-76)	6	0.871	1.904	2.186	Very High
(30.1641, -94.7621)	FM0834	FM0834 (1146-02)	5	0.421	0.92	2.185	Very High
(29.8672, -94.8443)	FM0565	LS0000 (LR86-98)	6	1.155	2.355	2.039	Very High
(29.8963, -94.8142)	FM1409	CR0000 (AA04-02)	6	1.266	2.522	1.992	Very High
(30.7384, -93.7003)	FM0363	FM2626 (2618-02)	4	0.32	0.623	1.947	Very High
(30.1286, -93.8212)	SH0062	CR0000 (AA70-28)	5	1.017	1.91	1.878	Very High
(30.3553, -95.1273)	FM1725	CR0000 (AA03-88)	7	2.158	3.997	1.852	Very High
(29.8458, -94.8094)	FM0565	CR0000 (AA04-41)	4	0.595	1.09	1.832	Very High
(30.2148, -95.0986)	FM2090	FM1010 (1061-01)	3	0.635	1.14	1.795	Very High
(29.7208, -94.9161)	FM1405	CR0000 (AA04-16)	4	0.768	1.363	1.775	Very High
(30.6379, -93.8903)	FM1013	CR0000 (AA05-86)	3	0.177	0.312	1.763	Very High
(30.4146, -94.9005)	FM0787	FM0223 (0395-06)	5	1.345	2.365	1.758	Very High
(30.0419, -94.7437)	FM0160	LS0000 (LZ35-85)	4	0.785	1.372	1.748	Very High
(29.913, -94.1122)	FM0365	CR0000 (AA03-59)	7	2.519	4.385	1.741	Very High
(30.1953, -93.8662)	SH0062	CR0000 (AA61-02)	5	1.385	2.407	1.738	Very High
(30.1215, -93.8211)	SH0062	CR0000 (AA04-73)	2	0.676	1.161	1.717	Very High
(30.9964, -93.7175)	SH0063	FM1415 (3407-01)	3	0.267	0.458	1.715	Very High
(30.7845, -94.3924)	US0190	FM3497 (3548-01)	6	2.131	3.61	1.694	Very High
(30.767, -94.4152)	US0069	LS0000 (LY95-56)	5	1.508	2.553	1.693	Very High
(29.9906, -94.742)	FM0563	CR0000 (AA01-43)	4	0.939	1.588	1.691	Very High

Lat. & Long.	Major Road Name	Minor Road Name (Con-Sec)	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
(30.1638, -94.4909)	SH0105	CR0000 (AA04-63)	4	0.945	1.595	1.688	Very High
(30.3209, -94.1775)	US0096	LS0000 (LW48-58)	5	1.553	2.607	1.679	Very High
(30.363, -95.0231)	FM0787	CR0000 (AA22-43)	4	0.996	1.67	1.677	Very High
(30.346, -94.0768)	FM0105	FM1131 (0784-02)	7	3.29	5.459	1.659	Very High
(30.2163, -94.6099)	FM0770	CR0000 (AA02-97)	3	0.432	0.714	1.653	Very High
(31.1133, -93.9901)	US0096	FM1007 (1276-01)	7	2.837	4.661	1.643	Very High
(30.1675, -94.2042)	FC0000	FC0000 (B011-52)	7	2.908	4.763	1.638	Very High
(30.0417, -94.6721)	US0090	FM0770 (1096-03)	9	4.131	6.754	1.635	Very High
(30.4362, -93.9643)	SH0062	CR0000 (AA07-55)	5	1.723	2.812	1.632	Very High
(30.3103, -94.9485)	FM0163	FM2518 (2381-01)	5	1.762	2.846	1.615	Very High
(29.8655, -94.8476)	FM0565	LS0000 (LR12-11)	4	1.155	1.856	1.607	Very High
(30.2563, -94.9701)	SH0321	CR0000 (AA03-01)	5	1.798	2.887	1.606	Very High
(30.8094, -94.3399)	US0190	CR0000 (AA35-65)	3	0.554	0.884	1.596	Very High
(30.4434, -93.9685)	US0096	CR0000 (AA07-41)	4	1.327	2.101	1.583	Very High
(30.2726, -95.0852)	FM1010	CR0000 (AA03-37)	5	1.853	2.932	1.582	Very High
(30.7476, -94.43)	US0069	CR0000 (AA10-30)	4	1.262	1.98	1.569	Very High
(30.3937, -94.4321)	FM1293	FM1003 (0811-02)	3	0.789	1.219	1.545	Very High
(30.3554, -94.0599)	FM2246	CR0000 (AA07-92)	3	0.713	1.099	1.541	Very High
(30.2127, -94.0212)	FM0105	CR0000 (AA06-82)	4	1.38	2.127	1.541	Very High
(30.1917, -93.8619)	SH0062	CR0000 (AA71-39)	4	1.385	2.126	1.535	Very High
(29.9134, -94.0919)	FM0365	CR0000 (AA03-78)	3	0.74	1.134	1.532	Very High
(30.9195, -94.0561)	SH0063	CR0000 (AA01-15)	3	0.749	1.143	1.526	Very High
(30.3217, -94.562)	FM0787	CR0000 (AA02-62)	2	0.16	0.242	1.512	Very High
(30.2097, -93.8711)	SH0012	CR0000 (AA71-37)	4	1.462	2.2	1.505	Very High
(30.3311, -94.1567)	US0096	LS0000 (LW50-13)	4	1.47	2.208	1.502	Very High
(30.697, -94.2278)	FM1013	CR0000 (AA43-94)	2	0.152	0.228	1.5	Very High
(29.9292, -94.2485)	SH0124	CR0000 (AA03-44)	3	0.923	1.38	1.495	Very High

Lat. & Long.	Major Road Name	Minor Road Name (Con-Sec)	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
(30.2114, -93.8687)	SH0012	CR0000 (AA07-81)	4	1.462	2.186	1.495	Very High
(29.9482, -94.8434)	FM1409	CR0000 (AA04-44)	3	0.854	1.274	1.492	Very High
(30.2539, -93.8995)	SH0062	CR0000 (AA31-50)	3	0.803	1.198	1.492	Very High
(30.2287, -93.886)	SH0062	CR0000 (AA60-01)	3	0.851	1.258	1.478	Very High
(30.6181, -94.3693)	FM1943	CR0000 (AA47-96)	2	0.247	0.365	1.478	Very High
(30.3434, -94.2829)	US0069	CR0000 (AA12-20)	5	2.29	3.362	1.468	Very High
(30.7988, -94.1868)	FM0092	CR0000 (AA41-90)	2	0.274	0.402	1.467	Very High
(29.6758, -94.3743)	SH0124	FM1985 (0242-06)	3	0.917	1.331	1.451	Very High
(30.795, -94.1838)	FM0092	FD0000 (FD18-67)	2	0.274	0.397	1.449	Very High
(30.2152, -94.2859)	FM0421	CR0000 (AA04-94)	2	0.296	0.428	1.446	Very High
(30.1402, -94.4051)	SH0105	LS0000 (LW63-61)	3	1.057	1.518	1.436	Very High
(30.4351, -93.9634)	SH0062	CR0000 (AA07-54)	3	1.042	1.491	1.431	Very High
(29.9528, -94.3993)	FM1406	CR0000 (AA01-49)	2	0.297	0.422	1.421	Very High
(30.773, -93.6889)	US0190	CR0000 (AA50-00)	2	0.343	0.486	1.417	Very High
(30.5547, -94.4)	US0069	FM2827 (2889-02)	4	1.815	2.572	1.417	Very High
(30.6137, -94.4037)	FM1943	CR0000 (AA44-76)	2	0.394	0.558	1.416	Very High

Table D18. Rural 3 Leg Unsignalized Intersections with High Potential for Safety Improvement.

Lat. & Long.	Major Road Name	Minor Road Name (Con-Sec)	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
(29.8507, -94.6275)	SH0061	CR0000 (AA03-21)	2	0.405	0.573	1.415	High
(29.8111, -94.384)	SH0124	CR0000 (AA02-44)	3	1.092	1.545	1.415	High
(30.2926, -94.9782)	SH0321	CR0000 (AA22-74)	3	1.116	1.576	1.412	High
(29.8709, -94.6963)	FM0563	CR0000 (AA04-60)	2	0.43	0.605	1.407	High
(30.2348, -93.7692)	SH0087	CR0000 (AA10-87)	3	1.118	1.567	1.402	High
(30.6126, -93.8773)	FM1004	FM1013 (0785-03)	2	0.475	0.665	1.4	High
(30.8639, -94.1227)	US0190	FM1747 (0948-02)	3	1.149	1.604	1.396	High
(30.2157, -93.8436)	FM1130	CR0000 (AA07-79)	2	0.449	0.625	1.392	High
(30.0697, -93.9721)	FM0105	CR0000 (AA03-49)	2	0.42	0.584	1.39	High
(29.849, -94.8844)	FM0565	LS0000 (LR12-27)	3	1.195	1.66	1.389	High
(30.4297, -93.9415)	FM0253	CR0000 (AA07-34)	2	0.457	0.633	1.385	High
(29.7723, -94.6705)	FM0563	LS0000 (LA64-91)	3	1.24	1.701	1.372	High
(30.6874, -93.8363)	FM0363	CR0000 (AA50-62)	2	0.433	0.591	1.365	High
(30.2647, -94.0304)	FM0105	CR0000 (AA08-26)	2	0.533	0.727	1.364	High
(30.3715, -93.9352)	SH0062	CR0000 (AA08-06)	2	0.534	0.728	1.363	High
(29.8349, -94.4007)	FM1406	CR0000 (AA01-63)	2	0.478	0.651	1.362	High
(29.7465, -94.8512)	FM2354	CR0000 (AA05-05)	2	0.551	0.75	1.361	High
(30.2116, -94.7445)	SH0146	CR0000 (AA20-98)	3	1.282	1.742	1.359	High
(29.8861, -94.6136)	SH0061	CR0000 (AA03-08)	2	0.549	0.744	1.355	High
(30.8101, -94.3379)	US0190	CR0000 (AA40-50)	2	0.554	0.75	1.354	High
(30.551, -94.1815)	FM0092	CR0000 (AA49-00)	2	0.597	0.807	1.352	High
(29.8447, -94.6985)	FM0563	CR0000 (AA04-07)	2	0.484	0.653	1.349	High
(29.8663, -94.8294)	FM0565	LS0000 (LR86-69)	2	0.595	0.802	1.348	High
(29.8656, -94.8246)	FM0565	LS0000 (LR86-73)	2	0.595	0.802	1.348	High
(29.8516, -94.8138)	FM0565	CR0000 (AA04-43)	2	0.595	0.802	1.348	High
(30.2486, -94.0244)	FM0105	CR0000 (AA08-28)	2	0.585	0.788	1.347	High

Lat. & Long.	Major Road Name	Minor Road Name (Con-Sec)	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
(30.9262, -94.072)	SH0063	CR0000 (AA10-49)	2	0.52	0.7	1.346	High
(30.3702, -94.3125)	US0069	LS0000 (LO07-25)	4	2.059	2.764	1.342	High
(30.8435, -94.4257)	US0069	CR0000 (AA27-75)	2	0.616	0.825	1.339	High
(30.7904, -94.3803)	US0190	CR0000 (AA40-20)	2	0.599	0.802	1.339	High
(30.3383, -94.2754)	US0069	CR0000 (AA04-30)	3	1.395	1.865	1.337	High
(30.4492, -94.8401)	FM0787	FM2610 (2591-02)	3	1.358	1.816	1.337	High
(29.866, -94.8729)	FC0000	LS0000 (LR12-30)	2	0.64	0.851	1.33	High
(30.2812, -93.7887)	SH0087	CR0000 (AA07-52)	2	0.64	0.85	1.328	High
(31.0082, -93.7069)	FM1415	CR0000 (AA10-90)	1	0.043	0.057	1.326	High
(30.6459, -94.3995)	US0069	CR0000 (AA12-30)	2	0.801	1.056	1.318	High
(29.8344, -94.6874)	FM0563	CR0000 (AA01-83)	2	0.684	0.899	1.314	High
(29.82, -94.6615)	FM0563	CR0000 (AA96-28)	2	0.684	0.899	1.314	High
(30.0718, -93.9186)	FM0105	CR0000 (AA03-77)	2	0.687	0.901	1.311	High
(30.6728, -93.8847)	FM0363	CR0000 (AA05-54)	2	0.639	0.836	1.308	High
(30.0718, -93.9167)	FM0105	CR0000 (AA70-34)	2	0.687	0.898	1.307	High
(30.3309, -94.4188)	FM0770	FM1003 (0811-02)	2	0.713	0.931	1.306	High
(30.8659, -93.7372)	SH0087	SL0505 (0304-09)	2	0.722	0.941	1.303	High
(30.9656, -93.6355)	FM1414	CR0000 (AA06-75)	1	0.053	0.069	1.302	High
(30.9851, -93.986)	US0096	CR0000 (AA17-14)	2	0.731	0.946	1.294	High
(30.4444, -93.9682)	US0096	CR0000 (AA07-42)	3	1.449	1.875	1.294	High
(30.6868, -94.1753)	FM0092	CR0000 (AA45-50)	2	0.752	0.973	1.294	High
(30.4447, -94.1868)	FM0092	CR0000 (AA02-01)	2	0.743	0.96	1.292	High
(31.0678, -93.9851)	US0096	CR0000 (AA02-27)	2	0.718	0.928	1.292	High
(29.9488, -94.7094)	FM0563	FM0770 (1096-03)	3	1.52	1.964	1.292	High
(30.9358, -93.9649)	SH0063	FM0776 (0214-05)	2	0.728	0.94	1.291	High
(30.1395, -94.387)	SH0105	LS0000 (LW63-79)	4	2.38	3.041	1.278	High
(30.4242, -94.3978)	FM1003	FM0943 (1194-02)	2	0.714	0.911	1.276	High
(30.2848, -93.9082)	SH0062	CR0000 (AA08-23)	2	0.878	1.118	1.273	High

Lat. & Long.	Major Road Name	Minor Road Name (Con-Sec)	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
(30.1308, -94.4037)	SH0326	LS0000 (LW63-61)	2	0.805	1.024	1.272	High
(30.1158, -94.7382)	SH0146	FM2830 (2887-01)	5	3.229	4.104	1.271	High
(30.1691, -93.8738)	FM1136	CR0000 (AA05-09)	2	0.819	1.04	1.27	High
(29.7889, -94.3832)	SH0124	CR0000 (AA02-89)	2	0.757	0.957	1.264	High
(30.4451, -94.7373)	FM0787	CR0000 (AA26-50)	2	0.861	1.086	1.261	High
(30.9437, -93.8257)	FM1012	CR0000 (AA50-14)	1	0.088	0.111	1.261	High
(29.944, -94.238)	SH0124	CR0000 (AA06-79)	2	0.824	1.038	1.26	High
(30.6186, -94.4082)	US0069	CR0000 (AA44-73)	2	0.801	1.007	1.257	High
(30.6377, -94.4021)	US0069	CR0000 (AA12-50)	2	0.801	1.007	1.257	High
(29.8155, -94.6583)	FM0563	FM2041 (1946-01)	4	2.5	3.137	1.255	High
(30.2295, -93.8866)	SH0062	CR0000 (AA07-51)	2	0.953	1.193	1.252	High
(29.859, -94.6015)	FM1663	CR0000 (AA01-67)	1	0.112	0.14	1.25	High
(30.9626, -93.6941)	FM1415	CR0000 (AA05-26)	1	0.064	0.08	1.25	High
(30.0586, -94.2552)	US0090	CR0000 (AA01-25)	4	2.505	3.127	1.248	High
(30.6158, -93.8154)	FM1004	CR0000 (AA03-39)	1	0.117	0.146	1.248	High
(30.7753, -94.4172)	US0190	LS0000 (LY95-36)	2	0.918	1.145	1.247	High
(30.989, -93.6576)	FM1414	CR0000 (AA51-16)	1	0.053	0.066	1.245	High
(30.8463, -94.4206)	FM3065	CR0000 (AA31-20)	1	0.053	0.066	1.245	High
(30.9392, -94.0496)	FM3414	CR0000 (AA17-92)	1	0.131	0.163	1.244	High
(30.4433, -94.1742)	FM2937	CR0000 (AA08-35)	1	0.099	0.123	1.242	High
(30.9124, -93.8887)	FM1408	CR0000 (AA02-82)	1	0.046	0.057	1.239	High
(30.6891, -93.9219)	FM0252	CR0000 (AA04-86)	1	0.21	0.26	1.238	High
(30.832, -93.7655)	SL0505	LS0000 (LR58-25)	1	0.141	0.174	1.234	High
(30.4973, -94.3979)	US0069	CR0000 (AA00-12)	2	0.961	1.185	1.233	High
(30.9244, -94.1104)	FM2799	FM1747 (0244-07)	1	0.159	0.196	1.233	High
(30.2348, -94.9652)	SH0321	FM1008 (0953-01)	5	3.385	4.174	1.233	High
(30.738, -93.6444)	FM1416	CR0000 (AA02-91)	1	0.138	0.17	1.232	High
(30.5966, -93.9121)	FM1004	CR0000 (AA05-70)	1	0.157	0.193	1.229	High

Lat. & Long.	Major Road Name	Minor Road Name (Con-Sec)	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
(29.976, -94.7349)	FM0563	CR0000 (AA01-33)	2	0.992	1.219	1.229	High
(30.1452, -94.6419)	FM0834	CR0000 (AA24-26)	1	0.149	0.183	1.228	High
(29.985, -94.2012)	SH0124	CR0000 (AA02-89)	2	1.001	1.227	1.226	High
(30.9053, -94.3848)	FM0256	CR0000 (AA32-30)	1	0.201	0.246	1.224	High
(30.8937, -94.3507)	FM0256	CR0000 (AA32-40)	1	0.201	0.246	1.224	High
(31.0024, -93.6806)	SH0087	CR0000 (AA99-94)	1	0.127	0.155	1.22	High
(30.3311, -94.5709)	FM0787	CR0000 (AA02-54)	1	0.16	0.195	1.219	High
(30.9412, -94.0193)	FM2800	CR0000 (AA01-23)	1	0.178	0.217	1.219	High
(30.2276, -94.0902)	FM1131	CR0000 (AA09-45)	1	0.202	0.246	1.218	High
(30.4285, -93.9722)	BU0096E	CR0000 (AA07-77)	2	0.988	1.201	1.216	High
(30.7039, -93.7972)	FM0363	CR0000 (AA06-27)	1	0.195	0.237	1.215	High
(30.2057, -94.0832)	FM1131	CR0000 (AA60-47)	1	0.205	0.249	1.215	High
(29.7282, -93.8981)	SH0087	LS0000 (LT21-84)	1	0.183	0.222	1.213	High
(30.665, -93.9044)	FM1013	FM0252 (0785-01)	2	0.977	1.182	1.21	High
(30.301, -93.7476)	SS0272	CR0000 (AA05-43)	1	0.187	0.226	1.209	High
(30.6576, -93.8929)	FM1013	LS0000 (LO05-22)	1	0.226	0.273	1.208	High
(30.8542, -93.6862)	FM2626	CR0000 (AA06-87)	1	0.092	0.111	1.207	High
(31.0685, -93.5447)	SH0063	CR0000 (AA06-69)	1	0.215	0.259	1.205	High
(30.5182, -94.1882)	FM0092	FM2937 (2952-01)	2	1.104	1.328	1.203	High
(30.6792, -94.3289)	FM1013	CR0000 (AA44-97)	1	0.232	0.279	1.203	High
(29.8077, -94.3839)	SH0124	CR0000 (AA02-46)	2	1.092	1.311	1.201	High
(29.807, -94.3839)	SH0124	CR0000 (AA02-45)	2	1.092	1.311	1.201	High
(30.642, -93.9261)	FM0082	CR0000 (AA04-03)	1	0.195	0.234	1.2	High
(30.6159, -93.8146)	FM0082	FM1004 (1274-02)	1	0.449	0.539	1.2	High
(30.9183, -93.722)	SH0087	CR0000 (AA03-89)	1	0.26	0.312	1.2	High
(30.6174, -94.3707)	FM1943	CR0000 (AA47-95)	1	0.247	0.296	1.198	High
(29.8586, -94.3842)	FM1663	CR0000 (AA01-60)	1	0.304	0.364	1.197	High
(29.8604, -94.627)	SH0061	CR0000 (AA03-16)	1	0.265	0.317	1.196	High

Lat. & Long.	Major Road Name	Minor Road Name (Con-Sec)	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
(30.642, -93.903)	FM0082	CR0000 (AA04-19)	1	0.219	0.262	1.196	High
(29.9577, -94.9535)	FM1413	CR0000 (AA04-86)	3	1.944	2.32	1.193	High
(30.439, -93.9664)	SH0062	CR0000 (AA17-44)	2	1.105	1.317	1.192	High
(30.9253, -93.7245)	SH0087	CR0000 (AA20-38)	1	0.26	0.31	1.192	High
(30.1389, -94.3463)	SH0105	CR0000 (AA10-97)	2	1.092	1.299	1.19	High
(30.1239, -93.8211)	SH0062	CR0000 (AA04-77)	1	0.655	0.779	1.189	High
(29.8251, -94.3632)	FM1406	CR0000 (AA01-97)	1	0.291	0.345	1.186	High
(29.7896, -94.5733)	SH0065	FM1724 (1580-01)	1	0.291	0.345	1.186	High
(29.7925, -94.4315)	SH0065	CR0000 (AA01-09)	1	0.318	0.377	1.186	High
(30.8434, -94.2623)	US0190	FM0256 (0703-03)	2	1.127	1.337	1.186	High
(30.4515, -94.8379)	FM0787	CR0000 (AA21-50)	1	0.313	0.371	1.185	High
(30.6194, -94.3516)	FM1943	CR0000 (AA44-85)	1	0.292	0.346	1.185	High
(30.8357, -94.2251)	FM0092	CR0000 (AA41-15)	1	0.317	0.375	1.183	High
(30.1397, -94.3967)	SH0105	LS0000 (LW63-71)	2	1.127	1.333	1.183	High
(30.7189, -94.1717)	FM0092	CR0000 (AA44-16)	1	0.318	0.376	1.182	High
(30.2842, -94.5294)	FM0770	CR0000 (AA11-83)	1	0.33	0.389	1.179	High
(29.7631, -94.3769)	SH0124	CR0000 (AA01-04)	1	0.497	0.584	1.175	High
(30.08, -94.773)	SH0146	LS0000 (LP15-13)	4	2.885	3.39	1.175	High
(30.1046, -93.9035)	FM1442	CR0000 (AA03-03)	2	1.157	1.358	1.174	High
(30.9027, -94.5776)	US0287	LS0000 (LE24-82)	1	0.328	0.385	1.174	High
(29.8622, -94.8536)	FM0565	LS0000 (LR12-35)	2	1.155	1.356	1.174	High
(30.9407, -93.9496)	SH0063	CR0000 (AA02-73)	1	0.313	0.367	1.173	High
(30.2951, -94.9793)	SH0321	CR0000 (AA22-71)	2	1.183	1.388	1.173	High
(30.1999, -93.8159)	FM1130	CR0000 (AA10-74)	1	0.342	0.401	1.173	High
(30.2928, -95.087)	FM1010	CR0000 (AA03-30)	2	1.156	1.351	1.169	High

Table D19. Rural 4 Leg Unsignalized Intersections with Very High Potential for Safety Improvement.

Lat. & Long.	Major Road Name	Minor Road Name (Con-Sec)	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
(30.5924, -93.9167)	US0096	CR0000 (AA05-97)	11	2.364	5.672	2.399	Very High
(30.9243, -94.0696)	SH0063	CR0000 (AA01-10)	7	0.982	2.165	2.205	Very High
(30.1397, -94.4004)	SH0105	LS0000 (LW63-81)	9	2.019	4.325	2.142	Very High
(30.0458, -95.0124)	FM1960	CR0000 (AA06-12)	10	3.198	6.292	1.967	Very High
(30.653, -93.8955)	US0096	LS0000 (LO05-21)	13	5.197	9.603	1.848	Very High
(30.6912, -94.1775)	FM0092	FM1013 (1237-01)	10	3.719	6.747	1.814	Very High
(30.6587, -93.894)	US0096	LS0000 (LO05-19)	8	2.604	4.694	1.803	Very High
(29.9193, -94.1629)	FM0365	CR0000 (AA05-79)	10	3.906	6.903	1.767	Very High
(29.8599, -94.3093)	SH0124	CR0000 (AA02-62)	5	1.224	2.156	1.761	Very High
(30.9182, -94.0496)	SH0063	FM3414 (3405-01)	8	2.923	5.096	1.743	Very High
(30.2842, -94.5238)	FM0770	CR0000 (AA11-74)	4	0.866	1.421	1.641	Very High

Table D20. Rural 4 Leg Unsignalized Intersections with High Potential for Safety Improvement.

Lat. & Long.	Major Road Name	Minor Road Name (Con-Sec)	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
(29.8205, -94.3754)	CR0000	CR0000 (AA02-07)	5	1.613	2.581	1.6	High
(29.8742, -94.8864)	FC0000	LS0000 (LR12-15)	4	1.194	1.839	1.54	High
(30.4406, -94.7664)	SH0146	FM0787 (0813-01)	6	2.502	3.84	1.535	High
(30.6121, -94.4061)	US0069	CR0000 (AA15-15)	5	1.857	2.851	1.535	High
(30.6683, -93.8098)	SH0087	CR0000 (AA03-09)	3	0.591	0.901	1.525	High
(30.7744, -94.4149)	US0069	LS0000 (LY94-98)	6	2.648	3.949	1.491	High
(29.8226, -94.384)	SH0124	CR0000 (AA02-59)	5	2.036	3.01	1.478	High
(30.7754, -94.4138)	US0190	LS0000 (LY95-32)	4	1.73	2.447	1.414	High
(30.6617, -93.8939)	US0096	LS0000 (LO05-64)	5	2.447	3.386	1.384	High
(30.075, -95.0124)	FM0686	CR0000 (AA06-12)	2	0.253	0.35	1.383	High
(29.8236, -94.384)	SH0124	CR0000 (AA02-58)	4	2.036	2.712	1.332	High
(30.9996, -93.668)	SH0063	CR0000 (AA01-10)	2	0.665	0.88	1.323	High
(30.2002, -93.7623)	SH0087	LS0000 (LR93-69)	4	2.092	2.748	1.314	High
(29.8327, -94.3432)	SH0124	CR0000 (AA02-51)	3	1.305	1.701	1.303	High
(31.0636, -94.0351)	RE0255	CR0000 (AA16-03)	2	0.712	0.909	1.277	High
(29.8585, -94.6269)	SH0061	FM1663 (1464-01)	3	1.48	1.889	1.276	High
(29.8231, -94.4006)	FM1406	CR0000 (AA02-76)	4	2.36	2.993	1.268	High
(29.8013, -94.3835)	SH0124	CR0000 (AA02-40)	3	1.557	1.957	1.257	High
(30.1882, -93.8034)	FM1130	LS0000 (LR94-24)	2	0.764	0.96	1.257	High
(30.6597, -93.8939)	US0096	LS0000 (LO05-20)	4	2.447	3.02	1.234	High
(30.3792, -94.3149)	US0069	LS0000 (LO07-01)	4	2.475	3.052	1.233	High
(30.9495, -94.1022)	SH0063	FM0254 (0948-01)	2	0.982	1.205	1.227	High

Table D21. Urban 3 Leg Unsignalized Intersections with Very High Potential for Safety Improvement.

Lat. & Long.	Major Road Name	Minor Road Name (Con-Sec)	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
(29.9471, -93.9933)	FM0365	LS0000 (LT21-91)	54	8.269	37.057	4.481	Very High
(29.9418, -93.9983)	FM0365	LS0000 (LT20-92)	23	4.537	13.479	2.971	Very High
(29.9448, -93.9954)	FM0365	LS0000 (LT19-70)	23	4.537	13.453	2.965	Very High
(30.0578, -94.7704)	US0090	LS0000 (LP14-33)	18	3.773	9.987	2.647	Very High
(30.1363, -94.1905)	FM0364	LS0000 (LC51-62)	14	2.713	6.755	2.49	Very High
(30.0463, -94.8926)	FM1960	LS0000 (LG50-01)	12	2.364	5.639	2.385	Very High
(30.0473, -94.8852)	US0090	LS0000 (LG51-20)	18	4.725	11.25	2.381	Very High
(30.0674, -94.1874)	US0090	LS0000 (LC40-79)	20	5.688	13.387	2.354	Very High
(30.0343, -93.8489)	FM1442	LS0000 (LD14-53)	13	2.98	6.777	2.274	Very High
(30.91, -93.9952)	US0096	LS0000 (LN43-00)	11	2.717	5.696	2.096	Very High
(29.9142, -93.9145)	SH0087	LS0000 (LT22-02)	12	3.09	6.465	2.092	Very High
(30.1334, -94.1713)	SH0105	LS0000 (LC42-92)	17	5.994	11.996	2.001	Very High
(30.1179, -94.0091)	FM0105	LS0000 (LY08-35)	9	2.071	4.129	1.994	Very High
(29.9241, -93.9168)	SH0347	LS0000 (LT21-59)	11	3.196	6.316	1.976	Very High
(30.0435, -94.8843)	FM1409	LS0000 (LG50-86)	7	1.22	2.403	1.97	Very High
(30.2395, -94.1956)	US0096	LS0000 (LP74-70)	15	5.276	10.35	1.962	Very High
(30.0244, -93.8426)	SH0073	LS0000 (LD15-17)	19	7.378	14.38	1.949	Very High
(30.102, -94.0067)	FM0105	LS0000 (LY06-70)	7	1.393	2.641	1.896	Very High
(30.0558, -94.7574)	US0090	LS0000 (LP14-35)	8	2.063	3.838	1.86	Very High
(30.3411, -95.0806)	SH0321	LS0000 (LE44-24)	9	2.739	4.987	1.821	Very High
(30.0877, -94.1899)	FM0364	LS0000 (LC55-94)	11	3.965	7.123	1.796	Very High
(30.2522, -94.2145)	US0069	LS0000 (LP75-43)	15	6.322	11.235	1.777	Very High
(29.9158, -93.913)	SH0087	LS0000 (LT22-68)	9	2.917	5.117	1.754	Very High
(29.9128, -93.9158)	SH0087	LS0000 (LT21-16)	9	3.046	5.319	1.746	Very High
(29.9763, -93.9892)	SH0347	LS0000 (LR39-87)	9	3.181	5.493	1.727	Very High
(30.0623, -94.2274)	US0090	CR0000 (AA13-88)	9	3.554	6.079	1.71	Very High

Lat. & Long.	Major Road Name	Minor Road Name (Con-Sec)	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
(30.1443, -94.0164)	FM0105	LS0000 (LY06-69)	13	5.668	9.617	1.697	Very High
(30.113, -93.7802)	FM3247	LS0000 (LS70-84)	7	2.182	3.68	1.687	Very High
(29.963, -93.9785)	FM0365	LS0000 (LR40-66)	13	5.766	9.676	1.678	Very High
(30.0566, -94.7971)	US0090	LS0000 (LP15-10)	18	8.921	14.767	1.655	Very High
(30.248, -94.1969)	US0096	FC0000 (T024-47)	23	12.035	19.835	1.648	Very High
(29.7827, -94.8827)	FM0565	CR0000 (AA05-16)	6	1.824	2.968	1.627	Very High
(30.0345, -94.8784)	FM1409	LS0000 (LG50-91)	5	1.22	1.981	1.624	Very High

Table D22. Urban 3 Leg Unsignalized Intersections with High Potential for Safety Improvement.

Lat. & Long.	Major Road Name	Minor Road Name (Con-Sec)	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
(30.0522, -93.8138)	SH0087	CR0000 (AA04-32)	14	6.902	11.067	1.603	High
(30.2561, -94.1899)	FM3513	LS0000 (LP74-37)	4	0.687	1.099	1.6	High
(30.0784, -94.7755)	SL0227	LS0000 (LP14-29)	6	1.969	3.125	1.587	High
(30.0665, -93.7455)	FM1006	LS0000 (LR93-17)	4	0.799	1.241	1.553	High
(29.8136, -94.9014)	SH0146	LS0000 (LC35-67)	15	7.925	12.3	1.552	High
(30.0484, -94.8839)	US0090	LS0000 (LG50-92)	10	4.725	7.314	1.548	High
(30.0343, -93.8324)	SH0073	LS0000 (LD14-91)	15	8.092	12.4	1.532	High
(30.1254, -93.7477)	SH0087	LS0000 (LR95-04)	8	3.531	5.404	1.53	High
(30.3445, -95.0891)	SL0573	LS0000 (LE43-84)	6	2.256	3.447	1.528	High
(29.8864, -94.0103)	SH0073	LS0000 (LT21-20)	7	3.11	4.718	1.517	High
(30.1002, -94.9197)	SH0321	FM0686 (1067-01)	6	2.336	3.524	1.509	High
(30.0326, -93.8365)	FM1442	LS0000 (LD16-51)	8	3.663	5.51	1.504	High
(30.1147, -93.7474)	SH0087	LS0000 (LR94-82)	10	5.072	7.578	1.494	High
(30.3566, -95.0812)	SL0573	LS0000 (LE43-18)	4	0.949	1.412	1.488	High
(30.0037, -94.1854)	FM0364	LS0000 (LC56-00)	4	1.171	1.727	1.475	High
(29.8056, -94.8391)	FM0565	CR0000 (AA05-64)	4	1.142	1.683	1.474	High
(30.3598, -94.1701)	FM0418	LS0000 (LW48-49)	4	1.054	1.553	1.473	High
(30.0682, -94.1897)	FM0364	LS0000 (LC48-54)	8	3.965	5.777	1.457	High
(30.1788, -93.758)	SH0087	CR0000 (AA10-40)	5	1.951	2.817	1.444	High
(30.3358, -95.0631)	SH0321	FC0000 (B008-25)	7	3.402	4.906	1.442	High
(30.3999, -94.1829)	FM1122	CR0000 (AA01-38)	3	0.593	0.854	1.44	High
(30.0638, -94.2168)	US0090	CR0000 (AA13-84)	8	4.143	5.936	1.433	High
(30.162, -94.0179)	FM0105	FM1132 (0784-05)	15	8.966	12.816	1.429	High
(30.1206, -94.0109)	FM0105	LS0000 (LY06-05)	5	2.071	2.944	1.422	High
(30.1187, -94.0097)	FM0105	LS0000 (LY08-34)	5	2.071	2.942	1.421	High
(30.3508, -94.1993)	SH0327	LS0000 (LW49-83)	5	2.115	2.998	1.417	High

Lat. & Long.	Major Road Name	Minor Road Name (Con-Sec)	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
(30.3969, -94.2248)	FM0418	FM1122 (1581-01)	4	1.424	2.015	1.415	High
(30.3404, -95.0697)	SH0321	LS0000 (LE43-94)	8	4.269	6.031	1.413	High
(30.0371, -93.8509)	FM0408	LS0000 (LD15-72)	4	1.417	2	1.411	High
(30.0421, -94.1336)	SH0124	LS0000 (LC48-45)	7	3.288	4.615	1.404	High
(30.3937, -94.2213)	FM0418	CR0000 (AA09-51)	3	0.754	1.055	1.399	High
(29.9529, -93.9877)	FM0365	FC0000 (E005-69)	17	10.961	15.144	1.382	High
(30.1057, -94.8587)	FM1008	LS0000 (LN73-36)	3	0.868	1.198	1.38	High
(30.3361, -95.0975)	BS0105T	LS0000 (LE44-03)	5	2.263	3.117	1.377	High
(30.0292, -93.8376)	SH0073	LS0000 (LD14-56)	12	7.378	10.159	1.377	High
(30.2739, -94.2273)	US0069	LS0000 (LP75-22)	6	3.089	4.249	1.376	High
(30.3482, -95.0769)	FM0787	LS0000 (LE43-61)	3	0.867	1.189	1.371	High
(30.3411, -95.0754)	SH0321	LS0000 (LE44-74)	8	4.587	6.262	1.365	High
(30.36, -94.1709)	FM0418	LS0000 (LW49-60)	4	1.535	2.094	1.364	High
(30.1504, -94.0177)	FM0105	LS0000 (LY08-52)	13	8.249	11.197	1.357	High
(29.9621, -93.9176)	FM0366	FC0000 (D004-25)	7	3.87	5.244	1.355	High
(30.0734, -93.7378)	FM1006	LS0000 (LR92-87)	3	0.963	1.304	1.354	High
(30.3464, -94.18)	BU0096F	LS0000 (LW50-24)	7	3.858	5.217	1.352	High
(30.133, -94.1995)	SH0105	LS0000 (LC56-42)	6	3.168	4.28	1.351	High
(30.103, -94.8468)	FM2797	LS0000 (LN73-22)	2	0.19	0.256	1.347	High
(30.0895, -94.1899)	FM0364	LS0000 (LC43-32)	7	3.965	5.328	1.344	High
(30.1049, -94.8585)	FM1008	LS0000 (LN73-18)	3	0.99	1.33	1.343	High
(29.9023, -94.0096)	SS0093	FC0000 (C017-60)	5	2.522	3.376	1.339	High
(30.1474, -93.9773)	FM1132	LS0000 (LY07-29)	3	1.008	1.35	1.339	High
(30.0264, -93.8406)	SH0073	FC0000 (D003-40)	19	12.962	17.347	1.338	High
(30.031, -94.1893)	FM0364	LS0000 (LZ53-40)	3	0.948	1.268	1.338	High
(30.05, -94.894)	SH0321	FC0000 (D006-25)	9	5.335	7.136	1.338	High
(30.0431, -94.7763)	FM0563	LS0000 (LP14-38)	3	1.038	1.383	1.332	High

Lat. & Long.	Major Road Name	Minor Road Name (Con-Sec)	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
(29.887, -94.0166)	SH0073	FC0000 (C010-70)	8	4.864	6.436	1.323	High
(30.1115, -94.9244)	SH0321	CR0000 (AA88-90)	3	1.112	1.469	1.321	High
(30.349, -95.0744)	FM0787	FC0000 (B002-60)	4	1.919	2.511	1.308	High
(30.9003, -94.0101)	FM0252	FC0000 (B000-88)	4	1.947	2.543	1.306	High
(30.1106, -93.728)	BU0090Y	FC0000 (B002-25)	3	1.135	1.481	1.305	High
(30.009, -94.1769)	SH0124	FC0000 (B006-58)	3	1.438	1.87	1.3	High
(30.0996, -93.7272)	BU0090Y	FC0000 (B004-39)	3	1.248	1.605	1.286	High
(30.1199, -94.1902)	FM0364	LS0000 (LC55-95)	8	5.168	6.625	1.282	High
(30.1483, -94.1911)	FM0364	LS0000 (LC55-64)	5	2.83	3.629	1.282	High
(30.2344, -94.1901)	FM3513	FC0000 (T013-97)	4	2.068	2.644	1.279	High
(30.122, -94.0116)	FM0105	LS0000 (LY07-62)	4	2.071	2.648	1.279	High
(30.0601, -93.8055)	SH0087	CR0000 (AA04-26)	7	4.427	5.653	1.277	High

Table D23. Urban 4 Leg Unsignalized Intersections with Very High Potential for Safety Improvement.

Lat. & Long.	Major Road Name	Minor Road Name (Con-Sec)	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
(29.9045, -93.9235)	SH0087	LS0000 (LT18-33)	20	4.678	12.875	2.752	Very High
(30.0939, -94.1113)	SS0380	LS0000 (LC46-40)	25	6.519	17.802	2.731	Very High
(30.03, -93.8368)	SH0073	LS0000 (LD14-29)	30	8.438	22.865	2.71	Very High
(30.0661, -94.1999)	US0090	LS0000 (LC56-61)	23	6.378	16.426	2.575	Very High
(30.0459, -94.8871)	US0090	LS0000 (LG51-30)	19	5.256	12.927	2.459	Very High
(30.071, -94.1072)	FC0000	LS0000 (LC40-90)	19	5.433	13.212	2.432	Very High
(30.1135, -93.7474)	SH0087	LS0000 (LR94-74)	21	6.577	15.388	2.34	Very High
(29.9089, -93.9194)	SH0087	LS0000 (LZ11-36)	15	4.678	10.029	2.144	Very High
(30.3384, -95.0869)	FM1010	LS0000 (LE44-59)	6	0.641	1.36	2.122	Very High
(30.0949, -94.1115)	SS0380	LS0000 (LC49-21)	22	8.744	17.723	2.027	Very High

Table D24. Urban 4 Leg Unsignalized Intersections with High Potential for Safety Improvement.

Lat. & Long.	Major Road Name	Minor Road Name (Con-Sec)	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
(30.9076, -94.0297)	SH0063	FM0777 (1109-01)	14	5.034	10.006	1.988	High
(30.9085, -94.0017)	US0190	LS0000 (LN43-50)	17	6.573	12.949	1.97	High
(30.4191, -94.1822)	FM0092	CR0000 (AA08-44)	10	3.059	5.999	1.961	High
(30.0686, -94.1123)	FC0000	LS0000 (LC40-36)	14	5.433	10.256	1.888	High
(30.045, -94.8852)	FM1409	LS0000 (LG50-75)	12	4.429	8.328	1.88	High
(30.1426, -94.016)	FM0105	FC0000 (C025-45)	37	18.559	33.616	1.811	High
(29.9001, -93.9277)	SH0087	LS0000 (LT17-97)	11	4.678	8.081	1.727	High
(30.0697, -94.1089)	FC0000	LS0000 (LC40-91)	12	5.433	9.067	1.669	High
(29.9023, -93.9256)	SH0087	LS0000 (LZ11-38)	8	3.16	5.18	1.639	High
(30.1749, -93.7572)	SH0087	LS0000 (LR94-89)	10	4.512	7.367	1.633	High
(30.3464, -95.0818)	FM0787	LS0000 (LE44-23)	4	0.871	1.418	1.628	High
(30.0676, -94.1755)	US0090	LS0000 (LC51-61)	21	11.334	18.449	1.628	High
(29.8774, -93.9488)	SH0087	LS0000 (LT22-05)	6	2.218	3.557	1.604	High
(30.1294, -94.0149)	FM0105	LS0000 (LY08-38)	21	11.594	18.51	1.597	High
(30.133, -94.2127)	SH0105	LS0000 (LC48-22)	7	2.954	4.603	1.558	High
(30.1703, -93.7949)	FM1130	LS0000 (LR91-73)	5	1.743	2.713	1.557	High
(30.0686, -94.1135)	FC0000	LS0000 (LC46-58)	10	4.822	7.458	1.547	High
(29.8995, -93.9296)	US0069	LS0000 (LT17-82)	10	5.011	7.733	1.543	High
(30.0691, -94.1098)	FC0000	LS0000 (LC40-92)	10	5.433	8.02	1.476	High
(30.0833, -93.7738)	FM0105	LS0000 (LY54-66)	9	4.964	7.145	1.439	High
(30.0685, -94.1146)	FC0000	LS0000 (LC53-03)	7	3.65	5.22	1.43	High

Table D25. 3 Leg Signalized Intersections with Very High Potential for Safety Improvement.

Lat. & Long.	Major Road Name	Minor Road Name (Con-Sec)	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
(29.9138, -93.9494)	US0069	FC0000 (C017-04)	84	23.603	73.714	3.123	Very High
(30.2555, -94.2165)	US0069	LS0000 (LP74-46)	44	13.268	35.756	2.695	Very High
(29.9514, -93.9892)	FM0365	LS0000 (LT19-22)	72	25.569	64.599	2.526	Very High

Table D26. 3 Leg Signalized Intersections with High Potential for Safety Improvement.

Lat. & Long.	Major Road Name	Minor Road Name (Con-Sec)	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
(30.3338, -95.0604)	SH0321	SH0105 (0338-12)	37	15.315	31.81	2.077	High
(29.952, -93.9561)	SH0347	FC0000 (C011-57)	36	19.46	32.679	1.679	High
(30.1512, -93.7525)	SH0087	FM3247 (1284-02)	24	13.475	21.221	1.575	High
(29.8098, -94.8325)	FM0565	LS0000 (LF48-20)	10	4.676	7.306	1.562	High
(29.9384, -93.9371)	SH0347	CR0000 (AA01-14)	39	23.724	36.409	1.535	High

Table D27. 4 Leg Signalized Intersections with Very High Potential for Safety Improvement.

Lat. & Long.	Major Road Name	Minor Road Name (Con-Sec)	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
(30.2538, -94.1978)	US0096	LS0000 (LP75-38)	54	19.556	43.929	2.246	Very High
(30.0681, -94.143)	US0090	LS0000 (LZ53-28)	18	6.841	14.848	2.17	Very High
(30.0679, -94.1555)	US0090	FC0000 (B007-12)	25	10.916	22.213	2.035	Very High

Table D28. 4 Leg Signalized Intersections with High Potential for Safety Improvement.

Lat. & Long.	Major Road Name	Minor Road Name (Con-Sec)	Observed Crashes	Predicted Crashes	Expected Crashes	Ratio of Expected to Predicted Crashes	Potential to Improve Safety Ranking
(30.266, -94.1997)	US0096	FC0000 (C002-20)	57	28.021	50.564	1.805	High
(29.9545, -93.9863)	FM0365	FC0000 (E005-65)	69	36.18	63.012	1.742	High
(29.9045, -93.9366)	US0069	FC0000 (C016-45)	53	27.652	47.269	1.709	High
(30.2425, -94.2089)	US0069	FM0421 (0813-03)	52	27.99	46.619	1.666	High
(30.0536, -94.8964)	SH0321	LS0000 (LG50-88)	31	16.137	25.989	1.611	High
(30.0793, -93.8218)	SH0062	FM0105 (0689-02)	47	28.363	42.868	1.511	High
(30.2561, -94.1982)	US0096	LS0000 (LP74-37)	33	19.556	29.069	1.486	High

APPENDIX E: LIST OF PEDESTRIAN COUNTERMEASURES AND LIST OF EXISTING BEAUMONT DISTRICT PROJECTS WITH SEGMENTS WITH HIGH AND VERY HIGH POTENTIAL FOR SAFETY IMPROVEMENTS

LIST OF PEDESTRIAN COUNTERMEASURES

Table E1. List of Countermeasures to Address Pedestrian Safety Issues.

Category	Countermeasure
Along the roadway	Sidewalks, walkways, and paved shoulders
	Street furniture/walking environment
At crossing locations	Curb ramps
	Marked crosswalks and enhancements
	Curb extensions
	Crossing islands
	Raised pedestrian crossings
	Lighting and illumination
	Parking restrictions (at crossing locations)
	Pedestrian overpasses/underpasses
	Automated pedestrian detection
	Leading pedestrian interval
	Advance yield/stop lines
Transit	Transit stop improvements
	Access to transit
	Bus bulb-outs
Roadway design	Bicycle lanes
	Lane narrowing
	Lane reduction (road diet)
	Driveway improvements
	Raised medians
	One-way/two-way street conversions
	Improved right-turn slip-lane design
Intersection design	Roundabouts
	Modified T-intersections
	Intersection median barriers
	Curb radius reduction
	Modify skewed intersections
	Pedestrian accommodations at complex interchanges
Traffic calming	Temporary installations for traffic calming
	Chokers
	Chicanes
	Mini-circles

Category	**Countermeasure**
	Speed humps
	Speed tables
	Gateways
	Landscaping
	Specific paving treatments
	Serpentine design
Traffic management	Diverters
	Full street closure
	Partial street closure
	Left-turn prohibitions
Signals and signs	Traffic signals
	Pedestrian signals
	Pedestrian signal timing
	Traffic signal enhancements
	Right-turn-on-red restrictions
	Advanced stop lines at traffic signals
	Left-turn phasing
	Push buttons and signal timing
	Pedestrian hybrid beacon
	Rectangular rapid flash beacon
	Puffin crossing
	Signing
Other measures	School zone improvement
	Neighborhood identity
	Speed monitoring
	On-street parking enhancements
	Pedestrian/driver education
	Police enforcement
	Automated enforcement systems
	Pedestrian streets/malls
	Work zones and pedestrian detours
	Pedestrian safety at railroad crossings
	Shared streets

Note: As listed in Harkey and Zegeer, 2004.

LIST OF EXISTING BEAUMONT DISTRICT PROJECTS WITH SEGMENTS WITH HIGH AND VERY HIGH POTENTIAL FOR SAFETY IMPROVEMENTS

Table E2. List of Existing Beaumont District Projects with Segments with High and Very High Potential for Safety Improvements.

IH 10 0028-09-116 High Mast Lighting			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
854.272	854.667	1.53	High
IH 10 0028-14-108 Reconstruct Main Lanes Of Existing Four-Lane Freeway			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
876.170	877.097	1.58	High
877.886	878.527	1.31	High
IH 10 0028-14-091 Widen Road—Add Lanes			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
876.170	877.097	1.58	High
877.886	878.527	1.31	High
IH 10 0028-14-109 Replace Bridge and Approaches			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
876.170	877.097	1.58	High
IH 10 0028-11-179 Widen Existing Mainlanes from Four to Six Lanes			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
867.020	867.646	1.45	High
871.601	872.100	1.60	High
IH 10 0028-09-111 Replace Existing Bridge and Approaches			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
854.272	854.667	1.53	High
IH 10 0739-02-164 Overlay Existing Roadway			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
848.512	849.189	1.62	High
IH 10 0739-02-162 Widen Freeway from Four to Six Lanes			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
844.303	844.421	1.93	High
IH 10 0739-02-161 Widen Freeway from Four to Six Lanes			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
833.626	835.331	1.24	High
837.036	837.284	1.47	Very High
IH 10 0739-02-160 Widen Freeway from Four to Six Lanes			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
833.626	835.331	1.24	High
IH 10 0739-02-156 Install High Mast Lighting			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved

848.512	849.189	1.62	High
IH 10 0739-02-140 Widen Freeway from Four to Six Lanes			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
848.512	849.189	1.62	High
IH 10 0739-01-039 Widen Existing Four Lanes to Six Lanes			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
827.637	828.463	1.66	Very High
IH 10 0508-02-120 Construct Overpass and Reconfigure Interchange			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
798.801	799.858	1.73	High
IH 10 0739-02-168 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
848.512	849.189	1.62	High
IH 10 0028-14-117 Deck Repairs, End Span Improvements			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
876.170	877.097	1.58	High
877.886	878.527	1.31	High
IH 10 0028-14-116 Deck Repairs, End Span Improvements			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
876.170	877.097	1.58	High
877.886	878.527	1.31	High
IH 10 0739-02-174 Ramp and Intersection Improvements			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
833.626	835.331	1.24	High
837.036	837.284	1.47	Very High
844.303	844.421	1.93	High
IH 10 0508-02-124 Feasibility Study			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
798.801	799.858	1.73	High
IH 10 0028-13-135 Widen Freeway to Six Main Lanes and Reconstruct Interchange			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
850.706	851.056	1.79	High
IH 10 0739-02-170 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
848.512	849.189	1.62	High
IH 10 0028-11-207 Install Pedestrian Signal, Install Pedestrian Crosswalk			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
871.601	872.100	1.60	High
IH 10 0508-02-125 Deck Repairs, End Span Improvements			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
811.271	811.588	1.65	Very High
IH 10 0028-11-208 Rehabilitate Existing Roadway			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved

871.601	872.100	1.60	High
IH 10 0508-02-127 Surfacing/Roadway Restoration			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
804.312	805.471	1.37	High
811.271	811.588	1.65	Very High
IH 10 0508-02-126 Surfacing/Roadway Restoration			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
804.312	805.471	1.37	High
811.271	811.588	1.65	Very High
US 69 0065-06-062 Resurface Roadway			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
314.416	314.553	2.19	Very High
US 69 0200-15-021 Mill and Overlay, Joint Seal			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
338.838	339.117	1.59	High
US 69 0200-11-099 Repair Existing Pavement and Overlay Roadway			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
320.715	321.479	1.70	High
321.553	321.915	1.83	High
321.915	322.292	3.55	Very High
322.292	322.429	12.04	Very High
323.332	323.475	2.44	Very High
323.475	324.081	1.75	High
US 69 0200-14-078 Install High Mast Lighting			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
327.891	328.366	3.84	Very High
332.516	332.864	2.03	Very High
US 69 0200-14-060 Widen to Six Lanes			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
327.271	327.459	1.84	High
327.891	328.366	3.84	Very High
332.516	332.864	2.03	Very High
US 69 0200-11-100 Ramp Relocation/Reconfiguration			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
320.715	321.479	1.70	High
321.553	321.915	1.83	High
321.915	322.292	3.55	Very High
322.292	322.429	12.04	Very High
US 69 0200-11-098 Ramp Relocation/Reconfiguration			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
323.332	323.475	2.44	Very High
323.475	324.081	1.75	High
US 69 0200-11-095 Widen Freeway from Four to Six Lanes			

From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
320.715	321.479	1.70	High
321.553	321.915	1.83	High
321.915	322.292	3.55	Very High
322.292	322.429	12.04	Very High
323.332	323.475	2.44	Very High
323.475	324.081	1.75	High
US 69 0200-08-049 Construct New Location Four-Lane Divided Facility			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
281.795	282.005	1.35	High
282.190	282.342	1.57	Very High
283.145	283.263	1.24	High
283.566	283.723	1.49	Very High
283.723	283.950	1.25	High
286.683	286.797	1.25	High
286.797	287.200	1.32	High
287.632	288.587	1.17	High
US 69 0200-08-056 Safety Treat Fixed Objects			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
278.852	279.128	1.35	High
279.128	279.412	2.32	Very High
281.795	282.005	1.35	High
282.190	282.342	1.57	Very High
283.145	283.263	1.24	High
283.566	283.723	1.49	Very High
283.723	283.950	1.25	High
286.683	286.797	1.25	High
286.797	287.200	1.32	High
287.632	288.587	1.17	High
US 69 0200-05-036 Reconstruct Existing Two-Lane Highway to Four-Lane Divided			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
253.974	254.338	1.27	High
257.777	257.999	1.52	Very High
US 69 0200-04-020 Widen Road—Add Lanes			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
252.404	252.505	1.59	Very High
US 69 0200-15-024 Bridge Maintenance			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
338.838	339.117	1.59	High
US 69 0200-15-025 Ramp and Intersection Improvements			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
338.838	339.117	1.59	High
US 69 0200-16-019 Safety Lighting			

From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
342.875	342.995	5.29	Very High
US 69 0200-16-020 Highway Improvement			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
342.875	342.995	5.29	Very High
343.160	343.264	2.72	High
US 69 0200-14-085 Repaint Steel Members, Replace Back Walls and Approach Slabs			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
332.516	332.864	2.03	Very High
US 69 0200-07-054 Mill and Overlay			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
271.229	271.536	1.13	High
271.556	272.255	1.21	High
272.255	272.444	2.74	Very High
272.842	273.107	1.40	Very High
275.534	277.107	1.15	High
277.252	277.725	1.15	High
US 69 0200-11-106 Install High Mast Lighting			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
320.715	321.479	1.70	High
US 69 0065-06-067 Widen Freeway from Four to Six Lanes			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
314.416	314.553	2.19	Very High
US 69 0200-16-022 2 / Mill and Overlay, Joint Seal			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
342.875	342.995	5.29	Very High
343.160	343.264	2.72	High
US 69 0200-14-089 1.5 / Mill and Overlay			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
327.271	327.459	1.84	High
327.891	328.366	3.84	Very High
332.516	332.864	2.03	Very High
US 69 0065-06-068 1.5\ Mill and Overlay			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
314.416	314.553	2.19	Very High
US 69 0200-06-055 Overlay Existing Roadway			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
263.111	263.797	1.50	Very High
269.355	269.487	1.33	High
269.487	269.674	1.18	High
269.716	269.874	1.17	High
US 69 0200-05-048 Overlay Existing Roadway			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved

253.974	254.338	1.27	High
257.777	257.999	1.52	Very High
260.345	260.541	1.30	High
US 69 0200-04-024 Overlay Existing Roadway			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to be Improved
252.404	252.505	1.59	Very High
US 69 0200-08-057 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
281.795	282.005	1.35	High
282.190	282.342	1.57	Very High
283.145	283.263	1.24	High
283.566	283.723	1.49	Very High
283.723	283.950	1.25	High
286.683	286.797	1.25	High
286.797	287.200	1.32	High
287.632	288.587	1.17	High
US 69 0200-11-108 Install Pedestrian Signal			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
322.292	322.429	12.04	Very High
US 90 0028-04-069 Widen and Reconstruct to Four-Lane Divided Rural			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
701.638	701.920	1.16	High
US 90 0028-03-105 Improve Traffic Signals			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
688.142	688.319	1.65	High
US 90 0028-04-077 Widen to Four Lanes With Ctl			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
694.766	694.917	3.28	High
695.140	695.446	2.05	High
US 90 0028-03-108 Mill and Inlay			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
681.657	681.759	2.04	Very High
684.405	684.568	1.67	High
686.866	687.625	2.54	Very High
US 90 0028-05-054 Seal Coat (West Bound)			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
711.414	711.531	2.14	Very High
US 90 0028-03-106 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
687.627	687.900	2.97	Very High
688.142	688.319	1.65	High
US 90 0028-03-109 Install Raised Median			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved

687.627	687.900	2.97	Very High
688.142	688.319	1.65	High
US 90 0028-03-110 Construct Pedestrian Infrastructure			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
688.142	688.319	1.65	High
US 96 0065-04-082 Bridge Maintenance			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
113.968	114.207	1.33	High
US 96 0065-05-145 Overlay Existing Roadway			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
131.146	131.510	2.54	High
US 96 0065-03-044 Overlay Existing Roadway			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
94.630	94.999	1.56	High
94.999	95.229	1.40	High
95.413	95.565	1.77	Very High
US 96 0065-02-055 Overlay Existing Roadway			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
92.971	93.170	1.40	High
US 96 0064-08-059 Milled Edgeline RSs			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
64.862	65.026	1.41	Very High
70.254	70.445	1.64	Very High
70.455	70.639	1.67	Very High
70.639	70.893	1.58	High
70.895	71.221	2.57	Very High
US 96 0065-05-146 Hazard Elimination and Safety			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
124.527	124.823	1.32	High
US 96 0065-01-057 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
75.534	75.816	8.72	Very High
US 96 0064-08-062 Widen To Four-Lane Divided Highway			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
64.862	65.026	1.41	Very High
US 96 0065-01-058 Overlay Existing Roadway			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
75.534	75.816	8.72	Very High
US 96 0065-05-149 Improve Traffic Signals			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
131.146	131.510	2.54	High
US 96 0064-08-057 Overlay Existing Roadway			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved

64.862	65.026	1.41	Very High
70.254	70.445	1.64	Very High
70.455	70.639	1.67	Very High
70.639	70.893	1.58	High
70.895	71.221	2.57	Very High
US 96 0065-01-056 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
75.534	75.816	8.72	Very High
US 96 0065-05-152 Install Raised Median			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
131.146	131.510	2.54	High
US 190 0213-08-074 Replace Bridge and Approaches			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
546.789	546.964	1.15	High
US 190 0213-06-041 Construct Passing Lanes			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
521.519	522.300	1.14	High
522.301	522.774	1.24	High
522.809	524.245	1.36	High
524.245	525.682	1.13	High
US 190 0213-08-091 Improve Traffic Signals			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
557.186	557.854	1.80	High
US 190 0213-08-090 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
557.186	557.854	1.80	High
US 190 0213-06-044 Surfacing/Roadway Restoration			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
521.519	522.300	1.14	High
522.301	522.774	1.24	High
522.809	524.245	1.36	High
524.245	525.682	1.13	High
527.348	527.924	1.56	High
US 190 0244-03-063 Surfacing/Roadway Restoration			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
567.453	567.690	1.42	Very High
US 287 0341-04-070 Overlay Existing Roadway			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
663.485	663.595	1.57	High
673.589	673.944	1.15	High
674.417	674.601	1.30	High
677.763	677.897	1.46	Very High
SH 12 0499-03-058 Install Continuous Turn Lane, Passing Lanes, and Rumble Strip			

From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
3.888	4.060	6.15	Very High
4.060	4.386	1.36	High
4.390	5.880	1.37	High
7.448	8.457	1.19	High
8.457	8.657	1.25	High
SH 12 0499-03-060 Install Intersection Flashing Beacon, Safety Lighting			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
3.888	4.060	6.15	Very High
4.060	4.386	1.36	High
SH 12 0499-02-031 Mill, Joint Repair, Overlay			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
16.272	16.663	1.15	High
18.480	18.588	1.26	High
SH 62 0243-03-066 Safety Lighting			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
17.924	18.218	1.66	Very High
SH 62 0243-04-056 Widen Highway from Two to Four Lanes			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
23.228	23.559	1.22	High
24.147	24.389	1.52	High
SH 63 0214-03-032 Replace and Realign Bridge Approach			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
61.689	61.995	1.37	High
62.075	62.185	2.17	Very High
SH 63 0214-03-035 Replace Bridge			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
63.851	64.090	1.19	High
SH 63 0244-02-099 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
28.142	28.971	1.28	High
29.654	29.948	2.30	Very High
29.948	30.172	1.68	Very High
30.499	31.114	1.31	High
SH 63 0214-03-036 Retrofit Bridge Bents			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
63.851	64.090	1.19	High
SH 63 0244-02-100 Surfacing/Roadway Restoration			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
27.568	27.735	1.59	Very High
28.142	28.971	1.28	High
SH 73 0306-01-065 Mill and Overlay Existing Roadway			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved

41.784	41.998	4.24	Very High
SH 73 0508-03-098 Rehab and Extend Existing Frontage Roads			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
2.136	2.283	1.81	High
SH 73 0508-03-099 Grade Separation and Close Crossover			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
2.136	2.283	1.81	High
SH 73 0508-04-164 Overlay Existing Roadway			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
28.615	28.908	2.25	Very High
31.562	32.567	1.70	High
SH 87 0307-01-146 Construct Shoreline Protection			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
184.768	185.249	1.13	High
SH 87 0305-02-049 Overlay Existing Roadway			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
115.406	115.690	1.39	Very High
SH 87 0305-01-035 Overlay Existing Roadway			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
110.932	111.277	1.53	Very High
SH 87 0305-07-062 Overlay Existing Roadway			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
150.800	151.034	1.47	Very High
158.036	158.145	4.54	Very High
SH 87 0305-03-043 Safety Lighting			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
121.823	122.111	2.04	Very High
122.111	122.313	1.19	High
SH 87 0305-03-044 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
121.823	122.111	2.04	Very High
122.111	122.313	1.19	High
SH 87 0305-07-072 Widen Highway from Two to Four Lanes			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
149.589	149.744	1.15	High
150.800	151.034	1.47	Very High
SH 87 0305-06-028 Overlay Existing Roadway			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
149.140	149.261	1.69	Very High
SH 87 0028-15-056 Install Sidewalks			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
160.314	160.601	2.03	High
160.601	160.890	2.27	High

SH 99 3187-02-006 Construct Two 2-Ln Frontage Roads			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
180.318	180.443	2.63	Very High
180.745	181.434	1.32	High
181.434	181.836	1.48	High
181.836	182.073	1.69	High
SH 105 0951-01-066 Widen Highway to Super 2 Standard			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
116.321	117.665	1.14	High
119.008	119.179	1.52	Very High
SH 105 0338-05-028 Widen from Two- to Four-Lanes Divided			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
0.000	0.322	1.68	Very High
SH 105 0339-04-036 Widen to Four Lanes With Ctl			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
138.373	138.590	1.19	High
138.590	138.953	1.58	Very High
SH 105 0951-01-068 Level Up and Overlay			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
107.962	108.369	1.25	High
108.837	108.959	1.33	High
108.959	109.202	1.31	High
SH 105 0593-01-130 Install Continuous Turn Lane			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
94.341	96.100	1.48	Very High
SH 105 0951-01-070 Surfacing/Roadway Restoration			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
96.718	96.859	1.14	High
SH 105 0593-01-132 Surfacing/Roadway Restoration			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
6.140	6.966	1.21	High
93.993	94.096	2.37	Very High
94.341	96.100	1.48	Very High
SH 124 0368-03-033 Install Left- and Right-Turn Lanes			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
3.650	4.238	1.29	High
4.262	4.386	1.20	High
SH 124 0368-03-034 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
3.650	4.238	1.29	High
4.262	4.386	1.20	High
SH 124 0368-01-089 Improve Traffic Signals			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved

23.640	23.799	3.48	Very High
SH 124 0368-02-044 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
11.544	11.691	1.30	High
11.954	12.140	1.49	Very High
14.522	14.689	1.67	Very High
16.494	16.699	1.41	Very High
18.806	20.085	1.23	High
20.085	20.223	1.80	Very High
SH 124 0367-01-069 Base Repair and Overlay			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
37.261	37.455	1.40	Very High
SH 124 0367-01-070 Base Repair, Level Up, and Overlay			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
29.981	31.566	1.14	High
SH 124 0368-03-037 Install Continuous Turn Lane, Milled Edgeline Rumble Strips			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
3.650	4.238	1.29	High
SH 124 0367-01-071 Surfacing/Roadway Restoration			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
25.780	26.269	1.18	High
27.189	27.337	1.21	High
29.981	31.566	1.14	High
SH 124 0368-01-090 Surfacing/Roadway Restoration			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
22.942	23.145	1.37	High
23.640	23.799	3.48	Very High
SH 146 0389-02-051 Improve Traffic Signals			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
73.104	73.315	2.90	Very High
73.441	73.556	5.51	Very High
SH 146 0389-02-052 Hazard Elimination and Safety			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
73.441	73.556	5.51	Very High
73.556	73.749	4.24	Very High
74.050	74.258	2.44	High
SH 146 0388-03-080 Improve Traffic Signals			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
48.638	48.935	1.58	Very High
SH 146 0388-03-081 Install Continuous Turn Lane			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
46.897	47.817	1.30	High

SH 146 0389-02-055 Install Sidewalks			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
73.441	73.556	5.51	Very High
73.556	73.749	4.24	Very High
SH 321 0593-01-122 Safety Treat Fixed Objects			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
6.140	6.966	1.21	High
SH 321 0593-01-124 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
6.140	6.966	1.21	High
14.145	14.876	1.18	High
17.237	17.350	1.31	High
17.373	17.525	1.98	Very High
SH 321 0593-01-126 Improve Traffic Signals			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
24.945	25.143	2.23	Very High
SH 321 0593-01-123 Resurface Roadway			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
0.169	0.522	1.85	High
1.029	1.429	1.29	High
SH 321 0593-01-131 Construct Pedestrian Infrastructure			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
24.423	24.945	1.35	High
24.945	25.143	2.23	Very High
SH 326 0601-01-061 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
18.284	18.424	1.17	High
19.893	19.993	1.36	High
SH 326 0601-01-062 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
16.658	16.917	1.28	High
SH 326 0601-02-023 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
24.125	24.275	1.21	High
SH 327 0602-01-046 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
1.087	2.173	1.31	High
4.691	4.823	1.23	High
SH 347 0667-01-115 Rehabilitate Existing Roadway			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
5.018	5.300	6.58	Very High
SH 347 0667-01-123 Install Pedestrian Signal, Install Pedestrian Crosswalk			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved

8.947	9.427	2.02	High
FM 82 1583-02-019 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
9.953	10.343	1.55	Very High
FM 82 1583-01-023 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
5.286	5.991	1.38	High
FM 92 0703-02-059 Milled Edgeline Rumble Strips			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
26.546	27.137	1.35	High
FM 92 0703-01-065 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
5.399	5.641	1.19	High
8.083	8.334	1.16	High
12.994	13.398	1.53	Very High
FM 92 0703-02-061 Surfacing/Roadway Restoration			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
26.546	27.137	1.35	High
FM 92 0703-01-067 Surfacing/Roadway Restoration			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
24.374	24.516	1.23	High
FM 105 0883-02-086 Provide Additional Paved Surface Width, Milled Edgeline			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
23.083	23.428	1.25	High
FM 105 0883-02-087 Safety Treat Fixed Objects, Construct Paved Shoulders(1–4ft)			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
17.773	17.957	2.58	High
FM 105 0710-01-050 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
7.555	8.130	1.49	Very High
8.130	8.331	1.14	High
8.331	8.819	1.34	High
8.836	8.960	1.34	High
FM 105 0710-02-068 Mill And Overlay, Joint Seal			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
16.482	16.630	1.87	High
FM 105 0710-02-065 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
8.964	9.164	1.40	Very High
FM 252 0785-01-035 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
2.641	2.756	1.39	High
13.332	15.073	1.15	High

17.605	17.885	1.20	High
FM 256 0703-03-027 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
19.194	19.437	1.20	High
26.249	26.478	1.30	High
FM 363 0627-03-028 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
4.437	4.811	1.32	High
FM 365 0932-01-090 Replace Bridge and Approaches			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
26.059	26.370	1.18	High
26.498	27.751	1.33	High
FM 365 0932-02-044 Add Shoulders and Overlay			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
13.937	14.038	1.48	Very High
FM 365 0932-01-116 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
31.679	31.806	2.59	High
32.047	32.222	3.09	High
FM 365 0932-01-114 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
15.211	15.442	1.21	High
15.625	15.933	1.43	Very High
20.630	21.199	1.21	High
25.524	26.059	1.36	High
26.059	26.370	1.18	High
26.498	27.751	1.33	High
28.288	28.601	2.71	Very High
28.601	28.969	1.39	High
FM 365 0932-02-057 Surfacing/Roadway Restoration			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
3.712	5.039	1.14	High
FM 366 0667-02-115 Improve Traffic Signals			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
3.255	3.463	2.08	High
FM 418 0784-01-049 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
11.418	11.801	1.38	High
FM 418 0784-01-051 Surfacing/Roadway Restoration			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
3.478	5.065	1.14	High
5.065	5.673	1.26	High

FM 563 1023-01-033 Hazard Elimination and Safety			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
17.240	17.367	1.41	Very High
FM 563 1023-01-034 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to be Improved
17.109	17.240	1.87	Very High
17.240	17.367	1.41	Very High
FM 565 1024-01-042 Widen Road—Add Shoulders			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
13.016	13.851	1.51	High
13.851	14.652	1.87	Very High
FM 565 1024-01-074 Widen Paved Surface Width, Install Continuous Turn Lane			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
8.681	10.004	1.51	High
10.504	10.639	2.38	Very High
10.639	11.650	1.29	High
FM 565 1024-01-076 Provide Additional Paved Surface Width. Install Milled			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
0.071	0.369	1.28	High
FM 565 1024-01-078 Hazard Elimination and Safety			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
2.937	3.451	1.29	High
FM 565 1024-01-077 Widen to Four Lanes with Ctl and Overpass at Up Rr			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
13.016	13.851	1.51	High
13.851	14.652	1.87	Very High
14.688	15.191	1.48	High
15.191	15.388	1.50	High
FM 770 1096-01-061 Safety Treat Fixed Objects			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
2.910	4.391	1.15	High
11.134	11.382	1.17	High
FM 770 1096-01-065 Safety Treat Fixed Objects, Milled Edgeline and Centerline			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
17.874	17.996	1.37	High
18.787	19.011	1.45	Very High
20.844	22.051	1.19	High
FM 777 1109-01-022 Widen and Overlay Existing Roadway			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
6.690	6.872	1.39	Very High
FM 787 0813-01-103 River Migration Study			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
15.728	15.847	1.97	Very High

16.371	17.465	1.16	High
FM 834 1146-02-021 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
1.233	1.962	1.17	High
2.009	2.664	1.14	High
FM 1006 0882-02-059 Safety Treat Fixed Objects, Milled Centerline Rumble Strips			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
0.000	0.230	2.08	High
FM 1008 0953-01-014 Widen/Two-Course Surface Treatment			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
1.954	2.136	1.33	High
FM 1010 1061-01-032 Construct Paved Shoulders(1–4 ft), Milled Edgeline Rumble			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
2.167	2.984	1.62	Very High
6.918	8.121	1.17	High
8.192	9.350	1.23	High
FM 1010 1061-01-033 Install Chevrons(Curve), Increase Superelevation, Milled			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
6.918	8.121	1.17	High
FM 1013 1237-01-034 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
2.317	2.554	1.21	High
2.554	3.918	1.23	High
FM 1078 1286-01-018 Safety Treat Fixed Objects, Milled Centerline Rumble Strips			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
0.497	0.660	1.39	Very High
0.660	1.205	1.19	High
FM 1130 1284-01-079 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
1.548	1.675	1.35	High
FM 1131 0784-04-023 Modernize Bridge Rail and Approach Guardrail, Safety Treat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
11.158	12.096	1.23	High
12.108	12.563	2.04	Very High
12.947	13.219	1.43	Very High
14.353	14.620	1.44	Very High
14.658	15.599	1.30	High
15.599	15.999	1.41	Very High
FM 1131 0784-04-022 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
11.158	12.096	1.23	High
12.108	12.563	2.04	Very High
12.947	13.219	1.43	Very High

14.353	14.620	1.44	Very High
14.658	15.599	1.30	High
15.599	15.999	1.41	Very High
FM 1293 1947-01-020 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
0.118	0.264	1.39	Very High
FM 1409 0762-02-049 Milled Edgeline Rumble Strips			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
8.774	10.194	1.14	High
11.614	12.151	1.43	Very High
FM 1409 0762-02-048 Safety Lighting			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
2.019	2.291	1.18	High
FM 1410 1420-02-014 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
12.826	13.172	1.18	High
FM 1413 1421-01-026 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
0.000	0.150	2.03	Very High
0.162	1.238	1.23	High
1.238	2.314	1.18	High
FM 1416 0627-04-035 Widen and Overlay Roadway			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
1.632	1.891	1.26	High
9.658	10.445	1.17	High
FM 1442 1284-01-078 Install Chevrons (Curve)			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
7.448	8.024	1.14	High
FM 1442 1284-01-077 Safety Lighting			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
7.448	8.024	1.14	High
FM 1442 2562-01-023 Safety Treat Fixed Objects, Install Continuous Turn Lane			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to be Improved
11.093	11.276	1.65	High
FM 1746 1585-01-024 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
0.000	1.140	1.15	High
1.140	2.280	1.22	High
FM 1943 1828-01-026 Centerline Texturing			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
19.365	20.263	1.20	High
FM 1943 1828-01-032 Surfacing/Roadway Restoration			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved

8.032	8.261	1.40	Very High
8.900	10.485	1.16	High
19.365	20.263	1.20	High
FM 1960 0762-01-033 Safety Lighting			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
44.371	44.643	1.28	High
FM 1960 1685-04-024 Install Intersection Flashing Beacon, Safety Lighting			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
39.472	39.812	1.56	Very High
FM 2354 2242-02-022 Add Center Left-Turn Lane and Widen Shoulders, Add NB Left			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
2.503	4.231	1.18	High
4.231	5.425	1.24	High
FM 2518 2381-01-010 Surfacing/Roadway Restoration			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
4.449	4.584	1.35	High
FM 2610 2591-02-011 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
5.652	6.238	1.19	High
FM 2684 0388-04-015 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
0.954	1.453	1.27	High
FM 3513 0065-15-005 Surfacing/Roadway Restoration			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
1.470	2.368	1.40	High
FM 3514 3579-01-006 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
0.312	0.553	1.26	High
SS 380 0065-08-166 Improve Traffic Signals			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
0.296	1.194	1.86	High
SL 505 0305-10-008 Seal Coat			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
2.306	2.644	1.16	High
2.644	2.995	1.14	High
BU 90-Y 0028-15-054 Overlay Existing Roadway			
From DFO	To DFO	Ratio (Exp./Pred.)	Potential to Be Improved
1.484	1.788	2.95	High

Table E3. List of Existing Beaumont District Projects with Intersections that Have Potential for Safety Improvements.

US 69 0200-16-018 Improve Traffic Signals			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
4146	US0069 @ 39TH	3.12	Very High
US 69 0200-10-067 Widen Existing Highway to Four Lanes with a Continuous Left			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3550	US0069 @ FM0421	1.67	High
US 69 0200-10-081 Improve Traffic Signals			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3550	US0069 @ FM0421	1.67	High
US 69 0200-09-069 Construct New Location Four-Lane Divided Facility			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
557	US0069 @ NEUSHAFER	1.23	High
US 69 0200-08-049 Construct New Location Four-Lane Divided Facility			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2408	US0069 @ FM2827	1.42	Very High
2460	US0069 @ CR4473	1.26	High
2379	US0069 @ CR1515	1.54	High
US 69 0200-08-056 Safety Treat Fixed Objects			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2408	US0069 @ FM2827	1.42	Very High
2460	US0069 @ CR4473	1.26	High
2465	US0069 @ CR1250	1.26	High
2466	US0069 @ CR1230	1.32	High
2379	US0069 @ CR1515	1.54	High
US 69 0200-08-057 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2408	US0069 @ FM2827	1.42	Very High
2460	US0069 @ CR4473	1.26	High
2465	US0069 @ CR1250	1.26	High
2466	US0069 @ CR1230	1.32	High
2379	US0069 @ CR1515	1.54	High
US 69 0200-07-054 Mill And Overlay			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2448	US0069 @ CR1030	1.57	Very High
US 69 0200-08-049 Construct New Location Four-Lane Divided Facility			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2408	US0069 @ FM2827	1.42	Very High
2460	US0069 @ CR4473	1.26	High
2379	US0069 @ CR1515	1.54	High

US 69 0200-08-056 Safety Treat Fixed Objects			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2408	US0069 @ FM2827	1.42	Very High
2460	US0069 @ CR4473	1.26	High
2465	US0069 @ CR1250	1.26	High
2466	US0069 @ CR1230	1.32	High
2379	US0069 @ CR1515	1.54	High
US 69 0200-08-057 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2408	US0069 @ FM2827	1.42	Very High
2460	US0069 @ CR4473	1.26	High
2465	US0069 @ CR1250	1.26	High
2466	US0069 @ CR1230	1.32	High
2379	US0069 @ CR1515	1.54	High
US 69 0200-08-056 Safety Treat Fixed Objects			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2408	US0069 @ FM2827	1.42	Very High
2460	US0069 @ CR4473	1.26	High
2465	US0069 @ CR1250	1.26	High
2466	US0069 @ CR1230	1.32	High
2379	US0069 @ CR1515	1.54	High
US 69 0200-08-057 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2408	US0069 @ FM2827	1.42	Very High
2460	US0069 @ CR4473	1.26	High
2465	US0069 @ CR1250	1.26	High
2466	US0069 @ CR1230	1.32	High
2379	US0069 @ CR1515	1.54	High
US 69 0200-08-056 Safety Treat Fixed Objects			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2408	US0069 @ FM2827	1.42	Very High
2460	US0069 @ CR4473	1.26	High
2465	US0069 @ CR1250	1.26	High
2466	US0069 @ CR1230	1.32	High
2379	US0069 @ CR1515	1.54	High
US 69 0200-08-057 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2408	US0069 @ FM2827	1.42	Very High
2460	US0069 @ CR4473	1.26	High
2465	US0069 @ CR1250	1.26	High
2466	US0069 @ CR1230	1.32	High
2379	US0069 @ CR1515	1.54	High

US 69 0200-06-055 Overlay Existing Roadway			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2485	US0069 @ CR2775	1.34	High
US 69 0200-08-049 Construct New Location Four-Lane Divided Facility			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2408	US0069 @ FM2827	1.42	Very High
2460	US0069 @ CR4473	1.26	High
2379	US0069 @ CR1515	1.54	High
US 69 0200-08-056 Safety Treat Fixed Objects			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2408	US0069 @ FM2827	1.42	Very High
2460	US0069 @ CR4473	1.26	High
2465	US0069 @ CR1250	1.26	High
2466	US0069 @ CR1230	1.32	High
2379	US0069 @ CR1515	1.54	High
US 69 0200-08-057 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2408	US0069 @ FM2827	1.42	Very High
2460	US0069 @ CR4473	1.26	High
2465	US0069 @ CR1250	1.26	High
2466	US0069 @ CR1230	1.32	High
2379	US0069 @ CR1515	1.54	High
US 69 0200-10-083 Improve Traffic Signals			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3569	US0069 @ RIVER BIRCH	1.78	Very High
US 90 0028-07-058 Safety Lighting			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2823	US0090 @ LINDBERGH	2.04	Very High
2829	US0090 @ 23RD	2.17	Very High
2814	US0090 @ AVALON	2.35	Very High
2818	US0090 @ PINCHBACK	1.63	High
US 90 0028-07-058 Safety Lighting			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2823	US0090 @ LINDBERGH	2.04	Very High
2829	US0090 @ 23RD	2.17	Very High
2814	US0090 @ AVALON	2.35	Very High
2818	US0090 @ PINCHBACK	1.63	High
US 90 0028-04-069 Widen and Reconstruct to Four-Lane Divided Rural			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1292	US0090 @ FM0770	1.64	Very High
US 90 0028-03-106 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3236	US0090 @ LOWE	1.55	High

3237	US0090 @ PRAIRIE	2.38	Very High
3233	US0090 @ SCHURCH	2.46	Very High
US 90 0028-03-109 Install Raised Median			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3236	US0090 @ LOWE	1.55	High
3237	US0090 @ PRAIRIE	2.38	Very High
3233	US0090 @ SCHURCH	2.46	Very High
US 90 0028-03-110 Construct Pedestrian Infrastructure			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3236	US0090 @ LOWE	1.55	High
3237	US0090 @ PRAIRIE	2.38	Very High
3233	US0090 @ SCHURCH	2.46	Very High
US 90 0028-03-106 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3236	US0090 @ LOWE	1.55	High
3237	US0090 @ PRAIRIE	2.38	Very High
3233	US0090 @ SCHURCH	2.46	Very High
US 90 0028-03-109 Install Raised Median			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3236	US0090 @ LOWE	1.55	High
3237	US0090 @ PRAIRIE	2.38	Very High
3233	US0090 @ SCHURCH	2.46	Very High
US 90 0028-03-110 Construct Pedestrian Infrastructure			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3236	US0090 @ LOWE	1.55	High
3237	US0090 @ PRAIRIE	2.38	Very High
3233	US0090 @ SCHURCH	2.46	Very High
US 90 0028-04-077 Widen to Four Lanes with Ctl			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3531	US0090 @ LAYL	2.65	Very High
3532	US0090 @ LEETIM	1.86	Very High
US 90 0028-04-078 Safety Lighting			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3531	US0090 @ LAYL	2.65	Very High
US 90 0028-07-058 Safety Lighting			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2823	US0090 @ LINDBERGH	2.04	Very High
2829	US0090 @ 23RD	2.17	Very High
2814	US0090 @ AVALON	2.35	Very High
2818	US0090 @ PINCHBACK	1.63	High
US 90 0028-04-077 Widen to Four Lanes with Ctl			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3531	US0090 @ LAYL	2.65	Very High

3532	US0090 @ LEETIM	1.86	Very High
US 90 0028-04-076 Improve Traffic Signals			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3545	US0090 @ TRAVIS	1.66	Very High
US 90 0028-03-105 Improve Traffic Signals			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3233	US0090 @ SCHURCH	2.46	Very High
US 90 0028-03-106 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3236	US0090 @ LOWE	1.55	High
3237	US0090 @ PRAIRIE	2.38	Very High
3233	US0090 @ SCHURCH	2.46	Very High
US 90 0028-03-109 Install Raised Median			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3236	US0090 @ LOWE	1.55	High
3237	US0090 @ PRAIRIE	2.38	Very High
3233	US0090 @ SCHURCH	2.46	Very High
US 90 0028-03-110 Construct Pedestrian Infrastructure			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3236	US0090 @ LOWE	1.55	High
3237	US0090 @ PRAIRIE	2.38	Very High
3233	US0090 @ SCHURCH	2.46	Very High
US 90 0028-07-058 Safety Lighting			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2823	US0090 @ LINDBERGH	2.04	Very High
2829	US0090 @ 23RD	2.17	Very High
2814	US0090 @ AVALON	2.35	Very High
2818	US0090 @ PINCHBACK	1.63	High
US 96 0065-05-145 Overlay Existing Roadway			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3576	US0096 @ ECHANCE CUTOFF	1.81	High
3581	US0096 @ ECANDLESTICK	1.49	High
3596	US0096 @ RAIDER	2.25	Very High
3591	US0096 @ ISOM	1.96	Very High
3595	US0096 @ DA	1.65	Very High
US 96 0065-05-152 Install Raised Median			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3576	US0096 @ ECHANCE CUTOFF	1.81	High
3581	US0096 @ ECANDLESTICK	1.49	High
3596	US0096 @ RAIDER	2.25	Very High
3591	US0096 @ ISOM	1.96	Very High

3595	US0096 @ DA	1.65	Very High
US 96 0065-05-145 Overlay Existing Roadway			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3576	US0096 @ ECHANCE CUTOFF	1.81	High
3581	US0096 @ ECANDLESTICK	1.49	High
3596	US0096 @ RAIDER	2.25	Very High
3591	US0096 @ ISOM	1.96	Very High
3595	US0096 @ DA	1.65	Very High
US 96 0065-05-152 Install Raised Median			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3576	US0096 @ ECHANCE CUTOFF	1.81	High
3581	US0096 @ ECANDLESTICK	1.49	High
3596	US0096 @ RAIDER	2.25	Very High
3591	US0096 @ ISOM	1.96	Very High
3595	US0096 @ DA	1.65	Very High
US 96 0065-05-145 Overlay Existing Roadway			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3576	US0096 @ ECHANCE CUTOFF	1.81	High
3581	US0096 @ ECANDLESTICK	1.49	High
3596	US0096 @ RAIDER	2.25	Very High
3591	US0096 @ ISOM	1.96	Very High
3595	US0096 @ DA	1.65	Very High
US 96 0065-05-152 Install Raised Median			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3576	US0096 @ ECHANCE CUTOFF	1.81	High
3581	US0096 @ ECANDLESTICK	1.49	High
3596	US0096 @ RAIDER	2.25	Very High
3591	US0096 @ ISOM	1.96	Very High
3595	US0096 @ DA	1.65	Very High
US 96 0064-07-044 Widen to Four-Lane Divided Highway			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
714	US0096 @ FM1007	1.64	Very High
1017	US0096 @ CR227	1.29	High
US 96 0064-08-059 Milled Edgeline Rumble Strips			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1004	US0096 @ CR245	1.29	High
US 96 0064-08-057 Overlay Existing Roadway			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1004	US0096 @ CR245	1.29	High
1017	US0096 @ CR227	1.29	High

US 96 0064-08-062 Widen to Four-Lane Divided Highway			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1017	US0096 @ CR227	1.29	High
US 96 0064-07-044 Widen to Four-Lane Divided Highway			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
714	US0096 @ FM1007	1.64	Very High
1017	US0096 @ CR227	1.29	High
US 96 0064-08-057 Overlay Existing Roadway			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1004	US0096 @ CR245	1.29	High
1017	US0096 @ CR227	1.29	High
US 96 0065-05-146 Hazard Elimination and Safety			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
4283	US0096 @ VERDO TRC	1.50	Very High
US 96 0065-03-044 Overlay Existing Roadway			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3425	US0096 @ ELANIER	1.80	Very High
3430	US0096 @ ELAVIELLE	1.23	High
3433	US0096 @ ELESTER HAWTHORNE	1.85	Very High
US 96 0065-03-044 Overlay Existing Roadway			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3425	US0096 @ ELANIER	1.80	Very High
3430	US0096 @ ELAVIELLE	1.23	High
3433	US0096 @ ELESTER HAWTHORNE	1.85	Very High
US 96 0065-02-055 Overlay Existing Roadway			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3431	US0096 @ WHARRIS	1.38	High
US 96 0065-03-044 Overlay Existing Roadway			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3425	US0096 @ ELANIER	1.80	Very High
3430	US0096 @ ELAVIELLE	1.23	High
3433	US0096 @ ELESTER HAWTHORNE	1.85	Very High
US 96 0065-01-056 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3348	US0096 @ MAYS	2.10	Very High
US 96 0065-05-145 Overlay Existing Roadway			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3576	US0096 @ ECHANCE CUTOFF	1.81	High
3581	US0096 @ ECANDLESTICK	1.49	High
3596	US0096 @ RAIDER	2.25	Very High

3591	US0096 @ ISOM	1.96	Very High
3595	US0096 @ DA	1.65	Very High
US 96 0065-05-150 Improve Traffic Signals			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3591	US0096 @ ISOM	1.96	Very High
US 96 0065-05-152 Install Raised Median			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3576	US0096 @ ECHANCE CUTOFF	1.81	High
3581	US0096 @ ECANDLESTICK	1.49	High
3596	US0096 @ RAIDER	2.25	Very High
3591	US0096 @ ISOM	1.96	Very High
3595	US0096 @ DA	1.65	Very High
US 96 0065-05-145 Overlay Existing Roadway			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3576	US0096 @ ECHANCE CUTOFF	1.81	High
3581	US0096 @ ECANDLESTICK	1.49	High
3596	US0096 @ RAIDER	2.25	Very High
3591	US0096 @ ISOM	1.96	Very High
3595	US0096 @ DA	1.65	Very High
US 96 0065-05-149 Improve Traffic Signals			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3595	US0096 @ DA	1.65	Very High
US 96 0065-05-152 Install Raised Median			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3576	US0096 @ ECHANCE CUTOFF	1.81	High
3581	US0096 @ ECANDLESTICK	1.49	High
3596	US0096 @ RAIDER	2.25	Very High
3591	US0096 @ ISOM	1.96	Very High
3595	US0096 @ DA	1.65	Very High
US 190 0213-07-058 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2503	US0190 @ SVILLAGE	1.25	High
US 287 0341-04-070 Overlay Existing Roadway			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2535	US0287 @ CR2390	1.17	High
SH 62 0243-04-057 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3771	SH0062 @ FM0105	1.51	High
SH 62 0243-04-056 Widen Highway from Two to Four Lanes			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2160	SH0062 @ N	1.19	High

2161	SH0062 @ FISH FARM	1.72	Very High
2165	SH0062 @ WAGNER	1.88	Very High
SH 62 0243-04-056 Widen Highway from Two to Four Lanes			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2160	SH0062 @ N	1.19	High
2161	SH0062 @ FISH FARM	1.72	Very High
2165	SH0062 @ WAGNER	1.88	Very High
SH 62 0243-03-066 Safety Lighting			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2162	SH0062 @ COHENOUR	1.74	Very High
SH 62 0243-04-056 Widen Highway from Two to Four Lanes			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2160	SH0062 @ N	1.19	High
2161	SH0062 @ FISH FARM	1.72	Very High
2165	SH0062 @ WAGNER	1.88	Very High
SH 63 0244-02-099 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
913	SH0063 @ CR115	1.53	Very High
844	SH0063 @ FM3414	1.74	Very High
3311	SH0063 @ FM0777	1.99	High
SH 63 0244-02-100 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
913	SH0063 @ CR115	1.53	Very High
941	SH0063 @ CR1049	1.35	High
836	SH0063 @ CR110	2.21	Very High
SH 63 0244-02-100 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
913	SH0063 @ CR115	1.53	Very High
941	SH0063 @ CR1049	1.35	High
836	SH0063 @ CR110	2.21	Very High
SH 63 0214-03-032 Replace and Realign Bridge Approach			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1815	SH0063 @ CR2118	1.21	High
SH 63 0244-02-100 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
913	SH0063 @ CR115	1.53	Very High
941	SH0063 @ CR1049	1.35	High
836	SH0063 @ CR110	2.21	Very High
SH 63 0244-02-099 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
913	SH0063 @ CR115	1.53	Very High
844	SH0063 @ FM3414	1.74	Very High
3311	SH0063 @ FM0777	1.99	High

SH 63 0214-03-038 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1662	SH0063 @ CR2096	1.32	High
SH 63 0244-02-099 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
913	SH0063 @ CR115	1.53	Very High
844	SH0063 @ FM3414	1.74	Very High
3311	SH0063 @ FM0777	1.99	High
SH 73 0306-02-070 Mill and Overlay Existing Roadway			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2994	SH0073 @ ROBERTS	1.34	High
2999	SH0073 @ CHARLES	1.38	High
3001	SH0073 @ HILLCREST	1.95	Very High
3004	SH0073 @ EVICK	1.53	High
2997	SH0073 @ BAILEY	2.71	Very High
SH 73 0306-02-070 Mill and Overlay Existing Roadway			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2994	SH0073 @ ROBERTS	1.34	High
2999	SH0073 @ CHARLES	1.38	High
3001	SH0073 @ HILLCREST	1.95	Very High
3004	SH0073 @ EVICK	1.53	High
2997	SH0073 @ BAILEY	2.71	Very High
SH 73 0306-02-070 Mill and Overlay Existing Roadway			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2994	SH0073 @ ROBERTS	1.34	High
2999	SH0073 @ CHARLES	1.38	High
3001	SH0073 @ HILLCREST	1.95	Very High
3004	SH0073 @ EVICK	1.53	High
2997	SH0073 @ BAILEY	2.71	Very High
SH 73 0306-02-070 Mill and Overlay Existing Roadway			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2994	SH0073 @ ROBERTS	1.34	High
2999	SH0073 @ CHARLES	1.38	High
3001	SH0073 @ HILLCREST	1.95	Very High
3004	SH0073 @ EVICK	1.53	High
2997	SH0073 @ BAILEY	2.71	Very High
SH 73 0306-02-070 Mill and Overlay Existing Roadway			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2994	SH0073 @ ROBERTS	1.34	High
2999	SH0073 @ CHARLES	1.38	High
3001	SH0073 @ HILLCREST	1.95	Very High
3004	SH0073 @ EVICK	1.53	High
2997	SH0073 @ BAILEY	2.71	Very High

SH 87 0305-07-062 Overlay Existing Roadway

Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3830	SH0087 @ FM3247	1.58	High
2185	SH0087 @ PINE PARK	1.40	High
3864	SH0087 @ OWENS	1.31	High
3872	SH0087 @ LITTLE CYPRESS	1.44	High
3858	SH0087 @ YALE	1.53	High
3865	SH0087 @ WBLUFF	1.63	High

SH 87 0305-07-062 Overlay Existing Roadway

Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3830	SH0087 @ FM3247	1.58	High
2185	SH0087 @ PINE PARK	1.40	High
3864	SH0087 @ OWENS	1.31	High
3872	SH0087 @ LITTLE CYPRESS	1.44	High
3858	SH0087 @ YALE	1.53	High
3865	SH0087 @ WBLUFF	1.63	High

SH 87 0305-07-070 Safety Lighting

Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2185	SH0087 @ PINE PARK	1.40	High

SH 87 0305-07-072 Widen Highway from Two to Four Lanes

Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2185	SH0087 @ PINE PARK	1.40	High
3864	SH0087 @ OWENS	1.31	High
3872	SH0087 @ LITTLE CYPRESS	1.44	High

SH 87 0307-02-051 Surfacing/Roadway Restoration

Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
4091	SH0087 @ S14TH	1.21	High

SH 87 0305-02-050 Safety Lighting at Intersection

Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1710	SH0087 @ CR3073	1.53	High

SH 87 0305-07-064 Safety Treat Fixed Objects

Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3864	SH0087 @ OWENS	1.31	High
3872	SH0087 @ LITTLE CYPRESS	1.44	High
3865	SH0087 @ WBLUFF	1.63	High

SH 87 0305-07-062 Overlay Existing Roadway

Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3830	SH0087 @ FM3247	1.58	High
2185	SH0087 @ PINE PARK	1.40	High
3864	SH0087 @ OWENS	1.31	High
3872	SH0087 @ LITTLE CYPRESS	1.44	High
3858	SH0087 @ YALE	1.53	High
3865	SH0087 @ WBLUFF	1.63	High

SH 87 0305-07-072 Widen Highway from Two to Four Lanes			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2185	SH0087 @ PINE PARK	1.40	High
3864	SH0087 @ OWENS	1.31	High
3872	SH0087 @ LITTLE CYPRESS	1.44	High
SH 87 0306-01-060 Overlay Existing Roadway			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2183	SH0087 @ PATILLO	1.60	High
3861	SH0087 @ VICTPAR	1.28	High
SH 87 0305-07-064 Safety Treat Fixed Objects			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3864	SH0087 @ OWENS	1.31	High
3872	SH0087 @ LITTLE CYPRESS	1.44	High
3865	SH0087 @ WBLUFF	1.63	High
SH 87 0305-07-062 Overlay Existing Roadway			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3830	SH0087 @ FM3247	1.58	High
2185	SH0087 @ PINE PARK	1.40	High
3864	SH0087 @ OWENS	1.31	High
3872	SH0087 @ LITTLE CYPRESS	1.44	High
3858	SH0087 @ YALE	1.53	High
3865	SH0087 @ WBLUFF	1.63	High
SH 87 0305-07-072 Widen Highway from Two to Four Lanes			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2185	SH0087 @ PINE PARK	1.40	High
3864	SH0087 @ OWENS	1.31	High
3872	SH0087 @ LITTLE CYPRESS	1.44	High
SH 87 0305-07-071 Mill and Overlay			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3887	SH0087 @ WPUTM	1.49	High
3884	SH0087 @ WLUTCHER	2.34	Very High
SH 87 0305-07-073 Install Pedestrian Signal, Install Pedestrian Crosswalk			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3887	SH0087 @ WPUTM	1.49	High
SH 87 0305-07-062 Overlay Existing Roadway			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3830	SH0087 @ FM3247	1.58	High
2185	SH0087 @ PINE PARK	1.40	High
3864	SH0087 @ OWENS	1.31	High
3872	SH0087 @ LITTLE CYPRESS	1.44	High
3858	SH0087 @ YALE	1.53	High
3865	SH0087 @ WBLUFF	1.63	High

SH 87 0306-01-060 Overlay Existing Roadway			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2183	SH0087 @ PATILLO	1.60	High
3861	SH0087 @ VICTPAR	1.28	High
SH 87 0305-07-071 Mill and Overlay			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3887	SH0087 @ WPUTM	1.49	High
3884	SH0087 @ WLUTCHER	2.34	Very High
SH 87 0306-03-134 Install Pedestrian Signal			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
4001	SH0087 @ 10TH	2.14	Very High
SH 87 0305-07-064 Safety Treat Fixed Objects			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3864	SH0087 @ OWENS	1.31	High
3872	SH0087 @ LITTLE CYPRESS	1.44	High
3865	SH0087 @ WBLUFF	1.63	High
SH 87 0305-07-062 Overlay Existing Roadway			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3830	SH0087 @ FM3247	1.58	High
2185	SH0087 @ PINE PARK	1.40	High
3864	SH0087 @ OWENS	1.31	High
3872	SH0087 @ LITTLE CYPRESS	1.44	High
3858	SH0087 @ YALE	1.53	High
3865	SH0087 @ WBLUFF	1.63	High
SH 87 0307-01-149 Mill and Inlay			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
4086	SH0087 @ SAN ANTONIO	1.60	High
SH 105 0593-01-132 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3065	SH0321 @ SH0105	2.08	High
SH 105 0339-03-038 Widen Highway to Super 2 Standard			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
496	SH0105 @ ATLANTIC	1.69	Very High
SH 105 0339-03-040 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
496	SH0105 @ ATLANTIC	1.69	Very High
SH 105 0339-04-036 Widen to Four Lanes With Ctl			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
501	SH0105 @ RYAN	1.28	High
506	SH0105 @ VAGLICA	1.19	High
4295	SH0105 @ MITCHELL	1.44	Very High
4297	SH0105 @ NEVADA	1.18	High
4299	SH0105 @ SCANNON	2.14	Very High

SH 105 0339-04-036 Widen to Four Lanes With Ctl			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
501	SH0105 @ RYAN	1.28	High
506	SH0105 @ VAGLICA	1.19	High
4295	SH0105 @ MITCHELL	1.44	Very High
4297	SH0105 @ NEVADA	1.18	High
4299	SH0105 @ SCANNON	2.14	Very High
SH 105 0339-04-036 Widen to Four Lanes With Ctl			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
501	SH0105 @ RYAN	1.28	High
506	SH0105 @ VAGLICA	1.19	High
4295	SH0105 @ MITCHELL	1.44	Very High
4297	SH0105 @ NEVADA	1.18	High
4299	SH0105 @ SCANNON	2.14	Very High
SH 105 0339-04-037 Mill and Overlay, Concrete Repair			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
4295	SH0105 @ MITCHELL	1.44	Very High
SH 105 0339-04-036 Widen to Four Lanes With Ctl			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
501	SH0105 @ RYAN	1.28	High
506	SH0105 @ VAGLICA	1.19	High
4295	SH0105 @ MITCHELL	1.44	Very High
4297	SH0105 @ NEVADA	1.18	High
4299	SH0105 @ SCANNON	2.14	Very High
SH 105 0339-04-036 Widen to Four Lanes With Ctl			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
501	SH0105 @ RYAN	1.28	High
506	SH0105 @ VAGLICA	1.19	High
4295	SH0105 @ MITCHELL	1.44	Very High
4297	SH0105 @ NEVADA	1.18	High
4299	SH0105 @ SCANNON	2.14	Very High
SH 124 0367-01-070 Base Repair, Level Up, And Overlay			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
128	SH0124 @ FM1985	1.45	Very High
SH 124 0367-01-071 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
184	SH0124 @ AVENUE C	1.26	High
202	SH0124 @ FIG RIDGE	1.18	High
SH 124 0367-01-071 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
184	SH0124 @ AVENUE C	1.26	High
202	SH0124 @ FIG RIDGE	1.18	High

SH 124 0368-01-090 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
204	SH0124 @ PALM	1.42	High
205	SH0124 @ FREEMAN	1.20	High
206	SH0124 @ OGDEN	1.20	High
SH 124 0368-01-089 Improve Traffic Signals			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
205	SH0124 @ FREEMAN	1.20	High
206	SH0124 @ OGDEN	1.20	High
SH 124 0368-01-090 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
204	SH0124 @ PALM	1.42	High
205	SH0124 @ FREEMAN	1.20	High
206	SH0124 @ OGDEN	1.20	High
SH 124 0368-01-089 Improve Traffic Signals			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
205	SH0124 @ FREEMAN	1.20	High
206	SH0124 @ OGDEN	1.20	High
SH 124 0368-01-090 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
204	SH0124 @ PALM	1.42	High
205	SH0124 @ FREEMAN	1.20	High
206	SH0124 @ OGDEN	1.20	High
SH 124 0368-01-091 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
174	SH0124 @ FEAR	1.26	High
SH 124 0368-02-044 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1121	SH0124 @ HAMSHIRE	1.76	Very High
1131	SH0124 @ ROLLINS	1.30	High
SH 124 0368-02-044 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1121	SH0124 @ HAMSHIRE	1.76	Very High
1131	SH0124 @ ROLLINS	1.30	High
SH 124 0368-04-030 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2711	SH0124 @ LAFIN	1.40	High
2719	SH0124 @ LA BELLE	1.30	High
SH 124 0368-04-030 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2711	SH0124 @ LAFIN	1.40	High
2719	SH0124 @ LA BELLE	1.30	High

SH 124 0368-04-031 Safety Lighting			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2719	SH0124 @ LA BELLE	1.30	High
SH 124 0368-03-037 Install Continuous Turn Lane, Milled Edgeline Rumble Strips			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2719	SH0124 @ LA BELLE	1.30	High
SH 124 0368-04-032 Install Continuous Turn Lane, Milled Edgeline Rumble Strips			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2719	SH0124 @ LA BELLE	1.30	High
SH 146 0388-03-080 Improve Traffic Signals			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3497	SH0146 @ VALLEY	1.18	High
SH 146 0389-02-052 Hazard Elimination and Safety			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2601	SH0146 @ OLD NEEDLEPOINT	1.55	High
SH 321 0593-01-123 Resurface Roadway			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3065	SH0321 @ SH0105	2.08	High
3072	SH0321 @ NHOLLY	1.82	Very High
3073	SH0321 @ TANNER	1.37	High
3075	SH0321 @ TRUMAN	1.44	High
3078	SH0321 @ KIRBY WOODS	1.41	High
SH 321 0593-01-131 Construct Pedestrian Infrastructure			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3219	SH0321 @ LINNEY	1.61	High
3218	SH0321 @ WWARING	1.34	High
SH 321 0593-01-122 Safety Treat Fixed Objects			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1326	SH0321 @ FM1008	1.23	High
1521	SH0321 @ CR2271	1.17	High
1522	SH0321 @ CR2274	1.41	High
1530	SH0321 @ CR301	1.61	Very High
SH 321 0593-01-124 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1326	SH0321 @ FM1008	1.23	High
1521	SH0321 @ CR2271	1.17	High
1522	SH0321 @ CR2274	1.41	High
1530	SH0321 @ CR301	1.61	Very High
3179	SH0321 @ FM0686	1.51	High
3226	SH0321 @ PRISON	1.32	High
SH 321 0593-01-122 Safety Treat Fixed Objects			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved

1326	SH0321 @ FM1008	1.23	High
1521	SH0321 @ CR2271	1.17	High
1522	SH0321 @ CR2274	1.41	High
1530	SH0321 @ CR301	1.61	Very High
SH 321 0593-01-124 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1326	SH0321 @ FM1008	1.23	High
1521	SH0321 @ CR2271	1.17	High
1522	SH0321 @ CR2274	1.41	High
1530	SH0321 @ CR301	1.61	Very High
3179	SH0321 @ FM0686	1.51	High
3226	SH0321 @ PRISON	1.32	High
SH 321 0593-01-122 Safety Treat Fixed Objects			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1326	SH0321 @ FM1008	1.23	High
1521	SH0321 @ CR2271	1.17	High
1522	SH0321 @ CR2274	1.41	High
1530	SH0321 @ CR301	1.61	Very High
SH 321 0593-01-124 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1326	SH0321 @ FM1008	1.23	High
1521	SH0321 @ CR2271	1.17	High
1522	SH0321 @ CR2274	1.41	High
1530	SH0321 @ CR301	1.61	Very High
3179	SH0321 @ FM0686	1.51	High
3226	SH0321 @ PRISON	1.32	High
SH 321 0593-01-122 Safety Treat Fixed Objects			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1326	SH0321 @ FM1008	1.23	High
1521	SH0321 @ CR2271	1.17	High
1522	SH0321 @ CR2274	1.41	High
1530	SH0321 @ CR301	1.61	Very High
SH 321 0593-01-124 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1326	SH0321 @ FM1008	1.23	High
1521	SH0321 @ CR2271	1.17	High
1522	SH0321 @ CR2274	1.41	High
1530	SH0321 @ CR301	1.61	Very High
3179	SH0321 @ FM0686	1.51	High
3226	SH0321 @ PRISON	1.32	High
SH 321 0593-01-123 Resurface Roadway			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3065	SH0321 @ SH0105	2.08	High

3072	SH0321 @ NHOLLY	1.82	Very High
3073	SH0321 @ TANNER	1.37	High
3075	SH0321 @ TRUMAN	1.44	High
3078	SH0321 @ KIRBY WOODS	1.41	High
SH 321 0593-01-123 Resurface Roadway			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3065	SH0321 @ SH0105	2.08	High
3072	SH0321 @ NHOLLY	1.82	Very High
3073	SH0321 @ TANNER	1.37	High
3075	SH0321 @ TRUMAN	1.44	High
3078	SH0321 @ KIRBY WOODS	1.41	High
SH 321 0593-01-123 Resurface Roadway			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3065	SH0321 @ SH0105	2.08	High
3072	SH0321 @ NHOLLY	1.82	Very High
3073	SH0321 @ TANNER	1.37	High
3075	SH0321 @ TRUMAN	1.44	High
3078	SH0321 @ KIRBY WOODS	1.41	High
SH 321 0593-01-123 Resurface Roadway			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3065	SH0321 @ SH0105	2.08	High
3072	SH0321 @ NHOLLY	1.82	Very High
3073	SH0321 @ TANNER	1.37	High
3075	SH0321 @ TRUMAN	1.44	High
3078	SH0321 @ KIRBY WOODS	1.41	High
SH 321 0593-01-120 Install Continuous Turn Lane, Passing Lanes, and Rumble Strips			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3179	SH0321 @ FM0686	1.51	High
3226	SH0321 @ PRISON	1.32	High
SH 321 0593-01-124 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1326	SH0321 @ FM1008	1.23	High
1521	SH0321 @ CR2271	1.17	High
1522	SH0321 @ CR2274	1.41	High
1530	SH0321 @ CR301	1.61	Very High
3179	SH0321 @ FM0686	1.51	High
3226	SH0321 @ PRISON	1.32	High
SH 321 0593-01-131 Construct Pedestrian Infrastructure			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3219	SH0321 @ LINNEY	1.61	High
3218	SH0321 @ WWARING	1.34	High
SH 321 0593-01-120 Install Continuous Turn Lane, Passing Lanes, and Rumble Strips			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved

3179	SH0321 @ FM0686	1.51	High
3226	SH0321 @ PRISON	1.32	High
SH 321 0593-01-124 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1326	SH0321 @ FM1008	1.23	High
1521	SH0321 @ CR2271	1.17	High
1522	SH0321 @ CR2274	1.41	High
1530	SH0321 @ CR301	1.61	Very High
3179	SH0321 @ FM0686	1.51	High
3226	SH0321 @ PRISON	1.32	High
SH 326 0601-01-061 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
4300	SH0326 @ MITCHELL	1.27	High
SH 327 0602-01-046 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
4274	SH0327 @ S21ST	1.42	High
SH 327 0602-01-047 Safety Lighting			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
4274	SH0327 @ S21ST	1.42	High
SH 347 0667-01-123 Install Pedestrian Signal, Install Pedestrian Crosswalk			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1139	SH0347 @ MONROE	1.54	High
SH 347 0667-01-115 Rehabilitate Existing Roadway			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3641	SH0347 @ ATLANTA	1.73	Very High
FM 82 1583-01-024 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
621	FM0082 @ CR403	1.20	High
623	FM0082 @ CR419	1.20	High
FM 82 1583-01-024 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
621	FM0082 @ CR403	1.20	High
623	FM0082 @ CR419	1.20	High
FM 82 1583-02-019 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1561	FM0082 @ FM1004	1.20	High
FM 92 0703-02-059 Milled Edgeline Rumble Strips			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
267	FM0092 @ WILLIFORD	1.29	High
275	FM0092 @ FM2937	1.20	High
258	FM0092 @ POST PLANT	1.96	High
FM 92 0703-02-061 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved

267	FM0092 @ WILLIFORD	1.29	High
275	FM0092 @ FM2937	1.20	High
258	FM0092 @ POST PLANT	1.96	High
FM 92 0703-02-059 Milled Edgeline Rumble Strips			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
267	FM0092 @ WILLIFORD	1.29	High
275	FM0092 @ FM2937	1.20	High
258	FM0092 @ POST PLANT	1.96	High
FM 92 0703-02-061 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
267	FM0092 @ WILLIFORD	1.29	High
275	FM0092 @ FM2937	1.20	High
258	FM0092 @ POST PLANT	1.96	High
FM 92 0703-01-065 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2202	FM0092 @ CR4416	1.18	High
2255	FM0092 @ CR4190	1.47	Very High
2257	FM0092 @ UNMED	1.45	Very High
2217	FM0092 @ FM1013	1.81	Very High
FM 92 0703-01-065 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2202	FM0092 @ CR4416	1.18	High
2255	FM0092 @ CR4190	1.47	Very High
2257	FM0092 @ UNMED	1.45	Very High
2217	FM0092 @ FM1013	1.81	Very High
FM 92 0703-01-065 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2202	FM0092 @ CR4416	1.18	High
2255	FM0092 @ CR4190	1.47	Very High
2257	FM0092 @ UNMED	1.45	Very High
2217	FM0092 @ FM1013	1.81	Very High
FM 92 0703-01-067 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2266	FM0092 @ CR4900	1.35	High
FM 92 0703-01-065 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2202	FM0092 @ CR4416	1.18	High
2255	FM0092 @ CR4190	1.47	Very High
2257	FM0092 @ UNMED	1.45	Very High
2217	FM0092 @ FM1013	1.81	Very High
FM 92 0703-02-059 Milled Edgeline Rumble Strips			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
267	FM0092 @ WILLIFORD	1.29	High

275	FM0092 @ FM2937	1.20	High
258	FM0092 @ POST PLANT	1.96	High
FM 92 0703-02-061 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
267	FM0092 @ WILLIFORD	1.29	High
275	FM0092 @ FM2937	1.20	High
258	FM0092 @ POST PLANT	1.96	High
FM 105 0710-01-050 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
651	FM0105 @ CR826	1.36	High
656	FM0105 @ CR828	1.35	High
FM 105 0710-01-050 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
651	FM0105 @ CR826	1.36	High
656	FM0105 @ CR828	1.35	High
FM 105 0710-02-065 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1963	FM0105 @ NORTHWOOD	1.54	Very High
1990	FM0105 @ FM1132	1.43	High
FM 105 0710-02-068 Mill and Overlay, Joint Seal			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1990	FM0105 @ FM1132	1.43	High
4342	FM0105 @ WEXFORD	1.36	High
4345	FM0105 @ GRAND	1.70	Very High
4332	FM0105 @ WCOURTLAND	1.60	High
4344	FM0105 @ WTRAM	1.81	High
FM 105 0710-02-065 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1963	FM0105 @ NORTHWOOD	1.54	Very High
1990	FM0105 @ FM1132	1.43	High
FM 105 0883-02-087 Safety Treat Fixed Objects, Construct Paved Shoulders(1–4 ft)			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
4319	FM0105 @ BEACH	1.42	High
4320	FM0105 @ PINEGROVE	1.28	High
4323	FM0105 @ VIDOR VILLAS	1.99	Very High
4324	FM0105 @ VIDOR	1.42	High
4326	FM0105 @ GREATHOUSE	1.90	Very High
FM 105 0883-02-087 Safety Treat Fixed Objects, Construct Paved Shoulders(1–4 ft)			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
4319	FM0105 @ BEACH	1.42	High
4320	FM0105 @ PINEGROVE	1.28	High
4323	FM0105 @ VIDOR VILLAS	1.99	Very High
4324	FM0105 @ VIDOR	1.42	High

4326	FM0105 @ GREATHOUSE	1.90	Very High
FM 105 0883-02-087 Safety Treat Fixed Objects, Construct Paved Shoulders(1–4 ft)			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
4319	FM0105 @ BEACH	1.42	High
4320	FM0105 @ PINEGROVE	1.28	High
4323	FM0105 @ VIDOR VILLAS	1.99	Very High
4324	FM0105 @ VIDOR	1.42	High
4326	FM0105 @ GREATHOUSE	1.90	Very High
FM 105 0883-02-087 Safety Treat Fixed Objects, Construct Paved Shoulders(1–4 ft)			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
4319	FM0105 @ BEACH	1.42	High
4320	FM0105 @ PINEGROVE	1.28	High
4323	FM0105 @ VIDOR VILLAS	1.99	Very High
4324	FM0105 @ VIDOR	1.42	High
4326	FM0105 @ GREATHOUSE	1.90	Very High
FM 105 0883-02-087 Safety Treat Fixed Objects, Construct Paved Shoulders(1–4 ft)			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
4319	FM0105 @ BEACH	1.42	High
4320	FM0105 @ PINEGROVE	1.28	High
4323	FM0105 @ VIDOR VILLAS	1.99	Very High
4324	FM0105 @ VIDOR	1.42	High
4326	FM0105 @ GREATHOUSE	1.90	Very High
FM 105 0710-02-068 Mill and Overlay, Joint Seal			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1990	FM0105 @ FM1132	1.43	High
4342	FM0105 @ WEXFORD	1.36	High
4345	FM0105 @ GRAND	1.70	Very High
4332	FM0105 @ WCOURTLAND	1.60	High
4344	FM0105 @ WTRAM	1.81	High
FM 105 0710-02-068 Mill and Overlay, Joint Seal			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1990	FM0105 @ FM1132	1.43	High
4342	FM0105 @ WEXFORD	1.36	High
4345	FM0105 @ GRAND	1.70	Very High
4332	FM0105 @ WCOURTLAND	1.60	High
4344	FM0105 @ WTRAM	1.81	High
FM 105 0710-02-068 Mill and Overlay, Joint Seal			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1990	FM0105 @ FM1132	1.43	High
4342	FM0105 @ WEXFORD	1.36	High
4345	FM0105 @ GRAND	1.70	Very High
4332	FM0105 @ WCOURTLAND	1.60	High
4344	FM0105 @ WTRAM	1.81	High

FM 105 0710-02-068 Mill and Overlay, Joint Seal			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1990	FM0105 @ FM1132	1.43	High
4342	FM0105 @ WEXFORD	1.36	High
4345	FM0105 @ GRAND	1.70	Very High
4332	FM0105 @ WCOURTLAND	1.60	High
4344	FM0105 @ WTRAM	1.81	High
FM 160 0787-02-021 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3475	FM0160 @ FM2830	2.62	Very High
FM 160 0787-01-018 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2569	FM0160 @ NBAKER	1.75	Very High
FM 163 0952-01-056 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1205	FM0163 @ FM2518	1.62	Very High
FM 252 0785-01-035 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
586	FM0252 @ CR487	1.24	High
3394	FM1013 @ FM0252	1.21	High
FM 252 0785-01-035 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
586	FM0252 @ CR487	1.24	High
3394	FM1013 @ FM0252	1.21	High
FM 256 0703-03-027 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2290	FM0256 @ CR3230	1.22	High
2293	FM0256 @ CR3240	1.22	High
2299	US0190 @ FM0256	1.19	High
FM 256 0703-03-027 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2290	FM0256 @ CR3230	1.22	High
2293	FM0256 @ CR3240	1.22	High
2299	US0190 @ FM0256	1.19	High
FM 256 0703-03-027 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2290	FM0256 @ CR3230	1.22	High
2293	FM0256 @ CR3240	1.22	High
2299	US0190 @ FM0256	1.19	High
FM 363 0627-03-028 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1571	FM0363 @ FM2626	1.95	Very High
1579	FM0363 @ CR4046	1.22	High

FM 363 0627-03-028 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1571	FM0363 @ FM2626	1.95	Very High
1579	FM0363 @ CR4046	1.22	High
FM 364 0786-01-085 Add 10 ft Shoulders and Left-Turn Bays			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2673	FC0000 @ TRAM	1.64	Very High
2662	FM0364 @ WALKER	1.28	High
2666	FM0364 @ PINDO	2.49	Very High
FM 364 0786-01-085 Add 10 ft Shoulders and Left-Turn Bays			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2673	FC0000 @ TRAM	1.64	Very High
2662	FM0364 @ WALKER	1.28	High
2666	FM0364 @ PINDO	2.49	Very High
FM 364 0786-01-085 Add 10 ft Shoulders and Left-Turn Bays			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2673	FC0000 @ TRAM	1.64	Very High
2662	FM0364 @ WALKER	1.28	High
2666	FM0364 @ PINDO	2.49	Very High
FM 364 0786-01-083 Widen to Four Lanes with a Center Left-Turn Lane			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2674	FM0364 @ WESTPARK	1.48	High
FM 365 0932-01-116 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3969	FM0365 @ CENTRAL	2.53	Very High
3966	FM0365 @ 27TH	1.74	High
3959	FM0365 @ MEDICAL CENTER	2.97	Very High
3961	FM0365 @ EL PASO	2.97	Very High
3963	FM0365 @ S37TH	4.48	Very High
3967	FM0365 @ 29TH	1.38	High
FM 365 0932-01-116 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3969	FM0365 @ CENTRAL	2.53	Very High
3966	FM0365 @ 27TH	1.74	High
3959	FM0365 @ MEDICAL CENTER	2.97	Very High
3961	FM0365 @ EL PASO	2.97	Very High
3963	FM0365 @ S37TH	4.48	Very High
3967	FM0365 @ 29TH	1.38	High
FM 365 0932-01-114 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1062	FM0365 @ KENNER	1.53	Very High

1069	FM0365 @ HILLEBRANDT	1.74	Very High
1055	FM0365 @ LABELLE	1.77	Very High
FM 365 0932-01-114 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1062	FM0365 @ KENNER	1.53	Very High
1069	FM0365 @ HILLEBRANDT	1.74	Very High
1055	FM0365 @ LABELLE	1.77	Very High
FM 365 0932-01-114 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1062	FM0365 @ KENNER	1.53	Very High
1069	FM0365 @ HILLEBRANDT	1.74	Very High
1055	FM0365 @ LABELLE	1.77	Very High
FM 365 0932-01-116 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3969	FM0365 @ CENTRAL	2.53	Very High
3966	FM0365 @ 27TH	1.74	High
3959	FM0365 @ MEDICAL CENTER	2.97	Very High
3961	FM0365 @ EL PASO	2.97	Very High
3963	FM0365 @ S37TH	4.48	Very High
3967	FM0365 @ 29TH	1.38	High
FM 365 0932-01-116 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3969	FM0365 @ CENTRAL	2.53	Very High
3966	FM0365 @ 27TH	1.74	High
3959	FM0365 @ MEDICAL CENTER	2.97	Very High
3961	FM0365 @ EL PASO	2.97	Very High
3963	FM0365 @ S37TH	4.48	Very High
3967	FM0365 @ 29TH	1.38	High
FM 365 0932-01-116 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3969	FM0365 @ CENTRAL	2.53	Very High
3966	FM0365 @ 27TH	1.74	High
3959	FM0365 @ MEDICAL CENTER	2.97	Very High
3961	FM0365 @ EL PASO	2.97	Very High
3963	FM0365 @ S37TH	4.48	Very High
3967	FM0365 @ 29TH	1.38	High
FM 365 0932-01-116 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3969	FM0365 @ CENTRAL	2.53	Very High
3966	FM0365 @ 27TH	1.74	High

3959	FM0365 @ MEDICAL CENTER	2.97	Very High
3961	FM0365 @ EL PASO	2.97	Very High
3963	FM0365 @ S37TH	4.48	Very High
3967	FM0365 @ 29TH	1.38	High
FM 418 0784-01-051 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
298	FM0418 @ FM1122	1.42	High
299	FM0418 @ STONES THROW	1.40	High
FM 418 0784-01-051 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
298	FM0418 @ FM1122	1.42	High
299	FM0418 @ STONES THROW	1.40	High
FM 418 0784-01-049 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
4244	FM0418 @ BONNER	1.47	High
4245	FM0418 @ RAILROAD	1.36	High
FM 418 0784-01-049 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
4244	FM0418 @ BONNER	1.47	High
4245	FM0418 @ RAILROAD	1.36	High
FM 563 1023-01-034 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
23	FM0563 @ PINE HOLLOW	1.41	High
41	FM0563 @ NO NINE	1.35	High
44	FM0563 @ FM2041	1.26	High
45	FM0563 @ BAY	1.31	High
47	FM0563 @ SIMON	1.31	High
FM 563 1023-01-034 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
23	FM0563 @ PINE HOLLOW	1.41	High
41	FM0563 @ NO NINE	1.35	High
44	FM0563 @ FM2041	1.26	High
45	FM0563 @ BAY	1.31	High
47	FM0563 @ SIMON	1.31	High
FM 563 1023-01-033 Hazard Elimination and Safety			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
44	FM0563 @ FM2041	1.26	High
45	FM0563 @ BAY	1.31	High
47	FM0563 @ SIMON	1.31	High
FM 563 1023-01-034 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
23	FM0563 @ PINE HOLLOW	1.41	High

41	FM0563 @ NO NINE	1.35	High
44	FM0563 @ FM2041	1.26	High
45	FM0563 @ BAY	1.31	High
47	FM0563 @ SIMON	1.31	High
FM 563 1023-01-035 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
44	FM0563 @ FM2041	1.26	High
47	FM0563 @ SIMON	1.31	High
FM 563 1023-01-036 Widen Road—Add Lanes			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
44	FM0563 @ FM2041	1.26	High
FM 563 1023-01-033 Hazard Elimination and Safety			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
44	FM0563 @ FM2041	1.26	High
45	FM0563 @ BAY	1.31	High
47	FM0563 @ SIMON	1.31	High
FM 563 1023-01-034 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
23	FM0563 @ PINE HOLLOW	1.41	High
41	FM0563 @ NO NINE	1.35	High
44	FM0563 @ FM2041	1.26	High
45	FM0563 @ BAY	1.31	High
47	FM0563 @ SIMON	1.31	High
FM 563 1023-01-033 Hazard Elimination and Safety			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
44	FM0563 @ FM2041	1.26	High
45	FM0563 @ BAY	1.31	High
47	FM0563 @ SIMON	1.31	High
FM 563 1023-01-034 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
23	FM0563 @ PINE HOLLOW	1.41	High
41	FM0563 @ NO NINE	1.35	High
44	FM0563 @ FM2041	1.26	High
45	FM0563 @ BAY	1.31	High
47	FM0563 @ SIMON	1.31	High
FM 563 1023-01-035 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
44	FM0563 @ FM2041	1.26	High
47	FM0563 @ SIMON	1.31	High
FM 565 1024-01-074 Widen Paved Surface Width, Install Continuous Turn Lane			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3157	FM0565 @ PLANTATION	1.56	High
3158	FM0565 @ VERANDA	1.47	High

FM 565 1024-01-076 Provide Additional Paved Surface Width. Install Milled			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3598	FM0565 @ EWINFREE	1.39	High
FM 565 1024-01-078 Hazard Elimination and Safety			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3715	FM0565 @ SUNNYSIDE	2.04	Very High
FM 565 1024-01-074 Widen Paved Surface Width, Install Continuous Turn Lane			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3157	FM0565 @ PLANTATION	1.56	High
3158	FM0565 @ VERANDA	1.47	High
FM 565 1024-01-042 Widen Road—Add Shoulders			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
13	FM0565 @ CARLSWOOD	1.63	Very High
FM 565 1024-01-077 Widen to Four Lanes With Ctl and Overpass at Up Rr			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
13	FM0565 @ CARLSWOOD	1.63	Very High
FM 770 1096-01-061 Safety Treat Fixed Objects			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
322	FM0770 @ FM1003	1.31	High
352	FM0770 @ BRONX	1.64	Very High
FM 770 1096-01-065 Safety Treat Fixed Objects, Milled Edgeline, and Centerline			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
356	FM0770 @ GUEDRY CEMETERY	1.65	Very High
358	FM0770 @ TAYLOR	3.43	Very High
FM 770 1096-01-065 Safety Treat Fixed Objects, Milled Edgeline, and Centerline			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
356	FM0770 @ GUEDRY CEMETERY	1.65	Very High
358	FM0770 @ TAYLOR	3.43	Very High
FM 770 1096-01-061 Safety Treat Fixed Objects			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
322	FM0770 @ FM1003	1.31	High
352	FM0770 @ BRONX	1.64	Very High
FM 777 1109-01-024 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3311	SH0063 @ FM0777	1.99	High
FM 787 0813-01-101 Safety Treat Fixed Objects, Modernize Bridge Rail			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1225	FM0787 @ FM0223	1.76	Very High
FM 787 0813-01-107 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1245	FM0787 @ CR2650	1.26	High

1230	SH0146 @ FM0787	1.54	High
FM 787 0813-01-107 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1245	FM0787 @ CR2650	1.26	High
1230	SH0146 @ FM0787	1.54	High
FM 834 1146-03-015 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1295	FM0834 @ FM0834	2.19	Very High
FM 834 1146-02-021 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1295	FM0834 @ FM0834	2.19	Very High
FM 943 1194-02-018 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
386	FM1003 @ FM0943	1.28	High
FM 1006 0882-02-058 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3796	FM1006 @ MARYLAND	1.35	High
3811	FM1006 @ MYERS	1.55	High
FM 1006 0882-02-058 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3796	FM1006 @ MARYLAND	1.35	High
3811	FM1006 @ MYERS	1.55	High
FM 1008 0953-01-014 Widen/Two-Course Surface Treatment			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1326	SH0321 @ FM1008	1.23	High
FM 1008 0952-01-057 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3381	FM1008 @ CR 640	1.34	High
3382	FM1008 @ NPARKER	1.38	High
FM 1008 0952-01-057 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3381	FM1008 @ CR 640	1.34	High
3382	FM1008 @ NPARKER	1.38	High
FM 1010 1061-01-032 Construct Paved Shoulders(1–4 ft), Milled Edgeline Rumble			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1362	FM1010 @ CR337	1.58	Very High
1368	FM1010 @ CR330	1.17	High
3924	FM2090 @ FM1010	1.80	Very High
FM 1010 1061-01-032 Construct Paved Shoulders(1–4 ft), Milled Edgeline Rumble			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1362	FM1010 @ CR337	1.58	Very High
1368	FM1010 @ CR330	1.17	High
3924	FM2090 @ FM1010	1.80	Very High

FM 1010 1061-01-032 Construct Paved Shoulders(1–4 ft), Milled Edgeline Rumble			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1362	FM1010 @ CR337	1.58	Very High
1368	FM1010 @ CR330	1.17	High
3924	FM2090 @ FM1010	1.80	Very High
FM 1011 1146-02-022 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1295	FM0834 @ FM0834	2.19	Very High
FM 1012 1277-01-016 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1625	FM1012 @ CR1550	1.26	High
FM 1013 1237-01-034 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2311	FM1013 @ CR4497	1.20	High
2322	FM1013 @ CR4394	1.50	Very High
FM 1013 1237-01-034 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2311	FM1013 @ CR4497	1.20	High
2322	FM1013 @ CR4394	1.50	Very High
FM 1130 1284-01-079 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2074	FM1130 @ MORRIS	1.39	High
FM 1131 0784-04-023 Modernize Bridge Rail and Approach Guardrail, Safety Treat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2064	FM1131 @ RENFRO	1.22	High
2072	FM1131 @ CONNOLLY	1.22	High
FM 1131 0784-04-022 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2064	FM1131 @ RENFRO	1.22	High
2072	FM1131 @ CONNOLLY	1.22	High
FM 1131 0784-04-023 Modernize Bridge Rail and Approach Guardrail, Safety Treat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2064	FM1131 @ RENFRO	1.22	High
2072	FM1131 @ CONNOLLY	1.22	High
FM 1131 0784-04-022 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2064	FM1131 @ RENFRO	1.22	High
2072	FM1131 @ CONNOLLY	1.22	High
FM 1136 1285-01-019 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2018	FM1136 @ LINSCOMB	1.27	High
FM 1293 1947-02-015 Safety Lighting			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved

392	FM1293 @ FM1003	1.55	Very High
FM 1293 1947-02-016 Cement Treat, Widen to 28 ft, and Surface Treat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
392	FM1293 @ FM1003	1.55	Very High
FM 1406 1324-01-021 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1093	FM1406 @ OLD LEAGUE	1.42	Very High
FM 1408 1419-01-009 Replace Bridge and Approaches			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
794	FM1408 @ CR282	1.24	High
FM 1408 1419-01-011 Safety Treat Fixed Objects			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
794	FM1408 @ CR282	1.24	High
FM 1408 1419-01-013 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
794	FM1408 @ CR282	1.24	High
FM 1409 0762-02-049 Milled Edgeline Rumble Strips			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1389	FM1409 @ CHAMPION	1.99	Very High
1400	FM1409 @ CR444	1.49	Very High
FM 1409 0762-02-049 Milled Edgeline Rumble Strips			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1389	FM1409 @ CHAMPION	1.99	Very High
1400	FM1409 @ CR444	1.49	Very High
FM 1413 1421-01-026 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1381	FM1413 @ CR486	1.19	High
FM 1416 0627-04-035 Widen and Overlay Roadway			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1629	FM1416 @ CR4070	1.23	High
FM 1442 1284-01-076 Safety Lighting			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2113	FM1442 @ LISTON RD CUTOFF	1.17	High
FM 1442 1284-01-078 Install Chevrons (Curve)			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2113	FM1442 @ LISTON RD CUTOFF	1.17	High
FM 1442 2562-01-020 Rehabilitate Existing Roadway			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2968	FM1442 @ CAROLI	2.27	Very High
2976	FM1442 @ TURNER	1.50	High

FM 1442 2562-01-020 Rehabilitate Existing Roadway			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2968	FM1442 @ CAROLI	2.27	Very High
2976	FM1442 @ TURNER	1.50	High
FM 1663 0368-05-018 Milled Edgeline Rumble Strips, Provide Additional Paved			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
109	FM1663 @ NHAMSHIRE	1.20	High
FM 1663 1464-01-018 Milled Edgeline Rumble Strips, Provide Additional Paved			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
109	FM1663 @ NHAMSHIRE	1.20	High
FM 1724 1580-01-011 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
111	SH0065 @ FM1724	1.19	High
FM 1943 1828-01-032 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2376	FM1943 @ CR4796	1.48	Very High
2377	FM1943 @ CR4795	1.20	High
2381	FM1943 @ CR4476	1.42	Very High
2407	FM1943 @ CR4485	1.19	High
2379	US0069 @ CR1515	1.54	High
FM 1943 1828-01-032 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2376	FM1943 @ CR4796	1.48	Very High
2377	FM1943 @ CR4795	1.20	High
2381	FM1943 @ CR4476	1.42	Very High
2407	FM1943 @ CR4485	1.19	High
2379	US0069 @ CR1515	1.54	High
FM 1943 1828-01-032 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2376	FM1943 @ CR4796	1.48	Very High
2377	FM1943 @ CR4795	1.20	High
2381	FM1943 @ CR4476	1.42	Very High
2407	FM1943 @ CR4485	1.19	High
2379	US0069 @ CR1515	1.54	High
FM 1943 1828-01-032 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2376	FM1943 @ CR4796	1.48	Very High
2377	FM1943 @ CR4795	1.20	High
2381	FM1943 @ CR4476	1.42	Very High
2407	FM1943 @ CR4485	1.19	High
2379	US0069 @ CR1515	1.54	High
FM 1943 1828-01-032 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved

2376	FM1943 @ CR4796	1.48	Very High
2377	FM1943 @ CR4795	1.20	High
2381	FM1943 @ CR4476	1.42	Very High
2407	FM1943 @ CR4485	1.19	High
2379	US0069 @ CR1515	1.54	High
FM 1960 1685-04-024 Install Intersection Flashing Beacon, Safety Lighting			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1420	FM1960 @ CR612	1.97	Very High
FM 1985 0242-06-019 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
128	SH0124 @ FM1985	1.45	Very High
FM 2354 2242-02-022 Add Center Left-Turn Lane and Widen Shoulders, Add Nb Left			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2597	FM2354 @ BEACH HAVEN	1.36	High
FM 2518 2381-01-010 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1205	FM0163 @ FM2518	1.62	Very High
FM 2610 2591-02-011 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
1229	FM0787 @ FM2610	1.34	High
FM 2937 2952-01-007 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
275	FM0092 @ FM2937	1.20	High
443	FM2937 @ OLD ARCO	1.24	High
FM 2937 2952-01-007 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
275	FM0092 @ FM2937	1.20	High
443	FM2937 @ OLD ARCO	1.24	High
FM 3247 1284-02-018 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3830	SH0087 @ FM3247	1.58	High
FM 3414 3405-01-007 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
846	FM3414 @ CR159	1.24	High
844	SH0063 @ FM3414	1.74	Very High
FM 3414 3405-01-007 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
846	FM3414 @ CR159	1.24	High
844	SH0063 @ FM3414	1.74	Very High
FM 3497 3548-01-004 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
2436	US0190 @ FM3497	1.69	Very High

FM 3513 0065-15-005 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
476	FM3513 @ HOLMES	1.28	High
486	FM3513 @ ECANDLESTICK	1.60	High
FM 3513 0065-15-005 Surfacing/Roadway Restoration			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
476	FM3513 @ HOLMES	1.28	High
486	FM3513 @ ECANDLESTICK	1.60	High
SL 505 0305-10-008 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3672	SL0505 @ CR4002	1.23	High
SL 505 0304-09-006 Seal Coat			
Intersection ID	Crossing Streets	Ratio (Exp./Pred.)	Potential to Be Improved
3647	SH0087 @ SL0505	1.30	High

REFERENCES

AASHTO. (2001). *Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT less than or equal to 400)*. Washington, DC: American Association of State Highway and Transportation Officials.

AASHTO. (2010). *Highway Safety Manual* (1st ed.). Washington, DC: American Association of State Highway and Transportation Officials.

AASHTO. (2011). *A Policy on Geometric Design of Highways and Streets*. Washington, DC: American Association of State Highway and Transportation Officials.

Andrey, J., and S. Yagar. (1993). A temporal analysis of rain-related crash risk. *Accident Analysis & Prevention,* Vol. 25, No. 4, pp. 465–472.

Bonneson, J. A., and M. P. Pratt. (2009). *Roadway Safety Design Workbook.* FHWA/TX-09/0-4703-P2). College Station, TX: Texas Transportation Institute.

Bonneson, J. A., and M. P. Pratt. (2010). *Highway Safety Design Workshops*. College Station, TX: Texas Transportation Institute.

Geedipally, S. R., M. Martin, and R. Wunderlich. (2017). *Highway Safety Improvement Program Screening Tool*. College Station, TX: Texas A&M Transportation Institute.

Jackson, T. L., and H. O. Sharif. (2016). Rainfall impacts on traffic safety: Rain-related fatal crashes in Texas. *Geomatics, Natural Hazards and Risk,* Vol. 7, pp. 843–860.

Harkey, D. L., and C. V. Zegeer. (2004). *PEDSAFE: Pedestrian Safety Guide and Countermeasure Selection System*. FHWA-SA-04-003. Chapel Hill, NC: University of North Carolina.

Harmon, T., G. Bahar, and F. Gross. (2018). *Crash Costs for Highway Safety Analysis*. Washington, DC: Federal Highway Administration Office of Safety.

Kay, J., P. T. Savolainen, T. J. Gates, T. K. Datta, J. Finkelman, and B. Hamadeh. (2015). Safety impacts of a statewide centerline rumble strip installation program. *Transportation Research Record: Journal of the Transportation Research Board,* No. 2515, pp. 34–40.

Lamm, R., E. M. Choueiri, and T. Mailaender. (1990). Comparison of operating speeds on dry and wet pavements of two-lane rural highways. *Transportation Research Record: Journal of the Transportation Research Board,* No. 1280, pp. 199–207.

Neuman, T. R., R. Pfefer, K. L. Slack, K. K. Hardy, F. Council, H. McGee, L. Prothe, and K. Eccles. (2003). *Guidance for Implementation of the AASHTO Strategic Highway Safety Plan. Volume 6: A Guide for Addressing Run-Off-Road Collisions*. NCHRP Report 500. Washington, DC: Transportation Research Board.

Preston, H., R. Storm, J. Dowds Bennett, and B. Wemple. (2013). *Systemic Safety Project Selection Tool*. Retrieved from https://safety.fhwa.dot.gov/systemic/fhwasa13019/sspst.pdf

Satterthwaite, S. (1976). An assessment of seasonal and weather effects on the frequency of road accidents in California. *Accident Analysis & Prevention*, Vol. 8, No. 2, pp. 87–96.

TxDOT. (n.d.). *Roadway Inventory*. Retrieved from http://www.txdot.gov/inside-txdot/division/transportation-planning/roadway-inventory.html

TxDOT. (2014). *Roadway Design Manual*. Retrieved from http://onlinemanuals.txdot.gov/txdotmanuals/rdw/rdw.pdf

TxDOT. (2017). *Texas Strategic Highway Safety Plan 2017–2022*. Retrieved from http://ftp.dot.state.tx.us/pub/txdot-info/library/pubs/gov/shsp.pdf

Texas Manual on Uniform Traffic Control Devices, 2014. Retrieved from https://ftp.dot.state.tx.us/pub/txdot-info/trf/tmutcd/2011-rev-2/revision-2.pdf

Wu, H., Z. Han, M. R. Murphy, and Z. M. Zhang. (2015). Empirical Bayes before-after study on safety effect of narrow pavement widening projects in Texas. *Transportation Research Record: Journal of the Transportation Research Board*, No. 2515, pp. 63–69.