

# FINAL

## PEDESTRIAN CROSSWALK WARRANT STUDY

SR 89A

Dry Creek Road to Airport Road

MP 371 - 373

ADOT Project No. 89A YV 371 H7130 01C

Federal Project No. HES-A89-B(202)

PREPARED FOR:



ARIZONA DEPARTMENT OF TRANSPORTATION  
INTERMODAL TRANSPORTATION DIVISION  
TRAFFIC ENGINEERING GROUP  
HIGHWAY ENHANCEMENT FOR SAFETY (HES) TEAM

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# 1.0 INTRODUCTION

## 1.1 Purpose

This study has been prepared to support the development of the final design for Arizona Department of Transportation (ADOT) project 89A YV 371 H7130 01C, HES A89-B(202). State Route (SR) 89A, between milepost 371 and 373 has been the site of four nighttime fatal vehicle-pedestrian crashes. The purpose of the project is to improve pedestrian safety in the corridor through the installation of a continuous roadway lighting system.

During the development of the Initial Project Assessment, ADOT and the City of Sedona received a high volume of public input from concerned citizens regarding the implementation of highway lighting along the corridor. As a result, the project scope was re-evaluated by ADOT and the City of Sedona. The City of Sedona formed a Pedestrian Safety Advisory Committee. ADOT project team members also participated on the committee. The committee met several times and investigated several safety improvement alternatives. As a result of the City of Sedona Pedestrian Safety Advisory Committee meetings and subsequent actions by the Sedona City Council, it was determined that further investigation of safety enhancements and pedestrian crossing alternatives beyond the original intent of the initial scoping document was required.

This study evaluates the installation of marked crosswalks and the installation of HAWK (High-intensity Activated CrossWalk) signal at two intersections on SR 89A between Dry Creek Road and Airport Road. The two intersections are SR 89A at Tortilla Drive and SR 89A at Old Marketplace/Willow Way (see Figure 1).

## 1.2 Study Area

State Route 89A from Dry Creek Road to Airport Road is a five lane urban highway with two westbound lanes, two eastbound lanes and a center lane that alternates between a continuous two-way left turn lane and exclusive left turn lanes at major intersections. For the purposes of this discussion, SR 89A is treated as an east-west roadway, following compass directions. Additionally, at some intersections and driveway locations there are exclusive right turn lanes.

Tortilla Drive is stop-controlled at the intersection of SR 89A with Tortilla Drive forming the stem of the intersection to the north. At the intersection of Tortilla Drive, SR 89A has two westbound lanes, two eastbound lanes, a center two-way left turn lane.



Willow Way forms the south leg of the intersection at SR 89A, with the Old Marketplace driveway forming the north leg of the intersection. Willow Way and Old Marketplace are stop-controlled. At the intersection of Old Marketplace/Willow Way, SR 89A has two westbound lanes, two eastbound lanes, a center two-way left turn lane, and an exclusive westbound right turn lane.



**STUDY INTERSECTION**  
**SR 89A & Tortilla Drive**

**STUDY INTERSECTION**  
**SR 89A & Old Marketplace/Willow Way**

**Legend**

-  Existing Signalized Intersection
-  Proposed Signalized Intersection



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Vicinity Map

**FIGURE 1**

## 2.0 2006 SEDONA PEDESTRIAN CROSSING STUDY

### 2.1 Purpose

The ADOT Northern Traffic Engineering Regional Office prepared the Sedona Pedestrian Crossing Study in May of 2006 for SR 89A between MP 370.0 and MP 372.99. This study was prepared in partnership with the City of Sedona as the result of a nighttime pedestrian fatality that occurred on January of 2006 as well as two other nighttime pedestrian fatalities that occurred in June of 2005 and December of 2000.

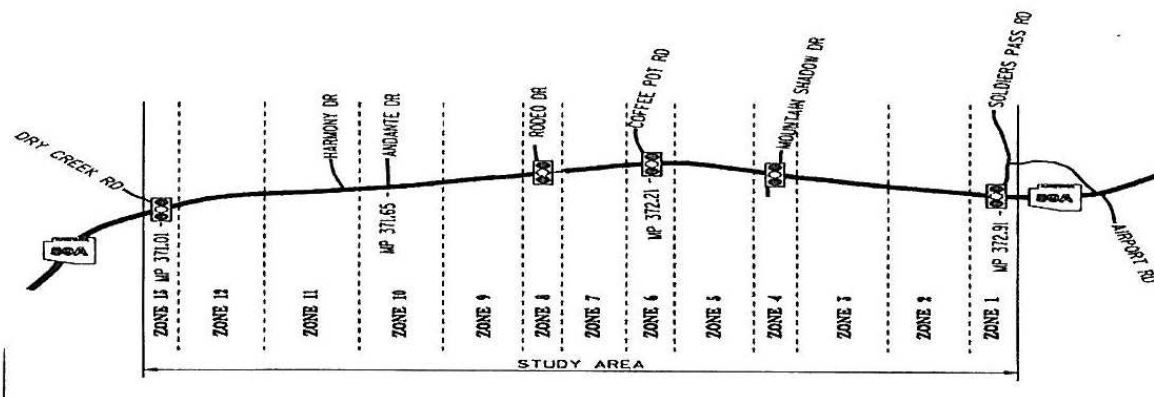
### 2.2 Crash History

Crash data was analyzed for a three year period, from September 1, 2002 to August 31, 2005. Of the 322 crashes occurring during this time frame, 6 involved pedestrians and 7 involved bicyclists. According to the 2006 study, the only fatality was in June 2005 about an hour before midnight, a pedestrian attempted to cross SR 89A between Rigby Road and Stutz Bearcat Drive. The victim was struck by a westbound vehicle in the leftmost westbound lane and the driver stated that the victim was not seen until immediately prior to impact. Four of the six pedestrian accidents and five of the seven bicycle crashes occurred during non-daylight conditions.

Two other pedestrian fatality crashes occurred within the study area, but outside of the study period. The first one occurred in December of 2000 at Andante Drive, the second one was in April of 2006 just west of Dry Creek Road. In both instances, the victims were struck by westbound vehicles in the leftmost westbound lane and the drivers stated that the victims were not seen until immediately prior to impact.

### 2.3 Pedestrian & Bicyclist Crossings

For this study, pedestrian and bicyclist crossing data were collected and recorded in zones. For each zone, data was collected from 6:00 am to 6:00 pm. Signalized intersections were designated as separate zones and an additional 3 hours of data (6:00 pm to 9:00 pm) were collected at these locations.



The tables below, provided in the 2006 Sedona Pedestrian Crossing Study, summarize the total number of pedestrian and bicycle crossings observed. Approximately 880 pedestrian and 170 cyclists crossed 89A during the daytime hours between 6:00 am and 6:00 pm. Fifty-two percent of the pedestrians crossed at signalized intersections. Approximately 80 pedestrian and 17 cyclists crossed 89A at the signalized intersections between the hours of 6:00 pm to 9:00 pm. Nighttime crossing data was not collected away from the signalized intersections because it was too dark to see the pedestrians and cyclists crossing.

**Pedestrian Crossing Volumes  
SR 89A in West Sedona  
April 11 thru 13, 2006**

Hour	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9	Zone 10	Zone 11	Zone 12	Zone 13	Totals
6:00 – 7:00 am	2	2	1	3	7	6	0	11	4	4	3	0	1(1)	44(1)
7:00 – 8:00 am	0	7	3	5	7	9	1	7	1	7	4	1	3(1)	55(1)
8:00 – 9:00 am	6	5	2	5	7	11	18	17	2	3	1	7	8(2)	92(2)
9:00 – 10:00 am	2	2	2	2	1	26	18	12	5	4	2	6	0(1)	82(1)
10:00 – 11:00 am	4	4	4	4	4	8	8	16	8	0	3	1	7	71
11:00 – 12:00 pm	2	9	5	11	11	16	12	4	7	3	0	6	1	87
12:00 – 1:00 pm	0	7	0	26	0	12	4	2	7	1	0	10	9(2)	78(2)
1:00 – 2:00 pm	6	13	3	23	0	15	2	8	5	3	2	1	4(2)	85(2)
2:00 – 3:00 pm	3	3	11	8	2	9	4	8	8	6	2	1	9	74
3:00 – 4:00 pm	8	7	7	9	7	8	0	7	6	7	2	3	8	79
4:00 – 5:00 pm	2	9	0	3	6	5	4	10	6	4	1	4	12	66
5:00 – 6:00 pm	3	3	1	12	9	6	0	11	3	5	2	6	4	65
<b>12 Hour Totals</b>	<b>38</b>	<b>71</b>	<b>39</b>	<b>111</b>	<b>61</b>	<b>131</b>	<b>71</b>	<b>113</b>	<b>62</b>	<b>47</b>	<b>22</b>	<b>46</b>	<b>66(9)</b>	<b>878(9)</b>
6:00 – 7:00 pm	2			8		13		6		3			3	35
7:00 – 8:00 pm	1			5		7		5		6			3	27
8:00 – 9:00 pm	0			2		4		3		7			1	17
<b>3 Hour Totals</b>	<b>3</b>			<b>15</b>		<b>24</b>		<b>14</b>		<b>16</b>			<b>7</b>	<b>79</b>
<b>15 Hour Totals</b>	<b>41</b>			<b>126</b>		<b>155</b>		<b>127</b>		<b>63</b>			<b>73(9)</b>	<b>957(9)</b>

(x) # crossing outside of crosswalk west of Dry Creek Road

**Bicycle Crossing Volumes  
SR 89A in West Sedona  
April 11 thru 13, 2006**

Hour	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9	Zone 10	Zone 11	Zone 12	Zone 13	Totals
6:00 – 7:00 am	0	0	0	0	0	1	1	2	0	0	0	0	0	4
7:00 – 8:00 am	0	2	3	1	0	1	0	4	0	0	1	0	0	12
8:00 – 9:00 am	0	0	0	0	0	3	0	3	0	0	1	0	1	8
9:00 – 10:00 am	1	3	10	0	0	5	0	3	0	0	0	0	0	22
10:00 – 11:00 am	0	1	0	1	0	0	1	1	0	2	0	0	0	6
11:00 – 12:00 pm	0	0	8	7	0	0	0	1	0	0	0	0	0	16
12:00 – 1:00 pm	1	0	8	7	0	1	0	0	0	0	1	0	0	18
1:00 – 2:00 pm	1	1	1	14	2	4	0	0	0	0	0	1	0	24
2:00 – 3:00 pm	2	1	4	9	0	3	0	0	0	0	0	0	0	19
3:00 – 4:00 pm	2	0	3	1	0	3	0	2	0	0	1	0	3	15
4:00 – 5:00 pm	1	3	2	1	1	0	0	1	0	0	1	0	0	10
5:00 – 6:00 pm	1	3	1	0	0	7	0	1	0	0	0	0	6	19
<b>12 Hour Totals</b>	<b>9</b>	<b>14</b>	<b>40</b>	<b>41</b>	<b>3</b>	<b>28</b>	<b>2</b>	<b>18</b>	<b>0</b>	<b>2</b>	<b>5</b>	<b>1</b>	<b>10</b>	<b>173</b>
6:00 – 7:00 pm	1			4		6		1		0			0	12
7:00 – 8:00 pm	0			0		1		0		0			0	1
8:00 – 9:00 pm	0			0		1		1		0			0	2
<b>3 Hour Totals</b>	<b>1</b>			<b>4</b>		<b>8</b>		<b>2</b>		<b>0</b>			<b>0</b>	<b>15</b>
<b>15 Hour Totals</b>	<b>10</b>			<b>45</b>		<b>36</b>		<b>20</b>		<b>2</b>			<b>10</b>	<b>188</b>

**2.4 Recommendations**

The recommendations stated in the Sedona Pedestrian Crossing Study include installing pedestrian warning signs with mileage panels in the study area, along with installing highway illumination in the study area.

## **3.0 EXISTING CONDITIONS**

### **3.1 Pedestrian & Bicycle Crossings**

Pedestrian and bicycle crossing data were collected at the following intersections:

- SR 89A and Tortilla Drive (Zone 11)
- SR 89A and Andante Drive (Zone 10)
- SR 89A and Old Marketplace/Willow Way (Zone 3)

Based on the pedestrian and bicycle crossing data as documented in the Sedona Pedestrian Crossing Study conducted by the ADOT Northern Traffic Engineering Region in May of 2006, the three highest consecutive hours of pedestrian and bicyclist crossings in zones 3, 10 and 11 was from 1:00 pm to 4:00 pm. Therefore, for this study, pedestrian and bicyclist crossing data was collected during these three hours. Additionally, data was collected between the hours of 6:00 pm and 9:00 pm (see Figures 2, 3 and 4). From the data collected, Figure 4 shows the highest hour of pedestrian and bicyclist crossings. Detailed data sheets can be found in Appendix A.

A traffic signal is proposed for installation at the intersection of SR 89A and Andante Drive. This intersection will not be evaluated for the installation of a pedestrian crosswalk since crosswalks and pedestrian signal indications will be installed as part of the traffic signal installation.

### **3.2 Gap and Speed Data**

Bi-directional approach speeds and gap data were also collected at the approach to the following intersections:



- SR 89A and Tortilla Drive (Zone 11)
- SR 89A and Old Marketplace/Willow Way (Zone 3)

Detailed data sheets can be found in Appendix B.

### **3.3 Pedestrian & Bicycle Crashes**

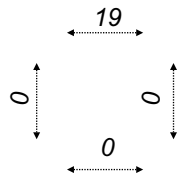
Crash data was obtained from the Arizona Department of Transportation for the intersections of SR 89A and Tortilla Drive, and SR 89A and Old Marketplace/Willow Way. The latest available data covers a three year period from January 2006 to December 2008. There were no pedestrian or bicycle crashes within 200 ft. of either of the intersections. Detailed data sheets can be found in Appendix C.

**Legend**

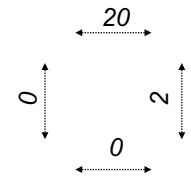
-  Existing Signalized Intersection
-  Proposed Signalized Intersection



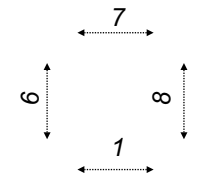
SR 89A & Tortilla Drive



SR 89A & Andante Drive





SR 89A & Old Marketplace/Willow Way



Pedestrian Crossings  
 Wednesday, April 8, 2009  
 1:00 - 4:00 pm

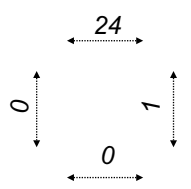
FIGURE 2

Legend

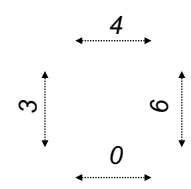
-  Existing Signalized Intersection
-  Proposed Signalized Intersection



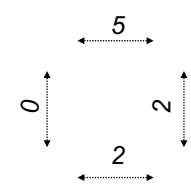
SR 89A & Tortilla Drive



SR 89A & Andante Drive





SR 89A & Old Marketplace/Willow Way



Pedestrian Crossings  
 Wednesday, April 8, 2009  
 6:00 - 9:00 pm

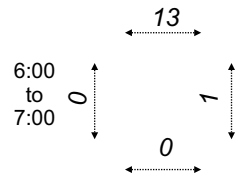
FIGURE 3

Legend

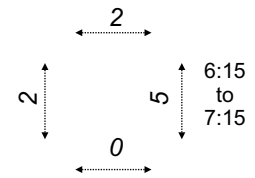
-  Existing Signalized Intersection
-  Proposed Signalized Intersection



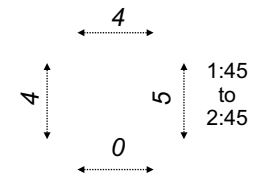
SR 89A & Tortilla Drive



SR 89A & Andante Drive



SR 89A & Old Marketplace/Willow Way



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Pedestrian Crossings  
Peak Hour

FIGURE 4

## 4.0 PEDESTRIAN CROSSWALK WARRANTS

The Arizona Department of Transportation Traffic Engineering Policies, Guidelines, and Procedures (PGP) Section 910 Pedestrian Crosswalks (see Appendix D) indicates that by legal definition there are three or more crosswalks at every intersection whether marked or unmarked. 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. Marked crosswalks are a useful traffic control device but should not be installed unless the anticipated benefits clearly outweigh their associated risks.

Accident history and the investigating engineer's opinion have been eliminated to afford maximum objectivity in determining crosswalk needs. There are four warrants that are based on a point system evaluation, as follows:

- Gap Time, 10 points
- Pedestrian Volumes, 10 points
- Vehicle Approach Speed, 5 points
- General Conditions, 8 points

The maximum score is 33 points. The minimum warrant for the installation of a marked crosswalk at an unsignalized location is satisfied when 16 or more points are accrued.

The intersections of SR 89A at Tortilla Drive and SR 89A at Old Marketplace/Willow Way were evaluated to determine whether marked crosswalk installations are warranted, under the ADOT PGP 910 criteria.

### 4.1 SR 89A and Tortilla Drive

Pedestrian and bicyclist crossing data were collected on Wednesday, April 8, 2009 between the hours of 1:00 pm to 4:00 pm and 6:00 pm to 9:00 pm. During the observation periods, the highest hour of pedestrian and bicyclist crossings of SR 89A occurred from 6:00 pm to 7:00 pm, with 1 crossing. According to the 2006 Sedona Pedestrian Crossing Study the highest hour of pedestrian and bicyclist crossings of SR 89A occurred from 7:00 am to 8:00 am, with 5 crossings. Therefore, the crossing data and peak hour that will be used for this analysis will be from the 2006 Sedona Pedestrian Crossing Study with a peak hour of 7:00 am to 8:00 am.

#### *Gap Time Warrant (maximum 10 points)*

Gap data was collected for a 48 hour period beginning at 12:00 pm on Tuesday, April 7 and ending 12:00 pm on Thursday, April 9. The worst case scenario average gap data between 7:00 am and 8:00 am were used to calculate the average gaps per 5-minute period.

$$\text{Pedestrian Crossing Time} = \frac{\text{Street Width Curb to Curb}}{\text{Walking Rate}} = \frac{76}{4} = 19 \text{ seconds}$$

$$\text{Total Usable Gap Time in Seconds} = 673.2 \text{ seconds}$$

$$\text{Avg \# of Gaps per 5 Minute Period} = \frac{\text{Total Usable Gap Time in Seconds}}{\text{Pedestrian Crossing Time} \times 12} = \frac{673.2}{19 \times 12} = 2.95 \text{ gaps}$$

According to these calculations, there is an average of 2.95 usable gaps per every 5-minute period. Therefore, a total of 6 points are given for the gap time warrant.

**Gap Time Warrant total = 6 points.**

*Pedestrian Volume Warrant (maximum 10 points)*

As previously stated, there were 5 pedestrians and bicyclists observed crossing SR 89A during the highest hour. Therefore, no points are given for the pedestrian volume warrant for the intersection of SR 89A and Tortilla Dr. A minimum of 11 pedestrian and bicyclist crossings must be observed in order to earn points for this warrant.

**Pedestrian Volume Warrant total = 0 points.**

Additionally, as stated in the PGP 910, crosswalks shall not be installed where ten or fewer crossings are made by individual or groups of pedestrians during the study period.

*Approach Speed Warrant (maximum 5 points)*

The approach speed data was collected during the same time period as the gap data. During the 48 hour data collection period, the eastbound 85<sup>th</sup> percentile approach speed was 42.5 mph, and the westbound 85<sup>th</sup> percentile approach speed was 43.8 mph. Therefore, a total of 1 point is given for the approach speed warrant.

**Approach Speed Warrant total = 1 point.***General Conditions Warrant (maximum 8 points)*

Points are assigned only if a marked crosswalk would:

	<u>Max Points</u>	<u>Points</u>
1. Clarify and define pedestrian routes across complex intersections.	2	0
2. Channelize pedestrians into a significantly shorter path.	2	0
3. Position pedestrians to be seen better by motorists.	2	0
4. Position pedestrians to expose them to fewer vehicles.	2	0
Total		0

**General Conditions Warrant total = 0 points.**

**The total for the four pedestrian crosswalk warrants is 7 points.** A minimum of 16 points must be accrued to warrant the installation of a marked crosswalk at an unsignalized location. Therefore, at the intersection of SR 89A and Tortilla Drive, a marked crosswalk should not be installed, based on the warrant criteria in PGP 910. Additionally, as stated in the PGP 910, crosswalks shall not be installed where ten or fewer crossings are made by individual or groups of pedestrians during the study period.

**4.2 SR 89A and Old Marketplace/Willow Way**

Pedestrian and bicyclist crossing data were collected on Wednesday, April 8, 2009 between the hours of 1:00 pm to 4:00 pm and 6:00 pm to 9:00 pm. During the observation periods, the highest hour of pedestrian and bicyclist crossings across SR 89A was from 1:45 pm to 2:45 pm, with 9 crossings. According to the 2006 Sedona Pedestrian Crossing Study the highest hour of pedestrian and bicyclist crossings across SR 89A was from 2:00 pm to 3:00 pm, with 15 crossings. Therefore, the crossing data and peak hour that will be used for this analysis will be from the 2006 Sedona Pedestrian Crossing Study with a peak hour of 2:00 pm to 3:00 pm.

*Gap Time Warrant (maximum 10 points)*

Gap data was collected for a 48 hour period beginning 12:00 pm on Tuesday, April 7 and ending 12:00 pm on Thursday, April 9. The worst case scenario average gap data between 2:00 pm and 3:00 pm were used to calculate the average gaps per 5-minute period.

$$\text{Pedestrian Crossing Time} = \frac{\text{Street Width Curb to Curb}}{\text{Walking Rate}} = \frac{76}{4} = 19 \text{ seconds}$$

$$\text{Total Usable Gap Time in Seconds} = 270.4 \text{ seconds}$$

$$\text{Avg \# of Gaps per 5 Minute Period} = \frac{\text{Total Usable Gap Time in Seconds}}{\text{Pedestrian Crossing Time} \times 12} = \frac{450.2}{19 \times 12} = 1.19 \text{ seconds}$$

According to these calculations, there is an average of 1.19 usable gaps per every 5-minute period. Therefore, a total of 8 points are given for the gap time warrant.

**Gap Time Warrant total = 8 points.**

*Pedestrian Volume Warrant (maximum 10 points)*

As previously stated, there were 15 pedestrians and bicyclists observed crossing SR 89A during the highest hour. Therefore, 2 points are given for the pedestrian volume warrant for the intersection of SR 89A and Old Marketplace/Willow Way.

**Pedestrian Volume Warrant = 2 points.**

*Approach Speed Warrant (maximum 5 points)*

The approach speed data was collected during the same time period as the gap data. During the 48 hour data collection period, the eastbound 85<sup>th</sup> percentile approach speed was 39.8 mph, and the westbound 85<sup>th</sup> percentile approach speed was 41.7 mph. Therefore, a total of 1 point is given for the approach speed warrant.

**Approach Speed Warrant total = 1 point.**

*General Conditions Warrant (maximum 8 points)*

Points are assigned only if a marked crosswalk would:

	<u>Max Points</u>	<u>Points</u>
1. Clarify and define pedestrian routes across complex intersections.	2	0
2. Channelize pedestrians into a significantly shorter path.	2	0
3. Position pedestrians to be seen better by motorists.	2	0
4. Position pedestrians to expose them to fewer vehicles.	2	0
 Total		 0

**General Condition Warrant total = 0 points.**

---

**The total for the four pedestrian crosswalk warrants is 11 points.** A minimum of 16 points must be accrued to warrant the installation of a marked crosswalk at an unsignalized location. Therefore, at the intersection of SR 89A and Old Marketplace/Willow Way, a marked crosswalk should not be installed, based on the warrant criteria in PGP 910.

## 5.0 HAWK FLASHER EVALUATION

The HAWK (High-intensity Activated CrossWalk) is a traffic control signaling technique for marked crossings. The HAWK signal is used in at a number of marked crosswalks in Tucson, Arizona. The signal consists of a standard traffic signal head with two red indications and one yellow indication. The indications are normally dark until activated by a pedestrian. When a pedestrian wishes to cross the street, they press a button and the signal begins with a flashing yellow indication to warn the approaching drivers. The flashing yellow is then followed by a solid yellow indication, advising the drivers to prepare to stop. The signal then changes to a solid red indication at which time the pedestrian is shown a walk indication. The signal then converts to an alternating flashing red, allow the drivers to proceed when safe, after stopping at the crosswalk.



The City of Tucson uses a HAWK Priority Evaluation form which consists of ten questions with points assigned to each based on the specific intersection data. The minimum number of points for the installation of the HAWK is 25 points.

### 5.1 SR 89A and Tortilla Drive

- |  |                                |           |
|--|--------------------------------|-----------|
| 1. Accidents involving pedestrians/bicycles at the crossing:                             |                                | 0 points  |
| Latest 12-month period (01-12)   | 3 points per accident: Ans = 0 |           |
| Middle 12-month period (13-24)   | 2 points per accident: Ans = 0 |           |
| Earliest 12-month period (25-36)   | 1 point per accident: Ans = 0  |           |
| 2. Peak hour pedestrian/bicycle activity in crossing: <i>Ans = 5</i>                     |                                | 0 points  |
| 0-10   | 0 points                       |           |
| 11-20  | 3 points                       |           |
| 21-40  | 6 points                       |           |
| over 40  | 9 points                       |           |
| 3. Proximity of nearest signalized or stop controlled intersection: <i>Ans = 0.28 mi</i> |                                | 10 points |
| Less than 0.125 mi (660 ft)  | -10 points                     |           |
| 0.125 – 0.25 mi (660 – 1320 ft)  | 0 points                       |           |
| Over 0.25 mi (1320 ft)   | 10 points                      |           |
| 4. Posted speed limit: <i>Ans = 35 mph</i>   |                                | 3 points  |
| Under 30   | 0 points                       |           |
| 30 and 35  | 3 points                       |           |
| 40 and over  | 6 points                       |           |

5. Roadway traffic volume (ADT): <i>Ans = 25,540 vehicles per day</i>	8 points
<u>++4 lanes w/median</u>	
0 - <= 9000	0 points
> 9k - <= 12k	4 points
> 12k - <= 15 k	6 points
> 15k	8 points
6. When the roadway does not have a midpoint safety haven, 5 points should be assigned. When the roadway has a midpoint safety haven 0 points should be assigned:	5 points
7. When the crossing is part of a designated bike and/or pedestrian route, 5 points should be assigned.	0 points
8. When the crossing is identified on the "School Route Plan" and/or is known to be a special needs route, 5 points should be assigned.	0 points
9. Meet state crosswalk marking warrant, yes = 0 points, no = -10 points.	-10 points
10. Area is illuminated, yes = 0 points, no = 5 points.	5 points
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SR 89A and Tortilla Drive Total	21 points

The intersection of SR 89A and Tortilla Drive scores 21 points using the City of Tucson HAWK Priority Evaluation criteria. This is less than the minimum 25 points necessary for the installation of a HAWK signal, based on the City of Tucson procedure. It should also be noted that the area will be illuminated with the installation of the proposed continuous roadway lighting system. Therefore, based on this evaluation, a HAWK should not be installed at the intersection of SR 89A and Tortilla Drive.

## 5.2 SR 89A and Old Marketplace/Willow Way

1. Accidents involving pedestrians/bicycles at the crossing:	0 points
Latest 12-month period (01-12)	3 points per accident: Ans = 0
Middle 12-month period (13-24)	2 points per accident: Ans = 0
Earliest 12-month period (25-36)	1 point per accident: Ans = 0
2. Peak hour pedestrian/bicycle activity in crossing: <i>Ans = 15</i>	3 points
0-10	0 points
11-20	3 points
21-40	6 points
over 40	9 points

3. Proximity of nearest signalized or stop controlled intersection: <i>Ans = 0.16 mi</i>	0 points
Less than 0.125 mi (660 ft)	-10 points
0.125 – 0.25 mi (660 – 1320 ft)	0 points
Over 0.25 mi (1320 ft)	10 points
4. Posted speed limit: <i>Ans = 35 mph</i>	3 points
Under 30	0 points
30 and 35	3 points
40 and over	6 points
5. Roadway traffic volume (ADT): <i>Ans = 27,982 vehicles per day</i>	8 points
	<u>++4 lanes w/median</u>
0 - <= 9000	0 points
> 9k - <= 12k	4 points
> 12k - <= 15 k	6 points
> 15k	8 points
6. When the roadway does not have a midpoint safety haven, 5 points should be assigned. When the roadway has a midpoint safety haven 0 points should be assigned:	5 points
7. When the crossing is part of a designated bike and/or pedestrian route, 5 points should be assigned.	0 points
8. When the crossing is identified on the “School Route Plan” and/or is known to be a special needs route, 5 points should be assigned.	0 points
9. Meet state crosswalk marking warrant, yes = 0 points, no = -10 points.	-10 points
10. Area is illuminated, yes = 0 points, no = 5 points.	5 points
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SR 89A and Old Marketplace/Willow Way Total	14 points

The intersection of SR 89A and Old Marketplace/Willow Way scores 14 points using the City of Tucson HAWK Priority Evaluation criteria. This is less than the minimum 25 points necessary for the installation of a HAWK signal, based on the City of Tucson procedure. It should also be noted that the area will be illuminated with the installation of the proposed continuous roadway lighting system. Therefore, based on this evaluation, a HAWK should not be installed at the intersection of SR 89A and Old Marketplace/Willow Way.

## 6.0 CONCLUSIONS AND RECOMMENDATIONS

As part of the City of Sedona Continuous Lighting project, Stanley Consultants, Inc. was retained by the Arizona Department of Transportation (ADOT) to prepare a Pedestrian Crosswalk Warrant Study at two locations on SR 89A between Dry Creek Road and Airport Road. The two locations are SR 89A at Tortilla Drive and SR 89A at Old Marketplace/Willow Way.

Two different evaluations were performed. The first evaluation was to determine whether a marked crosswalk should be installed at these unsignalized intersections. Using four warrants as described in the ADOT Traffic Engineering PGP Section 910 Pedestrian Crosswalks (see Appendix D), both intersections failed to meet the minimum warrant criteria. Therefore, based on this evaluation, a marked crosswalk should not be installed at either one of these intersections.

A second evaluation was performed to determine whether a HAWK signal should be installed at these intersections. Using the City of Tucson's HAWK Priority Evaluation, which consists of ten questions with points assigned to each question, both intersections fail to meet the minimum points required. Therefore, based on this evaluation, a HAWK signal should not be installed at either one of these intersections.

The 2006 Sedona Pedestrian Crossing Study indicates there are several hundred pedestrians and bicyclists crossing SR 89A in West Sedona on days with peak pedestrian activity. The study also indicates many of these crossings are occurring away from the signalized intersections, at unsignalized intersections and mid-block locations. Nevertheless, these two unsignalized intersections, taken in isolation, do not generate sufficient pedestrian crossings to warrant a marked crosswalk. The current roadway, with open access, allows pedestrians to cross anywhere along this corridor. This dispersion of pedestrian activity works against the concept of a few organized crossings, with respect to the warranting criteria and effective implementation of this concept. The design and installation of effective pedestrian crossings with enhanced traffic controls such as the HAWK would also require the installation of some combination of medians, pedestrian barriers, and landscape. These treatments would need to be carried throughout the corridor to channelize the pedestrians to the existing signalized crossings and to the new organized crossings.

The design and locations of the median and pedestrian barrier system would be problematic in the West Sedona corridor, as many of the businesses have direct driveway access to SR 89A. The design of such a system would need to include a thorough analysis of business access as well as vehicular and pedestrian traffic flows throughout the corridor.

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