Central Texas Grade Crossing Study

Summary Report

May 2018

Williamson, Travis, Hays, Comal, and Bexar Counties
CSJ: 83-1175-34-083

Texas Department of Transportation - Rail Division

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Overview

The purpose of the Central Texas Grade Crossing Study is to develop candidate projects that could potentially server to improve mobility and reduce vehicular delays associated with the Union Pacific Railroad (UPRR) freight railroad system located in the counties of Williamson, Travis, Hays, Comal, and Bexar through potential improvements to highway-railroad at-grade crossings. The Texas Department of Transportation (TxDOT) is undertaking this study to provide planning support to its partners in rapidly growing communities along these important freight railroad corridors. This study includes the analysis, planning, conceptual engineering, preparation of cost estimates, and the development of project implementation information for a select number of highway-railroad at-grade crossings in the study area.

TxDOT initiated this study in January 2017 after the Capital Area Metropolitan Planning Organization removed the Lone Star Rail project from the long range transportation plan and the Federal Highway Administration rescinded the Notice of Intent to conduct an Environmental Impact Study. The UPRR corridor was the preferred alternative for Lone Star Rail, a planned regional passenger rail service connecting the greater Austin and San Antonio areas. Lone Star Rail proposed to improved rail-highway conflicts on the UPRR corridor by moving the majority of freight traffic to a bypass route; the Central Texas Grade Crossing Study continues this goal of mobility improvement.

The majority of recommended improvements in this study are not under TxDOT jurisdiction. Given the rapid development of the corridor, local communities will need to incorporate these concepts early in their land management and comprehensive corridor planning efforts.

The study area consists of approximately 330 miles of UPRR track on the Austin Mainline and Austin Track 2 Subdivisions as well as portions of the Waco, Lockhart, Glidden, Del Rio, Kerrville, Laredo, Rockport, and Corpus Christi Subdivisions and more than 400 highway-railroad at-grade crossings. A railroad segment extending from Bexar County into Guadalupe County is also included in the study. The Guadalupe County extension is discussed with the crossings in Bexar County.

The five-county study area (including the Guadalupe County extension) and the UPRR's Subdivisions are displayed in Figure 1.

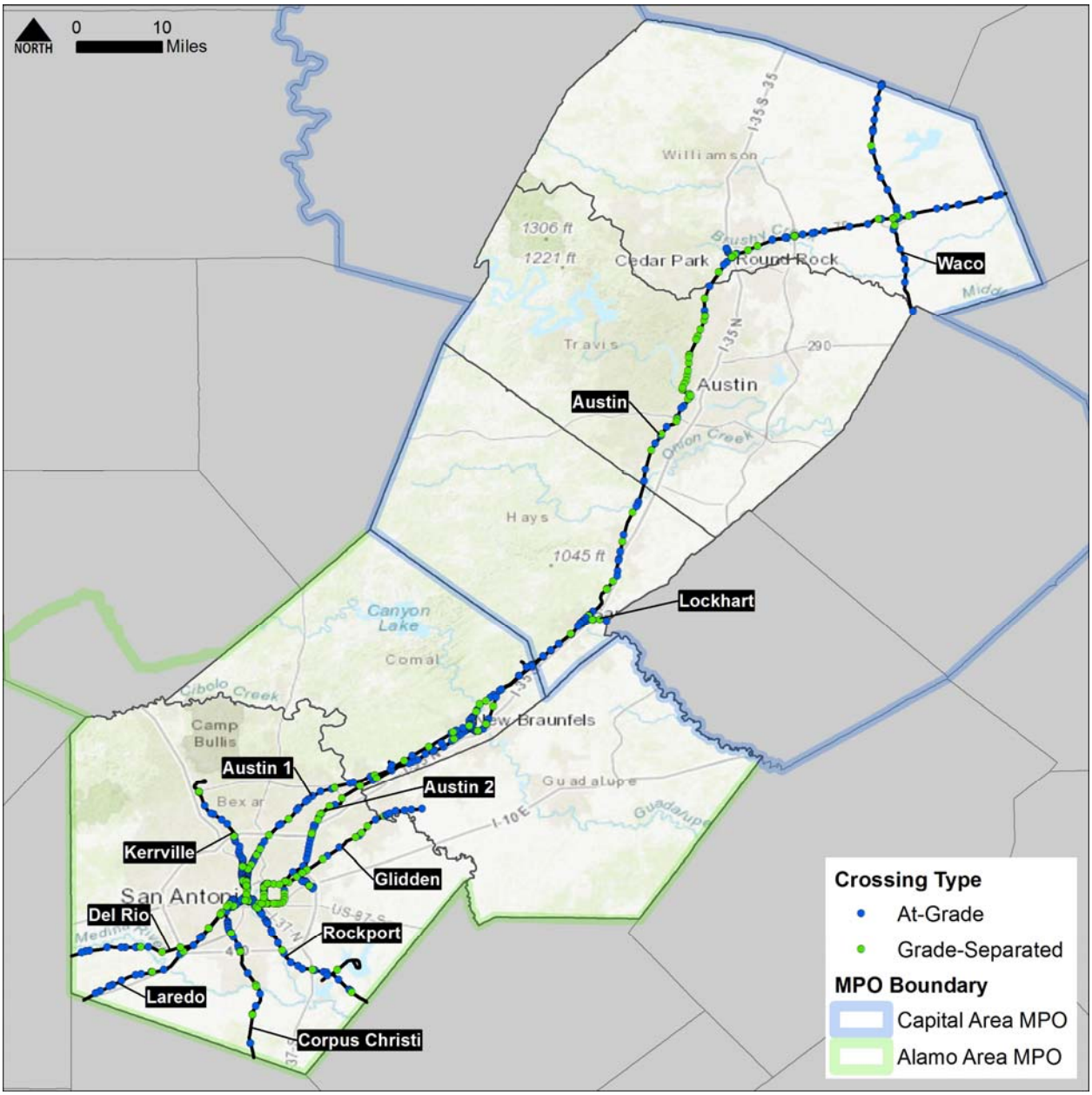
Report Outline

The report is organized by county and by railroad subdivision. This report includes the following sections:

- Grade Crossing Review: This section assembles physical and operational information along the railroad, roadways, and crossings to serve as baseline data for use during the screening process.

- Screening Methodology: This section outlines the quantitative and qualitative information used to screen the highway-railroad at-grade crossing locations to review for potential improvements.
- Improvement Type Overview: This section provides a summary of improvement types considered in this study.
- Summary of Improvement Concepts: This section summarizes the improvement concepts considered at select highway-railroad at-grade crossings.
- Implementation and Next Steps: This section summarizes the benefit-cost analysis of ten grade separation projects. It notes next steps to be taken if the improvement concepts are chosen to advance for implementation.

Figure 1: Five-County Study Area – Railroad Subdivisions



Source: TranSystems and TRIMS

Technical Memoranda

The following Technical Memoranda were prepared during the course of the study:

- *Review and Analysis*
- *Grade Crossing Screening Methodology*
- *Grade Crossing Improvement Toolbox*
- *Benefit Cost Analysis*

- *Utility Review*

Stakeholder Engagement

During the study, meetings with local governments, railroad partners, and other public-entity stakeholders were held to discuss and review data, the screening process, concept layouts with estimated costs, and implementation. Table 1 outlines the primary stakeholder meetings held during the study.

Table 1: Stakeholder Engagement Meetings

Stakeholder Engagement Meeting	Date
Project Kick-off Meeting	April 17, 2017
Stakeholder Conference Call (Travis County)	June 12, 2018
Stakeholder Meetings (Williamson, Hays, Comal, Bexar Counties)	July 18, 19 and 20, 2017
Union Pacific Hi-Rail Site Visit	October 2, 2017
Union Pacific Coordination Conference Call	January 17, 2018
Stakeholder Meeting (Bexar County)	February 15, 2018
Stakeholder Webinars (Williamson, Hays, Comal Counties)	April 19 and 20, 2018

Grade Crossing Analysis

Physical Conditions

The physical conditions are discussed first by railroad elements and then by highway characteristics. Figure 2 displays the five-county study area by UPRR's railroad subdivisions and number of tracks.

Within TxDOT's Rail Division (RRD), the Rail Highway Section develops and manages railroad-related programs, including railroad crossing improvements and highway projects that interface with railroad right-of-way. The Rail Highway Section uses the Texas Railroad Information Management System (TRIMS) to manage inventory data, prioritize ranking calculations and determine railroad crossing projects. TRIMS is the primary source of data for this Study.

Railroad Elements

The Austin Subdivision is the main subdivision spanning the five-county study area. The Austin Subdivision begins at Mile Post (MP) 133.0 at the Williamson-Milam County line and traverses southwesterly through Taylor and Round Rock before heading into McNeil near the Williamson-Travis County line at MP 165.6. The Austin Subdivision then heads southerly through Travis County into the City of Austin and crosses the Colorado River. The Bergstrom Industrial Lead is out of service and is not included in this analysis. The Austin Subdivision continues southerly to the Travis-Hays County line at MP 192.0. In Hays County, the Austin Subdivision traverses through Buda, Kyle, and San Marcos. At MP 208.0, the Austin Subdivision diverges and has two parallel main lines referred to as Mainline 1 and Track 2. At this point, Track 2 is on the east side yet crisscrosses Mainline 1 on several occasions. The Austin Subdivision enters Comal County at MP 216.9. The lines diverge through New Braunfels to a point nearly 1.6 miles apart before crossing in downtown New Braunfels. The Austin 1 and 2 Subdivisions enter Bexar County at MP 241.8.

Other subdivisions include the:

- Waco Subdivision in Williamson County traversing in a southeasterly direction from Barlett at the Bell-Williamson County line (MP 902.7) through Taylor towards Elgin in Bastrop County. In Travis County there is one at-grade crossing on the Waco Subdivision before the Travis-Bastrop County line (MP 929.3).
- Lockhart Subdivision in Hays County ends within San Marcos at MP 51.9. The rail corridor enters Hays County southwesterly from Caldwell County at MP 49.8.
- The Laredo Subdivision in Bexar County is a continuation of the Austin Subdivision's mile post reference beginning at MP 260.4 and extending southwesterly to Lytle in Atascosa County (MP 282.7).

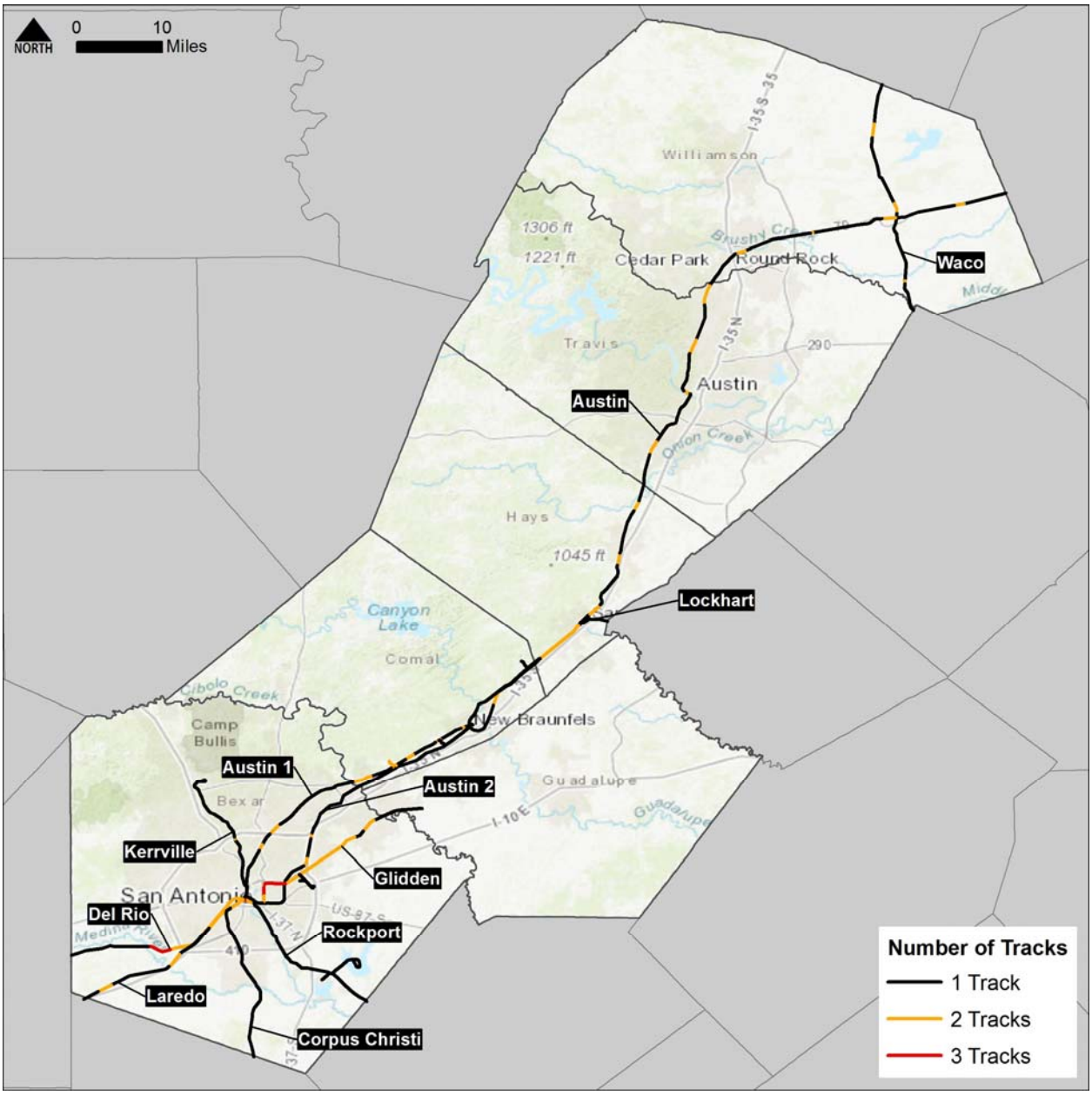
- The Glidden Subdivision begins in Guadalupe County near MP 189 and traverses southwesterly into Bexar County towards the UPRR's East Yard in San Antonio. The railroad corridor then becomes the Del Rio Subdivision from MP 201.4 continuing in a southwesterly direction through Macdona towards Lacoste in Medina County. These subdivisions were the former Southern Pacific Railroad alignment.
- The Corpus Christi Subdivision in Bexar County begins at MP 3.1 near the SoSan Yard and traverses southeasterly towards Pleasanton in Atascosa County. The corridor under evaluation stops at MP 21.5 at the county line.
- The Rockport Subdivision in Bexar County breaks from the Del Rio Subdivision at MP 0.2 near South Presa Street and traverses southeasterly towards Elmendorf before crossing the county line into Wilson County at MP 17.3 and Mission Rail Park. Service is also provided to the CPS Energy facility.
- The Kerrville Subdivision in Bexar County begins at MP 0.0 near S Presa Street and traverses northeasterly towards the junction of I-10 and Loop 1604. The corridor terminates at MP 16.3 before entering the Martin Marietta Beckmann Quarry.
- The Georgetown Industrial Lead in Williamson County breaks from the Austin Subdivision at MP 0.2 beneath I-35 in Round Rock and proceeds northwesterly for just over a mile before changing ownership.
- The Salado Lead in Bexar County begins at MP 133.4 near Pace Picante Drive and the Glidden Subdivision and heads southeasterly towards the junction of I-10 and 410 while serving numerous industrial properties.

Sidings

Throughout the entire 330 miles of railroad in the Study Area counties, there are 25 sidings totaling nearly 35 miles in length. By mileage, the majority (68%) of the sidings are along the Austin Subdivision. The mile post locations of the sidings, their respective name (according to track charts), and lengths, are outlined in Table 3. A key element of a siding is its length, which in turn can control the length of a train using the corridor. With increasing train lengths, the desired siding length approaches 9,000 feet. Approximately one-quarter (7) of the sidings are 9,000 feet or longer. The longest siding is nearly 2.2 miles long and is located north of New Braunfels. The shortest siding is just over 0.5 miles in Converse on the Glidden Subdivision. This location is where a new crossing is being installed for the realignment of FM 1516.

When trains are staged on a siding, they can occupy at-grade crossings. Therefore a review of sidings may identify improvements that are needed. A relocation of the siding in Kyle is proposed that would move the siding farther north and potentially increase its length.

Figure 2: Five-County Study Area – Railroad Subdivisions and Number of Tracks



Source: TranSystems and TRIMS

Table 2: Railroad Mileage by County and Subdivision

County	Subdivision	Begin Mile Post	End Mile Post	Length (Miles)
Williamson	Austin	133.0	165.6	32.6
	Waco	902.7	929.3	26.6
	Georgetown Industrial	0.0	1.4	1.4
Travis	Austin	165.6	192.0	26.4
	Waco	929.3	930.3	1.0
Hays	Austin	192.0	216.9	24.9
	Austin Track 2	208.5	216.6	8.1
	Lockhart	49.8	51.9	2.1
Comal	Austin	216.9	241.8	24.9
	Austin Track 2	216.6	240.1	23.5
Guadalupe	Glidden	189.0	193.1	4.1
Bexar	Austin	241.8	260.4	18.6
	Austin Track 2	240.1	259.6	19.5
	Glidden	193.1	201.4	8.3
	Rockport	0.2	17.3	17.1
	Corpus Christi	3.1	21.5	18.4
	Laredo	260.4	282.7	22.3
	Del Rio	201.4	233.4	32.0
	Kerrville	0.0	16.3	16.3
	Salado Lead	136.0	133.9	2.1
TOTAL				**330.2**

Source: TranSystems and TRIMS

Table 3: Railroad Sidings by Mile Post

County	Subdivision	Name	Begin Mile Post	End Mile Post	Length (Miles)
Williamson	Austin	Thrall	137.24	138.99	1.75
		Hestes	149.91	151.43	1.52
		Hutto	153.04	153.81	0.77
		Round Rock	160.37	161.84	1.47
	Waco	Granger	907.3	908.90	1.60
		Birge	916.64	918.48	1.84
Travis	Austin	McNeil	166.09	167.16	1.07
		Sneed	172.59	174.34	1.75
		Bergstrom	186.57	188.08	1.51
Hays	Austin	Buda	194.25	195.37	1.12
		Lehigh	196.03	197.14	1.11
		Kyle	200.19	201.74	1.55
		Centex	206.64	208.31	1.67
Comal	Austin	Goodwin	220.91	223.14	2.23
		New Braunfels	227.90	228.61	0.71
		Ogden	235.89	237.02	1.13
Bexar	Austin	Bracken	239.35	241.11	1.76
		North Loop	250.52	252.12	1.60
		Adams	253.38	254.26	0.88
	Glidden	Randolph	194.33	196.06	1.73
		Converse	196.40	196.94	0.54
	Corpus Christ	Lehr	19.95	20.66	0.71
	Laredo	84 Lumber	269.50	270.59	1.09
		Gessner	277.62	279.31	1.69
	Del Rio	Macdona	223.62	225.50	1.87
TOTAL					**34.67**

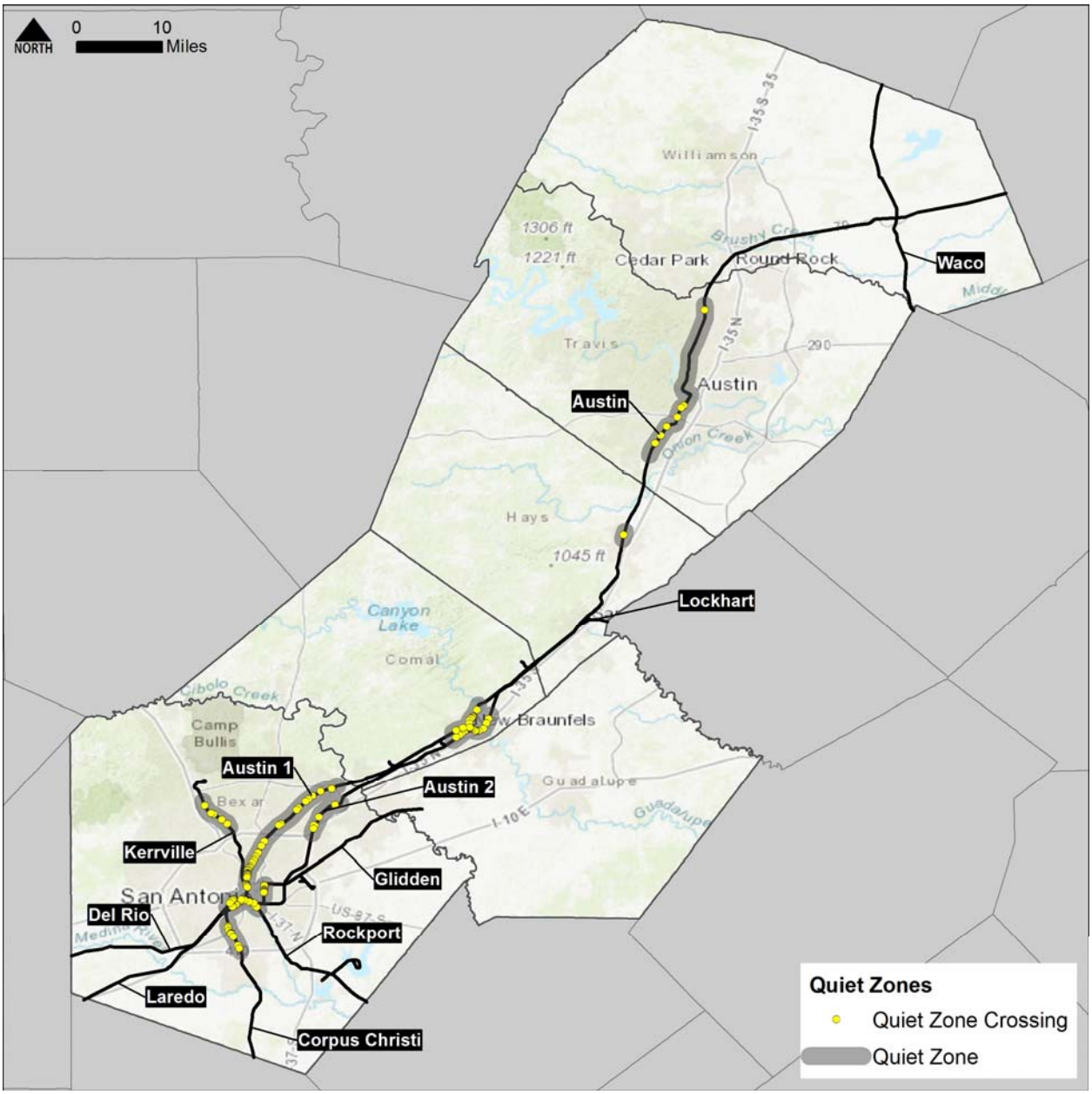
Source: TranSystems and TRIMS

Note: There are no sidings along the Guadalupe County segment.

Quiet Zones

As displayed in Figure 3, there are four individual crossing Quiet Zone and 16 other segments of two or more crossings Quiet Zones. The length of the Quiet Zone segments vary from 0.05 miles with two crossings to 12.9 miles with 27 continuous crossings. Table 4 outlines the listings of the Quiet Zone segments. The total length of Quiet Zone segments (excluding individual crossings) amounts to over 37 miles with 106 crossings. Further analysis of Quiet Zones may indicate extending existing Quiet Zone segments or exploring the elimination of short gaps in between segments of existing Quiet Zones.

Figure 3: Five-County Study Area – Quiet Zones and Crossings



Source: TranSystems and TRIMS

Table 4: Quiet Zones by Mile Post

County	Subdivision	City	Length (Miles)	Crossings
Travis	Austin	Austin	N/A	1
			5.64	6
Hays	Austin	Kyle	N/A	1
Comal	Austin	New Braunfels	0.89	4
			0.30	2
			0.05	2
			2.40	16
Bexar	Austin	San Antonio	12.91	27
			0.50	5
			3.81	4
	Rockport		0.60	3
	Corpus Christi		2.84	9
	Laredo		N/A	1
			1.00	5
	Del Rio		N/A	1
			0.17	2
			2.34	7
			0.35	2
	Kerrville		3.27	4
TOTAL			**37.32**	**106**

Source: TranSystems and TRIMS

Note: There are no Quiet Zones along the Guadalupe County segment.

Roadway Elements

Each highway-railroad at-grade crossing under evaluation is an open, public roadway. While statistics can be developed by the type and range of variables at the county or railroad subdivision level, the aggregate numbers for the five-county area are viewed as sufficient to gain an understanding of the overall characteristics. Figure 4.1 to Figure 4.5.1 display the roadway classification at each crossing by county. Just over half of the crossings are classified as a rural roadway facility. Overall, the majority of crossings have a local functional classification, yet that percentage is heavily influenced from urban roadways. Collector roadways account for more than one-quarter of all crossings, yet that percentage is heavily influenced from rural roadways.

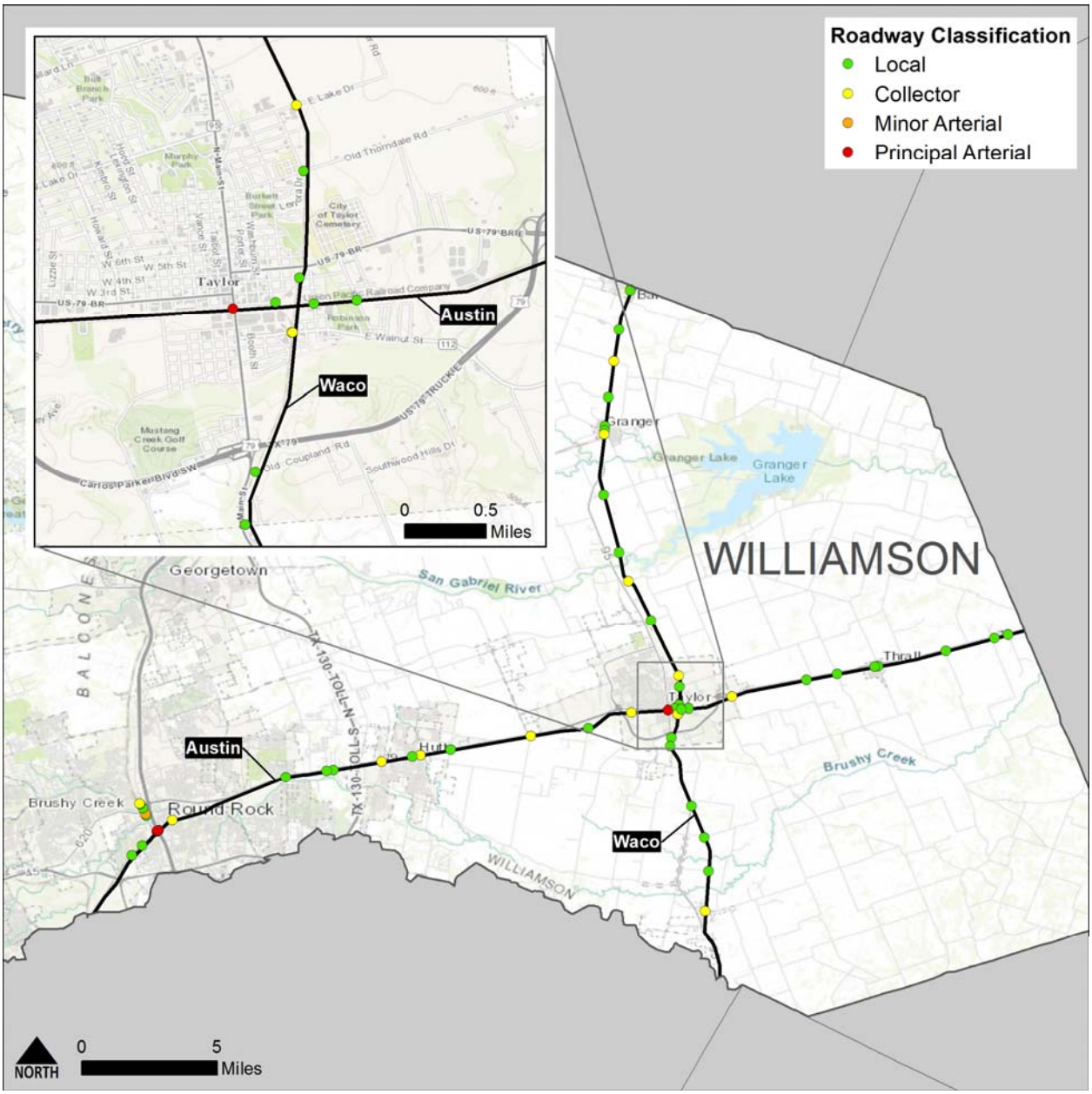
More than 70 percent of the crossings have less than 5,000 vehicles per day crossing them. Figure 5.1 to Figure 5.5.1 show the range of vehicles per day at each crossing by county. Less than 20 percent of the crossings have greater than 10,000 vehicles per day.

The majority of the crossings have a posted speed between 25 and 34 mph. Figure 6.1 to Figure 6.5.1 display the range of posted vehicular speed at each crossing by county. Approximately ten percent have a posted speed of less than 25 mph and eleven percent have a posted speed greater than 45 mph.

Figure 7.1 to Figure 7.5.1 display the type of crossing by County, whether the crossing is grade separated or at-grade. At the highway-railroad at-grade crossings, the warning device type is also shown by active and passive warning device. An active warning device has gates and/or flashings lights. Passive control is crossbucks or stop and yield signs. The symbol for passive warning devices does not distinguish between the types of sign control, if any. Table 5 summarizes the type of warning devices by county and subdivision. Overall, the majority of at-grade crossings are controlled by gates and flashing lights while only 14 percent are under passive control. All crossings in Hays County have active warning devices. The subdivisions with the highest percentages of passive control (25 percent or more) occur on the Waco Subdivision in Williamson County and the Kerrville and Rockport Subdivisions in Bexar County. It is also worth noting the number of trains per day on these corridors as well as their length as several of these corridors primarily provide industry service. The Kerrville Subdivision is 16.3 miles long with two trains per day, and the Rockport Subdivision is 17.1 miles long with six trains per day. The Georgetown Industrial and the Salado Lead also have a similar percentage of crossings under passive control, although their lengths are 1.4 miles and 2.1 miles, respectively.

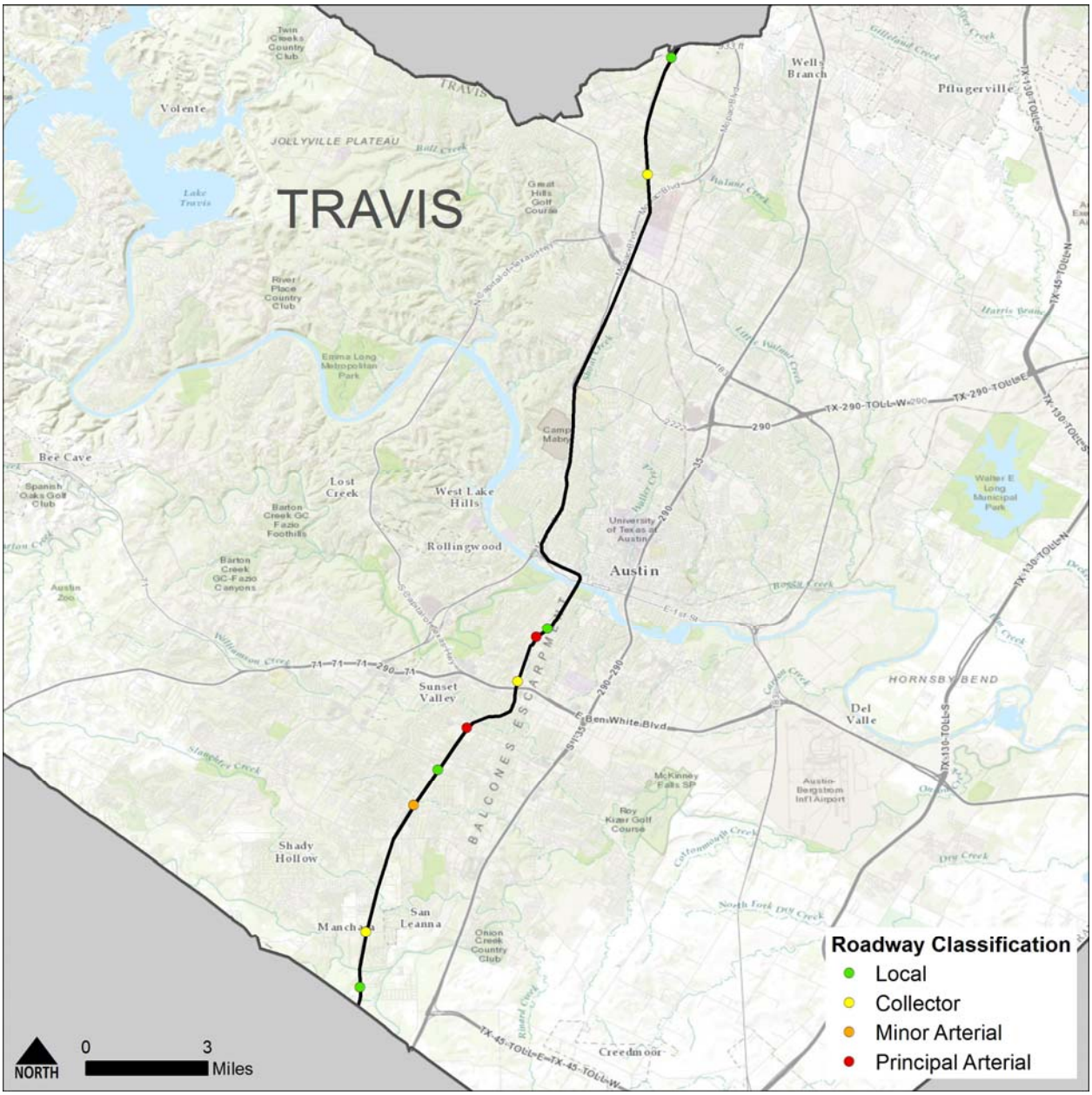
The percentage for passive crossings on the Austin Subdivisions in Comal County also approaches 25 percent. While the majority of the passive crossings are located along industry service tracks, there are a few passive crossings with mainline traffic.

Figure 4.1: Williamson County – Roadway Functional Classification at Crossings



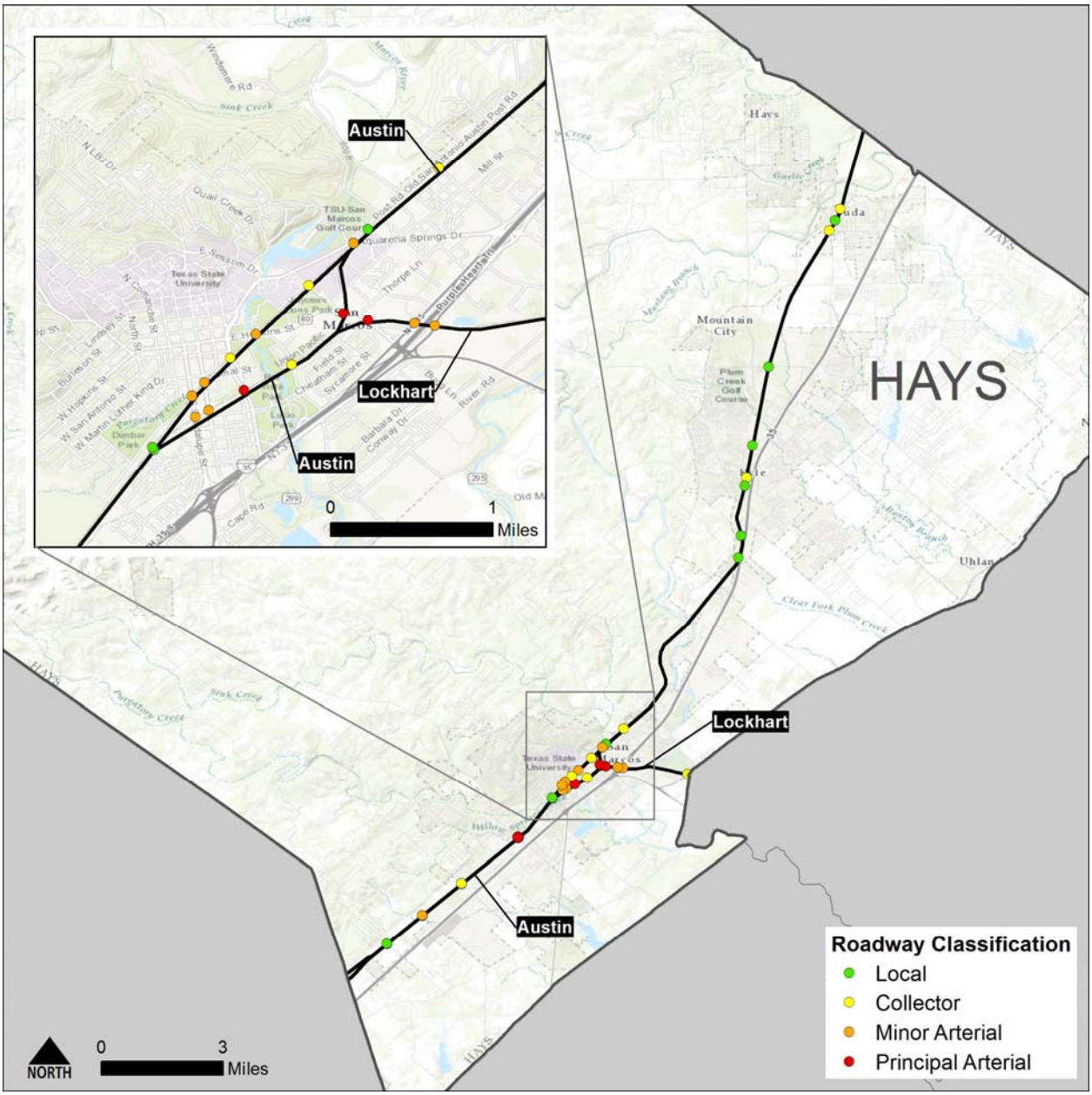
Source: TranSystems and TRIMS

Figure 4.2: Travis County – Roadway Functional Classification at Crossings



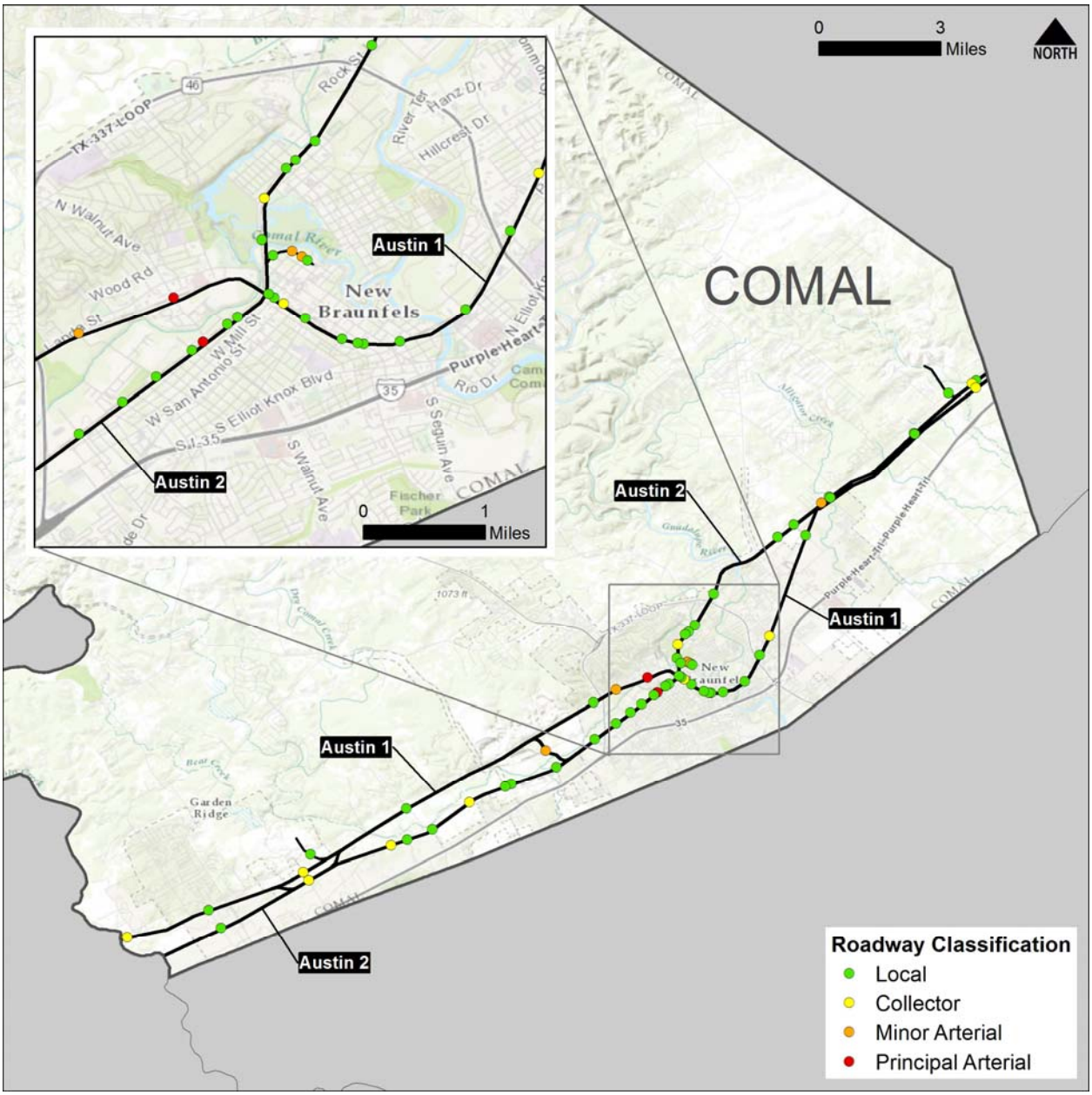
Source: TranSystems and TRIMS

Figure 4.3: Hays County – Roadway Functional Classification at Crossings



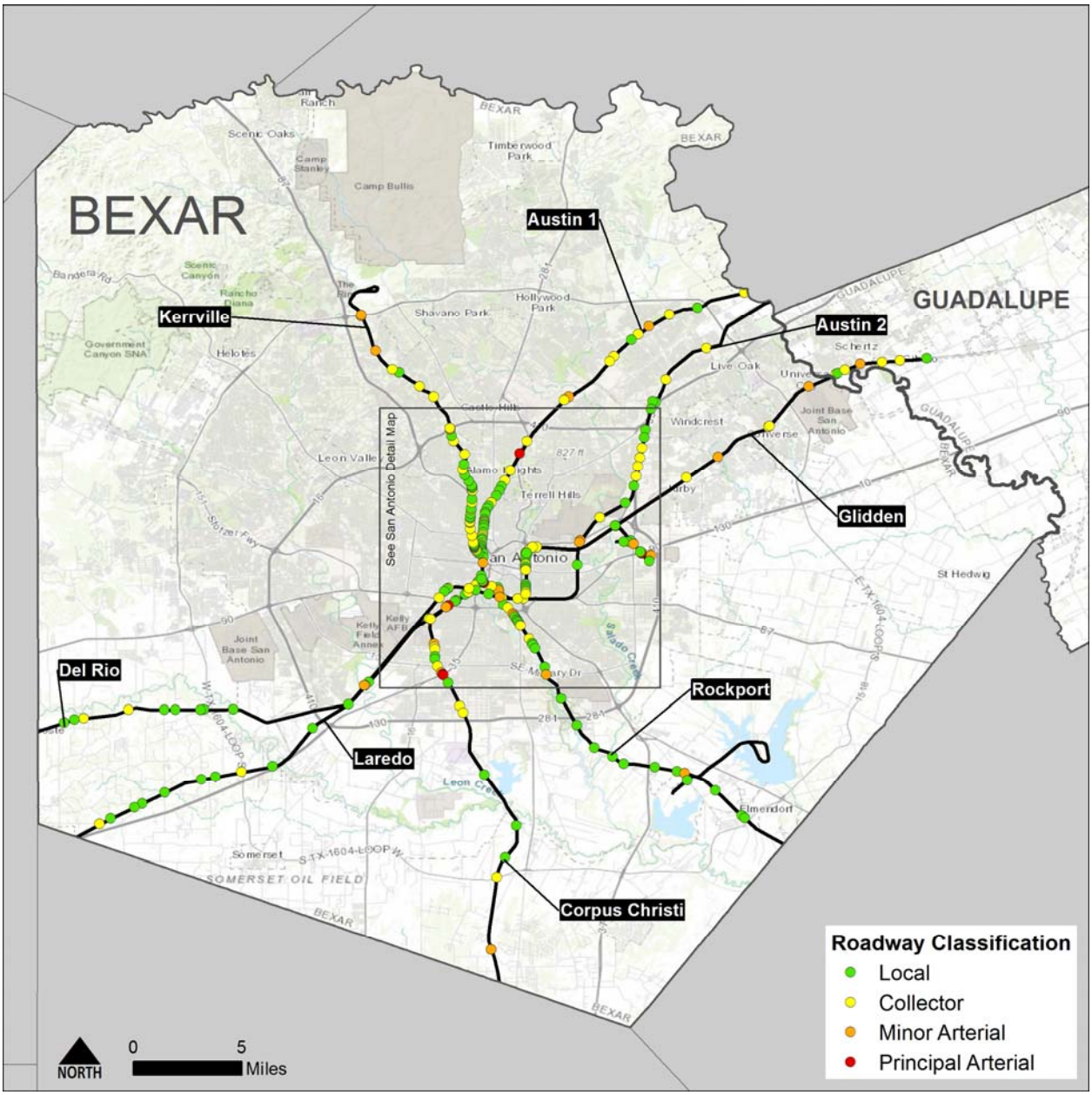
Source: TranSystems and TRIMS

Figure 4.4: Comal County – Roadway Functional Classification at Crossings



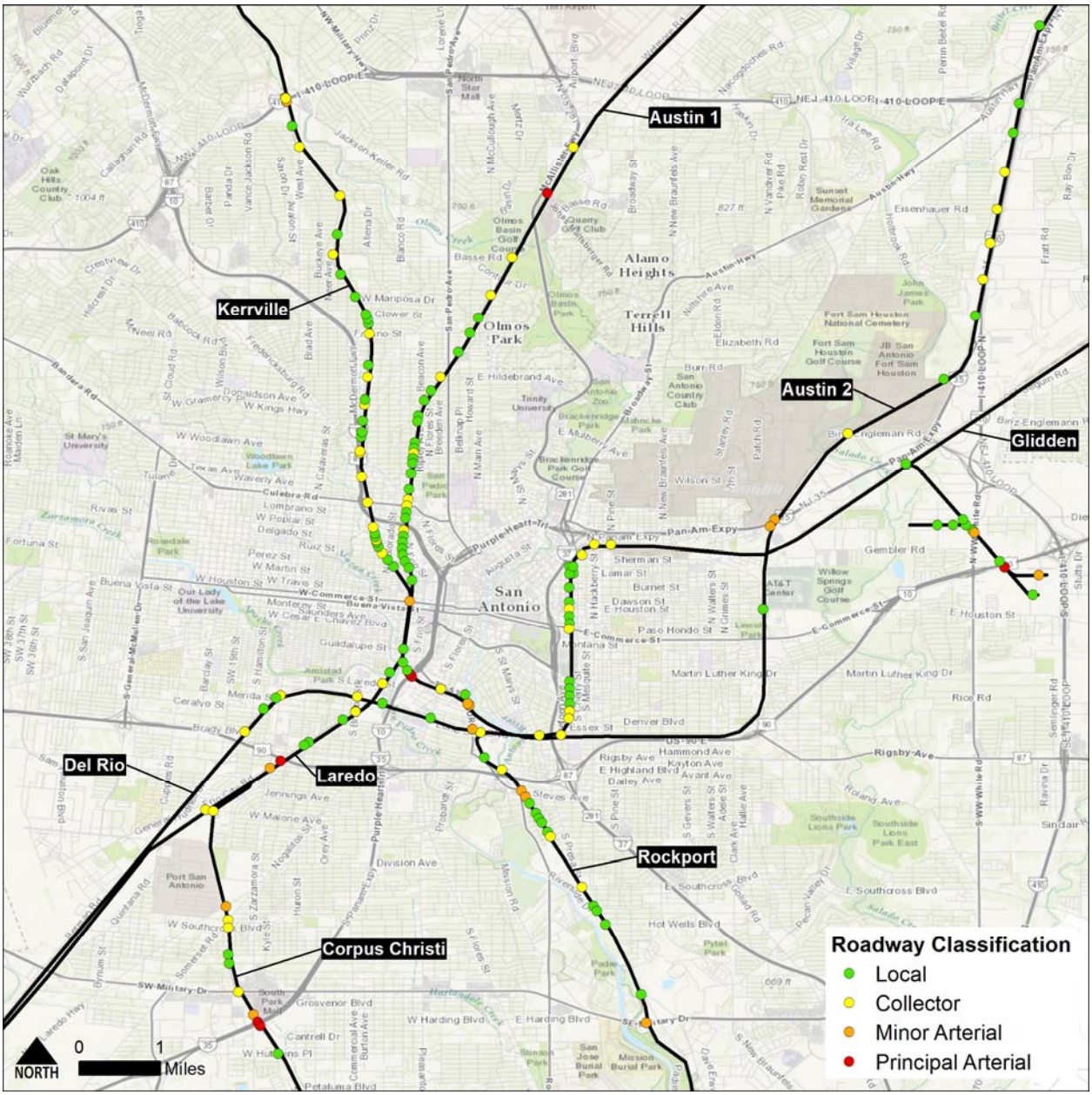
Source: TranSystems and TRIMS

Figure 4.5: Bexar County – Roadway Functional Classification at Crossings



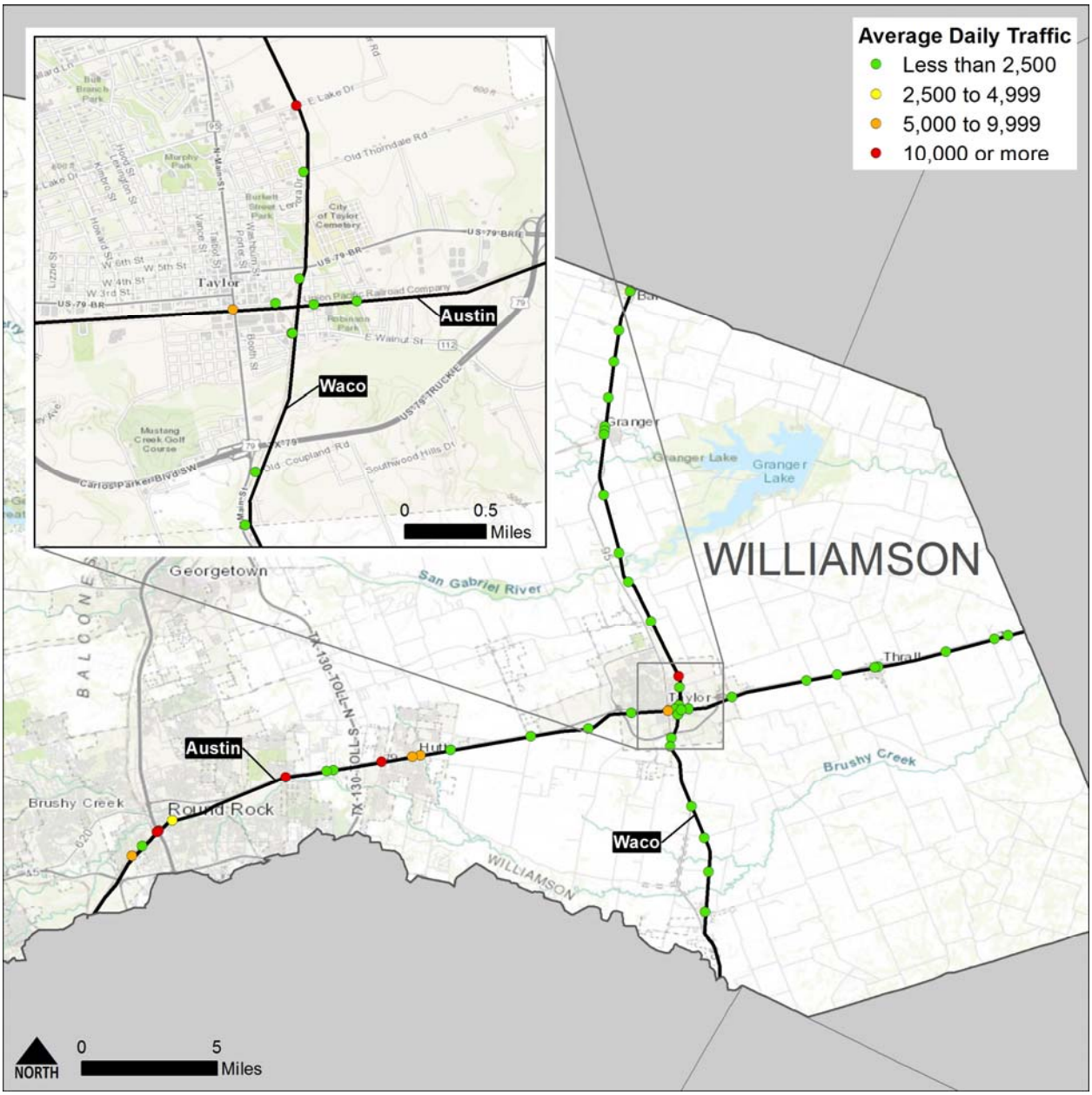
Source: TranSystems and TRIMS

Figure 4.5.1: San Antonio Detail - Roadway Functional Classification at Crossings



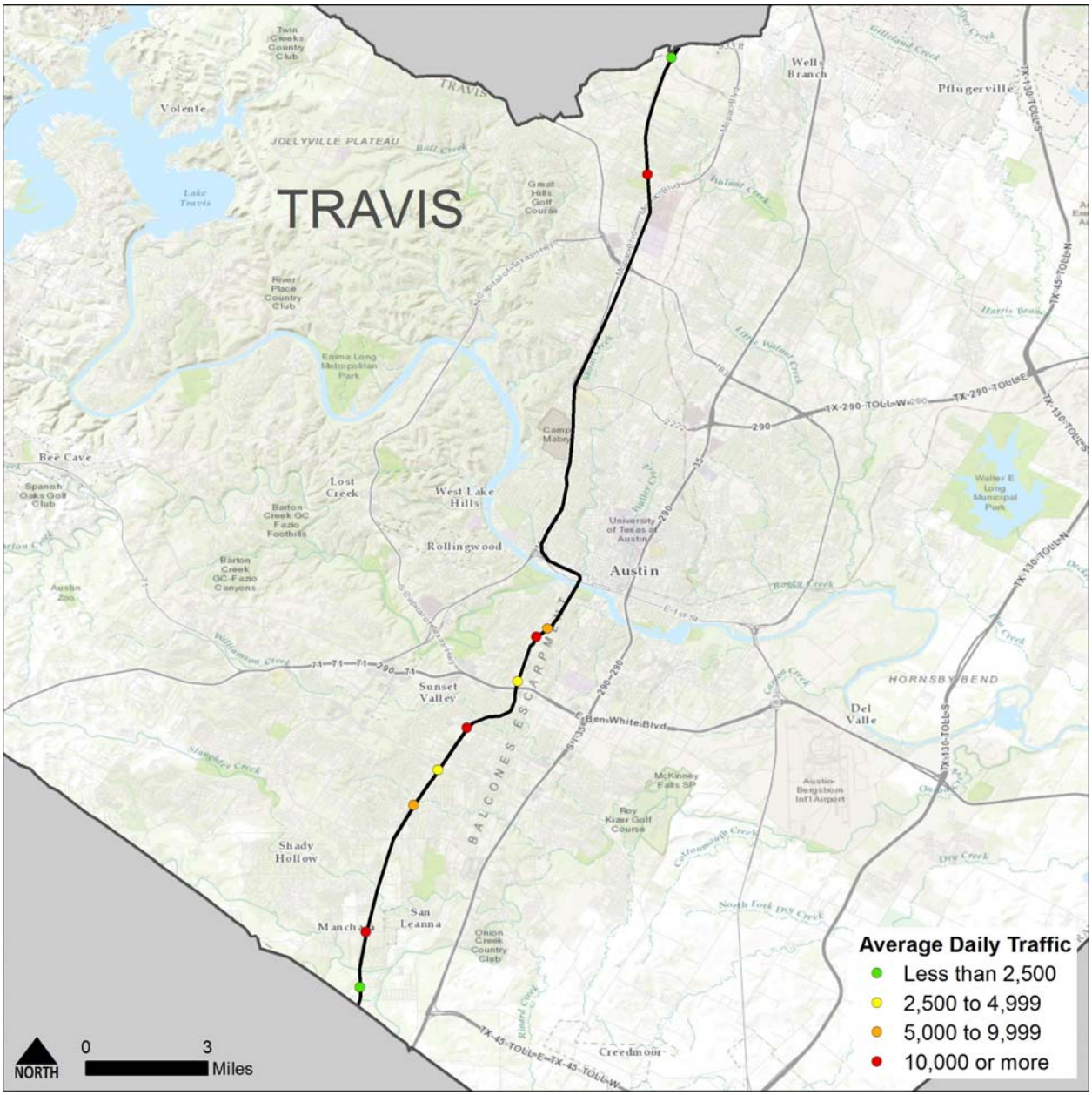
Source: TranSystems and TRIMS

Figure 5.1: Williamson County – Roadway Volume at Crossings



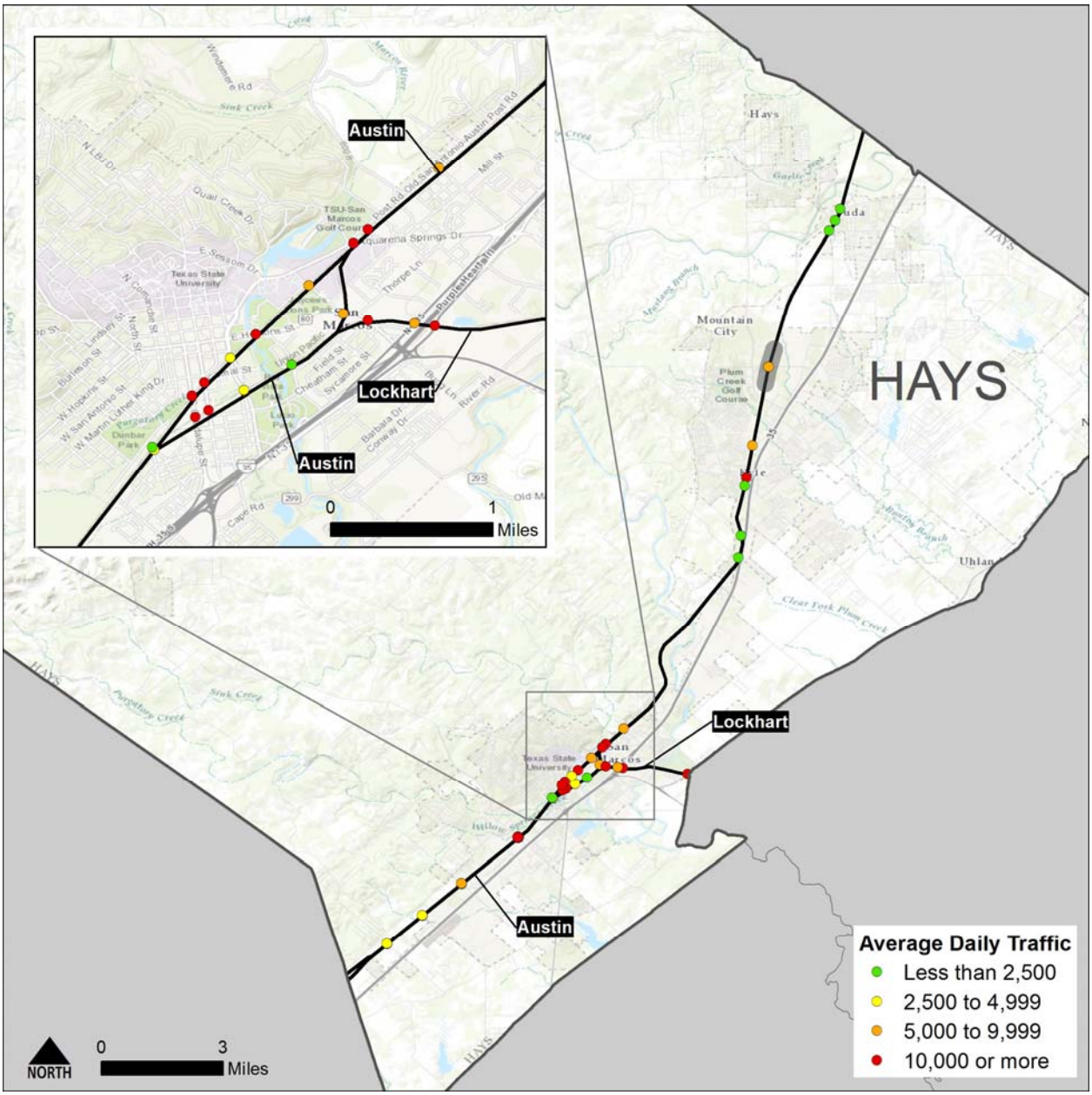
Source: TranSystems and TRIMS

Figure 5.2: Travis County – Roadway Volume at Crossings



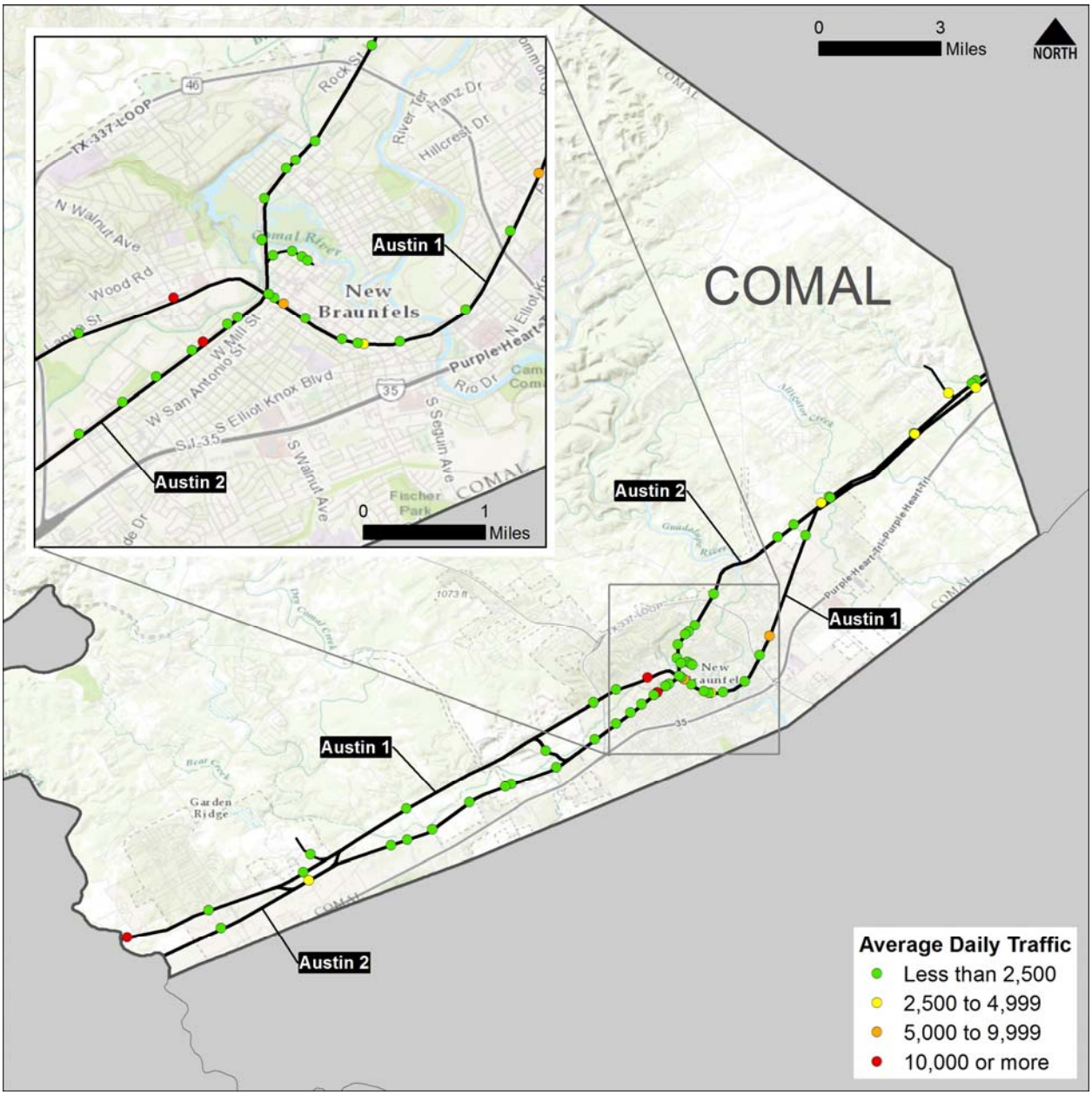
Source: TranSystems and TRIMS

Figure 5.3: Hays County – Roadway Volume at Crossings



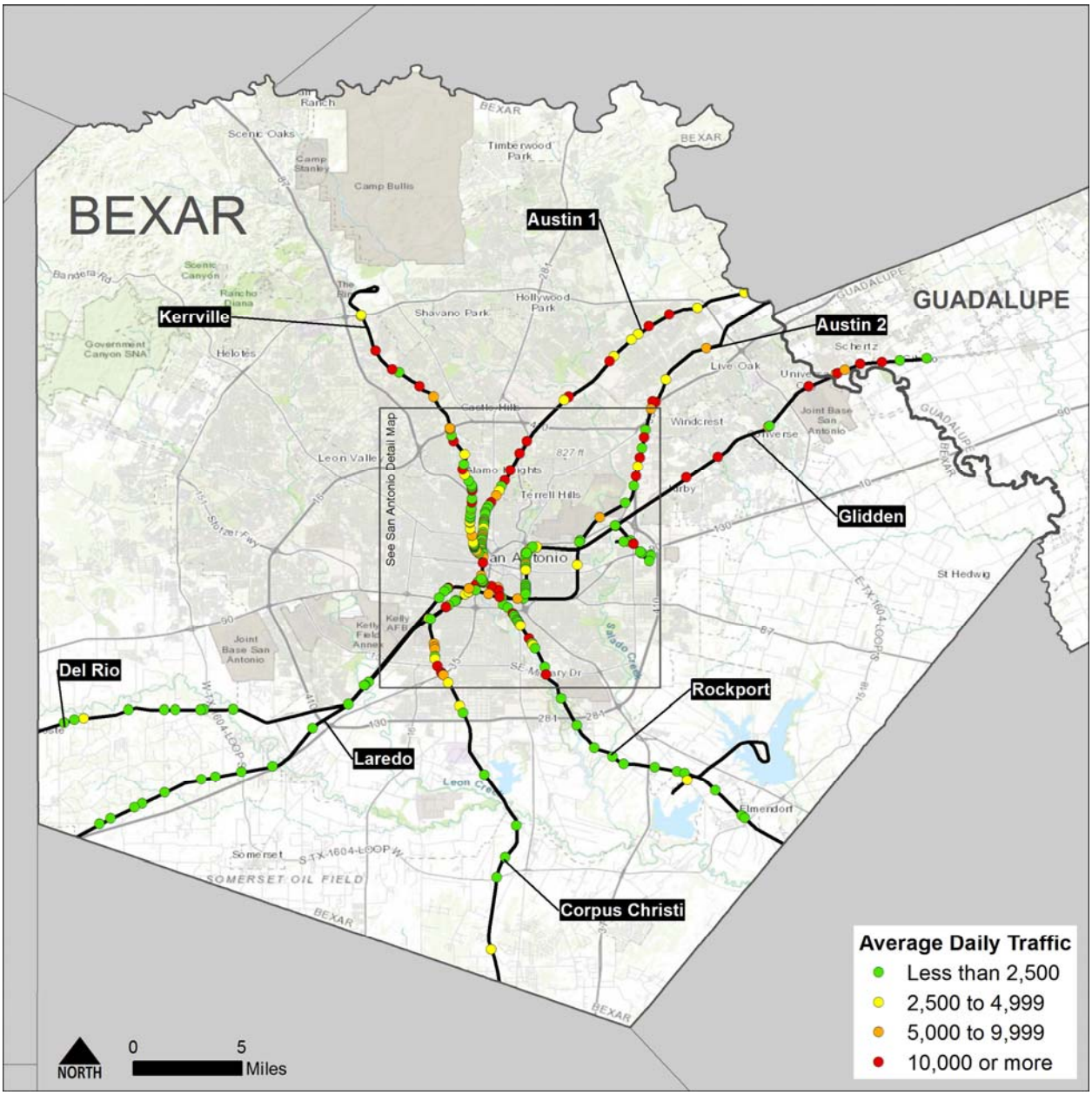
Source: TranSystems and TRIMS

Figure 5.4: Comal County – Roadway Volume at Crossings



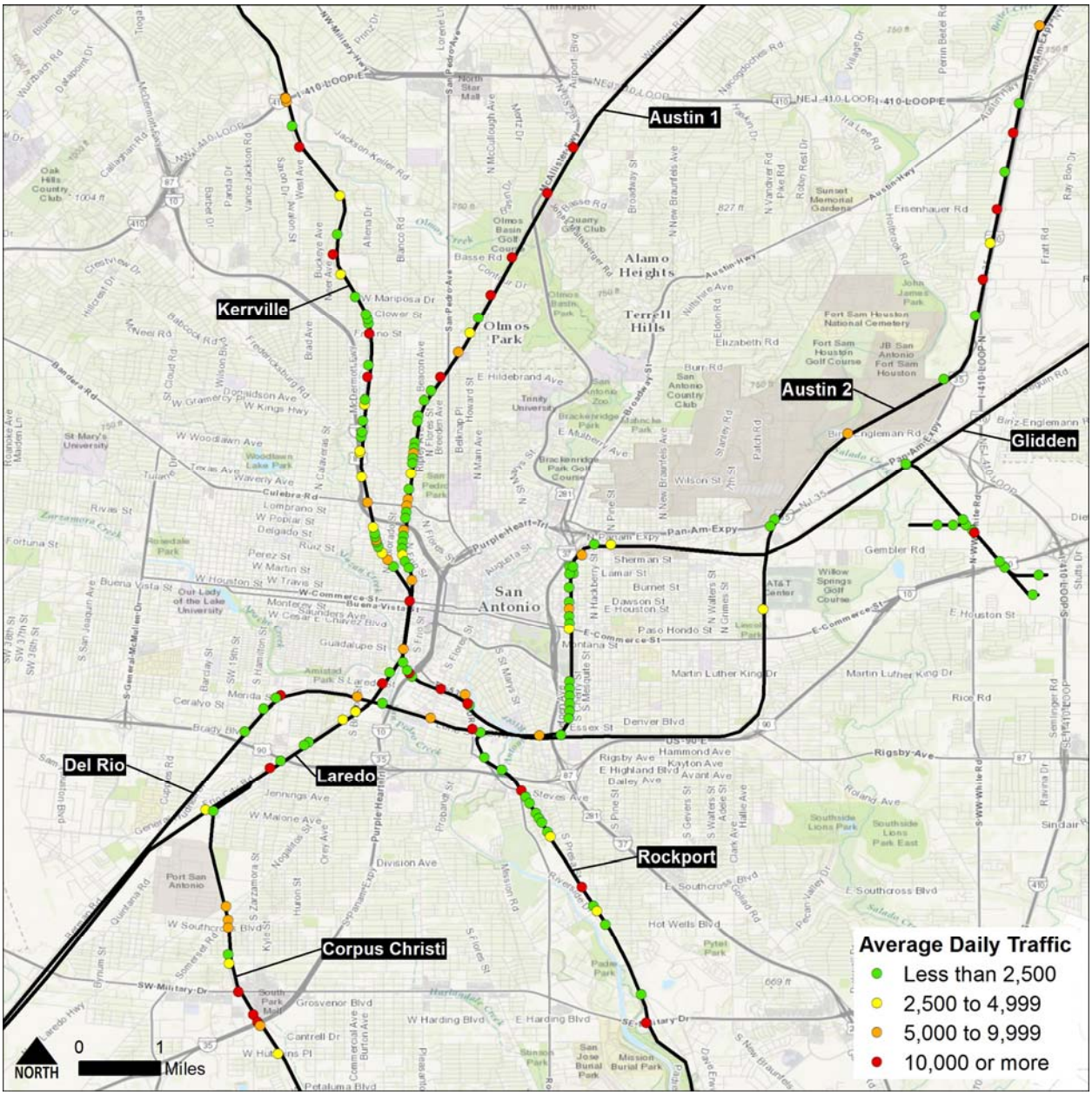
Source: TranSystems and TRIMS

Figure 5.5: Bexar County – Roadway Volume at Crossings



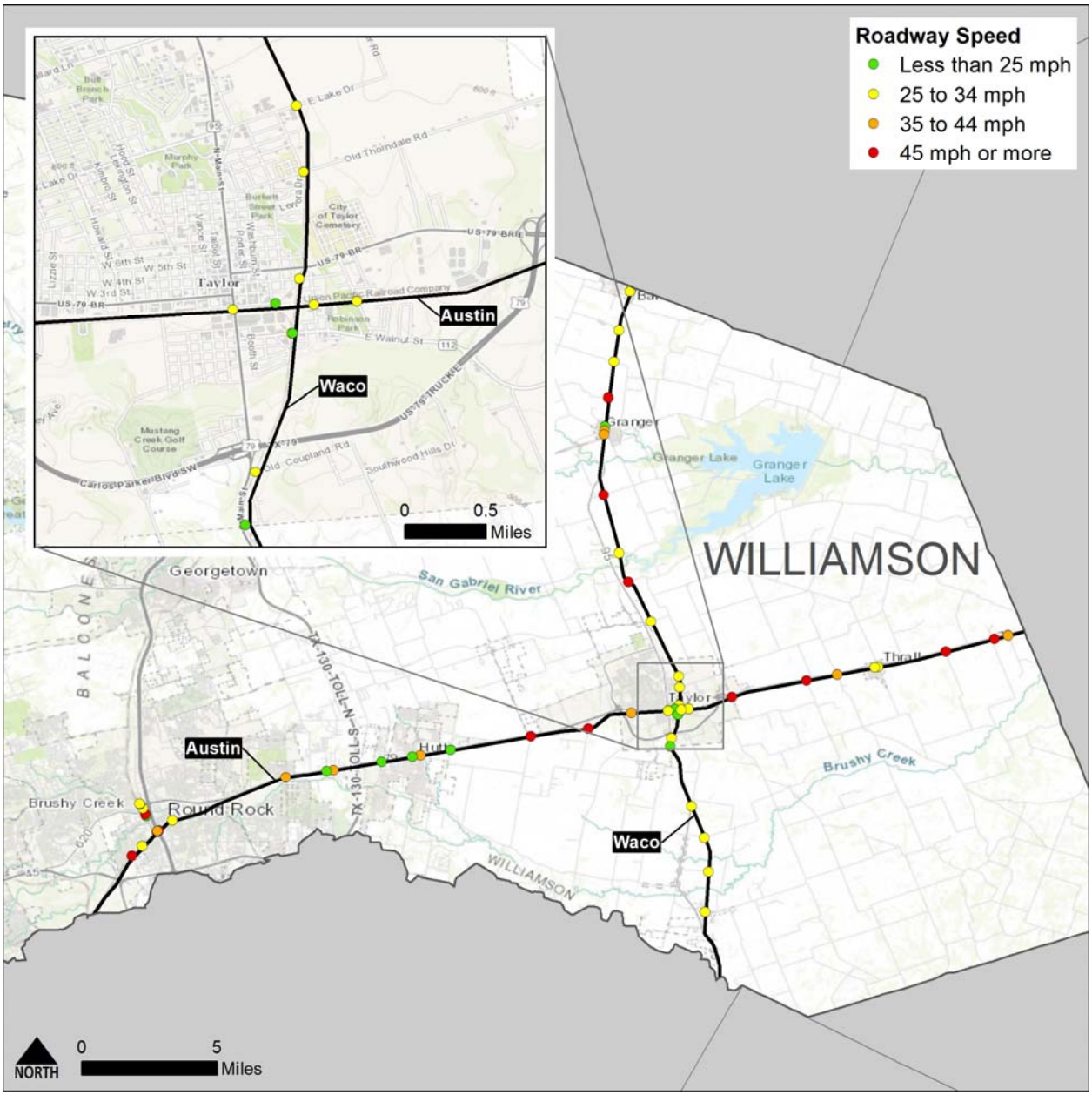
Source: TranSystems and TRIMS

Figure 5.5.1: San Antonio Detail – Roadway Volume at Crossings



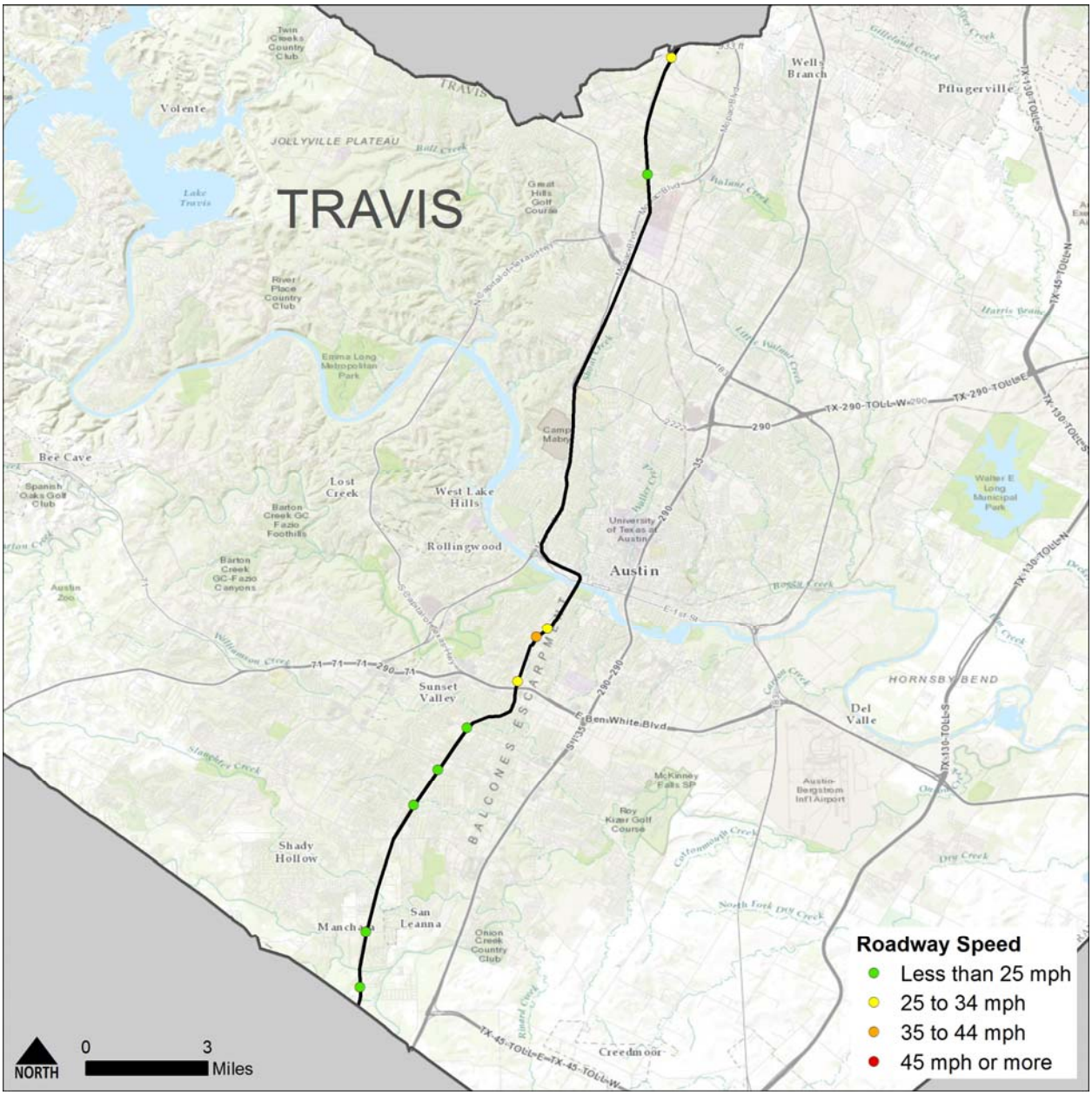
Source: TranSystems and TRIMS

Figure 6.1: Williamson County – Roadway Posted Speed at Crossings



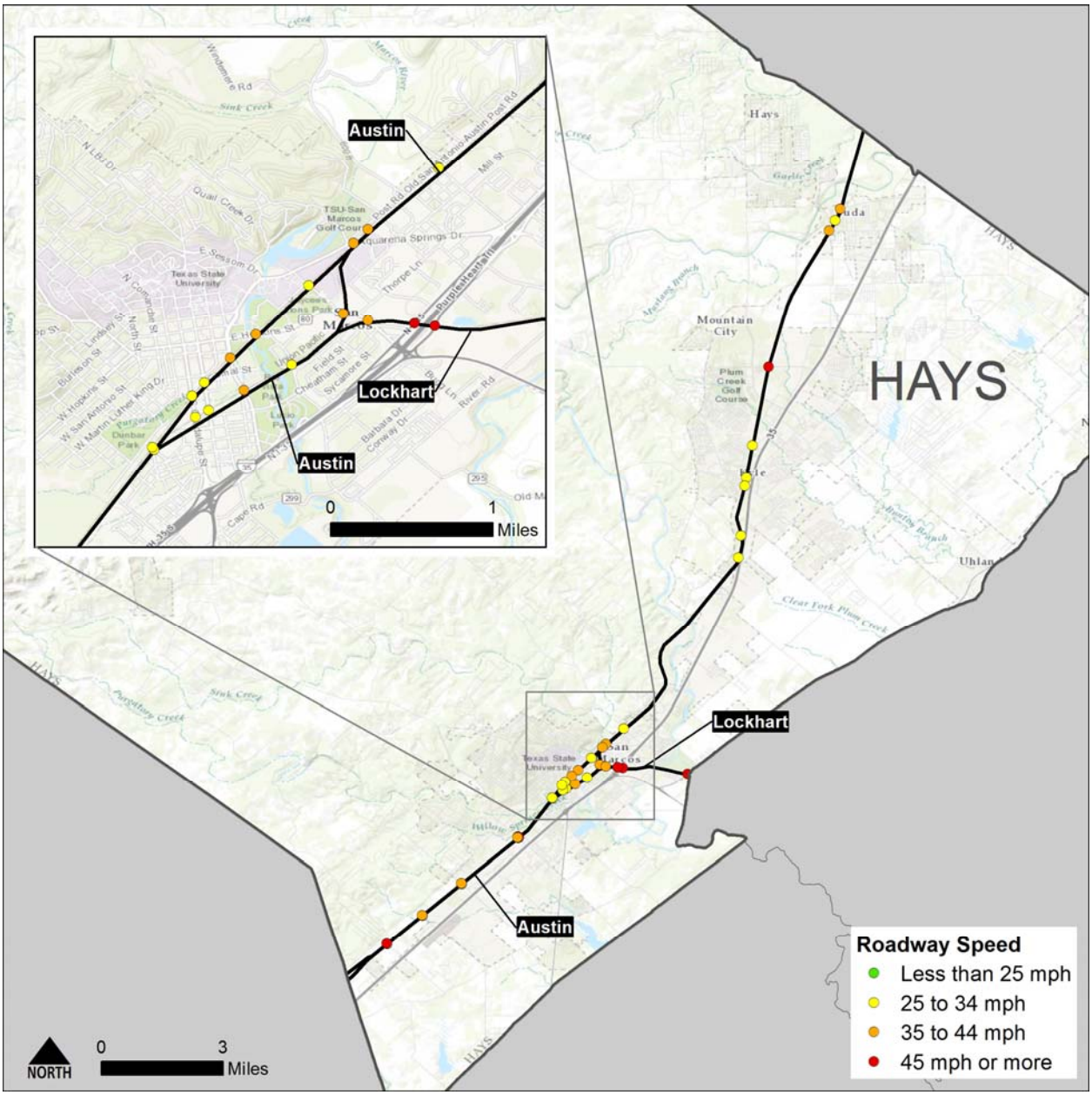
Source: TranSystems and TRIMS

Figure 6.2: Travis County – Roadway Posted Speed at Crossings



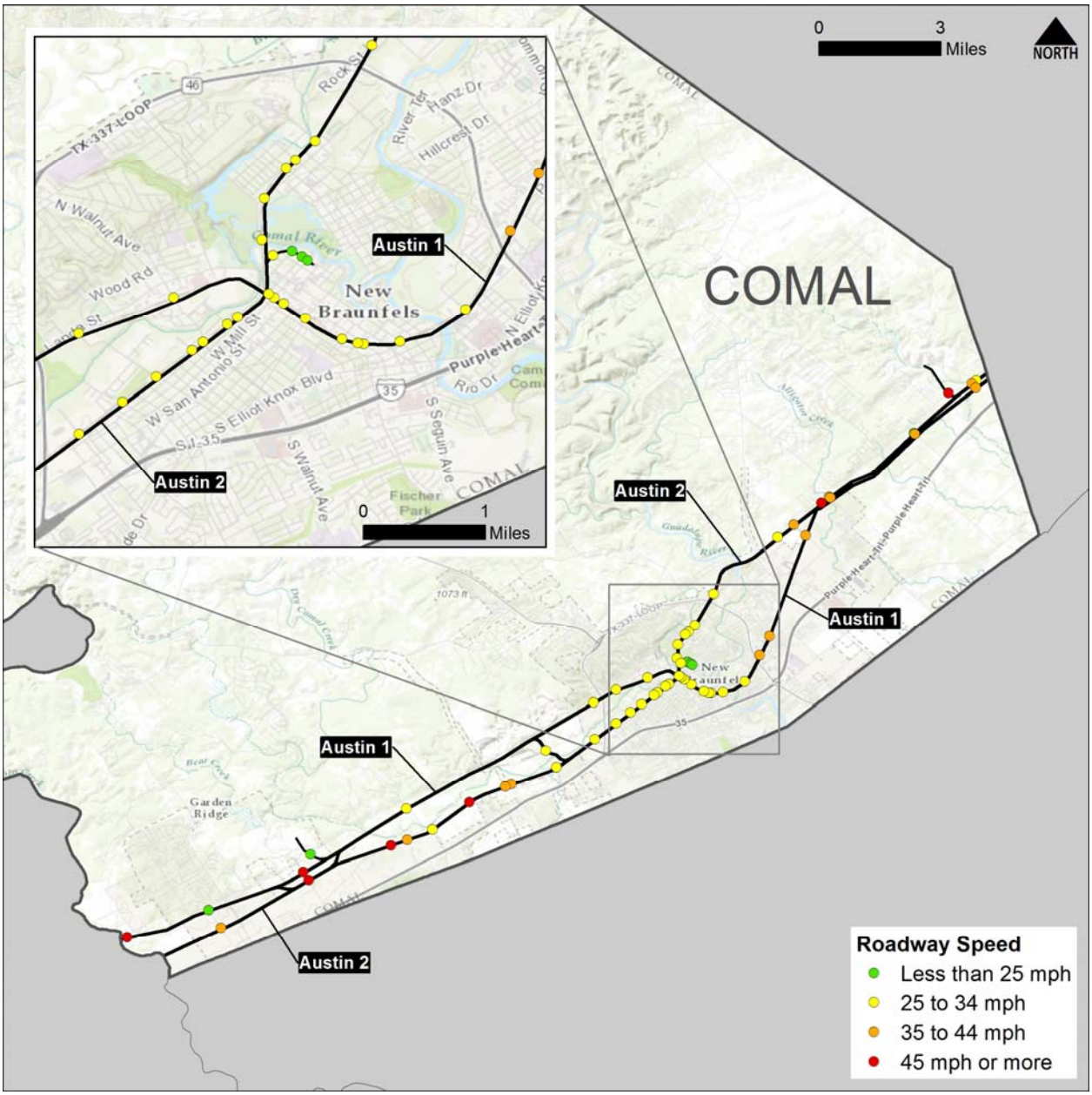
Source: TranSystems and TRIMS

Figure 6.3: Hays County – Roadway Posted Speed at Crossings



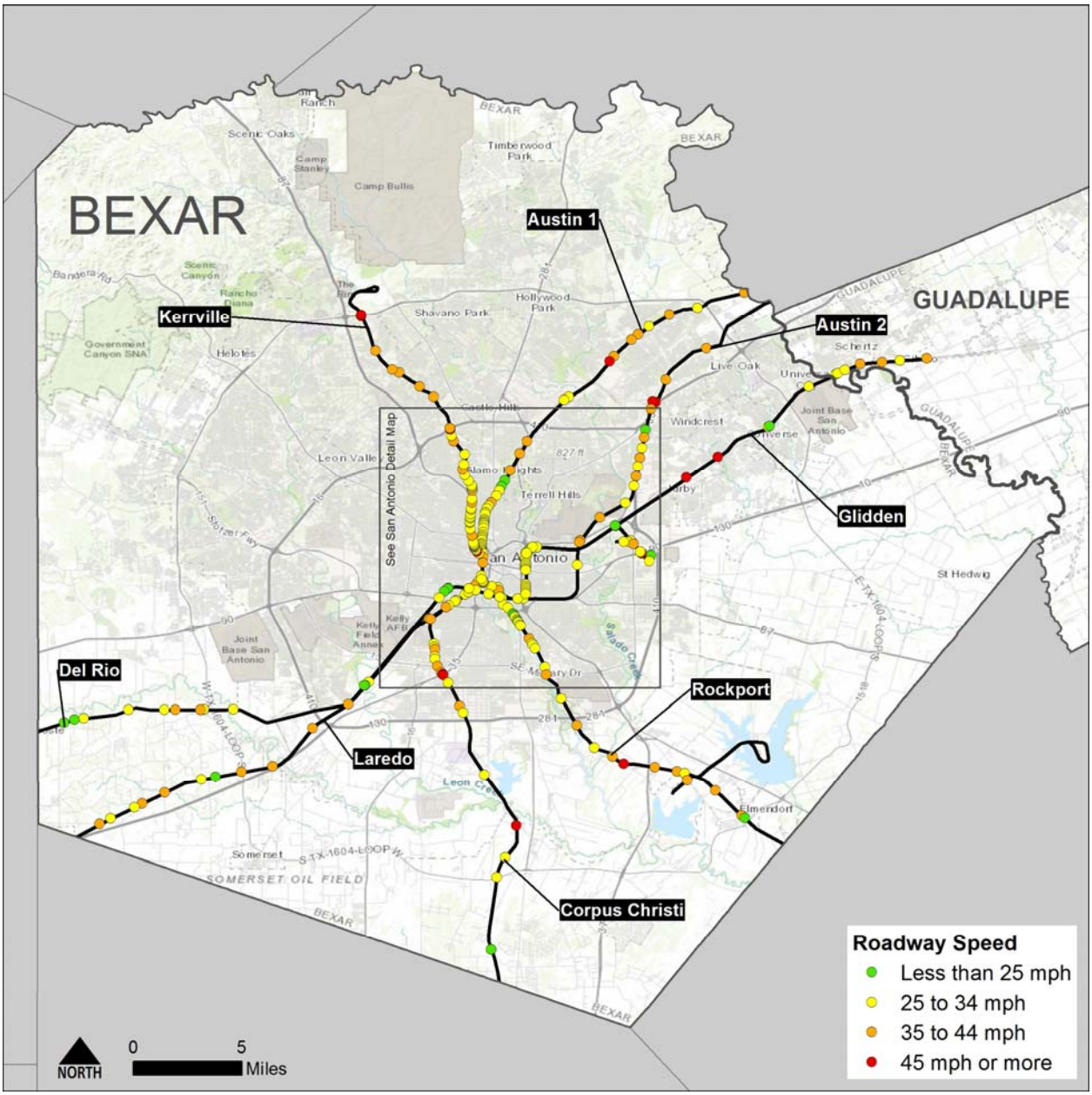
Source: TranSystems and TRIMS

Figure 6.4: Comal County – Roadway Posted Speed at Crossings



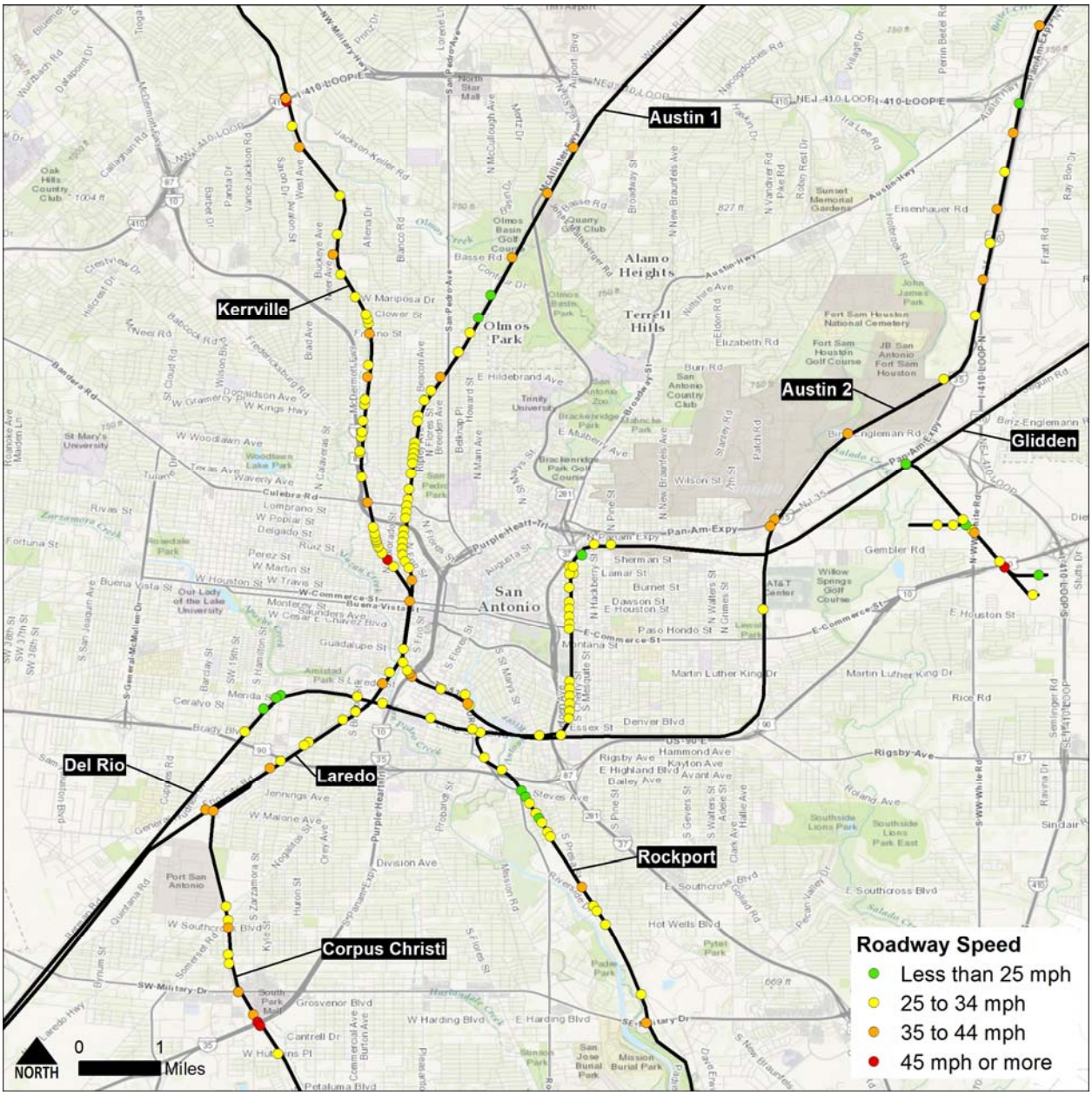
Source: TranSystems and TRIMS

Figure 6.5: Bexar County – Roadway Posted Speed at Crossings



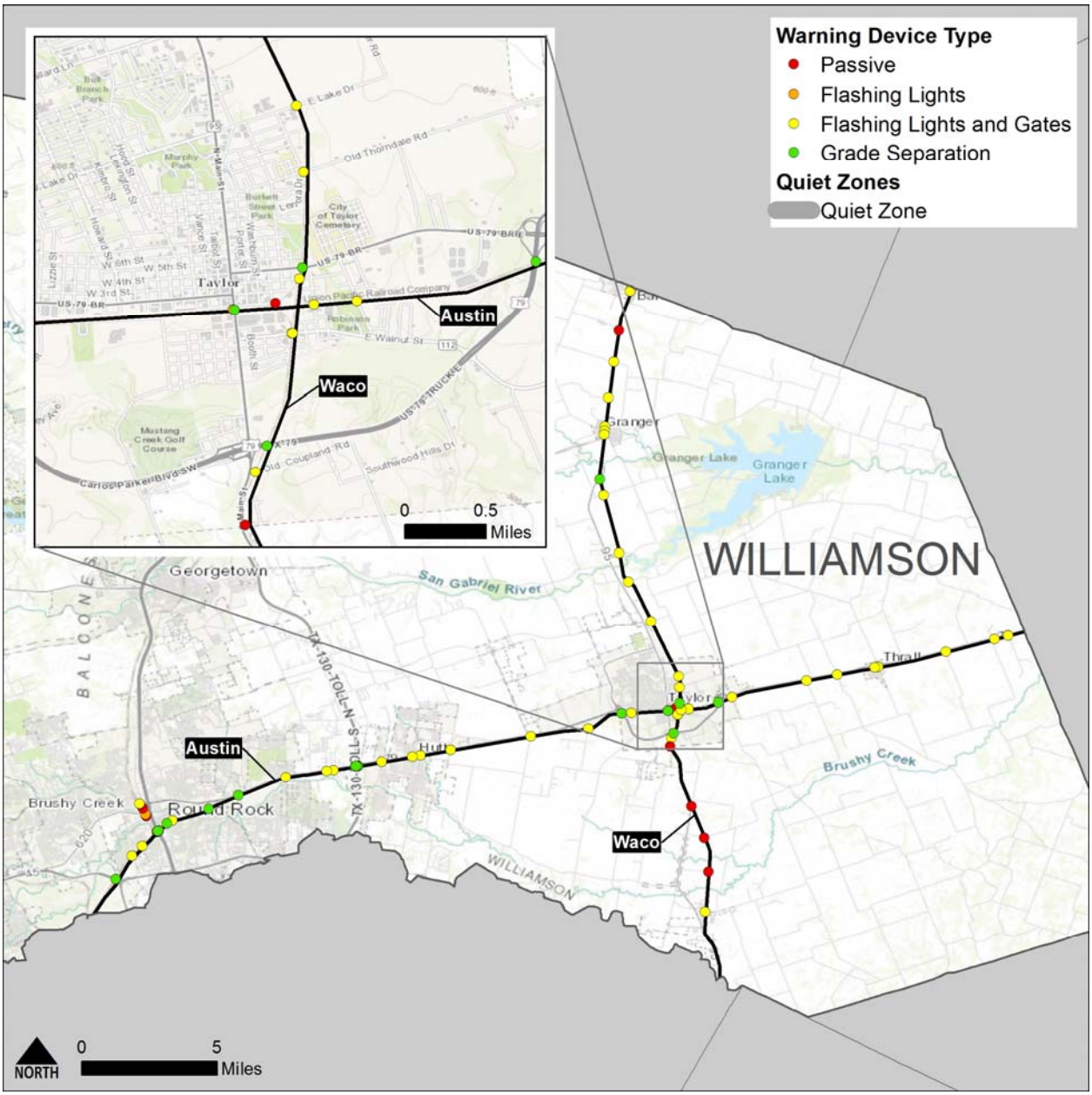
Source: TranSystems and TRIMS

Figure 6.5.1: San Antonio Detail - Roadway Posted Speed at Crossings



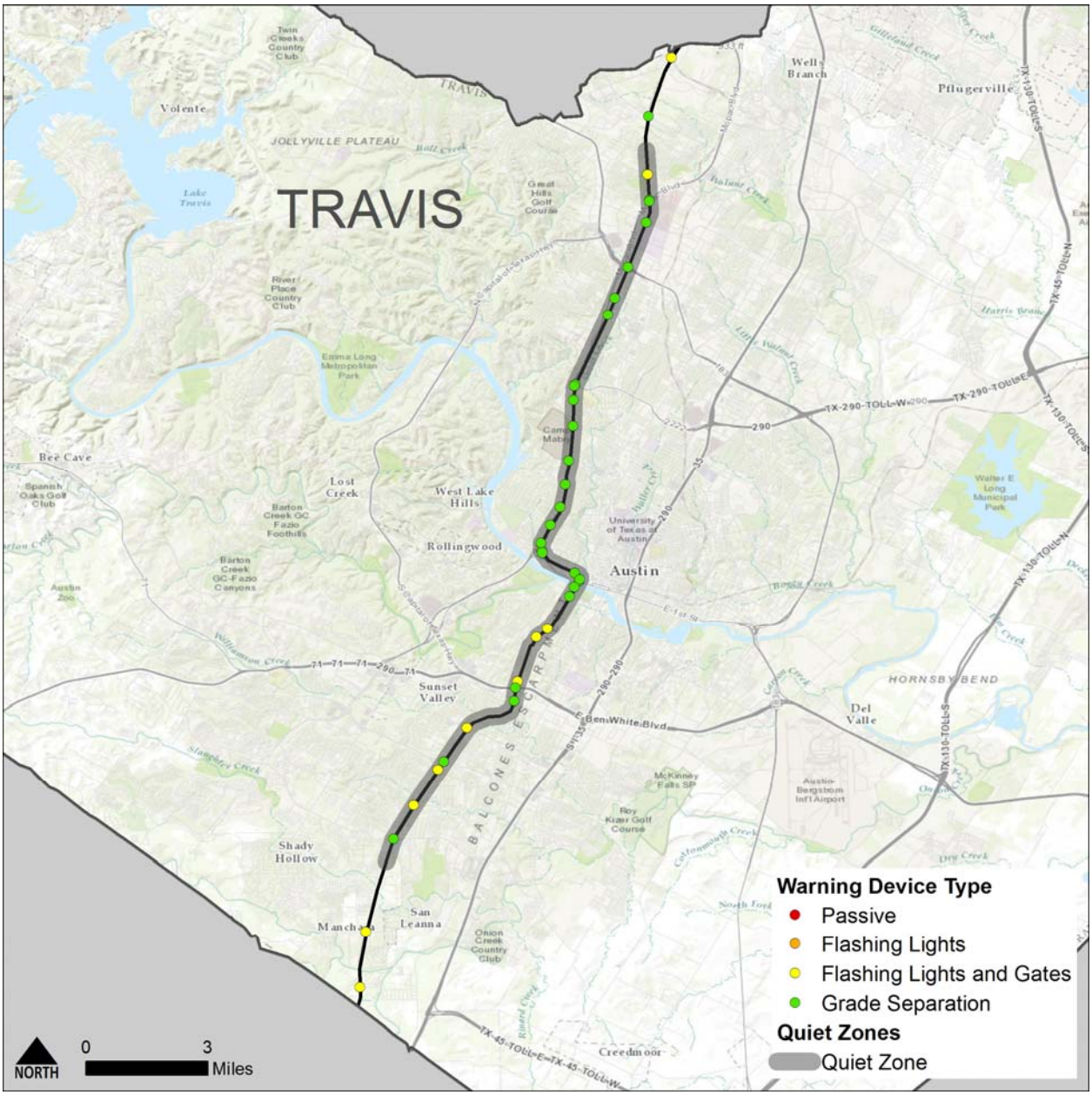
Source: TranSystems and TRIMS

Figure 7.1: Williamson County – Warning Device Type at Crossings



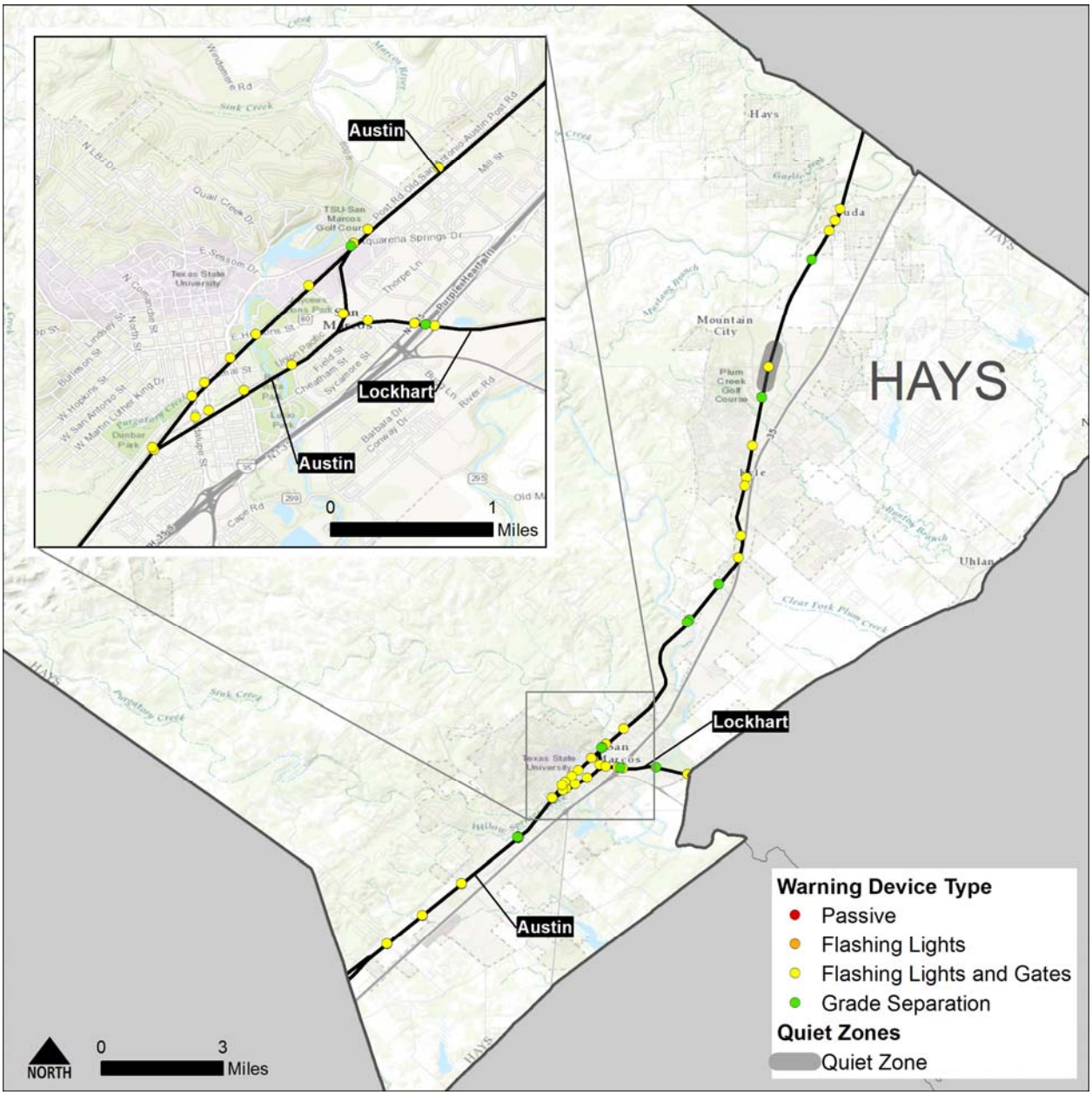
Source: TranSystems and TRIMS

Figure 7.2: Travis County – Warning Device Type at Crossings



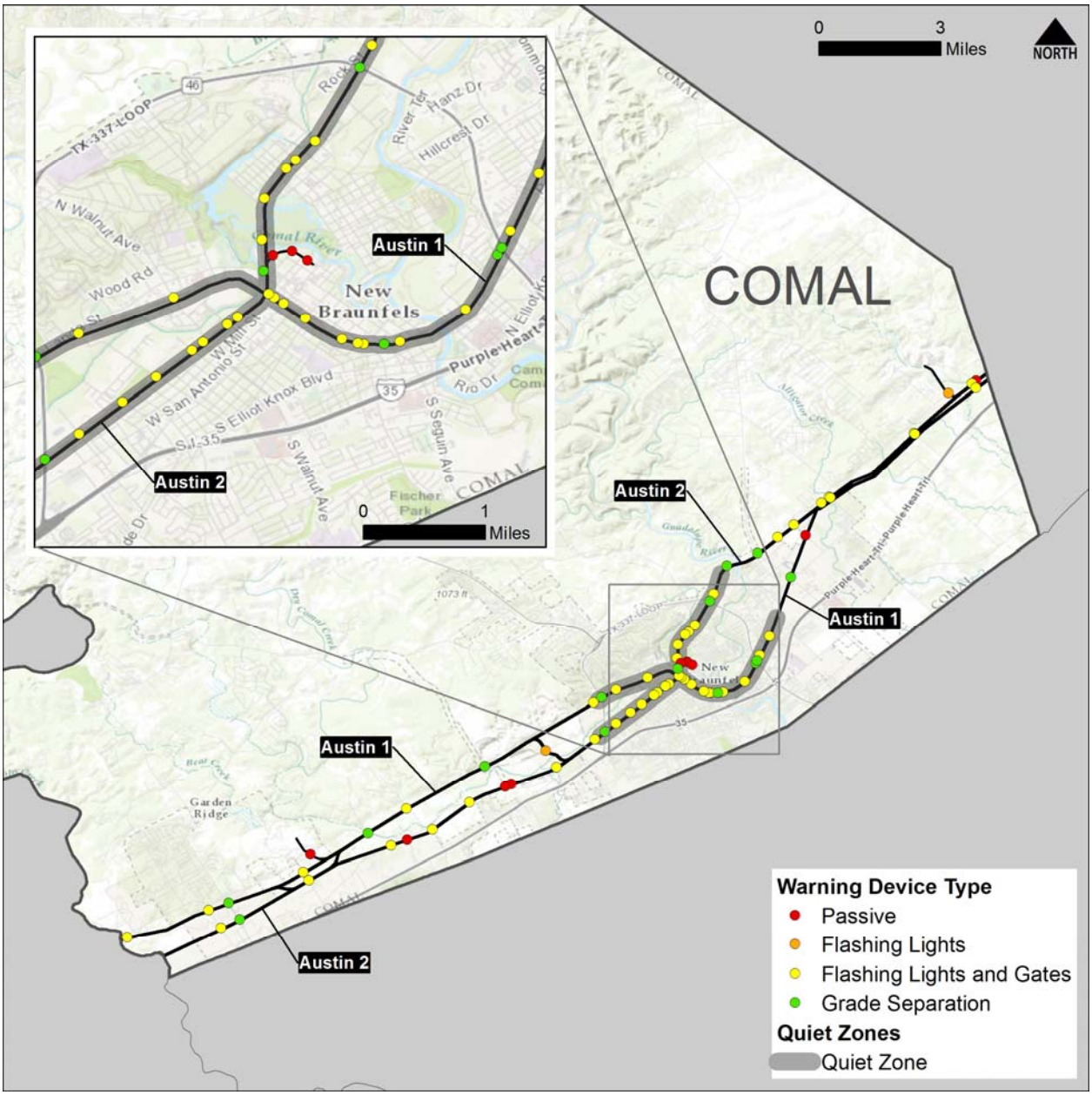
Source: TranSystems and TRIMS

Figure 7.3: Hays County – Warning Device Type at Crossings



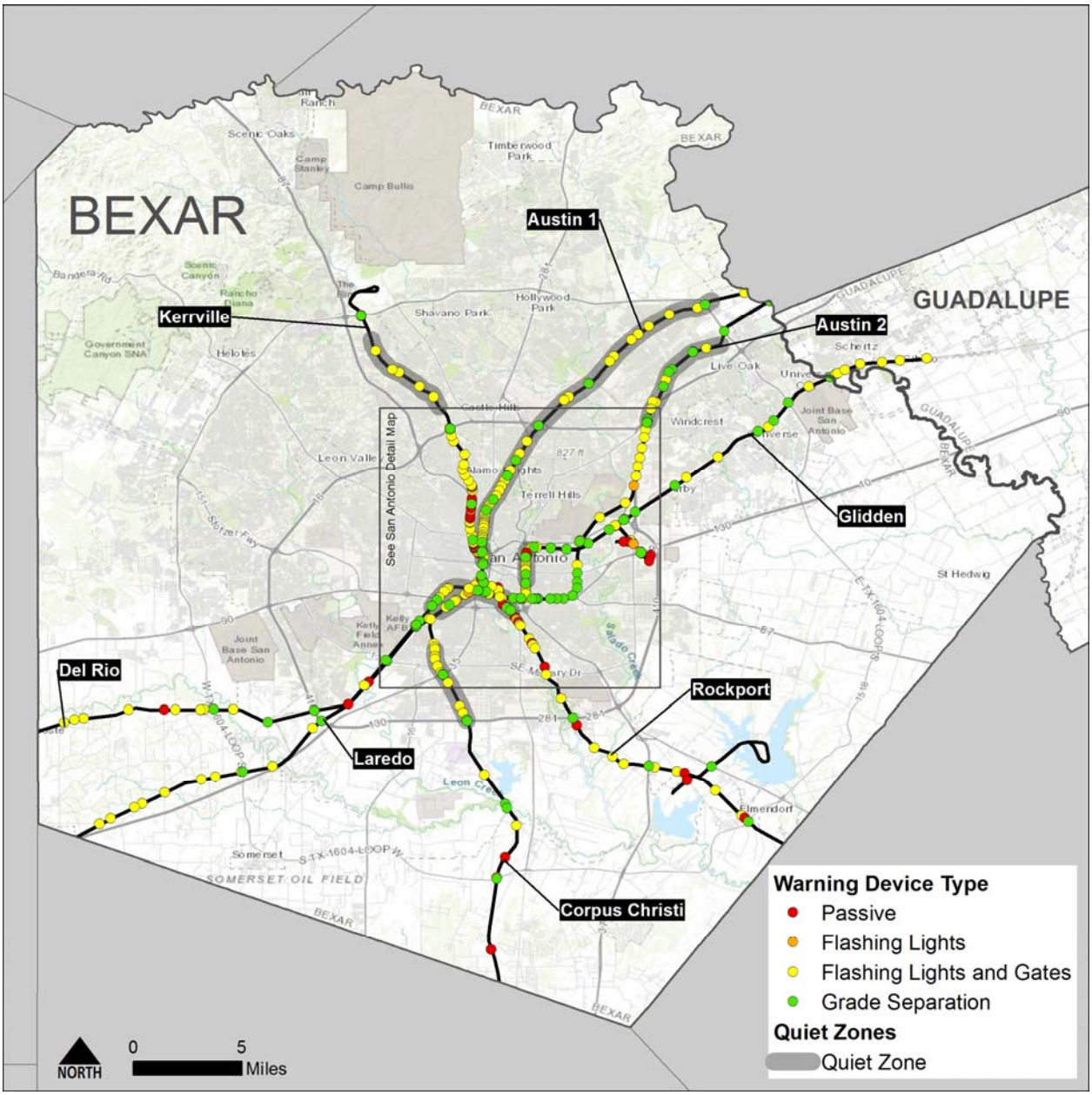
Source: TranSystems and TRIMS

Figure 7.4: Comal County – Warning Device Type at Crossings



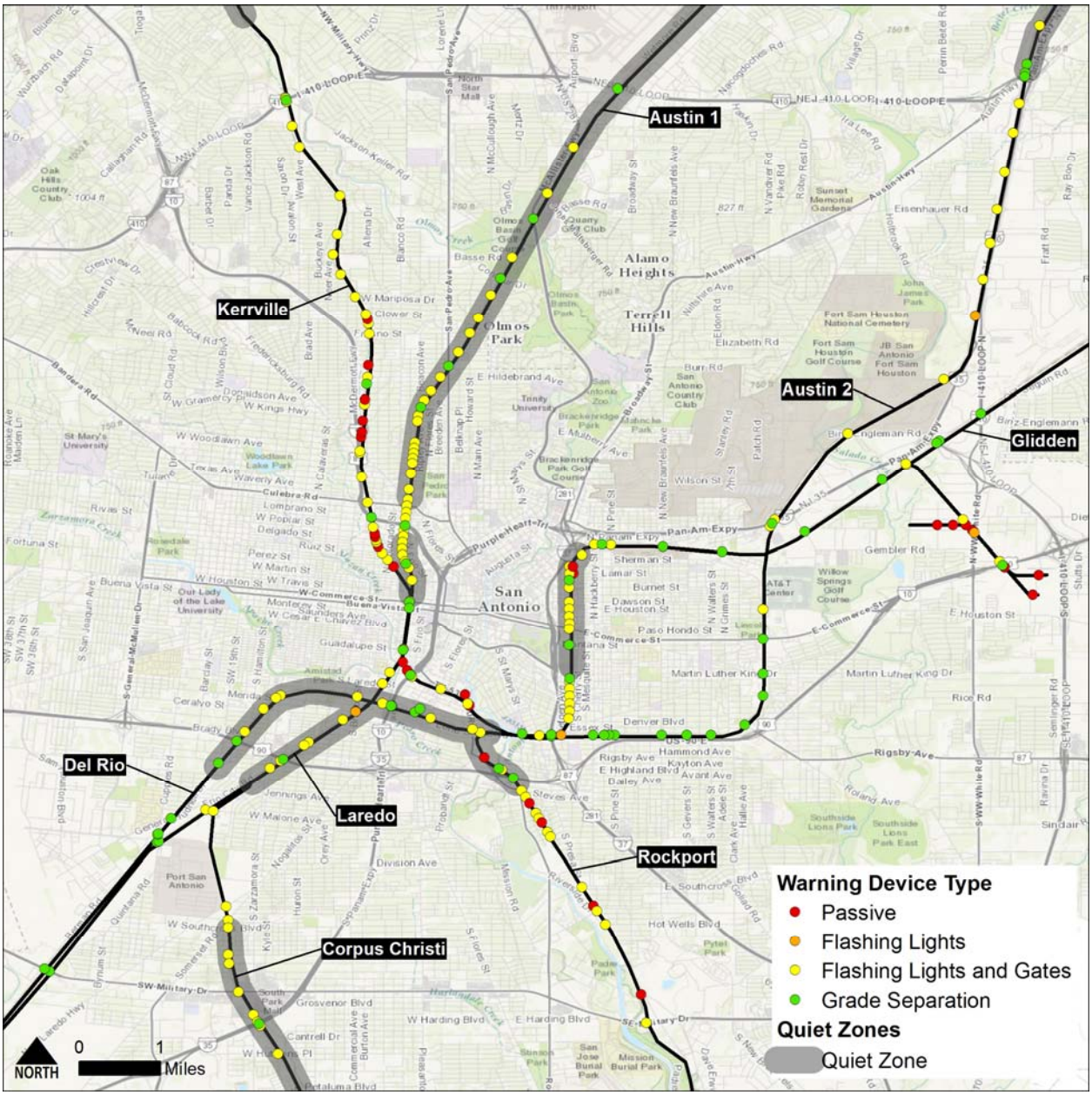
Source: TranSystems and TRIMS

Figure 7.5: Bexar County – Warning Device Type at Crossings



Source: TranSystems and TRIMS

Figure 7.5.1: San Antonio Detail - Warning Device Type at Crossings



Source: TranSystems and TRIMS

Table 5 – Warning Device Type by Railroad Subdivision

County	Subdivision	Gates	Flashing Lights	Passive Signs
Williamson	Austin	24	1	0
	Waco	18	0	6
	Georgetown Industrial	3	2	3
Travis	Austin	10	0	0
	Waco	0	0	1
Hays	Austin	23	0	0
	Austin Track 2	11	0	0
	Lockhart	4	0	0
Comal	Austin	21	1	6
	Austin Track 2	26	0	4
Gualalupe	Glidden	7	0	0
Bexar	Austin	44	1	0
	Austin Track 2	17	2	0
	Glidden	4	0	0
	Rockport	20	0	9
	Corpus Christi	15	1	2
	Laredo	18	1	2
	Del Rio	35	0	3
	Kerrville	35	0	14
	Salado Lead	3	1	7
TOTAL		**338**	**10**	**57**

Source: TranSystems and TRIMS

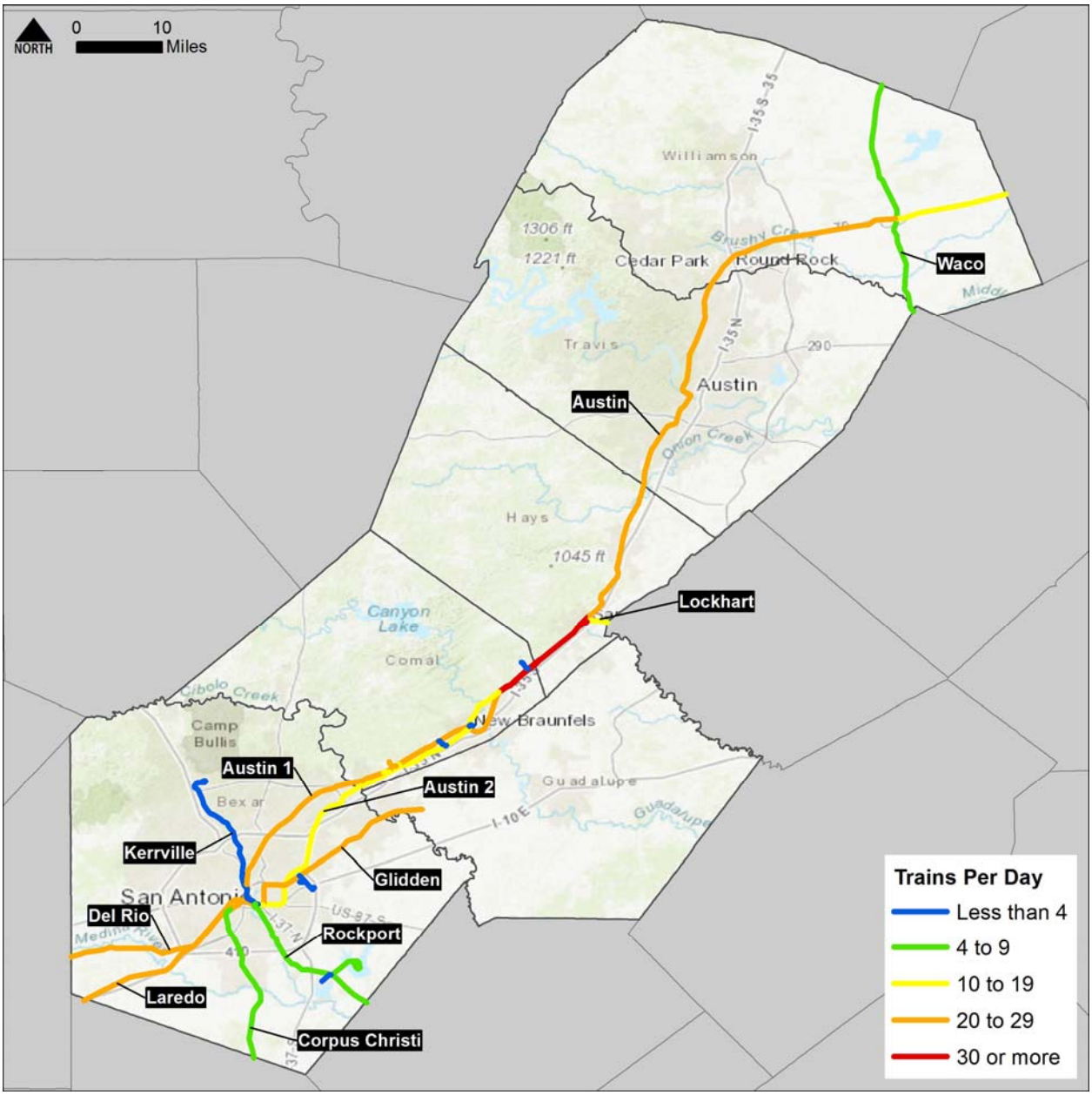
Operational Conditions

Train volume is based upon Federal Railroad Administration (FRA) inventory records. A majority of the railroad corridors under evaluation have 20 or more trains per day, as displayed in Figure 8. This includes the majority of the Austin Subdivision, as well as the Glidden, Del Rio, and Laredo Subdivisions. The segment of the Austin Subdivision north of Taylor has 16 trains per day while the Austin Track 2 in Comal and Bexar Counties has 18 trains per day, and the Lockhart Subdivision has 12 trains per day. The Waco Subdivision, as well as the Rockport, Corpus Christi, and Kerrville Subdivisions, have six or fewer trains per day. The segment north of New Braunfels through San Marcos where the Austin Mainline and Track 2 are close together is displayed as a combined volume of 40 trains per day.

The maximum speed of the train is represented in Figure 9. The majority of the railroad corridors under evaluation operate at 40 mph or more. Speeds typically decrease in the developed urban areas of Taylor, Austin, San Marcos, New Braunfels, and San Antonio. Significant portions of the Rockport and Corpus Christi Subdivisions operate at less than 30 mph, as does the entire length of the Kerrville Subdivision. Maximum train speeds by railroad subdivision are summarized in Table 6.

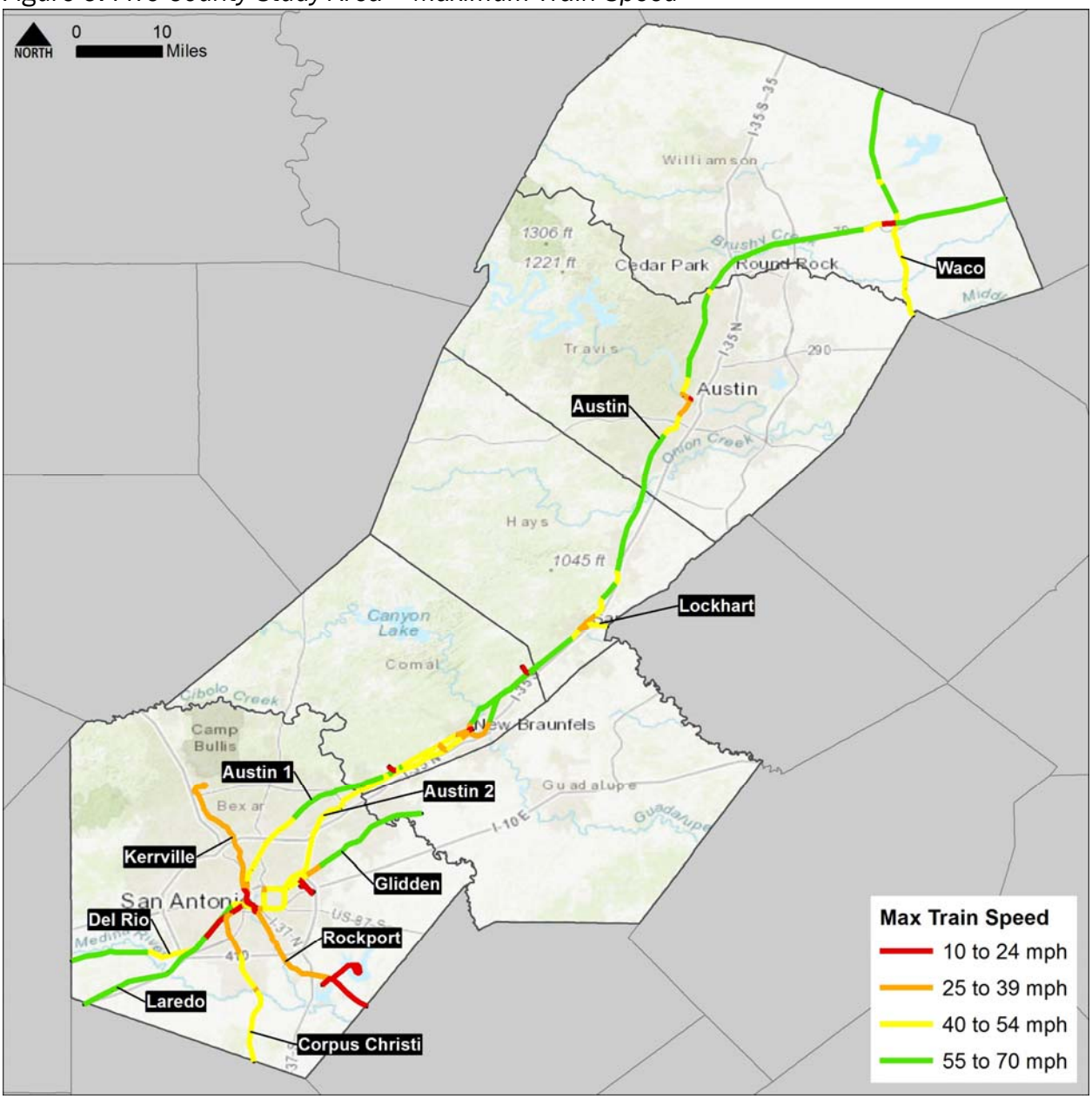
Crashes within the last five years are represented by raw numbers in Figure 10. Table 7 outlines the raw data by county for each of the last five years. The I-35 Southbound Frontage Road on the Corpus Christi Subdivision in Bexar County experienced the most crashes in the study area with six crashes over the five-year period. Other high crash locations in the study area include W Martin Street in San Antonio on the Austin Subdivision, the S Flores Street crossing on the Del Rio Subdivision in San Antonio, and the Castell Street crossing on the Austin Subdivision in New Braunfels.

Figure 8: Five-County Study Area – Daily Train Volumes



Source: TranSystems and TRIMS

Figure 9: Five-County Study Area – Maximum Train Speed



Source: TranSystems and TRIMS

Table 6: Maximum Train Speeds by Length by Railroad Subdivision

County	Subdivision	Less than 25 mph	25 to 39 mph	40 to 54 mph	More than 55 mph
Williamson	Austin	1.4	0	0	29.5
	Waco	0	0	12.5	10.7
	Georgetown Industrial				
Travis	Austin	0.4	3.1	5.3	19.3
	Waco	0	0	0	1.0
Hays	Austin	0	3.6	5.0	22.7
	Lockhart	0	0.7	0	0
Comal	Austin	0	5.7	7.2	11.9
	Austin Track 2	2.5	2.2	15.7	4.4
Guadalupe	Glidden	0	0	0	4.1
Bexar	Austin	0	3.0	11.2	7.2
	Austin Track 2	0	0.4	16.1	8.6
	Glidden	0	0	0	0
	Rockport	5.7	11.7	0	0
	Corpus Christi	0	5.7	13.0	0
	Laredo	5.3	0	0	15.2
	Del Rio	0	2.3	16.4	13.1
	Kerrville	3.1	15.6	0	0
	Salado Lead	10.1	0	0	0
TOTAL		**24.2**	**38.7**	**56.7**	**48.1**

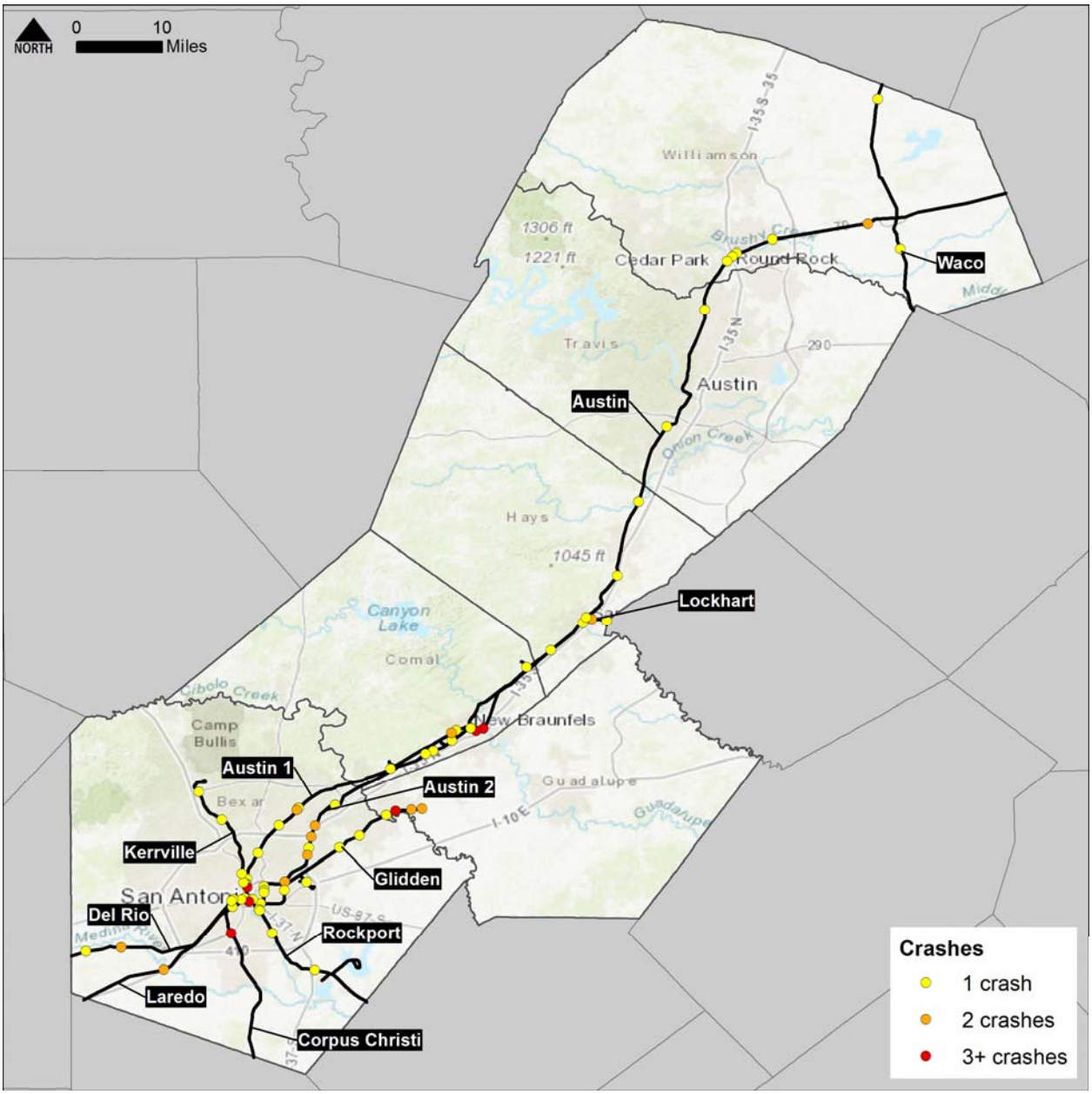
Source: TranSystems and TRIMS

Table 7: Crashes (within last five years) by County by Railroad Subdivision

County	Subdivision	Total Crashes
Williamson	Austin	6
	Waco	2
	Georgetown Industrial	0
Travis	Austin	2
	Waco	0
Hays	Austin	4
	Austin Track 2	1
	Lockhart	3
Comal	Austin	14
	Austin Track 2	3
Guadalupe	Glidden	7
Bexar	Austin	13
	Austin Track 2	12
	Glidden	2
	Rockport	4
	Corpus Christi	6
	Laredo	3
	Del Rio	13
	Kerrville	5
	Salado Lead	1
TOTAL		**94**

Source: TranSystems and TRIMS

Figure 10: Five-County Study Area – Crashes (within last five years) at Crossings



Source: TranSystems and TRIMS

Analysis

TxDOT uses a Priority Index formula in order to rank and evaluate more than 9,000 crossing in Texas. The original Priority Index formula was based upon the following factors:

- Average daily traffic
- School bus traffic
- Trains per day
- Maximum speed of trains
- Protection factor
- Vehicle crashes in the last five years

As improvements were made to the crossings over the years, it became necessary to update the formula to address the issues of crash prediction. Therefore, a revised formula was developed that uses the following factors:

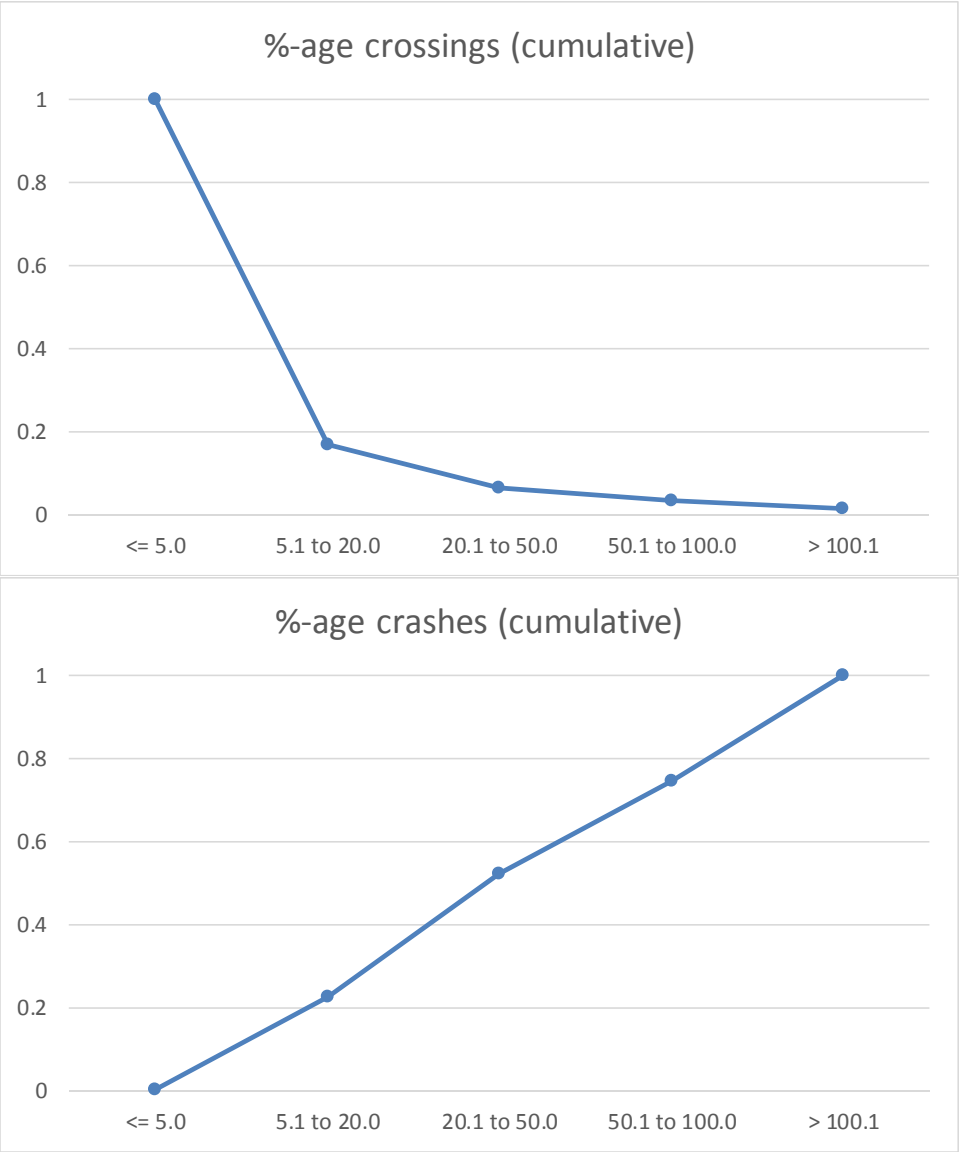
- Protection factor
- Highway paved
- Land use
- Main track count
- Other track count
- Minimum stopping distance
- Maximum speed of vehicles
- Minimum speed of trains
- Maximum speed of trains
- Total train volume per day
- Average daily traffic
- Nearby intersection distance
- Accident rate prediction factor based upon crashes in the last five years

For the highway-railroad at-grade crossings under evaluation in the five-county study area, an analysis of the Priority Index range of values was conducted. The analysis indicates that presenting the value in three categories would allow for identification of high (value is greater than 50), moderate (value is between 20 and 50), and low rankings (value less than 20). The range of the Priority Index within the study area varies from a high of 325 to a low of 0. Of all crossings under evaluation within the study area, there are 61 crossings with a Priority Index value greater than 20. There are 44 crossings with a Priority Index value greater than 50.

A review of the Priority Index values across the state's more than 9,000 crossings confirms the initial targeting of values greater than 20. The highest Priority Index value in the state is 1,729.1, more than five times higher than the highest Priority Index value in the five-county study area. Within the study area, the highest crossing value is ranked 16th in the state. Figure 11 displays two charts based upon the break point values selected for the Priority

Index. The first chart has a sharp descending curve, which indicates that the majority of crossings have a Priority Index value less than 5. The second chart has a steady ascending curve relating the Priority Index value to the number of crashes. This shows that more than half of the crashes occur at 6.5 percent of the crossings. Table 8 outlines the range of Priority Index values at the county level. It is worth noting that Bexar County has more than half of the crossings with Priority Index values greater than 20 and greater than 50 throughout the five-county area. Figure 12 displays the five-county area with crossings that have a Priority Index greater than 20.

Figure 11: Priority Index Values by Number of Crossings and Crashes (Statewide)



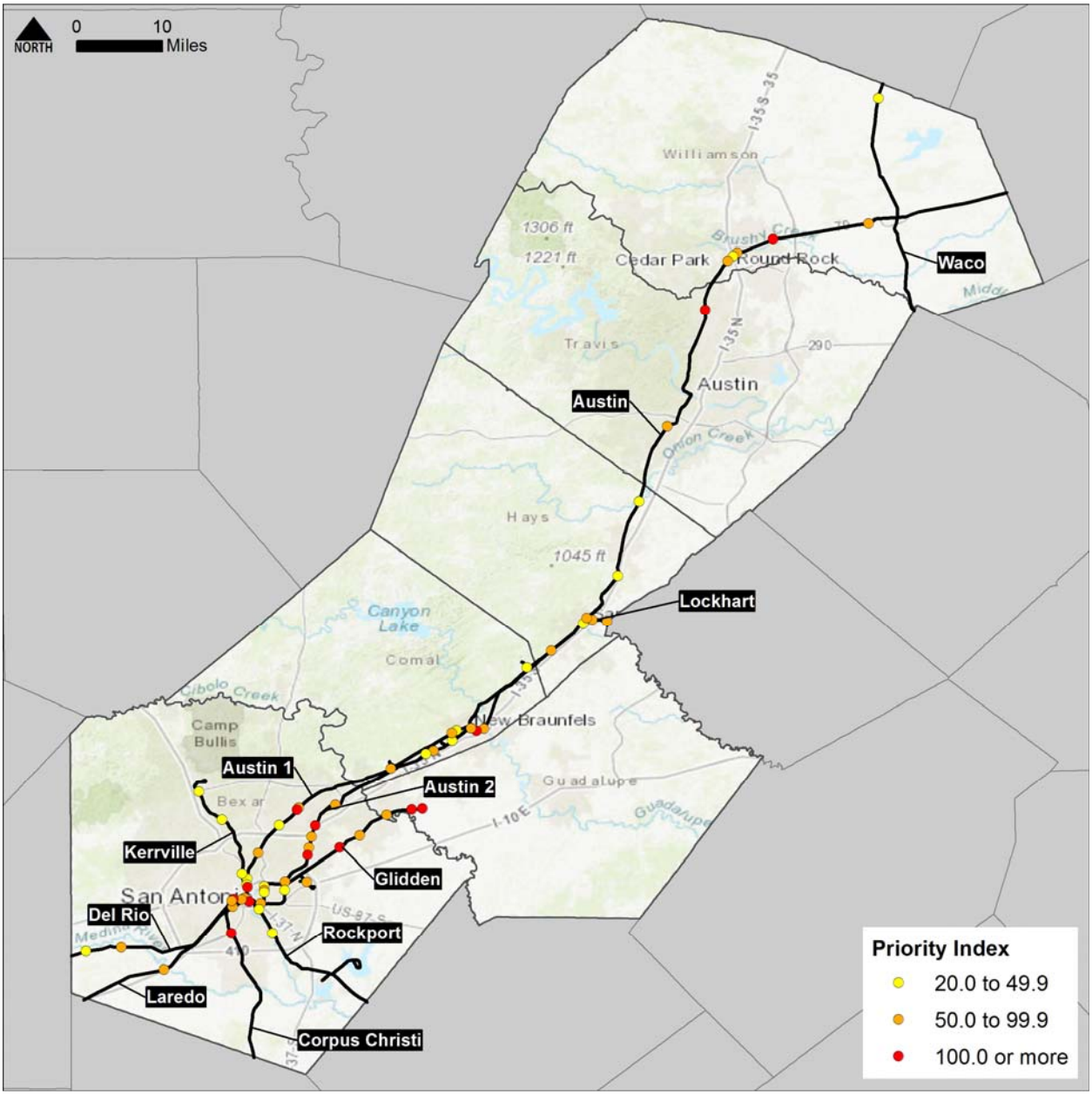
Source: TranSystems and TRIMS

Table 8: Range of Priority Index Values by County by Railroad Subdivision

County	Subdivision	Crossings with Priority Index > 20	Crossings with Priority Index > 50	Highest Priority Index Value
Williamson	Austin	5	4	106.9
	Waco	1	0	20.8
	Georgetown Industrial	0	0	8.9
Travis	Austin	2	2	114.6
	Waco	0	0	0.9
Hays	Austin	4	2	68.5
	Austin Track 2	1	0	37.2
	Lockhart	2	2	65.2
Comal	Austin	7	5	151.2
	Austin Track 2	3	1	57.6
Guadalupe	Glidden	4	4	377.9
Bexar	Austin	9	5	182.6
	Austin Track 2	8	7	208.3
	Glidden	2	2	140.2
	Rockport	2	0	42.3
	Corpus Christi	1	1	275.7
	Laredo	2	2	65.2
	Del Rio	9	6	325.4
	Kerrville	3	0	30.8
	Salado Lead	1	1	51.4
TOTAL		**65**	**44**	**N/A**

Source: TranSystems and TRIMS

Figure 12: Five-County Study Area – Crossings with Priority Index greater than 20



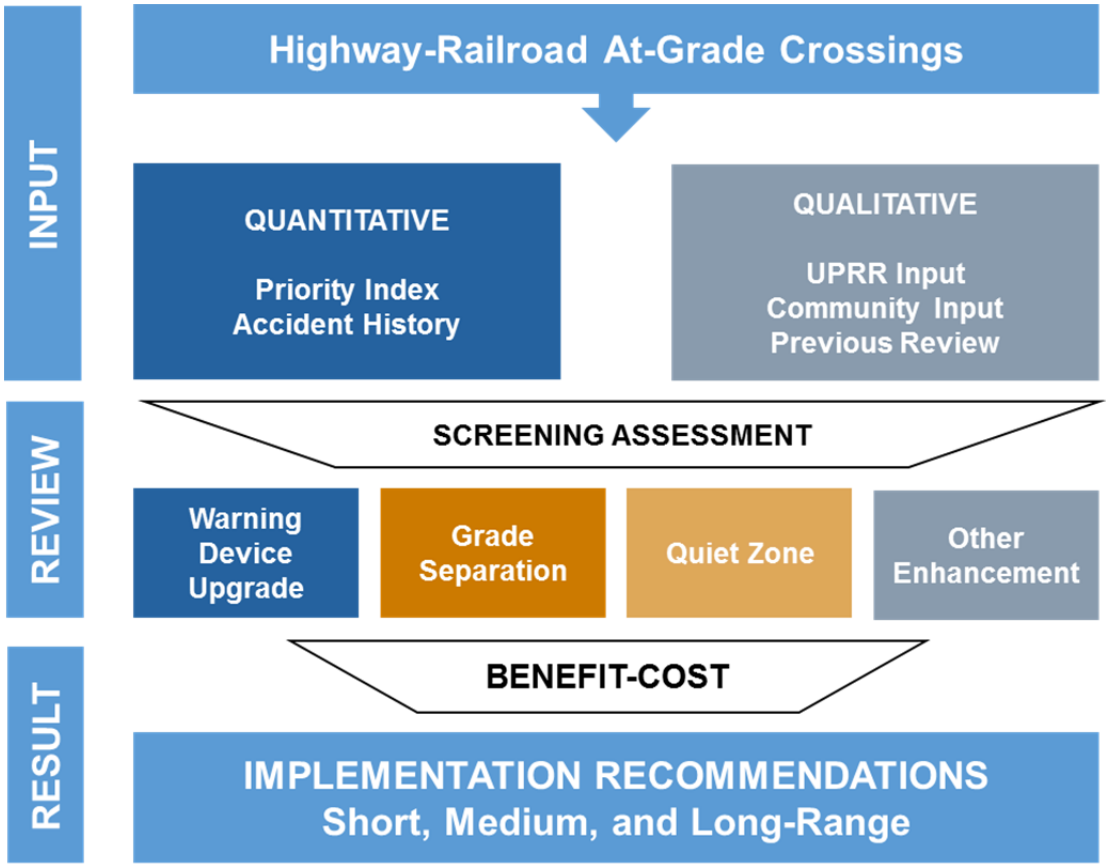
Source: TranSystems and TRIMS

Screening Methodology

This screening methodology identifies specific highway-railroad at-grade crossings to advance for further review. With nearly 400 highway-railroad at-grade crossings in the Study Area, the screening methodology prioritizes locations where various improvement types apply.

The overall screening methodology involves three steps: Input, Review and Result. The Input step inventories quantitative data and qualitative information at all highway-railroad at-grade crossings within the Study Area. The Review step considers the inventory of data and information at each crossing and reviews it against a toolbox of potential improvement types. The Result step uses a benefit-cost analysis to provide a comprehensive program of activities. In simple terms, Figure 13 illustrates the process.

Figure 13: Screening Methodology Flow Chart



Source: TranSystems

Input Step

Information on the average daily traffic, train volumes, train speed, number of tracks, and other information is tracked in the TRIMS database. The Priority Index, calculated from TRIMS data, serves as the principle quantitative determinant of action at a crossing. In this screening process, quantitative information on accident history at each crossing is also reviewed. Accident history is based on US DOT crash history for the last five years.

The qualitative information reviewed includes UPRR and community input, along with review of previous studies and on-going projects in the Study Area. Information from the UPRR was obtained through participation in formal meetings and a hi-rail trip on the Austin 1 and Austin 2 Subdivisions in Bexar County. The community input includes information from communities along the railroad corridors obtained through formal meetings and follow-up data requests. Information on previous studies and on-going projects that may require coordination were obtained as part of stakeholder coordination and through available sources.

Review Step

The Review step of the screening process first evaluates then selects an improvement type, if any, at a crossing location. Four basic improvement types are considered at highway-railroad at-grade crossings. Although the inventory of improvement types could be expanded, this study focuses on four improvement types:

- Warning Device Upgrade
- Grade Separation
- Quiet Zones
- Other Enhancements

Some improvement types are applicable to specific crossings, while other improvement types need to be applied across a grouping of crossings or a segment of a railroad corridor.

Because of the magnitude of the number of crossings, a large number of crossings may be potential candidates for an improvement type. The Review step goes through a sketch-level design assessment before selecting the crossing locations with the highest implementation potential to advance to a field survey and refined design.

Result Step

The Result step of the screening process evaluates the crossings advanced to field survey and refined design for technical, financial, and institutional feasibility to prepare an implementation plan.

Technical reviews focus on how well the improvement conforms to appropriate design criteria and constructability reviews. Financial feasibility is tested through a benefit-cost analysis. Institutional feasibility is a measure of stakeholder support including the railroad, TxDOT, municipalities, and the general public. At this stage, the ability to measure institutional feasibility is limited due to the need for future, more comprehensive engagement.

Improvement Type Review

Warning Device Upgrade

Warning device upgrades focus on the subset of crossings in the Study Area that are under passive control. Only 24 out of the nearly 400 highway-railroad at-grade crossings are under passive control. Most of the passive crossings are on less traveled railroad corridors; however, there are a few crossings with as many as 40 trains per day.

These relatively few passive crossings are reviewed in a contextual manner, meaning that adjacent crossings, the transportation network, and type of control is also considered. An upgrade to an active warning device (e.g., flashing lights and gates) is focused at crossings with crash experience. In some cases the improvement concept may also include the potential for a roadway closure.

At a limited number of locations currently under active control, warning device upgrades are considered. Based on specific crash experience and input from the UPRR, upgrades to reduce crossing violations (e.g., driving around gates) are considered. The review of these locations consider vehicular and train volumes, along with geometry of the crossing.

Grade Separation

Grade separations eliminate an existing highway-railroad at-grade crossing by elevating either the highway or the railroad tracks, thus allowing traffic to move unimpeded at crossings. Grade separations are costly projects, which may require the financial support of federal, state, and/or local agencies as well as the cooperation of the railroad.

The screening process to select locations for grade separations primarily uses the Priority Index along with stakeholder and UPRR input. Any crossing with a Priority Index greater than 50 is consider a candidate for grade separation. However, since many locations are potential candidates considering that criteria, stakeholder input and adherence to design criteria is also reviewed.

The screening of crossing locations for grade separation improvements is intended to categorize potential candidate locations for field survey and refined design. An initial screening reviews previously developed concepts[1] or creates a new sketch-level design. Further screening determines whether to assign the concept to potential immediate

[1] The 2008 San Antonio Regional Freight Study (SARFS) explored numerous grade separation locations. While several of the grade separation recommendations were built, many more locations remain as at-grade crossings. SARFS concepts were reviewed for applicability. Additionally, information learned from various local planning documents are included on base mapping to illustrate potential future changes to or within the surrounding area that may influence the need for or type of improvement concept.

implementation (field survey and refined design), more systemic development, or a future time frame. A systemic development approach may involve comparison of alternative designs as well as a more inclusive public engagement component. A systemic approach acknowledges that additional planning and coordination is needed with other parties and/or agencies to better define the actual project. Corridor preservation for future implementation is a long-term focus. This approach acknowledges that greater issues such as roadway corridor expansion or land development may complicate a grade separation concept.

Commonly, grade separations are focused at a single crossing location. In this Study, three specific grade separation improvement concepts are considered, in additional to singular locations:

- At crossings associated with railroad operational improvements
- Elevated railroad corridors
- Existing grade separations

Railroad Operational Improvements

During the stakeholder workshops in each County, UPRR discussed locations for railroad operational improvements that would decrease the number and duration of crossings occupied by staging trains. It was noted that the limited number and length of train meet locations affect train operations. Consequently, several railroad segments could be explored in conjunction with grade separations or closures to provide longer sidings for improved railroad operations in conjunction with improved highway mobility with grade separations. Some of the railroad operational improvement segments may not include any railroad improvements, only highway grade separations that result in improved overall mobility for railroad and highway users.

The screening process prioritizes a coordinated transportation approach that results in direct benefits to motorists with a grade separation in conjunction with railroad operational benefits by either:

- clearing an existing track slot,
- enhancing an existing track slot, or
- creating a new track slot.

A slot is typically a 10,000-foot long siding or additional track for staging of trains. Such improvements also have benefits by reducing the time crossings are occupied at other locations.

Elevated Rail Corridors

Rail elevations are considered when a series of closely spaced crossings occur that cannot be adequately addressed through a highway grade separation concept. However, due to the

distance for a rail profile to climb over a roadway, lengthy segments before and after the crossings are needed to minimize impacts to other crossings. No segments were identified during the stakeholder workshops and a limited number of segments have been identified with suitable length and multiple crossings. A rail elevation concept is deemed technically feasible when:

- Crossings are closely spaced
- Sufficient length is available on either end of separated crossing(s)
- Maximum desirable grade of 0.8%
- No industry service is present
- Sufficiently wide right-of-way for constructability

Existing Grade Separations

Several existing railroad over roadway grade separations in the Study Area are constrained by physical features such as horizontal or vertical restrictions. For each County a list is provided that includes notes on vertical and horizontal issues typically identified through posted signs. Comments are noted for conditions needing further review.

Quiet Zones

Quiet Zones are a tool used to silence train horns while maintaining safe conditions at highway-railroad at-grade crossings. As a quality of life improvement, local governments generally initiate a Quiet Zone improvement. During stakeholder meetings locations that are already under consideration for Quiet Zone implementation were identified. These locations are listed in the summary evaluation of each County and are considered a work in progress.

The screening process for a Quiet Zone improvement uses input from stakeholders to identify candidate corridors. At the locations identified by stakeholders the ability of the corridor to meet formal requirements set forth by the Federal Railroad Administration is reviewed.

Other Enhancements

A series of other enhancements to consider when reviewing mobility and safety at highway-railroad at-grade crossings include:

- Existing Planned or Programmed Improvements
- Crossing Consolidation
- Corridor and Land Use Plans
- Crossing Geometry

In the screening process for other enhancements, if a crossing already is planned or programmed for an improvement no further action is taken for that crossing. Crossing consolidations are not reviewed in isolation – they are integrated with other improvements in the screening process. Crossing Geometry is also integrated with other improvement types.

Growth and development potential in an area play a stronger role in this improvement category. The screening process acknowledges that coordination on future corridor preservation to reflect dynamic changes to the transportation system is important. This creates a potentially long list of future projects because of the intense development in the region as well as numerous adjacent highway projects that range from minor street realignments to multi-lane highway corridors on new alignment. These projects are grouped into areas or segments so that if no specific improvement types are identified at a crossing location the need for future planning activities is stated.

When a crossing's evaluation does not assign it to any of the action-related improvement categories, it merely means that monitoring of operational data such as accidents, train, and vehicular volumes should continue. At certain locations, education and enforcement measures should be considered.

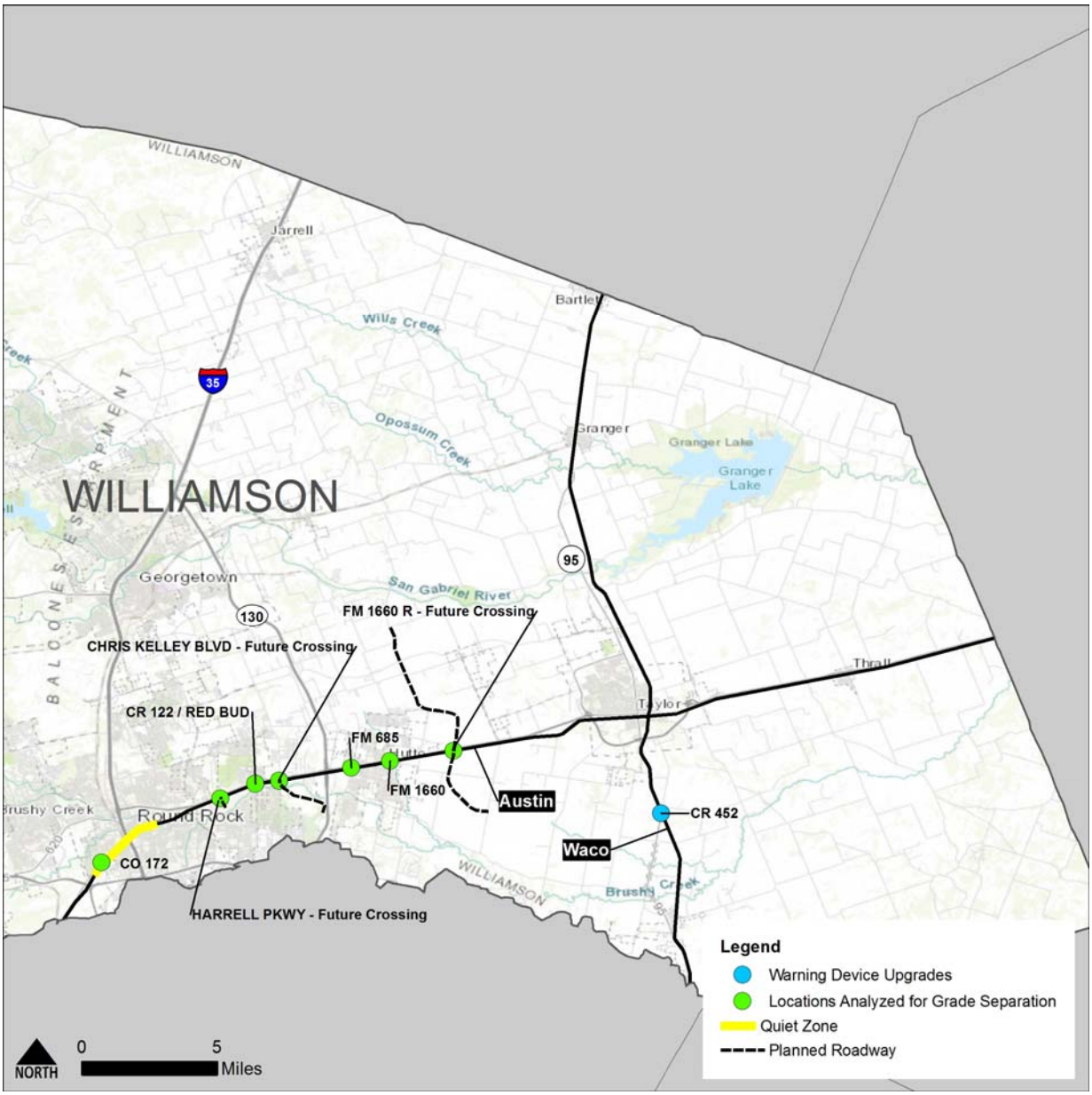
Summary of Improvement Concepts

This summary provides an overview of the four types of improvements reviewed, including Warning Device Upgrades, Grade Separations, Quiet Zones, and Other Enhancements, at the crossings throughout each County by Subdivision. A more detailed description of the crossings is provided for each County in a separate document.

Williamson County

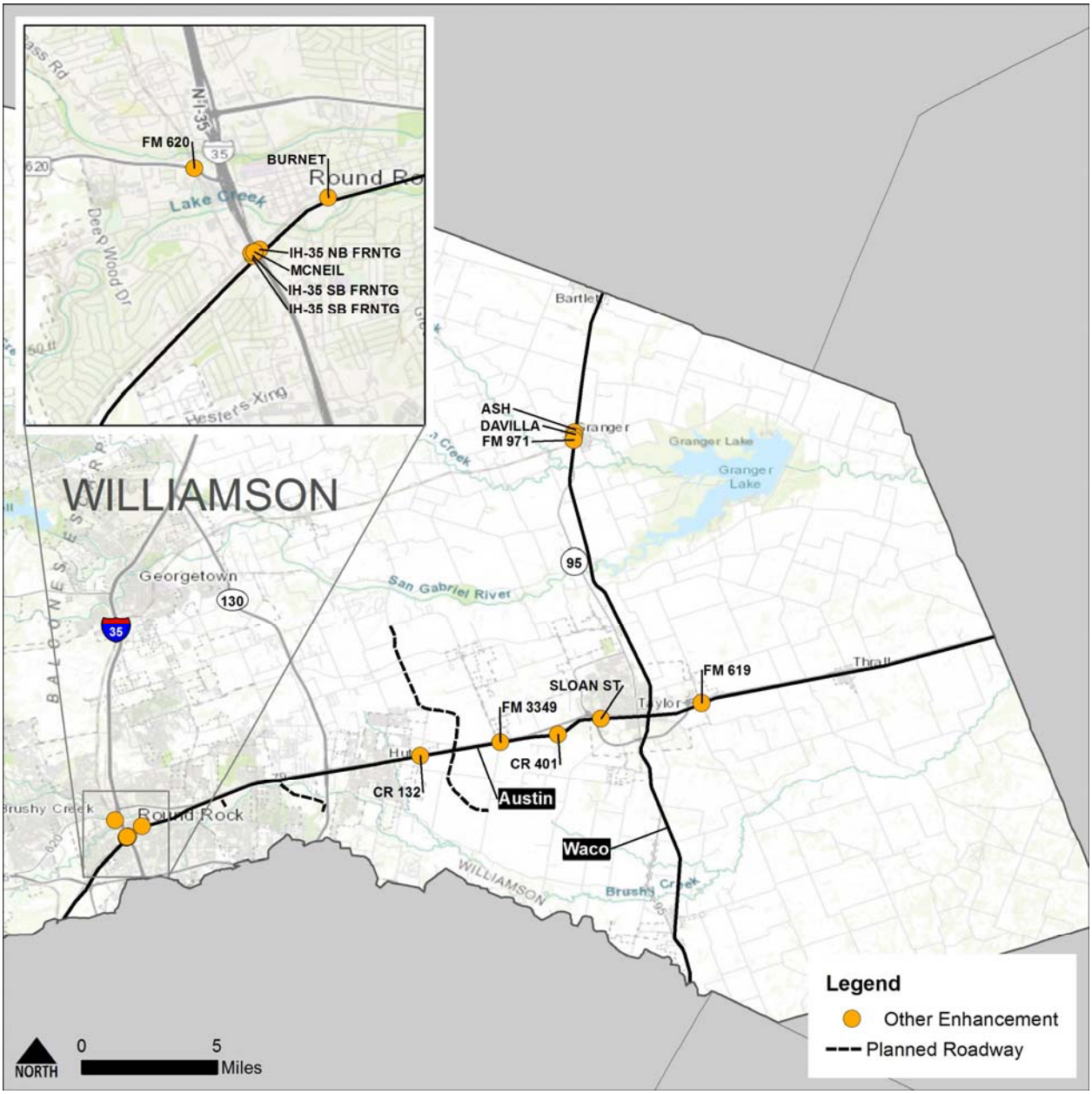
There are three Subdivisions in Williamson County, including the Austin Subdivision, the Georgetown Industrial Lead, and the Waco Subdivision as shown in Figures 14.1 and 14.2.

Figure 14.1: Williamson County – Crossings by Improvement Type



Source: TranSystems and TRIMS

Figure 14.2: Williamson County – Crossings by Improvement Type



Source: TranSystems and TRIMS

Austin Subdivision

The 30-mile long Austin Subdivision in Williamson County has 25 at-grade crossings. All of the at-grade crossings along the Austin Subdivision in Williamson County are controlled by active warning devices. The SH 95 Frontage Road is controlled by flashings lights (without gates).

There are four crossings with a TRIMS Priority Index above 50, the threshold used to review candidate crossings as potential grade separations. A fifth crossing at the I-35 NB Frontage Road has a PI value just below 50, at 47.3. Three other crossings were previously studied for grade separation. A schematic-level highway grade separation plan was prepared at the following crossings:

- FM 1660
- FM 685
- CR 122
- CO 172

The plans illustrate the challenges and issues with the existing street network. Several of these crossings parallel the multi-lane highway of US 79. The assessment takes into consideration the future nature of the US 79 highway corridor.

The City of Hutto expressed interest in a Quiet Zone corridor during stakeholder meetings. A Quiet Zone corridor at four crossings was evaluated – CR 132, FM 1660, Jim Cage Lane, and FM 685. Several options for quiet zone implementation were presented for the City to consider and advance to implementation with further coordination and funding required.

The City of Round Rock is currently implementing a Quiet Zone corridor. UPRR is in the final design stage and material acquisition phase for the project limits from CR172/Quick Hill Rd (US DOT 439695E) to Burnet St (US DOT 439389B). The construction on this phase is scheduled to begin in August 2018. The remainder of the quiet zone corridor is still in preliminary design between the new Harrell Parkway/Kalahari Blvd (US DOT 972310C) to Red Bud Ln (US DOT 439680P). The city is finalizing the pre-emption timing for Harrell Parkway and Brushy Creek, for signal design to begin in early 2018.

Other enhancements were considered at several crossings that could include crossing consolidation with transportation network improvements. These crossings are at FM 619, Sloan Street, CR 401, FM 3349, CR 132 and Burnet Street.

A potential realignment of FM 1660 to the east of Hutto is being considered. The grade separation concept should consider the overall transportation network including closure of existing adjacent highway-railroad grade crossings and providing connecting roadways to a new grade separation.

With the newly proposed crossing at Harrell Parkway (USDOT 972310C) in Round Rock, development potential on the south side of US 79 is expected to increase. This in turn suggests the need for access management to allow, and direct, internal circulation to adjacent grade separated crossings through Kenney Fort Blvd.

None of the railroad over highway grade separations along the Austin Subdivision appear to have any physical constraints for the mainline roadway. The bridge over A W Grimes Blvd also crosses Brushy Creek Trail and the access road to the Play for All Abilities Park. That access road is posted with a 12'-6" vertical clearance. Additional planning and coordination should occur to identify and integrate any planned roadway improvements that could affect these railroad structures.

Georgetown Industrial Lead

The 1.5 -mile long Georgetown Industrial Lead in Williamson County has seven at-grade crossings; three crossings are under passive control. None of the passive crossings experienced an accident in the past five years. No other crossings experienced accidents.

The FM 620 crossing controlled by flashing lights is programmed for a grade separation. Potential improvements are also planned for the McNeil Road and I-35 Frontage Road crossings. The concepts reviewed retain the at-grade crossings to accommodate certain traffic movements, yet provide a grade separated collector-distributor roadway that is likely to substantially reduce vehicular traffic volumes at the crossing.

Waco Subdivision

The nearly 28-mile long Waco Subdivision in Williamson County has 25 at-grade crossings, seven of which are under passive control. Two of the passive crossings experienced an accident in the past five years. No other crossings experienced accidents. All passive crossings were reviewed for a warning device upgrade. The crossing at CR 387 was upgraded in early 2017 and is therefore removed from evaluation. A warning device upgrade plan at CR 452 was developed.

Several other crossings were reviewed for potential improvements. These include three closely spaced crossings in Granger (Ash, Davilla and Mesquite), as well as Lake Drive and Walnut Street. In Granger a potential solution would involve relocation of highway FM 971 around the city (with a grade separation) or the relocation of railroad sidings.

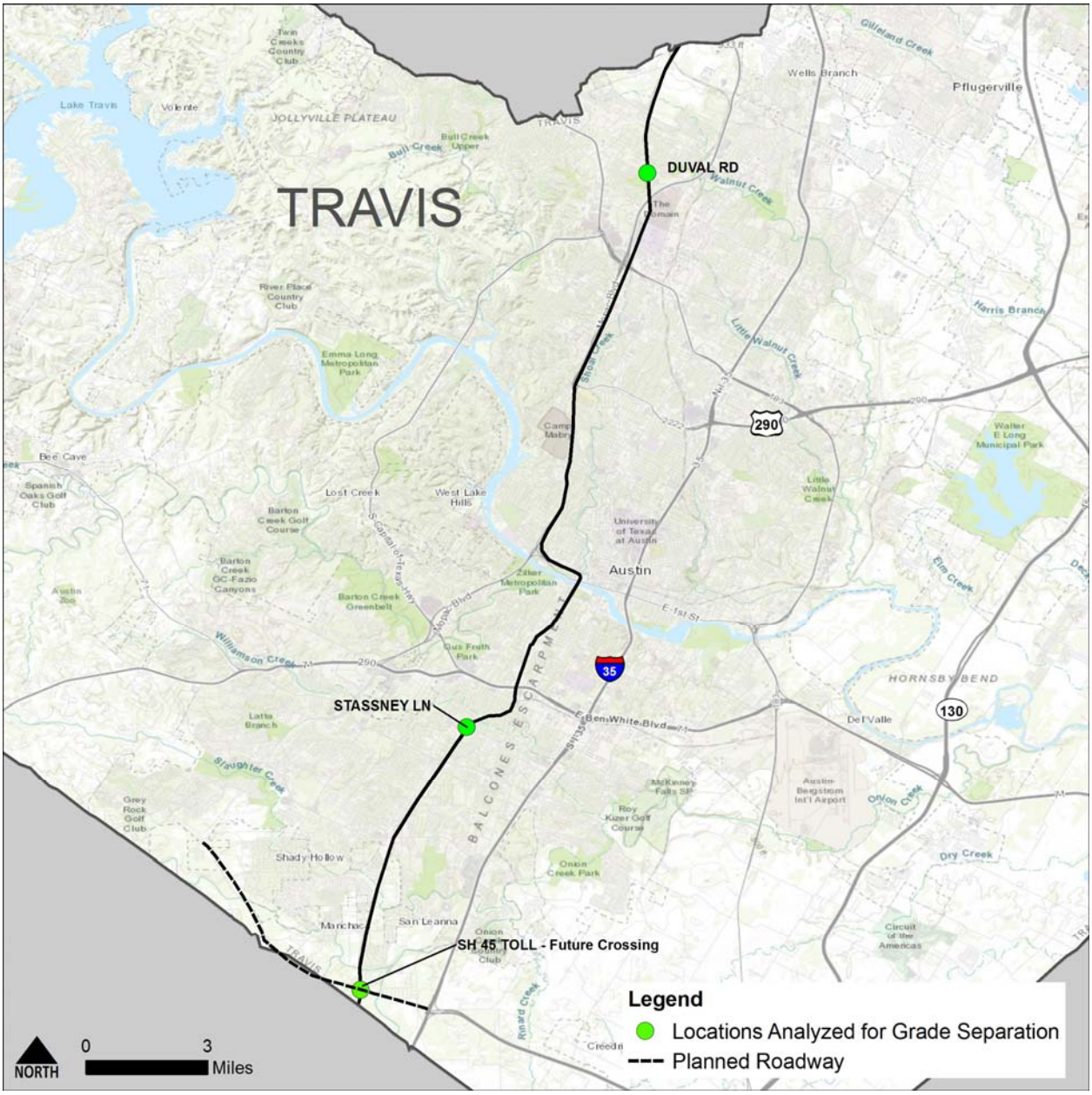
The railroad over highway grade separations along the Waco Subdivision are posted with a roadway vertical clearance of 16'-1" on SH 95 in Granger and at 14'-4" on Fourth Street in Taylor. At Fourth Street, bridge piers are located immediately at the back of curb and are protected by guard rail and sidewalk is provided on the north side. Additional planning and coordination should occur to identify and integrate any planned roadway improvements that could affect these railroad structures.

A separate document detailing each crossing with summary information, the screening method reviewed, and the improvement type considered is provided for Williamson County.

Travis County

Austin Subdivision in Travis County as shown in Figure 15.

Figure 15: Travis County – Crossings by Improvement Type



Source: TranSystems and TRIMS

The nearly 25-mile long Austin Subdivision in Travis County has 10 at-grade crossings, none of which are under passive control. The crossings that experienced accidents have a Priority Index that exceeds a value of 50 and were reviewed for potential grade separation.

Both crossings at Duval Road and Stassney Lane were evaluated at a schematic level to assess potential challenges and issues with the implementation of a grade separation.

Similar to other existing grade separations, access to adjacent properties is necessary through a frontage road system. However, the ability to recirculate internally to allow for fully directional mobility from the adjacent properties is limited at both Duval and Stassney Lane. While the concepts envision potential construction within the existing right-of-way, construction phasing may necessitate closure of the existing roadway during the construction period.

Four other crossings were previously studied for grade separation: W Oltorf St., Matthews Lane, Ditmar Rd., and FM 1626. None of those crossings experienced accidents in the last five years and none have a Priority Index above 10.

In south Travis County, future extensions to the SH 45 Toll Road would cross over the UPRR corridor approximately at the county line near MP 197.9. As a toll facility with limited access, no additional at-grade crossings are anticipated.

There are thirteen railroad structures over highways in Travis County. Seven of the crossings are posted with warning signs for vertical clearances ranging from 13'-4" to 15'-2". Additional planning and coordination should occur to identify and integrate any planned roadway improvements that could affect these railroad structures.

A separate document detailing each crossing with summary information, the screening method reviewed, and the improvement type considered is provided for Travis County.

Hays County

There are three Subdivisions in Hays County, including the Austin and Austin 2 Subdivision and the Lockhart Subdivision as shown in Figure 16.

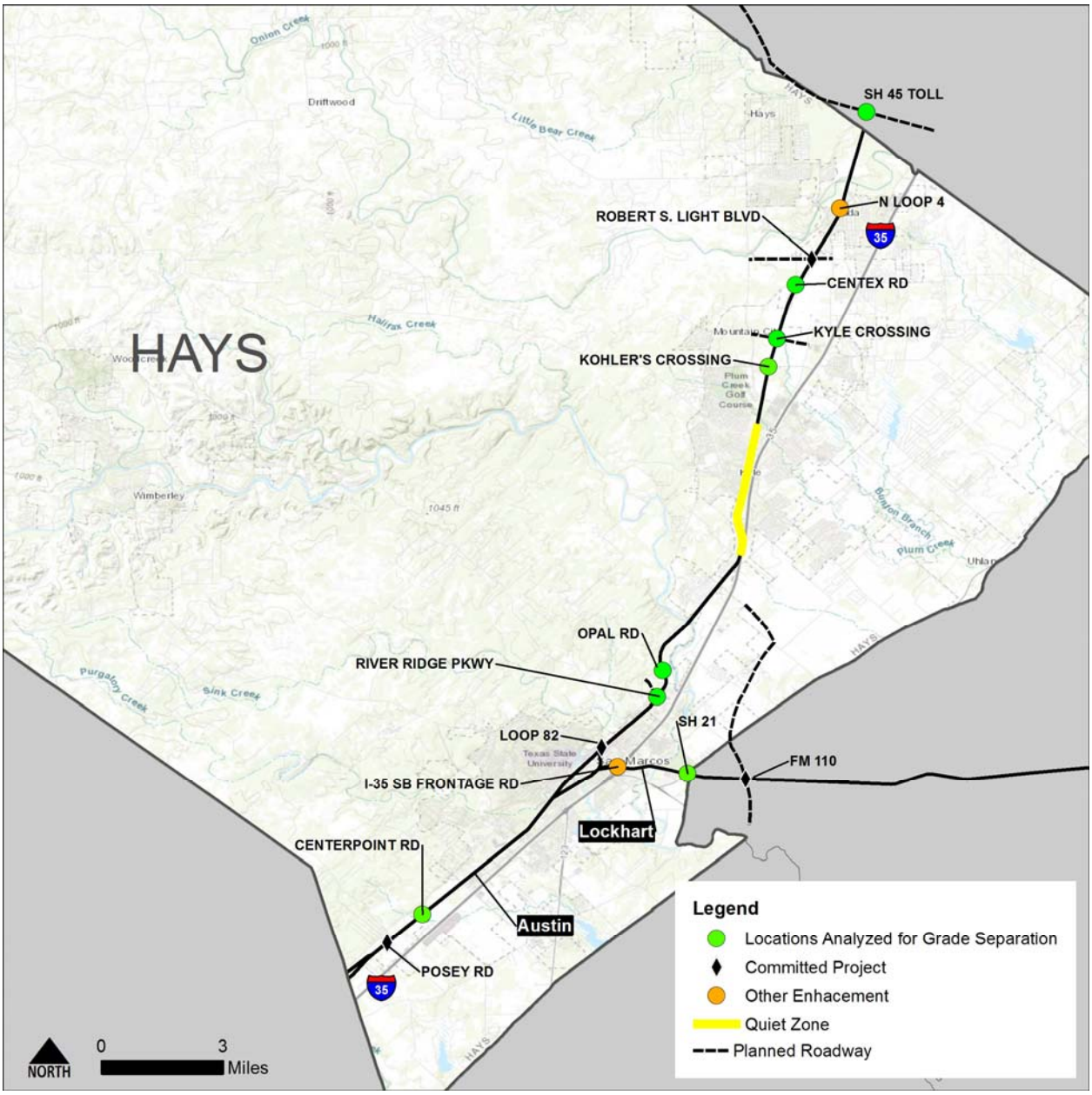
Austin and Austin 2 Subdivisions

This nearly 22-mile long Subdivision in Hays County has a total of 34 at-grade crossings (23 on the Austin Subdivision and 11 on the Austin 2 Subdivision). While the two railroad corridors are physically separate, they are often close to each other and can be within the same railroad right-of-way.

All of the at-grade crossings along the Austin Subdivision in Hays County are controlled by active warning devices. Therefore, no warning device upgrades are considered.

There are two crossings with a TRIMS PI above 50. Three other crossings experienced accidents in the last five years but are below the 50 PI threshold. A highway grade separation plan was prepared at Kohler's Crossing and Centerpoint Road.

Figure 16: Hays County – Crossings by Improvement Type



Source: TranSystems and TRIMS

At Centerpoint Road the design was advanced to a conceptual review in anticipation of a more immediate ability to implement a grade separation due to increased traffic volumes associated with surrounding development. Similar grade separation concepts could be applied to McCarty Lane and Posey Road as these roadways also provide access between Hunter Road and Interstate 35. Two grade separation options are considered in the on-going Posey Road Corridor Study.

Portions of Hays County are expected to continue to experience significant growth. Such growth is likely to place additional traffic across numerous highway-railroad at-grade crossings. A review of the Hays County Major Thoroughfare Plan and local community plans indicate the potential for numerous new roadways that would cross the railroad. New roadways shown on the countywide map include:

- Robert S Light Blvd
- Centex Rd (FM 132)
- Kyle Crossing
- River Ridge Parkway

Projects are under consideration at Opal Road and Roland Lane including roadway widening, realignment and a potential grade separation. A grade separation at Loop 82 is currently under construction.

The City of Kyle in conjunction with UPRR is exploring the implementation of a Quiet Zone associated with a railroad siding relocation. The Quiet Zone limits would extend from Burleson Road through CR 137 (Roland St.).

Other enhancements are considered at N Loop 4, Houston Street, S Loop 4, Charles Austin Drive, CM Allen Parkway, LBJ Avenue, and Guadalupe Street. The enhancements include using access management strategies to realign the approaches to the crossing and installing medians as a more appropriate improvement measure than a grade separation.

Lockhart Subdivision

This less than 2-mile long Subdivision in Hays County has four at-grade crossings, none of which are under passive control. There are two crossings with a TRIMS Priority Index above 50.

At SH 21 a conceptual grade separation design was prepared in anticipation of increased traffic volumes associated with other proposed transportation improvements such as the nearby FM 110 extension. The network configuration for SH 21 appears to lend itself to a straightforward grade separation design, although frontage road access will be needed to existing adjacent properties south of the railroad corridor. Additional planning and coordination should occur to identify corridor preservation prior to any additional development as well as addressing any potential impacts to adjacent parkland.

The I-35 SB frontage road experienced two accidents in the last five years. TxDOT conducted a diagnostic review in July 2017 and has initiated a project to upgrade circuits and signals, install advance warning signs, and replank the crossing. The City plans to extend the sidewalk.

There are three railroad structures over highways in Hays County. There is one lengthy railroad structure, nearly 540 feet long, over two highways on the Austin Subdivision. This structure also crosses the Blanco River. There is also a combination highway and river crossing railroad structure on the Lockhart Subdivision, with a posted warning sign for vertical clearances at 11'-8". Additional planning and coordination should occur to identify and integrate any planned roadway improvements that could affect these railroad structures.

A separate document detailing each crossing with summary information, the screening method reviewed, and the improvement type considered is provided for Hays County.

Comal County

The Austin 1 and Austin 2 Subdivisions in Comal County are shown in Figures 17.1 and 17.2.

Austin 1 and 2 Subdivisions

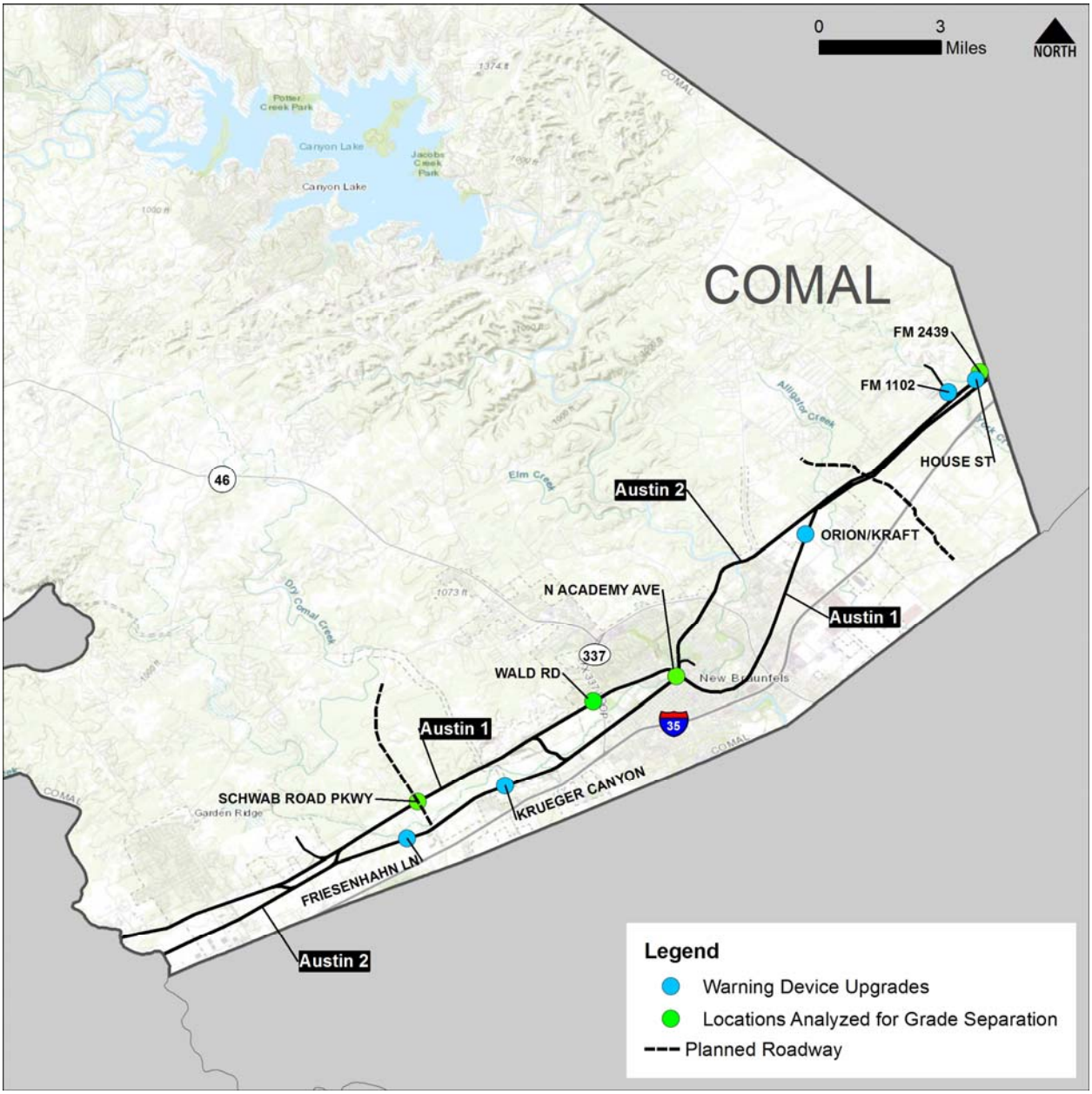
The nearly 24-mile long Austin 1 Subdivision in Comal County has 29 at-grade crossings with five crossings under passive control. The nearly 24-mile long Austin 2 Subdivision in Comal County has 31 at-grade crossings with four under passive control. A new at-grade crossing (DOT 924481Y) was recently constructed near the Comal-Travis County line on FM 2439. The Krueger Canyon crossing is currently programmed for a warning device upgrade.

A warning device upgrade should be considered at Orion Road on the Austin 1, consistent with the warning device treatment on the Austin 2 just 0.4 miles to the west. Additionally, the transportation network in the area surrounding the crossings at Orion and Conrads Road needs to consider the location and spacing of grade separations at both existing and future roadways along the FM 1102 corridor.

An upgrade to an active warning device at House Street is considered; however, a review of the street network suggests the possibility to close House Street and consolidate traffic to cross at FM 1102. The remaining passive crossing, with an industry service track to Colorado Materials, was also reviewed for a warning device upgrade. With the new spur crossing, recently completed across FM 2439 which also serves Colorado Materials, it is suggested that the existing FM 1102 spur crossing be explored for an upgrade to flashing lights and gates.

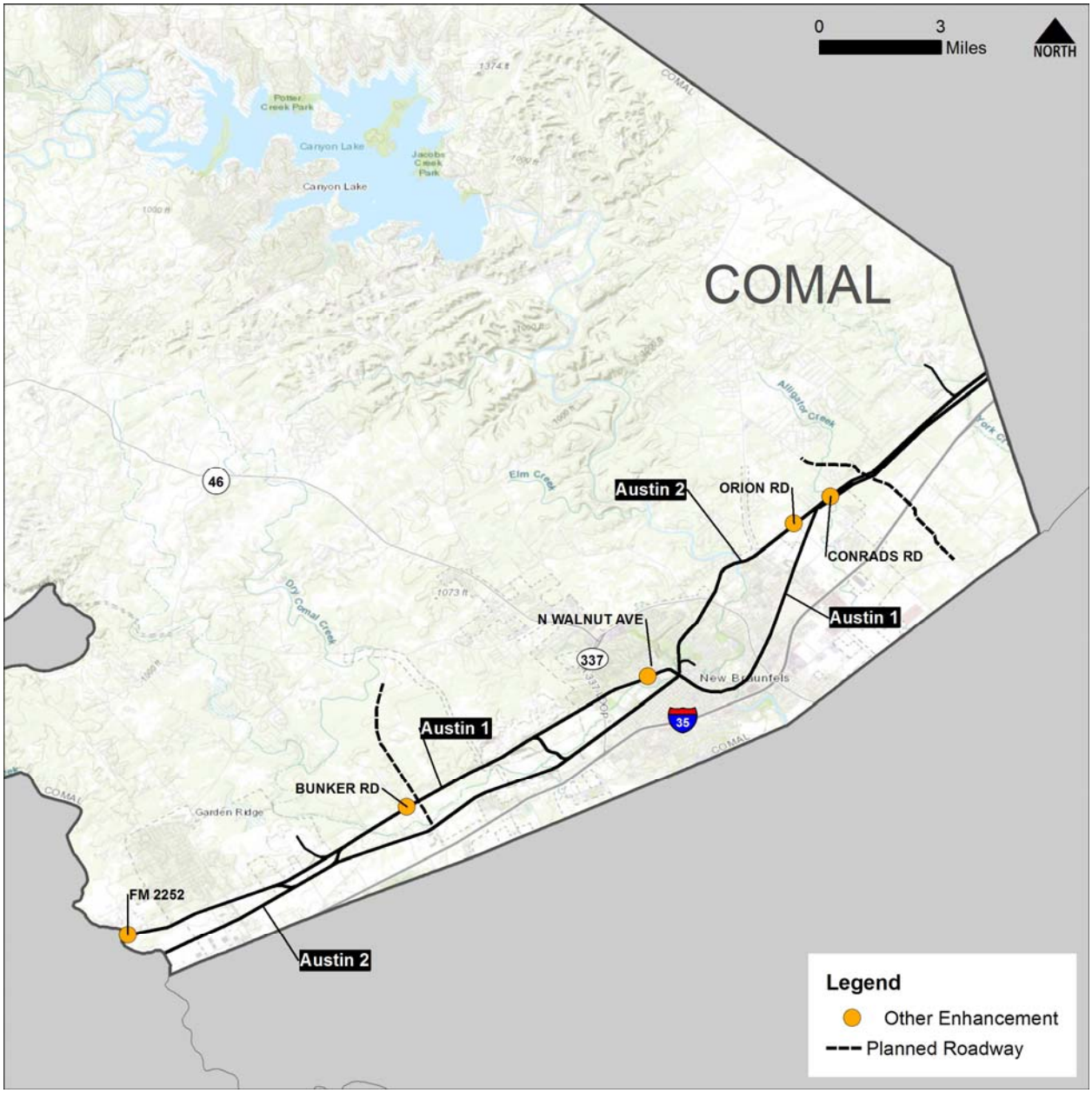
A warning device upgrade at Friesenhahn Lane is suggested, while the Rusch Lane crossing is recommended for monitoring or potential closure as traffic volumes on this dead-end street are low.

Figure 17.1: Comal County – Crossings by Improvement Type



Source: TranSystems and TRIMS

Figure 17.2: Comal County – Crossings by Improvement Type



Source: TranSystems and TRIMS

There are nine crossings with a TRIMS Priority Index above 50. One additional crossing at N Live Oak Avenue experienced one accident (PI value below 50). Two crossings are currently programmed for improvements. A schematic-level highway grade separation plan was prepared at the following crossings:

- Wald Road
- Schwab Parkway
- Academy Avenue

The plans illustrate the challenges and issues with the existing and planned street network. The Wald Road crossing was reviewed in anticipation of increased traffic volumes associated with the planned improvements to Loop 337. The potential shift in crew change from Downtown New Braunfels to Corbin Yard near Bunker Road prompted a transportation network review that includes a concept at Schwab Parkway. Another area under review is associated with the Town Creek development, which could include the development of a new at-grade crossing as an extension of Fredericksburg Road to connect with N Academy Boulevard.

FM 482 crosses the railroad tracks in two locations where accidents were experienced in the last five years. Neither location lends itself to a straightforward grade separation; however, it is suggested that the highway-railroad grade crossings and future grade separations be integrated into a corridor study of FM 482.

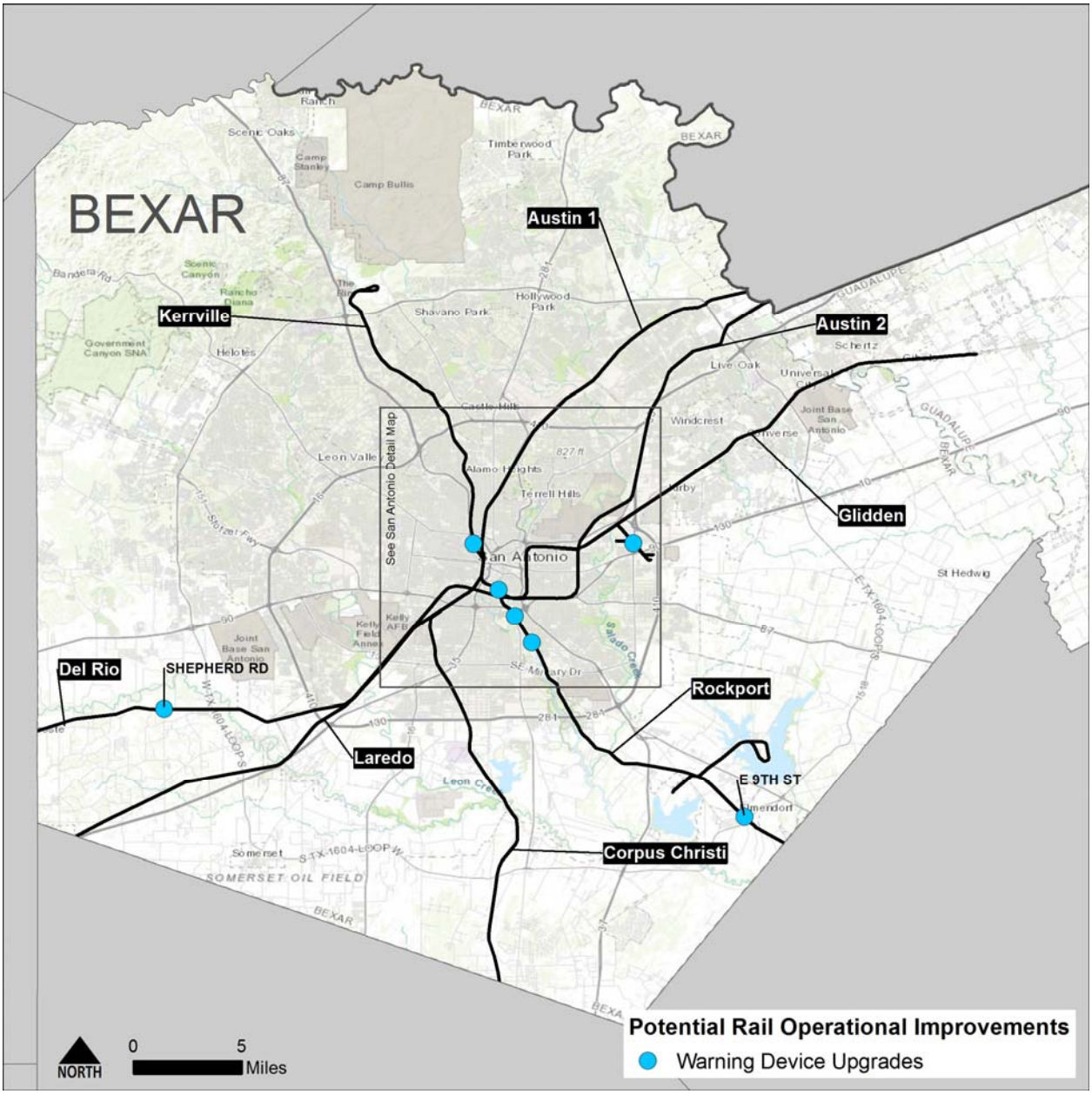
There are a total of seven railroad structures over highways in Comal County. Broadway Street appears to be a former roadway that is no longer open to traffic; therefore, restrictions are not applicable. The structures on the Austin 2 all have posted vertical clearance ranging from 7'-10" to 12'-6". The Ervendberg crossing provides essentially one-lane of passage. The piers have reflectorized markers and signing is posted for westbound traffic to yield to oncoming traffic. The structures over Old Nacogdoches Road on the Austin 1 and Evans Road on the Austin 2 have piers in the center of the roadway which result in lateral constraints. Additional planning and coordination should occur to identify and integrate any planned roadway improvements that could affect these railroad structures.

A separate document detailing each crossing with summary information, the screening method reviewed, and the improvement type considered is provided for Comal County.

Bexar County

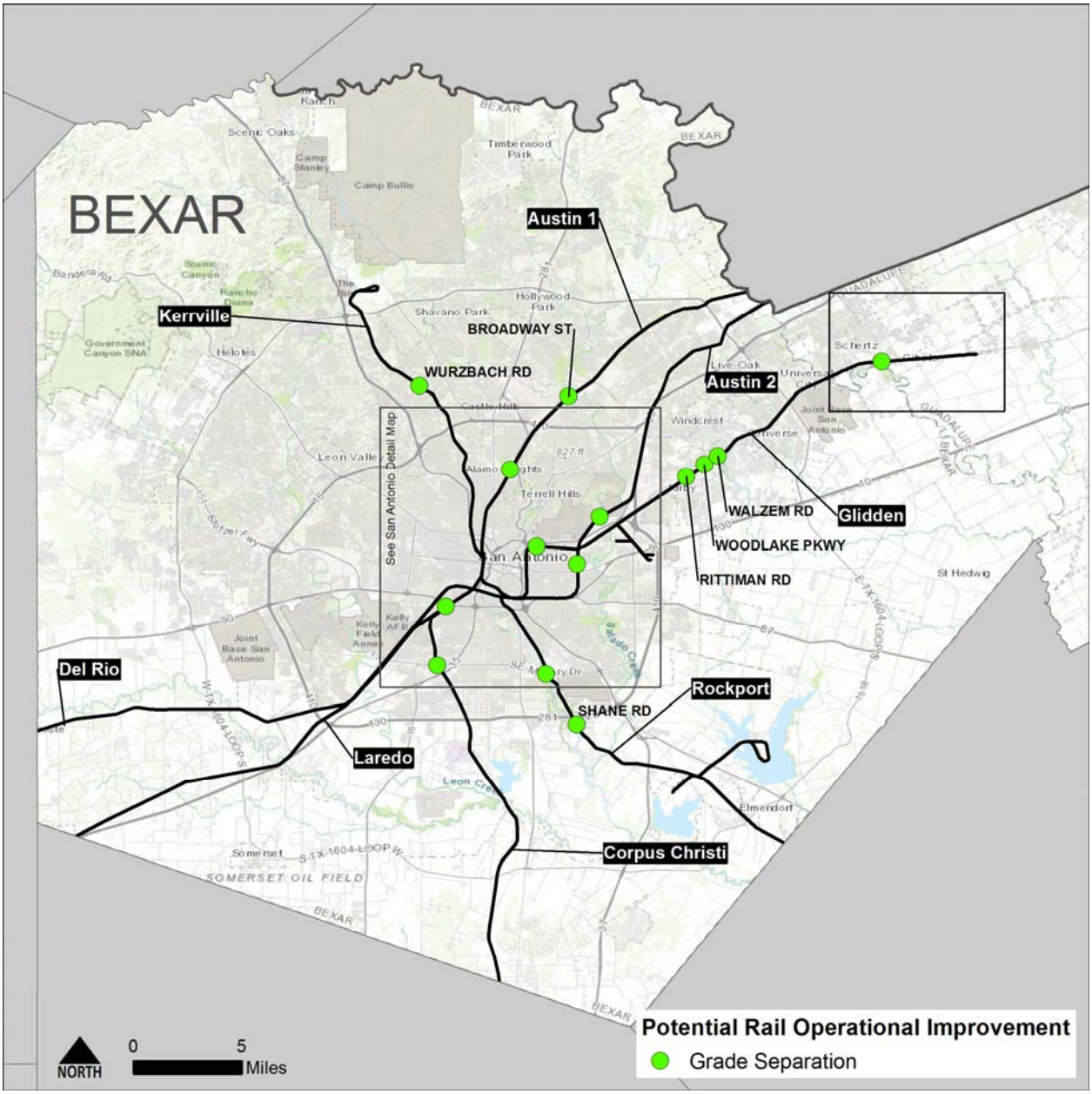
There are eight Subdivisions in Bexar County, including the Austin and Austin 2 Subdivisions, the Corpus Christi Subdivision, the Del Rio Subdivision, the Glidden Subdivision, the Laredo Subdivision, the Kerrville Subdivision, and the Salado Lead as shown in Figures 18.1 and 18.2. While crossings were reviewed independently, in several Subdivisions and segments the assessment considers grouping several crossings into a more comprehensive network evaluation. This is a result of rail corridor improvements, such as with rail siding extensions that would also benefit from highway grade separations.

Figure 18.1: Bexar and Guadalupe Counties – Crossings by Improvement Type



Source: TranSystems and TRIMS

Figure 18.2: Bexar County Detail – Crossings by Improvement Type



Source: TranSystems and TRIMS

Austin Subdivision

This nearly 17-mile long Subdivision in Bexar County has 42 at-grade crossings, one of which is under passive control. This passive crossing has not experienced an accident in the past five years. The passive crossing was reviewed for roadway closure as the location is at the ground level beneath the Guadalupe Street viaduct. Nine other active warning crossings experienced accidents, five of which have a Priority Index that exceeds a value of 50. The crossings that experienced accidents were reviewed for potential grade separation.

Two crossings were advanced to a concept level including Broadway and Basse Road. Both crossings are within or immediately adjacent to an area of interest to extend a railroad siding. The Broadway crossing also involves the closure of the adjacent MacArthur View (Bitters Road) crossing. A rendering of the grade separation is provided in Figure 19. The grade separation crosses over the railroad and the parallel Wetmore Road before looping back to connect to Wetmore Road. The loop crosses into property associated with the San Antonio Airport.

Figure 19: Grade Separation Rendering – Broadway on Austin Subdivision

Source: TranSystems

Austin 2 Subdivision

This nearly 17-mile long Subdivision in Bexar County has 19 at-grade crossings, two of which are under passive control. None of the passive crossings experienced an accident in the past five years. Eight other crossings experienced accidents, seven of which have a Priority Index that exceeds a value of 50. The eighth crossing has a PI value of 49.8.

The eight crossings with accidents were reviewed for grade separation. Several crossing are grouped together as part of a rail operational improvement between Fratt Road and Binz Engelman Road. A rendering of the grade separation is provided in Figure 20. Other crossings were reviewed independently. The Houston Street crossing has been advanced to a concept level for two design configurations, highway over railroad and with an elevated railroad segment. A rendering of the highway grade separation is provided in Figure 21.

Figure 20: Grade Separation Rendering – Binz Engelman on Austin 2 Subdivision

Source: TxDOT

Figure 21: Grade Separation Rendering – E Houston on Austin 2 Subdivision

Source: TranSystems

Corpus Christi Subdivision

This nearly 17-mile long Subdivision in Bexar County has 18 at-grade crossings, two of which are under passive control. None of the passive crossings experienced an accident in the past five years. While only one other crossing experienced accidents, that crossing of the I-35 Southbound frontage road had six accidents with a Priority Index of 275.

The I-35 Frontage Road crossing with the elevated section of mainline Interstate 35 immediately adjacent does not lend itself to a potential grade separation. The close proximity to the heavily trafficked intersection of Zarzamora Street (225 feet to the west) appears to be generating vehicular queues that may block the railroad crossing. Consequently, it is recommended that a pre-signal enhancement be explored. Other crossings that were previously reviewed for grade separation were revisited, including the Loop 13 crossing.

Figure 22: I-35 Southbound Traffic Queues

Source: GoogleEarth

Del Rio Subdivision

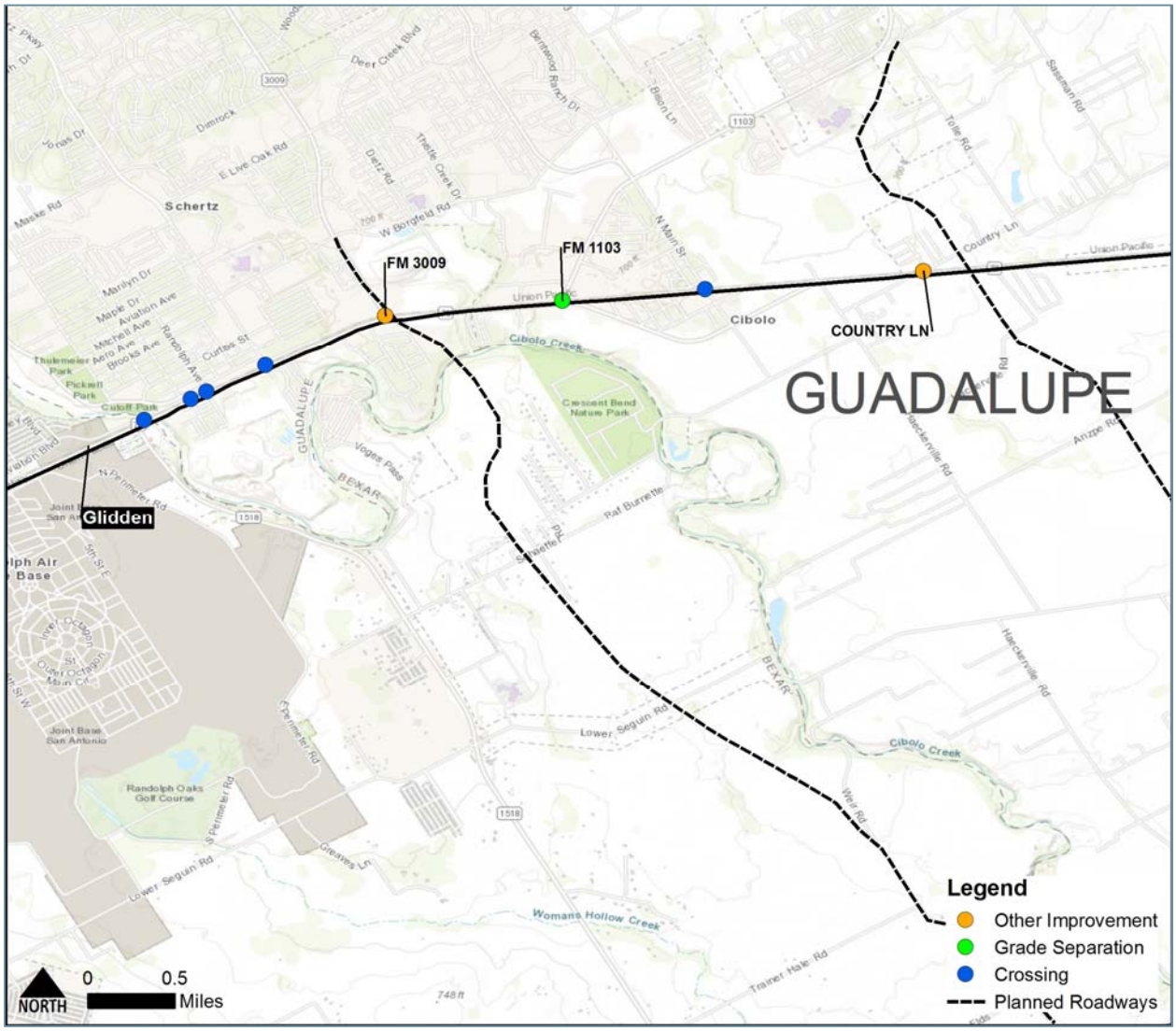
This nearly 28-mile long Subdivision in Bexar County has 37 at-grade crossings, three crossings are under passive control. Only the passive crossing at Shepherd Road experienced an accident in the past five years. Eight other crossings experienced accidents, five of which have a Priority Index that exceeds a value of 50. All passive crossings were reviewed for a warning device upgrade. Even though the Shepherd Road crossing has very low traffic volumes and is essentially a dead-end roadway, the two accidents that occurred in the last five years suggest the need for additional crossing control.

Many of the crossings are constrained by adjacent development and the surrounding street network. Other network enhancements, such as conversion to a one-way street pattern and a rail elevation were explored. A potential grade separation schematic design of the multi-track crossing at Pine Street was developed because of its proximity to UPRR's East Yard. This included a review of both an overpass and an underpass configuration. Both concepts are constrained by design criteria, impact to surrounding development, and constructability issues. The concepts illustrate the challenges associated with implementing grade separations.

Glidden Subdivision (Including portion of Guadalupe County)

The only subdivision being reviewed in Guadalupe County is the Glidden Subdivision through the communities of Schertz and Cibolo as shown in Figure 23.

Figure 23: Guadalupe County – Crossings by Improvement Type



Source: TranSystems and TRIMS

This nearly 12-mile long Subdivision in both Bexar County and a portion of Guadalupe County has 11 at-grade crossings, none of which are under passive control. Six crossings experienced accidents, all with a Priority Index value exceeding 50. The crossings that experienced accidents were reviewed for potential grade separation. The resulting assessment considers grouping several crossings in a more comprehensive network evaluation as part of a rail operational improvements in conjunction with siding extensions. The crossings include Rittiman Road and Walzem Road, as well as a potential grade separation at Woodlake Parkway. A rendering of the grade separation of Rittiman Road is provided in Figure 24.

Figure 24: Grade Separation Rendering – Rittiman on Glidden Subdivision

Source: TranSystems

FM 1103 and FM 3009 in Guadalupe County were selected as examples of the issues that would need to be addressed with a series of crossings all of which are immediately parallel to FM 78. FM 1103 is treated as a three-legged junction, while FM 3009 explores a new alignment to continue farther south and eventually connect with Interstate 10. The rapid growth occurring in the communities of Cibolo and Schertz suggest the need to plan ahead in order to preserve right-of-way to accommodate grade separations of the railroad and the necessary connections to the adjacent highway system.

Kerrville Subdivision

This nearly 15.5-mile long Subdivision in Bexar County has 49 at-grade crossings, fourteen of which are under passive control. Two of the passive crossings experienced one accident

in the past five years. Three other crossings experienced accidents, though none of the Priority Indices exceed a value of 50. All passive crossings were reviewed for a warning device upgrade. Three were reviewed in greater detail. The Blue Star crossing is suggested for a warning device upgrade. The Rivas Street crossing is also suggested for consideration as a roadway closure.

The crossings that experienced accidents were reviewed for potential grade separation. The Wurzbach Street crossing was reviewed at a schematic level to illustrate issues of maintaining adjacent property access. While the network configuration may offer the potential for a grade separation design, there is very little train traffic.

Laredo Subdivision

This nearly 18-mile long Subdivision in Bexar County has 21 at-grade crossings, two of which are under passive control. None of the passive crossings experienced an accident in the past five years. Two crossings experienced accidents, both with a Priority Index value that exceeds 50. Both passive crossings were reviewed for a warning device upgrade. These crossings are for industry service and should continue to be monitored. The crossings that experienced accidents were reviewed for potential grade separation. The Zarzamora Street crossing is already under design for a grade separation by the City of San Antonio. The other crossing at Quintana Road has an indirect connection with an interchange on I-35 (Exit 141). With very low traffic volume, a grade separation is not advanced.

Rockport Subdivision

This nearly 13-mile long Subdivision in Bexar County has 29 at-grade crossings, nine of which are under passive control. Only one of the passive crossings (Kirkpatrick Street) experienced an accident in the past five years. Three other crossings experienced an accident, though none of the Priority Indices exceed a value of 50. All passive crossings were reviewed for a warning device upgrade. Three locations are candidates for roadway closure because nearby crossings are under active control.

The crossings that experienced accidents were reviewed for potential grade separation. One crossing at Loop 13 was advanced to a conceptual level. A key issue at this location is maintaining access to adjacent properties. Additional design investigation is necessary to determine circulation and access. A rendering of the grade separation of Loop 13 is provided in Figure 25.

Other rail operation improvements were reviewed that includes a siding between MP 5.7 and 8.0. This siding affects the Shane Road crossings. A pedestrian only grade separation should be considered with a vehicular closure at Shane Road.

Figure 25: Grade Separation Rendering – Loop 13 on Rockport Subdivision

Source: TranSystems

Salado Lead

This 2.2 mile long industrial lead has seven public at-grade crossings. There are also two spur tracks with an additional four at-grade crossings. A total of seven crossings are under passive control. The Loop 13 (W White Road) crossing controlled by flashing lights only has five lanes and average daily traffic at 19,000 vehicles per day. This crossing experienced one crash in the last five years. The addition of gates and also medians to control vehicular turning movements is considered.

It is worth noting that farther south along the Salado Lead, there is the on-going project with improvement to Interstate 10 that will alter the crossing of Emil Street and at the I-10E Frontage Road.

There are a total of 31 railroad structures over active highways in Bexar County. Eleven of the structures have vertical clearance postings less than 14'-0". More than half of those (six) occur on the Austin 2 Subdivision. Another three occur on the Del Rio Subdivision. The majority of these railroad structures are located within Downtown San Antonio. Additional planning and coordination should occur to identify and integrate any planned roadway improvements that could affect these railroad structures.

A separate document detailing each crossing with summary information, the screening method reviewed and the improvement type considered is provided for Bexar County.

Implementation and Next Steps

The purpose of the Central Texas Grade Crossing Study is to develop a program of projects to improve mobility and reduce vehicular delays associated with the Union Pacific Railroad (UPRR) freight railroad system located in Williamson, Travis, Hays, Comal, and Bexar Counties, Texas through potential improvements to highway-railroad at-grade crossings. With nearly 400 highway-railroad at-grade crossings in the Study Area, only select locations were identified for potential improvements. TxDOT is undertaking this study to provide planning support to its partners in rapidly growing communities along these important freight railroad corridors. Implementation will need to be coordinated among local, state and railroad partners to advance the projects.

Grade Separation Evaluation through Benefit Cost Analysis

To support implementation efforts, a Benefit-Cost Analysis (BCA) for ten conceptual grade separations was completed. Figure 26 provides a location map for the potential grade separations. The grade separations advanced to a concept level were selected because the location could be affected by adjacent railroad operations, other planned transportation networks, or development that indicates rapidly changing conditions.

In Hays County, the Centerpoint Road crossing was selected because of adjacent development pressure and the need for corridor preservation. Multi-lane state highways with at-grade crossings such as SH 21 were also targeted because of their state highway classification.

The potential grade separations on the Austin 1 and Austin 2 Subdivisions (Broadway Street, Basse Road, Binz-Engelman Road, Houston Street) are directly associated with rail siding improvements. The grade crossings on the Glidden Subdivision (Rittiman Road, Walzem Road) are directly associated with railroad yard operations. A new railroad siding on the Rockport Subdivision may result in trains occupying the crossing at Shane Road, although its crossing traffic volumes are currently very low.

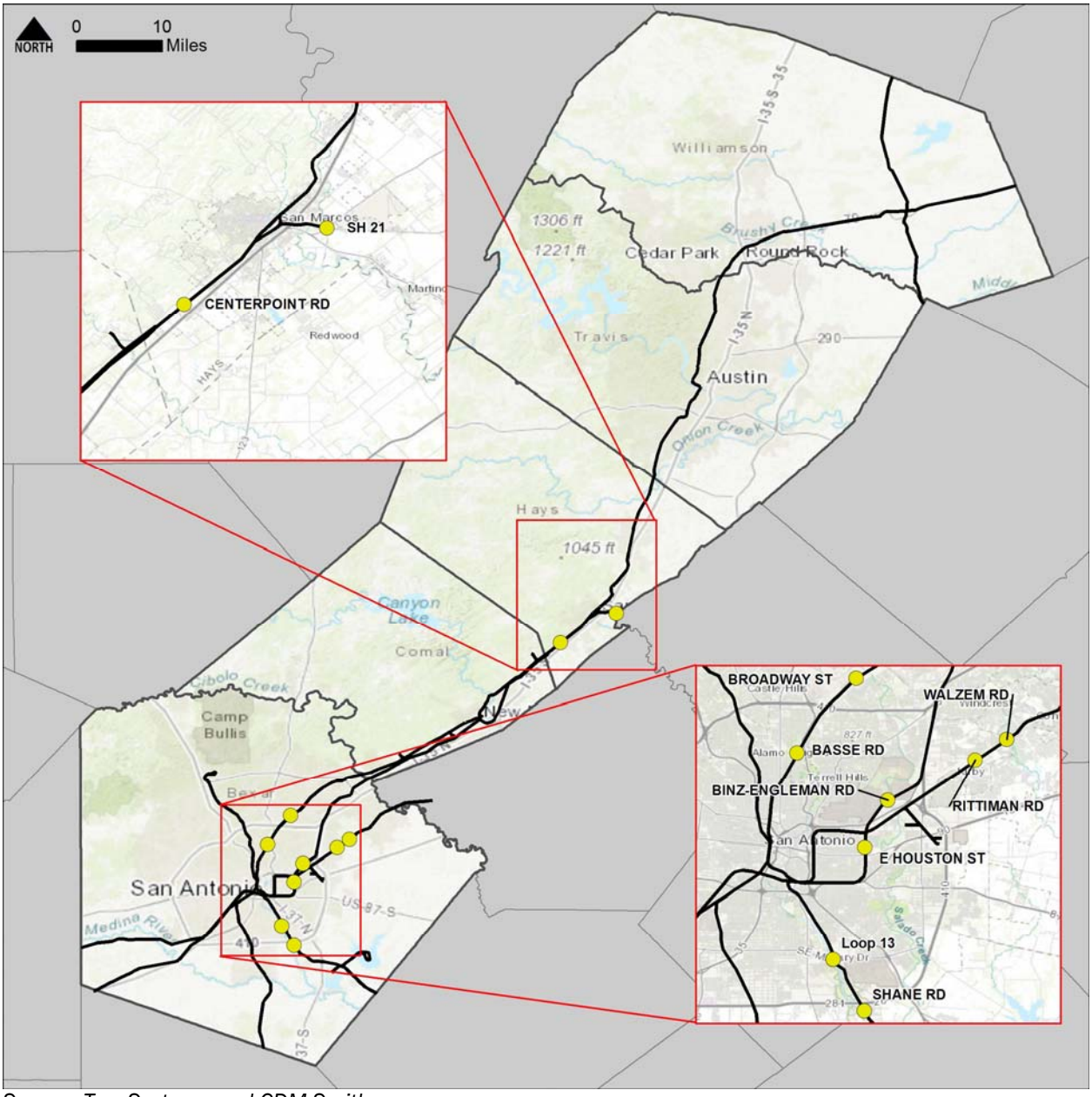
This BCA compares estimated crossing improvement and lifecycle costs to projected monetized societal benefits for each project. Costs and benefits are compared in net-present, real (constant) 2017 dollars.

- *Improvement costs* – Improvement costs include development costs and subsequent annual operations and maintenance (O&M) costs. Development costs comprise: right-of-way (ROW), planning and engineering design (P/E), construction, inspection, and contingencies.
- *Societal benefits* – Resulting monetized benefits primarily include travel efficiencies associated with vehicular savings in: travel time, operating cost, accidents, and

emissions. Pedestrian time savings and railroad operating costs were also considered but were not quantified due to data limitations.

Comparing annual monetized benefits to costs in a BCA framework yields three standardized metrics of economic feasibility: benefit-cost ratio (BCR); net present value (NPV); and internal rate of return (IRR).

Figure 26: Study Area – Benefit-Cost Analysis Grade Separation Locations

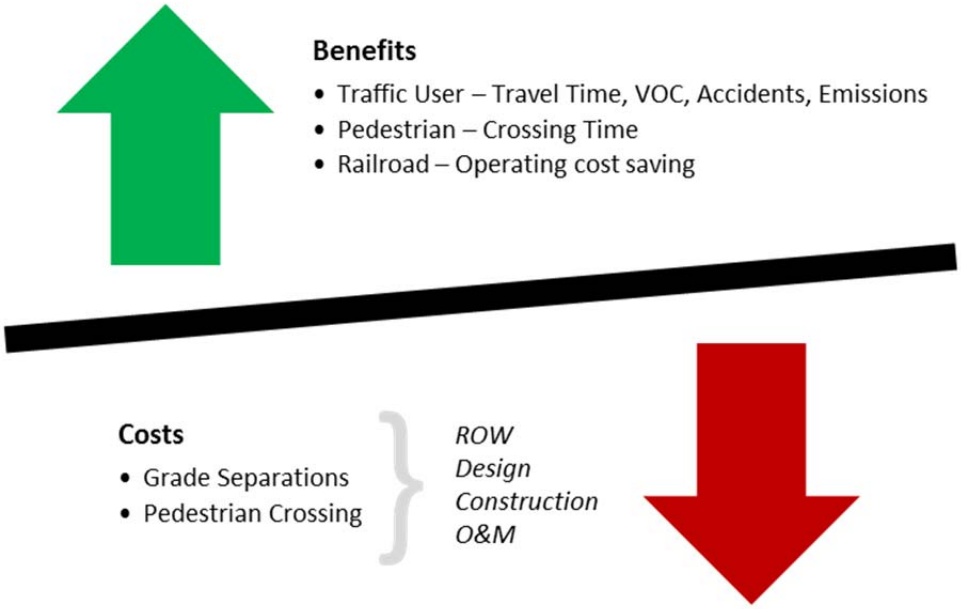


Source: TranSystems and CDM Smith

Methodology

Benefits associated with the ten improvement projects are compared to the total costs (improvements and operation) to ascertain if society is "better-off" economically with the proposed infrastructure and to compare the projects. Conceptually, the improvement cost and benefit types are outlined in Figure 27.

Figure 27: Improvement Costs and Benefits Types



Source: CDM Smith

Costs evaluated predominantly reflect public sector expenditures intended to improve vehicle traffic flows in urban/suburban areas of San Marcos and San Antonio. While not evaluated, private sector UPRR operation costs might also change. Total costs for each project comprise initial improvement phase and subsequent annual operation and maintenance costs. Improvement costs include rights-of-way (ROW), design (planning and engineering), and construction (including inspection and contingency). All costs are presented in constant 2017 dollars. Post-improvement annual maintenance costs are estimated at 0.5% of the improvement phase construction costs. Table 9 summarizes improvement costs by project by type.

Table 9: BCA Grade Separation Improvement Type Costs (in 2017$)

Project	Construction	P/E	ROW	Total
Centerpoint Rd.	$16,000,000	$1,000,000	$100,000	$17,100,000
SH 21	$38,250,000	$2,000,000	$100,000	$40,350,000
Broadway & Bitters Rd	$12,500,000	$750,000	$3,000,000	$16,250,000
Basse Rd.	$22,250,000	$1,000,000	$500,000	$23,750,000
Houston St.	$19,250,000	$1,000,000	$1,000,000	$21,250,000
Walzem Rd	$39,250,000	$2,000,000	$250,000	$41,500,000
Rittiman Rd.	$28,000,000	$1,500,000	$250,000	$29,750,000
Loop 13	$19,250,000	$1,000,000	$100,000	$20,350,000
Shane Rd.	$5,000,000	$800,000	$200,000	$6,000,000
Binz-Engleman	$13,500,000	$750,000	$750,000	$15,000,000
Total	$213,800,000	$11,250,000	$6,250,000	$231,300,000

Source: TranSystems

Discounted project benefits are compared with discounted project costs across the multi-year analysis period from three perspectives. While the results from each perspective indicate the same feasibility finding, the three metrics provide different perspectives as to the dollar magnitude, relativity, and robustness:

- *Net Present Value (NPV)* – discounted benefits less discounted costs; a positive monetary value indicates the investment is economically feasible.
- *Benefit-Cost Ratio (BCR)* – discounted benefits divided by discounted costs; a ratio greater than 1.0 indicates the project is economically feasible.
- *Internal Rate of Return (IRR)* – discount rate at which the present-value of the benefits is equal to the present-value of the costs; an IRR > than the threshold discount rate (either 3% or 7%) indicates the project is economically feasible.

Summary of BCA Results

Economic feasibility metrics (NPV, BCR, and IRR) are summarized for all ten projects in Table 10 under both a modest 3% and conservatively high 7% real discount rate. The red font highlights the infeasible economic metrics for all projects using only project benefits focused immediately at the project site.

Table 10: BCA Grade Separation Economic Evaluation Metric Comparison

Grade Separation	NPV (m. of 2017$)		BCR		IRR
	3%	7%	3%	7%	
Broadway & Bitters Rd	$8.0	-$1.93	1.48	0.87	5.9%
Centerpoint Rd.	-$0.1	-$7.6	0.99	0.52	3.0%
Binz-Engleman	-$5.1	-$8.9	0.67	0.36	0.7%
Rittiman Rd.	-$14.4	-$19.3	0.53	0.30	-0.6%
Walzem Rd	-$24.3	-$29.0	0.44	0.24	-1.7%
Loop 13	-$12.8	-$14.7	0.39	0.22	-2.3%
Houston St.	-$14.6	-$16.0	0.34	0.19	-2.9%
Basse Rd.	-$17.8	-$18.4	0.27	0.16	-4.8%
SH 21	-$36.7	-$34.9	0.12	0.07	-8.0%
Shane Rd.	NA	NA	NA	NA	NA

Source: CDM Smith

- *3% Discount Rate* – Sorted from high to low in terms of economic feasibility, Broadway and Bitters Road is economically feasible at the 3% discount rate with an NPV of $8.0 million, a BCR of 1.48, and an IRR of 5.9% (greater than the discount rate). The second most encouraging project, Centerpoint Road, approaches feasibility at the 3% discount rate with an NPV of -$0.1 million, a BCR of 0.99, and an IRR of 3.0% (nearly the same as the discount rate, followed by Binz-Engleman at a BCR of 0.67.
- *7% Discount Rate* – While the ranking remains the same, the economic feasibility metrics are lower than the 3% rate analysis. For example, the BCR falls to 0.87 for Broadway and Bitters, 0.52 for Center Point Road, and 0.36 for Binz-Engleman. Similarly, the NPV typically falls notably for each project as well.

Ten grade-separation projects were evaluated for economic feasibility, based on available sketch-level assumptions. Vehicular benefits from the grade separations, mostly in terms of travel time and accident savings, are estimated to be insufficient to surpass the improvement costs. Relatively low traffic-user benefits compared to costs stem from multiple factors affecting estimated gate-down time (VHT delay), including the assumed average annual daily traffic (AADT), train speeds, train length, staging, etc. Generally, too few trains, traveling too quickly, and/or interfacing with potentially low forecasted AADT volumes generate insubstantial travel delay benefits to economically justify improvement costs.

The sketch-level BCA conducted is one of several areas of feasibility assessed, other areas include, engineering, environmental, funding, etc. While the BCA does not provide strong economic feasibility metrics, the project may warrant development for other reasons. The results illustrate how sketch-level traffic volume assumptions affect economic feasibility, key variables that affect benefits, and how the various projects compare to one another. Moreover, project feasibility is a function of many quantifiable and qualitative analyses, of which this sketch-level economic analysis is a contributing factor.

To illustrate how a more detailed BCA analysis could improve the economic feasibility of a project, a more detailed review of the Broadway and Bitters Road grade separation was conducted. The original analysis looked at an isolated grade separation and did not acknowledge the potential for greater network benefits from combining improvements along the Austin 1 subdivision. Currently, UPRR uses its main track between Mistletoe Avenue and West Martin Street to hold trains approaching the diamond crossing at Tower 105 (an at-grade railroad-railroad crossing), sometimes coming to a complete stop and occupying 16 at-grade crossings for a period of time each day. A grade separation at Broadway and closure of Bitters would provide UPRR a nearly 20,000-foot distance without an at-grade highway-railroad grade crossing. Accordingly, UPRR could modify its existing 6,850-foot Airport siding in the vicinity of a new grade separation at Broadway and stage its trains there

(instead of between Mistletoe Avenue and West Martin Street), eliminating interference with roadway traffic on those 16 streets.

This revised BCA suggests that such an expanded project (i.e., grade separation and siding) would have a benefit-cost ratio of 1.47 at a 7% discount rate (and a BCR of 2.43 at 3%) and an internal rate of return at 10.9%.

Table 11: Revised Results of Broadway and Bitters BCA with Train Staging for Tower 105

Grade Separation	NPV (m. of 2017$)		BCR		IRR
	3%	7%	3%	7%	
Broadway & Bitters Rd	$32.6	$9.6	2.43	1.47	10.9%

Source: TranSystems

Further economic review of all of the potential grade separations for wider benefits associated with railroad operations and the network-effect of gate-down time on traffic should be considered as projects progress toward implementation.

Next Steps

TxDOT is undertaking this study to provide planning support to its partners in rapidly growing communities along these important freight railroad corridors. Many of the potential improvements are not under TxDOT's jurisdiction. Only State Highway 21 (Lockhart Subdivision) in Hays County and Loop 13 (Rockport Subdivision) in Bexar County are state highways where conceptual grade separations were developed. Only two crossings identified for potential warning device upgrades are on state controlled roadways – Loop 13 (Salado Lead) in Bexar County and FM 1102 (spur crossing) in Comal County. Other identified enhancements, such as installation of pre-signals at various frontage roads will be TxDOT's responsibility.

The communities will need to take the initiative to advance projects, yet TxDOT can assist with coordination if the projects cross multiple jurisdictions or with the UPRR. Rapid growth in the region suggests the need for early planning in several locations including those crossings parallel to State or municipal roadways. Several of these locations suggest the need for a comprehensive corridor planning approach that includes corridor preservation as well as crossing consolidation in conjunction with future grade separations.