7 Safety (Crash) Analysis

The proposed improvements are likely to have a positive impact on crash occurrence. As part of this study a safety analysis was conducted based on the required procedures and methodology for an Interchange Modification Report (IMR) per the FDOT Systems Implementation Office Interchange Access Request Users Guide (IARUG) dated January 2018 that follows the criteria contained in the Highway Safety Manual (HSM). It should be noted that with the construction of the proposed new interchange of I-10 at CR 4/Antioch Road, the study would experience change in traffic pattern. Therefore, crash data was not used in ISATe safety analysis tool.

7.1 Historical Crash Data Information

Crash statistics along I-10 and SR 85 were obtained from Signal Four Analytics and the CARS database based on the latest available five (5) years of crash data (from January 1, 2013 to December 31, 2017).

7.1.1 Interstate 10 (I-10)

A total of 179 crashes were reported along the study segment of Interstate 10 (I-10) corridor extending 0.6 miles to the east and 3.3 miles to the west of the I-10 and SR 85 interchange. Of the 179 reported crashes, 60 involved injuries, and one crash resulted in a fatality. The contributing cause for the fatal crash was determined to be “Distracted Driving”. Figure 19 illustrates the crash data summary by crash type along the study segment of I-10 for the analysis period. As shown in Figure 19, “Rear End” was the predominantly reported crash type with 80 crashes, followed by “Off Road” with 28 reported crashes. During the analysis period, the highest number of crashes were reported during Year 2015 (50 crashes) and since then the number of crashes per year have gradually reduced from 50 crashes to 18 crashes in Year 2017. Figure 20 illustrates the total number of crashes, injuries and estimated damages ($) by year.

Table 24 summarizes the number of crashes involving injuries, fatalities, and property damage by year. As shown in Figure 20, Year 2015 experienced the highest number of crashes while Year 2014 experienced the highest economic loss. Of the 179 reported crashes, 119 crashes were reported to be “Property Damage Only” crashes, 59 “Injury” crashes, and 1 “Fatality” crash. The crash rate for the I-10 study area segment, 0.973 MVM (Million Vehicle Miles of Travel), is greater than the statewide average crash rate for an urban interstate facility (0.850 MVM). Table 25 summarizes the crash rates for the I-10 study area segment by year from 2013 to 2017. The locations of the crashes that occurred during the study period along I-10 are mapped in Figure 21. Crash analysis is provided in **Appendix N.**

FIGURE 19: NUMBER OF CRASHES BY CRASH TYPE (I-10)

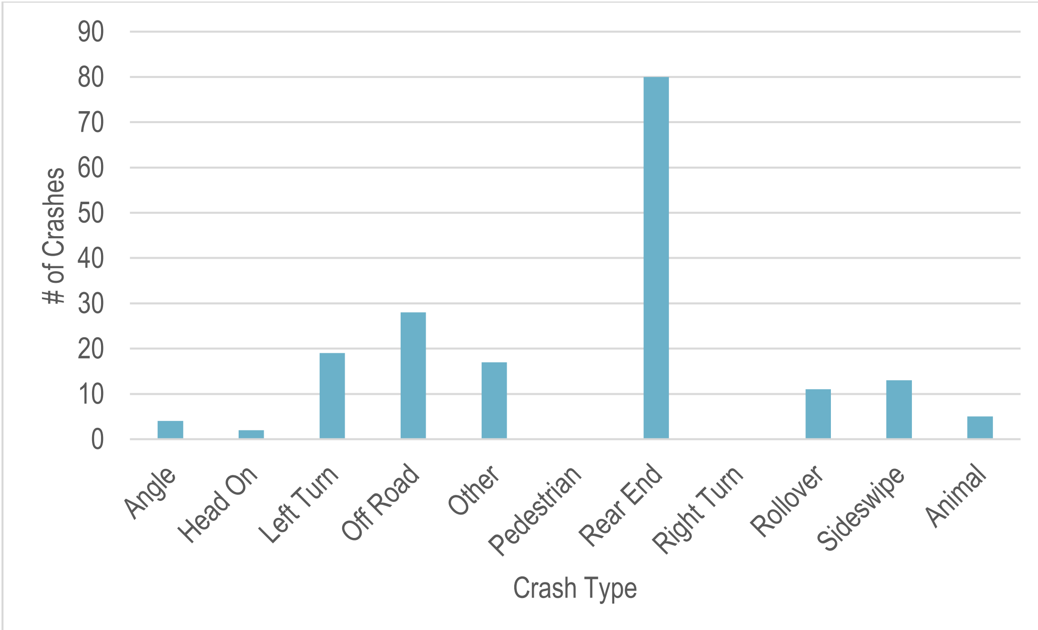

FIGURE 20: CRASH SUMMARY BY YEAR (I-10)

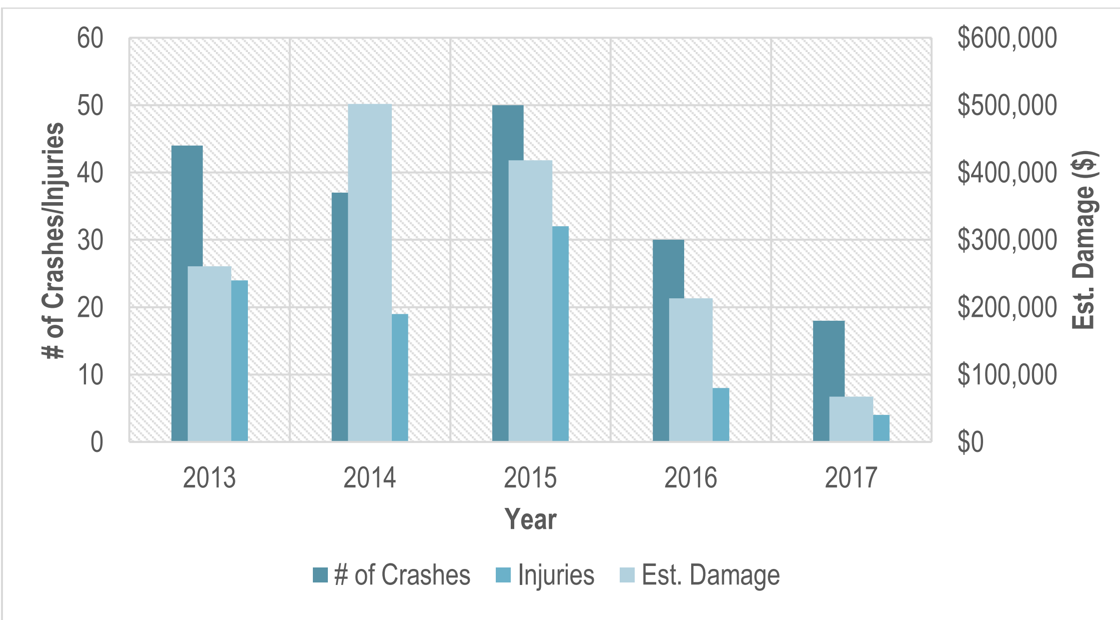

TABLE 24: CRASH SUMMARY BY YEAR (I-10)

Crash Type	2013	2014	2015	2016	2017	Total	%
Fatality	0	1	0	0	0	1	0.56%
Injury	18	10	22	6	3	59	32.96%
Property Damage Only	26	26	28	24	15	119	66.48%
Total	**44**	**37**	**50**	**30**	**18**	**179**	**100.00%**

TABLE 25: I-10 MAINLINE CRASH RATES BY YEAR

	2013	2014	2015	2016	2017	Average
Average AADT	22,871	24,227	26,018	27,818	28,283	25,843
Crashes	44	37	50	30	18	179
Crash Rate (MVM)	1.351	1.073	1.350	0.758	0.447	0.973

\\vhb\proj\Orlando\62464.13 TWO 13 SR 85 Feasibility\graphics\FIGURES\PDF\SR 85 IMR

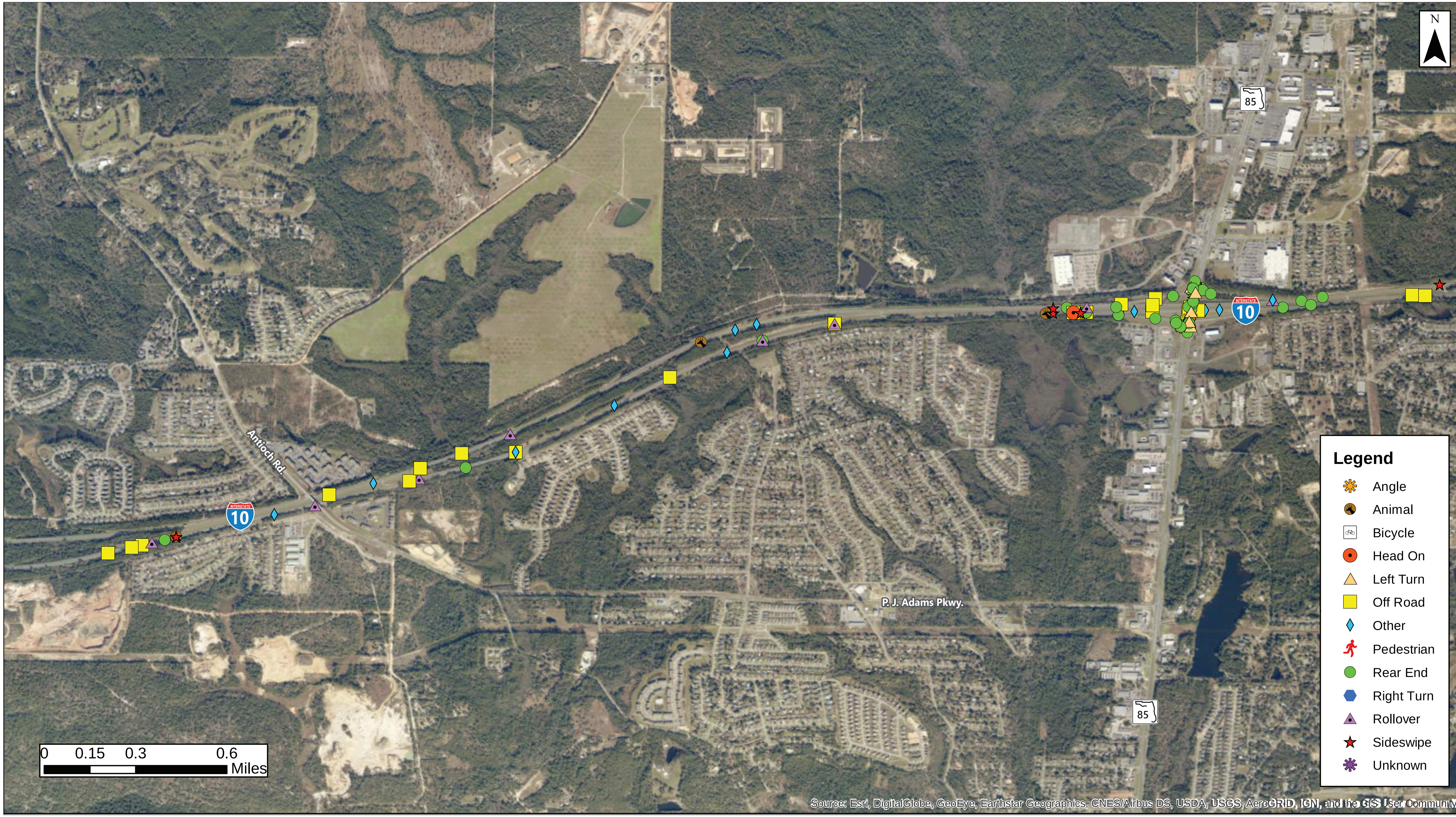

Figure 21

I-10 Historical Crash Locations
SR 85 at I-10 Interchange Modification Report (IMR)

Financial Project ID: 220171-3-12-01
Roadway ID: 5705000

7.1.2 SR 85 (S. Ferdon Boulevard)

A total of 427 crashes were reported along the study corridor of SR 85 (S. Ferdon Boulevard) which extends from John King Road, south of I-10 to Mirage Avenue, north of I-10. Figure 22 illustrates the crash data summary by crash type along the study segment of SR 85 for the analysis period. As shown in Figure 22, "Rear-End" was the predominantly reported crash type with 231 crashes, followed by "Left-Turn" and "Other" crashes with 62 and 46 reported crashes, respectively. Figure 23 illustrates the total number of crashes, injuries and estimated damages ($) by year. During the analysis period, the highest number of crashes were during year 2013 (112 crashes). Table 26 details SR 85 crashes involving fatalities, injuries, and property damage by year. Of the 427 reported crashes, 329 were reported to be "Property Damage Only" crashes, 96 "Injury" crashes and 2 "fatal" crashes. The crash rate for the SR 85 study segment, 7.610 MVM which is above the statewide average crash rate for an urban four lane divided facility (3.124 MVM). Table 27 provides a breakdown of the crash rate of the SR 85 study segment for each year. The locations of the crashes that occurred during the study period are mapped in Figure 24. Crash analysis is provided in **Appendix N.**

FIGURE 22: NUMBER OF CRASHES BY CRASH TYPE (SR 85)

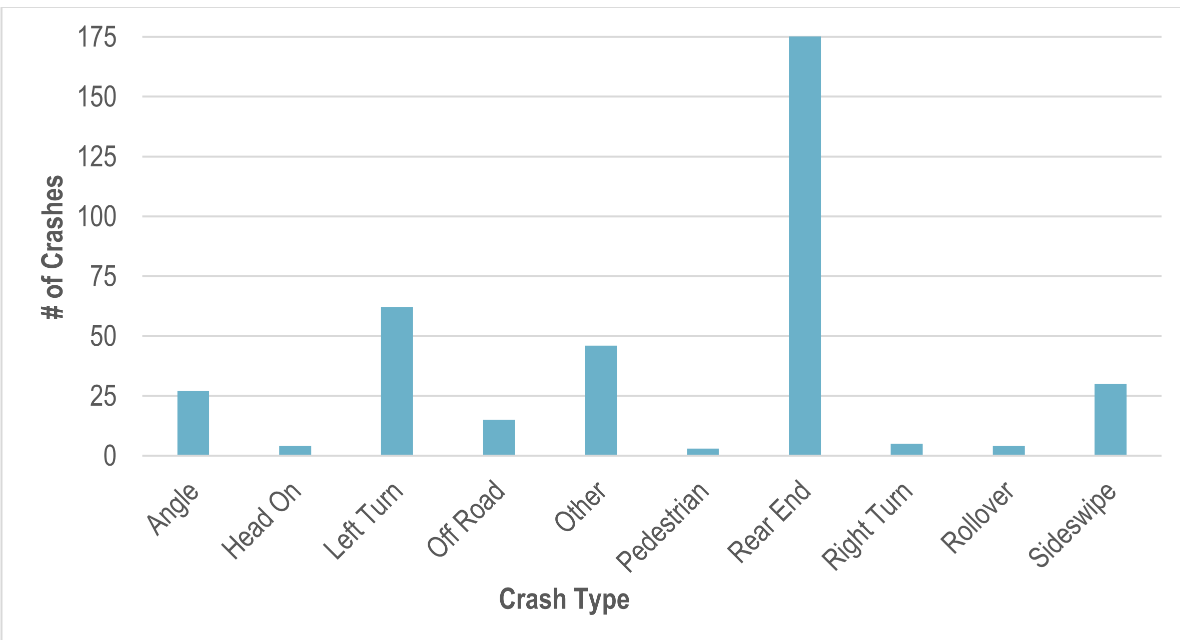

FIGURE 23: CRASH SUMMARY BY YEAR (SR 85)

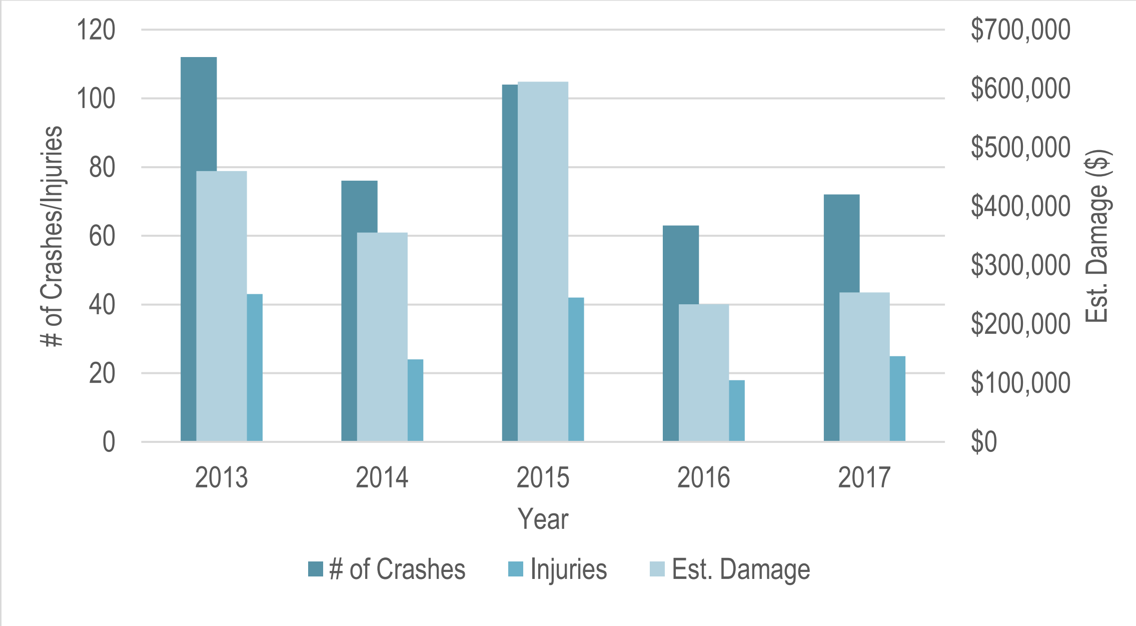

TABLE 26: CRASH SUMMARY BY YEAR (SR 85)

	2013	2014	2015	2016	2017	Total	%
Fatality Crashes	0	0	0	0	2	2	0.47%
Injury Crashes	28	14	27	14	13	98	22.48%
Property Damage Only	84	62	77	49	57	327	77.05%
Total	112	76	104	63	72	427	100.00%

TABLE 27: CRASH RATES BY YEAR (SR 85)

	2013	2014	2015	2016	2017	Average
Average AADT	47,000	46,000	46,000	45,500	52,000	47,300
Crashes	112	76	104	63	72	427
Crash Rate (MVM)	10.044	6.964	9.529	5.836	5.836	7.610

FDOT

Figure 24

SR 85 Historical Crash Locations
SR 85 at I-10 Interchange Modification Report (IMR)

Financial Project ID: 220171-3-12-01
Roadway ID: 5705000

7.2 Interim-Build Alternative Safety Analysis

A quantitative analysis was completed to predict the crash frequency and provide a comparison between the No-Build and Interim-Build Alternative. The quantitative analysis involves prediction of number of crashes on the freeway facility using tools identified in HSM. The Enhanced Interchange Safety Analysis Tool (ISATe) is a safety analysis tool approved by FDOT to evaluate freeway and interchange safety. The ISATe was developed for inclusion as a Part C predictive method for the HSM. The ISATe predicts crashes by crash location, i.e., mainline freeway segments, ramp segments, and ramp terminals. The methodology also predicts crash severity for each crash type using the KABCO scale (K – fatal crashes; A, B, C – injury crashes of decreasing severity; O – Property Damage Only crashes). Inputs to the tool include both geometric and operational characteristics of roadway and ramp facilities. In this regard, the freeway facility is broken into one or more freeway sections based on the geometric characteristics and ramp junctions. ISATe also accounts for annual average daily traffic (AADT) volumes through user inputs. The measures are then combined as needed to describe the performance of the freeway section, interchange, or facility as a whole.

As part of the I-10/SR 85 IMR, ISATe was used to estimate crashes on mainline freeway, ramp segments, and ramp terminals. The roadway inventory data including lane width, shoulder width, median width, clear zone, rumble strips, and roadway barriers was obtained from the Roadway Characteristics Inventory (RCI) and as-built plans. Future traffic projections developed as part of the IMR were included in the analysis.

The study area analyzed consists of I-10 from approximately 3.3 miles west of SR 85 to approximately 0.5 miles east of SR 85 ramps. All existing and proposed ramps and ramp terminals were included as needed. The segmentation was performed based on the procedure provided in NCHRP 17-45. The study section of I-10 was divided into segments within which the characteristics such as traffic volume and geometry are consistent. For the No-Build and Interim Build Alternative, the I-10 mainline is divided into 18 segments and the SR 85 ramps are divided into 13 segments.

The opening year (2024) and design year (2044) conditions were analyzed using HSM predictive methods coded in the ISATe tool, to predict the number and severity of crashes expected to occur within the interchange area. Table 28 shows the predicted crashes by severity for the No-Build Alternative during the study period (2024 – 2044) using the ISATe analysis. Most of predicted crashes are single injury (C) and property damage only crashes.

Table 28 provides a comparison of the ISATe Output between No-Build and the Build Alternative. These results are the predicted crashes during the study period based on a statistical model from the ISATe software. The ISATe outputs are provided in **Appendix O**.

TABLE 28: ISATE OUTPUT COMPARISON – INTERIM BUILD ALTERNATIVE

Alternative	Crash Severity					Total	Total Percent Change
	K	A	B	C	PDO		
No-Build	4.7	25.1	141.1	469.3	614.1	1254.3	**-**
Interim Build Alternative	4.5	18.4	104.3	338.3	538.6	1004.1	**-19.9%**

Similar to the No-Build Alternative, the Interim Build alternative shows the majority of predicted crashes are single injury (C) and property damage only crashes. As shown in Table 28, the Interim Build Alternative showed reduction in all crash types during the study period.

7.3 Ultimate-Build Alternative Safety Analysis

Table 29 summarizes the predicted crashes for the two Ultimate Build Alternatives using the ISATe Tool. The two-ultimate alternatives showed reduction in all crash types except for fatal crashes, in comparison to the interim build alternative during the study period.

TABLE 29: ISATE OUTPUT COMPARISON – ULTIMATE BUILD ALTERNATIVES

Alternative	K	A	B	C	PDO	Total	% Change
Interim Build	4.5	18.4	104.3	338.3	538.6	1004.1	-
Ultimate Build- Improved Diamond Interchange	4.5	17.6	99.3	310.8	524.6	956.8	**-4.7%**
Ultimate Build- DDI	4.5	17.4	97.8	302.6	524.6	946.9	**-5.7%**

7.4 Benefit – Cost Analysis – Interim Build Alternative

The Benefit - Cost Analysis is used to analyze the benefit to society the crash reduction has compared to the cost the project has to society. The FDOT documents crash costs by type in the FDOT Design Manual Section 122, Table 23.6.2, FDOT KABCO Crash Costs. Table 30 is the crash cost comparison and savings between No-Build and Interim-Build Alternatives using FDOT crash cost and the outputs from the ISATe evaluation.

TABLE 30: CRASH COST COMPARISON – NO-BUILD VERSUS INTERIM BUILD

Alternative	Average Crash Cost by type					Crash Cost over Study Period	Crash Cost Savings
	K	A	B	C	PDO		
No-Build	$48,081,000	$14,566,032	$22,176,687	$45,827,145	$4,667,160	$135,318,024	-
Interim-Build	$46,035,000	$10,677,888	$16,392,831	$33,034,995	$4,093,360	$110,234,074	$25,083,950

Table 31 is the crash cost comparison and savings between Interim-Build and the two Ultimate Build Alternatives using FDOT crash cost and the outputs from the ISATe evaluation.

TABLE 31: CRASH COST COMPARISON – INTERIM BUILD VERSUS ULTIMATE BUILD

Alternative	Average Crash Cost by type					Crash Cost over Study Period	Crash Cost Savings
	K	A	B	C	PDO		
Interim-Build	$46,035,000	$10,677,888	$16,392,831	$33,034,995	$4,093,360	$110,234,074	-
Ultimate Build-Improved Diamond Interchange	$46,035,000	$10,213,632	$15,606,981	$30,349,620	$3,986,960	$106,192,193	$4,041,881
Ultimate Build-DDI	$46,035,000	$10,097,568	$15,371,226	$29,548,890	$3,986,960	$105,039,644	$5,194,430