7.0 SAFETY ANALYSIS

Detailed crash data within the study area from 2011 to 2015 were reviewed and evaluated for the previously-completed Signal Warrant Study. The previously completed study is included in **Appendix B** for reference.

For this IOAR, updated crash data from January 1, 2013 to December 31, 2017 were documented and evaluated. The crash data included long and short form reports and were obtained from the FDOT Crash Analysis Reporting (CAR) online database and the Signal Four Analytics web application. The raw crash data is included in **Appendix J**. For every crash included in the analysis, the corresponding crash report narrative was reviewed to gain a better understanding of the crash and to ensure the details of the crash were coded correctly. The crashes were compiled into collision diagrams in **Figure 10**, **Figure 11**, and **Figure 12**.

A total of 58 crashes were reported during the five-year study period. The crashes included 2 fatal crashes and 20 injury crashes. The number of crashes that occurred each year fluctuated: 6 crashes were reported in 2013, 11 crashes in 2014, 17 crashes in 2015, 11 crashes in 2016, and 13 crashes in 2017.

Crashes at the three subject intersections were of primary concern for this evaluation. **Table 16** summarizes the number of crashes and the associated crash rate per million entering vehicles (MEV) at each intersection from 2013 to 2017. Total crash numbers in **Table 16** do not sum to 58 because some crashes within the Area of Influence were not at one of the three subject intersections. The crash rates per MEV are compared to the average crash rates for similar facilities statewide.

Table 16: Crashes and Crash Rates, 2013 – 2017

Intersection	Year	2013	2014	2015	2016	2017	5-Year Avg
S.R. 75 (U.S. 231) & S.R. 8 (I-10) WB ramps	Crashes	0	3	3	1	5	**2.1**
	Crash Rate (per MEV)	0.000	0.563	0.492	0.159	0.780	**0.368**
	Statewide Average Crash Rate (per MEV)	1.639	1.488	1.567	N/A*	N/A*	**1.565**
S.R. 75 (U.S. 231) & S.R. 8 (I-10) EB ramps	Crashes	0	2	6	4	1	**1.9**
	Crash Rate (per MEV)	0.000	0.406	1.100	0.740	0.176	**0.346**
	Statewide Average Crash Rate (per MEV)	1.639	1.488	1.567	N/A*	N/A*	**1.565**
S.R. 75 (U.S. 231) & Dilmore Road	Crashes	3	3	4	3	7	**4.7**
	Crash Rate (per MEV)	0.596	0.663	0.749	0.555	1.265	**0.933**
	Statewide Average Crash Rate (per MEV)	0.236	0.236	0.224	N/A*	N/A*	**0.232**

***Statewide average crashes rates for 2016 and 2017 have not been published by FDOT

The historical crash rate per MEV is lower at the two S.R. 75 (U.S. 231) and S.R. 8 (I-10) ramp intersections than the statewide average crash rate for three-leg rural interstate ramp intersections, which was 1.565 crashes per MEV from 2013 through 2017. The historical crash rate per MEV at the S.R. 75 (U.S. 231) and Dilmore Road intersection is significantly higher than the statewide average crash rate for rural, four-lane, divided four-leg intersections, which was 0.232 crashes per MEV from 2013 through 2017.

LEGEND:

- VEHICLE PATH
- BACKING VEHICLE
- BIKE/PED PATH
- FIXED OBJECT
- PARKED VEHICLE
- PERSONAL INJURY
- FATALITY
- REAR-END COLLISION
- SIDESWIPE
- OUT OF CONTROL
- OVERTURNED VEHICLE
- LEFT-TURN COLLISION
- RIGHT-TURN COLLISION
- LEFT ANGLE COLLISION

PAVEMENT CONDITION:
D=DRY W=WET U=UNKNOWN
WEATHER CONDITION:
C=CLEAR Y=CLOUDY R=RAIN
LIGHT CONDITION:
L=DAYLIGHT N=NIGHTTIME
TIME OF DAY: MILITARY

0 20 100
Feet

SR 75 (US 231)

Race Way Gas Station

Love's Travel Stop

McDonald's

Dilmore Road

DITCH

57 12/10/17 10:03 D-C-L

53 7/14/17 18:30 D-C-L

48 4/2/17 14:10 D-C-L

25 7/11/15 12:05 D-C-L

46 1/9/17 14:00 D-C-L

28 8/8/15 20:48 W-Y-N

8 4/5/14 19:00 W-R-N

6 12/18/13 18:20 D-C-N

37 3/27/16 7:40 W-R-L

15 8/3/14 12:00 W-R-L

56 10/29/17 8:15 D-C-L

50 5/16/17 12:15 D-C-L

42 8/19/16 5:57 D-C-L

10 4/27/14 14:25 D-C-L

5 11/16/13 15:55 W-R-L

2 7/6/13 13:40 D-C-L

3 9/1/13 14:00 D-C-L

9 7/7/14 18:00 D-C-L

20 2/26/15 17:35 D-C-N

32 10/12/15 22:30 D-C-L

39 6/7/16 14:15 D-C-N

40 6/27/16 23:20 D-C-L

51 5/25/17 12:30 D-C-L

44 10/31/16 7:50 D-C-L

SHORT FORM #
LONG FORM #
2013 #
2014 #
2015 #
2016 #
2017 #

SR 75 (US 231) AT I-10 OFF-RAMPS INTERCHANGE OPERATIONAL ANALYSIS REPORT	COLLISION DIAGRAM (SHEET 1 OF 3)	Figure 10

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LEGEND:

- VEHICLE PATH
- BACKING VEHICLE
- BIKE/PED PATH
- FIXED OBJECT
- PARKED VEHICLE
- PERSONAL INJURY
- FATALITY
- REAR-END COLLISION
- SIDESWIPE
- OUT OF CONTROL
- OVERTURNED VEHICLE
- LEFT-TURN COLLISION
- RIGHT-TURN COLLISION
- LEFT ANGLE COLLISION

PAVEMENT CONDITION:
D=DRY W=WET U=UNKNOWN
WEATHER CONDITION:
C=CLEAR Y=CLOUDY R=RAIN
LIGHT CONDITION:
L=DAYLIGHT N=NIGHTTIME
TIME OF DAY: MILITARY

0 20 100
Feet

SR 75 (US 231)
SR 8 (I-10)
SR 8 (I-10) EB On-Ramp
SR 8 (I-10) EB Off-Ramp

35 3/4/16 10:12 FENCE D-C-L
34 12/9/15 7:07 D-C-L
19 1/17/15 15:03 D-C-L
29 8/11/15 15:35 D-C-L
1 6/30/13 13:10 W-R-L
58 12/27/17 9:31 W-R-L
26 7/24/15 11:15 D-C-L
17 11/30/14 17:00 D-C-N
11 5/17/14 21:45 D-C-N
16 8/12/14 10:50 D-C-L
45 11/29/16 18:00 D-C-N
43 10/6/16 17:20 D-C-L
41 8/3/16 13:45 W-R-L
7 2/12/14 7:29 D-C-L
18 1/5/15 13:15 D-C-L
21 3/28/15 14:20 D-C-L
30 9/19/15 12:31 D-C-L

SHORT FORM #
LONG FORM #
2013 #
2014 #
2015 #
2016 #
2017 #

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Bill Lemos

SR 75 (US 231) AT I-10 OFF-RAMPS INTERCHANGE OPERATIONAL ANALYSIS REPORT	COLLISION DIAGRAM (SHEET 2 OF 3)	Figure 11

LEGEND:

- VEHICLE PATH
- BACKING VEHICLE
- BIKE/PED PATH
- FIXED OBJECT
- PARKED VEHICLE
- PERSONAL INJURY
- FATALITY
- REAR-END COLLISION
- SIDESWIPE
- OUT OF CONTROL
- OVERTURNED VEHICLE
- LEFT-TURN COLLISION
- RIGHT-TURN COLLISION
- LEFT ANGLE COLLISION

PAVEMENT CONDITION:
D=DRY W=WET U=UNKNOWN
WEATHER CONDITION:
C=CLEAR Y=CLOUDY R=RAIN
LIGHT CONDITION:
L=DAYLIGHT N=NIGHTTIME
TIME OF DAY: MILITARY

0 20 100
Feet

Hardee's

SR 75 (US 231)

SR 8 (I-10) WB On-Ramp

SR 8 (I-10) WB Off-Ramp

10/2/15 18:50 W-Y-N 31
7/28/15 14:40 D-C-L 27
6/18/14 15:25 D-C-L 12
4/6/15 7:35 D-Y-L 23
4/8/17 7:38 D-C-L 49
6/28/17 12:48 D-Y-L 52
9/29/17 16:13 D-C-L 55
4/2/17 12:40 D-Y-L 47
8/7/17 18:15 D-C-L 54
FENCE 4/13/16 16:35 W-R-L 38
6/22/14 14:15 W-R-L 13
7/5/14 10:12 D-C-L 14
3/25/16 15:00 0000000 W-R-L 36
22 4/1/15 13:00 D-C-L
33 10/28/15 6:30 W-R-L
24 5/1/15 9:40 D-C-L
4 10/6/13 11:08 D-Y-L

SHORT FORM #
LONG FORM #
2013 #
2014 #
2015 #
2016 #
2017 #

A. Fatal Crashes

The two fatal crashes reported in the study area from 2013 to 2017 were reviewed in detail to determine the circumstances surrounding each crash:

- January 2015, daylight, dry surface, resulted in one fatality. The left-turn fatal crash occurred when a southbound semi-truck failed to yield the right-of-way to a northbound vehicle while attempting to turn onto the S.R. 8 (I-10) eastbound on-ramp. Before the collision, V2 traveled into the left lane attempting to avoid V1, but V2 was unsuccessful and V2 traveled under the right rear of V1's trailer and was dragged for approximately 54 feet. D2 expired due to injuries sustained.
- April 2017, daylight, dry surface, resulted in one fatality and two injuries. The fatal angle crash occurred when a westbound vehicle failed to yield the right-of-way to a northbound vehicle while attempting to make a left turn onto S.R. 75 (U.S. 231) southbound from the S.R. 8 (I-10) westbound off-ramp. After the collision, V1 overturned multiple times and D1 expired due to injuries sustained.

B. Crash Circumstances and Trends

The overall crash data was further analyzed to determine significant trends in the circumstances surrounding the study area crashes. The following observations were made and are graphically depicted in the subsequent **Figures 12 through 15**:

- The predominant crash types were angle crashes (18 crashes), rear-end crashes (11 crashes), left-turn crashes (7 crashes), off road crashes (7 crashes), and sideswipe crashes (7 crashes).
- More than 40 percent of recorded crashes (25 crashes) occurred between 12:00 PM and 4:00 PM.
- 11 crashes (19 percent) occurred under dark conditions (including dawn/dusk) and 13 crashes (22 percent) occurred with wet surface conditions.
- The at-fault vehicle was traveling in the westbound direction in more than half of the recorded crashes (30 crashes).
- 12 of the 18 angle crashes were the result of a westbound vehicle failing to yield the right-of-way while attempting to make a left-turn onto S.R. 75 (U.S. 231) southbound. Four of those occurred at the Dilmore Road intersection, six occurred at the S.R. 8 (I-10) eastbound off-ramp, and two occurred at the S.R. 8 (I-10) westbound off-ramp.
- Six of the seven left-turn crashes were the result of a southbound vehicle failing to yield the right-of-way to a northbound vehicle while attempting to make a left-turn. Three of those crashes occurred at the S.R. 8 (I-10) westbound on-ramp, two occurred at the S.R. 8 (I-10) eastbound on-ramp, and one occurred at the Dilmore Road intersection.

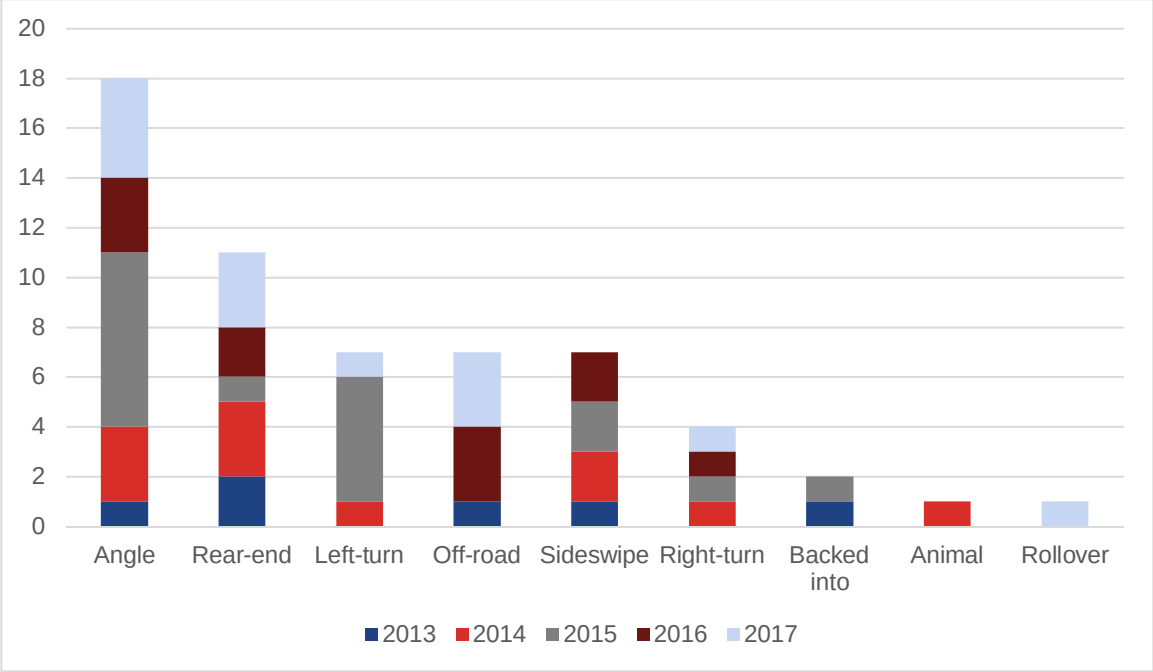

Figure 13: Crashes by Type, 2013-2017

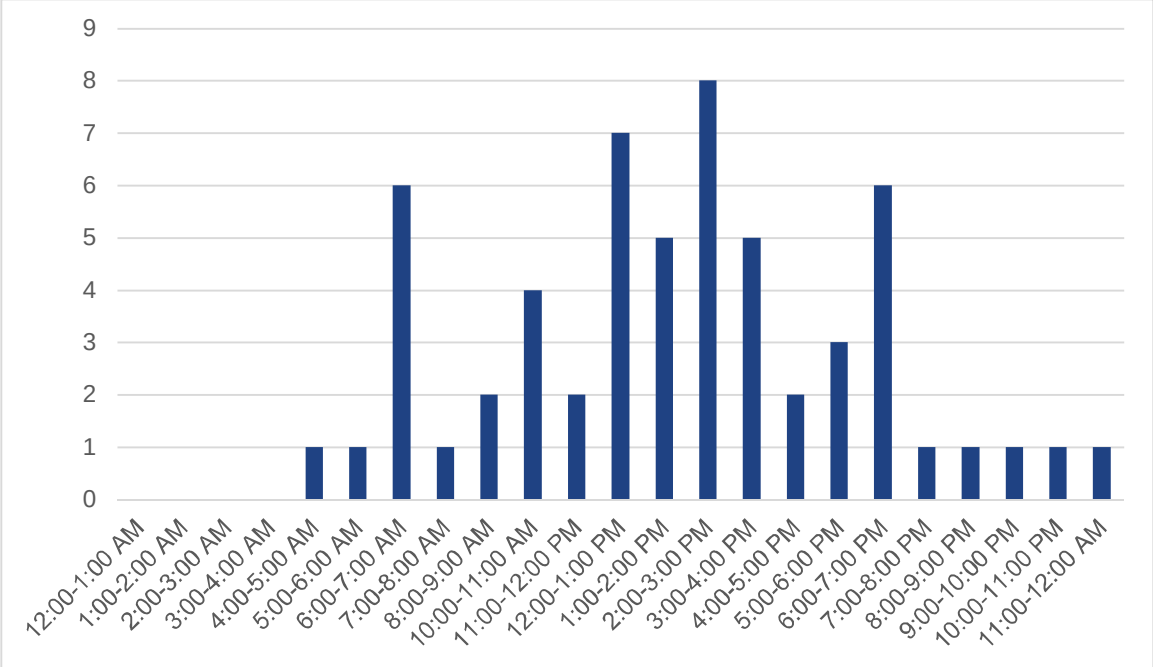

Figure 14: Crashes by Time of Day, 2013 – 2017

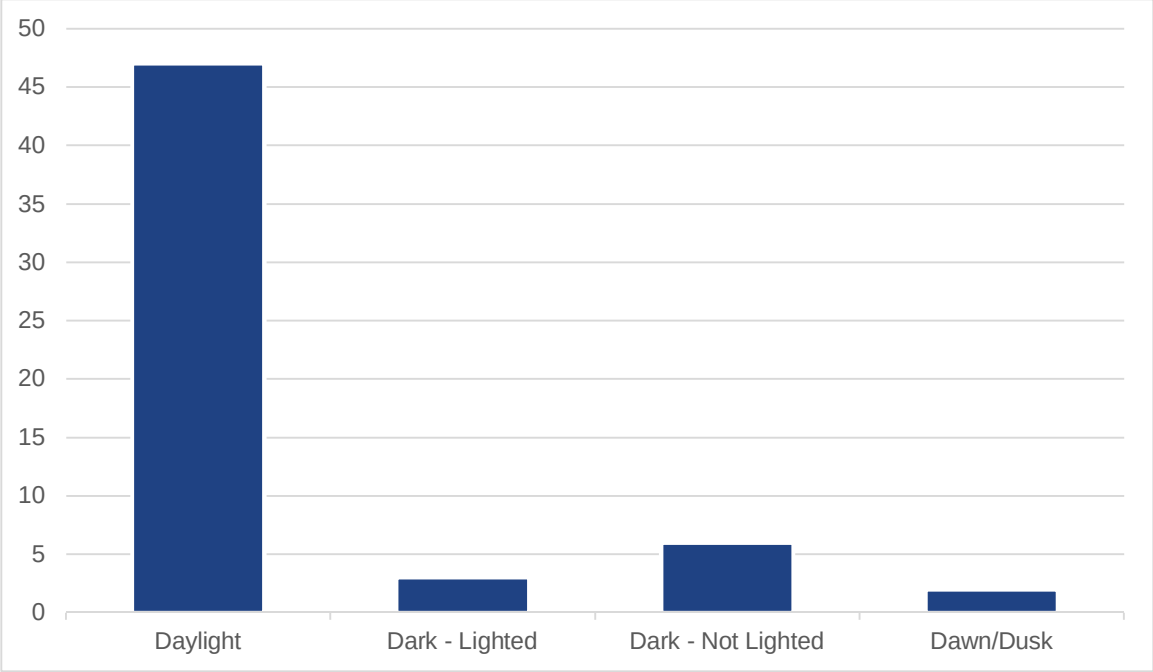

Figure 15: Crashes by Lighting Condition, 2013 – 2017

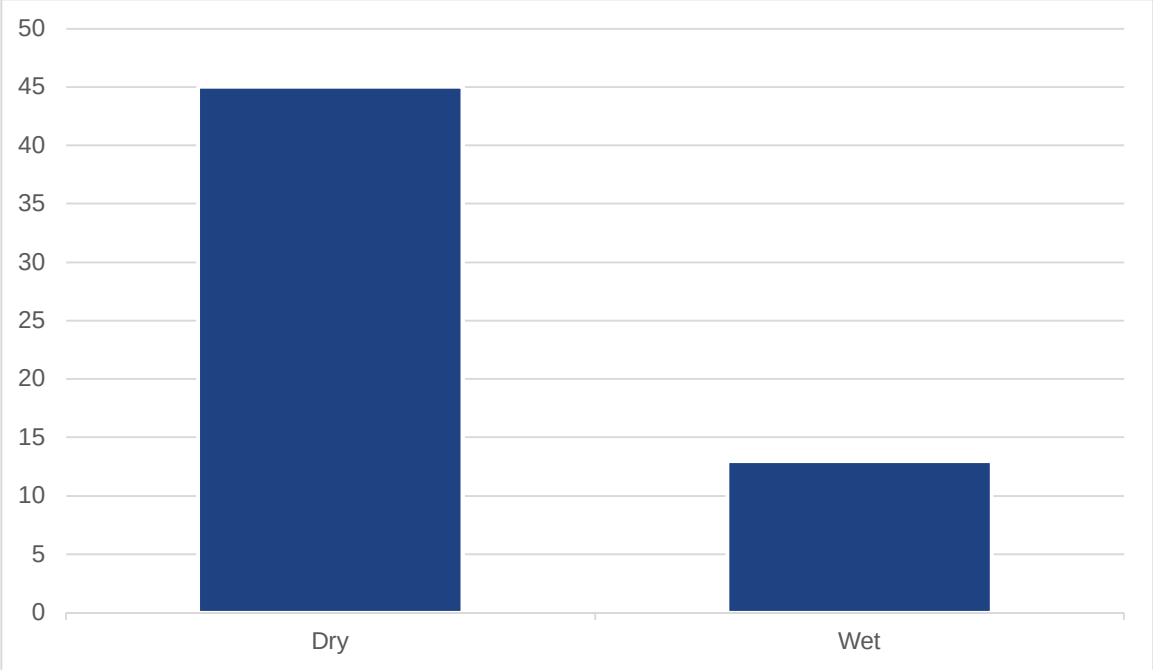

Figure 16: Crashes by Surface Condition, 2013 – 2017

C. Crash Modification Factors

The Crash Modification Factors (CMFs) for installing a traffic signal are unique to the different crash types affected by the installation. Per the Federal Highway Administration (FHWA) CMF Clearinghouse, CMF 326, CMF 327, and CMF 328 are applicable in determining the potential crash reduction due to traffic signal installation. CMF 326 applies a 77 percent reduction in angle crashes, CMF 327 applies a 60 percent reduction in left-turn crashes, and CMF 328 applies a 58 percent *increase* in rear-end crashes. The CMF Clearinghouse reports are included in **Appendix K**.

Table 17 summarizes the average crashes by type at all three subject intersections from 2013 to 2017 and calculates the anticipated reduction in crashes due to the installation of traffic signal controls. Crashes are only included in **Table 17** if they were at one of the three subject intersections and could be corrected by the recommended traffic signal installation, so quantities may not match those in **Figure 13.**

Table 17: Crash Reduction Calculations

CMF	Crash Type	Crashes (2013-2017)	Annual Crash Rate (crashes/year)	Crash Reduction Factor	Expected Annual Crash Reduction (crashes/year)
326	Angle	16	3.2	77%	2.5
327	Left-turn	6	1.2	60%	0.7
328	Rear-end	7	1.4	-58%	-0.8
	TOTAL	**29**	**5.8**	**-**	**2.4**

Accounting for the anticipated decrease in angle crashes and left turn crashes and the anticipated increase in rear-end crashes, the overall safety benefit of installing traffic signals is a reduction of approximately 2.4 crashes per year. Of the 22 angle and left-turn crashes included in the crash reduction calculations, 2 were fatal crashes, 14 were injury crashes (resulting in 38 injuries), and 6 were PDO crashes; of the 7 rear-end crashes, 2 were injury crashes (resulting in 3 injuries) and 5 were PDO crashes. Thus, the reduction in angle and left-turn crashes can be expected to have more significant safety benefits (in terms of avoiding crash-related injuries and fatalities) than the increase in rear-end crashes.

Benefit-Cost Analysis

To quantify the safety benefits expected from the proposed signalization of the intersections of S.R. 75 (U.S. 231) with the S.R. 8 (I-10) westbound off-ramp, S.R. 8 (I-10) eastbound off-ramp, and Dilmore Road, a benefit-cost analysis was prepared using the anticipated crash reduction benefits and a preliminary cost estimate. For a rural, divided, four-lane roadway, the average crash cost was reported in the 2018 Florida Design Manual as $461,464 per crash based on average crash costs from 2011 through 2015. Given the annual reduction of 2.4 crashes, this yields an annual safety benefit of approximately $1.1 million.

A preliminary opinion of probable cost for the Signal Build scenario was prepared using the FDOT Long Range Estimate system. The estimated cost, including allocations for mobilization (10 percent), maintenance of traffic (10 percent), preliminary engineering and construction engineering inspection (50 percent), and contingency (20 percent), is approximately $776,760.

Based on those figures, the benefit-cost ratio of the proposed improvements would be approximately 11.43 and the Net Present Value would be approximately $14 million. The supporting Long-Range Estimate, Benefit-Cost Analysis, and Net Present Value documentation is included in **Appendix L**.