

FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN

Task Assignment
MPD 04-08



JUNE 2009
Kimley-Horn
and Associates, Inc.

Arizona Department of Transportation

Pedestrian Safety Action Plan

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Final Report

ADOT Task Assignment MPD 04-08

Prepared by:



Kimley-Horn
and Associates, Inc.

Prepared for:

ARIZONA DEPARTMENT OF TRANSPORTATION



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FINAL REPORT
**PEDESTRIAN SAFETY
 ACTION PLAN**



TABLE OF CONTENTS

EXECUTIVE SUMMARY 1

1.0 INTRODUCTION..... 7

1.1 Problem and Need Statement 7

1.2 Study Overview 7

1.3 Study Area and Scope of the ADOT Pedestrian Safety Action Plan 8

1.4 Tribal Coordination 9

1.5 Purpose and Content of the Final Report..... 9

2.0 PEDESTRIAN SAFETY GOALS AND EMPHASIS AREAS..... 11

3.0 STATE HIGHWAY HIGH PEDESTRIAN CRASH LOCATIONS..... 13

4.0 PRIORITIZATION OF HIGH PEDESTRIAN CRASH LOCATIONS 19

4.1 Segment Prioritization and Methodology..... 19

4.2 Interchange Prioritization and Methodology 24

5.0 POTENTIAL COUNTERMEASURES FOR HIGH PEDESTRIAN CRASH AND TRIBAL COMMUNITY LOCATIONS..... 26

6.0 RECOMMENDED POLICIES AND PROGRAMS..... 69

6.1 Recommended Policies and Programs..... 69

6.2 Suggested Modifications to Policies and Practices for Consideration by ADOT 79

 6.2.1 *ADOT Traffic Engineering Policies, Guidelines and Procedures, January 2000, Section 200 – Traffic Studies, Subsection 240 – Traffic Impact Analysis 79*

 6.2.2 *ADOT Traffic Engineering Policies, Guidelines and Procedures, March 2001, Section 600 – Traffic Signals, Subsection 621 – Signal Phase Change Intervals..... 79*

 6.2.3 *ADOT Traffic Engineering Policies, Guidelines and Procedures, January 2003, Section 700 – Illumination..... 79*

 6.2.4 *ADOT Traffic Engineering Policies, Guidelines and Procedures, November 2008, Section 900 – Pedestrians, Subsection 910 – Pedestrian Crosswalks 79*

 6.2.5 *ADOT Roadway Design Guidelines, Section 107.2 – Pedestrian Facilities..... 85*

 6.2.6 *ADOT Roadway Design Guidelines, Section 404 – Driveway and Turnout Access 86*

 6.2.7 *ADOT Roadway Design Guidelines, Section 408.11 – Right-Turn Channelization..... 86*

7.0 RESPONSES TO FHWA HOW TO DEVELOP A PEDESTRIAN SAFETY ACTION PLAN QUESTIONNAIRE 88

7.1 Goals and Objectives..... 88

7.2 Stakeholders 89

7.3 Data Collection..... 90

7.4 Analyzing Information and Prioritizing Concerns 91

7.5 Providing Funding 93

7.6 Creating the Pedestrian Safety Action Plan 95



FINAL REPORT
**PEDESTRIAN SAFETY
 ACTION PLAN**



TABLE OF CONTENTS

APPENDICES..... 96

Appendix A – Maps of High-crash Locations

LIST OF EXHIBITS

Exhibit E1–Pedestrian Crashes on and off of the State Highway System, 2002 - 2006 1

Exhibit E-3 – Total Cost of Improvements for High Crash Segments..... 3

Exhibit E-4 – Total Cost of Improvements for High Crash Interchanges 5

Exhibit E-5 – Total Cost of Improvements for Tribal Community Locations 5

Exhibit 1-1 – Summary of Pedestrian Crashes on and off of the State Highway System..... 8

Exhibit 1-2 – Arizona State Highway System..... 10

Exhibit 2-1 – Pedestrian Safety Emphasis Areas for State Highway System 12

Exhibit 3-1 – Summary Statistics of Higher Crash State Highway Locations 13

Exhibit 3-2 – List of High Pedestrian Crash State Highway Locations 15

Exhibit 3-3 – Tribal Community Locations 17

Exhibit 4-1 – Segment Prioritization Matrix 22

Exhibit 4-2 – Interchange Prioritization Matrix 25

Exhibit 5-1 – Potential Countermeasures for Segment 1 27

Exhibit 5-2 – Potential Countermeasures for Segment 2 28

Exhibit 5-3 – Potential Countermeasures for Segment 3 29

Exhibit 5-4 – Potential Countermeasures for Segment 4A..... 30

Exhibit 5-5 – Potential Countermeasures for Segment 4B..... 31

Exhibit 5-6 – Potential Countermeasures for Segment 4C..... 32

Exhibit 5-7 – Potential Countermeasures for Segment 5 33

Exhibit 5-8 – Potential Countermeasures for Segment 6 34

Exhibit 5-9 – Potential Countermeasures for Segment 7 35

Exhibit 5-10 – Potential Countermeasures for Segment 8A..... 36

Exhibit 5-11 – Potential Countermeasures for Segment 8B..... 37

Exhibit 5-12 – Potential Countermeasures for Segment 8C..... 38

Exhibit 5-13 – Potential Countermeasures for Segment 11 39

Exhibit 5-14 – Potential Countermeasures for Segment 12 40

Exhibit 5-15 – Potential Countermeasures for Segment 13 41

Exhibit 5-16 – Potential Countermeasures for Segment 14 42

Exhibit 5-17 – Potential Countermeasures for Segment 15 43

Exhibit 5-18 – Potential Countermeasures for Segment 16 44

Exhibit 5-19 – Potential Countermeasures for Segment 17 45

Exhibit 5-20 – Potential Countermeasures for Segment 18 46

Exhibit 5-21 – Potential Countermeasures for Segment 20 47

Exhibit 5-22 – Potential Countermeasures for Segment 21 48

Exhibit 5-23 – Potential Countermeasures for Interchange 1 49

Exhibit 5-24 – Potential Countermeasures for Interchange 3..... 50

Exhibit 5-25 – Potential Countermeasures for Interchange 4..... 51

Exhibit 5-26 – Potential Countermeasures for Interchange 5..... 52

Exhibit 5-27 – Potential Countermeasures for Interchange 9..... 53

Exhibit 5-28 – Potential Countermeasures for Interchange 10..... 54



FINAL REPORT
**PEDESTRIAN SAFETY
 ACTION PLAN**



TABLE OF CONTENTS

Exhibit 5-29 – Potential Countermeasures for Interchange 11	55
Exhibit 5-30 – Potential Countermeasures for Interchange 12	56
Exhibit 5-31 – Potential Countermeasures for Interchange 13	57
Exhibit 5-32 – Potential Countermeasures for Interchange 14	58
Exhibit 5-33 – Potential Countermeasures for Interchange 18	59
Exhibit 5-34 – Potential Countermeasures for Tribal Community Location 1	60
Exhibit 5-35 – Potential Countermeasures for Tribal Community Location 2	60
Exhibit 5-36 – Potential Countermeasures for Tribal Community Location 3	61
Exhibit 5-37 – Potential Countermeasures for Tribal Community Location 4	61
Exhibit 5-38 – Potential Countermeasures for Tribal Community Location 5	62
Exhibit 5-39 – Potential Countermeasures for Tribal Community Location 6	62
Exhibit 5-40 – Potential Countermeasures for Tribal Community Location 7	63
Exhibit 5-41 – Potential Countermeasures for Tribal Community Location 8	63
Exhibit 5-42 – Potential Countermeasures for Tribal Community Location 9	64
Exhibit 5-43 – Potential Countermeasures for Tribal Community Location 10	64
Exhibit 5-44 – Potential Countermeasures for Tribal Community Location 11	65
Exhibit 5-45 – Potential Countermeasures for Tribal Community Location 12	66
Exhibit 5-46 – Potential Countermeasures for Tribal Community Location 13	67
Exhibit 5-47 – Potential Countermeasures for Tribal Community Location 14	67
Exhibit 5-48 – Potential Countermeasures for Tribal Community Location 15	68
Exhibit 6-1 – Access Management Driveway Design	78
Exhibit 6-2 – Proposed 2009 MUTCD Warrant Criteria for a Pedestrian Hybrid Signal	81
Exhibit 6-3 – Recommendations for Installing Marked Crosswalks	84
Exhibit 6-4 – Improved Free Right Turn Lane Design	87



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



EXECUTIVE SUMMARY

Introduction

In 2005, Arizona ranked 5th among states in pedestrian fatalities per 100,000 residents, with 164 pedestrian fatalities on Arizona’s roadways—a nearly 30 percent increase from 2003 levels. To reduce the number of pedestrian crashes in Arizona, the state of Arizona is participating with the Federal Highway Administration (FHWA) to reduce pedestrian crashes, fatalities, and injuries. The Arizona Department of Transportation (ADOT) is leading the initiative in coordination with FHWA Arizona Division Office and the Arizona Governor’s Office of Highway Safety. A key activity of the initiative is development of the ADOT Pedestrian Safety Action Plan. The ADOT Pedestrian Safety Action Plan recommends actions that when funded and implemented will reduce the number and rate of pedestrian crashes, fatalities, and injuries on the Arizona State Highway System. The Plan recommends achievable strategies to improve pedestrian safety on the State Highway System. Elements of the ADOT Pedestrian Safety Action Plan include:

- Identification and prioritization of high-crash segment locations
- Development of conceptual countermeasures and their estimated costs
- Recommendations for new or revisions to existing policies for consideration by ADOT

Crash Statistics, 2002 - 2006

A review of Arizona Motor Crash Facts Summary for the years 2002 through 2006 reveals that 8,033 pedestrian-motor vehicle crashes occurred in Arizona over the 5-year period. **Exhibit E1** lists the number of pedestrian crashes and fatalities that have occurred each year from 2002 to 2006.

Exhibit E1–Pedestrian Crashes on and off of the State Highway System, 2002 - 2006

	Pedestrian Crashes (on all Arizona Roadways), 2002 - 2006			Pedestrian Crashes on the State Highway System, 2002 - 2006		
	Total Pedestrian Crashes	Fatal Pedestrian Crashes	Pedestrian Fatalities	Total Pedestrian Crashes	Fatal Pedestrian Crashes	Pedestrian Fatalities
2002	1,608	147	158	139	30	33
2003	1,595	123	126	152	23	23
2004	1,631	132	135	161	35	35
2005	1,581	161	164	177	40	44
2006	1,618	163	170	142	45	45
TOTAL	8,033	726	753	771	173	180

Source: Arizona Motor Crash Facts Summary, 2002 through 2006

The study area for the ADOT Pedestrian Safety Action Plan is limited to roadways on the Arizona State Highway System. A review of crash data provided by the ADOT for the years 2002 through 2006 demonstrated that 771 pedestrian crashes occurred on roads within the Arizona State Highway System – representing less than 10% of the more than 8,000 pedestrian crashes that occurred on all Arizona roadways from January 1, 2002 to December 31, 2006. The remaining 90% of crashes occurred on roads constructed and maintained by local agencies; city, county, and tribal governments.



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



ADOT recognizes that the ADOT Pedestrian Safety Action Plan only addresses a small percentage of total pedestrian crashes in the state of Arizona. As such, development of the ADOT Pedestrian Safety Action Plan is the first of many steps required to adequately address pedestrian safety in Arizona. It is envisioned that other agencies and jurisdictions in Arizona will develop individual pedestrian safety action plans to meet their respective needs, and that each of the individual pedestrian safety action plans will subsequently be incorporated into a Statewide Pedestrian Safety Action Plan.

Proposed Pedestrian Safety Goal for Arizona

The ADOT Pedestrian Safety Action Plan proposed a goal to reduce pedestrian crashes (both fatal and non-fatal) by 20 percent by the year 2016. The reduction in pedestrian crashes will be measured by a five-year average (2012 to 2016). The five-year average for the years 2002 through 2006 will serve as the base years.

Pedestrian Safety Emphasis Areas

Review and analysis of crash data, coupled with stakeholder and technical advisory committee input lead to identification of pedestrian safety emphasis areas for Arizona. Identification of emphasis areas facilitates focusing of resources to areas where the largest benefits can be realized. Identified emphasis areas are:

- Reduce pedestrian crashes in urban areas at locations with **high pedestrian activity**
- Reduce pedestrian crashes at intersections involving **turning vehicles (right and left)**
- Reduce pedestrian crashes on **undivided (no median barrier) roadways**
- Reduce pedestrian crashes involving **pedestrians who had been drinking**
- Reduce **dart/dash / mid-block** pedestrian crashes
- Reduce pedestrian crashes involving **turning vehicles at interchanges**
- Improve **lighting conditions at high pedestrian activity locations**

High pedestrian Crash Locations, Potential Countermeasures, and Planning Level Cost Estimate

Review of pedestrian crash data led to identification of state highway locations, including segments and interchanges, with the highest numbers of pedestrian crashes. Throughout the development of the Pedestrian Safety Action Plan, the study team recognized the challenges associated with pedestrian crashes on tribal communities: comprehensive crash data on tribal lands is not available in state crash databases; and where data for crashes on tribal lands is available in state databases, it is often incomplete. To ensure that pedestrian safety needs for tribal communities was not overlooked, tribal communities were provided the opportunity to identify specific locations on state highways in need of pedestrian safety improvements.

A list of high pedestrian crash locations is provided in **Exhibit E-3**, and **E-4**. Locations identified by tribal communities are listed in **Exhibit E-5**.

Potential countermeasures that could be considered were identified for each high pedestrian crash location. Potential countermeasures include:

- Crosswalk Striping
- Pedestrian Crossing Warning signs
- "Turning Traffic Must Yield to Pedestrians" signs



FINAL REPORT

PEDESTRIAN SAFETY ACTION PLAN



- “No Right Turn on Red” signs
- Pedestrian Countdown Signals
- Lighting
- Curb Radii Reduction
- Pedestrian Hybrid Signals
- Pedestrian Refuge Islands
- Sidewalks
- Curb Ramps
- Raised Medians

A planning-level cost estimate was subsequently developed for each segment. Conceptual costs of improvements for each segment, interchange, and tribal community location are presented in **Exhibit E-3, E-4, and E-5**.

The total conceptual estimated cost of pedestrian safety projects for high pedestrian crash segments ranges between \$30 million and \$50 million. The lower range excludes construction of raised medians as a pedestrian safety countermeasure. The upper range of the cost estimate assumes that raised median islands are constructed on segments as appropriate.

As presented in **Exhibit E-4**, the total conceptual estimated cost of pedestrian safety projects for high pedestrian crash interchanges is approximately \$500,000.

As presented in **Exhibit E-5**, the total conceptual estimated cost of pedestrian safety improvements for locations identified by the Tribal communities is approximately \$42 million.

Exhibit E-3 – Total Cost of Improvements for High Crash Segments

Segment Number	Road Name	From	To	City	Segment Cost with Raised Median	Segment Cost without Raised Median
1	SR-95 & SR-68	North Oatman Rd (MP 243.5)	Davis Dam Rd (MP 251.3)	Bullhead City	\$14,237,840	\$5,751,440
2	SR-95	Joy Ln (MP 236.4)	Camp Mohave Rd (MP 238.4)	Bullhead City	N/A	\$2,800,920
3	SR-287 (Florence Blvd)	SR-387 (MP 111.8)	Arizola Rd (MP 114.3)	Casa Grande	\$4,777,600	\$2,347,600
4A	SR-40B	Riordan Rd (MP 195.3)	Elden St (MP 196.6)	Flagstaff	\$2,454,080	\$1,257,800
4B	SR-89A	University Ave (MP 402.5)	SR-40B (MP 216.1)	Flagstaff	\$1,279,060	\$723,100
4C	US-180	SR-40B (MP 215.4)	Birch Ave (MP 216.1)	Flagstaff	\$269,920	\$253,600
5	SR-40B	Arrowhead Ave (MP 198.3)	Postal Blvd (MP 199)	Flagstaff	\$1,006,440	\$139,200



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



Exhibit E-3 – Total Cost of Improvements for High Crash Segments (continued)

Segment Number	Road Name	From	To	City	Segment Cost with Raised Median	Segment Cost without Raised Median
6	US-89	Snowflake Dr / Trailsend Dr (MP 420.1)	Townsend Winona Rd (MP 420.7)	Flagstaff	\$951,840	\$382,800
7	SR-40B	5th Ave (MP 286.3)	I-40 Exit 286 G-Ramp (MP 287.4)	Holbrook	\$2,251,480	\$1,052,800
8A	SR-77	I-10 Frontage Rd (MP 68.1)	Limberlost Dr (MP 71)	Tucson	N/A	\$2,231,200
8B	SR-77	River Rd (MP 72)	Sahuaro Vista (MP 75.1)	Tucson	N/A	\$4,269,206
8C	SR-77	Magee Rd (MP 75.9)	Mountain Vista Dr (MP 76.2)	Tucson	N/A	\$402,579
11	SR-90	SR-92 (MP 321.5)	Giulio Cesare Ave (MP 322.5)	Sierra Vista	\$1,933,310	\$757,190
12	US-95	Alamo Dr (MP 25.2)	Avenue 3E (MP 25.8)	Yuma	\$1,442,675	\$766,115
13	SR-8B	1st St (MP 0.3)	32nd St (MP 4)	Yuma	\$5,476,080	\$1,128,000
14	SR-89A	Dry Creek Rd (MP 371)	Soldier Pass Rd (MP 372.9)	Sedona	N/A	N/A
15	SR-387/ Pinal Ave	SR-287 (MP 0)	Cottonwood Ln (MP 1)	Casa Grande	\$1,419,080	\$219,200
16	SR-86	La Cholla Blvd (MP 169.9)	16th Ave (MP 171.7)	Tucson	\$3,077,400	\$1,358,400
17	SR-87 / Arizona Blvd	Martin Rd (MP 131.5)	Vah Ki Inn Rd (MP 133.5)	Coolidge	\$3,751,600	\$1,615,600
18	US-95	SR-8B (MP 23.4)	Redondo Center Dr (MP 24.2)	Yuma	\$1,294,400	\$584,000
20	US-60X/ Apache Trail	Signal Butte Rd (MP 193)	Meridian Rd (MP 194)	Mesa	\$1,925,864	\$737,864
21	US-60X/ Apache Trail	Ellsworth Rd (MP 191)	Crismon Rd (MP 192)	Mesa	\$2,034,704	\$846,704
Total					\$49,583,373	\$29,625,318



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



Exhibit E-4 – Total Cost of Improvements for High Crash Interchanges

Interchange Number	City	On Road	Related State Highway System	Total Interchange Cost
1	Phoenix	Greenway Rd	I-17 Interchange	\$93,200
3	Phoenix	7th Ave	I-10 Interchange	\$6,800
4	Tempe	Apache Blvd	SR-101 / SB Price Rd Interchange	\$8,800
5	Phoenix	Cactus Rd	I-17 Interchange	\$93,200
9	Phoenix	32nd St	SR-202 Interchange	\$46,800
10	Phoenix	Bethany Home Rd	I-17 Interchange	\$52,800
11	Phoenix	Camelback Rd	I-17 Interchange	\$12,800
12	Phoenix	Dunlap Ave	I-17 Interchange	\$52,800
13	Tempe	University Dr	SR-101 / SB Price Rd Interchange	\$22,800
14	Tempe / Mesa	Baseline Rd	I-10 Interchange	\$93,200
18	Phoenix	Indian School Rd	I-17 Interchange	\$13,200
Total				\$496,400

Exhibit E-5 – Total Cost of Improvements for Tribal Community Locations

Location	State Route #	Tribal Community Name	From	To	Total Location Cost
1	SR-587	Gila River Indian Community	MP 220	--	\$300,000
2	SR-87	Gila River Indian Community	MP 135	MP 160	\$11,272,400
3	US-89	Navajo Nation (Cameron)	MP 464.7	MP 470	\$610,000
4	US-160	Navajo Nation (Tuba City)	MP 321.7	MP 323	\$846,643
5	US-160	Navajo Nation (Kayenta)	MP 393	MP 393.7	\$444,032
6	US-163	Navajo Nation (Kayenta)	MP 393.5	MP 395.4	\$3,259,600
7	US-191	Navajo Nation (Chinle)	MP 446.6	MP 448.2	\$3,798,822
8	SR-264	Navajo Nation (Ganado)	MP 446.3	MP 447.6	\$1,070,843
9	SR-264	Navajo Nation (Window Rock)	MP 474.7	MP 475.8	\$1,992,400
10	SR-86	Tohono O'odham Nation	MP 74	MP 76	\$1,450,000
11	SR-86	Tohono O'odham Nation	MP 90	MP 94	\$2,670,000
12	SR-86	Tohono O'odham Nation	MP 111.1	MP 116.6	\$1,755,000
13	SR-264	Hopi Tribe	MP 385	MP 390	\$3,250,000
14	SR-264	Hopi Tribe	MP 367	MP 369	\$766,864
15	SR-73	White Mountain Apache Tribe	Fort Apache Road	SR-260	\$8,170,728
Total					\$41,657,332



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



The Pedestrian Safety Action Plan recommends new policies and programs that upon their development and implementation will serve to reduce pedestrian crashes on the state highway system. In addition, the Plan recommends modifications to existing policies and practices that if adopted will improve pedestrian safety on the state highway system.

High pedestrian Crash Locations, Potential Countermeasures, and Planning Level Cost Estimate

The Pedestrian Safety Action Plan provides recommendations for the policies and programs that ADOT should consider to improve pedestrian safety on the state highway system. These are:

- Develop an ADOT internal pedestrian safety working group
- Develop and adopt an ADOT Pedestrian Policy
- Develop and adopt an ADOT Complete Streets Policy
- Develop traffic impact study agreements with local agencies
- Review all ADOT design and maintenance guidelines and manuals to identify effective measures for accommodating pedestrians on the State Highway System
- Develop partnerships with local law enforcement agencies
- Develop a mechanism to track the level of investment in pedestrian facilities
- Encourage implementation or expansion of educational programs
- Provide pedestrian facility training to state and local governments
- Review existing Arizona Revised Statutes related to pedestrians
- Develop transition plan for implementation of pedestrian countdown signals
- Develop transition plan for implementation of the Americans With Disabilities Act (ADA)
- Adopt Access Management Plan
- Develop an evaluation program



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



1.0 INTRODUCTION

1.1 Problem and Need Statement

In 2005, Arizona ranked 5th among states in pedestrian fatalities per 100,000 residents, with 164 pedestrian fatalities on Arizona’s roadways—a nearly 30 percent increase from 2003 levels. To reduce the number of pedestrian crashes throughout Arizona, the state of Arizona is participating with the Federal Highway Administration (FHWA) as one of fourteen “focus states¹” receiving technical assistance to reduce pedestrian crashes, fatalities, and injuries. The Arizona Department of Transportation (ADOT) is leading the initiative in coordination with FHWA Arizona Division Office and the Arizona Governor’s Office of Highway Safety.

1.2 Study Overview

The purpose of the ADOT Pedestrian Safety Action Plan was to recommend actions that when funded and implemented will reduce the number and rate of pedestrian crashes, fatalities, and injuries on the Arizona State Highway System. The Plan established a framework and practical and achievable strategies to improve pedestrian safety on the State Highway System. The Plan has been developed consistent with the guidance provided in the FHWA Report entitled *How to Develop a Pedestrian Safety Action Plan*² and the *Arizona Supplement*³ that was completed in April 2007 by the ADOT Highway Enhancements for Safety Team. The Plan included stakeholder input, identification and prioritization of high-crash segment locations, development of conceptual countermeasures that could be implemented at each high-crash location, and their estimated costs. The Plan also identified new or revisions to existing policies that ADOT should consider that upon implementation will improve pedestrian safety in Arizona. The Plan included development of five working papers and a final report (<http://mpd.azdot.gov/planning/PedSafety.php>).

	<i>Title</i>	<i>Content</i>
Working Paper No. 1	Profile of Pedestrian Safety in Arizona	Summary of existing pedestrian safety conditions on the state highways in Arizona;
Working Paper No. 2	Goals and Emphasis Areas to Improve Pedestrian Safety in Arizona	Pedestrian safety goals and emphasis areas for ADOT
Working Paper No. 3	Prioritization of Crash Locations and Identification of Pedestrian Crash Countermeasures	Prioritization system to rank locations and recommendations of potential countermeasures, policies, and programs to meet pedestrian safety goals for emphasis areas

¹ States for FY2008 are Arizona, California, District of Columbia, Florida, Georgia, Hawaii, Illinois, Nevada, New Jersey, New Mexico, New York, North Carolina, Pennsylvania, and Texas. The 14 “focus states” were selected if they had at least 150 pedestrian fatalities in 2005, or a pedestrian fatality rate per 100,000 population of greater than 2.5.

² How to Develop a Pedestrian Safety Action Plan, available at: <http://www.walkinginfo.org/library/details.cfm?id=229>

³ A Guide to Developing a Pedestrian Safety Action Plan, An Arizona Supplement to the National “How to Develop a Pedestrian Safety Action Plan” Arizona Department of Transportation, Highway Enhancements for Safety (HES), April 9, 2007, available at: http://www.gtsac.org/GTSAC/Studies_Reports/PDF/Guide_to_Developing_a_Pedestrian_Safety_Action_Plan.pdf



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



Working Paper No. 4	Funding Assessment	Cost estimates for high-crash locations and potential funding sources and collaborative funding alternatives for pedestrian infrastructure on Arizona's highways
Working Paper No. 5	Recommendations and Implementation Steps	Process for selecting and implementing pedestrian safety countermeasures

Throughout the development of the Pedestrian Safety Action Plan, six Technical Advisory Committee (TAC) meetings were held to solicit input and review of the plan and the content of each Working Paper. Attendees of the TAC meetings included the agencies and organizations listed below.

ADOT Flagstaff District	ADOT Roadway Design	City of Flagstaff
ADOT Highway Enhancements for Safety	ADOT Safford District	Inter Tribal Council of Arizona
ADOT Holbrook District	ADOT Traffic Engineering	City of Phoenix
ADOT Kingman District	ADOT Tucson District	Federal Highway Administration
ADOT Multimodal Planning Division	Arizona Department of Public Safety	Flagstaff Metropolitan Planning Organization
	Arizona Governor's Office of Highway Safety	Maricopa Association of Governments

1.3 Study Area and Scope of the ADOT Pedestrian Safety Action Plan

A review of Arizona Motor Crash Facts Summary for the years 2002 through 2006 identifies a total of 8,033 pedestrian-motor vehicle crashes in Arizona over the 5-year period⁴. **Exhibit 1-1** lists the number of pedestrian crashes and fatalities that have occurred each year from 2002 to 2006.

The Arizona State Highway System is depicted in **Exhibit 1-2**. The Arizona Department of Transportation is responsible for maintenance and construction of the Arizona State Highway System. The study area for the ADOT Pedestrian Safety Action Plan is limited to roadways on the Arizona State Highway System. A review of crash data provided by the ADOT for the years 2002 through 2006 demonstrated that 771 pedestrian crashes occurred on roads within the Arizona State Highway System, as listed in **Exhibit 1-1**, representing less than 10% of the more than 8,000 pedestrian crashes that occurred on all Arizona roadways from January 1, 2002 to December 31, 2006. The remaining 90% of crashes occurred on roads constructed and maintained by local city, county, and tribal governments.

Exhibit 1-1 – Summary of Pedestrian Crashes on and off of the State Highway System

	Pedestrian Crashes (on all Arizona Roadways), 2002 - 2006			Pedestrian Crashes on the State Highway System, 2002 - 2006		
	Total Pedestrian Crashes	Fatal Pedestrian Crashes	Pedestrian Fatalities	Total Pedestrian Crashes	Fatal Pedestrian Crashes	Pedestrian Fatalities
2002	1,608	147	158	139	30	33
2003	1,595	123	126	152	23	23
2004	1,631	132	135	161	35	35
2005	1,581	161	164	177	40	44

⁴ Arizona Motor Vehicle Crash Facts, available at: <http://www.azdot.gov/mvd/statistics/crash/index.asp>



FINAL REPORT

PEDESTRIAN SAFETY ACTION PLAN



Exhibit 1-1 – Summary of Pedestrian Crashes on and off of the State Highway System (continued)

2006	1,618	163	170	142	45	45
TOTAL	8,033	726	753	771	173	180

Source: Arizona Motor Crash Facts Summary, 2002 through 2006

ADOT recognizes that the ADOT Pedestrian Safety Action Plan does not address all pedestrian safety needs on all roads in the state of Arizona, as demonstrated by the crash statistics, but that the ADOT Pedestrian Safety Action Plan only addresses a small percentage of total pedestrian crashes in the state of Arizona. As such, development of the ADOT Pedestrian Safety Action Plan is the first of many steps required to adequately address pedestrian safety in Arizona. It is envisioned that other agencies and jurisdictions in Arizona will develop individual pedestrian safety action plans to meet their respective needs, and that each of the individual pedestrian safety action plans will subsequently be incorporated into a Statewide Pedestrian Safety Action Plan. As the large majority of pedestrian crashes and safety issues occur on roadways outside of ADOT control, they need to be addressed by local and regional agencies. The City of Phoenix has already taken the initiative to develop a pedestrian safety action plan.

1.4 Tribal Coordination

Coordination with tribal communities was an important element of development of the ADOT Pedestrian Safety Action Plan. Tribal communities comprise a significant percentage of the land area of Arizona. Tribal input to the ADOT Pedestrian Safety Action Plan was solicited and received through coordination with Inter Tribal Council of Arizona.

All references to *local agencies* within the ADOT Pedestrian Safety Action Plan are inclusive of tribal agencies and governments.

Continued coordination with tribal communities is important as the recommendations of the ADOT Pedestrian Safety Action Plan are implemented. The impacts of recommendations on tribal communities should be considered.

1.5 Purpose and Content of the Final Report

The objective of the Final Report is to summarize the findings and recommendations of the Pedestrian Safety Action Plan. The Final Report includes key findings from each of the five Working Papers. The Final Report is organized into the following sections:

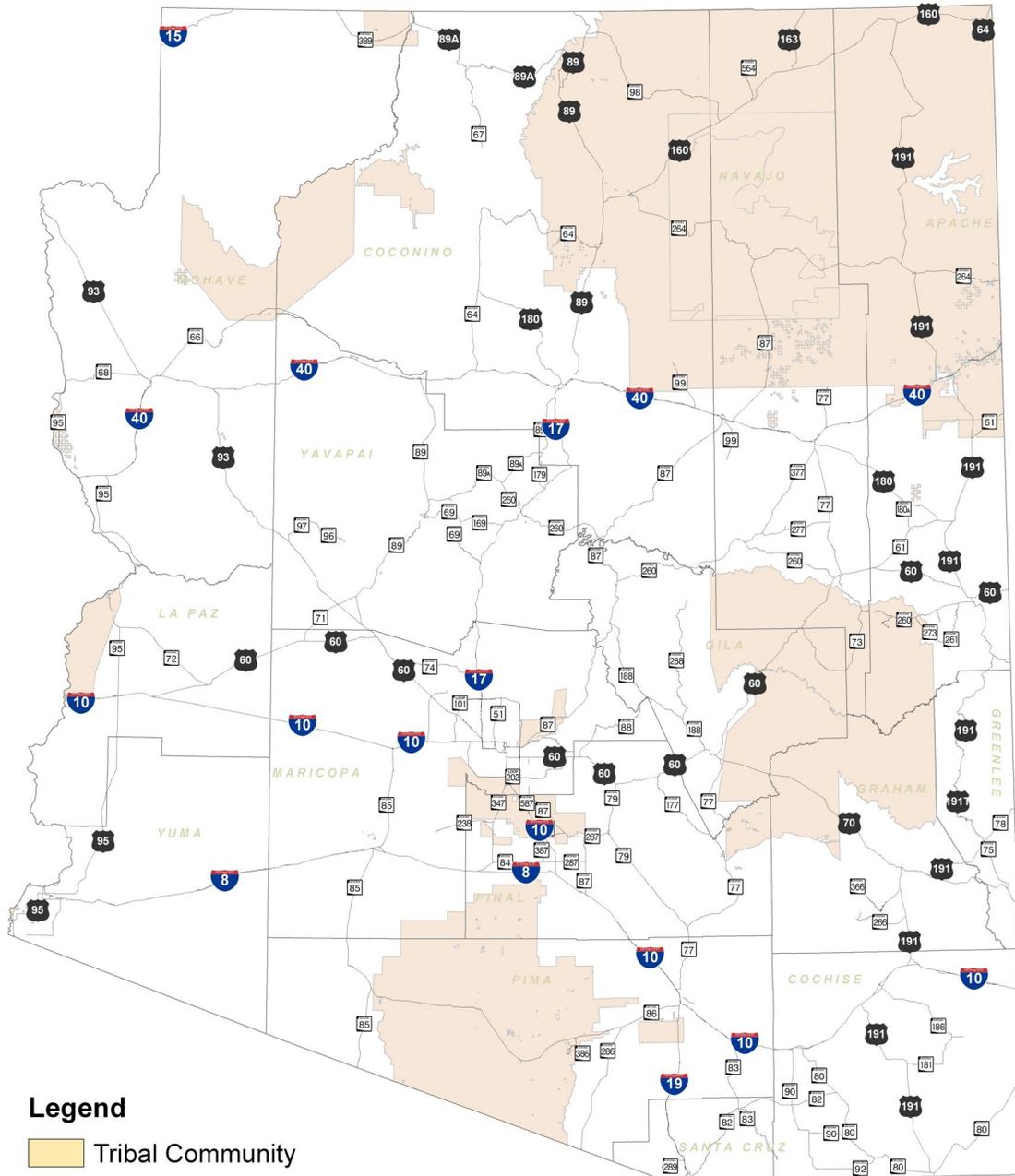
1. Introduction
2. Pedestrian Safety Goals and Emphasis Areas
3. High Pedestrian Crash Locations
4. Prioritization System for High Pedestrian Crash Locations
5. Recommended Countermeasures for High Pedestrian Crash and Tribal Community Locations
6. Recommended Policies and Programs
7. FHWA How to Develop a Pedestrian Safety Action Plan Questionnaire



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



Exhibit 1-2 – Arizona State Highway System





FINAL REPORT
**PEDESTRIAN SAFETY
 ACTION PLAN**



2.0 PEDESTRIAN SAFETY GOALS AND EMPHASIS AREAS

The FHWA and the State of Arizona have each established goals to improve pedestrian safety. In support of the Arizona safety vision and goal and the FHWA goals, the ADOT Pedestrian Safety Action Plan established a goal to reduce pedestrian crashes (both fatal and non-fatal) by 20 percent by the year 2016. The reduction in pedestrian crashes will be measured by a five-year average (2012 to 2016). The five-year average for the years 2002 through 2006 will serve as the base years. This equates to 31 fewer pedestrian crashes per year by the year 2016.

	Vision	Goal
Arizona Strategic Highway Safety Plan, Safety Vision and Goal	“Zero fatalities on Arizona roads, your life depends on it.” ⁵	The vision is supported by a state “stretch” goal designed to bring about clear progress towards the vision. The goal requires a reduction in the number of fatalities on Arizona’s roadways of approximately 12 percent by the year 2012. The base year of comparison will be 2007.
Federal Highway Administration		Reduce pedestrian fatalities and injuries by 10 percent by the year 2011, and by 20 percent in ten years (2005 serves as the baseline year) ⁶
ADOT Pedestrian Safety Action Plan Goal		Reduce the number of pedestrian crashes on Arizona state highways by 20 percent by 2016. This will be measured by the average annual number of pedestrian crashes from 2012 to 2016, compared to the average annual number of pedestrian crashes from 2002 to 2006. From 2002 to 2006, the average annual pedestrian crashes on state highways in Arizona were 154 pedestrian crashes. The 2016 goal is to have fewer than 123 pedestrian crashes on state highways (fatal and non-fatal) per year.

Pedestrian Safety Emphasis Areas for State Highways in Arizona

Crash data for the years 2002 to 2006 was provided to the project team. At the time of the data collection and analysis stage of the project, crash data beyond December 2006 was not yet available. Analysis of the data demonstrated that more than 700 pedestrian crashes occurred on state highways in Arizona from 2002 to 2006.

Ideally, countermeasures could be identified for each contributing factor for each pedestrian crash location. In reality, this is not practical. Identification of emphasis areas facilitates focusing of resources to areas where the largest benefits can be realized, and the identification of specific action items to improve pedestrian safety on Arizona’s state highways. Identified pedestrian safety emphasis areas are presented in **Exhibit 2-1**.

⁵ Arizona Strategic Highway Safety Plan, available at: http://www.gtsac.org/GTSAC/Studies_Reports/

⁶ Federal Highway Administration, Office of Safety, Pedestrian and Bicycle Safety, http://safety.fhwa.dot.gov/ped_bike/



FINAL REPORT
**PEDESTRIAN SAFETY
ACTION PLAN**



Exhibit 2-1 – Pedestrian Safety Emphasis Areas for State Highway System

Pedestrian Safety Emphasis Area	Description and Justification
Reduce pedestrian crashes in urban areas at locations with high pedestrian activity	Statewide, approximately 90 percent of pedestrian crashes occurred in urban areas. 65 percent of pedestrian crashes on state highways occurred in urban areas.
Reduce pedestrian crashes at intersections involving turning vehicles (right and left)	Turning vehicle type crashes make up 26 percent of pedestrian crashes on high-crash segments in focus urban areas.
Reduce pedestrian crashes on undivided (no median barrier) roadways	Pedestrian crashes occurring on two-way roadways without a raised median account for approximately 64 percent of statewide pedestrian crashes.
Reduce pedestrian crashes involving pedestrians who had been drinking	On high-crash segments, crashes involving pedestrians who had been drinking total 27 percent of crashes along segments and 22 percent of pedestrian crashes at interchanges. Alcohol consumption by pedestrians has also been expressed as a concern by local jurisdiction staff and by tribal communities.
Reduce dart/dash / mid-block pedestrian crashes	<p>Crash data for the study areas shows that dart/dash crashes make up 50 percent of the pedestrian crashes along segments and 43 percent of pedestrian crashes at interchanges. Targeting these types of crashes can help to reduce a significant amount of pedestrian crashes.</p> <p>Dart/dash crashes include crashes when the pedestrian walked or ran into the roadway at an intersection or mid-block location and was struck by a vehicle.</p>
Reduce pedestrian crashes involving turning vehicles at interchanges	<p>At interchanges 46 percent of pedestrian crashes are turning vehicle crashes with the majority being right-turning vehicles. Focusing on these types of pedestrian crashes may help to make crossing safer for pedestrians at interchanges.</p> <p>Turning vehicle crashes are crashes where the pedestrian was attempting to cross at an interchange and was struck by a vehicle that was turning right or left.</p>
Improve lighting conditions at high pedestrian activity locations	Approximately 50 percent of pedestrian crashes in high-crash segments occurred in dark conditions. This is significant since exposure is considerably less during the nighttime and early morning hours. A majority of pedestrian fatalities occur in dark conditions.



FINAL REPORT

PEDESTRIAN SAFETY ACTION PLAN



3.0 STATE HIGHWAY HIGH PEDESTRIAN CRASH LOCATIONS

771 pedestrian crashes were reported on state highways in Arizona between January 1, 2002 and December 31, 2006. State highway locations, including segments and interchanges, with the highest numbers of pedestrian crashes were identified based on density analysis using geographic information system tools and a visual review of crash locations. Crash records for high pedestrian crash locations were subsequently obtained and reviewed. Crash records were reviewed for 283 segment crashes and 37 interchange crashes. The crash type and contributing factors were identified for each reviewed crash.

A summary of crash statistics is presented in **Exhibit 3-1**. Crash types listed in **Exhibit 3-1** are based on definitions in the Pedestrian Bicycle Crash Analysis Tool (PBCAT)⁷ and Pedestrian Safety Guide and Countermeasure Selection System (PEDSAFE)⁸. The definitions for each crash type are listed in **Exhibit 3-1**.

Exhibit 3-2 lists each high pedestrian crash location. A map of each high-crash location is included in **Appendix A**.

Throughout the development of the Pedestrian Safety Action Plan, the study team recognized the challenges associated with pedestrian crashes on tribal communities: comprehensive crash data on tribal lands is not available in state crash databases; and where data for crashes on tribal lands is available in state databases, it is often incomplete. To ensure that pedestrian safety needs for tribal communities was not overlooked, tribal communities were provided the opportunity to identify specific locations on state highways in need of pedestrian safety improvements. Locations identified by tribal communities are displayed in **Exhibit 3-3**. **Exhibit 3-3** lists the state highway location, existing pedestrian facilities, and concerns as expressed by tribal communities. Maps showing each location are included in **Appendix A**.

Exhibit 3-1 – Summary Statistics of Higher Crash State Highway Locations

Segments	Total Crashes		Fatalities		Incapacitating Injuries	
	Count	Percentage	Count	Percentage	Count	Percentage
Crash Type						
Pedestrian Failed to Yield: Pedestrian was crossing the road in a non-crossing area and failed to yield to the motorist.	125	44%	23	74%	38	57%
Walking in Roadway: Pedestrian was walking in the roadway prior to the crash, but the crash cannot be further classified.	10	4%	4	13%	3	4%
Standing in Roadway: Pedestrian was standing in the roadway prior to the crash, but the crash cannot be further classified.	1	0%	0	0%	0	0%
Motorist Left Turn - Parallel Paths: Motorist was initially traveling on a parallel path with the pedestrian before making a left turn and striking the individual.	32	11%	0	0%	3	4%

⁷ Pedestrian and Bicycle Crash Analysis Tool (PBCAT), available at: <http://www.walkinginfo.org/facts/pbcats/index.cfm>

⁸ Pedestrian Safety Guide and Countermeasure Selection System, available at: <http://www.walkinginfo.org/pedsafe/>



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



Exhibit 3-1 – Summary Statistics of Higher Crash State Highway Locations (continued)

Segments (continued)	Total Crashes		Fatalities		Incapacitating Injuries	
	Count	Percentage	Count	Percentage	Count	Percentage
Crash Type						
Motorist Left Turn - Perpendicular Paths: Motorist was initially traveling on a crossing path with the pedestrian before making a left turn and striking the individual.	5	2%	0	0%	1	1%
Motorist Right Turn - Parallel Paths: Motorist was initially travelling on a parallel path with the pedestrian before making a right turn and striking the individual.	15	5%	0	0%	3	4%
Motorist Right Turn - Perpendicular Paths: Motorist was initially travelling on a crossing path with the pedestrian before making a right turn and striking the individual.	27	10%	0	0%	4	6%
Through Vehicle at Signalized Location: Pedestrian was struck at a signalized intersection or midblock location by a vehicle that was traveling straight ahead.	28	10%	1	3%	6	9%
Through Vehicle at Unsignalized Location: Pedestrian was struck at an unsignalized intersection or midblock location. Either the motorist or the pedestrian may have failed to yield.	9	3%	1	3%	5	7%
Multiple Threat/Trapped: Pedestrian entered the roadway in front of stopped or slowed traffic and was struck by a multiple-threat vehicle in an adjacent lane after becoming trapped in the middle of the roadway.	2	1%	0	0%	1	1%
Walking Along Roadway: Pedestrian was standing or walking along the roadway on the edge of a travel lane, or on a shoulder or sidewalk.	3	1%	1	3%	1	1%
Non-Roadway: Pedestrian was standing or walking near the roadway edge, on the sidewalk, in a driveway or alley, or in a parking lot, when struck by a vehicle.	19	7%	0	0%	1	1%
Unique Midblock: Pedestrian was struck while crossing the road to/from a mailbox, newspaper box, or ice-cream truck, or while getting into or out of a stopped vehicle.	1	0%	0	0%	0	0%
Miscellaneous: Other pedestrian crash types such as intentional crashes, driverless vehicle incidents, a pedestrian struck after a vehicle/vehicle collision, a pedestrian struck by falling cargo, or an emergency vehicle striking a pedestrian.	6	2%	1	3%	1	1%
Total Segment Crashes	283		31		67	
Interchanges						
Pedestrian Failed to Yield: Pedestrian was crossing the road in a non-crossing area and failed to yield to the motorist.	19	36%	3	75%	6	40%
Motorist Left Turn - Parallel Paths: Motorist was initially traveling on a parallel path with the pedestrian before making a left turn and striking the individual.	2	4%	0	0%	1	7%



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



Exhibit 3-1 – Summary Statistics of Higher Crash State Highway Locations (continued)

	Total Crashes		Fatalities		Incapacitating Injuries	
Interchanges (continued)						
Motorist Left Turn - Perpendicular Paths: Motorist was initially traveling on a crossing path with the pedestrian before making a left turn and striking the individual.	2	4%	0	0%	0	0%
Motorist Right Turn - Parallel Paths: Motorist was initially travelling on a parallel path with the pedestrian before making a right turn and striking the individual.	7	13%	0	0%	2	13%
Motorist Right Turn - Perpendicular Paths: Motorist was initially travelling on a crossing path with the pedestrian before making a right turn and striking the individual.	9	17%	0	0%	2	13%
Through Vehicle at Unsignalized Location: Pedestrian was struck at an unsignalized intersection or midblock location. Either the motorist or the pedestrian may have failed to yield.	9	17%	0	0%	3	20%
Miscellaneous Other pedestrian crash types such as intentional crashes, driverless vehicle incidents, pedestrian struck after a vehicle/vehicle collision, pedestrian struck by falling cargo, or an emergency vehicle striking a pedestrian.	5	9%	1	25%	1	7%
Total	53		4		15	

Exhibit 3-2 – List of High Pedestrian Crash State Highway Locations

Segments	City	Location	Total Crashes	Fatal and Incapacitating Crashes
1A	Bullhead City	SR-95, North Oatman Rd to SR-68	24	12
1B	Bullhead City	SR-68, SR-95 to Davis Dam Rd	2	2
2	Bullhead City	SR-95, Joy Ln to Camp Mohave Rd	7	4
3	Casa Grande	SR-287, SR-387 to Arizola Rd	24	5
4A	Flagstaff	SR-40B, Riordan Rd to Elden St	28	10
4B	Flagstaff	SR-89A, University Ave to SR-40B	15	4
4C	Flagstaff	US-180, SR-40B to Birch Ave	4	1
5	Flagstaff	SR-40B, Arrowhead Ave to Postal Blvd	11	3
6	Flagstaff	US-89, Snowflake Dr / Trailsend Dr to Townsend Winona Rd	5	2
7	Holbrook	SR-40B, 5th Ave to I-40 Exit 286 G-Ramp	17	3
8A	Tucson	SR-77, I-10 Frontage Rd to Limberlost Dr	23	9
8B	Tucson	SR-77, River Rd to Sahuaro Vista	21	10
8C	Tucson	SR-77, Magee Rd to Mountain Vista Dr	6	3



FINAL REPORT

PEDESTRIAN SAFETY ACTION PLAN



Exhibit 3-2 – List of High Pedestrian Crash State Highway Locations (continued)

	City	Location	Total Crashes	Fatal and Incapacitating Crashes
Segments (continued)				
11	Sierra Vista	SR-90, SR-92 to Giulio Cesare Ave	7	3
12	Yuma	US-95, Alamo Dr to Avenue 3E	5	3
13	Yuma	SR-8B, 1st St to 32rd St	29	11
14	Sedona	SR-89A, Dry Creek Rd to Soldier Pass Rd	14	4
15	Casa Grande	SR-387, SR-287 to Cottonwood Ln	7	0
16	Tucson	SR-86, La Cholla Blvd to 16th Ave	12	4
17	Coolidge	SR-87, Vah Ki Inn Rd to Martin Rd	10	2
18	Yuma	US-95, SR-8B to Redondo Center Dr	4	2
20	Mesa	US-60X / Apache Trail, Signal Butte Rd to Meridian Rd	4	0
21	Mesa	US-60X / Apache Trail, Ellsworth Rd to Crismon Rd	4	3
Interchanges				
1	Phoenix	Greenway Rd / I-17 Interchange	3	2
3	Phoenix	7th Ave / I-10 Interchange	2	2
4	Tempe	Apache Blvd / SR-101 Interchange	3	2
5	Phoenix	Cactus Rd / I-17 Interchange	4	2
9	Phoenix	32nd St / SR-202 Interchange	5	2
10	Phoenix	Bethany Home Rd / I-17 Interchange	5	2
11	Phoenix	Camelback Rd / I-17 Interchange	6	1
12	Phoenix	Dunlap Ave / I-17 Interchange	7	2
13	Tempe	University Dr / SR-101 Interchange	9	4
14	Tempe	Baseline Rd / I-10 Interchange	5	0
18	Phoenix	Indian School Rd / I-17 Interchange	4	1



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



Exhibit 3-3 – Tribal Community Locations

Location ID	State Route #	Tribal Community Name	Beginning	Ending	Existing Pedestrian Facilities	Tribal Community Concerns
1	SR-587	Gila River Indian Community	MP 220	--	Paved shoulders	<ul style="list-style-type: none"> ▪ Need for improved shoulders
2	SR-87	Gila River Indian Community*	MP 135	MP 160		<ul style="list-style-type: none"> ▪ Need for wider shoulders and lighting in residential areas ▪ Need signage alerting drivers entering residential areas ▪ Need better enforcement of speed
3	US-89	Navajo Nation (Cameron)	MP 464.7	MP 470	Paved shoulders	<ul style="list-style-type: none"> ▪ Lack of sidewalks ▪ Lack of street lighting
4	US-160	Navajo Nation (Tuba City)	MP 321.7	MP 323	Narrow paved shoulders	<ul style="list-style-type: none"> ▪ Lack of sidewalks ▪ Lack of street lighting
5	US-160	Navajo Nation (Kayenta)	MP 393	MP 393.7	Narrow paved shoulders	<ul style="list-style-type: none"> ▪ Lack of sidewalks ▪ Lack of street lights
6	US-163	Navajo Nation (Kayenta)	MP 393.5	MP 395.4	Narrow paved shoulders	<ul style="list-style-type: none"> ▪ Needs raised median ▪ Needs pedestrian crossing
7	US-191	Navajo Nation (Chinle)	MP 446.6	MP 448.2	Narrow paved shoulders, sidewalks	<ul style="list-style-type: none"> ▪ Needs raised median ▪ Needs pedestrian crossing
8	SR-264	Navajo Nation (Ganado)	MP 446.3	MP 447.6	Narrow paved shoulders	<ul style="list-style-type: none"> ▪ Lack of sidewalks ▪ Needs pedestrian crossing
9	SR-264	Navajo Nation (Window Rock)	MP 474.7	MP 475.8	Sidewalks	<ul style="list-style-type: none"> ▪ Needs raised median ▪ Needs pedestrian crossing
10	SR-86	Tohono O'odham Nation	MP 74	MP 76	Unpaved shoulders	<ul style="list-style-type: none"> ▪ No shoulders for pedestrians or cyclists ▪ Roads are narrow ▪ Vegetation is overgrown ▪ Lack of lighting
11	SR-86	Tohono O'odham Nation	MP 90	MP 94	Unpaved shoulders	<ul style="list-style-type: none"> ▪ No shoulders for pedestrians or cyclists ▪ Roads are narrow ▪ Overgrown Vegetation ▪ Lack of lighting
12	SR-86	Tohono O'odham Nation	MP 111.1	MP 116.6	Unpaved shoulders	<ul style="list-style-type: none"> ▪ No shoulders for pedestrians or cyclists ▪ Roads are narrow ▪ Vegetation is overgrown ▪ Lack of lighting



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



Exhibit 3-3 – Tribal Community Locations (continued)

Location ID	State Route #	Tribal Community Name	Beginning	Ending	Existing Pedestrian Facilities	Tribal Community Concerns
13	SR-264	Hopi Tribe	MP 385	MP 390	Narrow paved shoulders	<ul style="list-style-type: none">No crosswalks near Second Mesa Elementary SchoolNo sidewalks, bus stop provisions, or turn lanes
14	SR-264	Hopi Tribe	MP 367	MP 369	Narrow paved shoulders	<ul style="list-style-type: none">Need of pedestrian/bicycle walkway, school bus stop areas, and turn-out lanes
15	SR-73	White Mountain Apache Tribe	Fort Apache Road	SR-260	Paved shoulders, sidewalks	<ul style="list-style-type: none">Incomplete sidewalksVegetation growing on sidewalks



FINAL REPORT
**PEDESTRIAN SAFETY
 ACTION PLAN**



4.0 PRIORITIZATION OF HIGH PEDESTRIAN CRASH LOCATIONS

Chapter 4 summarizes prioritization of each of the high-crash locations identified in Chapter 3. Prioritization of high-crash locations serves as a tool for allocating resources to improve pedestrian safety. The prioritization methodology is described below for both segments and interchanges. A detailed explanation of the scoring methods can be found in Working Paper No. 3 (<http://mpd.azdot.gov/planning/PedSafety.php>).

It should be noted that the segment prioritization methodology described in chapter 4 is more applicable to urban or small urban areas. As such, the methodology was not applied to high pedestrian crash locations on tribal lands. The assessment of needs on tribal lands was more heavily reliant on direct tribal input.

4.1 Segment Prioritization and Methodology

A prioritization scoring system was developed by the study team to be applied to each high pedestrian crash location. The prioritization scoring system consists of criteria that quantify the need for pedestrian safety improvements at each high-crash location. The four categories (described below) include:

- Pedestrian Demand Index
- Pedestrian Safety Deficiency Index
- Stakeholder Input, and
- Crash Severity Index

Each high-crash segment was scored for each criterion. An overall composite score was subsequently calculated to represent the overall priority score for each segment, according to the equation below.

$$\text{Overall Score} = \text{Pedestrian Demand Index Score} + \text{Pedestrian Safety Deficiency Index Score} + \text{Stakeholder Input Score} + \text{Crash Severity Index Score}$$

Note:

Pedestrian Safety Deficiency Index Score was weighted by one sixth to account for the fact that this index score is comprised of six deficiency factor sub-scores.

Prioritization Criterion	Description
Pedestrian Demand Index ⁹	<p>Reflects the propensity for pedestrian facilities to be utilized if they were provided; comprised of four sub-indices that are developed on a census tract basis:</p> <ol style="list-style-type: none"> 1. <u>Activity Balance Index</u> (ABI): Measure of relationship between population and employment; computed by dividing employment by population. The results are subsequently divided into five quintiles and assigned a score of 1 to 3 where: <ul style="list-style-type: none"> - 1 = results in outer quintiles; (the most imbalance between employment and population) - 2 = zones in second and fourth quintile - 3 = zones in the middle quintile

⁹ Pedestrian Demand Index adapted from methodology published by: Matley, T., Goldman, L., Fineman, B., Pedestrian Travel Potential in Northern New Jersey. A Metropolitan Planning Organization’s Approach to Identifying Investment Priorities. In *Transportation Research Record 1705*, TRB, National Research Council, Washington, D.C., 2000; available at: <http://www.enhancements.org/download/trb/1705-001.pdf>



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



GIS data required: (1) population data, and (2) employment data by census tract.

2. Pedestrian Facilities Index (PFI): Measure of the urbanization and population density; computed by calculating population divided by land area for each census tract. The results are divided into quintiles and assigned a score of 1 to 5 where:
 - 1 = lowest results, or least relative index value; and
 - 5 = highest relative index value (most urban or densest population).

GIS data required: (1) population data, and (2) land area of census tract.

3. Road Density Index (RDI): Measure of urbanization computed as the total number of miles of non-limited access highway roads and streets in a census tract to the total land area of that tract. The results are divided into quintiles and assigned a score of 1 to 5, where:
 - 1 = lowest results, or least relative index value; and
 - 5 = highest relative index value.

GIS data required: (1) total number of miles of non-limited access highway facilities, per census tract (available through HPMS database), and (2) land area of census tract.

4. Journey to Work (JTW) – Based on the U.S. Census Journey to Work data; computed as the percentage of total workers (16 years and over) who travel to work by walking at the census tract level. The results are divided into quintiles and assigned a score of 1 to 5, where:
 - 1 = lowest results, or least index value; and
 - 5 = highest relative index value (highest percentage of workers travel to work by walking).

GIS data required: (1) number of workers 16 years and over and number of workers who travel to work by walking.

Each sub-index is summed to calculate a total Pedestrian Demand Index (PDI) score for each highway segment. The overall PDI scores were normalized from 0 to 100. Roadway segments within urbanized area boundaries (U.S. Census definition) were given an additional 10 points to their score, and the overall score was renormalized from 0 to 100.

To incorporate the overall PDI score into segment prioritization for the Pedestrian Safety Action Plan, the state highway segments were assigned points consistent with the following scale:

- 1 point for lowest PDI scores (less than 30),
- 2 points for moderate PDI scores (between 31 and 51), or
- 3 points for highest PDI scores (between 52 and 100).

Pedestrian Safety Deficiency Index

Quantifies the relative magnitude of pedestrian safety deficiencies of each segment by rating six factors:

1. Sidewalk Availability – Assesses sidewalk accessibility to pedestrians:
 - 0 points for maintained 8' shoulder (rural) or existing sidewalks (urban),
 - 1 point for damaged 8' shoulder (rural) or existing sidewalks (urban),
 - 2 points for no sidewalks, or
 - 3 points for discontinuous sidewalks.
2. Crossing Risk – Measures the roadway crossing risk associated with the roadway cross section:
 - 0 points for roadway segments with one lane in each direction,
 - 1 point for a multi-lane roadway with a center median,
 - 2 points for a multi-lane roadway with a two-way center left-turn lane, or
 - 3 points for a multi-lane roadway with no median or two-way center left-turn lane.



FINAL REPORT

PEDESTRIAN SAFETY ACTION PLAN



3. Crossing Opportunities – Assesses frequency of opportunities for pedestrians to cross at signalized intersections or mid-block:
 - 0 points for segments with average signal spacing of less than 1,000 feet, or
 - 2 points for segments with average signal spacing greater than 1,000 feet.
4. Pedestrian Crashes – Assesses pedestrian crash history of segment:
 - 1 point for segments with 1-5 crashes per mile,
 - 2 points for segments with 6-10 crashes per mile,
 - 3 points for segments with 11-15 crashes per mile,
 - 4 points for segments with 16-20 crashes per mile,
 - 5 points for segments with 21-25 crashes per mile, or
 - 6 points for segments with 26-30 crashes per mile.
5. Traffic Speed – Based on the speed limit of each segment; each segment scored from 1 to 3 and points:
 - 1 point for speed limit < 25 mph,
 - 2 points for speed limit < 35 mph, or
 - 3 points for speed limit > 45 mph.
6. Traffic Volume – Measures the average daily traffic along a segment
 - 1 point for volume > 2,500 vpd and < 7,500 vpd,
 - 2 points for volume > 7,500 vpd and < 12,500 vpd,
 - 3 points for volume > 12,500 vpd and < 17,500 vpd,
 - 4 points for volume > 17,500 vpd and < 25,000 vpd, or
 - 5 points for volume > 25,000 vpd.

Stakeholder Input, and	<p>Based on concerns expressed by jurisdictional stakeholders as documented in Working Paper No. 1.</p> <ul style="list-style-type: none"> ▪ 1 point for concern expressed about pedestrians crossing at unmarked locations, ▪ 1 point for concern expressed about discontinuous sidewalks, ▪ 1 point for concern expressed about adequate lighting, ▪ 1 point for concern expressed about crossing improvements, ▪ 1 point for concern expressed about school crossings, and ▪ 1 point for a request for a raised median or barrier.
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Crash Severity Index	<p>The Crash Severity Index quantifies the severity of injuries along the segment. The type and number of injuries or fatalities were taken into account and scores were assigned as follows:</p> <ul style="list-style-type: none"> ▪ 0 points for segments with no incapacitating injury crashes or fatal crashes, ▪ 1 point for segments with incapacitating injury crashes but no fatal crashes, ▪ 2 points for segments with one fatal crash, or ▪ 3 points for segments with multiple fatal crashes.
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Each segment score was normalized to 100. Each state highway segment was assigned a priority level based on the normalized score with the following scale:

- Highest Priority: Normalized score between 85 and 100
- Moderate Priority: Normalized score from 72 to 84
- Lowest Priority: Normalized score below 72

Exhibit 4-1 shows the prioritization of each segment for all four categories and the overall prioritization score. Highest priority segments are depicted by a solid circle (●), medium priority segments are depicted by a half-circle (◐), and lowest priority segments are depicted by a hollow circle (○).



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



Exhibit 4-1 – Segment Prioritization Matrix

Segment #	Road Name	From	To	City	○ = Lowest Priority, ◐ = Moderate Priority, ● = Highest Priority						
					Pedestrian Demand	Deficiency	Stakeholder Input	Crash Severity	Overall Score ¹	Normalized Score ²	Overall Priority
1A	SR-95	North Oatman Rd (MP 243.5)	SR-68 (MP 249.7)	Bullhead City	2	3	2	3	10	100	●
1B	SR-68	SR-95 (MP 249.7)	Davis Dam Rd (MP 251.3)	Bullhead City	2	2	1	3	8	84	◐
2	SR-95	Joy Ln (MP 236.4)	Camp Mohave Rd (MP 238.4)	Bullhead City	2	3	2	3	10	100	●
3	SR-287 (Florence Blvd)	SR-387 (MP 111.8)	Arizola Rd (MP 114.3)	Casa Grande	2	2	2	3	9	96	●
4A	SR-40B	Riordan Rd (MP 195.3)	Elden St (MP 196.6)	Flagstaff	3	3	2	1	9	91	●
4B	SR-89A	University Ave (MP 402.5)	SR-40B (MP 216.1)	Flagstaff	2	3	2	2	9	88	●
4C	US-180	SR-40B (MP 215.4)	Birch Ave (MP 216.1)	Flagstaff	3	2	2	1	8	81	◐
5	SR-40B	Arrowhead Ave (MP 198.3)	Postal Blvd (MP 199)	Flagstaff	2	2	2	2	8	84	◐
6	US-89	Snowflake Dr / Trailsend Dr (MP 420.1)	Townsend Winona Rd (MP 420.7)	Flagstaff	2	2	2	3	9	94	●
7	SR-40B	5th Ave (MP 286.3)	I-40 Exit 286 G-Ramp (MP 287.4)	Holbrook	2	3	1	2	8	77	◐
8A	SR-77	I-10 Frontage Rd (MP 68.1)	Limberlost Dr (MP 71)	Tucson	3	2	0	2	7	72	◐
8B	SR-77	River Rd (MP 72)	Sahuaro Vista (MP 75.1)	Tucson	3	3	0	3	9	88	●

1. Overall Score = Pedestrian Demand Index Score + Pedestrian Safety Deficiency Index Score + Stakeholder Input Score + Crash Severity Index Score
 2. Normalized Score = 10.3*(Overall Score)



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



Exhibit 4-1 – Segment Prioritization Matrix (continued)

Seg- ment #	Road Name	From	To	City	○ = Lowest Priority, ◐ = Moderate Priority, ● = Highest Priority						
					Pedestrian Demand	Deficiency	Stakeholder Input	Crash Severity	Overall Score ⁽¹⁾	Normalized Score ⁽²⁾	Overall Priority
8C	SR-77	Magee Rd (MP 75.9)	Mountain Vista Dr (MP 76.2)	Tucson	3	3	0	1	7	72	◐
11	SR-90	SR-92 (MP 321.5)	Giulio Cesare Ave (MP 322.5)	Sierra Vista	2	3	0	2	7	67	○
12	US-95	Alamo Dr (MP 25.2)	Avenue 3E (MP 25.8)	Yuma	2	2	1	3	8	86	●
13	SR-8B	1st St (MP 0.3)	32nd St (MP 4)	Yuma	3	2	1	2	8	81	◐
14	SR-89A	Dry Creek Rd (MP 371)	Soldier Pass Rd (MP 372.9)	Sedona	2	2	2	3	9	93	●
15	SR-387 (Pinal Ave)	SR-287 (MP 0)	Cottonwood Ln (MP 1)	Casa Grande	3	3	1	0	7	67	○
16	SR-86	La Cholla Blvd (MP 169.9)	16th Ave (MP 171.7)	Tucson	3	3	0	1	7	70	○
17	SR-87 (Arizona Blvd)	Martin Rd (MP 131.5)	Vah Ki Inn Rd (MP 133.5)	Coolidge	2	2	2	1	7	69	○
18	US-95	SR-8B (MP 23.4)	Redondo Center Dr (MP 24.2)	Yuma	3	2	1	1	7	72	◐
20	US-60X/ Apache Trail	Signal Butte Rd (MP 193)	Meridian Rd (MP 194)	Mesa	3	2	0	0	5	53	○
21	US-60X/ Apache Trail	Ellsworth Rd (MP 191)	Crismon Rd (MP 192)	Mesa	3	2	0	3	8	84	◐

1. Overall Score = Pedestrian Demand Index Score + Pedestrian Safety Deficiency Index Score + Stakeholder Input Score + Crash Severity Index Score
 2. Normalized Score = 10.3*(Overall Score)



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



4.2 Interchange Prioritization and Methodology

Interchange prioritization utilized three of the indices described in Section 4.1: Pedestrian Demand Index, a Pedestrian Safety Deficiency Index, and Crash Severity Index. An overall priority score was calculated using the scores from all three categories.

The overall priority score was computed for each interchange by summing each of the sub indices:

$$\text{Overall Score} = \text{Pedestrian Demand Index Score} + \text{Pedestrian Safety Deficiency Index Score} + \text{Crash Severity Index Score}$$

Exhibit 4-2 shows the index score for each interchange, the overall normalized score, and the prioritization of each interchange consistent with the following scale:

- Highest Priority: Normalized score between 85 and 100
- Moderate Priority: Normalized score from 72 to 84
- Lowest Priority: Normalized score below 72



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



Exhibit 4-2 – Interchange Prioritization Matrix

Interchange Number	Interchange Location		○ = Lowest Priority, ◐ = Moderate Priority, ● = Highest Priority					Overall Priority
			Pedestrian Demand	Deficiency	Crash Severity	Overall Score ⁽¹⁾	Normalized Score ⁽²⁾	
1	I-17	Greenway Rd	3	1	1	5	63	○
3	I-10	7th Ave	3	1	1	5	63	○
4	SR-101 / SB Price Rd	Apache Blvd	3	1	2	6	75	◐
5	I-17	Cactus Rd	3	2	1	6	75	◐
9	SR-202	32nd St	3	2	1	6	75	◐
10	I-17	Bethany Home Rd	3	2	2	7	88	●
11	I-17	Camelback Rd	3	2	2	7	88	●
12	I-17	Dunlap Ave	3	3	1	7	88	●
13	SR-101 / SB Price Rd	University Dr	3	3	2	8	100	●
14	I-10	Baseline Rd	3	2	0	5	63	○
18	I-17	Indian School Rd	3	2	2	7	88	●

1. Overall Score = Pedestrian Demand Index Score + Pedestrian Safety Deficiency Index Score + Crash Severity Index Score
 2. Normalized Score = 12.5*(Overall Score)



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



5.0 POTENTIAL COUNTERMEASURES FOR HIGH PEDESTRIAN CRASH AND TRIBAL COMMUNITY LOCATIONS

Chapter 5 presents potential countermeasures that may be considered for implementation at each high pedestrian crash location. It must be emphasized that additional site-specific engineering analysis is required for each pedestrian crash location prior to final countermeasure selection.

Potential countermeasures are presented in **Exhibit 5-1**. Potential countermeasures were identified considering crash typing, field review, and stakeholder input.

Exhibit 5-1 through **5-33** list key characteristics of each high pedestrian crash location, field review observations, stakeholder input, potential countermeasures for each location, and estimated conceptual costs.

Potential countermeasures for implementation on state highways located within tribal lands are also identified. Potential countermeasures and estimated conceptual costs are shown in **Exhibit 5-34** through **5-46**.

Exhibit 5-1 – Potential Countermeasures for Segment 1

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
Segment 1, SR-95, North Oatman Road to SR-68, Bullhead City			
<p>This segment is a 7.8-mile-long 4-lane state highway in urban area from North Oatman Road to Davis Dam Road (MP 243.5 to MP 251.3). The segment can be separated into two sub-segments, which are continuous. The AADT is approximately 32,600 vehicles per day (vpd) on SR-95 and 13,000 vpd on SR-68. Other key features include:</p> <p>SR-95</p> <ul style="list-style-type: none"> ▪ Bicycle Lane – none ▪ Sidewalks – yes ▪ Median – TWLT median ▪ Posted Speed Limit – 45 mph ▪ Illumination – poor ▪ Adjacent Land Use – mostly commercial, open space in middle of segment ▪ Building Setback – majority > 25 feet ▪ Crosswalk Locations – only at intersections ▪ Bus Stop Locations – none <p>SR-68</p> <ul style="list-style-type: none"> ▪ Bicycle Lane – none ▪ Sidewalks – only for a short segment ▪ Median – majority raised median, a small segment of TWLT median ▪ Posted Speed Limit – 45 mph ▪ Illumination – poor ▪ Adjacent Land Use – open space ▪ Building Setback – N/A ▪ Crosswalk Locations – only at intersections ▪ Bus Stop Locations – none 	<p>The City had the following comments:</p> <ul style="list-style-type: none"> ▪ Pedestrian traffic crosses mid-block ▪ SR-95 has no median ▪ SR-68 is not well lit <p>The regional traffic engineer had the following comments:</p> <ul style="list-style-type: none"> ▪ HAWK signals may work in highly concentrated areas ▪ Installing a raised median would be best for pedestrians ▪ Recent road safety assessment (RSA) suggested a median ▪ Alternating lighting but most of segment is lit ▪ Pedestrian walk time may need to be extended (discussed in RSA) ▪ Countdown pedestrian signals would be helpful ▪ Photo radar enforcement could be considered, as suggested in Road Safety Assessment <p>Countermeasures identified for consideration in SR-95 Road Safety Assessment, MP 242 to 250, Bullhead City, October 20-22, 2008:</p> <ul style="list-style-type: none"> ▪ Improve lighting between 3rd Street and 6th Street, particularly near 5th Street, to increase pedestrian visibility at night ▪ Consider one of the following signal/crosswalk recommendations: <ol style="list-style-type: none"> a. Conduct a signal warrants analysis to determine the need for a traffic signal at 5th Street b. Install an In-Road Warning Light System with a high visibility crosswalk and LED pedestrian crossing signs at 5th Street c. Install 2-stage pedestrian crosswalks near 5th Street d. Install a Pedestrian Hybrid Signal, similar to the HAWK that the City of Tucson uses, near 5th Street ▪ Provide additional advanced warning of pedestrian crossing areas with oversized pedestrian crossing signs on both sides of SR-95, in both directions, with "Next xx Feet" plaque ▪ Long term, consider eliminating the crest curve near 5th Street ▪ Improve lighting between Thunderstruck Drive and Ramar Road ▪ Provide a Leading Pedestrian Interval phase at Thunderstruck Drive 	<p>The following is a list of potential countermeasures that could be implemented at this location. The list is not intended to be a final list of countermeasures. Actual implementation will depend on further investigations, engineering evaluation, project development, and availability of funding The list is provided to estimate the magnitude of costs that may be required to improve pedestrian safety at this location.</p> <p><i>Crosswalk Improvements</i></p> <p>SR 95 Milepost 242 to 250, Bullhead City, Road Safety Assessment, October 20-22, 2008, recommended consideration of installation of an In-Road Warning Light System with high visibility crosswalk(s) and LED pedestrian crossing signs as well as additional advanced warning of pedestrian crossing areas with oversized signs.</p> <hr/> <p><i>Enhance Pedestrian Signals</i></p> <p>Install pedestrian countdown signals along the corridor. Evaluate existing signal timing and modify pedestrian crossing time if needed.</p> <hr/> <p><i>Provide Lead Pedestrian Interval</i></p> <p>Provide leading pedestrian interval signal phase on SR-95 to allow pedestrians to enter and occupy the crosswalk before turning motorists enter it.</p> <hr/> <p><i>Increased Enforcement Plans</i></p> <p>Develop an enforcement plan that will help to deter careless and reckless driving and increase motorists' awareness to share the roadway with pedestrians and bicyclists along the corridor. Enforcement should be focused on speeding and pedestrians crossing illegally.</p> <hr/> <p><i>Improve Roadway Lighting</i></p> <p>Evaluate lighting to determine appropriate lighting improvements. Design and construct lighting improvements at intersections and along the roadway.</p> <hr/> <p><i>Improve Pedestrian Crossings</i></p> <p>Install pedestrian hybrid signal crossings, with pedestrian refuges.</p> <hr/> <p><i>Sidewalk Improvements</i></p> <p>Install and improve sidewalks along SR-68 to separate pedestrians from roadway vehicles and improve mobility for pedestrians.</p> <hr/> <p><i>Construct Raised Median on SR-95</i></p> <p>Construct a raised median to provide a refuge for pedestrians and improve safety by reducing conflicts with left-turning vehicles.</p>	<p style="text-align: right;">\$130,000</p> <hr/> <p style="text-align: right;">\$52,000</p> <hr/> <p style="text-align: right;">--</p> <hr/> <p style="text-align: right;">--</p> <hr/> <p style="text-align: right;">\$220,000</p> <hr/> <p style="text-align: right;">\$4,280,000</p> <hr/> <p style="text-align: right;">\$1,069,440</p> <hr/> <p style="text-align: right;">\$9,266,400</p> <hr/> <p style="text-align: right;">Planning Level Total Segment Cost with Raised Median</p> <p style="text-align: right;">\$14,237,840</p> <hr/> <p style="text-align: right;">Planning Level Total Segment Cost without Raised Median</p> <p style="text-align: right;">\$5,751,440</p>

Exhibit 5-2 – Potential Countermeasures for Segment 2

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
<i>Segment 2, SR-95, Joy Lane to Camp Mohave Road, Bullhead City</i>			
<p>This segment is a 2-mile-long 4-lane state highway in transitioning area from Joy Lane to Camp Mohave Road (MP 236.4 to MP 238.4). The AADT along this segment is approximately 30,200 vpd. The segment consists of other key features as below:</p> <ul style="list-style-type: none"> ▪ Bicycle Lane – none ▪ Sidewalks – none ▪ Median – TWLT median ▪ Posted Speed Limit – 45 mph ▪ Illumination – poor ▪ Adjacent Land Use – commercial / open space ▪ Building Setback – majority > 25 feet ▪ Crosswalk Locations – only at intersections ▪ Bus Stop Locations – none 	<p>The regional traffic engineer had the following comments:</p> <ul style="list-style-type: none"> ▪ No roadway lighting or sidewalks are present ▪ A raised median would be a good option ▪ Raised median may be more feasible on Segment 2 as compared to Segment 1, because of business access considerations, etc. ▪ May be difficult to have sidewalks installed 	<p><i>Crosswalk Improvements</i></p> <p>Evaluate and improve crosswalks along the corridor. Roadway geometry and field conditions must be analyzed.</p>	\$8,000
		<p><i>Enhance Pedestrian Signals</i></p> <p>Install pedestrian countdown signals along the corridor. Evaluate existing signal timing and modify pedestrian crossing time if needed.</p>	\$16,000
		<p><i>Increased Enforcement Plans</i></p> <p>Develop an enforcement plan that will help to deter careless and reckless driving and increase motorists' awareness to share the roadway with pedestrians and bicyclists along the corridor. Enforcement should be focused on speeding and pedestrians crossing illegally.</p>	--
		<p><i>Improve Roadway Lighting</i></p> <p>Install lighting at intersections and along the roadway to ensure safe pedestrian crossing at night.</p>	\$65,000
		<p><i>Improve Pedestrian Crossings</i></p> <p>Install pedestrian hybrid signal crossings, with pedestrian refuges.</p>	\$1,240,000
		<p><i>Sidewalk Improvements</i></p> <p>Install sidewalks to separate pedestrians from roadway vehicles and improve mobility for pedestrians.</p>	\$1,471,920
		Planning Level Total Segment Cost with Raised Median	
Planning Level Total Segment Cost without Raised Median			\$2,800,920

Exhibit 5-3 – Potential Countermeasures for Segment 3

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
Segment 3, SR-287, SR-387 to Arizola Road, Casa Grande			
<p>This 2.5-mile-long 4-lane segment of state highway is a main street in urban area from SR-387 to Arizola Road (MP 111.8 to MP 114.3). The AADT along this segment is approximately 25,100 vpd. Other key features of this segment include:</p> <ul style="list-style-type: none"> ▪ Bicycle Lane – none ▪ Sidewalks – yes ▪ Median – majority TWLT median, a short segment of raised median ▪ Posted Speed Limit – 35 mph and 45 mph ▪ Illumination – good ▪ Adjacent Land Use – mostly commercial ▪ Building Setback – majority > 25 feet ▪ Crosswalk Locations – only at intersections ▪ Bus Stop Locations – none 	<ul style="list-style-type: none"> ▪ Activity centers on both sides of the street ▪ Wide multi-lane roadway ▪ Consider a median ▪ This segment scheduled for turn-back to the City of Casa Grande in 2009 	<p><i>Crosswalk Improvements</i></p> <p>Evaluate and improve crosswalks along the corridor.</p>	\$18,000
		<p><i>Install Pedestrian Crossing Warning Signs</i></p> <p>Install Pedestrian Crossing warning signs to provide regulation, warning, and information to motorists as to what to expect and how to behave when approaching intersections or mid-block crossings.</p>	\$3,600
		<p><i>Enhance Pedestrian Signals</i></p> <p>Install pedestrian countdown signals along the corridor. Evaluate existing signal timing and modify pedestrian crossing time if needed.</p>	\$36,000
		<p><i>Increased Enforcement Plans</i></p> <p>Develop an enforcement plan that will help to deter careless and reckless driving and increase motorists' awareness to share the roadway with pedestrians and bicyclists along the corridor. Enforcement should be focused on speeding and pedestrians crossing illegally.</p>	--
		<p><i>Improve Pedestrian Crossings</i></p> <p>Install dual-stage pedestrian crossings at selected locations between signalized intersections. The pedestrian crossings should include pedestrian refuges.</p>	\$1,790,000
		<p><i>Driveway Improvements</i></p> <p>Evaluate and improve driveways along the corridor. Improvements may include narrowing or closing driveways, reducing turning radius.</p>	\$500,000
		<p><i>Construct Raised Median</i></p> <p>Construct a raised median to provide a refuge for pedestrians and improve safety by reducing conflicts with left-turning vehicles.</p>	\$2,970,000
		Planning Level Total Segment Cost with Raised Median	
Planning Level Total Segment Cost without Raised Median			\$2,347,600

Exhibit 5-4 – Potential Countermeasures for Segment 4A

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost		
<i>Segment 4A, SR-40B, Riordan Road to Elden Street, Flagstaff</i>					
<p>Segment 4A is along SR-40B (4), also known as Route 66, and extends from Riordan Road to Elden Street (MP 195.3 to MP 196.6). This segment is a 4-lane state highway with an estimated AADT of 38,300 vpd. Other key features of this segment include:</p> <ul style="list-style-type: none"> ▪ Bicycle Lane – none ▪ Sidewalks – yes ▪ Median – TWLT median ▪ Posted Speed Limit – 30 mph ▪ Illumination – good ▪ Adjacent Land Use – mostly commercial, some open space ▪ Building Setback – majority < 10 feet, next to sidewalk on westbound ▪ Crosswalk Locations – only at intersections ▪ Bus Stop Locations – yes 	<ul style="list-style-type: none"> ▪ Install no right turn on red signs at selected intersections that are activated when the pedestrian phase is called. ▪ High volume roadway, with no defined areas for pedestrian crossings. Consider raised median and pedestrian scale lighting. Consider two-stage pedestrian cross walks. ▪ City indicated that having no place to cross and high speeds are the two big issues. ▪ City indicated that linear improvements, e.g. sidewalks are good, but crossing improvements are lacking. ▪ City indicated that it is difficult to find a common place to build a crosswalk on Milton Avenue because there are no concentrated places where pedestrians cross the street. ▪ City indicated that there are not obvious places for a HAWK installation as there are so many driveways on the road. <p>The regional traffic engineer had the following comments:</p> <ul style="list-style-type: none"> ▪ Lighting is primarily from adjacent businesses causing light pollution but lighting uniformity needs to be addressed ▪ Median would be opposed by district due to problems related to snow removal ▪ Pedestrian crossings are random therefore it may be difficult to get pedestrians to use HAWK signal ▪ Study needed for pedestrian traffic to determine locations for HAWK signals ▪ Prohibiting right-turn on red may be considered, however, may cause queuing problems 	<p><i>Crosswalk Improvements</i></p> <p>Evaluate and improve crosswalks along the corridor.</p> <p>A study of pedestrian activity should be completed to determine suitable pedestrian crossings locations.</p>	\$12,000		
		<p><i>Install “No Right Turn on Red” Signs</i></p> <p>Install “No Right Turn on Red” signs to provide a safer crossing for pedestrians, when conditions meet engineering warrants per MUTCD Section 2B.45. Also provide a lead pedestrian interval to address concerns over increased right-turn-on-red conflicts.</p>	\$800		
		<p><i>Enhance Pedestrian Signals</i></p> <p>Install pedestrian countdown signals along the corridor. Evaluate existing signal timing and modify pedestrian crossing time if needed.</p>	\$24,000		
		<p><i>Reduce Curb Radii at Intersections</i></p> <p>Develop a plan to evaluate and reduce curb radii at large intersections along the corridor. Reducing the curb radius reduces pedestrian crossing distance and improves visibility between drivers and pedestrians.</p>	\$230,000		
		<p><i>Improve Pedestrian Crossings</i></p> <p>Install pedestrian hybrid signal crossings, with pedestrian refuges. A study of pedestrian activity should be conducted to determine ideal locations of pedestrian crossings.</p>	\$860,000		
		<p><i>Construct Shoulder</i></p> <p>Construct a shoulder to provide additional separation between vehicles and pedestrians. Shoulder may also be used as a designated bicycle lane.</p>	\$131,000		
		<p><i>Construct Raised Median</i></p> <p>Construct a raised median to provide a refuge for pedestrians and improve safety by reducing conflicts with left-turning vehicles.</p>	\$1,556,280		
				Planning Level Total Segment Cost with Raised Median	\$2,454,080
				Planning Level Total Segment Cost without Raised Median	\$1,257,800

Exhibit 5-5 – Potential Countermeasures for Segment 4B

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost		
<p>The following is a list of potential countermeasures that could be implemented at this location. The list is not intended to be a final list of countermeasures. Actual implementation will depend on further investigations, engineering evaluation, project development, and availability of funding The list is provided to estimate the magnitude of costs that may be required to improve pedestrian safety at this location.</p>					
<i>Segment 4B, SR-89A, University Avenue to SR-40B, Flagstaff</i>					
<p>Segment 4B spans from University Avenue to SR-40B (MP 402.5 to MP 403.2) along SR-89A (Milton Road). This segment is also a 4-lane state highway with an estimated AADT of 35,000 vpd. Other key features of this segment include:</p> <ul style="list-style-type: none"> ▪ Bicycle Lane – none ▪ Sidewalks – yes ▪ Median – TWLT median ▪ Posted Speed Limit – 35 mph ▪ Illumination – good ▪ Adjacent Land Use – mostly commercial ▪ Building Setback – majority > 25 feet ▪ Crosswalk Locations – only at intersections ▪ Bus Stop Locations – yes 	<ul style="list-style-type: none"> ▪ Install no right turn on red signs at selected intersections that are activated when the pedestrian phase is called. ▪ High volume roadway, with no defined areas for pedestrian crossings. Consider raised median and pedestrian scale lighting. Consider two-stage pedestrian cross walks. ▪ City indicated that having no place to cross and high speeds are the two big issues. ▪ City indicated that linear improvements, e.g. sidewalks are good, but crossing improvements are lacking. ▪ City indicated that it is difficult to find a common place to build a crosswalk on Milton Avenue because there are no concentrated places where pedestrians cross the street. ▪ City indicated that there are not obvious places for a HAWK installation as there are so many driveways on the road. <p>The regional traffic engineer had the following comments:</p> <ul style="list-style-type: none"> ▪ Pedestrian crossings are random therefore it may be difficult to get pedestrians to use HAWK signal ▪ Study needed for pedestrian traffic to determine locations for HAWK signals ▪ Prohibiting right-turn on red may be considered, however, may cause queuing problems 	<p><i>Crosswalk Improvements</i></p> <p>Evaluate and improve crosswalks along the corridor.</p>	\$8,000		
		<p><i>Install Pedestrian Crossing Warning Signs</i></p> <p>Install Pedestrian Crossing warning signs to provide regulation, warning, and information to motorists as to what to expect and how to behave when approaching intersections or mid-block crossings.</p>	\$1,600		
		<p><i>Install "No Right Turn on Red" Signs</i></p> <p>Install "No Right Turn on Red" signs to provide a safer crossing for pedestrians, when conditions meet engineering warrants per MUTCD Section 2B.45. Also provide a lead pedestrian interval to address concerns over increased right-turn-on-red conflicts.</p>	\$500		
		<p><i>Enhance Pedestrian Signals</i></p> <p>Install pedestrian countdown signals along the corridor. Evaluate existing signal timing and modify pedestrian crossing time if needed.</p>	\$16,000		
		<p><i>Reduce Curb Radii at Intersections</i></p> <p>Develop a plan to evaluate and reduce curb radii at intersections along the corridor. Reducing the curb radius should reduce pedestrian crossing distance and improve visibility between drivers and pedestrians.</p>	\$80,000		
		<p><i>Improve Pedestrian Crossings</i></p> <p>Install pedestrian hybrid signal crossings, with pedestrian refuges.</p>	\$490,000		
		<p><i>Driveway Improvements</i></p> <p>Evaluate and improve driveways along the corridor. Improvements may include narrowing or closing driveways, or reducing turning radius.</p>	\$60,000		
		<p><i>Construct Shoulder</i></p> <p>Construct a shoulder to provide additional separation between vehicles and pedestrians. Shoulder may also be used as a designated bicycle lane.</p>	\$67,000		
		<p><i>Construct Raised Median</i></p> <p>Construct a raised median to provide a refuge for pedestrians and improve safety by reducing conflicts with left-turning vehicles.</p>	\$795,960		
		Planning Level Total Segment Cost with Raised Median			\$1,279,060
		Planning Level Total Segment Cost without Raised Median			\$723,100

Exhibit 5-6 – Potential Countermeasures for Segment 4C

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
Segment 4C, US-180, SR-40B to Birch Avenue, Flagstaff			
<p>Segment 4C is along US-180 (Humphreys Street) from SR-40B to Birch Avenue (MP 215.4 to MP 216.1). This segment is a 2-lane state highway with an estimated AADT of 15,000 vpd. Other key features of these segments include:</p> <ul style="list-style-type: none"> ▪ Bicycle Lane – none ▪ Sidewalks – yes ▪ Median – TWLT median ▪ Posted Speed Limit – 25 mph ▪ Illumination – good ▪ Adjacent Land Use – mostly residential ▪ Building Setback – majority > 15 feet ▪ Crosswalk Locations – only at intersections ▪ Bus Stop Locations – none 	<ul style="list-style-type: none"> ▪ Install no right turn on red signs at selected intersections that are activated when the pedestrian phase is called. ▪ City indicated that linear improvements, e.g. sidewalks are good, but crossing improvements are lacking. <p>The regional traffic engineer had the following comments:</p> <ul style="list-style-type: none"> ▪ A multi-use path was recently installed, making access to crossings easier ▪ Midblock crossings may be well received ▪ Lighting is not continuous along the segment 	<p><i>Crosswalk Improvements</i></p> <p>Evaluate and improve crosswalks along the corridor.</p>	\$6,000
		<p><i>Install Pedestrian Crossing Warning Signs</i></p> <p>Install Pedestrian Crossing warning signs to provide regulation, warning, and information to motorists as to what to expect and how to behave when approaching intersections or mid-block crossings.</p>	\$1,200
		<p><i>Install “No Right Turn on Red” Signs</i></p> <p>Install “No Right Turn on Red” signs to provide a safer crossing for pedestrians, when conditions meet engineering warrants per MUTCD Section 2B.45. Also provide a lead pedestrian interval to address concerns over increased right-turn-on-red conflicts.</p>	\$400
		<p><i>Enhance Pedestrian Signals</i></p> <p>Install pedestrian countdown signals along the corridor. Evaluate existing signal timing and modify pedestrian crossing time if needed.</p>	\$12,000
		<p><i>Increased Enforcement Plans</i></p> <p>Develop an enforcement plan that will help to deter careless and reckless driving and increase motorists’ awareness to share the roadway with pedestrians and bicyclists along the corridor. Enforcement should be focused on speeding and pedestrians crossing illegally.</p>	--
		<p><i>Reduce Curb Radii at Intersections</i></p> <p>Develop a plan to evaluate and reduce curb radii at intersections along the corridor. Reducing the curb radius should reduce pedestrian crossing distance and improve visibility between drivers and pedestrians.</p>	\$50,000
		<p><i>Improve Pedestrian Crossings</i></p> <p>Install pedestrian hybrid signal crossings, with pedestrian refuges.</p>	\$150,000
		<p><i>Driveway Improvements</i></p> <p>Evaluate and improve driveways along the corridor. Improvements may include narrowing or closing driveways, or reducing turning radius.</p>	\$20,000
		<p><i>Construct Shoulder</i></p> <p>Construct a shoulder to provide additional separation between vehicles and pedestrians. Shoulder may also be used as a designated bicycle lane.</p>	\$14,000
		<p><i>Construct Raised Median</i></p> <p>Construct a raised median to provide a refuge for pedestrians and improve safety by reducing conflicts with left-turning vehicles.</p>	\$166,320
Planning Level Total Segment Cost with Raised Median			\$269,920
Planning Level Total Segment Cost without Raised Median			\$253,600

Exhibit 5-7 – Potential Countermeasures for Segment 5

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost		
<i>Segment 5, SR-40B, Arrowhead Avenue to Postal Boulevard, Flagstaff</i>					
<p>This segment is a 0.7-mile-long 4-lane state highway in urban area from Arrowhead Avenue to Postal Boulevard (MP 198.3 to MP 199). The AADT along this segment is approximately 27,400 vpd. The segment has other key features including:</p> <ul style="list-style-type: none"> ▪ Bicycle Lane – none ▪ Sidewalks – yes ▪ Median – TWLT median ▪ Posted Speed Limit – 40 mph ▪ Illumination – good ▪ Adjacent Land Use – commercial on westbound, open space on eastbound ▪ Building Setback – some at 20 feet, some next to sidewalk ▪ Crosswalk Locations – only at intersections ▪ Bus Stop Locations – none 	<p>The City had the following comments:</p> <ul style="list-style-type: none"> ▪ Having no place to cross and high speeds are the two big issues ▪ Linear improvements, e.g. sidewalks are good, but crossing improvements are lacking <p>The regional traffic engineer had the following comments:</p> <ul style="list-style-type: none"> ▪ There is a residential area to the north and a possible retail development to the south of the segment ▪ Large distance between signals ▪ Afraid that pedestrian problem will worsen once the retail development is in place ▪ A new traffic signal may be possible at 1st Street ▪ Efforts should be coordinated with the new development ▪ Roadway lighting needs improvement 	<p><i>Crosswalk Improvements</i></p> <p>Evaluate and improve crosswalks along the corridor.</p>	\$6,000		
		<p><i>Install Pedestrian Crossing Warning Signs</i></p> <p>Install Pedestrian Crossing warning signs to provide regulation, warning, and information to motorists as to what to expect and how to behave when approaching intersections or mid-block crossings.</p>	\$1,200		
		<p><i>Enhance Pedestrian Signals</i></p> <p>Install pedestrian countdown signals along the corridor. Evaluate existing signal timing and modify pedestrian crossing time if needed.</p>	\$12,000		
		<p><i>Increased Enforcement Plans</i></p> <p>Develop an enforcement plan that will help to deter careless and reckless driving and increase motorists' awareness to share the roadway with pedestrians and bicyclists along the corridor. Enforcement should be focused on speeding and pedestrians crossing illegally.</p>	--		
		<p><i>Reduce Curb Radii at Intersections</i></p> <p>Develop a plan to evaluate and reduce curb radii at intersections along the corridor. Reducing the curb radius should reduce pedestrian crossing distance and improve visibility between drivers and pedestrians.</p>	\$80,000		
		<p><i>Driveway Improvements</i></p> <p>Evaluate and improve driveways along the corridor. Improvements may include narrowing or closing driveways, or reducing turning radius.</p>	\$40,000		
		<p><i>Construct Raised Median</i></p> <p>Construct a raised median to provide a refuge for pedestrians and improve safety by reducing conflicts with left-turning vehicles.</p>	\$867,240		
		Planning Level Total Segment Cost with Raised Median			\$1,006,440
		Planning Level Total Segment Cost without Raised Median			\$139,200

Exhibit 5-8 – Potential Countermeasures for Segment 6

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
<i>Segment 6, US-89, Snowflake Drive / Trailsend Drive to Townsend Winona Road, Flagstaff</i>			
<p>This segment is a 0.6-mile-long 4-lane state highway in a transitioning area from Snowflake Drive / Trailsend Drive to Townsend-Winona Road (MP 420.1 to MP 420.7). The AADT along this segment is approximately 26,400 vpd. Other key features include:</p> <ul style="list-style-type: none"> ▪ Bicycle Lane – none ▪ Sidewalks – yes ▪ Median – TWLT median ▪ Posted Speed Limit – 45 mph ▪ Illumination – good ▪ Adjacent Land Use – commercial, open space ▪ Building Setback – majority > 25 feet ▪ Crosswalk Locations – only at intersections ▪ Bus Stop Locations – none 	<p>The City had the following comments:</p> <ul style="list-style-type: none"> ▪ Having no place to cross and high speeds are the two big issues ▪ Linear improvements, e.g. sidewalks are good, but crossing improvements are lacking <p>The regional traffic engineer had the following comments:</p> <ul style="list-style-type: none"> ▪ There are no sidewalks on either side of the roadway for half of the segment, however there is a well worn footpath ▪ Installing sidewalks may be difficult since the county won't maintain the sidewalks ▪ Roadway lighting is present ▪ Alcohol related accidents are a major problem in this area 	<p><i>Crosswalk Improvements</i></p> <p>Evaluate and improve crosswalks along the corridor.</p>	\$4,000
		<p><i>Install Pedestrian Crossing Warning Signs</i></p> <p>Install Pedestrian Crossing warning signs to provide regulation, warning, and information to motorists as to what to expect and how to behave when approaching intersections or mid-block crossings.</p>	\$800
		<p><i>Enhance Pedestrian Signals</i></p> <p>Install pedestrian countdown signals along the corridor. Evaluate existing signal timing and modify pedestrian crossing time if needed.</p>	\$8,000
		<p><i>Increased Enforcement Plans</i></p> <p>Develop an enforcement plan that will help to deter careless and reckless driving and increase motorists' awareness to share the roadway with pedestrians and bicyclists along the corridor. Enforcement should be focused on speeding and pedestrians crossing illegally.</p>	--
		<p><i>Improve Pedestrian Crossings</i></p> <p>Install pedestrian hybrid signal crossings, with pedestrian refuges.</p>	\$370,000
		<p><i>Construct Raised Median</i></p> <p>Construct a raised median to provide a refuge for pedestrians and improve safety by reducing conflicts with left-turning vehicles.</p>	\$689,040
		Planning Level Total Segment Cost with Raised Median	
Planning Level Total Segment Cost without Raised Median			\$382,800

Exhibit 5-9 – Potential Countermeasures for Segment 7

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost		
<i>Segment 7, SR-40B (8), 5th Avenue to I-40 Exit 286 G-Ramp, Holbrook</i>					
<p>This segment is a 1.1-mile-long 4-lane state highway from SR-40B to 5th Avenue (MP 286.3 to MP 287.4). The AADT on this segment is approximately 11,100 vpd. Other key features include:</p> <ul style="list-style-type: none"> ▪ Bicycle Lane – none ▪ Sidewalks – yes ▪ Median – majority TWLT median, one segment without median ▪ Posted Speed Limit – 35 mph ▪ Illumination – good ▪ Adjacent Land Use – commercial, open space ▪ Building Setback – next to sidewalk in downtown, others > 25 feet ▪ Crosswalk Locations – only at intersections ▪ Bus Stop Locations – none 	<ul style="list-style-type: none"> ▪ The City is trying to increase enforcement along SR-77 and I-40 to reduce the number of intoxicated pedestrian crashes. <p>The regional traffic engineer had the following comments:</p> <ul style="list-style-type: none"> ▪ Alcohol related accidents account for most of the pedestrian crashes on this segment ▪ Sidewalks, pedestrian lighting, and benches have been recently installed ▪ Buildings are very close to the road - installed handrails to direct pedestrians to side streets 	<p><i>Crosswalk Improvements</i></p> <p>Evaluate and improve crosswalks along the corridor.</p>	\$4,000		
		<p><i>Install Pedestrian Crossing Warning Signs</i></p> <p>Install Pedestrian Crossing warning signs to provide regulation, warning, and information to motorists as to what to expect and how to behave when approaching intersections or mid-block crossings.</p>	\$800		
		<p><i>Enhance Pedestrian Signals</i></p> <p>Install pedestrian countdown signals along the corridor. Evaluate existing signal timing and modify pedestrian crossing time if needed.</p>	\$8,000		
		<p><i>Increased Enforcement Plans</i></p> <p>Develop an enforcement plan that will help to deter careless and reckless driving and increase motorists' awareness to share the roadway with pedestrians and bicyclists along the corridor. Enforcement should be focused on speeding and pedestrians crossing illegally.</p>	--		
		<p><i>Reduce Curb Radii at Intersections</i></p> <p>Develop a plan to evaluate and reduce curb radii at intersections along the corridor. Reducing the curb radius should reduce pedestrian crossing distance and improve visibility between drivers and pedestrians.</p>	\$200,000		
		<p><i>Improve Pedestrian Crossings</i></p> <p>Install pedestrian hybrid signal crossings, with pedestrian refuges.</p>	\$620,000		
		<p><i>Driveway Improvements</i></p> <p>Evaluate and improve driveways along the corridor. Improvements may include narrowing or closing driveways, or reducing turning radius.</p>	\$220,000		
		<p><i>Construct Raised Median</i></p> <p>Construct a raised median to provide a refuge for pedestrians and improve safety by reducing conflicts with left-turning vehicles.</p>	\$1,318,680		
		Planning Level Total Segment Cost with Raised Median			\$2,251,480
		Planning Level Total Segment Cost without Raised Median			\$1,052,800

Exhibit 5-10 – Potential Countermeasures for Segment 8A

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost		
<i>Segment 8A, SR-77, I-10 Frontage Road to Limberlost Drive, Tucson</i>					
<p>From the I-10 Frontage Road to Limberlost Drive, Segment 8A of SR-77 is a 2.9-mile-long state highway. It has 4 lanes from I-10 to Oracle Road and 6 lanes from Miracle Mile to Limberlost Drive (MP 68.1 to MP 71). The AADT on Segment 8A is approximately 40,200 vpd. Other features of this segment include:</p> <ul style="list-style-type: none"> ▪ Bicycle Lane – yes ▪ Sidewalks – yes ▪ Median – raised median ▪ Posted Speed Limit – 40 mph ▪ Illumination – good ▪ Adjacent Land Use – mostly commercial ▪ Building Setback – majority > 25 feet ▪ Crosswalk Locations – only at intersections ▪ Bus Stop Locations – none 	<ul style="list-style-type: none"> ▪ At Oracle Road and Fort Lowell Road, move bus stop closer to the intersection to encourage pedestrians to cross at the intersection. ▪ Install crosswalk on the south leg of the intersection at Oracle Road and Fort Lowell Road. ▪ At Oracle Road and Miracle Mile, provide a railing to prevent crossings on the north leg of the intersection and direct pedestrians to cross on the south leg. ▪ City of Tucson indicated that on Oracle Road, a number of changes were implemented: ▪ Signal timings were changed from 90 to 120 seconds to allow full pedestrian crossings. ▪ Slowed the assumption on walking speeds between River Road and Grant Road to 4 feet per second. ▪ All school crossings assumed 3.5 feet per seconds. ▪ Oracle Road is now fully illuminated. ▪ On Oracle Road, there are living areas on the east side of the street and shopping on the west side of the street, leading to more pedestrian crossings. ▪ There are socioeconomic factors regarding some of the pedestrian activities, such as alcohol and drug use. 	<p><i>Crosswalk Improvements</i></p> <p>Evaluate and improve crosswalks along the corridor.</p>	\$16,000		
		<p><i>Install Pedestrian Crossing Warning Signs</i></p> <p>Install Pedestrian Crossing warning signs to provide regulation, warning, and information to motorists as to what to expect and how to behave when approaching intersections or mid-block crossings.</p>	\$3,200		
		<p><i>Enhance Pedestrian Signals</i></p> <p>Install pedestrian countdown signals along the corridor. Evaluate existing signal timing and modify pedestrian crossing time if needed.</p>	\$32,000		
		<p><i>Increased Enforcement Plans</i></p> <p>Develop an enforcement plan that will help to deter careless and reckless driving and increase motorists' awareness to share the roadway with pedestrians and bicyclists along the corridor. Enforcement should be focused on speeding and pedestrians crossing illegally.</p>	--		
		<p><i>Reduce Curb Radii at Intersections</i></p> <p>Develop a plan to evaluate and reduce curb radii at intersections along the corridor. Reducing the curb radius should reduce pedestrian crossing distance and improve visibility between drivers and pedestrians.</p>	\$280,000		
		<p><i>Improve Pedestrian Crossings</i></p> <p>Install dual-stage pedestrian crossings.</p>	\$1,500,000		
		<p><i>Driveway Improvements</i></p> <p>Evaluate and improve driveways along the corridor. Improvements may include narrowing or closing driveways, or reducing turning radius.</p>	\$400,000		
		Planning Level Total Segment Cost with Raised Median			--
		Planning Level Total Segment Cost without Raised Median			\$2,231,200

Exhibit 5-11 – Potential Countermeasures for Segment 8B

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
<i>Segment 8B, SR-77, River Road to Sahuaro Vista, Tucson</i>			
Segment 8B of SR-77 is from River Road to Sahuaro Vista (MP 72 to MP 75.1), and is about 3.1 miles long. It has 6 lanes with an estimated AADT of 52,100 vpd. Other features of this segment include: <ul style="list-style-type: none"> ▪ Bicycle Lane – yes ▪ Sidewalks – none ▪ Median – raised median ▪ Posted Speed Limit – 45 mph ▪ Illumination – only at intersections ▪ Adjacent Land Use – commercial, open space ▪ Building Setback – majority > 25 feet ▪ Crosswalk Locations – only at intersections ▪ Bus Stop Locations – Oracle Road 	<ul style="list-style-type: none"> ▪ Refer to Segment 8A 	<p><i>Crosswalk Improvements</i></p> <p>Evaluate and improve crosswalks along the corridor.</p>	\$8,000
		<p><i>Install Pedestrian Crossing Warning Signs</i></p> <p>Install Pedestrian Crossing warning signs to provide regulation, warning, and information to motorists as to what to expect and how to behave when approaching intersections or mid-block crossings.</p>	\$1,600
		<p><i>Enhance Pedestrian Signals</i></p> <p>Install pedestrian countdown signals along the corridor. Evaluate existing signal timing and modify pedestrian crossing time if needed.</p>	\$16,000
		<p><i>Increased Enforcement Plans</i></p> <p>Develop an enforcement plan that will help to deter careless and reckless driving and increase motorists' awareness to share the roadway with pedestrians and bicyclists along the corridor. Enforcement should be focused on speeding and pedestrians crossing illegally.</p>	--
		<p><i>Improve Roadway Lighting</i></p> <p>Install lighting at intersections and along the roadway to ensure safe pedestrian crossing at night.</p>	\$100,000
		<p><i>Reduce Curb Radii at Intersections</i></p> <p>Develop a plan to evaluate and reduce curb radii at intersections along the corridor. Reducing the curb radius should reduce pedestrian crossing distance and improve visibility between drivers and pedestrians.</p>	\$270,000
		<p><i>Improve Pedestrian Crossings</i></p> <p>Install dual-stage pedestrian crossings.</p>	\$1,500,000
		<p><i>Driveway Improvements</i></p> <p>Evaluate and improve driveways along the corridor. Improvements may include narrowing or closing driveways, or reducing turning radius.</p>	\$100,000
		<p><i>Sidewalk Improvements</i></p> <p>Install sidewalks to separate pedestrians from roadway vehicles and improve mobility for pedestrians.</p>	\$2,273,606
		Planning Level Total Segment Cost with Raised Median	
Planning Level Total Segment Cost without Raised Median			\$4,269,206

Exhibit 5-12 – Potential Countermeasures for Segment 8C

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
<i>Segment 8C, SR-77, Magee Road to Mountain Vista Drive, Tucson</i>			
Segment 8C of SR-77, from Magee Road to Mountain Vista Drive (MP 75.9 to MP 76.2), is a 0.3-mile-long 6-lane state highway. The AADT on this segment is approximately 55,100 vpd. Other key features include:	<ul style="list-style-type: none"> ▪ None 	<p>The following is a list of potential countermeasures that could be implemented at this location. The list is not intended to be a final list of countermeasures. Actual implementation will depend on further investigations, engineering evaluation, project development, and availability of funding The list is provided to estimate the magnitude of costs that may be required to improve pedestrian safety at this location.</p>	
<ul style="list-style-type: none"> ▪ Bicycle Lane – yes ▪ Sidewalks – none ▪ Median – raised median ▪ Posted Speed Limit – 50 mph ▪ Illumination – only at intersections ▪ Adjacent Land Use – commercial on southbound ▪ Building Setback – majority > 25 feet ▪ Crosswalk Locations – only at intersections ▪ Bus Stop Locations – none 		<p><i>Crosswalk Improvements</i></p> <p>Evaluate and improve crosswalks along the corridor.</p> <hr/> <p><i>Install Pedestrian Crossing Warning Signs</i></p> <p>Install Pedestrian Crossing warning signs to provide regulation, warning, and information to motorists as to what to expect and how to behave when approaching intersections or mid-block crossings.</p> <hr/> <p><i>Enhance Pedestrian Signals</i></p> <p>Install pedestrian countdown signals along the corridor. Evaluate existing signal timing and modify pedestrian crossing time if needed.</p> <hr/> <p><i>Increased Enforcement Plans</i></p> <p>Develop an enforcement plan that will help to deter careless and reckless driving and increase motorists' awareness to share the roadway with pedestrians and bicyclists along the corridor. Enforcement should be focused on speeding and pedestrians crossing illegally.</p> <hr/> <p><i>Improve Roadway Lighting</i></p> <p>Install lighting at intersections and along the roadway to ensure safe pedestrian crossing at night.</p> <hr/> <p><i>Reduce Curb Radii at Intersections</i></p> <p>Develop a plan to evaluate and reduce curb radii at intersections along the corridor. Reducing the curb radius should reduce pedestrian crossing distance and improve visibility between drivers and pedestrians.</p> <hr/> <p><i>Improve Pedestrian Crossings</i></p> <p>Install dual-stage pedestrian crossings.</p> <hr/> <p><i>Sidewalk Improvements</i></p> <p>Install sidewalks to separate pedestrians from roadway vehicles and improve mobility for pedestrians.</p>	<p>\$2,000</p> <hr/> <p>\$400</p> <hr/> <p>\$4,000</p> <hr/> <p>--</p> <hr/> <p>\$15,000</p> <hr/> <p>\$40,000</p> <hr/> <p>\$135,000</p> <hr/> <p>\$206,479</p>
Planning Level Total Segment Cost with Raised Median			--
Planning Level Total Segment Cost without Raised Median			\$402,579

Exhibit 5-13 – Potential Countermeasures for Segment 11

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
Segment 11, SR-90, SR-92 to Giulio Cesare Avenue, Sierra Vista			
<p>This segment is a 0.99-mile-long 4-lane state highway from SR-92 to Giulio Cesare Avenue (MP 321.5 to MP 322.5). The AADT along this segment is approximately 17,000 vpd. The segment consists of other key features as below:</p> <ul style="list-style-type: none"> ▪ Bicycle Lane – none ▪ Sidewalks – yes from SR-92 to Tree Top Avenue, none from Tree Top Avenue to Giulio Cesare Avenue ▪ Median – TWLT median ▪ Posted Speed Limit – 45 mph ▪ Adjacent Land Use – commercial / open space ▪ Building Setback – majority > 25 feet ▪ Crosswalk Locations – only at intersections 	<ul style="list-style-type: none"> ▪ A multi-use trail is located on the north side of SR-90 ▪ There is a long wait to cross at SR-92 ▪ Large curb radii at SR-92 ▪ Heavy commercial use toward SR-92 ▪ No median on SR-90 and wide cross section ▪ Distance between crossings is minimal toward SR-92 ▪ Discontinuous sidewalks and narrow shoulders east of Tree Top Avenue ▪ Poor roadway lighting toward the east end of the segment 	<p><i>Crosswalk Improvements</i></p> <p>Evaluate and improve crosswalks along the corridor.</p>	\$6,000
		<p><i>Install Pedestrian Crossing Warning Signs</i></p> <p>Install Pedestrian Crossing warning signs to provide regulation, warning, and information to motorists as to what to expect and how to behave when approaching intersections or mid-block crossings.</p>	\$1,200
		<p><i>Enhance Pedestrian Signals</i></p> <p>Install pedestrian countdown signals along the corridor. Evaluate existing signal timing and modify pedestrian crossing time if needed.</p>	\$12,000
		<p><i>Increased Enforcement Plans</i></p> <p>Develop an enforcement plan that will help to deter careless and reckless driving and increase motorists' awareness to share the roadway with pedestrians and bicyclists along the corridor. Enforcement should be focused on speeding and pedestrians crossing illegally.</p>	--
		<p><i>Sidewalk Improvements</i></p> <p>Install and improve sidewalks to separate pedestrians from roadway vehicles and improve mobility for pedestrians.</p>	\$737,990
		<p><i>Construct Raised Median</i></p> <p>Construct a raised median to provide a refuge for pedestrians and improve safety by reducing conflicts with left-turning vehicles.</p>	\$1,176,120
		Planning Level Total Segment Cost with Raised Median	
Planning Level Total Segment Cost without Raised Median			\$757,190

Exhibit 5-14 – Potential Countermeasures for Segment 12

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost	
<i>Segment 12, US-95, Alamo Drive to Avenue 3E, Yuma</i>				
<p>This segment is a 0.62-mile-long 4-lane state highway from Alamo Drive to Avenue 3E (MP 25.2 to MP 25.8). The AADT along this segment is approximately 15,100 vpd. It should be noted that this route will be turned over to the City of Yuma in September 2009. The segment consists of other key features as below:</p> <ul style="list-style-type: none"> ▪ Bicycle Lane – none ▪ Sidewalks – none ▪ Median – TWLT median ▪ Posted Speed Limit – 55 mph ▪ Adjacent Land Use – commercial / open space ▪ Building Setback – majority > 25 feet ▪ Crosswalk Locations – only at intersections 	<ul style="list-style-type: none"> ▪ The City uses channelized right turn lanes to shorten pedestrian crossing distances (using pork chop islands). ▪ At SR 95 and Ave. 3E, an area with two fatal crashes, there is a bar in the vicinity; people park on opposite side of street. ▪ Raised medians have been recommended in past studies ▪ Roadway lighting is only present at Avenue 3E and not the rest of the segment ▪ This segment is scheduled for turn back in 2009. 	<p><i>Crosswalk Improvements</i></p> <p>Evaluate and improve crosswalks along the corridor.</p>	\$2,000	
		<p><i>Enhance Pedestrian Signals</i></p> <p>Install pedestrian countdown signals along the corridor. Evaluate existing signal timing and modify pedestrian crossing time if needed.</p>	\$4,000	
		<p><i>Increased Enforcement Plans</i></p> <p>Develop an enforcement plan that will help to deter careless and reckless driving and increase motorists' awareness to share the roadway with pedestrians and bicyclists along the corridor. Enforcement should be focused on speeding and pedestrians crossing illegally.</p>	--	
		<p><i>Improve Pedestrian Crossings</i></p> <p>Install pedestrian hybrid signal crossings, with pedestrian refuges.</p>	\$310,000	
		<p><i>Sidewalk Improvements</i></p> <p>Install sidewalks to separate pedestrians from roadway vehicles and improve mobility for pedestrians.</p>	\$450,115	
		<p><i>Construct Raised Median</i></p> <p>Construct a raised median to provide a refuge for pedestrians and improve safety by reducing conflicts with left-turning vehicles.</p>	\$736,560	
		Planning Level Total Segment Cost with Raised Median		\$1,442,675
		Planning Level Total Segment Cost without Raised Median		\$766,115

Exhibit 5-15 – Potential Countermeasures for Segment 13

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
Segment 13, SR-8B, 1st Street to 32nd Street, Yuma			
<p>This segment is a 3.66-mile-long 4-lane state highway from 1st Street , extending south to Catalina Drive at the “Big Curve”, and the intersection of 4th Avenue/SR-8B and 32nd Street (MP 0.3 to MP 4). The AADT along this segment is approximately 16,500 vpd. It should be noted that this route will be turned over to the City of Yuma in September 2009. The segment consists of other key features as below:</p> <ul style="list-style-type: none"> ▪ Bicycle Lane – none ▪ Sidewalks – yes ▪ Median – TWLT median ▪ Posted Speed Limit – 35 mph ▪ Adjacent Land Use – mostly commercial ▪ Building Setback – majority < 25 feet ▪ Crosswalk Locations – only at intersections 	<ul style="list-style-type: none"> ▪ There are more pedestrians on 4th Avenue (Business SR-8B), north of 16th Street. There are more homeless persons there and the library is near there. <p>The regional traffic engineer had the following comments:</p> <ul style="list-style-type: none"> ▪ Lighting is present now ▪ There are several signals along the corridor therefore, pedestrian crossings are not needed 	<p><i>Enhance Pedestrian Signals</i></p> <p>Install pedestrian countdown signals along the corridor. Evaluate existing signal timing and modify pedestrian crossing time if needed.</p>	\$48,000
		<p><i>Increased Enforcement Plans</i></p> <p>Develop an enforcement plan that will help to deter careless and reckless driving and increase motorists’ awareness to share the roadway with pedestrians and bicyclists along the corridor. Enforcement should be focused on speeding and pedestrians crossing illegally.</p>	--
		<p><i>Reduce Curb Radii at Intersections</i></p> <p>Develop a plan to evaluate and reduce curb radii at intersections along the corridor. Reducing the curb radius should reduce pedestrian crossing distance and improve visibility between drivers and pedestrians.</p>	\$480,000
		<p><i>Driveway Improvements</i></p> <p>Evaluate and improve driveways along the corridor. Improvements may include narrowing or closing driveways, or reducing turning radius.</p>	\$600,000
		<p><i>Construct Raised Median</i></p> <p>Construct a raised median to provide a refuge for pedestrians and improve safety by reducing conflicts with left-turning vehicles.</p>	\$4,348,080
		Planning Level Total Segment Cost with Raised Median	
Planning Level Total Segment Cost without Raised Median		\$1,128,000	

Exhibit 5-16 – Potential Countermeasures for Segment 14

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
Segment 14, SR-89A, Dry Creek Road to Soldier Pass Road, Sedona			
<p>This segment is a 1.88-mile-long 4-lane state highway from Dry Creek Road to Soldier Pass Road (MP 371 to MP 372.9). The AADT along this segment is approximately 24,700 vpd. The segment consists of other key features as below:</p> <ul style="list-style-type: none"> ▪ Bicycle Lane – none ▪ Sidewalks – yes ▪ Median – TWLT median ▪ Posted Speed Limit – 40 mph ▪ Adjacent Land Use – commercial / open space ▪ Building Setback – majority > 25 feet ▪ Crosswalk Locations – only at intersections 		<p>The following is a list of potential countermeasures that could be implemented at this location. The list is not intended to be a final list of countermeasures. Actual implementation will depend on further investigations, engineering evaluation, project development, and availability of funding The list is provided to estimate the magnitude of costs that may be required to improve pedestrian safety at this location.</p> <p>SR89A MP 371-373 has an ongoing safety project managed by ADOT-HES and funded by FHWA through the Highway Safety Improvement Program grants. The project scope includes continuous highway lighting, traffic signal at Andante Drive, and a right-turn lane on SR89A turning east onto Andante Drive.</p>	--
Planning Level Total Segment Cost with Raised Median			--
Planning Level Total Segment Cost without Raised Median			--

Exhibit 5-17 – Potential Countermeasures for Segment 15

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
<i>Segment 15, SR-387 (Pinal Avenue), SR-287 to Cottonwood Lane, Casa Grande</i>			
<p>This segment is a 1.01-mile-long 4-lane state highway from SR-287 to Cottonwood Lane (MP 0 to MP 1). The AADT along this segment is approximately 18,400 vpd. The segment consists of other key features as below:</p> <ul style="list-style-type: none"> ▪ Bicycle Lane – none ▪ Sidewalks – yes, break on west side, south of Ocotillo Street ▪ Median – TWLT median ▪ Posted Speed Limit – 35 mph ▪ Adjacent Land Use – commercial / open space ▪ Building Setback – majority > 25 feet ▪ Crosswalk Locations – only at intersections 	<ul style="list-style-type: none"> ▪ City of Casa Grande indicated that this area has activity centers, including - stores and residences. ▪ This is a wide roadway with large signal spacing. 	<p><i>Crosswalk Improvements</i></p> <p>Evaluate and improve crosswalks along the corridor.</p>	\$6,000
		<p><i>Install Pedestrian Crossing Warning Signs</i></p> <p>Install Pedestrian Crossing warning signs to provide regulation, warning, and information to motorists as to what to expect and how to behave when approaching intersections or mid-block crossings.</p>	\$1,200
		<p><i>Enhance Pedestrian Signals</i></p> <p>Install pedestrian countdown signals along the corridor. Evaluate existing signal timing and modify pedestrian crossing time if needed.</p>	\$12,000
		<p><i>Increased Enforcement Plans</i></p> <p>Develop an enforcement plan that will help to deter careless and reckless driving and increase motorists' awareness to share the roadway with pedestrians and bicyclists along the corridor. Enforcement should be focused on speeding and pedestrians crossing illegally.</p>	--
		<p><i>Driveway Improvements</i></p> <p>Evaluate and improve driveways along the corridor. Improvements may include narrowing or closing driveways, or reducing turning radius.</p>	\$200,000
		<p><i>Construct Raised Median</i></p> <p>Construct a raised median to provide a refuge for pedestrians and improve safety by reducing conflicts with left-turning vehicles.</p>	\$1,199,880
		Planning Level Total Segment Cost with Raised Median	
Planning Level Total Segment Cost without Raised Median		\$219,200	

Exhibit 5-18 – Potential Countermeasures for Segment 16

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
<p>The following is a list of potential countermeasures that could be implemented at this location. The list is not intended to be a final list of countermeasures. Actual implementation will depend on further investigations, engineering evaluation, project development, and availability of funding The list is provided to estimate the magnitude of costs that may be required to improve pedestrian safety at this location.</p>			
<i>Segment 16, SR-86, La Cholla Boulevard to 16th Avenue, Tucson</i>			
<p>This segment is a 1.75-mile-long 4-lane state highway from La Cholla Boulevard to 16th Avenue (MP 169.9 to MP 171.7). The AADT along this segment is approximately 31,000 vpd. The segment consists of other key features as below:</p> <ul style="list-style-type: none"> ▪ Bicycle Lane – yes ▪ Sidewalks – yes, break on north near I-19 ▪ Median – TWLT median ▪ Posted Speed Limit – 35 / 45 mph ▪ Adjacent Land Use – mostly commercial ▪ Building Setback – majority > 25 feet ▪ Crosswalk Locations – only at intersections 	<ul style="list-style-type: none"> ▪ At Mission Road, there is high pedestrian and vehicular activity ▪ There is not enough time to cross SR-86 at Mission Road and the median is too narrow to be used as a refuge ▪ Countdown pedestrian signals are located at Mission Road in the north and south directions ▪ At 16th Avenue, there is no crosswalk on the east leg and use crosswalk signs are present ▪ A bus stop is located west of the SR-86 and 16th Avenue intersection ▪ Lynn/Urquides Elementary School is located at Freedom Drive ▪ Four City of Tucson representatives indicated that on SR 86, some pedestrian crashes were at school crossings. At Freedom Drive there is a HAWK crossing now. 	<p><i>Crosswalk Improvements</i></p> <p>Evaluate and improve crosswalks along the corridor.</p>	\$12,000
		<p><i>Install Pedestrian Crossing Warning Signs</i></p> <p>Install Pedestrian Crossing warning signs to provide regulation, warning, and information to motorists as to what to expect and how to behave when approaching intersections or mid-block crossings.</p>	\$2,400
		<p><i>Enhance Pedestrian Signals</i></p> <p>Install pedestrian countdown signals along the corridor. Evaluate existing signal timing and modify pedestrian crossing time if needed.</p>	\$24,000
		<p><i>Increased Enforcement Plans</i></p> <p>Develop an enforcement plan that will help to deter careless and reckless driving and increase motorists' awareness to share the roadway with pedestrians and bicyclists along the corridor. Enforcement should be focused on speeding and pedestrians crossing illegally.</p>	--
		<p><i>Reduce Curb Radii at Intersections</i></p> <p>Develop a plan to evaluate and reduce curb radii at intersections along the corridor. Reducing the curb radius should reduce pedestrian crossing distance and improve visibility between drivers and pedestrians.</p>	\$210,000
		<p><i>Improve Pedestrian Crossings</i></p> <p>Install pedestrian hybrid signal crossings, with pedestrian refuges.</p>	\$1,110,000
		<p><i>Construct Raised Median</i></p> <p>Construct a raised median to provide a refuge for pedestrians and improve safety by reducing conflicts with left-turning vehicles.</p>	\$2,079,000
		Planning Level Total Segment Cost with Raised Median	
Planning Level Total Segment Cost without Raised Median			\$1,358,400

Exhibit 5-19 – Potential Countermeasures for Segment 17

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost		
<i>Segment 17, SR-87 (Arizona Boulevard), Vah Ki Inn Road to Martin Road, Coolidge</i>					
<p>This segment is a 2.0-mile-long 4-lane state highway from Martin Road to Vah Ki Inn Road (MP 131.5 to MP 133.5). The AADT along this segment is approximately 14,700 vpd. The segment consists of other key features as below:</p> <ul style="list-style-type: none"> ▪ Bicycle Lane – none ▪ Sidewalks – yes ▪ Median – TWLT median ▪ Posted Speed Limit – 35 mph ▪ Adjacent Land Use – mostly commercial ▪ Building Setback – majority > 25 feet ▪ Crosswalk Locations – only at intersections 	<ul style="list-style-type: none"> ▪ There is no traffic signal from Martin Road to Coolidge Avenue ▪ Speed limit quickly changes from 65 mph to 35 mph when travelling north toward Martin Road ▪ More pedestrian activity and heavy commercial use toward the northern end of the corridor ▪ Rough pavement and bumps at the end of sidewalk ramps may make crossing difficult for wheelchairs ▪ The Coolidge High School is located on Northern Avenue west of SR-87 <p>The City of Coolidge representative indicated that:</p> <ul style="list-style-type: none"> ▪ On Arizona Boulevard (SR 87), in the vicinity of Northern Avenue, there are a number of schools, and school children cross in this area, particularly to a convenience store on the east side of the road. ▪ On Arizona Boulevard (SR 87) north of Martin Avenue, there is a mobile home park on the east side of the street and a grocery store on the west side of the street, so there are pedestrians crossing. ▪ At the south end of Arizona Boulevard, the speed limits transitions quickly. ▪ There have been requests for mid-block crosswalks. 	<p><i>Crosswalk Improvements</i></p> <p>Evaluate and improve crosswalks along the corridor.</p>	\$8,000		
		<p><i>Install Pedestrian Crossing Warning Signs</i></p> <p>Install Pedestrian Crossing warning signs to provide regulation, warning, and information to motorists as to what to expect and how to behave when approaching intersections or mid-block crossings.</p>	\$1,600		
		<p><i>Enhance Pedestrian Signals</i></p> <p>Install pedestrian countdown signals along the corridor. Evaluate existing signal timing and modify pedestrian crossing time if needed.</p>	\$16,000		
		<p><i>Increased Enforcement Plans</i></p> <p>Develop an enforcement plan that will help to deter careless and reckless driving and increase motorists' awareness to share the roadway with pedestrians and bicyclists along the corridor. Enforcement should be focused on speeding and pedestrians crossing illegally.</p>	--		
		<p><i>Reduce Curb Radii at Intersections</i></p> <p>Develop a plan to evaluate and reduce curb radii at intersections along the corridor. Reducing the curb radius should reduce pedestrian crossing distance and improve visibility between drivers and pedestrians.</p>	\$350,000		
		<p><i>Improve Pedestrian Crossings</i></p> <p>Install pedestrian hybrid signal crossings, with pedestrian refuges.</p>	\$1,240,000		
		<p><i>Construct Raised Median</i></p> <p>Construct a raised median to provide a refuge for pedestrians and improve safety by reducing conflicts with left-turning vehicles.</p>	\$2,376,000		
				Planning Level Total Segment Cost with Raised Median	\$3,751,600
				Planning Level Total Segment Cost without Raised Median	\$1,615,600

Exhibit 5-20 – Potential Countermeasures for Segment 18

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
Segment 18, US-95, SR-8B to Redondo Center Drive, Yuma			
<p>This segment is a 0.8-mile-long 4-lane state highway from SR-8B to Redondo Center Drive (MP 23.4 to MP 24.2). The AADT along this segment is approximately 31,200 vpd. The segment consists of other key features as below:</p> <ul style="list-style-type: none"> ▪ Bicycle Lane – none ▪ Sidewalks – yes ▪ Median – TWLT median ▪ Posted Speed Limit – 35 mph ▪ Adjacent Land Use – mostly commercial ▪ Building Setback – majority > 25 feet ▪ Crosswalk Locations – only at intersections 	<p>The regional traffic engineer had the following comments:</p> <ul style="list-style-type: none"> ▪ A raised median would be helpful ▪ Roadway widening is planned next year – 6-lane highway with median ▪ Bikes lanes should be installed on project ▪ Medians would have to be terminated at intersections ▪ Countdown pedestrian signals would be helpful ▪ The area is over signed 	<p><i>Crosswalk Improvements</i></p> <p>Evaluate and improve crosswalks along the corridor.</p>	\$8,000
		<p><i>Enhance Pedestrian Signals</i></p> <p>Install pedestrian countdown signals along the corridor. Evaluate existing signal timing and modify pedestrian crossing time if needed.</p>	\$16,000
		<p><i>Increased Enforcement Plans</i></p> <p>Develop an enforcement plan that will help to deter careless and reckless driving and increase motorists' awareness to share the roadway with pedestrians and bicyclists along the corridor. Enforcement should be focused on speeding and pedestrians crossing illegally.</p>	--
		<p><i>Reduce Curb Radii at Intersections</i></p> <p>Develop a plan to evaluate and reduce curb radii at intersections along the corridor. Reducing the curb radius should reduce pedestrian crossing distance and improve visibility between drivers and pedestrians.</p>	\$70,000
		<p><i>Improve Pedestrian Crossings</i></p> <p>Install pedestrian hybrid signal crossings, with pedestrian refuges.</p>	\$490,000
		<p><i>Construct Raised Median</i></p> <p>Construct a raised median to provide a refuge for pedestrians and improve safety by reducing conflicts with left-turning vehicles.</p>	\$950,400
		Planning Level Total Segment Cost with Raised Median	
Planning Level Total Segment Cost without Raised Median			\$584,000

Exhibit 5-21 – Potential Countermeasures for Segment 20

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
Segment 20, US-60X (Apache Trail), Signal Butte Road to Meridian Road, Mesa			
<p>This segment is a 1.0-mile-long 6-lane state highway from Signal Butte Road to Meridian Road (MP 193 to MP 194). The AADT along this segment is approximately 21,900 vpd. The segment consists of other key features as below:</p> <ul style="list-style-type: none"> ▪ Bicycle Lane – none ▪ Sidewalks – some ▪ Median – earthen median ▪ Posted Speed Limit – 35 mph ▪ Adjacent Land Use – mostly commercial ▪ Building Setback – majority > 25 feet ▪ Crosswalk Locations – only at intersections 	<ul style="list-style-type: none"> ▪ None 	<p><i>Crosswalk Improvements</i></p> <p>Evaluate and improve crosswalks along the corridor.</p>	\$4,000
		<p><i>Install Pedestrian Crossing Warning Signs</i></p> <p>Install Pedestrian Crossing warning signs to provide regulation, warning, and information to motorists as to what to expect and how to behave when approaching intersections or mid-block crossings.</p>	\$800
		<p><i>Enhance Pedestrian Signals</i></p> <p>Install pedestrian countdown signals along the corridor. Evaluate existing signal timing and modify pedestrian crossing time if needed.</p>	\$8,000
		<p><i>Increased Enforcement Plans</i></p> <p>Develop an enforcement plan that will help to deter careless and reckless driving and increase motorists' awareness to share the roadway with pedestrians and bicyclists along the corridor. Enforcement should be focused on speeding and pedestrians crossing illegally.</p>	--
		<p><i>Driveway Improvements</i></p> <p>Evaluate and improve driveways along the corridor. Improvements may include narrowing or closing driveways, or reducing turning radius.</p>	\$60,000
		<p><i>Sidewalk Improvements</i></p> <p>Install and improve sidewalks to separate pedestrians from roadway vehicles and improve mobility for pedestrians.</p>	\$665,064
		<p><i>Construct Raised Median</i></p> <p>Construct a raised median to provide a refuge for pedestrians and improve safety by reducing conflicts with left-turning vehicles.</p>	\$1,188,000
		Planning Level Total Segment Cost with Raised Median	
Planning Level Total Segment Cost without Raised Median			\$737,864

Exhibit 5-22 – Potential Countermeasures for Segment 21

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
<i>Segment 21, US-60X (Apache Trail), Ellsworth Road to Crismon Road, Mesa</i>			
<p>This segment is a 1.0-mile-long 6-lane state highway from Ellsworth Road to Crismon Road (MP 191 to MP 192). The AADT along this segment is approximately 20,500 vpd. The segment consists of other key features as below:</p> <ul style="list-style-type: none"> ▪ Bicycle Lane – none ▪ Sidewalks – some ▪ Median – earthen median ▪ Posted Speed Limit – 35 mph ▪ Adjacent Land Use – mostly commercial ▪ Building Setback – majority > 25 feet ▪ Crosswalk Locations – only at intersections 	<ul style="list-style-type: none"> ▪ None 	<p><i>Crosswalk Improvements</i></p> <p>Evaluate and improve crosswalks along the corridor.</p>	\$4,000
		<p><i>Install Pedestrian Crossing Warning Signs</i></p> <p>Install Pedestrian Crossing warning signs to provide regulation, warning, and information to motorists as to what to expect and how to behave when approaching intersections or mid-block crossings.</p>	\$800
		<p><i>Enhance Pedestrian Signals</i></p> <p>Install pedestrian countdown signals along the corridor. Evaluate existing signal timing and modify pedestrian crossing time if needed.</p>	\$8,000
		<p><i>Evaluate Sight Obstructions</i></p> <p>Evaluate sight obstructions alongside the roadway, such as vegetation, etc.</p>	--
		<p><i>Increased Enforcement Plans</i></p> <p>Develop an enforcement plan that will help to deter careless and reckless driving and increase motorists' awareness to share the roadway with pedestrians and bicyclists along the corridor. Enforcement should be focused on speeding and pedestrians crossing illegally.</p>	--
		<p><i>Sidewalk Improvements</i></p> <p>Install and improve sidewalks to separate pedestrians from roadway vehicles and improve mobility for pedestrians.</p>	\$833,904
		<p><i>Construct Raised Median</i></p> <p>Construct a raised median to provide a refuge for pedestrians and improve safety by reducing conflicts with left-turning vehicles.</p>	\$1,188,000
		Planning Level Total Segment Cost without Raised Median	\$846,704

Exhibit 5-23 – Potential Countermeasures for Interchange 1

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost	
<p>The following is a list of potential countermeasures that could be implemented at this location. The list is not intended to be a final list of countermeasures. Actual implementation will depend on further investigations, engineering evaluation, project development, and availability of funding The list is provided to estimate the magnitude of costs that may be required to improve pedestrian safety at this location.</p>				
<i>Interchange 1, Greenway Road / I-17, Phoenix</i>				
<p>Greenway Road and I-17 interchange is a diamond interchange. The crossing street of Greenway Road has 3 through lanes in each direction with dual left-turn lanes and a single right-turn lane.</p>	<ul style="list-style-type: none"> ▪ Exiting right-turn vehicles enter crosswalks to turn due sight obstructions ▪ High speed right-turns – provide “Turning Traffic Must Yield to Pedestrians” signs ▪ Pedestrians do not wait for walk signal since time between phases are so long – have multiple phases during one cycle 	<p><i>Crosswalk Improvements</i></p> <p>Evaluate and improve crosswalks at the interchange.</p>	\$4,000	
		<p><i>Install “Turning Traffic Must Yield to Pedestrians” Signs</i></p> <p>Install yield to pedestrian signs to provide regulation, warning, and information to motorists as to what to expect and how to behave when approaching the interchange.</p>	\$800	
		<p><i>Install “No Right Turn on Red” Signs</i></p> <p>Install “No Right Turn on Red” signs to provide a safer crossing for pedestrians, when conditions meet engineering warrants per MUTCD Section 2B.45. Also provide a lead pedestrian interval to address concerns over increased right-turn-on-red conflicts.</p>	\$400	
		<p><i>Enhance Pedestrian Signals</i></p> <p>Install pedestrian countdown signals at the interchange. Evaluate existing signal timing and modify pedestrian crossing time if needed.</p>	\$8,000	
		<p><i>Increased Enforcement Plans</i></p> <p>Develop an enforcement plan that will help to deter careless and reckless driving and increase motorists’ awareness to share the roadway with pedestrians and bicyclists. Enforcement should be focused on speeding and pedestrians crossing illegally.</p>	--	
		<p><i>Reduce Curb Radii</i></p> <p>Develop a plan to evaluate and reduce curb radii. Reducing the curb radius should reduce pedestrian crossing distance and improve visibility between drivers and pedestrians.</p>	\$80,000	
		Planning Level Total Interchange Cost		\$93,200

Exhibit 5-24 – Potential Countermeasures for Interchange 3

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
<p>The following is a list of potential countermeasures that could be implemented at this location. The list is not intended to be a final list of countermeasures. Actual implementation will depend on further investigations, engineering evaluation, project development, and availability of funding The list is provided to estimate the magnitude of costs that may be required to improve pedestrian safety at this location.</p>			
<i>Interchange 3, 7th Avenue / I-10, Phoenix</i>			
<p>7th Avenue and I-10 interchange is a Single Point Urban Interchange. The crossing street of 7th Avenue has 3 through lanes in each direction with dual left-turn lanes. There is a pedestrian overpass crossing 7th Avenue north of the I-10 interchange.</p>	<ul style="list-style-type: none"> ▪ Current location of crosswalk on the southeast corner makes it difficult to see oncoming traffic - roadway is curved and shrubs are obstructing view ▪ Pedestrian signal button arrow is pointing the wrong way to cross the northbound left-turn exit ramp ▪ Exiting right-turn vehicles enter crosswalks to turn due sight obstructions ▪ High speed right-turns – provide “Turning Traffic Must Yield to Pedestrians” signs ▪ Pedestrians do not wait for walk signal since time between phases are so long – have multiple phases during one cycle 	<p><i>Crosswalk Improvements</i></p> <p>Evaluate and improve crosswalks at the interchange.</p>	\$2,000
		<p><i>Install “Turning Traffic Must Yield to Pedestrians” Signs</i></p> <p>Install yield to pedestrian signs to provide regulation, warning, and information to motorists as to what to expect and how to behave when approaching the interchange.</p>	\$400
		<p><i>Install “No Right Turn on Red” Signs</i></p> <p>Install “No Right Turn on Red” signs to provide a safer crossing for pedestrians, when conditions meet engineering warrants per MUTCD Section 2B.45. Also provide a lead pedestrian interval to address concerns over increased right-turn-on-red conflicts.</p>	\$400
		<p><i>Enhance Pedestrian Signals</i></p> <p>Install pedestrian countdown signals at the interchange. Evaluate existing signal timing and modify pedestrian crossing time if needed.</p>	\$4,000
		<p><i>Increased Enforcement Plans</i></p> <p>Develop an enforcement plan that will help to deter careless and reckless driving and increase motorists’ awareness to share the roadway with pedestrians and bicyclists. Enforcement should be focused on speeding and pedestrians crossing illegally.</p>	--
Planning Level Total Interchange Cost			\$6,800

Exhibit 5-25 – Potential Countermeasures for Interchange 4

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
<p>The following is a list of potential countermeasures that could be implemented at this location. The list is not intended to be a final list of countermeasures. Actual implementation will depend on further investigations, engineering evaluation, project development, and availability of funding The list is provided to estimate the magnitude of costs that may be required to improve pedestrian safety at this location.</p>			
<i>Interchange 4, Apache Boulevard / SR-101, Tempe</i>			
<p>The crossing street of Apache Boulevard at the SR 101 interchange has 3 through lanes in each direction.</p>	<ul style="list-style-type: none"> ▪ This intersection is wide, resulting in long pedestrian crossing distances. 	<p><i>Install “Turning Traffic Must Yield to Pedestrians” Signs</i></p> <p>Install yield to pedestrian signs to provide regulation, warning, and information to motorists as to what to expect and how to behave when approaching the interchange.</p>	\$800
		<p><i>Enhance Pedestrian Signals</i></p> <p>Install pedestrian countdown signals at the interchange. Evaluate existing signal timing and modify pedestrian crossing time if needed.</p>	\$8,000
		<p><i>Increased Enforcement Plans</i></p> <p>Develop an enforcement plan that will help to deter careless and reckless driving and increase motorists’ awareness to share the roadway with pedestrians and bicyclists. Enforcement should be focused on speeding and pedestrians crossing illegally.</p>	--
		Planning Level Total Interchange Cost	

Exhibit 5-26 – Potential Countermeasures for Interchange 5

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost	
<p>The following is a list of potential countermeasures that could be implemented at this location. The list is not intended to be a final list of countermeasures. Actual implementation will depend on further investigations, engineering evaluation, project development, and availability of funding The list is provided to estimate the magnitude of costs that may be required to improve pedestrian safety at this location.</p>				
<i>Interchange 5, Cactus Road / I-17, Phoenix</i>				
<p>Cactus Road and I-17 interchange is a diamond interchange. The crossing street of Cactus Road has 2 through lanes in each direction with single left-turn lanes.</p>	<ul style="list-style-type: none"> ▪ Exiting right-turn vehicles enter crosswalks to turn due sight obstructions ▪ High speed right-turns – provide “Turning Traffic Must Yield to Pedestrians” signs ▪ Pedestrians do not wait for walk signal since time between phases are so long – have multiple phases during one cycle 	<p><i>Crosswalk Improvements</i></p> <p>Evaluate and improve crosswalks at the interchange.</p>	\$4,000	
		<p><i>Install “Turning Traffic Must Yield to Pedestrians” Signs</i></p> <p>Install yield to pedestrian signs to provide regulation, warning, and information to motorists as to what to expect and how to behave when approaching the interchange.</p>	\$800	
		<p><i>Install “No Right Turn on Red” Signs</i></p> <p>Install “No Right Turn on Red” signs to provide a safer crossing for pedestrians, when conditions meet engineering warrants per MUTCD Section 2B.45. Also provide a lead pedestrian interval to address concerns over increased right-turn-on-red conflicts.</p>	\$400	
		<p><i>Enhance Pedestrian Signals</i></p> <p>Install pedestrian countdown signals at the interchange. Evaluate existing signal timing and modify pedestrian crossing time if needed.</p>	\$8,000	
		<p><i>Increased Enforcement Plans</i></p> <p>Develop an enforcement plan that will help to deter careless and reckless driving and increase motorists’ awareness to share the roadway with pedestrians and bicyclists. Enforcement should be focused on speeding and pedestrians crossing illegally.</p>	--	
		<p><i>Reduce Curb Radii</i></p> <p>Develop a plan to evaluate and reduce curb radii. Reducing the curb radius should reduce pedestrian crossing distance and improve visibility between drivers and pedestrians.</p>	\$80,000	
		Planning Level Total Interchange Cost		\$93,200

Exhibit 5-27 – Potential Countermeasures for Interchange 9

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
<p><i>Interchange 9, 32nd Street / SR-202, Phoenix</i></p>			
<p>32nd Street and SR-202 interchange is a Single Point Urban Interchange (SPUI). The segment of 32nd Street crossing SR-202 has 5 through lanes with 3 lanes going northbound and 2 lanes southbound. Dual left-turn lanes and single right-turn lane are present for both directions.</p>	<ul style="list-style-type: none"> ▪ Realign right-turn exit ramp to a right angle ▪ Move crosswalk back about 20 feet 	<p><i>Crosswalk Improvements</i></p> <p>Evaluate and improve crosswalks at the interchange.</p>	\$2,000
		<p><i>Install "Turning Traffic Must Yield to Pedestrians" Signs</i></p> <p>Install yield to pedestrian signs to provide regulation, warning, and information to motorists as to what to expect and how to behave when approaching the interchange.</p>	\$400
		<p><i>Install "No Right Turn on Red" Signs</i></p> <p>Install "No Right Turn on Red" signs to provide a safer crossing for pedestrians, when conditions meet engineering warrants per MUTCD Section 2B.45. Also provide a lead pedestrian interval to address concerns over increased right-turn-on-red conflicts.</p>	\$400
		<p><i>Enhance Pedestrian Signals</i></p> <p>Install pedestrian countdown signals at the interchange. Evaluate existing signal timing and modify pedestrian crossing time if needed.</p>	\$4,000
		<p><i>Increased Enforcement Plans</i></p> <p>Develop an enforcement plan that will help to deter careless and reckless driving and increase motorists' awareness to share the roadway with pedestrians and bicyclists. Enforcement should be focused on speeding and pedestrians crossing illegally.</p>	--
		<p><i>Reduce Curb Radii</i></p> <p>Develop a plan to evaluate and reduce curb radii. Reducing the curb radius should reduce pedestrian crossing distance and improve visibility between drivers and pedestrians.</p>	\$40,000
		Planning Level Total Interchange Cost	

Exhibit 5-28 – Potential Countermeasures for Interchange 10

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
<p>The following is a list of potential countermeasures that could be implemented at this location. The list is not intended to be a final list of countermeasures. Actual implementation will depend on further investigations, engineering evaluation, project development, and availability of funding The list is provided to estimate the magnitude of costs that may be required to improve pedestrian safety at this location.</p>			
<i>Interchange 10, Bethany Home Road / I-17, Phoenix</i>			
Bethany Home Road and I-17 interchange is a Single Point Urban Interchange. The crossing street of Bethany Home Road has 3 through lanes in each direction with dual left-turn lanes and single right-turn lane.	<ul style="list-style-type: none"> ▪ No refuge area for pedestrians on Bethany Home Road ▪ No walk phase provided for northbound and southbound pedestrians ▪ Exiting right-turn vehicles enter crosswalks to turn due sight obstructions ▪ High speed right-turns – provide “Turning Traffic Must Yield to Pedestrians” signs ▪ Pedestrians do not wait for walk signal since time between phases are so long – have multiple phases during one cycle 	<p><i>Crosswalk Improvements</i></p> <p>Evaluate and improve crosswalks at the interchange.</p>	\$2,000
		<p><i>Install “Turning Traffic Must Yield to Pedestrians” Signs</i></p> <p>Install yield to pedestrian signs to provide regulation, warning, and information to motorists as to what to expect and how to behave when approaching the interchange.</p>	\$400
		<p><i>Install “No Right Turn on Red” Signs</i></p> <p>Install “No Right Turn on Red” signs to provide a safer crossing for pedestrians, when conditions meet engineering warrants per MUTCD Section 2B.45. Also provide a lead pedestrian interval to address concerns over increased right-turn-on-red conflicts.</p>	\$400
		<p><i>Enhance Pedestrian Signals</i></p> <p>Install pedestrian countdown signals at the interchange. Evaluate existing signal timing and modify pedestrian crossing time if needed.</p>	\$10,000
		<p><i>Increased Enforcement Plans</i></p> <p>Develop an enforcement plan that will help to deter careless and reckless driving and increase motorists’ awareness to share the roadway with pedestrians and bicyclists. Enforcement should be focused on speeding and pedestrians crossing illegally.</p>	--
		<p><i>Evaluate Sight Distance</i></p> <p>Evaluate driver sight distance for pedestrians. Many interchanges have concrete barriers separating the pedestrian from the travel lane; many of these can introduce sight distance concerns.</p>	--
		<p><i>Reduce Curb Radii</i></p> <p>Develop a plan to evaluate and reduce curb radii. Reducing the curb radius should reduce pedestrian crossing distance and improve visibility between drivers and pedestrians.</p>	\$40,000
		Planning Level Total Interchange Cost	

Exhibit 5-29 – Potential Countermeasures for Interchange 11

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
<p>The following is a list of potential countermeasures that could be implemented at this location. The list is not intended to be a final list of countermeasures. Actual implementation will depend on further investigations, engineering evaluation, project development, and availability of funding The list is provided to estimate the magnitude of costs that may be required to improve pedestrian safety at this location.</p>			
<i>Interchange 11, Camelback Road / I-17, Phoenix</i>			
<p>Camelback Road and I-17 interchange is a Single Point Urban Interchange. The crossing street of Camelback Road has 3 through lanes in each direction with dual left-turn lanes and single right-turn lane.</p>	<ul style="list-style-type: none"> ▪ Narrow median does not provide a refuge for pedestrians ▪ Bus stop east of interchange should be moved to nearest signalized intersection – current location may encourage pedestrians to cross midblock ▪ Worn crosswalks striping ▪ Exiting right-turn vehicles enter crosswalks to turn due sight obstructions ▪ High speed right-turns – provide “Turning Traffic Must Yield to Pedestrians” signs ▪ Pedestrians do not wait for walk signal since time between phases are so long – have multiple phases during one cycle 	<p><i>Crosswalk Improvements</i></p> <p>Evaluate and improve crosswalks at the interchange.</p>	\$2,000
		<p><i>Install “Turning Traffic Must Yield to Pedestrians” Signs</i></p> <p>Install yield to pedestrian signs to provide regulation, warning, and information to motorists as to what to expect and how to behave when approaching the interchange.</p>	\$400
		<p><i>Install “No Right Turn on Red” Signs</i></p> <p>Install “No Right Turn on Red” signs to provide a safer crossing for pedestrians, when conditions meet engineering warrants per MUTCD Section 2B.45. Also provide a lead pedestrian interval to address concerns over increased right-turn-on-red conflicts.</p>	\$400
		<p><i>Enhance Pedestrian Signals</i></p> <p>Install pedestrian countdown signals at the interchange. Evaluate existing signal timing and modify pedestrian crossing time if needed.</p>	\$10,000
		<p><i>Increased Enforcement Plans</i></p> <p>Develop an enforcement plan that will help to deter careless and reckless driving and increase motorists’ awareness to share the roadway with pedestrians and bicyclists. Enforcement should be focused on speeding and pedestrians crossing illegally.</p>	--
		<p><i>Evaluate Sight Distance</i></p> <p>Evaluate driver sight distance for pedestrians. Many interchanges have concrete barriers separating the pedestrian from the travel lane; many of these can introduce sight distance concerns.</p>	--
		Planning Level Total Interchange Cost	

Exhibit 5-30 – Potential Countermeasures for Interchange 12

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
<p>The following is a list of potential countermeasures that could be implemented at this location. The list is not intended to be a final list of countermeasures. Actual implementation will depend on further investigations, engineering evaluation, project development, and availability of funding The list is provided to estimate the magnitude of costs that may be required to improve pedestrian safety at this location.</p>			
<i>Interchange 12, Dunlap Avenue / I-17, Phoenix</i>			
<p>Dunlap Avenue and I-17 interchange is a Single Point Urban Interchange. The crossing street of Dunlap Avenue has 3 through lanes in westbound direction with dual left-turn lanes and single right-turn lane, and 4 through lanes in eastbound direction with dual left-turn and right-turn lanes.</p>	<ul style="list-style-type: none"> ▪ Double right-turns may be problematic for pedestrians ▪ Exiting right-turn vehicles enter crosswalks to turn due sight obstructions ▪ High speed right-turns – provide “Turning Traffic Must Yield to Pedestrians” signs ▪ Not enough walk time is provided to cross exit and entrance ramps ▪ Pedestrians do not wait for walk signal since time between phases are so long – have multiple phases during one cycle 	<p><i>Crosswalk Improvements</i></p> <p>Evaluate and improve crosswalks at the interchange.</p>	\$2,000
		<p><i>Install “Turning Traffic Must Yield to Pedestrians” Signs</i></p> <p>Install yield to pedestrian signs to provide regulation, warning, and information to motorists as to what to expect and how to behave when approaching the interchange.</p>	\$400
		<p><i>Install “No Right Turn on Red” Signs</i></p> <p>Install “No Right Turn on Red” signs to provide a safer crossing for pedestrians, when conditions meet engineering warrants per MUTCD Section 2B.45. Also provide a lead pedestrian interval to address concerns over increased right-turn-on-red conflicts.</p>	\$400
		<p><i>Enhance Pedestrian Signals</i></p> <p>Install pedestrian countdown signals at the interchange. Evaluate existing signal timing and modify pedestrian crossing time if needed.</p>	\$10,000
		<p><i>Increased Enforcement Plans</i></p> <p>Develop an enforcement plan that will help to deter careless and reckless driving and increase motorists’ awareness to share the roadway with pedestrians and bicyclists. Enforcement should be focused on speeding and pedestrians crossing illegally.</p>	--
		<p><i>Reduce Curb Radii</i></p> <p>Develop a plan to evaluate and reduce curb radii. Reducing the curb radius should reduce pedestrian crossing distance and improve visibility between drivers and pedestrians.</p>	\$40,000
		Planning Level Total Interchange Cost	

Exhibit 5-31 – Potential Countermeasures for Interchange 13

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
<p>The following is a list of potential countermeasures that could be implemented at this location. The list is not intended to be a final list of countermeasures. Actual implementation will depend on further investigations, engineering evaluation, project development, and availability of funding The list is provided to estimate the magnitude of costs that may be required to improve pedestrian safety at this location.</p>			
<i>Interchange 13, University Drive / SR-101, Tempe</i>			
University Drive and SR-101 Interchange is a Diamond Interchange. The crossing street of University Drive has 3 through lanes in each direction with dual left-turn lanes and single right-turn lane.	▪ None	<i>Crosswalk Improvements</i> Evaluate and improve crosswalks at the interchange.	\$4,000
		<i>Install "Turning Traffic Must Yield to Pedestrians" Signs</i> Install yield to pedestrian signs to provide regulation, warning, and information to motorists as to what to expect and how to behave when approaching the interchange.	\$800
		<i>Enhance Pedestrian Signals</i> Install pedestrian countdown signals at the interchange. Evaluate existing signal timing and modify pedestrian crossing time if needed.	\$8,000
		<i>Increased Enforcement Plans</i> Develop an enforcement plan that will help to deter careless and reckless driving and increase motorists' awareness to share the roadway with pedestrians and bicyclists. Enforcement should be focused on speeding and pedestrians crossing illegally.	--
		<i>Improve Roadway Lighting</i> Install lighting at interchange to ensure safe pedestrian crossing at night.	\$10,000
Planning Level Total Interchange Cost			\$22,800

Exhibit 5-32 – Potential Countermeasures for Interchange 14

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
<p>The following is a list of potential countermeasures that could be implemented at this location. The list is not intended to be a final list of countermeasures. Actual implementation will depend on further investigations, engineering evaluation, project development, and availability of funding The list is provided to estimate the magnitude of costs that may be required to improve pedestrian safety at this location.</p>			
<i>Interchange 14, Baseline Road / I-10, Tempe / Mesa</i>			
<p>Baseline Road and I-10 Interchange is a Diamond Interchange. The crossing street of Baseline Road has 3 through lanes in each direction with dual left-turn lanes and single right-turn lane.</p>	<ul style="list-style-type: none"> ▪ Post may be blocking sight for pedestrians and drivers from westbound to I-10 NB entrance ramp ▪ Double right-turns may be problematic for pedestrians ▪ Exiting right-turn vehicles enter crosswalks to turn due to sight obstructions ▪ High speed right-turns – provide “Turning Traffic Must Yield to Pedestrians” signs ▪ Walk time is only long enough to get to median; Walk phase is only about 3 seconds before flashing don’t walk; pedestrians do not wait for walk signal since time between phases are so long – have multiple phases during one cycle 	<p><i>Crosswalk Improvements</i></p> <p>Evaluate and improve crosswalks at the interchange.</p>	\$4,000
		<p><i>Install “Turning Traffic Must Yield to Pedestrians” Signs</i></p> <p>Install yield to pedestrian signs to provide regulation, warning, and information to motorists as to what to expect and how to behave when approaching the interchange.</p>	\$800
		<p><i>Install “No Right Turn on Red” Signs</i></p> <p>Install “No Right Turn on Red” signs to provide a safer crossing for pedestrians, when conditions meet engineering warrants per MUTCD Section 2B.45. Also provide a lead pedestrian interval to address concerns over increased right-turn-on-red conflicts.</p>	\$400
		<p><i>Enhance Pedestrian Signals</i></p> <p>Install pedestrian countdown signals at the interchange. Evaluate existing signal timing and modify pedestrian crossing time if needed.</p>	\$8,000
		<p><i>Increased Enforcement Plans</i></p> <p>Develop an enforcement plan that will help to deter careless and reckless driving and increase motorists’ awareness to share the roadway with pedestrians and bicyclists. Enforcement should be focused on speeding and pedestrians crossing illegally.</p>	--
		<p><i>Reduce Curb Radii</i></p> <p>Develop a plan to evaluate and reduce curb radii. Reducing the curb radius should reduce pedestrian crossing distance and improve visibility between drivers and pedestrians.</p>	\$80,000
		Planning Level Total Interchange Cost	

Exhibit 5-33 – Potential Countermeasures for Interchange 18

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
<p>The following is a list of potential countermeasures that could be implemented at this location. The list is not intended to be a final list of countermeasures. Actual implementation will depend on further investigations, engineering evaluation, project development, and availability of funding The list is provided to estimate the magnitude of costs that may be required to improve pedestrian safety at this location.</p>			
Interchange 18, Indian School Road / I-17, Phoenix			
<p>Indian School Road and I-17 interchange is a diamond interchange. The crossing street Indian School Road has 4 through lanes in each direction with dual left-turn lanes and single right-turn lane.</p>	<ul style="list-style-type: none"> ▪ Double right-turn on northbound exit ramp conflicts with pedestrians crossing on walk signal ▪ Exiting right-turn vehicles enter crosswalks to turn due sight obstructions ▪ High speed right-turns – provide “Turning Traffic Must Yield to Pedestrians” signs ▪ Pedestrian signal is out near southbound exit ramp ▪ Pedestrians do not wait for walk signal since time between phases are so long – have multiple phases during one cycle <p>City of Phoenix staff indicated that :</p> <ul style="list-style-type: none"> ▪ Indian School Road between Central and I-17 is in a heavily populated area. ▪ Indian School Road is an 8-lane roadway with sidewalks adjacent to the road. The City wishes to put in bike lanes to separate the sidewalks from the road and to decrease the crossing distance. ▪ I-17 intersection is extremely wide, and pedestrian timing might be inadequate. The west side of I-17 is more economically depressed than the east, and it also has more destinations. 	<p><i>Crosswalk Improvements</i></p> <p>Evaluate and improve crosswalks at the interchange.</p>	\$4,000
		<p><i>Install “Turning Traffic Must Yield to Pedestrians” Signs</i></p> <p>Install yield to pedestrian signs to provide regulation, warning, and information to motorists as to what to expect and how to behave when approaching the interchange.</p>	\$800
		<p><i>Install “No Right Turn on Red” Signs</i></p> <p>Install “No Right Turn on Red” signs to provide a safer crossing for pedestrians, when conditions meet engineering warrants per MUTCD Section 2B.45. Also provide a lead pedestrian interval to address concerns over increased right-turn-on-red conflicts.</p>	\$400
		<p><i>Enhance Pedestrian Signals</i></p> <p>Install pedestrian countdown signals at the interchange. Evaluate existing signal timing and modify pedestrian crossing time if needed.</p>	\$8,000
		<p><i>Increased Enforcement Plans</i></p> <p>Develop an enforcement plan that will help to deter careless and reckless driving and increase motorists’ awareness to share the roadway with pedestrians and bicyclists. Enforcement should be focused on speeding and pedestrians crossing illegally.</p>	--
Planning Level Total Interchange Cost			\$13,200

Exhibit 5-34 – Potential Countermeasures for Tribal Community Location 1

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
		The following is a list of potential countermeasures that could be implemented at this location. The list is not intended to be a final list of countermeasures. Actual implementation will depend on further investigations, engineering evaluation, project development, and availability of funding The list is provided to estimate the magnitude of costs that may be required to improve pedestrian safety at this location.	
<i>Location 1, SR-587, MP 220, Gila River Indian Community</i>			
This location is near MP 220 on SR-587. At this location, SR-587 is a 2-lane state highway in a rural area. From the highway video log, it was found that no sidewalks are present; however, there are paved shoulders on both sides of the roadway.	<ul style="list-style-type: none"> ▪ Need for improved shoulders 	<i>Evaluate Paved Shoulder Widths</i>	\$300,000
		Evaluate paved shoulder width near MP 220 to determine if the shoulder is wide enough for pedestrians to walk alongside the roadway safely.	
Planning Level Total Location Cost			\$300,000

Exhibit 5-35 – Potential Countermeasures for Tribal Community Location 2

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
		The following is a list of potential countermeasures that could be implemented at this location. The list is not intended to be a final list of countermeasures. Engineering analysis and scoping are required for countermeasures selection. The list is provided to estimate the magnitude of costs that may be required to improve pedestrian safety at this location.	
<i>Location 2, SR-87, MP 135 to 160, Gila River Indian Community</i>			
This location is a 25.0-mile-long 2-lane segment of state highway from MP 135 to MP 160 on SR-87. SR-87 transitions from a rural area to a residential area at this location. The highway video log showed that paved shoulders are on both sides of the roadway; however in some areas the shoulder is too narrow for pedestrian use.	<ul style="list-style-type: none"> ▪ Need for wider shoulders and lighting in residential areas ▪ Need signage alerting drivers entering residential areas ▪ Need better enforcement of speed 	<i>Evaluate Roadway Lighting on SR-87</i>	\$130,000
		Evaluate lighting between MP 135 and MP 160, especially at intersections and near commercial and residential developments.	
		<i>Evaluate Need for Sidewalk / Walkway Improvements</i>	\$3,502,800
		Evaluate the need to install sidewalks/walkways near commercial development and bus stop locations to separate pedestrians from roadway vehicles and improve mobility for pedestrians.	
		<i>Evaluate Paved Shoulder Widths</i>	\$7,500,000
Evaluate paved shoulder width between MP 135 and MP 160 to determine if the shoulder is wide enough for pedestrians to walk alongside the roadway safely.			
<i>Bus Stop Improvements</i>	\$139,600		
Provide school bus stop areas and turnout lanes along SR-87 between MP 135 and MP 160.			
Planning Level Total Location Cost			\$7,630,000

Exhibit 5-36 – Potential Countermeasures for Tribal Community Location 3

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
		The following is a list of potential countermeasures that could be implemented at this location. The list is not intended to be a final list of countermeasures. Actual implementation will depend on further investigations, engineering evaluation, project development, and availability of funding The list is provided to estimate the magnitude of costs that may be required to improve pedestrian safety at this location.	
<i>Location 3, US-89, MP 464.7 to 470, Navajo Nation</i>			
This segment is a 5.3-mile-long 2-lane state highway from MP 464.7 to MP 470 in a rural area. The speed limit along this segment ranges from 50 mph to 65 mph. From the highway video log, it was found that paved shoulders are present on both sides of the roadway. From MP 465 to MP 469, the shoulder appears to be in a maintained condition. From MP 469 to MP 470, the shoulder is narrow and may be difficult for pedestrians to use.	<ul style="list-style-type: none"> ▪ Lack of sidewalks ▪ Lack of street lighting 	<i>Evaluate Roadway Lighting on US-89</i>	\$10,000
		Evaluate lighting between MP 465 and MP 470, especially at intersections and near commercial and residential developments.	
		<i>Evaluate Paved Shoulder Widths</i>	\$600,000
		Evaluate paved shoulder width between MP 465 and MP 470 to determine if the shoulder is wide enough for pedestrians to walk alongside the roadway safely.	
Planning Level Total Location Cost			\$610,000

Exhibit 5-37 – Potential Countermeasures for Tribal Community Location 4

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
		The following is a list of potential countermeasures that could be implemented at this location. The list is not intended to be a final list of countermeasures. Engineering analysis and scoping are required for countermeasures selection. The list is provided to estimate the magnitude of costs that may be required to improve pedestrian safety at this location.	
<i>Location 4, US-160, MP 321.7 to MP 323, Navajo Nation</i>			
This location is a 1.3-mile-long 2-lane segment of state highway from MP 321.7 to MP 323 on US-160. The segment is in a rural area. From the highway video log, it was found that paved shoulders are present. Near the intersection of SR-264 and US-160, there is some commercial development. Street lights are present but sidewalks are not.	<ul style="list-style-type: none"> ▪ Lack of sidewalks ▪ Lack of street lighting 	<i>Evaluate Roadway Lighting</i>	\$15,000
		Evaluate lighting on US-160, especially at intersections and near commercial and residential developments.	
		<i>Evaluate Need for Sidewalk / Walkway Improvements</i>	\$831,643
		Evaluate the need to install sidewalks/walkways along US-160 near commercial development to separate pedestrians from roadway vehicles and improve mobility for pedestrians.	
Planning Level Total Location Cost			\$846,643

Exhibit 5-38 – Potential Countermeasures for Tribal Community Location 5

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	
		The following is a list of potential countermeasures that could be implemented at this location. The list is not intended to be a final list of countermeasures. Actual implementation will depend on further investigations, engineering evaluation, project development, and availability of funding The list is provided to estimate the magnitude of costs that may be required to improve pedestrian safety at this location.	Estimated Conceptual Cost
<i>Location 5, US-160, MP 393 to MP 393.7, Navajo Nation</i>			
This location is a 0.7-mile-long 2-lane segment of state highway from MP 393 to MP 393.7 on US-160. The segment is in a rural area. From the highway video log, it was found that on US-160 much of the paved shoulder is too narrow for pedestrians and the vegetation along the side of the road is overgrown. There is some commercial development near US-163, where street lights are present but sidewalks are not.	<ul style="list-style-type: none"> ▪ Lack of sidewalks ▪ Lack of street lighting 	<i>Evaluate Roadway Lighting</i>	\$5,000
		Evaluate lighting on US-160, especially at intersections and near commercial and residential developments.	
		<i>Remove Vegetation Overgrowth</i>	--
		Remove the vegetation overgrown along the side of the road to allow pedestrians to walk on the shoulder more easily.	
		<i>Evaluate Need for Sidewalk / Walkway Improvements</i>	\$319,032
Evaluate the need to install sidewalks/walkways along US-160 near US-163 to separate pedestrians from roadway vehicles and improve mobility for pedestrians.			
<i>Extend Paved Shoulder Widths</i>	\$120,000		
Extend the paved shoulder width to 8 feet along US-160 to provide an area for pedestrians to walk alongside the roadway.			
Planning Level Total Location Cost			\$444,032

Exhibit 5-39 – Potential Countermeasures for Tribal Community Location 6

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	
		The following is a list of potential countermeasures that could be implemented at this location. The list is not intended to be a final list of countermeasures. Engineering analysis and scoping are required for countermeasures selection. The list is provided to estimate the magnitude of costs that may be required to improve pedestrian safety at this location.	Estimated Conceptual Cost
<i>Location 6, US-163, MP 393.5 to MP 395.4, Navajo Nation</i>			
This location is a 1.9-mile-long 5-lane segment of state highway from MP 393.5 to MP 395.4 on US-163. The segment is in a rural area. There is some commercial development near US-160 and sidewalks are present on the entire segment of US-163. In this area, there are very few crossing opportunities for pedestrians.	<ul style="list-style-type: none"> ▪ Needs raised median ▪ Needs pedestrian crossing 	<i>Evaluate Crossing Opportunities</i>	\$250,000
		Crossing opportunities should be evaluated to determine if signalized crossings should be installed.	
		<i>Evaluate Need for a Raised Median</i>	\$3,009,600
Evaluate the need for a continuous raised median to provide a refuge for pedestrians and improve overall safety and access management by reducing conflicts with left-turning vehicles.			
Planning Level Total Location Cost			\$3,259,600

Exhibit 5-40 – Potential Countermeasures for Tribal Community Location 7

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
<p><i>Location 7, US-191, MP 446.6 to MP 448.2, Navajo Nation</i></p>			
<p>This segment transitions from a 4-lane state highway to a 5-lane roadway from MP 446.6 to MP 448.2 on US-191. The highway video log showed that there is commercial development, and lighting and sidewalks are provided. In this area, there are very few crossing opportunities for pedestrians. The highway video log also showed that there was vegetation overgrown alongside the roadway and sidewalks.</p>	<ul style="list-style-type: none"> ▪ Needs raised median ▪ Needs pedestrian crossing 	<p><i>Evaluate Crossing Opportunities</i></p> <p>Crossing opportunities should be evaluated to determine if signalized crossings should be installed.</p>	\$250,000
		<p><i>Remove Vegetation Overgrowth</i></p> <p>Remove the vegetation overgrown along the side of the road and sidewalks to allow pedestrians to walk on the shoulder more easily.</p>	--
		<p><i>Evaluate Need for Sidewalk / Walkway Improvements</i></p> <p>Evaluate the need to improve sidewalks/walkways along US-191 to improve mobility for pedestrians.</p>	\$1,014,422
		<p><i>Evaluate Need for a Raised Median</i></p> <p>Evaluate the need for a continuous raised median to provide a refuge for pedestrians and improve overall safety and access management by reducing conflicts with left-turning vehicles.</p>	\$2,534,400
		Planning Level Total Location Cost	

Exhibit 5-41 – Potential Countermeasures for Tribal Community Location 8

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
<p><i>Location 8, SR-264, MP 446.3 to MP 447.6, Navajo Nation</i></p>			
<p>This segment is a 1.3-mile-long 2-lane state highway from MP 446.3 to MP 447.6 on SR-264. The segment is in a rural area. From the highway video log, it was found that paved shoulders are present on both sides of the roadway, however much of the shoulder is too narrow for pedestrians.</p>	<ul style="list-style-type: none"> ▪ Lack of sidewalks ▪ Needs pedestrian crossing 	<p><i>Evaluate Crossing Opportunities</i></p> <p>Crossing opportunities should be evaluated to determine if signalized crossings should be installed.</p>	\$250,000
		<p><i>Evaluate Need for Sidewalk / Walkway Improvements</i></p> <p>Evaluate the need to install sidewalks/walkways along SR-264 to separate pedestrians from roadway vehicles and improve mobility for pedestrians.</p>	\$820,843
		Planning Level Total Location Cost	

Exhibit 5-42 – Potential Countermeasures for Tribal Community Location 9

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
<i>Location 9, SR-264, MP 474.7 to MP 475.8, Navajo Nation</i>			
<p>This segment is a 1.1-mile-long 5-lane state highway from MP 474.7 to MP 475.8 on SR-264. At this location, the highway video log showed that sidewalks are present. In this area, there are very few crossing opportunities for pedestrians to cross the 5-lane roadway.</p>	<ul style="list-style-type: none"> ▪ Needs raised median ▪ Needs pedestrian crossing 	<p><i>Evaluate Crossing Opportunities</i></p> <p>Crossing opportunities should be evaluated to determine if signalized crossings should be installed.</p>	\$250,000
		<p><i>Evaluate Need for a Raised Median</i></p> <p>Evaluate the need for a continuous raised median to provide a refuge for pedestrians and improve overall safety and access management by reducing conflicts with left-turning vehicles.</p>	\$1,742,400
		Total Location Cost	\$1,992,400

Exhibit 5-43 – Potential Countermeasures for Tribal Community Location 10

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
<i>Location 10, SR-86, MP 74 to MP 76, Tohono O'odham Nation</i>			
<p>This segment is a 2.0-mile-long 2-lane state highway from MP 74 to MP 76 on SR-86. The segment is in a rural area. From the highway video log, it was found that only unpaved shoulders are present and much of the shoulder is overgrown with vegetation. It should be noted that American Recovery and Reinvestment Act – ADOT Approved Projects (March 13, 2009) includes shoulder widening on SR 86, between milepost 73.9 and 74.9.</p>	<ul style="list-style-type: none"> ▪ No shoulders for pedestrians or cyclists ▪ Roads are narrow ▪ Vegetation is overgrown ▪ Lack of lighting 	<p><i>Evaluate Crossing Opportunities</i></p> <p>Crossing opportunities should be evaluated to determine if signalized midblock crossings should be installed, especially near schools.</p>	\$250,000
		<p><i>Remove Vegetation Overgrowth</i></p> <p>Remove the vegetation overgrown along the side of the road to allow pedestrians to walk on the shoulder more easily.</p>	--
		<p><i>Extend Paved Shoulder Widths</i></p> <p>Extend the paved shoulder width to 8 feet along SR-86 to provide an area for pedestrians to walk alongside the roadway.</p>	\$1,200,000
Planning Level Total Location Cost			\$1,450,000

Exhibit 5-44 – Potential Countermeasures for Tribal Community Location 11

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
Location 11, SR-86, MP 90to MP 94, Tohono O'odham Nation			
<p>This segment is a 4.0-mile-long 2-lane state highway from MP 90 to MP 94 on SR-86. The segment is in a rural area. From the highway video log, it was found that only unpaved shoulders are present and much of the shoulder is overgrown with vegetation.</p>	<ul style="list-style-type: none"> ▪ No shoulders for pedestrians or cyclists ▪ Roads are narrow ▪ Vegetation is overgrown ▪ Lack of lighting 	<p><i>Evaluate Crossing Opportunities</i></p> <p>Crossing opportunities should be evaluated to determine if signalized midblock crossings should be installed, especially near schools.</p>	\$250,000
		<p><i>Evaluate Roadway Lighting</i></p> <p>Evaluate lighting between MP 90 and MP 94, especially at intersections and near commercial and residential developments.</p>	\$20,000
		<p><i>Evaluate Sight Distance</i></p> <p>Evaluate the need to improve sight distance along the roadway in ways such as cutting away from the hill side and reducing the slope of the road. If engineering studies identify a need for slope reduction of the road, alignment and grade modifications are complex countermeasures.</p>	--
		<p><i>Install Signs</i></p> <p>Install signs to indicate business areas and reduce speed limit.</p>	--
		<p><i>Remove Vegetation Overgrowth</i></p> <p>Remove the vegetation overgrown along the side of the road to allow pedestrians to walk on the shoulder more easily.</p>	--
		<p><i>Extend Paved Shoulder Widths</i></p> <p>Extend the paved shoulder width to 8 feet along SR-86 to provide an area for pedestrians to walk alongside the roadway.</p>	\$2,400,000
		Planning Level Total Location Cost	

Exhibit 5-45 – Potential Countermeasures for Tribal Community Location 12

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
<p>The following is a list of potential countermeasures that could be implemented at this location. The list is not intended to be a final list of countermeasures. Actual implementation will depend on further investigations, engineering evaluation, project development, and availability of funding The list is provided to estimate the magnitude of costs that may be required to improve pedestrian safety at this location.</p>			
<i>Location 12, SR-86, MP 111.1 to MP 116.6, Tohono O’odham Nation</i>			
<p>This segment is a 5.5-mile-long 2-lane state highway from MP 111.1 to MP 116.6 on SR-86. The segment is in a rural area. From the highway video log, it was found that only unpaved shoulders are present and much of the shoulder is overgrown with vegetation. A construction project between MP 112.59 and 115.76 is nearly complete. Upon completion, this section will have eight foot shoulders.</p>	<ul style="list-style-type: none"> ▪ No shoulders for pedestrians or cyclists ▪ Roads are narrow ▪ Vegetation is overgrown ▪ Lack of lighting 	<p><i>Evaluate Crossing Opportunities</i></p> <p>Crossing opportunities should be evaluated to determine if signalized midblock crossings should be installed, especially near schools.</p>	\$250,000
		<p><i>Evaluate Roadway Lighting</i></p> <p>Evaluate lighting between MP 111.1 and MP 116.6, especially at intersections and near commercial and residential developments.</p>	\$5,000
		<p><i>Evaluate Sight Distance</i></p> <p>Evaluate the need to improve sight distance along the roadway in ways such as cutting away from the hill side and reducing the slope of the road. If engineering studies identify a need for slope reduction of the road, alignment and grade modifications are complex countermeasures.</p>	--
		<p><i>Install Signs</i></p> <p>Install signs to indicate business areas and reduce speed limit.</p>	--
		<p><i>Remove Vegetation Overgrowth</i></p> <p>Remove the vegetation overgrown along the side of the road to allow pedestrians to walk on the shoulder more easily.</p>	--
		<p><i>Extend Paved Shoulder Widths</i></p> <p>Extend the paved shoulder width to 8 feet along SR-86 to provide an area for pedestrians to walk alongside the roadway.</p>	\$1,500,000
		Planning Level Total Location Cost	

Exhibit 5-46 – Potential Countermeasures for Tribal Community Location 13

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
		The following is a list of potential countermeasures that could be implemented at this location. The list is not intended to be a final list of countermeasures. Actual implementation will depend on further investigations, engineering evaluation, project development, and availability of funding The list is provided to estimate the magnitude of costs that may be required to improve pedestrian safety at this location.	
<i>Location 13, SR-264, MP 385 to MP 390, Hopi Tribe</i>			
This segment is a 5.0-mile-long 2-lane state highway from MP 385 to MP 390 on SR-264. The segment is in a rural area. The highway video log showed that much of the paved shoulder is too narrow for pedestrians. In this area, there are no crossing opportunities for pedestrians to cross the roadway.	<ul style="list-style-type: none"> ▪ No crosswalks near Second Mesa Elementary School ▪ No sidewalks, bus stop provisions, or turn lanes 	<i>Evaluate Crossing Opportunities</i>	\$250,000
		Crossing opportunities should be evaluated to determine if signalized midblock crossings should be installed, especially near Second Mesa Elementary School.	
		<i>Remove Vegetation Overgrowth</i>	--
		Remove the vegetation overgrown along the side of the road to allow pedestrians to walk on the shoulder more easily.	
		<i>Extend Paved Shoulder Widths</i>	\$3,000,000
		Extend the paved shoulder width to 8 feet along SR-264 to provide an area for pedestrians to walk alongside the roadway.	
Total Location Cost			\$3,250,000

Exhibit 5-47 – Potential Countermeasures for Tribal Community Location 14

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
		The following is a list of potential countermeasures that could be implemented at this location. The list is not intended to be a final list of countermeasures. Engineering analysis and scoping are required for countermeasures selection. The list is provided to estimate the magnitude of costs that may be required to improve pedestrian safety at this location.	
<i>Location 14, SR-264, MP 367 to MP 369, Hopi Tribe</i>			
This segment is a 2.5-mile-long 2-lane state highway from MP 367 to MP 369 on SR-264. The segment is in a rural area. The highway video log showed that much of the paved shoulder is too narrow for pedestrians.	<ul style="list-style-type: none"> ▪ Need of pedestrian/ bicycle walkway, school bus stop areas, and turn-out lanes 	<i>Evaluate Need for Sidewalk / Walkway Improvements</i>	\$627,264
		Evaluate the need to install sidewalks/walkways along SR-264 between MP 367 and MP 369 to improve mobility for pedestrians and bicycles. Particular consideration should be given to constructing a 10' multiuse path through this segment.	
		<i>Bus Stop Improvements</i>	\$139,600
		Provide school bus stop areas and turnout lanes along SR-264 between MP 367 and MP 369.	
Planning Level Total Location Cost			\$766,864

Exhibit 5-48 – Potential Countermeasures for Tribal Community Location 15

Location Description	Field Review Observations / Stakeholder Comments	Potential Countermeasures for Consideration	Estimated Conceptual Cost
<p><i>Location 15, SR-73, Fort Apache Road to SR-260, White Mountain Apache Tribe</i></p>			
<p>This segment is a 23.0-mile-long state highway from Fort Apache Road to SR-260. Through the segment, the roadway cross section varies between 2 lanes, 3 lanes, and 5 lanes. From the highway video log, it was found that a combination of paved shoulders and sidewalks were provided along the state highway. The highway video log also showed that there was vegetation overgrown alongside the roadway and sidewalks in several areas.</p> <p>Input from the White Mountain Apache Tribe is that all state highways that pass through the White Mountain Apache Tribe are in need of improvements for pedestrian safety, including US 60, SR 260, SR 73, SR 273, and SR 473. The primary routes on the reservation are US 60, SR 73, and SR 260. These primary routes are utilized by a high number of tribal members as they travel by foot along sections of these three state highways. Concerns identified by the White Mountain Apache Tribe are: high vehicle traffic, uncontrolled vegetation, narrow shoulders, lack of sidewalk maintenance, and lack of pedestrian crossing locations.</p> <p>Tribal staff also identified a need for funding education: seatbelt use, child safety, and underage, young and older drivers.</p> <p>It is recommended that a Roadway Safety Assessment be conducted for roadways on the White Mountain Apache Tribe.</p>	<ul style="list-style-type: none"> ▪ Incomplete sidewalks ▪ Vegetation growing on sidewalks 	<p><i>Evaluate Need for Sidewalk / Walkway Improvements</i></p> <p>Evaluate sidewalks to determine if sidewalks are well maintained and to determine if additional sidewalks should be installed for continuity.</p>	\$1,270,728
		<p><i>Remove Vegetation Overgrowth</i></p> <p>Remove the vegetation overgrown along the side of the road and sidewalks to allow pedestrians to walk on the shoulder more easily.</p>	--
		<p><i>Extend Paved Shoulder Widths</i></p> <p>Extend the paved shoulder width to 8 feet along SR-73 to provide an area for pedestrians to walk alongside the roadway.</p>	\$6,900,000
		Planning Level Total Location Cost	



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



6.0 RECOMMENDED POLICIES AND PROGRAMS

The Pedestrian Safety Action Plan recommends new policies and programs that upon their development and implementation will serve to reduce pedestrian crashes on the state highway system. In addition, the Plan recommends modifications to existing policies and practices that if adopted will improve pedestrian safety on the state highway system.

6.1 Recommended Policies and Programs

Section 6.1 identifies the policies and programs that ADOT should consider developing and implementing to improve pedestrian safety on the state highway system, including the following:

- Develop an ADOT internal pedestrian safety working group
- Develop and adopt an ADOT Pedestrian Policy
- Develop and adopt an ADOT Complete Streets Policy
- Develop traffic impact study agreements with local agencies
- Review all ADOT design and maintenance guidelines and manuals to identify effective measures for accommodating pedestrians on the State Highway System
- Develop partnerships with local law enforcement agencies
- Develop a mechanism to track the level of investment in pedestrian facilities
- Encourage implementation or expansion of educational programs
- Provide pedestrian facility training to state and local governments
- Review existing Arizona Revised Statutes related to pedestrians
- Develop transition plan for implementation of pedestrian countdown signals
- Develop transition plan for implementation of the Americans With Disabilities Act (ADA)
- Adopt Access Management Plan
- Develop an evaluation program

1. Develop an ADOT Pedestrian Safety Working Group

It is recommended that ADOT establish an internal Pedestrian Safety Working Group. The Pedestrian Safety Working Group will champion progress of the recommendations of the Pedestrian Safety Action Plan. The internal working group would work towards development of an ADOT Pedestrian Policy, and lay the foundation for development of an ADOT Complete Streets Policy. The group should be comprised of representatives from Traffic Design, Safety (HES), Roadway Design, Multimodal Planning, and the Districts. While the working group would be internal to ADOT, the group should collaborate and coordinate with outside stakeholders.

2. Develop and Adopt an ADOT Pedestrian Policy

Development and adoption of an ADOT Pedestrian Policy should be a high priority of the ADOT Bicycle and Pedestrian Program and the Pedestrian Safety Working Group. An ADOT Pedestrian Policy should be developed collaboratively with representatives from all pertinent ADOT divisions and groups, including Traffic Engineering, Roadway Design, Safety, Multimodal Planning, and the Districts. As the policy is developed, consideration should be given to the following:

- Recognize and emphasize that ADOT is a partner with local jurisdictions and tribal communities to provide pedestrian facilities on state highways.
- Develop specific criteria for provision of pedestrian facilities on state highways.



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



- Require a pedestrian facility criteria assessment to be completed for all new major reconstruction or new construction of state highways. The pedestrian criteria assessment, to be completed during the project scoping process, should document why pedestrian facilities will, or will not, be provided as part of the project. Potential pedestrian facility criteria include:
 - Sidewalks will be provided on state highways when there are origins and destinations within 0.5 miles walking distance from one another, and the state highway is anticipated to be a route used by pedestrians to access the origin / destination. Transit stops are considered a destination.
 - If the project is planned on a state highway that is within 2 miles of an elementary or middle school, the pedestrian facilities criteria assessment should include a review by the State Safe Routes to School Coordinator. If pedestrian facilities are not included in the project when the project is within 2 miles of a school, the specific reasoning behind the decision will need to be documented.
 - If the project is planned on a state highway that is a barrier to walking because of the difficulty of crossing the state highway, the most appropriate and effective crossing techniques shall be evaluated.
- Establish equitable cost sharing policies with local jurisdictions for both the construction and maintenance of sidewalks.
- State that sidewalks, when provided, will typically be placed on both sides of a highway. Exceptions could include commercial strips entirely on one side with no possible destinations on the other side (e.g. railroad tracks).
- Specifically endorse and allow construction of pedestrian crossing facilities on state highways that are adopted in the 2009 MUTCD, including the pedestrian hybrid signal. Specifically, allow for provision of two-stage pedestrian crossings on divided state highways.
- Encourage consideration of raised medians as pedestrian refuge areas. The FHWA Consideration and Implementation of Proven Safety Countermeasures Memo (July 10, 2008) states that “raised medians (or refuge areas) should be considered in curbed sections of multi-lane roadways in urban and suburban areas, particularly in areas where there are mixtures of a significant number of pedestrians, high volumes of traffic (more than 12,000 ADT) and intermediate or high travel speeds.” Installing raised medians can help to reduce pedestrian crashes and improve pedestrian safety.
- State that ADOT will comply with pedestrian and accessibility requirements set forth within the 1990 Americans with Disabilities Act (ADA). Adopt the Public Rights of Way Accessibility Guidelines as ADOT’s accessibility standard.

3. Develop and Adopt an ADOT Complete Streets Policy

The Complete Streets concept recognizes that the safety, interests, and convenience of all users – drivers, bicyclists, transit users, and pedestrians of all ages and abilities – should be considered in the design and construction of transportation projects. Detailed information about Complete Streets can be found at <http://www.completestreets.org>.

Design elements typically found on a Complete Street include sidewalks, bike lanes (or wide paved shoulders), comfortable and accessible transit stops, frequent pedestrian crossing opportunities, median islands, and accessible pedestrian signals. A Complete Street recognizes the context of the surrounding environments. For example, a Complete Street in a rural area is different from a Complete Street in an urban area. However, both streets are designed to balance safety and convenience for everyone using the road.



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



The Pedestrian Safety Working Group should consider ways to incrementally work towards implementing Complete Streets on state highways in the following ways:

- a. Recommend revisions to the State Transportation Board Policies to include language that bicycling and walking facilities will be incorporated into all transportation projects unless exceptional circumstances exist. Policies should define the exceptional circumstances in which facilities for bicyclists and pedestrians will NOT be required in all transportation projects.
- b. Recommend adoption of new manuals, or amendments to existing manuals, covering the geometric design of streets, the development of roadside safety facilities, and design of bridges and their approaches so they comprehensively address the development of bicycle and pedestrian facilities as an integral element of the design of all new and reconstructed roadways.
- c. Recommend adoption of stand-alone pedestrian facility design manuals as an interim step towards the adoption of new typical sections or manuals covering the design of streets and highways.
- d. Initiate an intensive education of transportation planners and engineers to make them conversant with the new information required to accommodate bicyclists and pedestrians. Training should be made available for, if not required of, agency traffic engineers and consultants who perform work in this field. Education of local city, county, and tribal staff is also important to successful development and implementation of Complete Streets.

4. Develop Traffic Impact Study Agreements with Local Agencies

Local jurisdictions and agencies typically require developers to submit traffic impact studies for new developments that desire access to the roadway. The purpose of the traffic impact studies is to evaluate the future traffic impacts of the development on the local roadway.

It is recommended that ADOT consider developing a policy or practice to request that traffic studies completed for local jurisdictions and tribal agencies for developments within ½ mile of a state highway be provided to ADOT for review. It is recommended ADOT encourage the local jurisdictions and tribal agencies to require a pedestrian assessment as part of the traffic impact analysis. The purpose of the pedestrian assessment is to identify potential pedestrian safety deficiencies and opportunities.

ADOT currently employs what is referred to as the Red Letter process. The Red Letter process is a means by which local jurisdictions and tribal agencies notify ADOT of new developments that are being planned for locations off of the state highway system, but that may affect state highways. For example, if a new subdivision is planned on a local road, but the state highway will serve as a route to access the local road, the city/county/tribal staff notifies ADOT so that any required improvements to the state highway system may be identified. Consideration should be given to modification of the ADOT Red Letter process to identify pedestrian needs.

5. Review all ADOT design and maintenance guidelines and manuals to identify effective measures for accommodating pedestrians on the State Highway System

The recommended Pedestrian Safety Working Group should consider commencing a review of all relevant design guidelines and manuals (including Roadway Design Guidelines, and Standards) to ensure that they adequately address pedestrian mobility and safety. These include areas of expertise that at first glance may not appear to be as relevant, such as interchange design guidelines; many pedestrian crashes on the ADOT system occur at interchanges.

Potential revisions to design and maintenance guidelines include:



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



- Require advance stop lines on all crosswalks on multi-lane highways.
- Revise vegetation management guidelines to emphasize the influence of proper vegetation on pedestrian safety. Proper vegetation management can improve sight distance, and allow pedestrians to utilize roadway shoulders more safely when alternative facilities are not available.

6. Develop Partnerships with Local Law Enforcement Agencies

Enforcement activities are a critical component of a comprehensive effort to improve pedestrian safety. The primary purpose of enforcement activities, combined with education activities, is to teach motorists and pedestrians about traffic safety and the laws that govern their rights and responsibilities. Cooperation and collaboration with local public safety and law enforcement agencies is critical to improving pedestrian safety throughout Arizona.

A high percentage of pedestrian crashes throughout the state are recorded as “pedestrian failed to yield right of way” or “driver failed to yield right of way.” Enforcement activities can play a major role in reducing these crash types. Potential enforcement activities may include spot enforcement of drivers-yield-to-pedestrian laws. It is recommended that ADOT Bicycle and Pedestrian Program develop partnerships with state and local law enforcement agencies to improve pedestrian and motorist enforcement of laws pertaining to pedestrian safety. The following enforcement pedestrian safety enforcement activities are recommended:

- The Arizona Department of Public Safety has law enforcement jurisdiction over all state highways. Local police departments, tribal, and BIA law enforcement agencies also have enforcement jurisdiction on state highways within their respective communities. The ADOT Bicycle and Pedestrian Program should meet with police departments and tribal law enforcement agencies that have enforcement jurisdiction on high-crash state highway segments and tribal community locations, including the following:
 - Arizona Department of Public Safety
 - Bullhead City Police Department
 - City of Coolidge Police Department
 - City of Casa Grande Police Department
 - City of Mesa Police Department
 - City of Sierra Vista Police Department
 - City of Tucson Police Department
 - City of Yuma Police Department
 - Tribal and BIA Law Enforcement Agencies

The purpose of the meetings will be to inform the agency of the ADOT Pedestrian Safety Action Plan, discuss the high segment locations and types of crashes that have occurred on the segments, and discuss potential enforcement activities that could be implemented. Potential enforcement activities include the following:

- Mobile Radar Speed Trailers (relay vehicle speed back to vehicle)
- Increased alcohol enforcement. High pedestrian crash segments on which alcohol was determined to be a contributing factor are:
 - Segment 1 (Bullhead City)
 - Segment 4A (Flagstaff)
 - Segment 5 (Flagstaff)
 - Segment 6 (Flagstaff)



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



- Segment 7 (Holbrook)
 - Segment 12 (Yuma)
 - Segment 14 (Sedona)
 - Segment 21 (Mesa)
- Pedestrian Safety Enforcement Operations (enforce pedestrian laws, such as vehicles failing to yield to pedestrians).
 - Radar Speed Photo Enforcement Vehicle
 - Red-light Running Photo Enforcement
 - Cooperative submission of funding proposals to the Governor's Office of Highway Safety for funding for targeted pedestrian enforcement activities as identified above.
- Identify opportunities to improve police officer training of pedestrian safety laws. Police officer training is a critical to an effective enforcement campaign. The ADOT Bicycle and Pedestrian Program should meet with Arizona POST (Peace Officer Standards and Training Board) to identify opportunities to improve training of police officers with respect to pedestrian safety.

7. Encourage Implementation or Expansion of Educational Programs

Education is an important element of a comprehensive effort to reduce pedestrian crashes, and to improve pedestrian safety throughout the State. A key role of the ADOT Bicycle and Pedestrian Program and the ADOT Pedestrian Safety Working Group will be to encourage the expansion of educational programs to support pedestrian safety.

Safe Routes to School Program

The Safe Routes to School Program was created by the U.S. Congress as part of SAFETEA-LU. Safe Routes was created to accomplish three goals:

1. To enable and encourage children, including those with disabilities to walk and bicycle to school;
2. To make bicycling and walking to school a safer and more appealing transportation alternative, thereby encouraging a healthy and active lifestyle from an early age; and
3. To facilitate the planning, development and implementation of projects and activities that will improve safety and reduce traffic, fuel consumption and air pollution near schools.

The Safe Routes program provides funds for schools and communities to implement infrastructure projects (such as sidewalk improvements and 'traffic calming') and non-infrastructure programs (such as education campaigns, law enforcement efforts, and prize giveaways). Two main criteria must be satisfied in order for a school area to be eligible to receive Safe Routes to School funding:

- Program funding is only for elementary and middle schools
- Programs and projects must be within a 2-mile radius of the school

As previously recommended, if a project is planned for a state highway within 2 miles of a middle school or elementary school, a pedestrian facilities criteria assessment should include a review by the State Safe Routes to School Coordinator. If pedestrian facilities are not included in the project, the specific reasoning behind the decision should be documented.

It is recommended that schools that are located within 1 mile of a state highway be identified. For each of these schools, ADOT should consider conducting a Safe Routes to School review of the state



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



highway segments that is located within 1 mile of the school. The purpose of the review will be to identify state highway segment pedestrian facility deficiencies. For each state highway that is utilized by children as a school route, or would potentially be utilized by children as a school route if pedestrian facilities were provided, it is recommended that the ADOT Bicycle and Pedestrian Program initiate and encourage Safe Routes to School funding applications from the respective elementary or middle schools to improve pedestrian conditions on the state highway.

ADOT / Governor's Office of Highway Safety "Be a Roll Model" Program

The ADOT Bicycle and Pedestrian program, through a grant provided by the Governor's Office of Highway Safety, developed and implemented a bicycle and pedestrian safety awareness campaign in the Verde Valley area (Sedona, Clarkdale, and Cottonwood, Arizona). The campaign included a message of "Be a Roll Model". The purpose of the campaign was to encourage motorists, cyclists, and pedestrians to obey the rules of the road.

It is the intent of the ADOT Bicycle and Pedestrian Program to gradually implement the "Be a Roll Model" campaign statewide as funding becomes available. It is recommended that the following jurisdictions be high-priority locations in which to implement the safety awareness campaign:



- Sedona (implemented in July 2008)
- Flagstaff
- Casa Grande / Coolidge
- Sierra Vista
- Yuma
- Bullhead City

FHWA Pedestrian Safety Campaign

Another pedestrian safety education resource that is available is the FHWA Pedestrian Safety Campaign. The campaign has extensive ready-made outreach materials that states and communities may customize for local use. The threefold purpose of the campaign is to (1) sensitize drivers to the fact that pedestrians are legitimate road users and should always be expected on or near the roadway, (2) educate pedestrians about minimizing risks to their safety, and (3) develop program materials to explain or enhance the operation of pedestrian facilities, such as crosswalks and pedestrian signals.

Campaign resource material can be accessed at http://safety.fhwa.dot.gov/local_program/pedcampaign/. The website includes materials designed for use in television, radio, and print advertising. A Campaign Planning Step by Step Guide that explains in detail how to implement the campaign successfully at the local level is also provided.

FHWA Safer Journey Interactive CD

Safer Journey is an interactive CD that guides the user through various pedestrian safety scenarios that are commonly encountered. The CD has been developed to improve pedestrian knowledge of all road users and safety practitioners. The CD-ROM can be included in state/local community pedestrian safety awareness materials kit and/or used at seminars, and conferences (driver education classes, policy



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



officer training courses, etc.). The CD can be ordered through http://safety.fhwa.dot.gov/PED_BIKE/ped/saferjourney.htm.

8. Provide Pedestrian Facility Training to State and Local Governments

In January 2006, FHWA Focus State training was held in Phoenix and Tucson for developing a pedestrian safety action plan. In February 2007, pedestrian safety design training was held in Phoenix and Flagstaff in February of 2007. In April 2008, ADOT conducted bicycle facility design training courses in Flagstaff and Phoenix. The purpose of the courses was to improve education of engineers and planners with respect to bicycle facilities design. A Complete Streets training course was held in May 2009. ADOT should continue to seek after opportunities for education opportunities to improve planning and design of bicycle and pedestrian design faculties. The education courses should be open to ADOT staff, as well as representatives from local city, county, and MPOs/COGs. Training courses will be most effective when they are held consistently. National organizations such as the Complete Streets Coalition and the Association of Pedestrian and Bicycle Professionals serve as potential resources for the training courses. Future courses could address the following:

- Pedestrian Crossings Warrants and Designs:
 - Marked Crosswalks
 - Crosswalks in School Zones
 - Two-Stage Signalized Pedestrian Crossings
 - Pedestrian Hybrid Signals
- Improved Intersection Design for Pedestrians
- Context Sensitive Design (consistent with ITE Recommended Practice for Building Walkable Communities)
- FHWA Pedestrian Safety Training and Workshops

9. Review existing Arizona Revised Statutes related to pedestrians

The ADOT Bicycle and Pedestrian Program, in collaboration with the Pedestrian Safety Working Group, and the Arizona Department of Public Safety, should review existing laws pertaining to pedestrian safety, compare them to model ordinances, and make necessary recommendations for changes to existing pedestrian laws. The review should ensure that existing laws are current and understood by the public and by law enforcement personnel. It is better to make sure existing laws are understood and applied correctly, rather than enact new laws. Arizona's pedestrian laws are comparable to those from across the U.S.

10. Develop a mechanism to track the level of investment in pedestrian facilities

It is recommended that ADOT develop a mechanism through which investment in pedestrian facilities can be documented and tracked. Potential opportunities through which this may be accomplished include:

- As previously recommended, all new construction or reconstruction projects should include a pedestrian facility criteria assessment to be completed during the project-scoping phase. The ADOT Bicycle and Pedestrian Program should develop a database to document the results of the assessment and a summary of recommendations. As projects are developed and implemented, the ADOT Bicycle and Pedestrian Program should ensure that project managers document the status of the improvements in the database. The Bicycle and Pedestrian Coordinator should be notified of any changes to the recommendations of the pedestrian facilities criteria assessment.



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



- Identify modifications that could be made to the ADOT Highway Performance Monitoring System dataset. The dataset is currently updated on an annual basis. Current data fields that relate to pedestrian safety include right and left shoulder widths. Other fields include type of access control, vehicle speed and volume, and number of traffic signals on a given segment. It is recommended that the ADOT Bicycle and Pedestrian Program collaborate with the HPMS data team to incorporate a sidewalk field; the data set could also include a pedestrian crossing field (crosswalks, hybrid signals, median islands etc.).
- The HPMS data team has recently procured a new data collection van that enables a 360-degree view of the environment surrounding the state highway. This new data collection van will enable the presence of sidewalks to be reviewed.

11. Develop Transition Plan for Implementation of Pedestrian Countdown Signals

The proposed 2009 MUTCD may require a transition to pedestrian countdown signals. The proposed 2009 MUTCD includes language requiring addition of pedestrian change interval countdown displays to all existing pedestrian signal heads, except those being used for crosswalks that are so short that the duration of the pedestrian change interval is 3 seconds or less, within the 10-year compliance period specified in the Introduction of the Manual. Pedestrian countdown signals provide the pedestrian with information about the amount of time remaining in a crossing interval. Countdown signals may be designed to begin counting down at the beginning of the walk phase or at the beginning of the clearance (flashing DON'T WALK) interval.

Upon ADOT adoption of the 2009 MUTCD, a transition plan should be developed for conversion of existing pedestrian signals to pedestrian countdown signals for all signals on the state highway system.

12. Develop Transition Plan for Implementation of the American Disabilities Act (ADA)

The ADA requires public agencies with more than 50 employees to develop a transition plan to ensure that pedestrian facilities become accessible (http://www.fhwa.dot.gov/civilrights/ada_qa.htm).

It is recommended that ADOT develop an ADA transition plan that identifies and integrates system needs into the state's planning process. FHWA recommends that the transition plan accomplish the following tasks:

- Identify physical obstacles on pedestrian facilities that limit the accessibility for activities to individuals with disabilities
- Describe in detail the methods that will be used to make the facilities accessible
- Specify the schedule for taking the steps necessary to upgrade pedestrian access to meet ADA requirements in each year following the transition plan
- Indicate the official responsible for implementation of the plan

The transition plan should be fully integrated into the State Transportation Improvement Program (STIP).

13. Adopt ADOT Access Management Plan

ADOT is currently developing a Statewide Access Management Plan in accordance with the policies of the State Transportation Board. The Plan will result in an access management classification system for the state highways and a comprehensive access management manual to guide the uniform application of access management throughout the state.



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



Access management can be an effective tool to improve pedestrian safety. Consolidation of driveways, minimizing access points, and construction of median islands, all have a positive benefit on pedestrian safety. Working documents can be accessed at azaccessmanagement.org. Working documents include several considerations with respect to pedestrians and improving pedestrian safety, including:

Source: Arizona Department of Transportation, Proposed DESIGN REQUIREMENTS AND SPECIFICATIONS FOR ACCESS APPROACH PERMITTING, Draft August 25, 2008

General Criteria

Bullet 4:

This section relies on general design techniques. The use of more exact geometric engineering standards and methods are permissible provided the design is consistent with the purposes and standards of this section and is based upon desirable nationally accepted engineering techniques and are determined acceptable to the Department.

Section D. Approach Width

Bullet 10:

Channelization of an approach using pavement markings or raised curbing may be required to accommodate the predominant approach traffic movement, to control angles of intersection, to provide refuge areas for pedestrians, to provide space for traffic control devices, to provide for vehicle auxiliary turns and to control prohibited turning movements.

Section E. Approach Radii

Bullet 8:

To minimize pedestrian conflict and minimize total approach width at the roadway edge, radii will not be constructed larger than required to accommodate the volume and types of vehicles using the approach on a regular basis.

Section H: Auxiliary Turn Lanes

Bullet 1.c.: Criteria for Auxiliary Turn Lanes

Where there are three or more through lanes in the direction of travel, the Department will not require a right turn acceleration lane unless it is determined to be necessary due to high right turn traffic volumes in excess of 300 vehicles per hour (VPH) or when a significant roadway capacity, operational or geometric safety problem will exist. Each case will be reviewed independently and a decision made based upon site specific conditions. Strong consideration will be given to the opinion of the local authority and their concerns regarding the anticipated and desirable future cross section of the highway. In urban areas where pedestrians are expected, a raised highway median providing pedestrian refuge may be required.

Bullet 6.a: Median Design for Turn Lane Installation

Where a single left turn lane is necessary the median area will normally consist of a 12-foot turn lane and a four-foot painted separator or four-foot inside shoulder. Where a median area does not exist or where the painted median area is less than 16-feet in width and a left turn lane is required, the roadway will be widened sufficiently in order to provide a median of at least 16 feet in width to accommodate the left turn lane. If a raised median is necessary, the median area should consist of a 12-foot lane exclusive of gutter, and a minimum six-foot raised median



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



separator. If a pedestrian refuge area is required with signal push button, the median island shall be a minimum of six-feet in width. Existing raised or other non-traversable medians will not have new openings unless a study analyzing all related traffic and safety issues is completed to the satisfaction of the Department and the Department issues a written determination why the median opening is acceptable.

Section I: Other Design Elements

Bullet 12:

Approach design will provide for the safe and convenient movement of all highway right-of-way users and modes of transportation, including but not limited to pedestrians, bicyclists, transit and the physically challenged. Sidewalks may be required where deemed appropriate by the Department or when required by the local authority. Bike paths and a local commitment to maintain the facility, may be included in the approach permit requirements upon request by the local authority or Department.

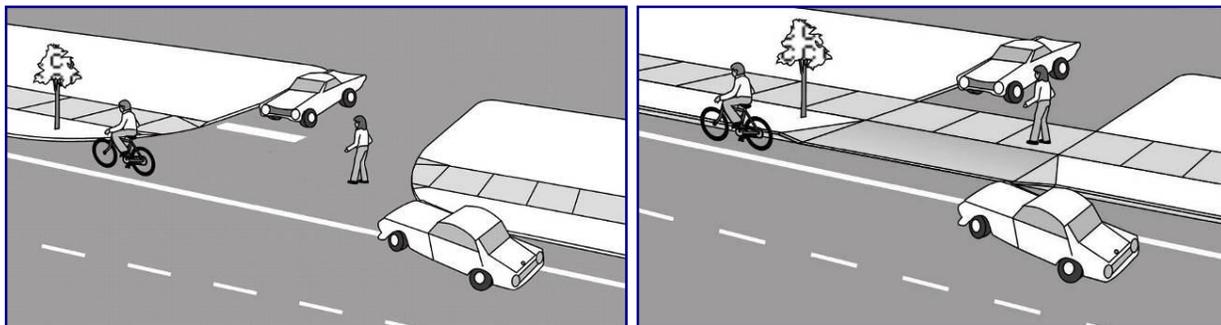
Bullet 13:

Sidewalks may be required where deemed appropriate by the Department or when required by the local authority. When a sidewalk is required it will normally be placed at least five feet from the back of curb and be five feet wide unless local standards require a greater width. At the driveway the sidewalk will be constructed at the back of the driveway slope with transitions to the normal sidewalk. Sidewalk design and transitions may not be inconsistent with Department standards or the federal Americans with Disabilities Act (ADA).

Bullet 13 above requires that sidewalks be constructed at the back of the driveway slope with transitions to the normal sidewalk. It is recommended that ADOT consider re-emphasizing that driveways should be designed to look like driveways, and not roadway intersections in areas of pedestrian activity. **Exhibit 3-1** depicts a design of a driveway as an intersection (on the left) and the design of a driveway where the sidewalk continues straight through the driveway (on the right). The sidewalk should be maintained through the driveway, and the driveway should be sloped so that the driver must go over the sidewalk (similar to a speed hump).

Exhibit 6-1 – Access Management Driveway Design

Source: <http://www.walkinginfo.org/training/pdps/collateral/PSAP%20Template%20v1.0CA%20long.doc>



14. Develop a Pedestrian Safety Action Plan Evaluation Program

In order for the Pedestrian Safety Action Plan to be successful, the plan must be implemented and continually evaluated. It is recommended that the recommended Pedestrian Safety Working Group



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



develop a program to evaluate the progress and effectiveness of the Pedestrian Safety Action Plan. The program should assess if the overall goals of the plan have been met and measure the overall effectiveness of implemented countermeasures.

6.2 Suggested Modifications to Policies and Practices for Consideration by ADOT

Suggested modifications to existing policies and practices for consideration by ADOT are identified in Section 5.2.

6.2.1 ADOT Traffic Engineering Policies, Guidelines and Procedures, January 2000, Section 200 – Traffic Studies, Subsection 240 – Traffic Impact Analysis

Access to the State highway system is managed through the encroachment permit process. The permit process requires those desiring access to the State highway system to apply for an encroachment permit. Since access to a State highway for a development may impact traffic on the highway, ADOT requires preparation of a Traffic Impact Analysis “for developments which desire an encroachment permit.”

ADOT defines two categories of traffic impact analyses. The category, and level of analysis required, is dependent upon the amount of traffic anticipated to be generated by the development.

It is recommended that ADOT consider modifying traffic impact analysis guidelines to require assessment of pedestrians and pedestrian facilities. The pedestrian assessment could require development pedestrian trips estimation, evaluation of pedestrian connectivity to and from the development, and ways that the development can be made pedestrian friendly to encourage more pedestrian trips.

6.2.2 ADOT Traffic Engineering Policies, Guidelines and Procedures, March 2001, Section 600 – Traffic Signals, Subsection 621 – Signal Phase Change Intervals

ADOT PGP Subsection 621 includes guidance for yellow and all-red clearance intervals.

It is recommended that ADOT consider modifying ADOT PGP Subsection 621 to allow for a lead pedestrian interval (LPI), as part of the all-red interval, where conflicts exist between turning vehicles and pedestrians.

6.2.3 ADOT Traffic Engineering Policies, Guidelines and Procedures, January 2003, Section 700 – Illumination

ADOT PGP Section 700 states that lighting will be installed by the State only where engineering judgment indicates there are sufficient traffic volumes and/or collisions to satisfy one or more of the conditions set forth where illumination would enhance highway safety.

It is recommended that illumination be provided routinely, like sidewalks, where pedestrian demand is present.

6.2.4 ADOT Traffic Engineering Policies, Guidelines and Procedures, November 2008, Section 900 – Pedestrians, Subsection 910 – Pedestrian Crosswalks

Subsection 910 states that by legal definition, there are three or more crosswalks at every intersection whether marked or unmarked. The policy states that a marked crosswalk should be installed at an intersection where an unmarked crosswalk would not be clearly discernable due to peculiar geometrics or other physical characteristics.



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



It is recommended that ADOT consider modifying Section 900 to explicitly state that marked crosswalks should be provided at all signalized intersections.

Subsection 910 states that crosswalks may only be provided if the following conditions are met:

- A. The length of the block between intersections shall be at least 1000 feet;
- B. There shall be a high pedestrian volume generator nearby; and
- C. There shall be a reasonable demand by the pedestrians to cross within a concentrated area at least 400 feet from the nearest intersection.

The dimensions listed in subsection 910 are oriented towards suburban locations; block lengths are usually much shorter in urban locations and often shorter in downtown areas in small-town rural locations.

It is recommended that ADOT consider allowing a context-sensitive review of crosswalk warrants. This is particularly applicable in communities where the state highway serves as “main street.” As communities desire to make their downtown areas more pedestrian friendly, shorter spacing between crosswalks may be desirable.

It is recommended that ADOT consider revising subsection 910 to emphasize alternative treatments to marked crosswalks, in locations where marked crosswalks are determined to be unsafe. ADOT PGP subsection 910 may be revised to emphasize that if pedestrian demand warrants are met, alternatives to help pedestrians safely cross the road should be provided, including a pedestrian hybrid signal.

As stated by the proposed 2009 MUTCD, a hybrid signal is a traffic signal that is intentionally placed in a dark mode (no indications displayed) between periods of operation and, when operated, displays both steady and flashing traffic control signal indications. A pedestrian hybrid signal is a special type of hybrid signal used to warn and control traffic at an unsignalized location to assist pedestrians in crossing a street or highway at a marked crosswalk. Currently, ADOT does not have a policy for pedestrian hybrid signals. The proposed 2009 MUTCD will allow the installation of pedestrian hybrid signals to facilitate pedestrian crossings at locations that do not meet other traffic signal warrants.

Exhibit 6-2 illustrates the proposed 2009 MUTCD pedestrian hybrid signal warrant criteria (Figure 4F-1, and 4F-2, 2009 MUTCD). A pedestrian hybrid signal is warranted if the engineering analysis finds that the plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding total of all pedestrians crossing the major street for 1 hour (any four consecutive 15-minute periods) of an average day falls above the applicable curve for the length of the crosswalk. It is recommended that ADOT adopt the 2009 MUTCD pedestrian hybrid signal warrant criteria.



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



Exhibit 6-2 – Proposed 2009 MUTCD Warrant Criteria for a Pedestrian Hybrid Signal

Source: 2007 Notice of Proposed Amendment for the Manual on Uniform Traffic Control Devices

Figure 4F-1. Guidelines for the Installation of Pedestrian Hybrid Signals on Low-Speed Roadways
Speeds of 60 km/h or 35 mph or less

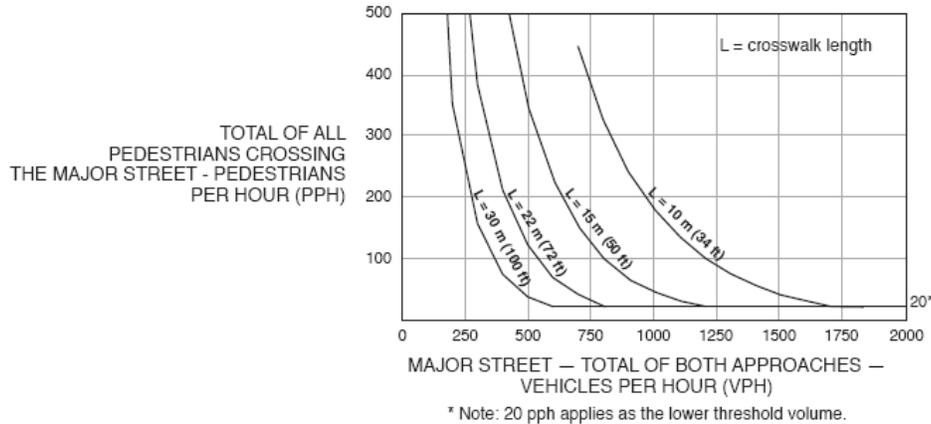
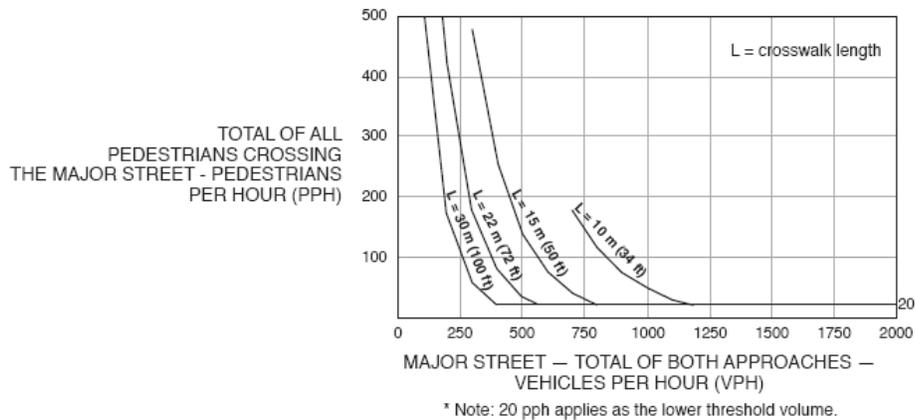


Figure 4F-2. Guidelines for the Installation of Pedestrian Hybrid Signals on High-Speed Roadways
Speeds of more than 60 km/h or 35 mph



The FHWA report entitled Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations (Zegeer, C., J. Stewart, and H. Huang, Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations, Report No. FHWA-RD-01-142, FHWA, Washington, DC, May 2001) includes guidelines that may be considered for incorporation into ADOT PGP 910. Key elements from the report's recommendations are outlined in **Exhibit 6-3**.

Recommended Guidelines from Report No. FHWA-RD-01-142

Marked pedestrian crosswalks may be used to delineate preferred pedestrian paths across roadways under the following conditions:

1. At locations with stop signs or traffic signals. Vehicular traffic might block pedestrian traffic when stopping for a stop sign or red light; marking crosswalks may help to reduce this occurrence.
2. At non-signalized street crossing locations in designated school zones. Use of adult crossing guards, school signs and markings, and/or traffic signals with pedestrian signals (when warranted) should be



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



used in conjunction with the marked crosswalk, as needed (ADOT PGP 920 identifies warrant criteria for crosswalks in school areas).

3. At non-signalized locations where engineering judgment dictates that the number of motor vehicle lanes, pedestrian exposure, average daily traffic (ADT), posted speed limit, and geometry of the location would make the use of specially designated crosswalks desirable for traffic/pedestrian safety and mobility. This must consider the conditions listed below, and in **Exhibit 6-3**.

Marked crosswalks alone are insufficient (i.e., without traffic-calming treatments, traffic signals and pedestrian signals when warranted, or other substantial crossing improvement) and should not be used under the following conditions:

1. Where the speed limit exceeds 40 mph.
2. On a roadway with four or more lanes without a raised median or crossing island that has (or will soon have) an ADT of 12,000 or greater.
3. On a roadway with four or more lanes with a raised median or crossing island that has (or will soon have) an ADT of 15,000 or greater.

Street crossing locations should be routinely reviewed to consider the following available options:

- Option 1 – No special provisions needed.
- Option 2 – Provide a marked crosswalk alone.
- Option 3 – Install other crossing improvements (with or without a marked crosswalk) to reduce vehicle speeds, shorten crossing distances, and increase the likelihood of motorists stopping and yielding.

Other Factors

Distance of Marked Crosswalks from Signalized Intersections: Marked midblock crosswalks should not be installed in close proximity to traffic signals, since pedestrians should be encouraged to cross at the signal in most situations. The minimum distance from a signal for installing a marked midblock crosswalk should be determined by local traffic engineers based on pedestrian crossing demand, type of roadway, traffic volume, and other factors. The objective of adding a marked crosswalk is to channel pedestrians to safer crossing points. It should be understood, however, that pedestrian crossing behavior may be difficult to control merely by the addition of marked crosswalks. The new marked crosswalk should not unduly restrict platooned traffic, and should also be consistent with marked crosswalks at other unsignalized locations in the area.

Other Treatments: In addition to installing marked crosswalks (or, in some cases, instead of installing marked crosswalks), there are other treatments that should be considered to provide safer and easier crossings for pedestrians at problem locations. Examples of these pedestrian improvements include:

- Providing raised medians (or raised crossing islands) on multi-lane roads.
- Installing traffic signals and pedestrian signals where warranted, and where serious pedestrian crossing problems exist.
- Reducing the exposure distance for pedestrians by:
 - Providing curb extensions.
 - Providing pedestrian islands.



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



- Reducing four-lane undivided road sections to two through lanes with a left-turn bay (or a two-way left-turn lane), sidewalks, and bicycle lanes.
- When marked crosswalks are used on uncontrolled multi-lane roads, consideration should be given to installing advance stop lines as much as 30 ft prior to the crosswalk (with a STOP HERE FOR CROSSWALK sign) in each direction to reduce the likelihood of a multiple-threat pedestrian collision.
- Bus stops should be located on the far side of uncontrolled marked crosswalks.

It is recommended that ADOT consider updating publications to reflect the findings for FHWA-RD-01-142, including the ADOT publication “Pedestrian Crosswalks – How Safe Are They?”



FINAL REPORT

PEDESTRIAN SAFETY ACTION PLAN



Exhibit 6-3 – Recommendations for Installing Marked Crosswalks and Other Needed Pedestrian Improvements at Uncontrolled Locations*

Source: Zegeer, C., J. Stewart, and H. Huang, Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations, Report No. FHWA-RD-01-142, FHWA, Washington, DC, May 2001

Roadway Type (Number of Travel Lanes and Median Type)	Vehicle ADT ≤ 9,000			Vehicle ADT >9000 to 12,000			Vehicle ADT >12,000 - 15,000			Vehicle ADT > 15,000		
	Speed Limit**											
	≤ 30 mi/h	35 mi/h	40 mi/h	≤ 30 mi/h	35 mi/h	40 mi/h	≤ 30 mi/h	35 mi/h	40 mi/h	≤ 30 mi/h	35 mi/h	40 mi/h
2 Lanes	C	C	P	C	C	P	C	C	N	C	P	N
3 Lanes	C	C	P	C	P	P	P	P	N	P	N	N
Multi-Lane (4 or More Lanes) With Raised Median***	C	C	P	C	P	N	P	P	N	N	N	N
Multi-Lane (4 or More Lanes) Without Raised Median	C	P	N	P	P	N	N	N	N	N	N	N

* These guidelines include intersection and midblock locations with no traffic signals or stop signs on the approach to the crossing. They do not apply to school crossings. A two-way center turn lane is not considered a median. Crosswalks should not be installed at locations that could present an increased safety risk to pedestrians, such as where there is poor sight distance, complex or confusing designs, a substantial volume of heavy trucks, or other dangers, without first providing adequate design features and/or traffic control devices. Adding crosswalks alone will not make crossings safer, nor will they necessarily result in more vehicles stopping for pedestrians. Whether or not marked crosswalks are installed, it is important to consider other pedestrian facility enhancements (e.g., raised median, traffic signal, roadway narrowing, enhanced overhead lighting, traffic-calming measures, curb extensions), as needed, to improve the safety of the crossing. **These are general recommendations; good engineering judgment should be used in individual cases for deciding where to install crosswalks.**

** Where the speed limit exceeds 40 mi/h (64.4 km/h) marked crosswalks alone should not be used at unsignalized locations.

C = Candidate sites for marked crosswalks. Marked crosswalks must be installed carefully and selectively. Before installing new marked crosswalks, an engineering study is needed to determine whether the location is suitable for a marked crosswalk. For an engineering study, a site review may be sufficient at some locations, while a more in-depth study of pedestrian volume, vehicle speed, sight distance, vehicle mix, etc. may be needed at other sites. It is recommended that a minimum of 20 pedestrian crossings per peak hour (or 15 or more elderly and/or child pedestrians) exist at a location before placing a high priority on the installation of a marked crosswalk alone.

P = Possible increase in pedestrian crash risk may occur if crosswalks are added without other pedestrian facility enhancements. These locations should be closely monitored and enhanced with other pedestrian crossing improvements, if necessary, before adding a marked crosswalk.

N = Marked crosswalks alone are insufficient, since pedestrian crash risk may be increased due to providing marked crosswalks alone. Consider using other treatments, such as traffic-calming treatments, traffic signals with pedestrian signals where warranted, or other substantial crossing improvement to improve crossing safety for pedestrians.

*** The raised median or crossing island must be at least 4 ft (1.2 m) wide and 6 ft (1.8 m) long to adequately serve as a refuge area for pedestrians in accordance with MUTCD and American Association of State Highway and Transportation Officials (AASHTO) guidelines.



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



6.2.5 ADOT Roadway Design Guidelines, Section 107.2 – Pedestrian Facilities

Sidewalks

The ADOT Roadway Design Guidelines, Section 107.2 – Pedestrian Facilities, states that sidewalks should not be constructed as a part of a highway project except as provided below. In urban areas, the highway cross section should provide space for sidewalks to be constructed by others in the future.

Exceptions:

- a. ADOT will construct and pay for sidewalk to replace existing sidewalks along a state highway or a local street which were removed as a part of an ADOT project.
- b. ADOT may construct additional sidewalks, over and above paragraph a), along local streets or along an urban arterial highway at the request of the local government, provided there is an agreement with the local government to pay ADOT's additional costs for design, construction and right-of-way. Agreements with local governments for the maintenance of the sidewalks must be executed before advertising the project for bids. Maintenance agreements will normally be the responsibility of the District Engineer; early notification to and coordination with the district is essential.
- c. ADOT will construct and pay for sidewalks on local street grade separation structures where there is a clear indication of future pedestrian traffic along the street after construction of the highway.

It is recommended that ADOT consider preparing a separate guideline or policy for sidewalk construction and maintenance that is more comprehensive than the guidelines currently provided in the ADOT Roadway Design Guidelines.

The policy or guideline should consider allowances and conditions under which ADOT may assume responsibility for construction and maintenance of sidewalks on state highways or establish cost-sharing guidelines with local jurisdiction for construction and maintenance of sidewalks.

The policy or guideline should include provisions that require construction of sidewalks associated with new development or redevelopment along state highways.

Pedestrian Grade Separated Crossings

ADOT Roadway Design Guidelines Section 107.2 states that to warrant construction of a pedestrian grade structure, six of the following criteria must be satisfied:

- High vehicular volumes conflict with high pedestrian volumes, constituting an extreme hazard;
- Modification of school routes, busing policies, campus procedures, or attendance boundaries to eliminate the need for a crossing is not feasible;
- Physical conditions make a grade separation structure feasible from an engineering standpoint, including pedestrian channelization to insure usage of the structure;
- Pedestrian movements can be restricted for at least 600 ft on each side of the proposed overpass;
- A demonstrated problem exists that simpler, more economic solutions have failed to remedy; and
- The anticipated benefits to be derived from the overpass clearly outweigh the costs.

It is recommended that consideration be given to amending Section 107.2 to state that the grade structure must be located where it is intuitive and convenient for pedestrians to access both ends of the structure.



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



As an example, the City of Madison, Wisconsin uses the following criteria when evaluating a grade separated crossing:

- Pedestrian attractors
- Perceived ease of accessibility
- Pedestrian demand
- Pedestrian origin and destination
- Pedestrian volumes
- Motor vehicle volumes
- Nearest alternative “safe” crossing
- Barriers, lighting, topography, etc.

6.2.6 ADOT Roadway Design Guidelines, Section 404 – Driveway and Turnout Access

ADOT Roadway Design Guidelines, Section 404 – Driveway and Turnout Access, governs driveway access to state highways. Section 404.1 states that “depressed curb openings are provided for driveways”.

It is recommended that consideration be given to modifying Section 404 to emphasize use of depressed curb openings on state highways with a sidewalk, ensuring that they are designed as a sidewalk with an apron and not as a street intersection.

6.2.7 ADOT Roadway Design Guidelines, Section 408.11 – Right-Turn Channelization

The analysis and design of right-turn lanes should consider pedestrian movements as per the ADOT Roadway Design Guidelines, Section 408.11 – Right Turn Channelization. ADOT Section 408.11 – Right Turn Channelization states the following:

C) Free Right Turns: Free right turns (without signal or sign control) are often used to improve the capacity of an intersection with a heavy right turn demand. The right turn is made "free" by channelizing the turning movement outside of the intersection controls. For free right turns to function properly, vehicles should not turn into a through traffic lane. Rear-end accidents can occur as turning cars slow down or stop while waiting for gaps in the through cross-traffic stream.

If turning traffic must stop, it is better to take the turning movement through a controlled intersection where it is expected to stop, then turn as cross traffic permits.

Free right turns shall only be provided where the turning movement can be made into an auxiliary or acceleration lane.

*It is recommended that ADOT Roadway Design Guidelines be amended to include reference to a free right turn design as illustrated in **Exhibit 3-4**, in areas where pedestrians are present. A free right turn lane with a tighter approach angle, as illustrated in **Exhibit 3-4**, results in slower vehicle approach speeds and improves pedestrian visibility. The design vehicle should not necessarily be the largest vehicle that can be expected to traverse the intersection. Large vehicles should be allowed to encroach into adjacent travel lanes in areas with a high number of pedestrians.*

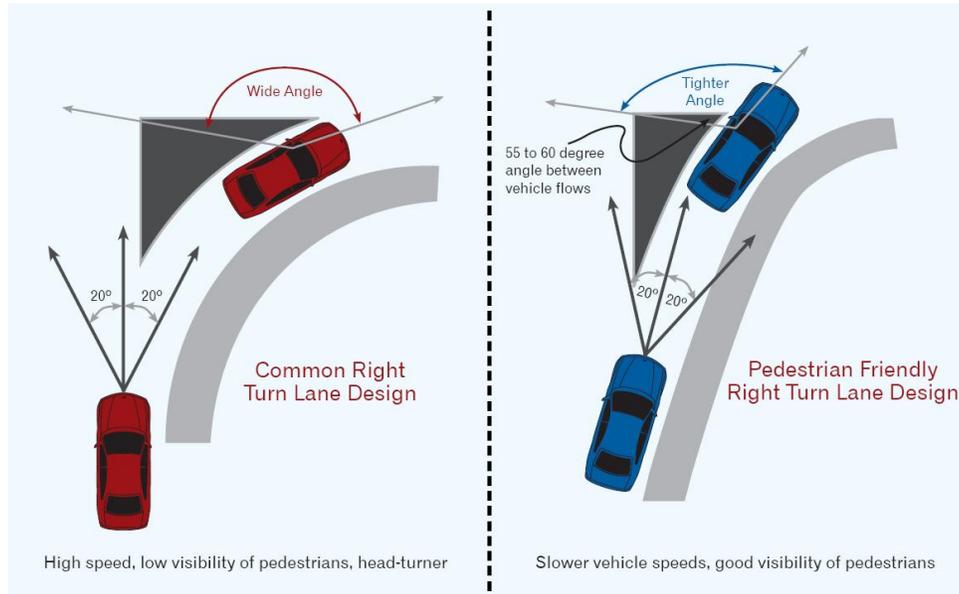


FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



Exhibit 6-4 – Improved Free Right Turn Lane Design

Source: Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities, An ITE Proposed Recommended Practice, Institute of Transportation Engineers, 2006; Figure 10.10





7.0 RESPONSES TO FHWA HOW TO DEVELOP A PEDESTRIAN SAFETY ACTION PLAN QUESTIONNAIRE

The ADOT Pedestrian Safety Action Plan was developed consistent with guidelines in the FHWA How to Develop a Pedestrian Safety Action Plan, May 2008 (The Guide). The Guide includes a Checklist for Pedestrian Safety Action Plan Elements. The sections below include the check list element, and how the ADOT Pedestrian Safety Action Plan addresses the checklist element.

7.1 Goals and Objectives

Commitment to safety for all modes should be the number one goal and priority of state and local transportation agencies. Once this commitment is made, it allows transportation agencies to allocate funds to reducing all crash types, including pedestrian crashes.

1. Do you have a clearly stated commitment to safety as your number one priority?

The Vision statement of the Arizona State Transportation Board clearly states safety as a high priority:

The Arizona State Transportation Board envisions a multimodal state transportation system that is safe, efficient, and dependable. Each mode performing it's appropriate role and all modes working together to provide the maximum mobility and connectivity for people, services, and goods with a high priority for the pursuit of advanced technology. Improvements to the mobility of passengers and goods will incorporate concerns for the environment and will be accomplished through coordination with government entities, consultation with stakeholders and the general public as well as consideration of community values.

Furthermore, the Transportation Board is committed to:

- An integrated, balanced, safe, efficient, multimodal statewide transportation system that will serve the mobility needs of people, services, and goods in Arizona.

Clear objectives are needed for a pedestrian plan to be successful in reducing pedestrian crashes. They allow for the development of practical and achievable strategies; they also provide a way to measure progress over time. To be effective, objectives must be specific and measurable.

2. Do you have a clearly stated objective for reducing pedestrian crashes?

Arizona's overall state safety vision and goal includes the following:

- The vision of the Arizona Strategic Highway Safety Plan is "zero fatalities on Arizona roads, your life depends on it".
- The vision is supported by a state "stretch" goal designed to bring about clear progress towards the vision. The goal requires a reduction in the number of fatalities on Arizona's roadways of approximately 12 percent by the year 2012. The base year of comparison will be 2007.

In support of the Arizona safety vision and goal, the ADOT Pedestrian Safety Action Plan proposes a goal to reduce pedestrian crashes (both fatal and non-fatal) by 20 percent by the year 2016. The reduction in pedestrian crashes will be measured by a five year average (2012 to 2016). The 5-year average for the years 2002 through 2006 will serve as the base years. This equates to 31 fewer pedestrian crashes per year by the year 2016.



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



7.2 Stakeholders

Individual stakeholder involvement is an excellent way to get a better product. Public stakeholders should be viewed as partners who are the on-the-ground scouts who can identify problems, needs and opportunities. To be effective, stakeholders must be involved in a regular, ongoing and systematic way.

1. Do you routinely provide for individual stakeholder involvement?

Stakeholders may provide input routinely by contacting the ADOT Bicycle/Pedestrian Coordinator. Contact information can be found on the ADOT Bicycle and Pedestrian Program website (azbikeped.org). Contact information for local bicycle and pedestrian coordinators is also included on the website.

Development of the Pedestrian Safety Action Plan included a survey that was completed by representatives of state, county, municipal and tribal governments. The purpose of the survey was to learn solicit input about roadways under Arizona Department of Transportation's (ADOT) jurisdiction, and where improvements are needed, from their perspective, to improve the safety of state highways for pedestrians.

Stakeholder interviews were also conducted with representatives of jurisdictions in April 2008. The purpose of the interviews was to elaborate on the issues and concerns identified in the survey. The interviews provided an opportunity for the jurisdiction representatives to explain their programs and policies further.

A survey form was also provided on azbikeped.org to be filled out by the public. The survey provided the opportunity for the public to identify specific concerns regarding pedestrian safety on the state highway system. Survey form questions included:

1. Option identifying information
2. Do you walk on, alongside or cross any roads on the State Highway System?
3. How often do you walk on, alongside or cross the state highway roads? (please count each round trip as one trip)
4. On average, approximately how far do you walk when you walk on, alongside, or cross the state highway roads?
5. What is the purpose of your walking trips on the state highway roads?
6. If you checked work in question #5, how far do you live from your work?
7. If you checked school in question #5, how far do you live from your school?
8. If you answered NO in question #2, (you don't walk) why don't you walk on, alongside or cross the state highway roads? Please check the top three reasons that you don't walk or don't walk more often to reach your destination.
9. Are you aware of any specific pedestrian safety issues on the state highway roads within or near your community, town, or city? Please describe as specifically as possible, including mileposts, landmarks, or intersections as appropriate. Refer to ADOT's website for maps showing ADOT maintained roads and mileposts.
10. The ADOT Pedestrian Safety Action Plan may result in recommendations for improvements to pedestrian improvement projects on state highways. Which of the following should be used to prioritize the construction of pedestrian improvement projects on the state highway roads?



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



A Pedestrian Advisory Board (PAB) is another excellent way to get a better product. They also build public support for policies, programs, and projects to reduce pedestrian crashes. To be effective, stakeholders must be involved in the review of policies, programs and projects.

2. Do you have a Pedestrian Advisory Board that regularly reviews policies, programs, and projects?

Currently, ADOT does not have a Pedestrian Advisory Board. The Pedestrian Safety Action Plan recommends that ADOT establish a Pedestrian Safety Working Group to foster implementation of pedestrian safety countermeasures throughout the state. The Working Group will champion progress of the recommendations of the Pedestrian Safety Action Plan and internal ADOT policy with respect to pedestrian safety.

Public agency staff in other agencies are also stakeholders. Building positive, working relationships is essential for coordination on regional planning issues; it also provides a way to coordinate on solving specific problems such as identifying high-crash locations where additional enforcement may be needed, and coordinating transit stops with crossing locations.

3. Do you routinely coordinate with other agencies on crash, transit, etc., issues?

The Highway Enhancements for Safety (HES) Team investigates and recommends improvements and countermeasures for traffic related problems on the state highways. The HES Teams identify and recommend countermeasures to reduce crashes frequency and severity at locations with perceived crash problems. Safety improvement projects are generated for those locations where roadway reconstruction or safety appurtenances such as lighting, traffic signals, or signing appear to be the most cost-effective means of reducing the crash experience. A critical element of the HES project development process is coordination with other agencies. A percentage of available HES funds each year are made available to local agencies and jurisdictions.

7.3 Data Collection

Computerized, timely, geo-coded pedestrian crash data are essential to identify high-crash locations, corridors, and/or larger areas and to select appropriate improvements to make conditions safer for pedestrians and other roadway users.

1. Do you routinely collect pedestrian crash data?

The ADOT Traffic Engineering Group is responsible for entering Arizona crash data into a State database. Motor vehicle/pedestrian crashes are included in the database.

The crash data is available in multiple electronic formats, including in database, spreadsheet, and geographic information system format. Crashes are geo-coded.

Development of the ADOT Pedestrian Safety Action Plan included a detailed review of pedestrian crash data for pedestrian crashes that occurred on the state highway system. Spatial analysis was utilized to identify high pedestrian crash segments and locations. Crash records were subsequently obtained and reviewed for performed for 22 high-crash segments and 11 high-crash interchanges.

Pedestrian counts along with crossing observations can be very useful in understanding pedestrian behavior and in considering the need for facilities. Counts and behavior studies, when combined with crash data, can also provide insights into specific crash causes and potential countermeasures.



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



2. Do you routinely collect pedestrian counts and complete crossing observations?

Pedestrian count data is not collected on a routine basis. Pedestrian counts are collected on an as-needed basis to support specific engineering studies.

Sidewalk and marked crosswalk (at uncontrolled locations) inventories help identify system gaps and unsafe conditions. When combined with crash data, pedestrian counts, and traffic characteristics, they can be very useful in prioritizing locations for countermeasures and other improvements.

3. Do you routinely inventory sidewalks and marked crosswalks?

ADOT does not currently inventory sidewalk and marked crosswalk locations.

The ADOT Pedestrian Safety Action Plan recommends identifying modifications that could be made to the ADOT Highway Performance Monitoring System (HPMS) dataset. Current data fields that relate to pedestrian safety include right and left shoulder widths. Other fields include type of access control, vehicle speed and volume, and number of traffic signals on a given segment. The Plan recommends that the ADOT Bicycle and Pedestrian Program collaborate with the HPMS data team to incorporate a sidewalk field; the data set could also include a pedestrian crossing field (crosswalks, hybrid signals, median islands etc.). Locations of sidewalks can be collected using the same vehicle that collections data such as shoulder width and pavement condition. The sidewalk data would then need to be entered into the HPMS.

Inventories of traffic characteristics (such as ADT, road widths, and speeds) help identify likely crash locations. When combined with actual crash data and pedestrian counts, they can be very useful in prioritizing locations for countermeasures and other improvements.

4. Do you routinely inventory roadway ADT, widths, and speeds?

The ADOT Highway Performance Monitoring System dataset identifies several traffic characteristics on given segments such as traffic volumes, road widths, shoulder widths, and speed limit. The dataset is currently updated on an annual basis. Vehicle speeds are collected on an as-needed basis for specific engineering studies.

7.4 Analyzing Information and Prioritizing Concerns

Categorizing pedestrian crash data should be done to determine whether they are occurring at a) spot locations, b) along corridors, c) in a neighborhood area, or d) throughout an entire jurisdiction (poor standard practice such as failing to install pedestrian indicators at signals). Once categorized, this information can be used to focus resources and prioritize projects.

1. Do you routinely categorize pedestrian crash data?

The Arizona crash database system does not facilitate the categorization of pedestrian crashes are consistent with the categories listed above (spot, corridor, neighborhood area, or in an entire jurisdiction). Pedestrian crash data in the Arizona crash database is currently categorized by intersection-related and locale. Under the intersection-related category, crashes can be located either at an intersection, driveway access, alley intersection, or have no relationship to an intersection. The locale of a crash can either be rural, urban, or unknown. The specific location of a pedestrian crash is also recorded and can be viewed using GIS mapping. This information can be utilized, supplemented by spatial analysis, to further classify crash data into the spot, corridor, neighborhood, or jurisdiction-wide categories.



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



Conducting field reviews and safety audits can be used to identify how each pedestrian crash occurred, and what may be done to prevent future similar crashes. The outcome is a list of improvements that can be implemented to address those crashes and enhance safety.

2. Do you routinely conduct field reviews and safety audits?

Development of the ADOT Pedestrian Safety Action Plan included field reviews for each high-crash segment and interchange. Findings from the field reviews served as input to the development of potential countermeasures for each high pedestrian crash location.

ADOT routinely conducts road safety assessments (RSAs). RSA are a formal analysis of user safety of a roadway by an independent, experienced, and multidisciplinary team. The RSA teams typically consist of representatives from local law enforcement, roadway safety education, traffic engineering, roadway design, and emergency medical response.

The purpose of the RSA is to:

- Identify roadway users, circumstances, and roadway elements that may present safety concerns
- Identify opportunities to eliminate or mitigate the identified safety concern.

A recommendation of the ADOT Pedestrian Safety Action Plan is to conduct Roadway Safety Audits for each of the high-crash segment locations identified in the Plan. Improving the safety for all roadway users will improve the safety of pedestrians. Results of the safety audits will serve as input to identification and refinement of countermeasures for each high-crash segment.

Crash typing describes the pre-crash actions of the parties involved. When crashes are “crash typed,” a pattern often emerges that helps identify what the problem is and what countermeasures are generally related to each crash type. Crash typing is particularly useful in developing education and enforcement strategies.

3. Do you routinely “crash type” your pedestrian crash data?

Currently, ADOT does not routinely crash type pedestrian crash data. The crash analysis for conducted for the Plan included crash-typing for each pedestrian crash on a high pedestrian crash location (segment and interchanges). Pedestrian crashes were typed consistent with categories continued in the Pedestrian Bicycle Crash Analysis Tool (PBCAT) and Pedestrian Safety Guide and Countermeasure Selection System (PEDSAFE). The crash types used include the following:

- Walking in Roadway
- Standing in Roadway
- Walking Along Roadway
- Pedestrian Failed to Yield
- Motorist Left Turn—Parallel Paths
- Motorist Left Turn—Perpendicular Paths
- Motorist Right Turn—Parallel Paths
- Motorist Right Turn—Perpendicular Paths
- Through Vehicle at Signalized Location
- Through Vehicle at Unsignalized Location
- Non-Roadway
- Multiple Threat/Trapped



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



- Unique Midblock
- Miscellaneous

Prioritizing pedestrian safety improvements is the final step once all appropriate data has been collected. Priorities should be established based on a variety of factors including safety consequences, cost, travel demand, availability of right-of-way, federal and/or state mandates and public support. Solutions can be phased and divided into temporary or permanent improvements.

4. Do you prioritize (rank) pedestrian safety improvements?

High pedestrian crash locations were prioritized in the Pedestrian Safety Action Plan. The prioritization methodology considered criteria that measured the level of need for pedestrian safety improvements, which included Pedestrian Demand Index, Pedestrian Safety Deficiency Index, Stakeholder Input (used only for segments), and Crash Severity Index. Each high-crash location was scored for each criterion. An overall composite score was subsequently calculated to represent the overall priority score for each location. A normalized score was also determined to compare rankings in relation to each other.

7.5 Providing Funding

Routine accommodation for pedestrians in all projects, programs and maintenance activities is the most cost-effective funding strategy for reducing pedestrian crashes and encouraging more walking. The majority of pedestrian infrastructure is built in conjunction with other projects. It allows for significant improvements over, time even if there is no special funding available for pedestrian safety improvements.

1. Do you routinely include pedestrian safety improvements in all projects, programs, and maintenance activities?

Current ADOT policy does not require pedestrian safety improvements in all projects, programs, and maintenance activities.

The Pedestrian Safety Action Plan recommends that ADOT develop and adopt a pedestrian policy that would reinforce consideration of pedestrians and provision of pedestrian facilities on state highways. It is recommended that the Policy be collaboratively developed by multi-disciplinary representatives from Traffic Engineering, Roadway Design, Safety, Multimodal Planning, and the Districts. Suggested elements of the policy include:

- Recognition that ADOT is a partner with local jurisdictions and tribal communities to provide pedestrian facilities on state highways.
- Specific criteria for provision of pedestrian facilities on state highways.
- Equitable cost sharing policies with local jurisdictions for both the construction and maintenance of sidewalks.
- Endorsement of construction of pedestrian crossing facilities on state highways that are adopted in the 2009 MUTCD, including the pedestrian hybrid signal.
- Endorsement of providing raised medians as pedestrian refuge areas. The FHWA Consideration and Implementation of Proven Safety Countermeasures Memo (July 10,2008) states that “raised medians (or refuge areas) should be considered in curbed sections of multi-lane roadways in urban and suburban areas, particularly in areas where there are mixtures of a significant number of pedestrians, high volumes of traffic (more than 12,000 ADT) and intermediate or high travel



FINAL REPORT

PEDESTRIAN SAFETY ACTION PLAN



speeds”. Installing raised medians can help to reduce pedestrian crashes and improve pedestrian safety.

- Statement that ADOT will comply with pedestrian and accessibility requirements set forth within the 1990 Americans with Disabilities Act (ADA). Adopt the Public Rights of Way Accessibility Guidelines as ADOT’s accessibility standard.

Dedicated funds and set-asides for pedestrian projects allow for immediate action in addressing high-crash locations, corridors, and other targeted areas. They can be federal, state or local funds and are often a percentage of another fund.

2. Do you routinely set aside funds that are dedicated to pedestrian safety?

ADOT does not receive any funds that are solely dedicated to pedestrian safety. Many of ADOT’s funding sources, however, can be used for projects that improve pedestrian safety on Arizona’s state highways. Arizona State funding sources for pedestrian improvement projects include those listed in the table below.

Funding Programs	Project Type (constr., non-constr.)	Required Matching Funds	Total Available Annual Funding to ADOT	Eligible Projects / Comments
Transportation Enhancement Activity	Both	5.7% Hard Cash Match	\$16.8 M	Provision of facilities for bicyclists and pedestrians, provision of safety and educational activities for pedestrians and bicyclists, preservation of abandoned railroad corridors (including conversion and use for pedestrian and bicycle trails)
Highway Safety Improvement Program (HSIP)	Construction	The Federal share is 90 %, subject to the sliding scale adjustment; Federal share is 100% for certain safety improvements listed in 23 USC 120(c).	\$24.4M	Pedestrian and bicycle safety improvements on any public road or publicly owned pedestrian or bicycle pathway.
Safe Routes to School	Both	Not Permitted	\$3.6M	Infrastructure related and behavioral projects that provide a safe and appealing walking atmosphere 10-30% of each state’s funding is to be spent on non-infrastructure activities
Local Transportation Assistance Fund (LTAF)	Both	Match from private monies is required if used for cultural, educational, historical, and recreational programs	\$23M	Street maintenance and improvements, street lighting, transportation service for the elderly and disabled, curbs, gutters, and sidewalks Funds are generated from the Arizona Lottery



FINAL REPORT PEDESTRIAN SAFETY ACTION PLAN



7.6 Creating the Pedestrian Safety Action Plan

A Pedestrian Safety Action Plan focuses resources on making the changes that reduce the greatest number of pedestrian crashes. To be effective, it must provide a framework for involving stakeholders, collecting and analyzing data, selecting countermeasures, developing implementation strategies and providing funding.

1. Do you have a Pedestrian Safety Action Plan that includes all these elements?

The Pedestrian Safety Action Plan includes the following documents and elements:

- Working Paper No. 1: Existing pedestrian safety conditions on the state highways in Arizona;
- Working Paper No. 2: Pedestrian safety goals and emphasis areas for ADOT;
- Working Paper No. 3: Prioritization system to rank locations and recommendations of potential countermeasures, policies, and programs to meet pedestrian safety goals for emphasis areas ;
- Working Paper No. 4: Cost estimates for high-crash locations and potential funding sources and collaborative funding alternatives for pedestrian infrastructure on Arizona's state highways; and
- Working Paper No. 5: Process for selecting and implementing pedestrian safety countermeasures.

Evaluation of results ensures that implemented solutions are effective in reducing crashes and improving the safety and accessibility of pedestrian facilities; it also helps ensure future funding opportunities if the plan is perceived as a success. Success should be measured against the objectives set forth in the Pedestrian Safety Action Plan—typically to reduce pedestrian crashes by a certain percentage.

2. Do you routinely evaluate results of your efforts to reduce pedestrian crashes?

The ADOT Pedestrian Safety Action Plan recommends development of a program to evaluate the progress and effectiveness of the Action Plan. The program should assess if the overall goals of the plan have been met and measure the overall effectiveness of implemented countermeasures.



FINAL REPORT
PEDESTRIAN SAFETY
ACTION PLAN



APPENDICES



FINAL REPORT
PEDESTRIAN SAFETY
ACTION PLAN



Appendix A – High-crash Locations

Segments Locations

Interchanges Locations

Tribal Community Locations



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Segments Locations

Segment 2

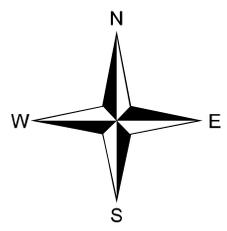
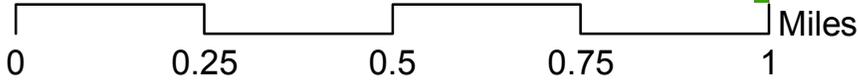
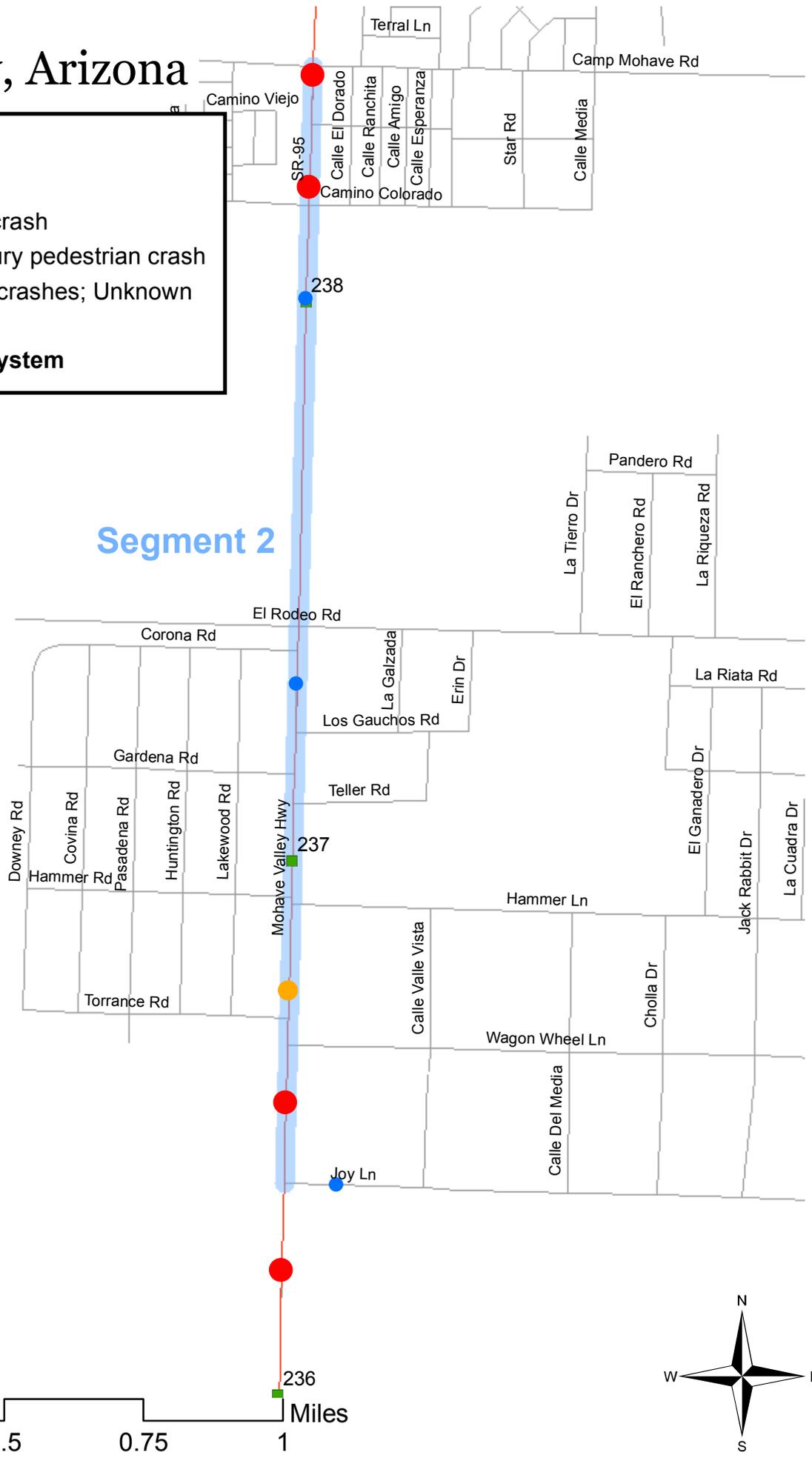
Bullhead City, Arizona

Legend

Injury Severity

- Fatal pedestrian crash
- Incapacitating injury pedestrian crash
- Other pedestrian crashes; Unknown
- Milepost

— State Highway System

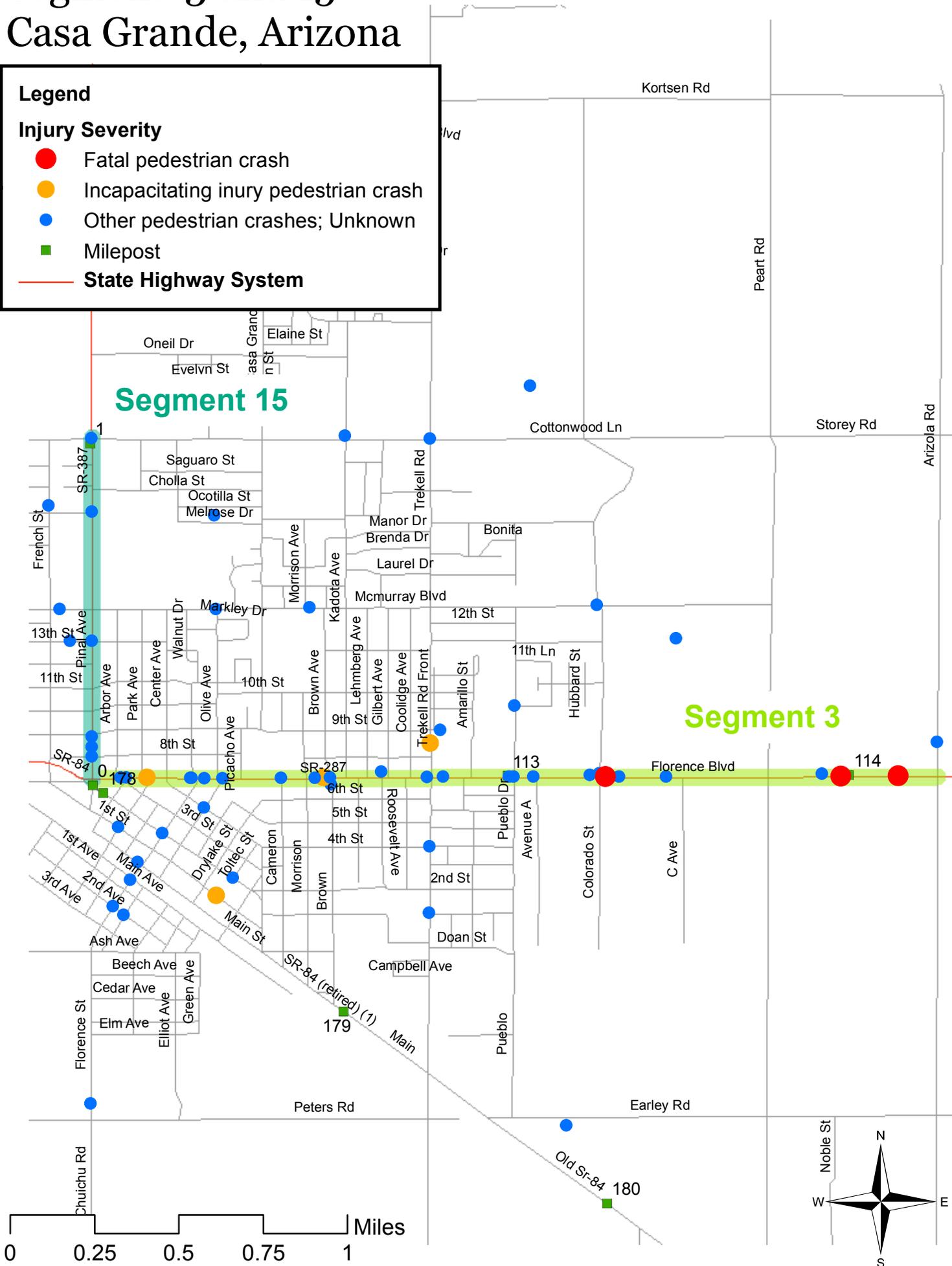


Segment 3 and 15 Casa Grande, Arizona

Legend

Injury Severity

- Fatal pedestrian crash
- Incapacitating injury pedestrian crash
- Other pedestrian crashes; Unknown
- Milepost
- State Highway System



Segment 5 and 6 Flagstaff, Arizona

Legend

Injury Severity

- Fatal pedestrian crash
- Incapacitating injury pedestrian crash
- Other pedestrian crashes; Unknown
- Milepost
- State Highway System



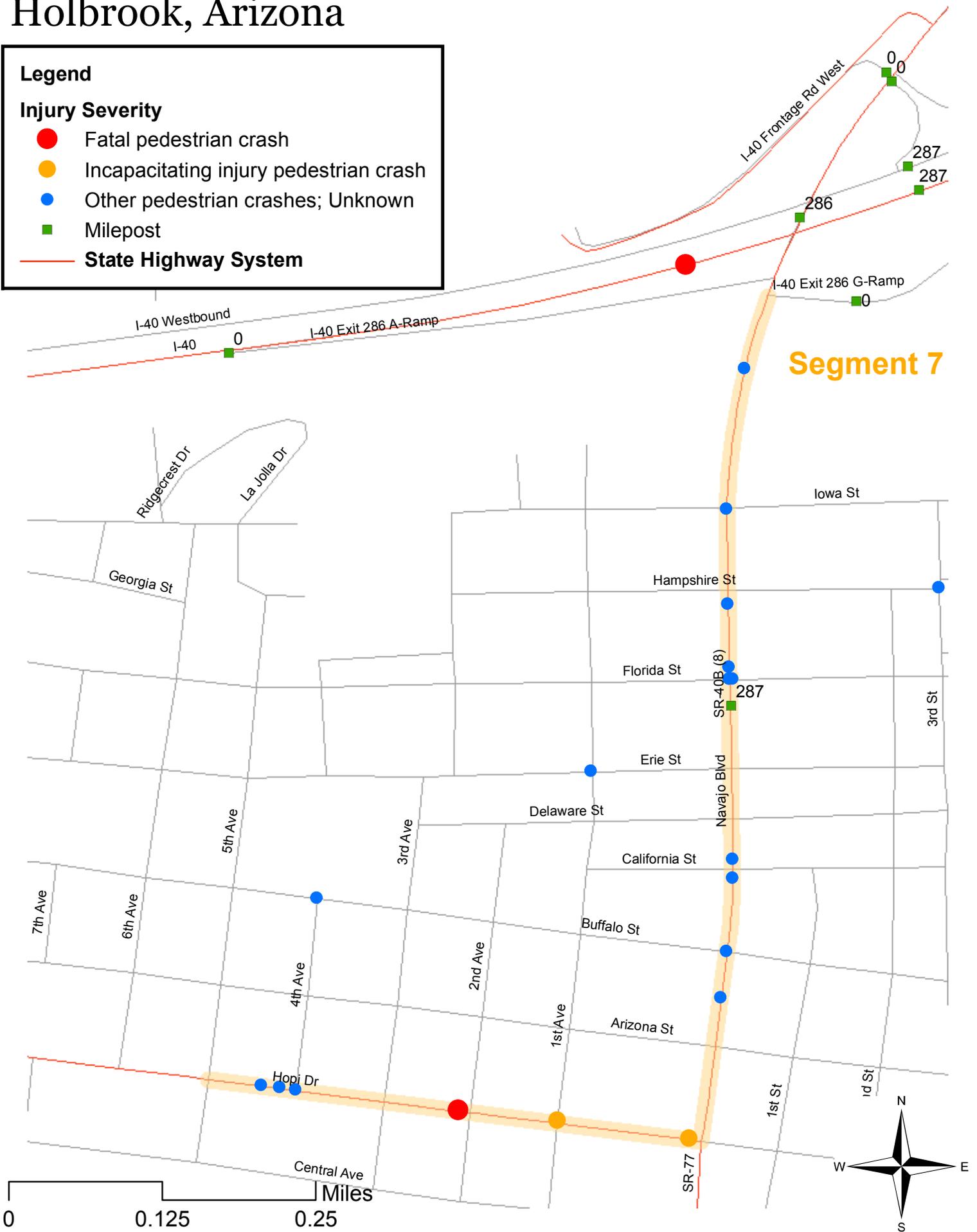
Segment 7 Holbrook, Arizona

Legend

Injury Severity

- Fatal pedestrian crash
- Incapacitating injury pedestrian crash
- Other pedestrian crashes; Unknown
- Milepost

— **State Highway System**

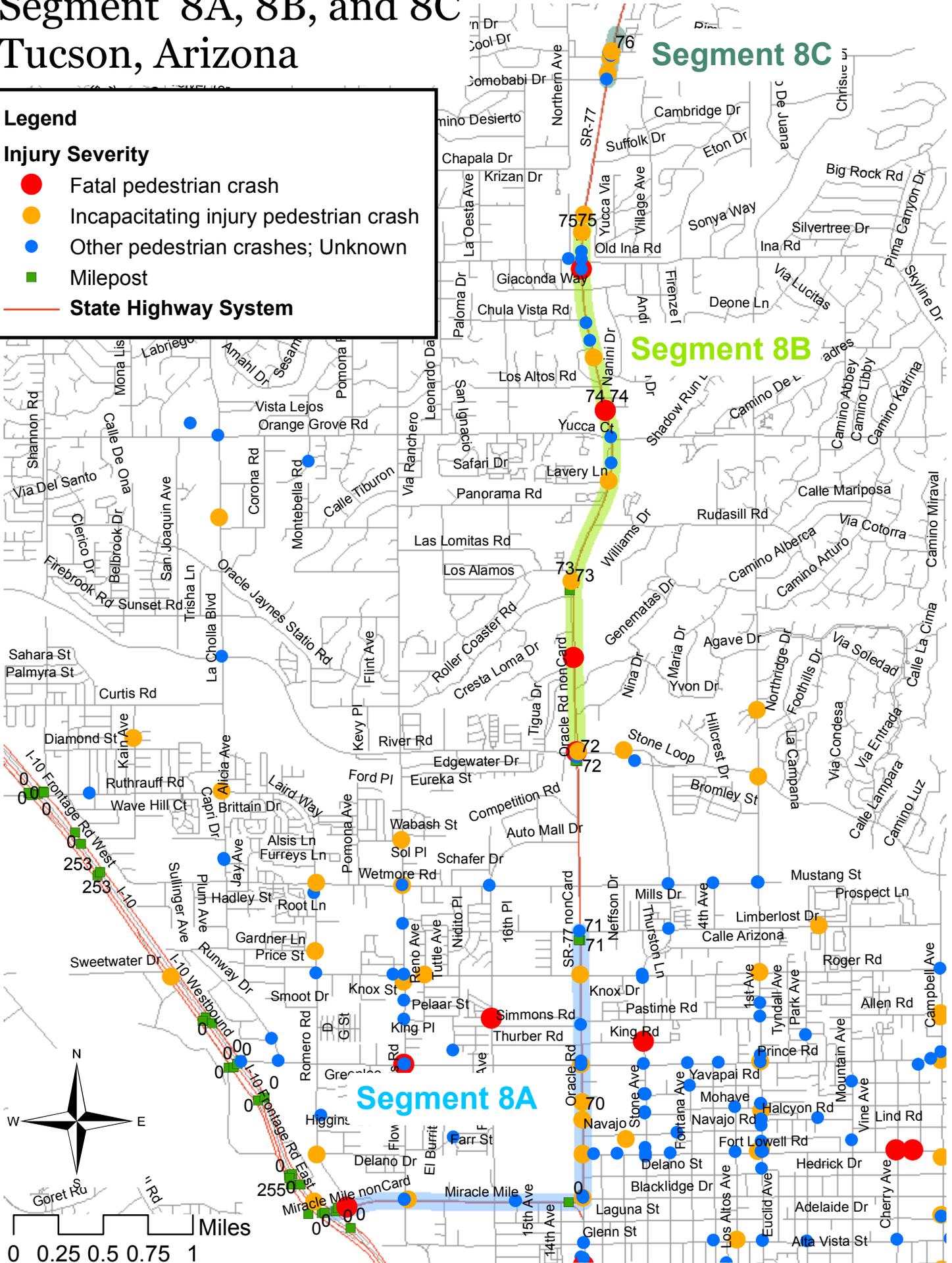


Segment 8A, 8B, and 8C Tucson, Arizona

Legend

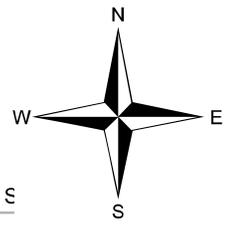
Injury Severity

- Fatal pedestrian crash
- Incapacitating injury pedestrian crash
- Other pedestrian crashes; Unknown
- Milepost
- State Highway System



Segment 11

Sierra Vista, Arizona

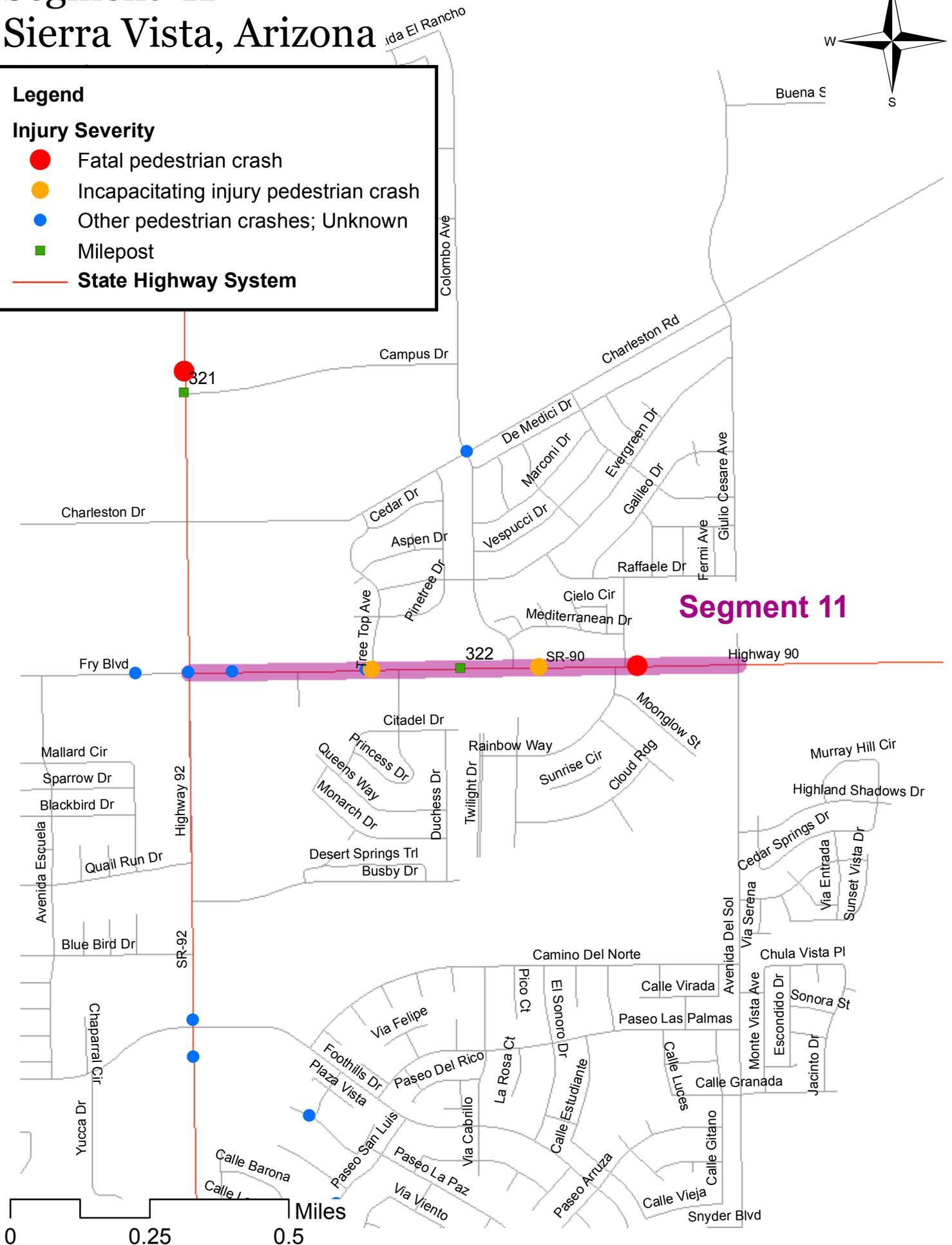


Legend

Injury Severity

- Fatal pedestrian crash
- Incapacitating injury pedestrian crash
- Other pedestrian crashes; Unknown
- Milepost

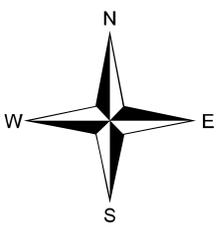
— State Highway System



Segment 11

0 0.25 0.5 Miles

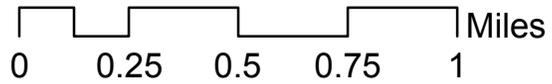
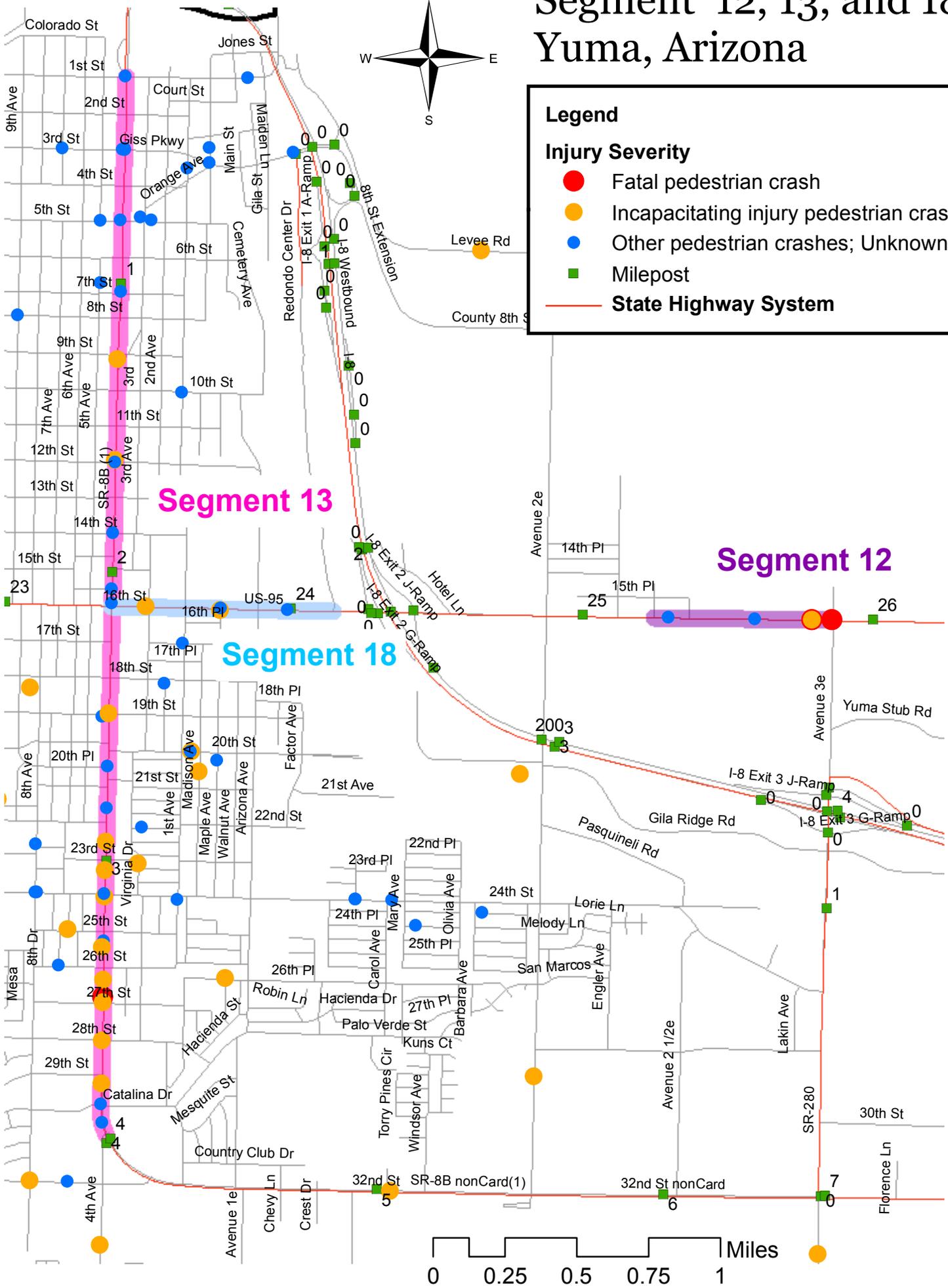
Segment 12, 13, and 18 Yuma, Arizona



Legend

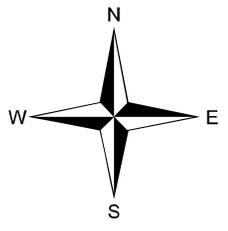
Injury Severity

- Fatal pedestrian crash
- Incapacitating injury pedestrian crash
- Other pedestrian crashes; Unknown
- Milepost
- State Highway System



Segment 14

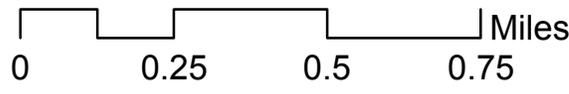
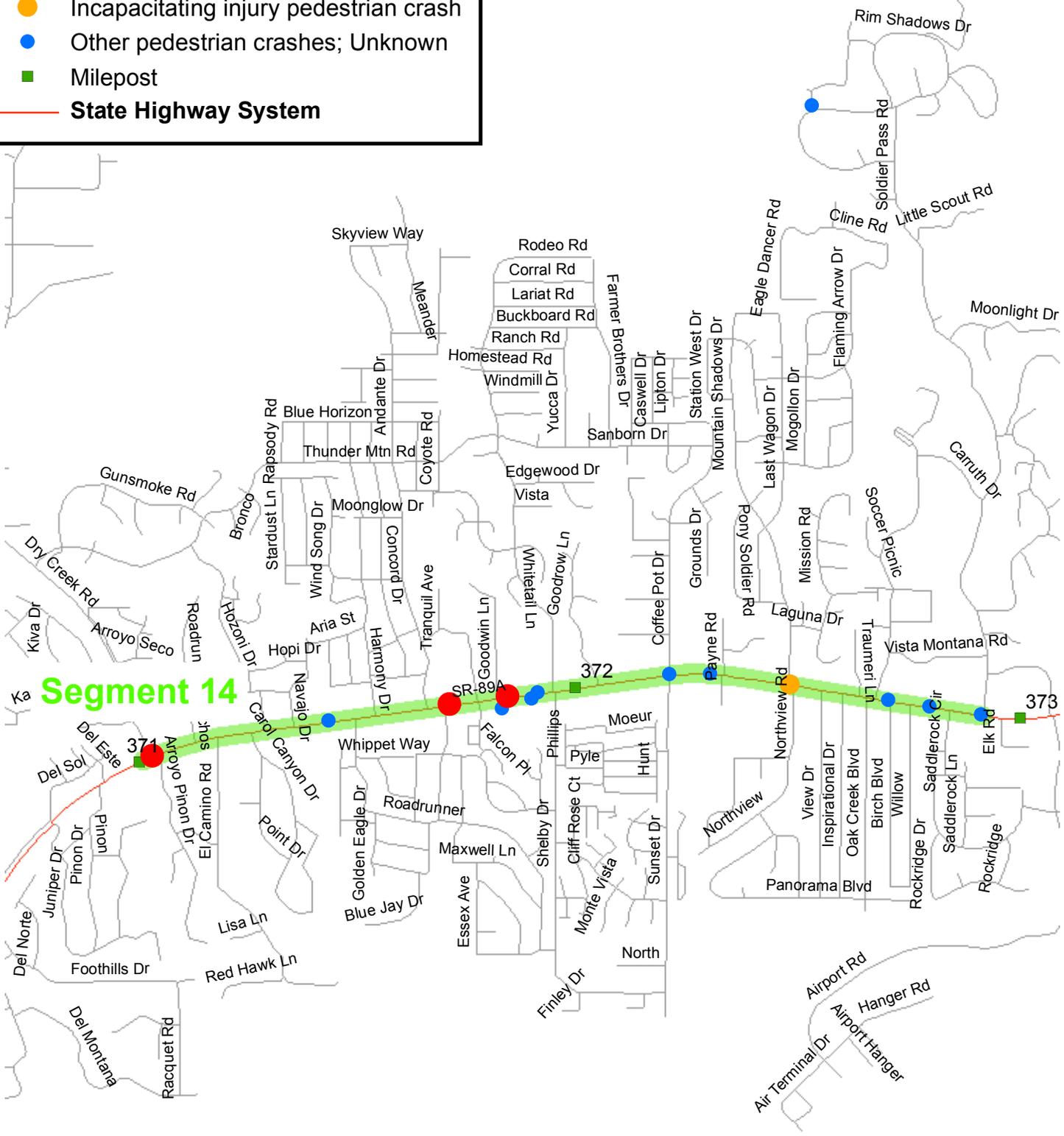
Sedona, Arizona



Legend

Injury Severity

- Fatal pedestrian crash
- Incapacitating injury pedestrian crash
- Other pedestrian crashes; Unknown
- Milepost
- State Highway System

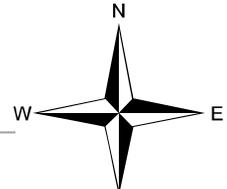


Segment 16 Tucson, Arizona

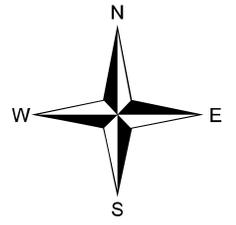
Legend

Injury Severity

- Fatal pedestrian crash
- Incapacitating injury pedestrian crash
- Other pedestrian crashes; Unknown
- Milepost
- State Highway System



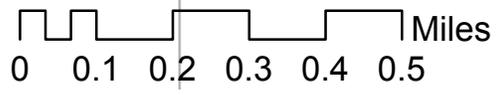
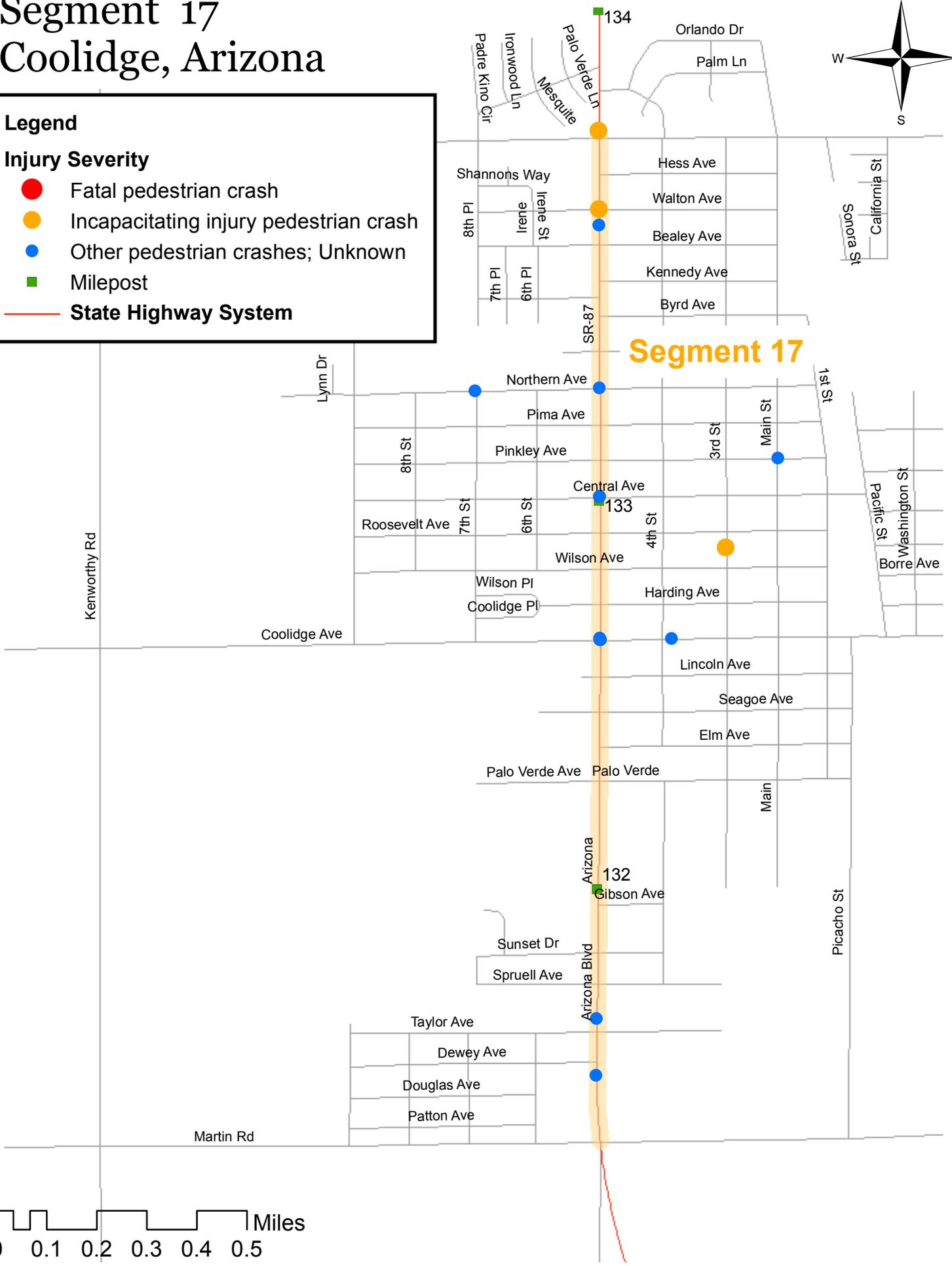
Segment 17 Coolidge, Arizona



Legend

Injury Severity

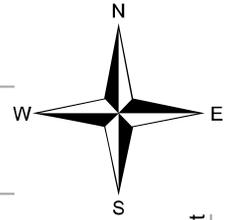
- Fatal pedestrian crash
- Incapacitating injury pedestrian crash
- Other pedestrian crashes; Unknown
- Milepost
- State Highway System





Interchanges Locations

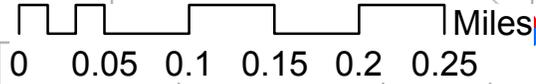
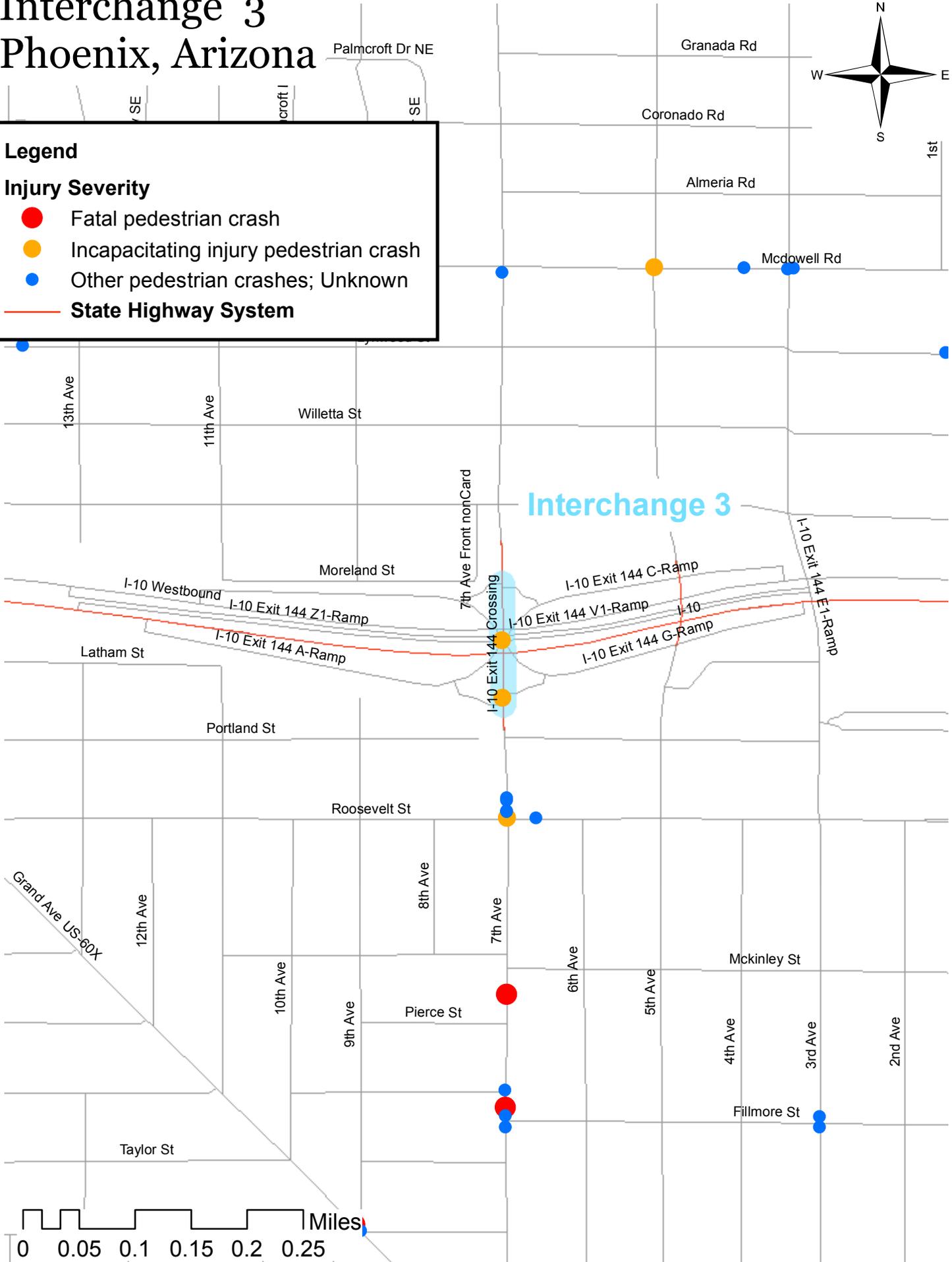
Interchange 3 Phoenix, Arizona



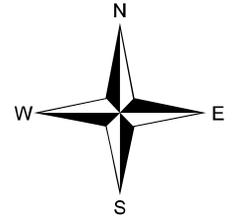
Legend

Injury Severity

- Fatal pedestrian crash
- Incapacitating injury pedestrian crash
- Other pedestrian crashes; Unknown
- State Highway System



Interchange 4 and 13 Tempe, Arizona



Legend

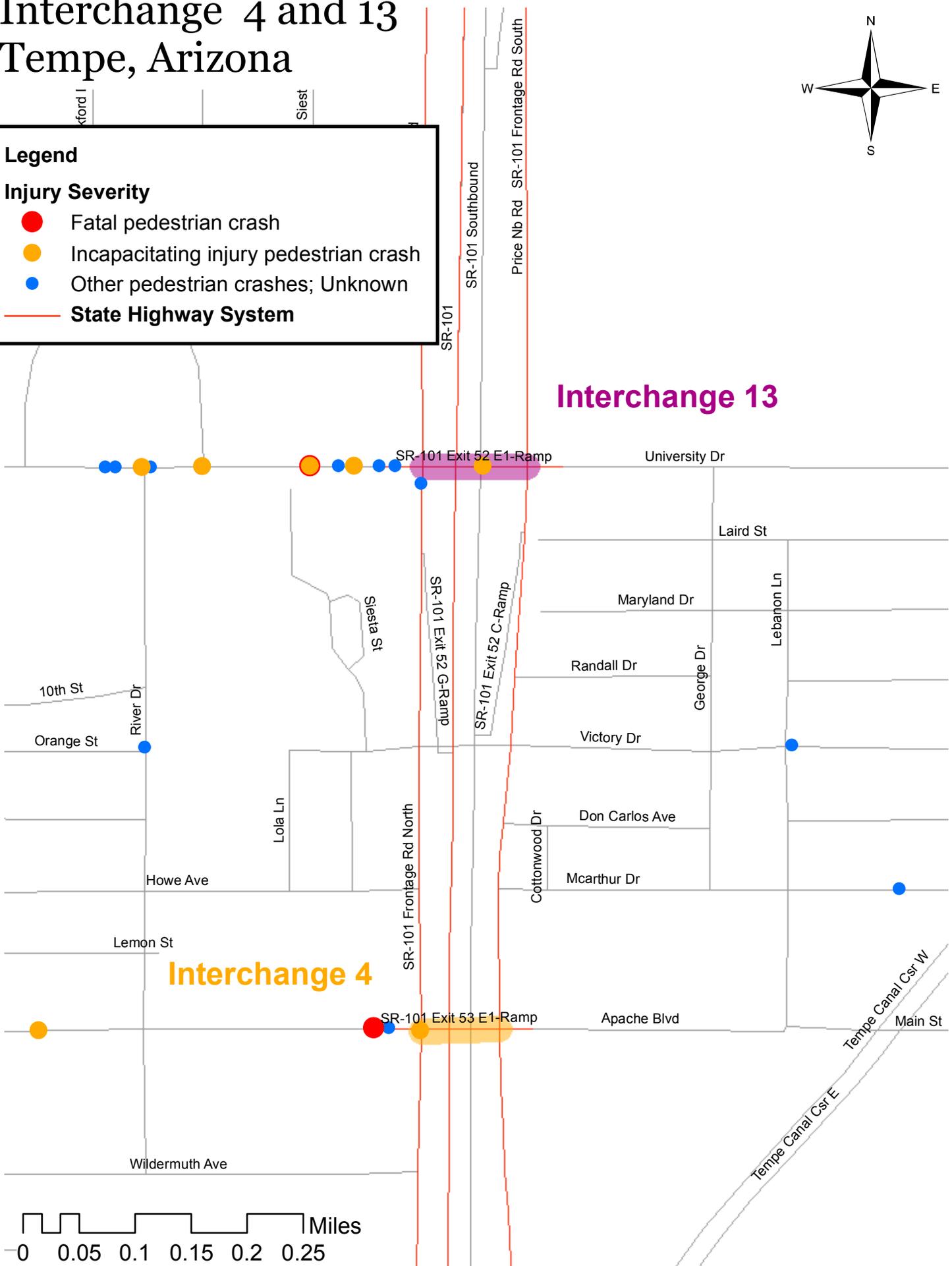
Injury Severity

- Fatal pedestrian crash
- Incapacitating injury pedestrian crash
- Other pedestrian crashes; Unknown

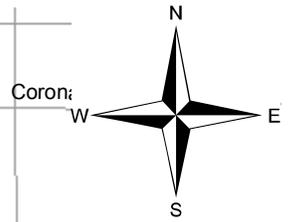
— State Highway System

Interchange 13

Interchange 4



Interchange 9 Phoenix, Arizona

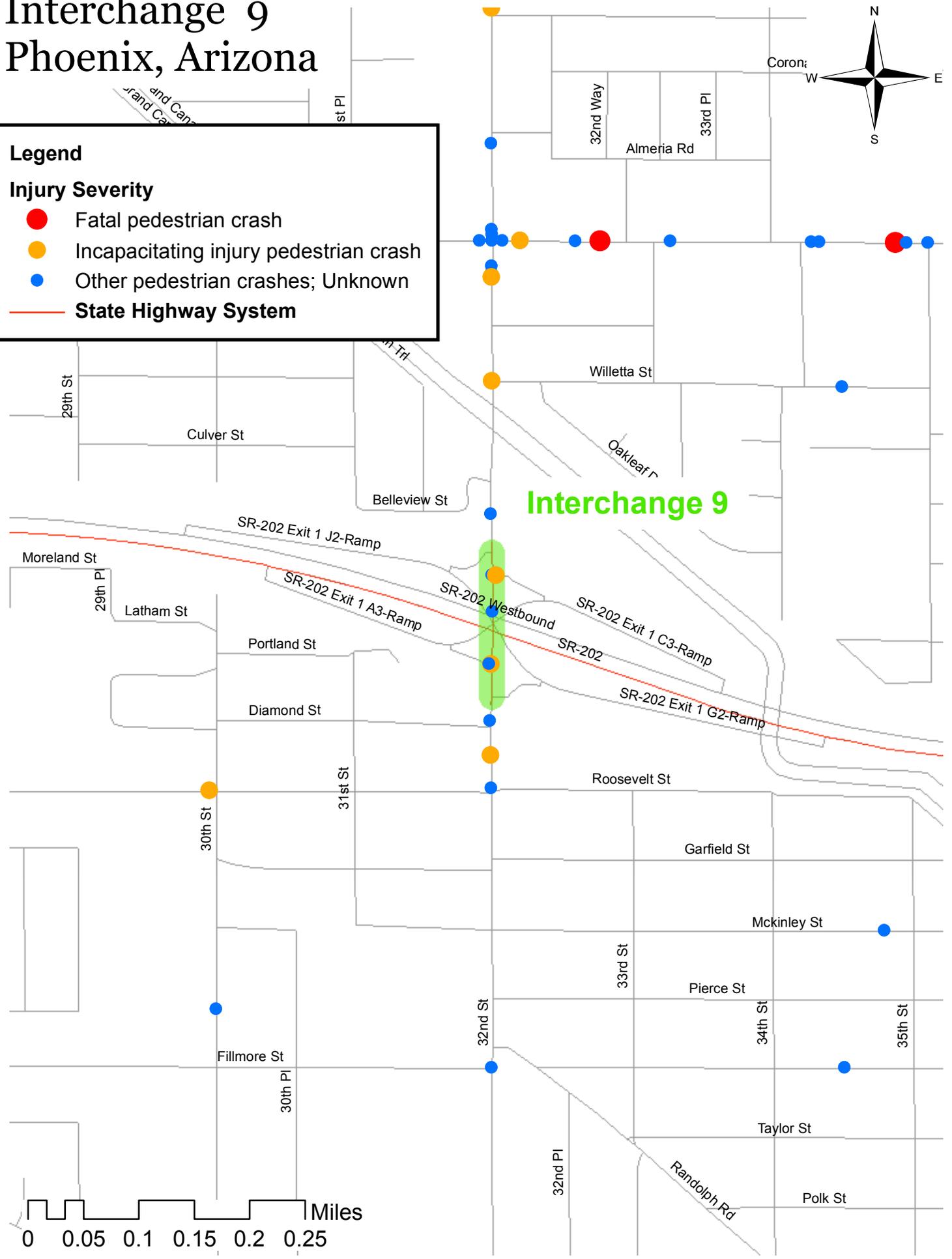


Legend

Injury Severity

- Fatal pedestrian crash
- Incapacitating injury pedestrian crash
- Other pedestrian crashes; Unknown

— State Highway System

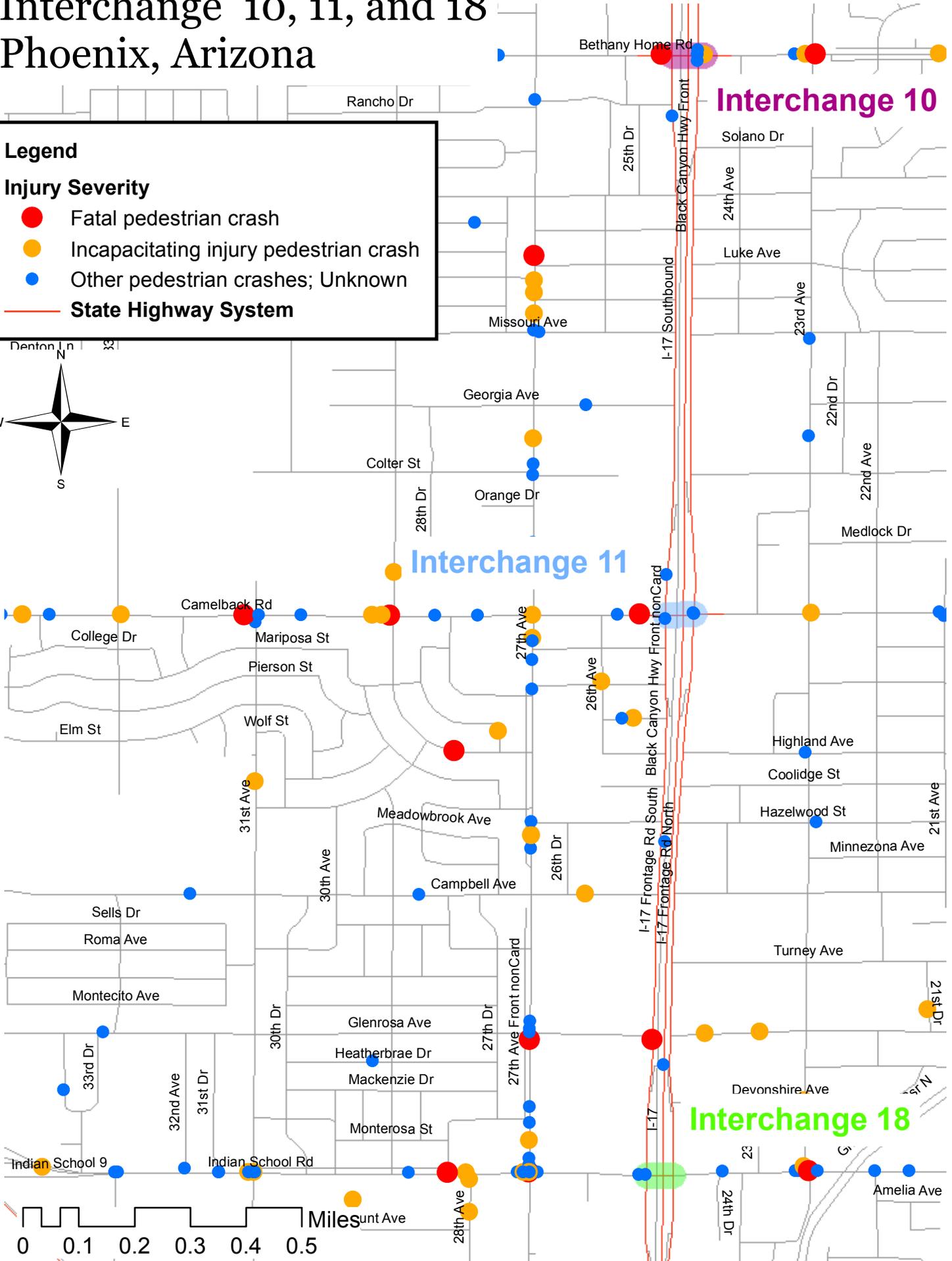
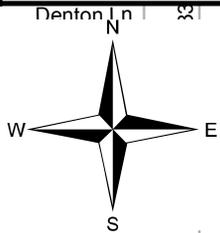


Interchange 10, 11, and 18 Phoenix, Arizona

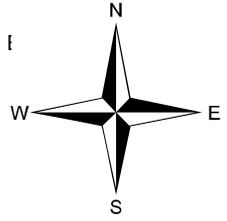
Legend

Injury Severity

- Fatal pedestrian crash
- Incapacitating injury pedestrian crash
- Other pedestrian crashes; Unknown
- State Highway System



Interchange 12 Phoenix, Arizona

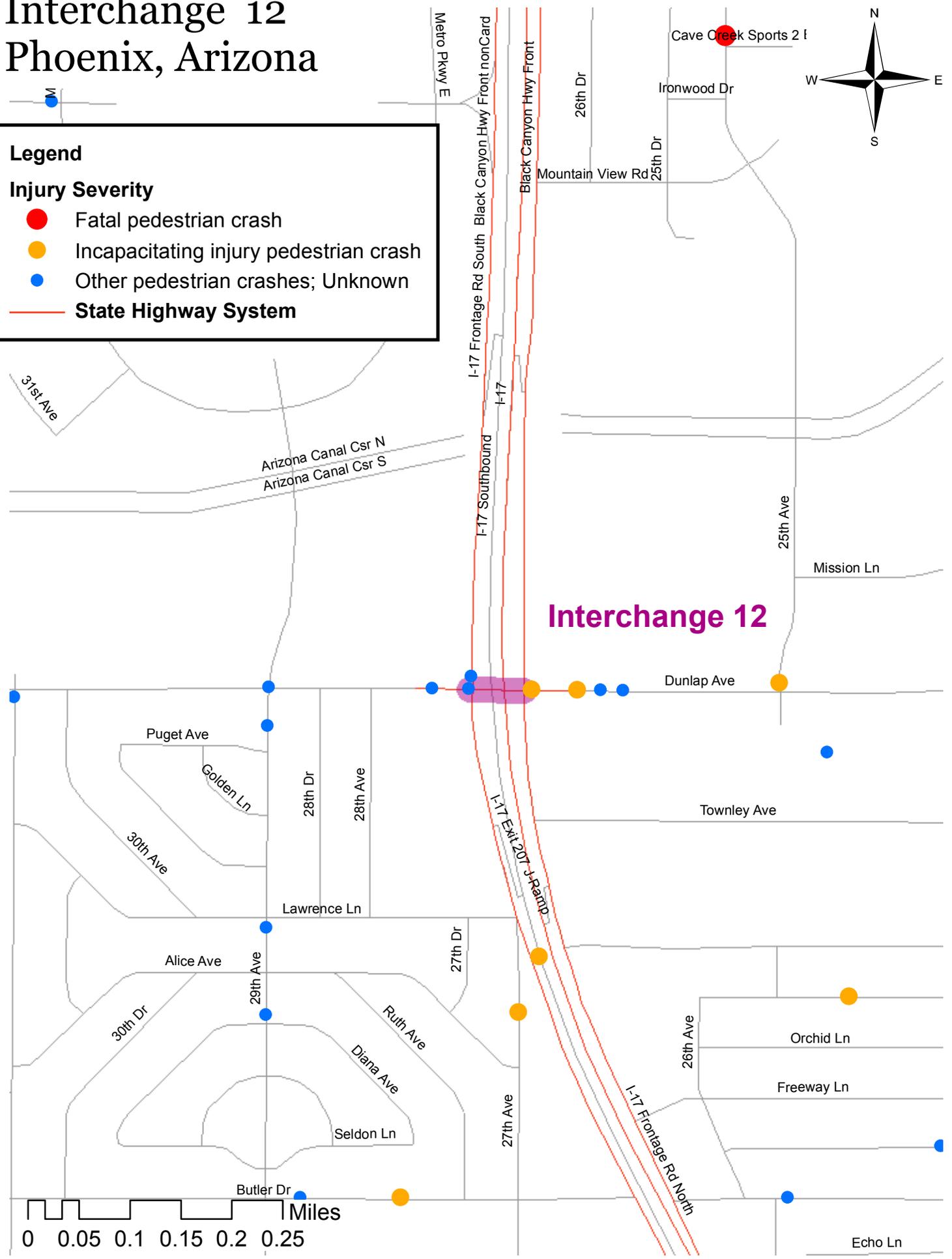


Legend

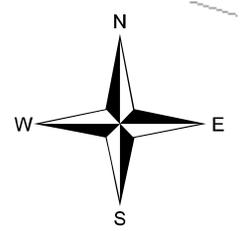
Injury Severity

- Fatal pedestrian crash
- Incapacitating injury pedestrian crash
- Other pedestrian crashes; Unknown

State Highway System



Interchange 14 Tempe/Mesa, Arizona

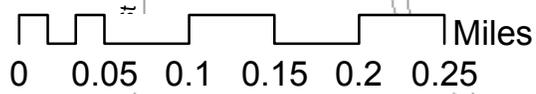
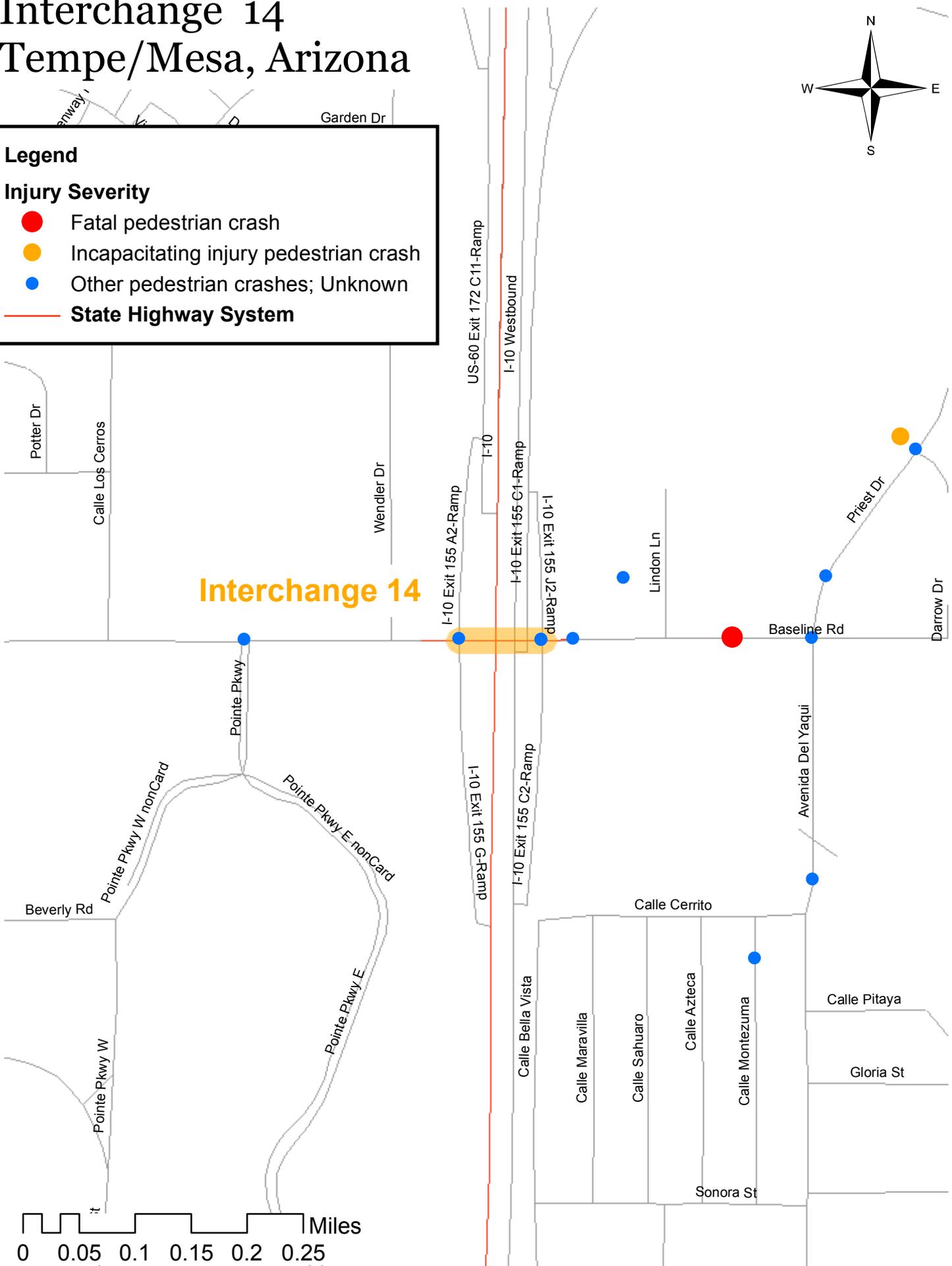


Legend

Injury Severity

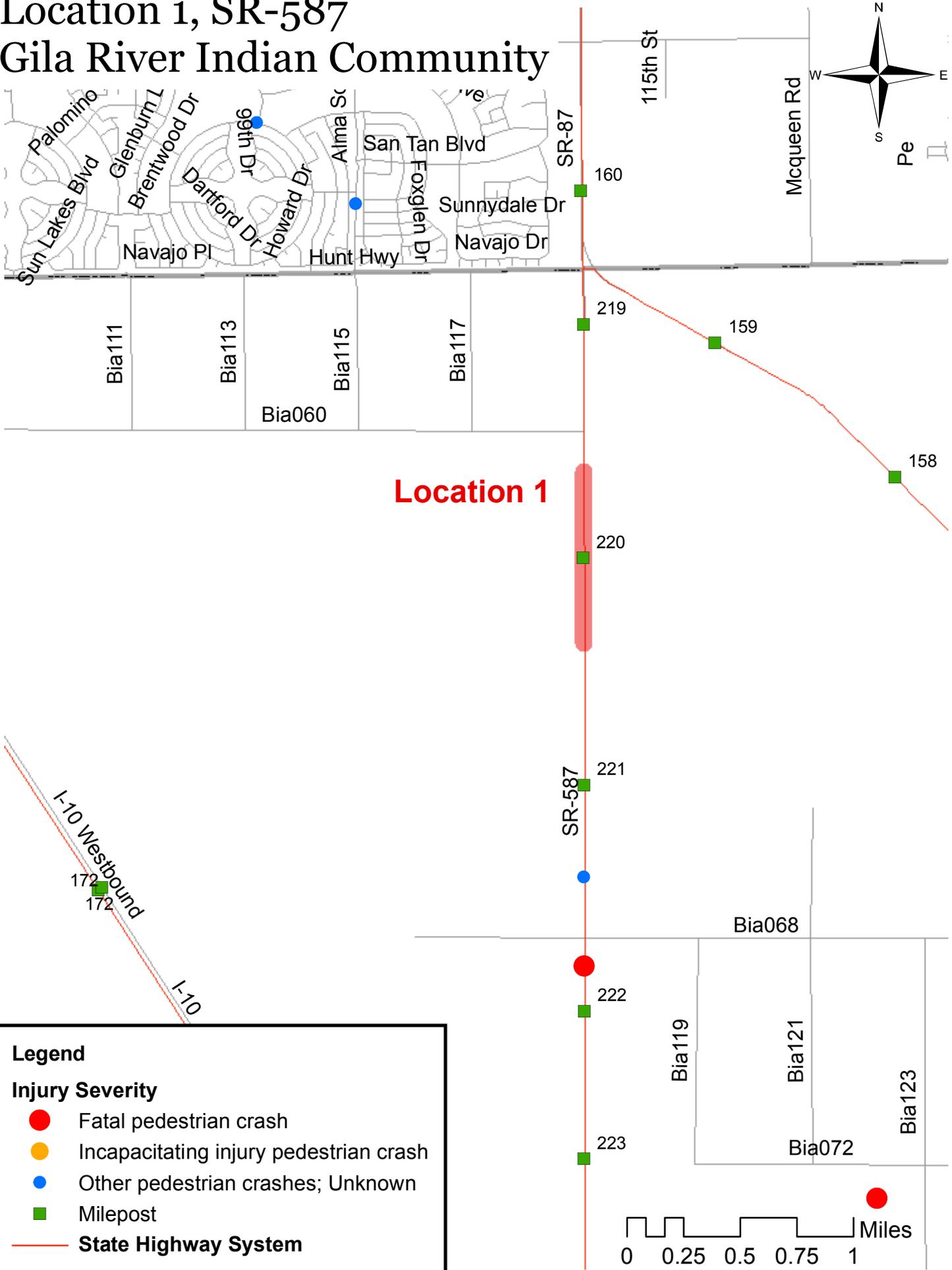
- Fatal pedestrian crash
- Incapacitating injury pedestrian crash
- Other pedestrian crashes; Unknown

— State Highway System



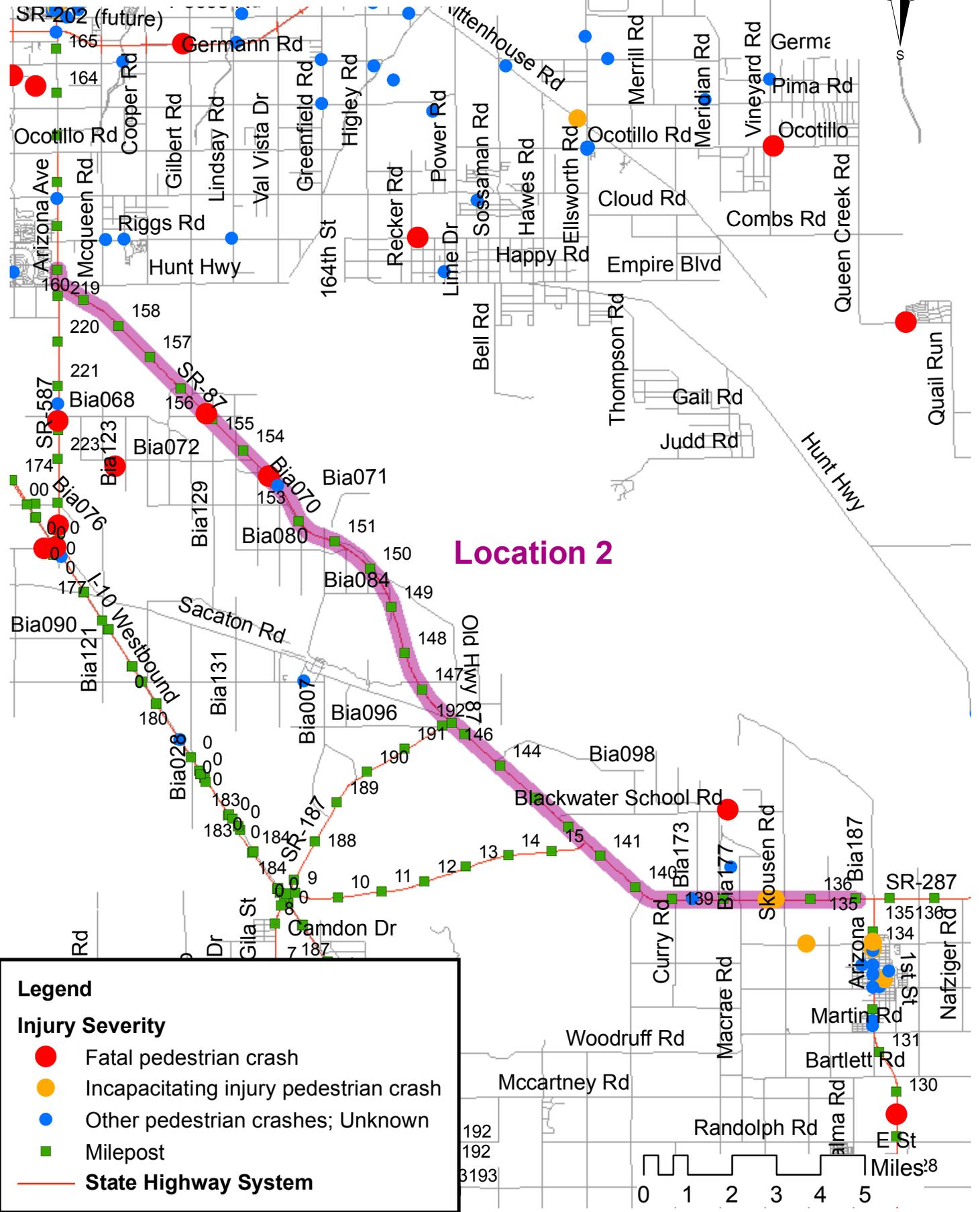
Tribal Community Locations

Location 1, SR-587 Gila River Indian Community



Location 1

Location 2, SR-87 Gila River Indian Community

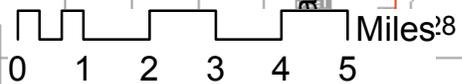


Location 2

Legend

Injury Severity

- Fatal pedestrian crash
- Incapacitating injury pedestrian crash
- Other pedestrian crashes; Unknown
- Milepost
- State Highway System

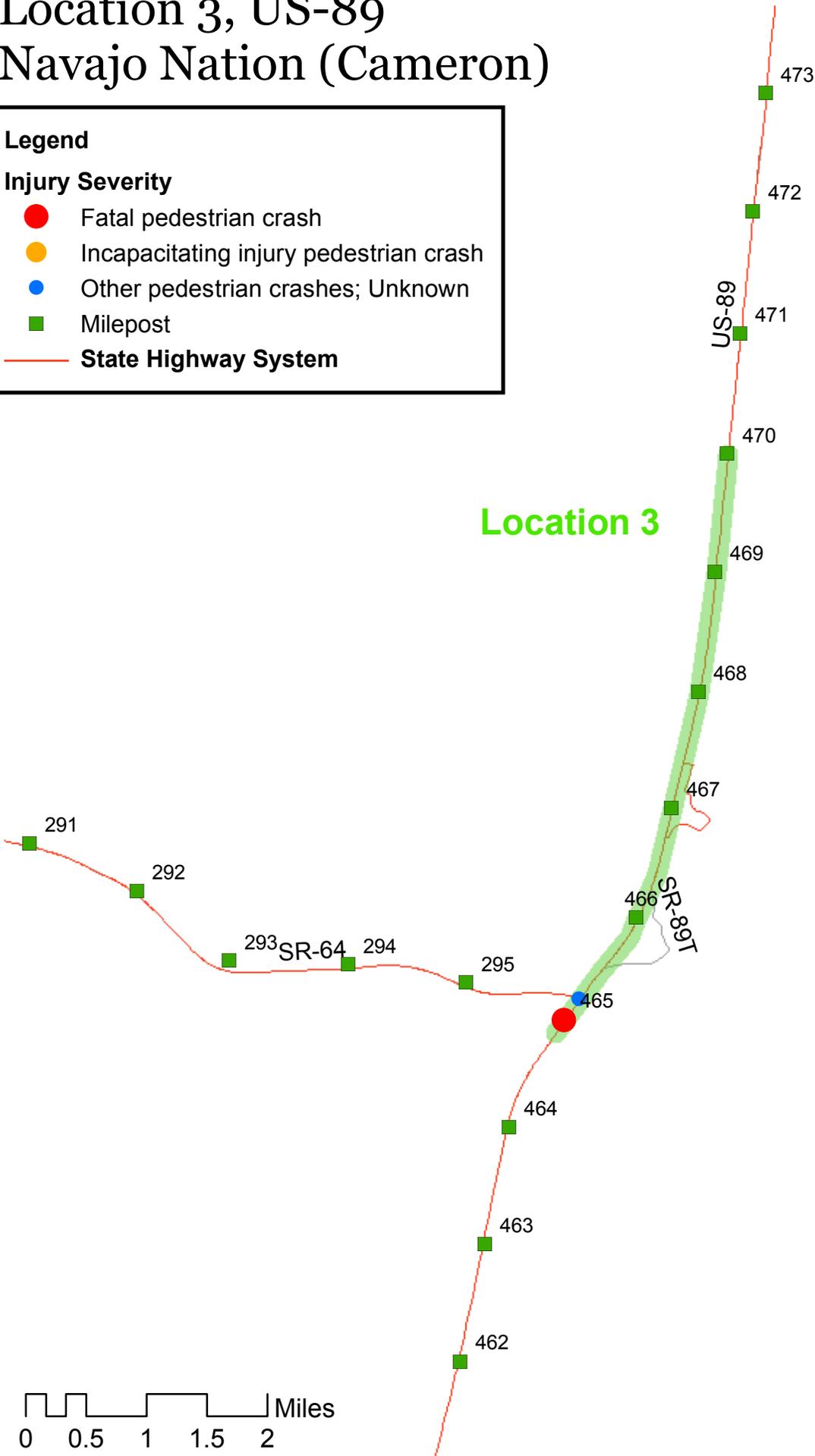
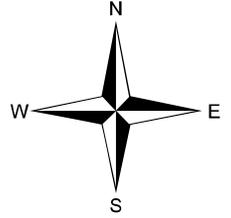


Location 3, US-89 Navajo Nation (Cameron)

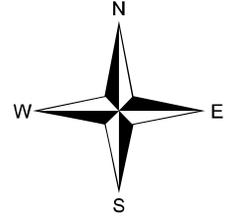
Legend

Injury Severity

- Fatal pedestrian crash
- Incapacitating injury pedestrian crash
- Other pedestrian crashes; Unknown
- Milepost
- State Highway System



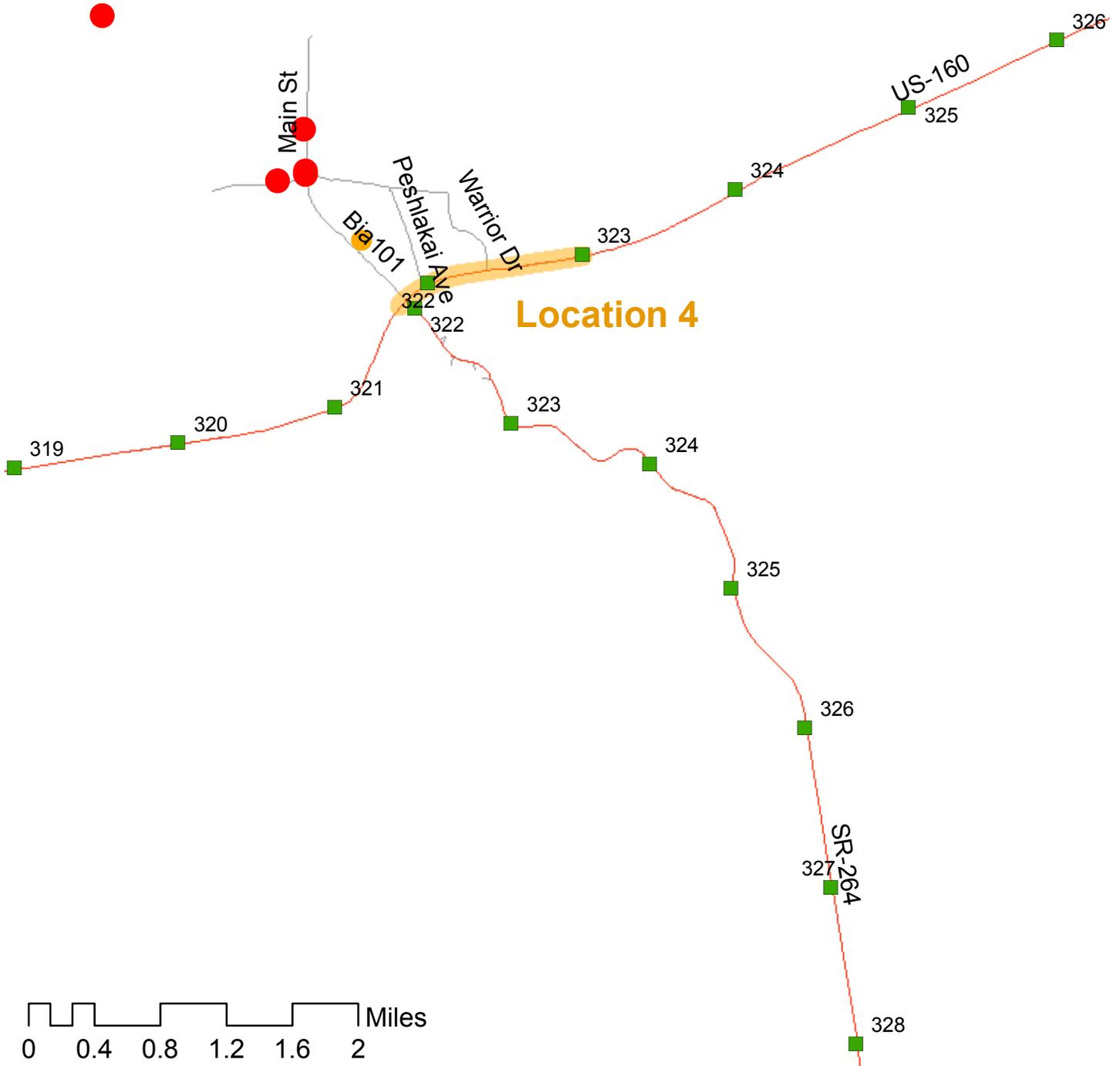
Location 4, US-160 Navajo Nation (Tuba City)



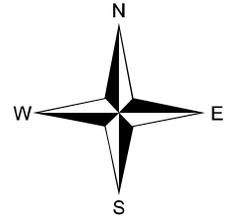
Legend

Injury Severity

- Fatal pedestrian crash
- Incapacitating injury pedestrian crash
- Other pedestrian crashes; Unknown
- Milepost
- State Highway System**



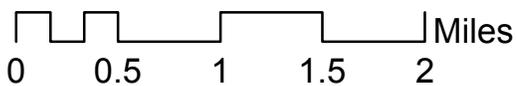
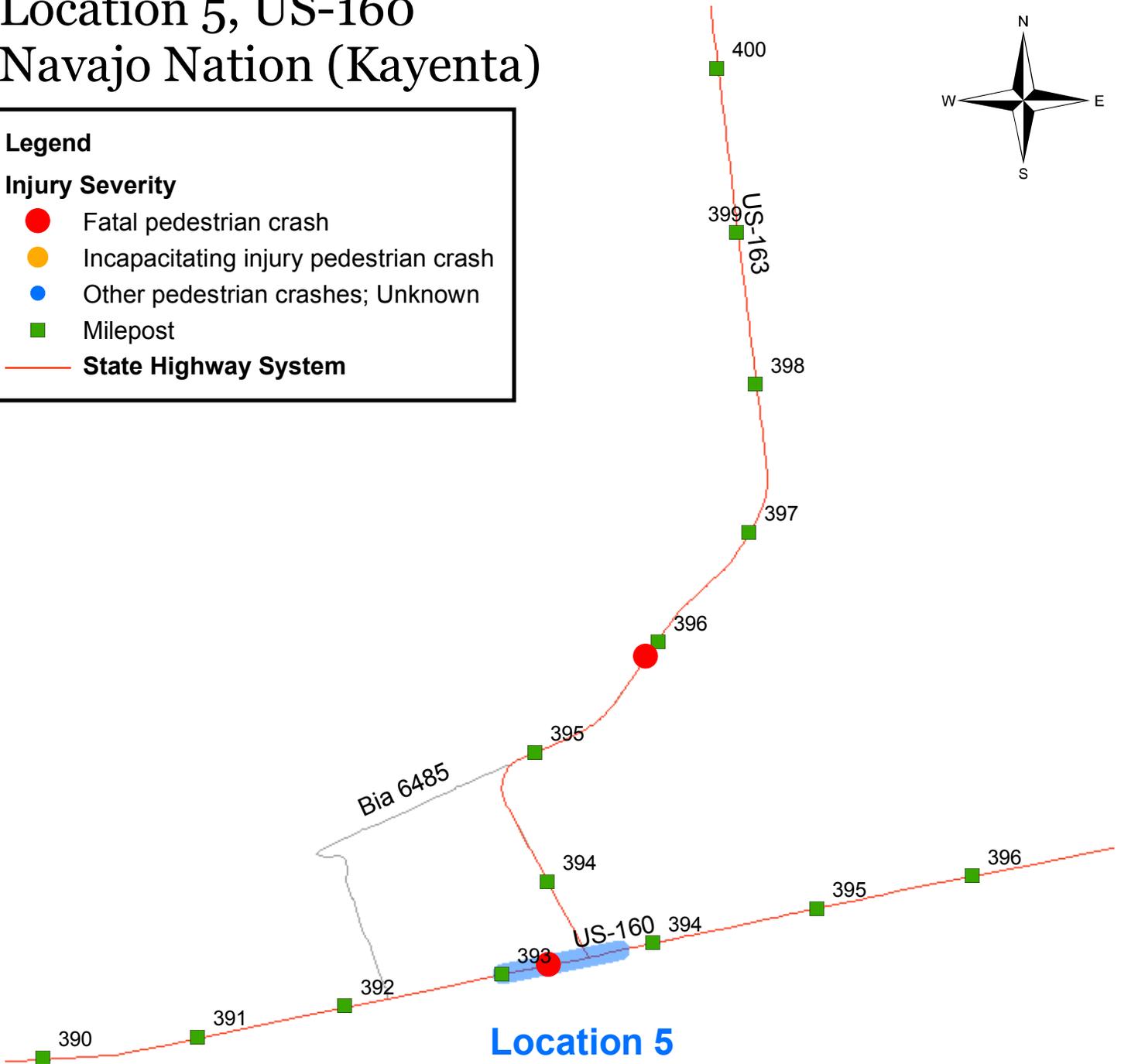
Location 5, US-160 Navajo Nation (Kayenta)



Legend

Injury Severity

- Fatal pedestrian crash
- Incapacitating injury pedestrian crash
- Other pedestrian crashes; Unknown
- Milepost
- State Highway System

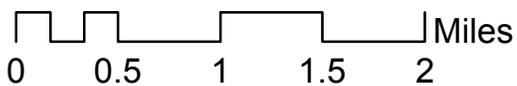
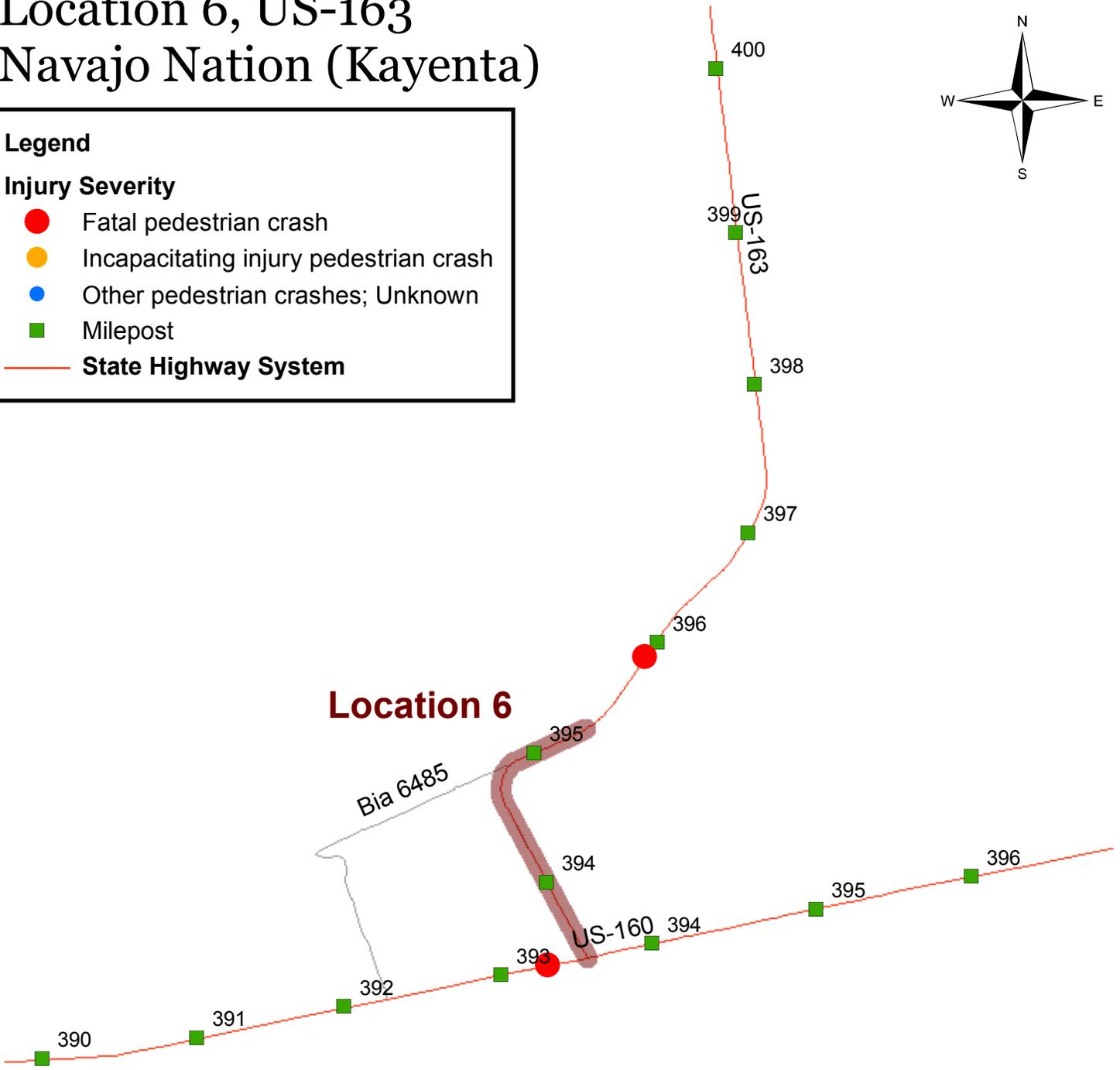
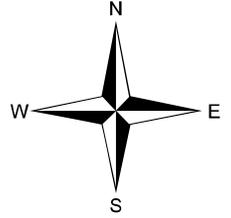


Location 6, US-163 Navajo Nation (Kayenta)

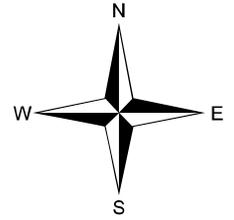
Legend

Injury Severity

- Fatal pedestrian crash
- Incapacitating injury pedestrian crash
- Other pedestrian crashes; Unknown
- Milepost
- State Highway System



Location 7, US-191 Navajo Nation (Chinle)

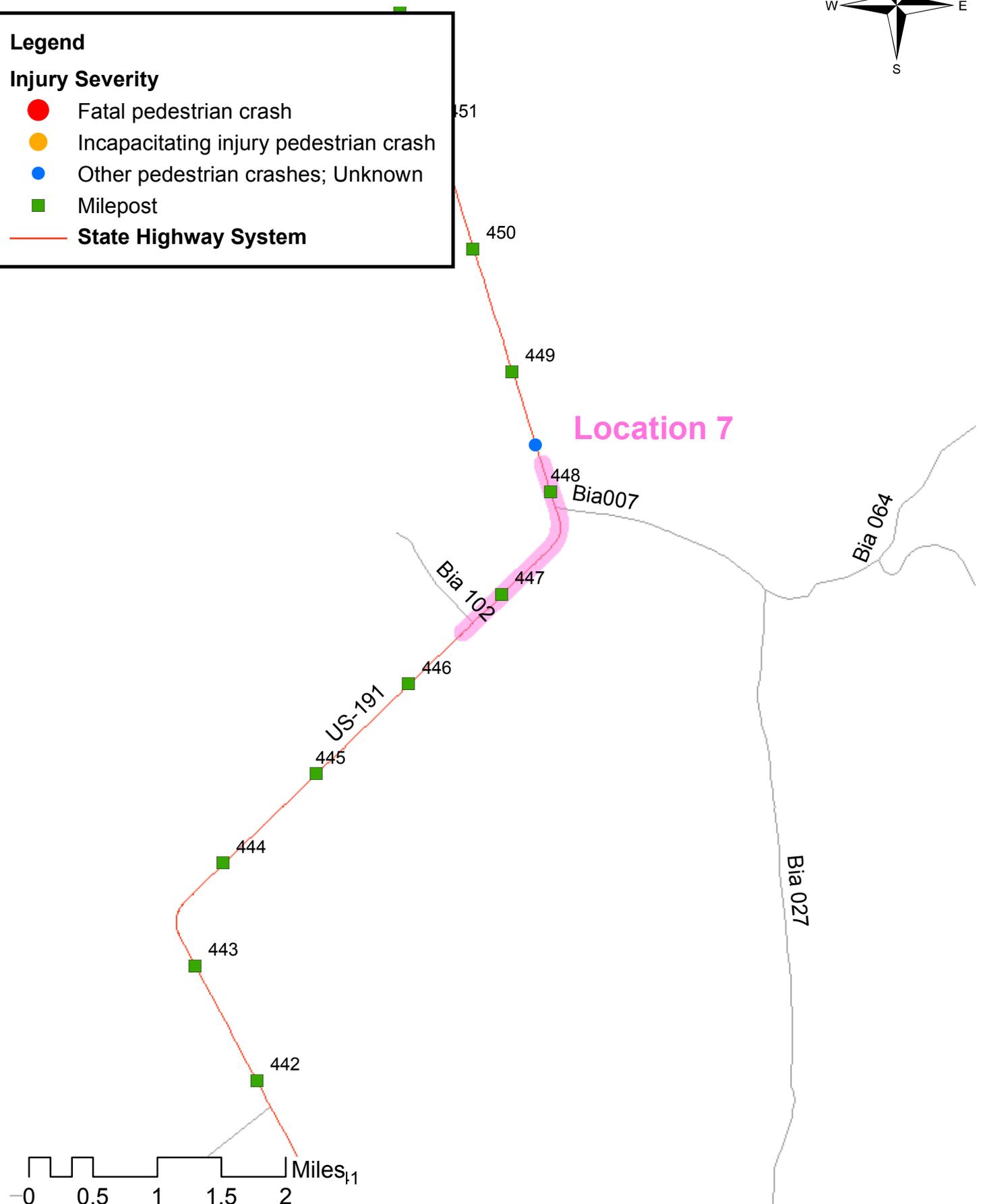


Legend

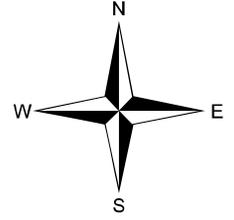
Injury Severity

- Fatal pedestrian crash
- Incapacitating injury pedestrian crash
- Other pedestrian crashes; Unknown
- Milepost

— State Highway System



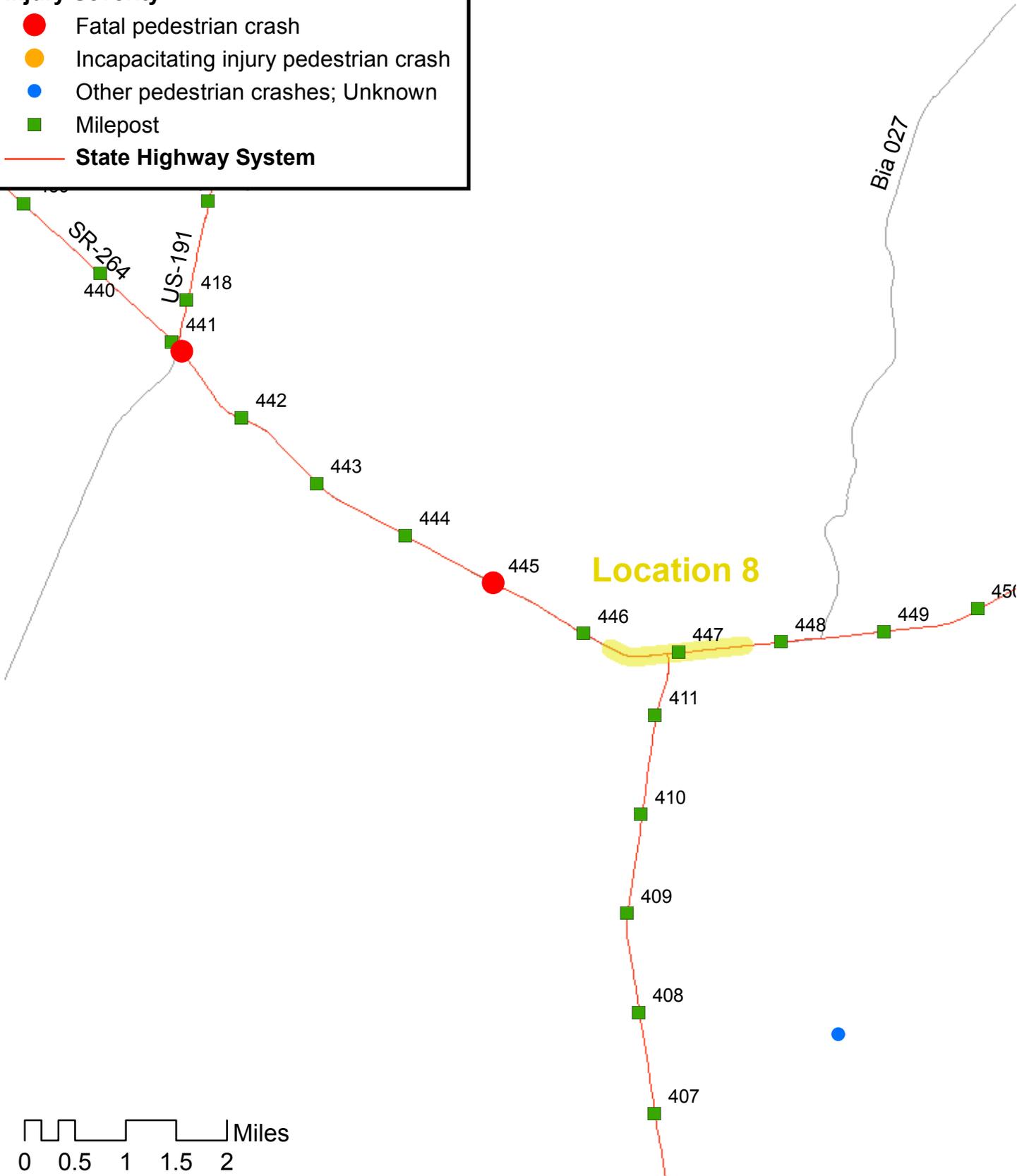
Location 8, SR-264 Navajo Nation



Legend

Injury Severity

- Fatal pedestrian crash
- Incapacitating injury pedestrian crash
- Other pedestrian crashes; Unknown
- Milepost
- State Highway System

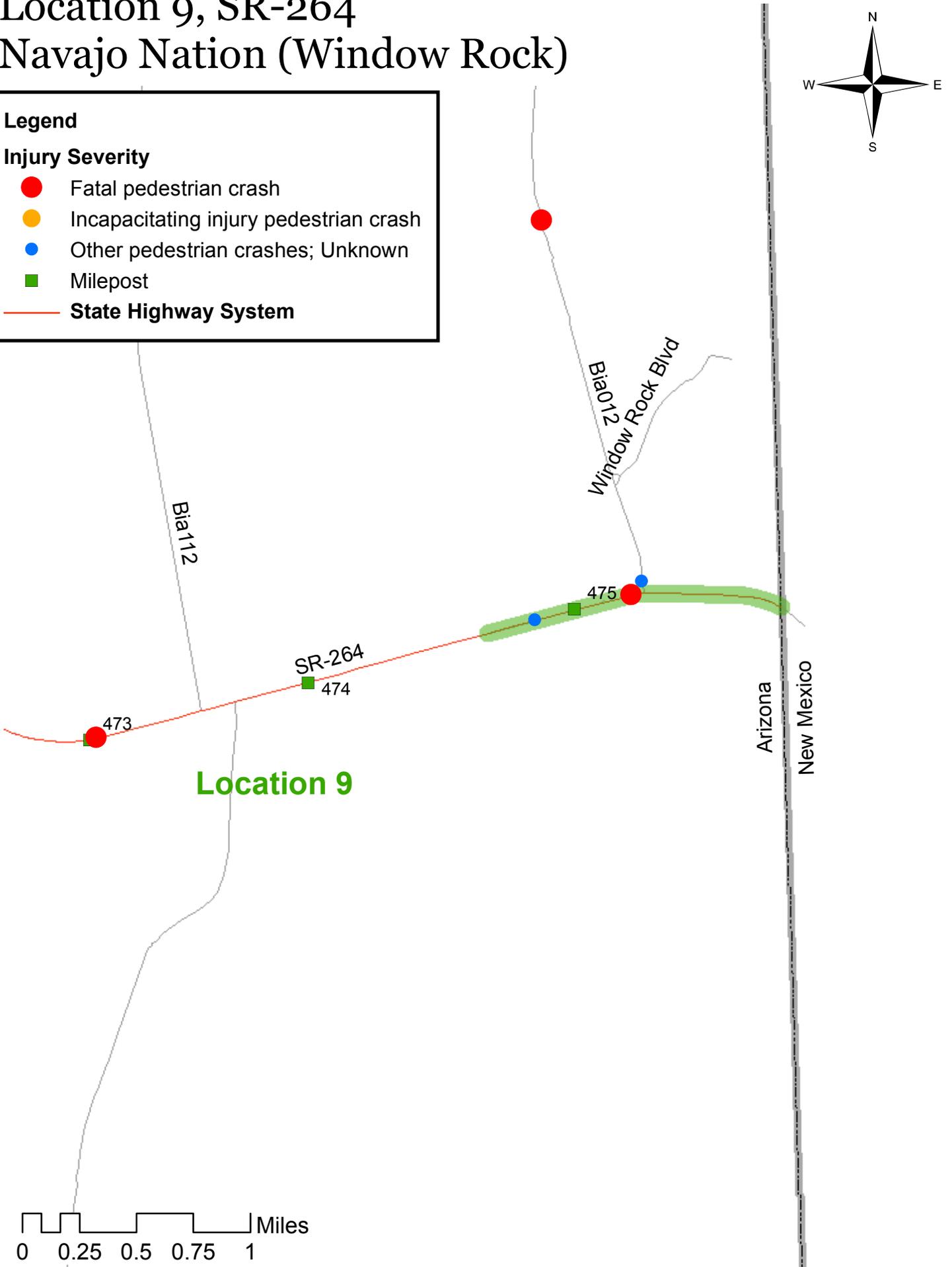


Location 9, SR-264 Navajo Nation (Window Rock)

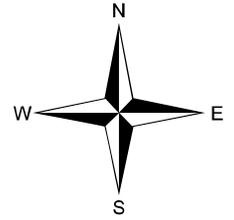
Legend

Injury Severity

- Fatal pedestrian crash
- Incapacitating injury pedestrian crash
- Other pedestrian crashes; Unknown
- Milepost
- State Highway System



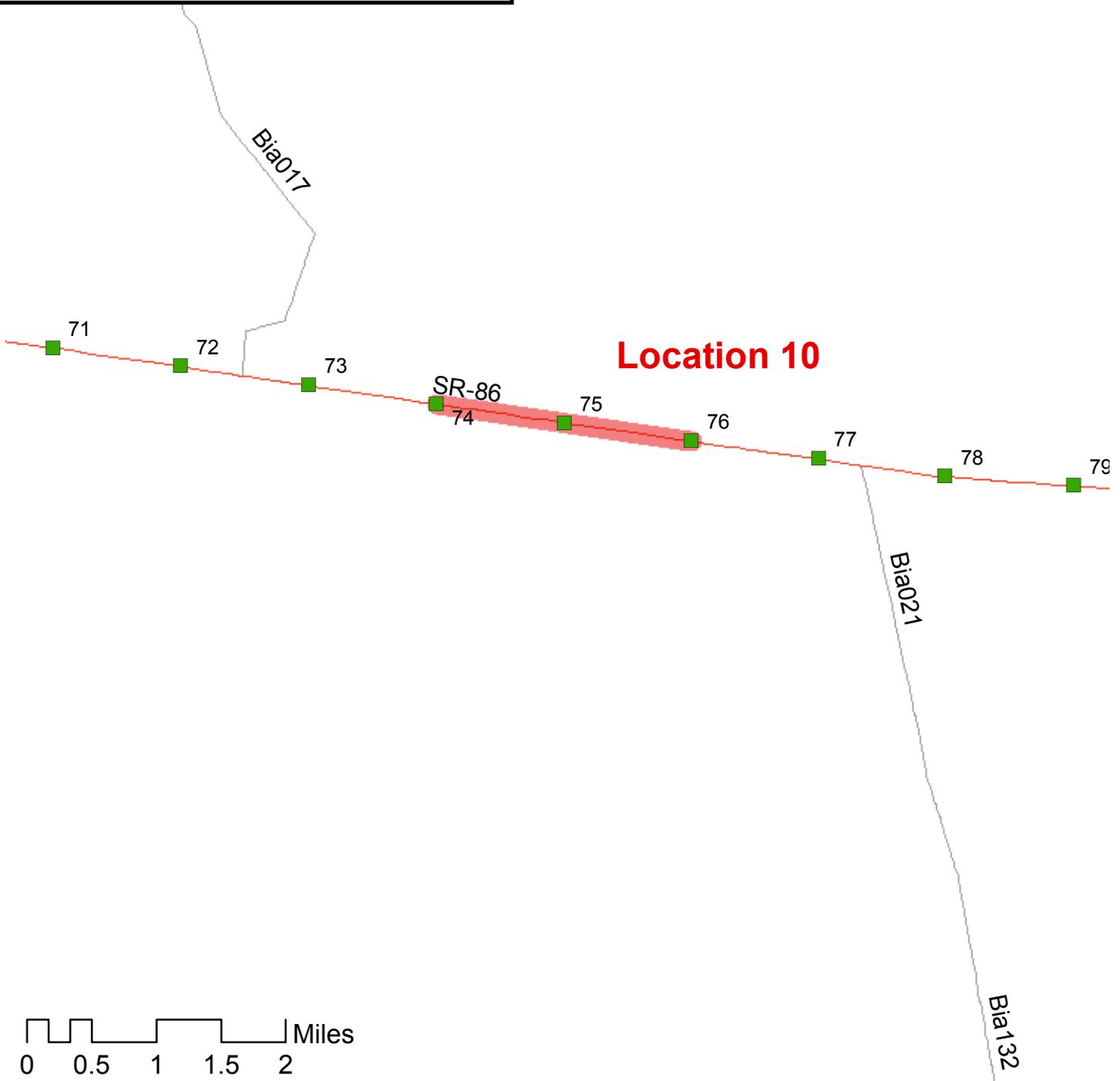
Location 10, SR-86 Tohono O'odham Nation



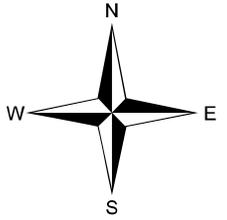
Legend

Injury Severity

- Fatal pedestrian crash
- Incapacitating injury pedestrian crash
- Other pedestrian crashes; Unknown
- Milepost
- State Highway System



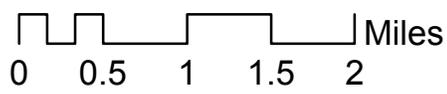
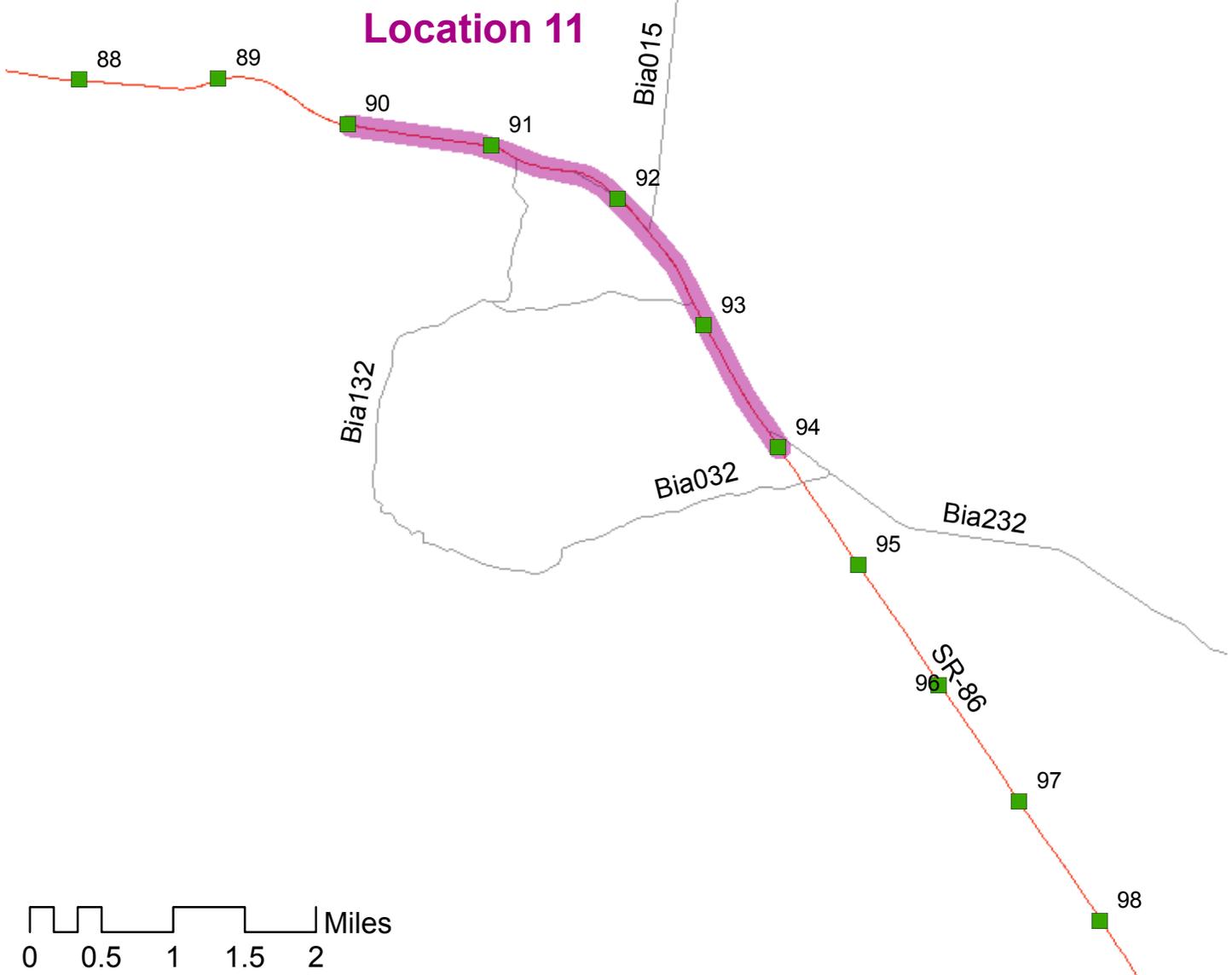
Location 11, SR-86 Tohono O'odham Nation



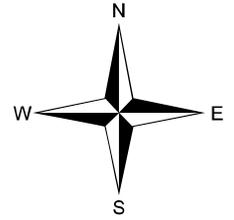
Legend

Injury Severity

- Fatal pedestrian crash
- Incapacitating injury pedestrian crash
- Other pedestrian crashes; Unknown
- Milepost
- State Highway System



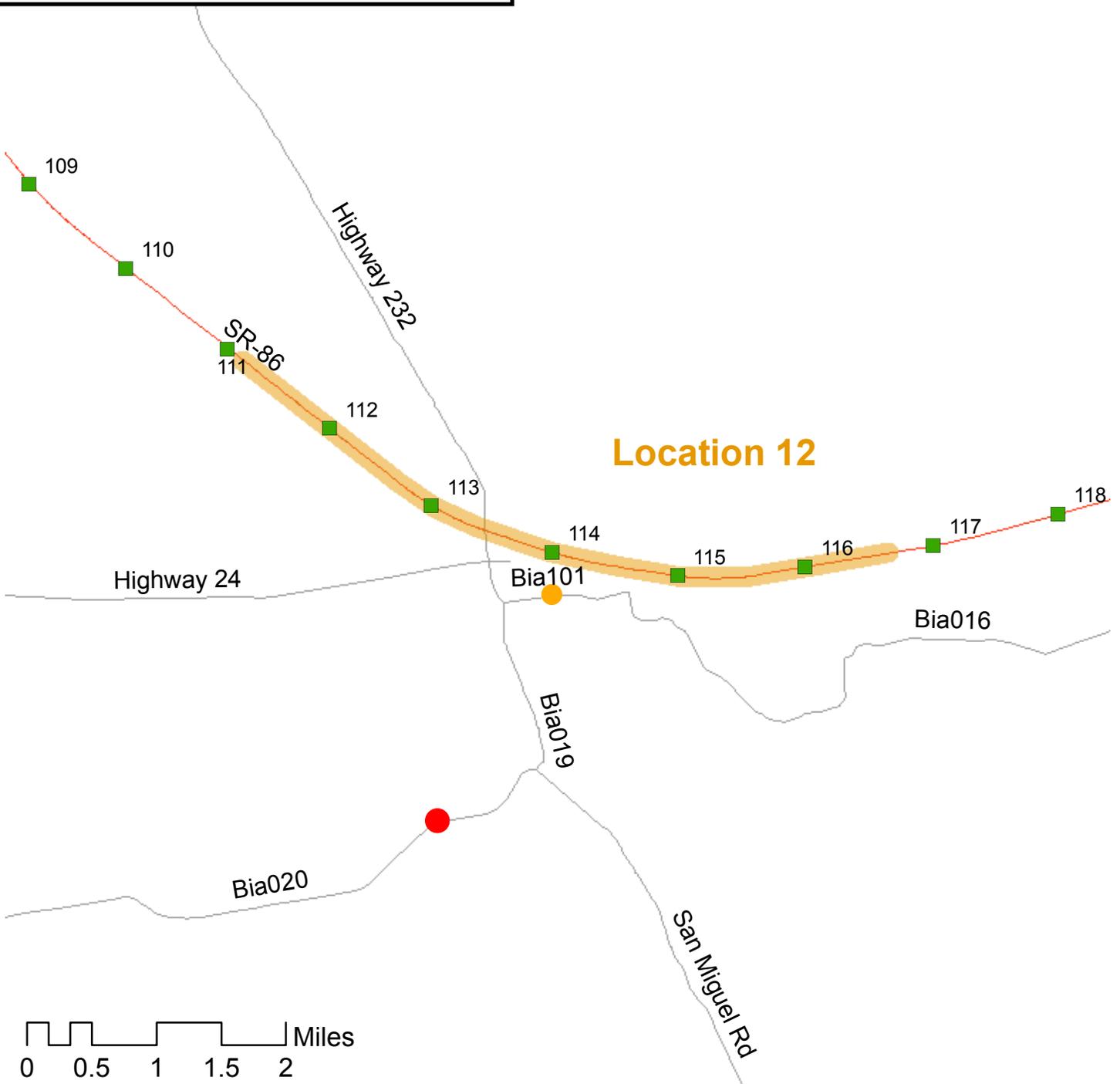
Location 12, SR-86 Tohono O'odham Nation



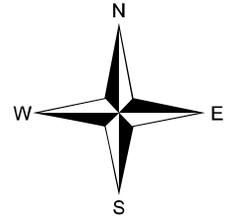
Legend

Injury Severity

- Fatal pedestrian crash
- Incapacitating injury pedestrian crash
- Other pedestrian crashes; Unknown
- Milepost
- State Highway System



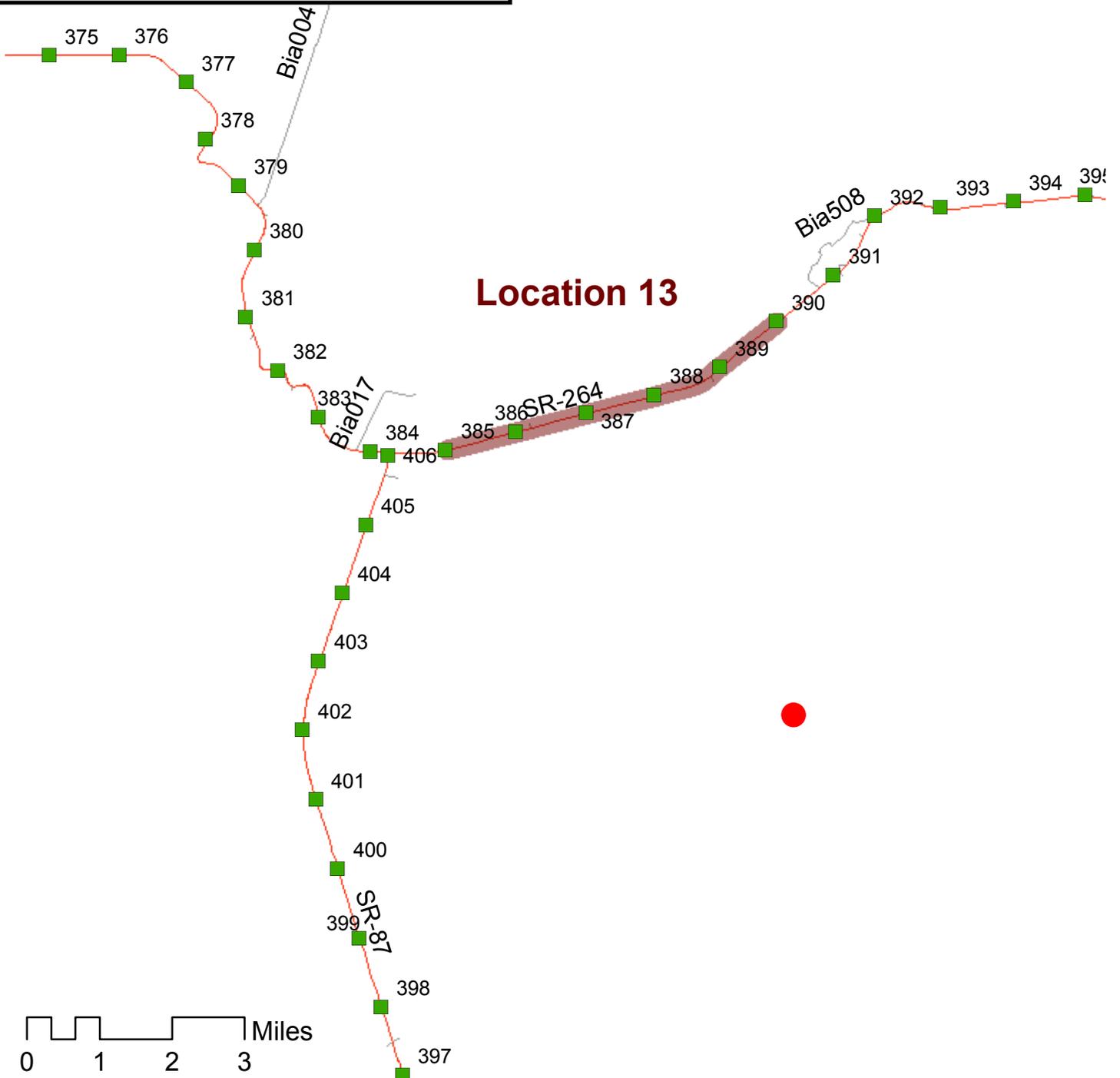
Location 13, SR-264 Hopi Tribe



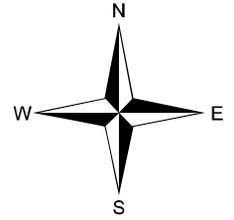
Legend

Injury Severity

- Fatal pedestrian crash
- Incapacitating injury pedestrian crash
- Other pedestrian crashes; Unknown
- Milepost
- State Highway System



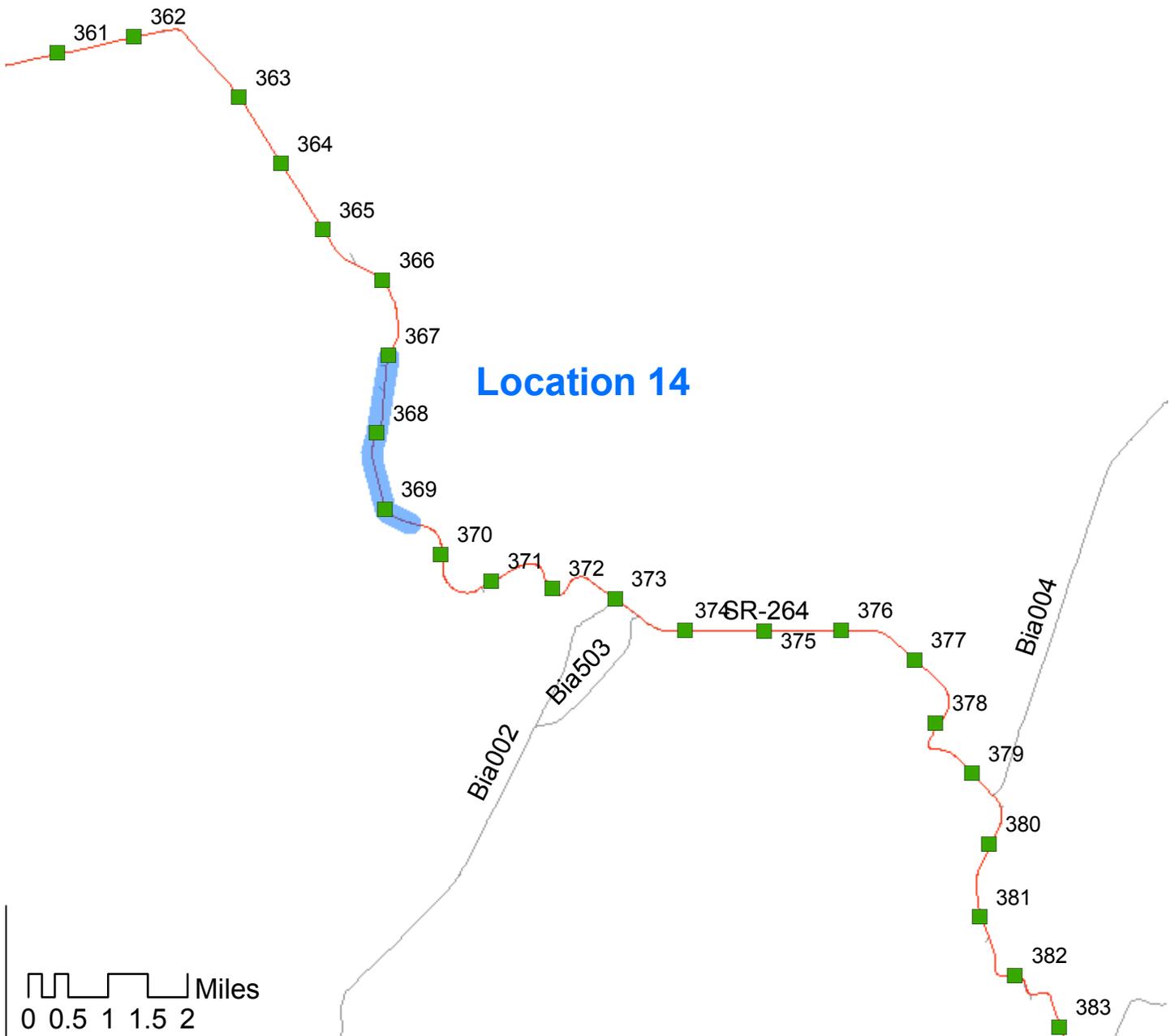
Location 14, SR-264 Hopi Tribe



Legend

Injury Severity

- Fatal pedestrian crash
- Incapacitating injury pedestrian crash
- Other pedestrian crashes; Unknown
- Milepost
- State Highway System



Location 15, SR-73 White Mountain Apache Tribe

