St. Michael's Drive (NM 466) &
NM Rail Runner Crossing (NMRX) / Santa Fe Rail Trail Crossing
Roadside Safety Audit (RSA)
FINAL REPORT

September 2014

NMDOT

SMA
Souder, Miller & Associates
Engineering • Environmental • Surveying

TABLE OF CONTENTS

FIGURES

TABLES

DESCRIPTION **PAGE NO.**

APPENDICIES

1.0 PROJECT DESCRIPTION AND SUMMARY

1.1 Location

The project is located at the intersection of St. Michael's Drive (NM 466) and the New Mexico Rail Runner (NMRX) / Santa Fe Rail Trail (SFRT) Crossing in Santa Fe County within the City of Santa Fe, New Mexico. NMRX / SFRT crossing intersects with St. Michael's Drive approximately 0.10 miles west of the intersection of St. Michael's Drive and Calle Lorca. Project Location Map (Figure 1.1) is shown on Page 2 and Project Vicinity Map (Figure 1.2) is located on Page 3. The entire project is located within the City of Santa Fe.

1.2 Project Description

The intersection of St. Michael's Drive and NMRX / SFRT crossing has been identified by the New Mexico Department of Transportation (NMDOT), City of Santa Fe (COSF) and Santa Fe Municipal Planning Organization (SFMPO) to be evaluated for potential safety improvements. The purpose of this report is to identify safety deficiencies and identify alternatives for the crossing.

The St. Michael's Drive & NMRX / SFRT crossing was upgraded as a part of the Rail Runner – Phase II project. This project was led by NMDOT/MRCOG in coordination with the City of Santa Fe and Santa Fe MPO. As a result of this project, the rail crossing on St. Michael's Drive was upgraded to a quiet zone crossing which included rail crossing signals, double crossing gates and a raised median. The double crossing gates were installed to eliminate trains from using horns when approaching the crossing. Along with the double crossing gates, a raised median was installed to eliminate vehicles from being able to cross the intersection as a train approaches. Prior to the Rail Runner project, the SFRT was completed by the City to the south side of St. Michael's Drive. With the Rail Runner project, the SFRT was extended to the north.

1.3 Project Objective

The project objective is to evaluate traffic safety, operations, and to determine if any improvements are warranted to enhance/improve safety and overall operations at the rail/trail crossing.

The City of Santa Fe and Santa Fe MPO have received comments from the community about pedestrian/bicycle safety at this crossing. In August 2011, the City of Santa Fe conducted a pedestrian study to examine safety conditions and operations at the above referenced crossing. The study included evaluating vehicular volumes, pedestrian/bicycle volumes and measuring available gaps for pedestrians.

1.4 Design Criteria

The following is a list of design criteria used in this Roadside Safety Audit (RSA) report:

- Highway Safety Manual, 1st Ed, 2010; AASHTO & FHWA (***HSM***)
- A Policy on Geometric Design of Highways and Streets, 6th Ed. 2011; AASHTO (***Green Book***)
- Roadside Design Guide, 4th Ed. 2011; AASHTO (***RSDG***)
- Manual on Uniform Traffic Control Devices, 2009; FHWA (***MUTCD***)
- Highway Capacity Manual, 5th Ed. 2010; TRB (***HCM***)
- Rails-with-Trails: Lessons Learned, August 2002; FHWA, FRA, NHTSA and FTA
- Roadside Safety Manual; 1st Ed. 2010; AASHTO
- Public Right-of-Way Accessibility Guidelines (PROWAG), July 2011; 36 CFR Part 1190
- Pedestrian Road Safety Audit Guidelines and Prompt List, FHWA; July 2007
- Bicycle Road Safety Audit Guidelines and Prompt List; FHWA, May 2012
- Guide for the Development of Bicycle Facilities; AASHTO, 2012
- Guide for the Planning, Design and Operation of Pedestrian Facilities; AASHTO, July 2004

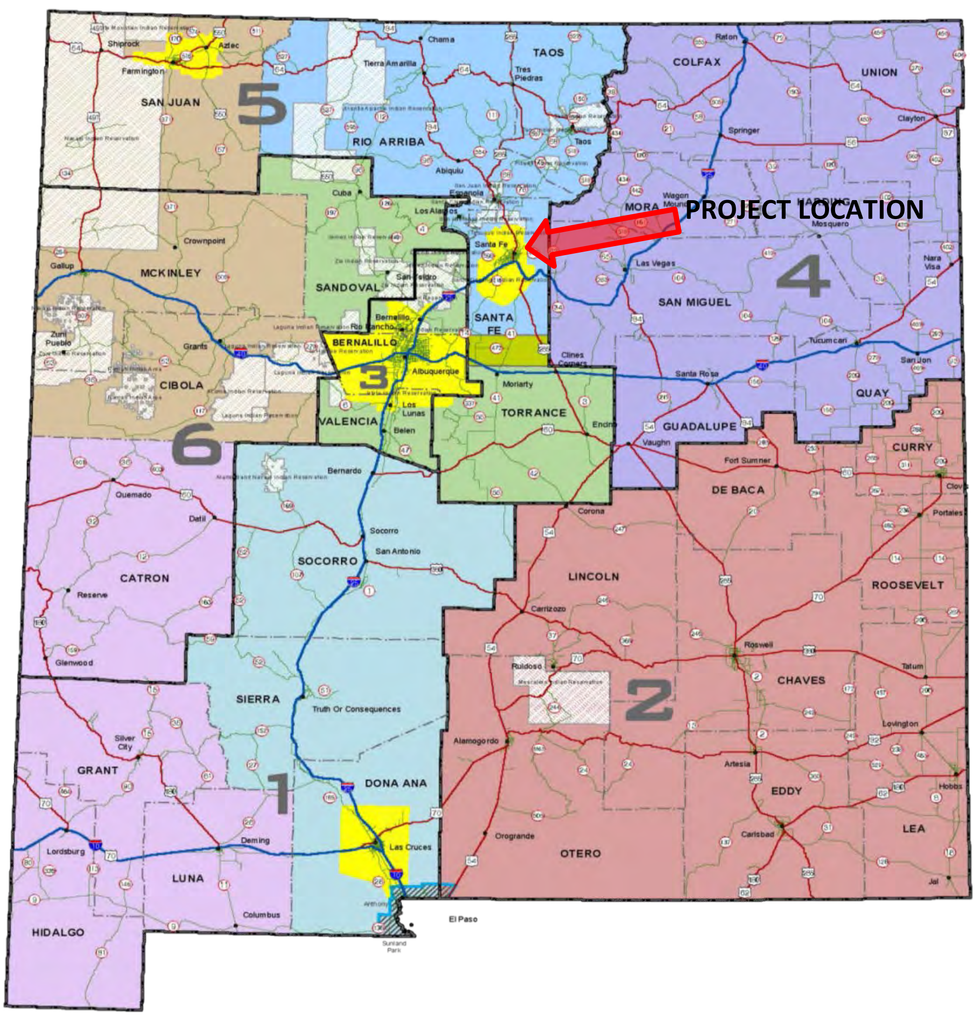

Figure 1.1
Project Location Map

Figure 1.2
Project Vicinity Map

2.0 EXISTING CONDITIONS

2.1 Functional Classifications

St. Michael's Drive (NM 466) is classified by Santa Fe MPO on their Function Classification Map as a Principal Arterial road. As per FHWA, urban roadways are classified as principal arterials, minor arterial streets, collector streets and local streets.

Santa Fe Rail Trail is classified by the Santa Fe Municipal Planning Organization (SFMPO) as a major paved multi-use path.

2.2 Existing Typical Sections

2.2.1 St. Michael's Drive

St. Michael's Drive is a State Route (NM 466) and major principal arterial road that is approximately 3.75 miles in length. St. Michael's Drive begins at the intersection of Cerrillos Road in Santa Fe, NM and terminates at the Interstate 25 interchange (Exit 284) to the east of Santa Fe. Daily AADT along St. Michael's Drive is 25,472 based on 2011 traffic counts conducted by the Santa Fe MPO.

Within the study area, St. Michael's Drive is a six-lane facility and approximately 130' in width (back of sidewalk to back of sidewalk based on field measurements) consisting of 6-12' driving lanes (3 lanes in each direction), 24' raised median separating east/west bound lanes, 24" curb/gutter, 8' landscaped area (8') and 6' sidewalks. Posted speed limit is 40 mph within the project area.

Below are photos showing the lane configurations of eastbound and westbound St. Michael's Drive at the NMRX crossing.

Eastbound St. Michael's Drive
Approaching NMRX Crossing

Westbound St. Michael's Drive
Approaching NMRX Crossing

Figure 2.1
St. Michael's Drive Existing Typical Sections

There are a total of 20 access driveways (10 along the north side and 10 along the south side) on St. Michael's Drive within the study area. These driveways provide access to local business. It was noted during a field review of the project that the proximity of three (3) driveways on the south side of St. Michael's Drive and west of the NMRX/SFRT crossing cause difficulty for motorists to see pedestrians/bicyclists crossing St. Michael's and vice versa. One driveway provides access to a City of Santa Fe facility and the other to a small strip mall and the other to Blake's Lota Burger.

2.2.2. Santa Fe Rail Trail (SFRT)

Santa Fe Rail Trail (SFRT) begins at the intersection of US 285 (South of Santa Fe in Santa Fe County), proceeds north along the Santa Fe Southern rail line and terminates at the Santa Fe Rail Yards in downtown Santa Fe and is approximately 17 miles in length.

Within the project study area, SFRT is approximately 12' in width on both sides of the St. Michael's Drive crossing. Figures 2.2, 2.3 and 2.4 below represent photos of the trail south and north of St. Michael's Drive.

Figure 2.2
Santa Fe Rail Trail south of St. Michael's Drive

Figure 2.3
Santa Fe Rail Trail Median Refuge on St. Michael's Drive

Figure 2.4
Santa Fe Rail Trail north of St. Michael's Drive

2.3 Intersection Traffic Control

St. Michael's Drive and NMRX / SFRT crossing is currently controlled by a railroad crossing. Figure 2.5 below shows three (3) photos identifying the rail crossing traffic control for both eastbound and westbound St. Michael's Drive. This crossing has a railroad signal mastarm with two (2) signal heads and six (6) crossing gates, four (4) crossing gates are for westbound traffic and two (2) crossing gates are for eastbound traffic. This crossing is considered a quiet zone crossing meaning that approaching trains do not sound the horn. There are no crossing gates to stop pedestrian/bicyclist traffic traveling along the sidewalks on St. Michael's Drive from crossing NMRX tracks.

Eastbound St. Michael's Drive
Approaching NMRX Crossing

Westbound St. Michael's Drive
Approaching NMRX Crossing

Figure 2.5
St. Michael's Drive Rail Crossing Traffic Control

The adjacent intersections to the NMRX/SFRT crossing are listed below:

- Calle Lorca (signalized) located approximately 550' east of the NMRX crossing;
- Espinacitas Street/Warner Avenue (unsignalized) approximately 520' west of the NMRX crossing;
- 5th Street (signalized) located 1,230' west of the NMRX crossing.

2.4 Posted Speed Limits

The existing posted speed limit along St. Michael's Drive is 40 mph through the project corridor.

2.5 Pedestrian Facilities

Pedestrian facilities within the project area are 6' sidewalks located on both the north and south sides of St. Michael's Drive.

Figure 2.6
Pedestrian Facilities along St. Michael's Drive at Santa Fe Rail Trail

3.0 ENGINEERING ANALYSIS

3.1 Traffic Data

Existing volume data was requested for the project area from the NMDOT – Planning Division as well as from the Santa Fe Municipal Planning Organization. Historical data provided by NMDOT was dated September 2006, May 2007 and June 2007. AADT from NMDOT is listed below:

September 2006:	30,005
May 2007:	31,579
July 2007:	30,545

No additional AADT data was available from NMDOT. AADT data from the Santa Fe MPO was collected in 2011 and available from the SFMPO web page. The Santa Fe MPO's 2011 AADT Map shows an AADT of 25,472 for St. Michael's Drive near the project site.

24-Hour turning movement counts (TMC) were collected by Mike Henderson Consulting on during the week of September 31, 2013. Specific days counted at the crossing were:

- October 1st (Tuesday)
- October 2nd (Wednesday)
- October 3rd (Thursday)
- October 5th (Saturday)

Turning movement counts (bicycles and pedestrians) were taken on both the north and south of St. Michael's Drive at the NMRX/SFRT crossing. Figures 3.1 and 3.2 on Page 10 identify the locations of weekday and weekend turning movement counts. All approaches of the trail at the crossing were counted.

Figure 3.1
Weekday Pedestrian / Bicycle Turning Movement Counts

Figure 3.2
Weekend Pedestrian / Bicycle Turning Movement Counts

For both the AM and PM peak hours, pedestrian/bicycle use along the SFRT is predominantly in a north/south direction.

Copies of the existing 24-hour turning movement counts for Figures 3.1 and 3.2 are located in in Appendix B.

3.2 Crash Analysis

The purpose of collecting and analyzing historical crash data for a project during consecutive periods is to identify possible crash patterns and to determine the probable cause of those crashes. The crash analysis includes patterns related to roadway conditions; time of day; weather conditions; type of crash; locations (i.e. roadway, intersections, etc.); crash severity and driver characteristics.

3.2.1 Crash Data

Crash data for a five (5) year period (2007 – 2012) was requested from the NMDOT - Traffic Safety Bureau. At the time of our request, crash data for 2013 was not available. After reviewing the crash data, there were a total of 54 crashes reported at the intersections of Warner Avenue, Espinacitas and Calle Lorca. There were no documented crashes between 2007 and 2011 along St. Michael's Drive at NMRX / SFRT crossing. The only documented crash at the NMRX/SFRT crossing occurred in June 2014 when a bicyclist traveling westbound on the St. Michael's Drive sidewalk (north side) collided with a northbound NMRX train. As a result of this collision, the bicyclist was killed. This is the only documented crash involving a pedestrian or bicyclist at the crossing since it was constructed as a part of the New Mexico Rail Runner project. While there are crossing gates along St. Michael's Drive that stops vehicular traffic at the NMRX crossing, there are no crossing gates or signals along the sidewalks on St. Michael's Drive to restrict pedestrian and/or bicycle traffic when a train is approaching.

3.2.2 Crash Analysis

In order to create a comparison between crashes from one location to the other, crash rates are used. These rates are based on data such as traffic volumes, length of road sections considered and period of time in years. Typical crash rate equations for intersections are rates per million entering vehicles (REMV) and for roadway segments are rates per 100 million vehicle miles (RMVM).

$$RMEV = \frac{C \times 1{,}000{,}000}{n * 365 * v}$$

Where:

R = Roadway Crash Rate per million entering vehicles (mev)

C = Total Crashes in an n-year period

n = year period of study (minimum of 3 years, suggested 5 years)

v = total entering volume of vehicles per day

$$RMVM = \frac{C \times 100{,}000{,}000}{n * 365 * I * v}$$

Where:

R = Roadway Crash Rate per 100,000,000 veh-mi

C = Total Crashes in an n-year period

n = year period of study (minimum of 3 years, suggested 5 years)

I = length of roadway in miles

v = total entering volume of vehicles per day

It should be noted that the NMDOT crash information presented yearly is based on modified formula of the crash rate/100-million vehicle miles. Their reports show a crash rate (CR) = total crashes/100 MVM. It could be assumed that the state crash rate calculation is a derivation of methodology typically used by the medical profession, where infection and mortality rates for various diseases are expressed in relation to population. This assumption can be made due to the inclusion of licensed drivers and population data in the crash summary report. Since the state crash rate is significantly higher than typical crash rates calculations, it can be concluded that comparing the state, county or city crash rates to the crash rates developed within this analysis will result in inconsistent comparisons due to the discriminating factors. Also noted, is that state crash rates are only calculated for roadway crashes (RMVM) not intersection crashes. An intersection crash may be included in a roadway crash, but are not provided in a separate calculation (RMEV). This analysis also includes a Critical Rate calculation for segment locations (C_{RI}). The critical rate analysis helps identify locations or spots with observed crash rates higher than would be expected due to normal variation. The critical rate is calculated as follows:

$$C_{(RI)} = R_{(AR)} + k * rt(R_{AI}/m) + 1/(2 * m)$$

Where:

R_{AR} = Average Roadway Crash Rate

k = statistical confidence level (typically 1.645 for a = 0.05)

m = travel on a particular section in million vehciles miles

Table 3.1 below shows the total number of crashes and crash rate per year for each of the intersections within the study area that were reported between 2007 and 2011 at the intersections within the project study area.

YEAR	2007	2008	2009	2010	2011	TOTAL	Average
Location	**St. Michael's Drive & Calle Lorca**						
Number of Crashes	8	12	5	6	8	**39**	**7.8**
Crash Rate	1.056	1.510	0.595	0.679	0.860	**-**	**0.939**
Location	**St. Michael's Drive & Espinacitas**						
Number of Crashes	3	1	2	4	3	**13**	**2.6**
Crash Rate	0.396	0.125	0.238	0.452	0.322	**-**	**0.307**
Location	**St. Michael's Drive & Warner Ave**						
Number of Crashes	0	0	0	2	0	**2**	**0.4**
Crash Rate	0.000	0.000	0.000	0.226	0.000	**-**	**0.045**
	TOTAL						
	11	13	7	12	11	**54**	-

Table 3.1
Crash Data Totals

A break down on the type of collisions (Fatal, Injury and Property Damage Only) are listed below in Table 3.2

Location	Type of Accident		
	Fatal	Injury	PDO
St. Michael's Drive & Calle Lorca	0	12	27
St. Michael's Drive & Espinacitas	0	4	9
St. Michael's Drive & Warner Ave	0	2	0

Table 3.2
Crash Breakdown Totals

Roadway crash rates were calculated between the intersections of Warner Avenue and Calle Lorca. This segment of St. Michael's Drive is approximately .33 miles in length. Roadway crash rates for this segment of St. Michael's Drive are listed below in Table 3.3.

YEAR	2007	2008	2009	2010	2011	TOTAL	Average
Number of Crashes	11	13	7	12	11	**54**	-
Crash Rate	440.18	494.20	252.80	411.71	371.63	-	**394.10**

Table 3.3
Roadway Crash Rate

Detailed crash reports for the project from 2007 thru 2011 are located in Appendix C.

3.3 Pedestrian Study

As previously discussed in the report, the City of Santa Fe conducted a Pedestrian Study in August 2011. The purpose of this report was to examine safety conditions at the NMRX/SFRT and St. Michael's Drive crossing. The study included vehicular volumes, pedestrian bicycle volumes and measuring available gaps for pedestrians.

The based on the pedestrian/bicycle and vehicular counts collected by the City, the crossing warranted a traffic signal based on the criteria outlined in the Manual on Uniform Traffic Control Devices (MUTCD), Part 4 – Traffic Signals. The only warrant that was satisfied was Warrant #4 – Pedestrian Volume; section 4C.05, paragraph 02.B and 03. None of the other warrants met the criteria for signalization.

With only one (1) of the eight (8) warrants satisfied for traffic signalization and that the NMRX crossing approximately 550' west of the intersection of Calle Lorca it was determined not feasible to install a traffic signal at the NMRX/SFRT crossing. After it was determined that the NMRX/SFRT crossing was not feasible to install a traditional traffic signal, City staff evaluated if the NMRX/SFRT crossing met the warrant criteria for a Pedestrian Hybrid Beacon (PHB). Data was analyzed that compared vehicles per hour versus pedestrians and bicyclists during the peak hours (AM, Mid-Day and PM). Based on this data, it was determined that warrant criteria outlined in Chapter 4F (sections 4F.01.07, 4F.01.08 and Figure 4F-2) of the MUTCD were satisfied for a PHB crossing at this location.

3.4 Roadway Capacity Analysis

The primary purpose of performing traffic analyses is to determine the operating characteristics of an identified transportation facility for existing and future conditions and to identify any deficient results. If any deficient results exist, recommendations to improve the facility can be made to improve its' performance.

The operational performance of an intersection and/or highway facility is based on Level of Service (LOS) criteria. LOS is a term used to qualitatively describe roadway and intersection traffic operations. LOS is expressed in letter grade format from A to F, with LOS A representing the best operating conditions and LOS F representing the worst. Per NMDOT State Access Management Manual, LOS C for rural conditions and LOS D for urban conditions are acceptable measures. In either case, a LOS F shall not be accepted for any individual movements. General descriptions of level of service are as follows:

LOS A: Travel time is as efficient as the roadway or intersection facility can provide. Individual users travel unaffected by the presence of other vehicles.

LOS B: Travel time remains efficient. Motorists have a high degree of freedom to select speed and operating conditions, but are slightly influenced by other road users.

LOS C: The efficiency of travel is reduced, but delays are will within reasonable limits. Traffic flow is becoming more restricted as individual users interact substantially with other road users.

LOS D: Travel time continues to increase, and motorist delay approaches but still within reasonable limits. Motorists are able to travel at designated speeds for the facility, but freedom to maneuver in the traffic stream is restricted.

LOS E: Travel time is substantially affected. Delays have reached and may exceed reasonable limits. The capacity of the facility is fully utilized.

LOS F: Travel along the roadway or through an intersection is very inefficient. Traffic flow is forced in the amount of traffic approaching a point exceeds the amount that can be served. The roadway facility fails.

LOS	Density Range (pc / mi / ln)
A	0 - 11
B	> 11 - 18
C	> 18 - 26
D	> 26 - 35
E	> 35 - 45
F	> 45

Table 3.4
LOS Criteria for Multi-Lane Roads

3.4.1 Study Methodology

In order to efficiently analyze the volumes of operation elements previously described, the use of various traffic analysis computer software packages is required. These software programs are developed using the Highway Capacity Manual accepted concepts.

Standard commercial software programs such as the *Highway Capacity Software (HCS)* by McTrans, are used for a variety of roadway and intersection analyses. The HCS is used to analyze freeway, multi-lane, two-lane segments; freeway ramps merge/diverge areas, lane weaving and unsignalized intersections.

3.4.2 Corridor Operations

Current year (2014) AM and PM peak hour conditions for the segment of St. Michael's Drive between Calle Lorca and 5th Street were analyzed for this study. AADT counts used for this analysis were projected to the current year (2014) using data provided by the COSF and SFMPO.

Results of the AM and PM peak hour conditions for St. Michael's Drive are listed below in Table 3.5.

Existing Year (2014) LOS	
AM	PM
D	D

Table 3.5
AM & PM Peak Hour LOS Analysis

Based on the length of the corridor (.33 miles), number of lanes (3 in each direction), posted speed limit and AADT, St. Michael's Drive between Calle Lorca and 5th Street has a LOS D in both the AM and PM peak hours. Based on the NMDOT Access Management Manual, this portion of St. Michael's Drive operates at an acceptable level of service for a multi-lane facility in urban conditions.

Please refer to Appendix D for detailed print outs of the AM and PM peak hour LOS reports for St. Michael's Drive.

4.0 PROPOSED ALTERNATIVES

Based on discussions with NMDOT, City of Santa Fe and the Santa Fe MPO; evaluating traffic conditions and crash data below are six (6) alternatives that have been evaluated for consideration.

4.1 Alternative #1 – Median Refuge Modifications

One concern that has been voiced by the general public to NMDOT, City and MPO staff pertains to the median refuge for this crossing is located behind the crossing gate on the west side of the NMRX crossing. As stated previously in the report, this rail crossing was upgraded as a part of the New Mexico Rail Runner – Phase II project back in 2009. The location of the median refuge behind the crossing gates creates a safety hazard for both pedestrians and bicyclists. When a train approaches the crossing, the gates are lowered and pedestrians/bicyclists traveling northbound on the SFRT are caught in between the gates and the train and are not able to continue north until after the train has cleared the crossing and the gates are in the upright position.

Please see Figure 4.1 below showing the median refuge behind the crossing gates along the west side of the crossing.

Figure 4.1
Median Refuge

A solution to this condition would be to construct a new median refuge approximately 25' west of its current location. By relocating the median refuge outside of the crossing gates will allow pedestrians/bicyclists to cross St. Michael's Drive unobstructed in both directions while the train crosses the St. Michael's Drive and vehicle traffic is stopped. Also by relocating this median refuge from its current location will significantly reduce any chances of a train versus pedestrian/bicyclists incident.

Please refer to Figure 4.2 on Page 13 for a schematic drawing showing the proposed new median refuge location.

Figure 4.2
Alternative #1

Approximate costs for Alternative #1 are as follows:

Surveying & Engineering:	\$2,500.00
Construction Costs:	\$25,000.00
Contingencies (25%):	\$6,875.00
NMGRT (8.8175%):	\$3,031.00
Project Total:	\$37,406.00

4.2 Alternative #2 – SFRT Trail Detour Routes

Alternative #2 would consist of creating detours to direct pedestrians/bicyclists from the current crossing (using existing sidewalks along both sides of St. Michael's Drive) to either the signalized intersection at St. Michael's Drive/Calle Lorca and/or St. Michael's Drive/5th Street. The intersection at Calle Lorca is approximately 580' east and the intersection at 5th Street is approximately 1,185' west of the existing crossing. With this alternative, it would allow pedestrians/bicyclists the ability to safely cross St. Michael's Drive at a signalized crossing instead of having to wait for gaps in traffic at the existing crossing. Current travel time for pedestrians (assuming 3.5 feet/second, which is an industry standard) is 11 seconds to the median refuge and 25.5 seconds to completely cross St. Michael's Drive. With this alternative, travel times for pedestrians would increase to approximately 5 minutes to cross at Calle Lorca and 10 minutes to cross at 5th Street.

This alternative would provide a safer crossing for pedestrians and bicyclists across St. Michael's Drive as it would be at signalized intersection where traffic would be stopped and allow pedestrian/bicyclists to cross. However, with alternative, it will add substantial travel times and distance. Even with a safe crossing at a signalized intersection, it is unlikely pedestrians/bicyclists would use either of these routes knowing the increased travel time.

Approximate construction costs for Alternative #2 would be $0.00.

4.3 Alternative #3 – Pedestrian Hybrid Beacon (**H**igh-Intensity **A**ctivated Cross**W**al**K** – HAWK Signal)

A **P**edestrian **H**ybrid **B**eacon – PHB (formerly known as **H**igh-Intensity **A**ctivated **C**ross**W**al**K** – HAWK Signal) is a special type of hybrid beacon used to warn and control traffic at an unsignalized location to assist pedestrians crossing a street or highway at a marked crosswalk. When activated, the PHB uses a red indication to inform drivers to stop, thereby creating a time period for pedestrians to cross the major roadway. Chapter 4F of the MUTCD Criteria for PHB's are Figure 4.3 shows an example of the current head configuration for the PHB.

Figure 4.3
PHB Signal Head and Sign Configuration

The PHB beacon is not illuminated until it is activated by a pedestrian, triggering the warning flashing yellow lens on the major street. After a set amount of time, the indication changes to a solid yellow light to inform drivers to prepare to stop. The beacon then displays a dual solid red light to drivers on the major street and a walking person symbol to pedestrians. At the conclusion of the walk phase, the beacon displays an alternating flashing red light, and pedestrians are shown an upraised hand symbol with a countdown display informing them of the time left to cross. During the alternating flashing red lights, drivers can proceed after coming to a full stop and checking that pedestrians have already crossed their lane of travel. Each successive driver is legally required to come to a full stop before proceeding during the alternating flashing red phase.

The alternating flashing red phase allows the driver delay to match the actual crossing needs of the pedestrian. Drivers can proceed with a stop-and-go operation during the flashing red phase if a pedestrian walks faster than the assumed walking speed and clears the lanes or roadway, as appropriate. If pedestrians need more time, then the drivers remain stopped until they finish crossing. The ability to balance the needs of the pedestrians with driver delay is a valuable component of the PHB treatment. Concerns have been expressed regarding driver behavior and understanding of the dark phase (not illuminated) and the flashing red phase. Figure 4.4 on Page 15 shows a PHB Beacon and Pedestrian Signal Indication.

Figure 4.4
PHB Beacon and Pedestrian Signal Indications

As a part of the City of Santa Fe's Gap Study conducted in August 2011, the City evaluated if a Pedestrian Hybrid Beacon (PHB) crossing was warranted. Results from the City's showed a standard traffic signal was not warranted. Based on a six-lane facility; posted speed limit of 40 mph; AADT; number of gaps being less 60 per hour; and pedestrian volumes that are greater than the minimum threshold, a PHB was warranted at this location based on this criteria.

The challenging part of installing a PHB at this location is making sure that the signal mast arms for the PHB do not conflict with the railroad mast arms nor interfere with railroad operations. Coordinating the PHB signal with the railroad crossing operations would be similar to that of a standard traffic signal. The traffic signal controller cabinet would have to be after conducting research, there does not

There are concerns about the placement of a PHB as they are to be placed at unsignalized intersections and this crossing in itself is a signalized intersection with the NMRX/SFRT crossing. Concerns with the installation of a PHB are the placement of the mastarms for the PHB's will conflict and obstruct with the mastarm and signal indications for the rail crossing as well as increase travel delays when pedestrians activate the PHB to cross St. Michael's Drive. After conducting research of various Pedestrian/Bicycle publications (Rails-with-Trails: Lessons Learned, Guide for the Development of Bicycle Facilities, Pedestrian Road Safety Audit Guidelines and Prompt List, etc.), as well as searching for locations where PHB and train signals operate together, there appears to not be a condition/location anywhere in the

United States where a PHB has been installed in the same location. One location where there is full pedestrian traffic signal in conjunction with a railroad crossing is in Napa, California. The location is along Jefferson Street in Napa, California. Please refer to Figure 4.5 below showing this crossing.

Figure 4.5
North Bound Jefferson Street approaching Napa Wine Train Crossing

The Napa Valley Wine Train provides a three-hour, thirty-six mile round-trip journey from the historic town of Napa, through one of the world's most known wine valleys to the quaint village of St. Helena, and back. This crossing has a full traffic signal and not a PHB signal. In Figures 4.5, 4.6 and 4.7, the rail signal mastarms are placed in advance of the traffic signal mastarms at the rail/trail crossing. The traffic signals are placed on the opposite side of the rail crossing as to not to interfere with the rail signal mastarm and indications. When activated (with rail signal or traffic signal), traffic is stopped in advance of the rail crossing.

Figure 4.6
Aerial Image of Jefferson Street/Napa Wine Train Crossing

Figure 4.7
Southbound Jefferson Street approaching Napa Wine Train Crossing

For a PBH signal to operate at the NMRX/SFRT crossing as to provide safe travel for pedestrians/bicyclists across St. Michael's Drive as well as to not interfere with the NMRX crossing signal and operations would require placing the PHB on the west side of the NMRX crossing in conjunction with the median improvements identified in Alternative #1. With this installation, eastbound St. Michael's Drive would require adjusting the STOP bar and railroad striping back as to stop traffic in advance of the crosswalk. This would also require traffic to stop at this location when the railroad crossing is active. For westbound St. Michael's Drive, the STOP bar railroad striping would not be affected and could remain at their current location. As a part of operations, it will be critical for the PHB signal to be interconnected with the railroad crossing. This would be similar to when a signalized intersection and a railroad crossing must function together. In this situation, when there is no train approaching a crossing, traffic signal operations for the intersection continue to operate under normal conditions. When a train is approaching a crossing, railroad crossing gates and flasher activate and the traffic signal controller stops vehicular traffic from entering the railroad crossing. Once the train clears the crossing, the intersection traffic signal goes back to normal operations. Under this alternative with a PHB operating in conjunction with a railroad crossing, as a train approaches the crossing, the PHB signals would not operate until after the train clears the crossing. Since the pedestrian/bicycle crossing itself does not interfere with the railroad crossing, when a train is approaching the crossing and vehicular traffic is stopped, pedestrian/bicycle traffic could still safely cross St. Michael's Drive.

With the installation of a PHB, traffic operations along St. Michael's Drive may be impacted. When a pedestrian activates a PHB, travel time to cross St. Michael's Drive is estimated to be 28 seconds per crossing. During peak hours, travel time delays for vehicular traffic along St. Michael's Drive based on pedestrian crossings will be approximately 17 minutes during the AM peak and 23 minutes during the PM peak hours. These potential delays during the peak hours could cause traffic along St. Michael's Drive to queue back to the traffic signal at Calle Lorca (approximately 580' east) as well as 5th Street. Further analysis of this alternative should be evaluated using micro simulation software with more up to date AADT data along St. Michael's Drive to determine the overall delays. Turning movement counts for pedestrian/bicycle traffic should still be adequate to use when conducting this analysis.

Approximate costs for Alternative #3 are as follows:

Surveying & Engineering:	$15,000.00
Construction Costs:	$150,000.00
Contingencies (25%):	$41,250.00
NMGRT (8.8175%):	$18,186.00
Project Total:	$224,436.00

4.4 Alternative # 4 – Median Refuge Modifications with Signal Flashers

Alternative #4 would consist of median refuge modification identified in Alternative #1 along with the following:

- Installation of NMDOT – Type II mast arms with flashing yellow beacons in advance of SFRT crossing with W11-1 and W11-2 or W11-15 signs on the mastarm
- Installation of W11-15 and W16-7PL/W16-7PR signs at the crossing ramps
- Installation of two (2) video detection camera mounted on a NMDOT – Type V pole next to the median refuge within the median

This alternative would not require vehicular traffic to stop while pedestrians/bicyclists cross St. Michael's Drive like a Pedestrian Hybrid Beacon (HAWK) would. With this alternative pedestrians/bicyclists would be detected by video detection cameras mounted in the median, when a pedestrian/bicyclist enter the detection zone of the video cameras, flashers mounted on the mastarms in both directions would be activated warning traffic along St. Michael's Drive of pedestrians/bicyclists approaching the crossing. This type of pedestrian/bicycle crossings have been installed at several locations (Wyoming Boulevard, Eubank Boulevard and Carlisle Boulevard) along major multi-use trails within the City of Albuquerque. The specific locations of these crossings are listed below:

- Wyoming Boulevard – between Indian School Road and Constitution Avenue
- Eubank Boulevard – between Indian School Road and Snow Heights Boulevard
- Carlisle Boulevard – between Comanche Road and Montgomery Boulevard

These pedestrian/bicycle crossings were upgraded to include the mastarms and flashing beacons were installed by the City of Albuquerque in 2010 and 2011. Based on discussions with City of Albuquerque staff (Department of Municipal Development and Traffic Engineering), these locations have been very successful in helping make drivers aware of pedestrians/bicyclists approaching a multi-use trail crossing and reducing crashes between vehicles and pedestrians/bicyclist. These multi-use trail crossings and advanced flashers are located on are similar type of transportation facilities (i.e. posted speed limits, number of driving lanes, raised medians, etc.) to that of St. Michael's Drive.

Location of the Type II mastarms would be approximately 300' away from the crossings with additional W11-15 and W16-7PL/W16-7PR signs mounted at the locations of the crosswalks.

Figure 4.8 on Page 21 shows the advanced flasher with appropriate MUTCD signing on Wyoming Boulevard just south of Indian School Road.

Figure 4.8
Type II Mastarm with Flashers and Pedestrian/Bicycle Signage

Approximate costs for Alternative #4 are as follows:

Surveying & Engineering:	$10,000.00
Construction Costs:	$100,000.00
Contingencies (25%):	$27,500.00
NMGRT (8.8175%):	$12,124.00
Project Total:	$149,624.00

4.5 Alternative #5 – Overhead Structure

Alternative #5 would involve the construction of an elevated bridge structure over St. Michael's Drive. This alternative would improve safety and decrease travel delays from pedestrians/bicyclists having to cross St. Michael's Drive at the current at–grade crossing.

An overhead structure for this crossing would be approximately 120' in length, 12' in width (accommodate pedestrian/bicycle traffic traveling in both directions) and elevated at a minimum of 16' above St. Michael's Drive. Approaches to the overhead structures would be approximately 350' each. The approaches to the bridge would tie-in along the existing trail alignment. In order to build the overhead structure and approaches ramps would require purchasing right-of-way to widen the trail to west. This additional right-of-way would widen the trail to allow pedestrian/bicycle traffic to access the bridge to/from St. Michael's Drive. Right-of-way acquisition to the west would only be allowed as the NMRX rail line is to the east of the trail and would not be viable to purchase. Without detailed engineering design of the bridge structure, it is very difficult to approximate the amount of right-of-way that would be required to build this structure. Contingency costs (25%) were used to approximate what potential right-of-way costs would be.

In discussion with staff from the City of Santa Fe on previous trail crossing projects, while overhead structures reduce crashes between pedestrian/bicyclists they have not been a favorable alternative with the public as they are aesthetically unappealing and impact views around the City.

Approximate costs for Alternative #5 are as follows:

Surveying & Engineering:	$300,000.00
Construction Costs:	$3,000,000.00
Contingencies (25%):	$825,000.00
NMGRT (8.8175%):	$363,721.00
Project Total:	$4,488,721.00

4.6 Alternative #6 – Tunnel Crossing

Alternative #6 would involve the construction of a tunnel (i.e. large concrete box culvert or large corrugated metal pipe) under St. Michael's Drive. Similar to the overhead structure described in Alternative #5, Alternative #6 would improve safety and decrease travel delays from pedestrians/bicyclists having to cross St. Michael's Drive at the current at–grade crossing.

A tunnel structure under St. Michael's Drive would be approximately 120' in length, 12' in width (accommodate pedestrian/bicycle traffic traveling in both directions) and a height of 10'. The depth of the structure beneath St. Michael's Drive would be estimated to be 10' to avoid impacting any utilities (i.e. water, gas, sewer, storm sewer, cable, phone, etc.). Actual depth of the structure would need to be evaluated in greater detail based a detailed location survey and subsurface utility investigations. Approaches to the tunnel would be approximately 400' on the north end and 135' on the south end. The approaches to the bridge would tie-in along the existing trail alignment. In order to build the tunnel structure and approaches ramps would require purchasing right-of-way to widen the trail to west. This additional right-of-way would widen the trail to allow pedestrian/bicycle traffic to access the tunnel to/from St. Michael's Drive. Right-of-way acquisition to the west would only be allowed as the NMRX rail line is to the east of the trail and would not be viable to purchase. Without detailed engineering design of the bridge structure, it is very difficult to approximate the amount of right-of-way that would be required to build this structure. Contingency costs (25%) were used to approximate what potential right-of-way costs would be.

Concerns with this alternative are that tunnel structures create an unsafe environment for pedestrians/bicyclists if the lighting within the structure is vandalized and that drainage would need to be addressed so that water is safely removed (i.e. pump system).

Approximate costs for Alternative #6 are as follows:

Surveying & Engineering:	$150,000.00
Construction Costs:	$1,500,000.00
Contingencies (25%):	$412,500.00
NMGRT (8.8175%):	$181,860.00
Project Total:	$2,224,360.00

5.0 CONCLUSION

Based on field observations and reviewing project documents and data (i.e. traffic counts, crash data, etc.) conclude improvements are warranted along St. Michael's Drive at the NMRX/SFRT crossing location to improve crossing of pedestrians/bicyclists using the SFRT. These improvements need to be conducted without impacting traffic operations of the rail crossing as well St. Michael's Drive.

Purposes of the Roadside Safety Audits (RSA) are to identify safety concerns and to develop and evaluate alternatives to improve safety. As it was discussed earlier in the report, there are significant operational issues associated with pedestrian/bicyclists utilizing the SFRT and crossing St. Michael's Drive at the NMRX/SFRT but there appear to be no safety issues. Prior to the bicyclist fatality that occurred in June 2014, there were no documents crashes between 2007 and 2012 at this crossing between pedestrian/bicyclist and vehicles or the New Mexico Rail Runner. While there are operational delays for pedestrian/bicyclist to cross St. Michael's Drive, there are no safety issues.

Six (6) alternatives have been presented with associated project costs. Each of these alternatives has various advantages and disadvantages. It is not required as a part of the RSA process to recommend a specific alternative. This process needs to be conducted as a part of the NMDOT Location Study Procedures. If the NMDOT deems this project is worthy of moving forward, a formal Location/Alignment Study would need to be conducted to further evaluate the alternatives presented in this report.