

7.0 Safety Analysis

7.1 Crash Data

Historical crash data within the study area was obtained from FDOT's *Crash Analysis Reporting System (CARS)* for the five-year period from 2014 to 2018. The historical crash data included crashes that occurred on the I-75 mainline, I-75 ramps, I-75/Big Bend Road ramp terminal intersections, on Big Bend Road, and at cross streets within the area of influence. The data collected includes crash frequency, type, severity, lighting conditions (day versus night), and pavement surface conditions (wet versus dry) and are summarized in **Table 33**. Approximately 62 percent of the more than 1,107 total crashes over the five-year period were rear end crashes, which is a crash type that is related to "stop-and-go driving" conditions and is indicative of traffic congestion. Of the 1,107 total crashes, there were three fatalities, 404 crashes involving personal injury, and 700 crashes that were property damage only.

Table 33 – I-75 at Big Bend Road Interchange Crash Summary (2014 – 2018)

Category	2014	2015	2016	2017	2018	Total	Mean	Percentage
TYPE								
Angle	7	10	11	8	8	44	8.8	4.0%
Head On	2	1	3	1	2	9	1.8	0.8%
Hit Fixed Object	8	20	10	15	24	77	15.4	7.0%
Hit Non-Fixed Object	6	4	5	8	2	25	5.0	2.3%
Left Turn	8	17	15	11	16	67	13.4	6.1%
Pedestrian	0	3	1	0	1	5	1.0	0.5%
Rear End	91	139	120	156	176	682	136.4	61.6%
Run Off Road	0	0	3	1	1	5	1.0	0.5%
Sideswipe	11	20	26	30	48	135	27.0	12.2%
Single Vehicle	8	12	12	12	6	50	10.0	4.5%
Unknown	0	3	1	0	0	4	0.8	0.4%
U-Turn	1	0	0	1	2	4	0.8	0.4%
Total	142	229	207	243	286	1107	221.4	100.0%
SEVERITY								
Fatal	0	1	1	1	0	3	0.6	0.3%
Incapacitating	11	14	12	15	13	65	13.0	5.9%
Property Damage Only	79	135	139	160	187	700	140.0	63.2%
Non-Incapacitating	25	28	30	28	45	156	31.2	14.1%
Possible Injury	27	51	25	39	41	183	36.6	16.5%
Total	142	229	207	243	286	1107	221.4	100.0%
LIGHTING CONDITION								
Dark-Lighted	17	33	37	28	23	138	27.6	12.5%
Dark-Not Lighted	18	28	15	18	19	98	19.6	8.9%
Day	107	168	155	197	244	871	174.2	78.7%
Total	142	229	207	243	286	1107	221.4	100%
SURFACE CONDITION								
Dry	114	172	170	206	235	897	179.4	81.0%
Wet	28	57	37	37	51	210	42.0	19.0%
Total	142	229	207	243	286	1107	221.4	100.0%

7.2 Crash Analysis

Roadway segment and spot crash rates were calculated and compared with statewide averages for similar highway facilities throughout the State of Florida. Utilizing the information obtained from the crash data, the safety evaluation identified the needs associated with the safety of the existing facility. The highest crash locations within the influence area of the I-75/Big Bend Road interchange include the I-75 mainline connections with the loop on and off ramps to/from Big Bend Road and on Big Bend Road at Covington Garden Drive, southbound I-75 ramp terminal intersection, northbound I-75 ramp terminal intersection, and Simmons Loop.

7.2.1 Segment Crash Rates

The roadway segment crash rates for I-75 and Big Bend Road are shown in **Table 34**. The segment crash rates exclude crashes that occurred on the I-75 on and off ramps to and from Big Bend Road. The calculated segment crash rates reveal that the I-75 mainline, within the vicinity of Big Bend Road, experiences an average crash rate of 1.48 crashes per million vehicle miles traveled (MVMT), which is 1.6 times greater than the statewide average crash rate for similar interstate facilities in the State of Florida. Similarly, Big Bend Road, west of I-75, experiences an average crash rate of 7.86 crashes per MVMT, which is 2.3 times greater than the statewide average crash rate for similar four-lane divided arterial roadways.

Table 34 – Five Year (2014 – 2018) Average Roadway Segment Crash Rates

Roadway Segment			Number of Crashes	Crash Rate (MVMT) ¹	Statewide Average Crash Rate
Roadway	From	To			
I-75 (SR 93A)	South of Big Bend Road	Big Bend Road	178	1.48	0.924
	Big Bend Road	North of Big Bend Road)	229	1.47	
Big Bend Road	West of Covington Garden Drive	I-75 (SR 93A)	352	7.86	3.412
	I-75 (SR 93A)	East of Simmons Loop	261	4.65	

¹Roadway segment crash rate reported as the number of crashes per million vehicle miles traveled (MVMT).

7.2.2 Intersection Crash Rates

The intersection crash rates within the influence area of the I-75/Big Bend Road interchange are shown in **Table 35**. The intersection crash rates range from a low of 0.26 crashes per million entering vehicles (MEV) at the entrance to East Bay High School to a high of 2.80 crashes per MEV at the southbound I-75 ramp terminal intersection. The crash rate at the southbound I-75 ramp terminal intersection is 1.85 times greater than the statewide average for similar intersection types throughout the State of Florida. The higher than expected number of crashes at this location is likely due to the unique geometric characteristics associated with the I-75 loop off ramp located in the southwest quadrant of the interchange.

Table 35 – Five Year (2014 – 2018) Average Intersection Crash Rates

Big Bend Road Intersection	Number of Crashes	Crash Rate (MEV) ¹	Statewide Average Crash Rate
Covington Garden Drive	83	1.16	0.59
East Bay High School Entrance	17	0.26	0.39
Southbound I-75 (SR 93A) Ramp Terminal	252	2.80	1.51
Northbound I-75 (SR 93A) Ramp Terminal	99	1.14	1.51
Simmons Loop	162	1.93	0.39

¹Intersection crash rate reported as the number of crashes per million entering vehicles (MEV).

7.2.3 Economic Loss

Monetary estimates of property damage and economic loss due to injury or a fatality were calculated using average unit costs from the United States Department of Transportation (USDOT)/FHWA KABCO (K-Fatal; A-Incapacitating injury; B-Non incapacitating injury; C-Possible injury; and O-No injury) injury classification scale. FDOT's CARS provides unit costs for calculating the cost of crashes and injuries. Based on these unit costs that are documented in Table 122.6.2 of the FDOT Design Manual (FDM), the crashes on I-75 in the five-year period from 2014-2018 resulted in an estimated economic loss of approximately \$140.7 million as shown in **Table 36**.

Table 36 – Estimated Economic Loss from Crashes (2014 – 2018)

Crash Severity	CARS Crash Cost ¹	Number of Crashes	Economic Loss
Fatal	\$10,670,000	3	\$32,010,000
Severe Injury (Incapacitating)	\$872,612	65	\$56,719,780
Moderate Injury (Non-incapacitating)	\$174,018	156	\$27,146,808
Minor Injury	\$106,215	183	\$19,437,345
Property Damage Only	\$7,700	700	\$5,390,000
Total		1,107	\$140,703,933

¹Source: Florida Department of Transportation State Safety Office's Crash Analysis Reporting (CAR) System, analysis years 2012 through 2016. Published by FDOT State Safety Office on 10/20/2018.

7.3 Quantitative Safety Analysis

A quantitative safety analysis was conducted to evaluate the highway safety benefits of implementing the Build Alternative. The *Highway Safety Manual (HSM)* provides techniques to estimate crashes for a given facility, test the effectiveness of design alternatives on crash reduction, and evaluate their economic crash benefits. The FDOT *Safety Analysis Guidebook for Project Development and Environment (PD&E) Studies* also gives guidance on performing safety analyses for studies such as this IMR.

For this quantitative safety analysis, Crash Modification Factors (CMFs) from the FHWA Crash Modification Factors Clearinghouse (www.cmfclearinghouse.org) were utilized to evaluate the safety benefits of the primary improvements proposed for the I-75/Big Bend Road interchange, as listed below:

1. Widen Big Bend Road from four lanes to six lanes from Covington Garden Drive to Simmons Loop;
2. Convert the I-75 ramp terminal intersections at Big Bend Road to highly efficient two-phase signal operation;
3. Widen the southbound I-75 off ramp to Big Bend Road from one lane to two lanes and place the off ramp on a barrier separated parallel roadway to the southbound I-75 mainline;
4. Remove the traffic signal and close the access on Big Bend Road at the Franklin Cast Bay / East Bay High School entrance;
5. Remove the existing loop ramp in southeast quadrant of the interchange and add new directional on and off ramps in the northeast and northwest quadrants of the interchange to better service the westbound Big Bend Road to northbound I-75 and southbound I-75 to westbound Big Bend Road traffic movements, respectively;
6. Widen the northbound I-75 on ramp from Big Bend Road from one to two lanes; and
7. Provide a second northbound to westbound left turn lane at the northbound I-75 ramp terminal intersection.

A summary of the safety benefits of implementing the proposed improvements of the Build Alternative is shown in **Table 37**.

Table 37 – Estimated Safety Benefit of Proposed Improvements

Description of Proposed Improvement	Annual Number of Crashes Reduced	Annual Cost of Crash Reduction
Safety Benefit Summary		
1. Big Bend Road Six-Lane Widening	20	\$2,542,080
2. I-75 Ramp Terminals Two-Phase Signal Control	8	\$1,016,832
3. Two-Lane / Barrier Separated Southbound I-75 Off Ramp	12	\$1,525,248
4. Frankland Cast Bay/East Bay High School Access and Signal Removal	2	\$254,208
5. New Directional Ramps in Northwest and Northeast Quadrants	16	\$2,033,664
6. Two-Lane Northbound I-75 On Ramp	12	\$1,525,248
7. Dual Northbound I-75 to Westbound Big Bend Road Left Turn Lanes	0	\$0
Total	70	\$8,897,280
Safety Benefit to Cost Evaluation Summary		
Total Cost of Improvements		\$74,754,656
Expected Service Life		25 years
Interest Rate		4%
Capital Recovery Factor		0.0640
Annual Cost of Improvement		\$4,784,298
Safety Benefit to Cost (B/C) Ratio		1.9

Appendix M provides the FDOT District Seven Benefit-to-Cost (B/C) Worksheets used to document the CMFs employed to determine the annual number of crashes reduced and the annual cost of the crash reduction for each of the primary transportation improvements proposed as part of the Build Alternative. The average cost per crash used in the safety B/C analysis was calculated from the estimated economic loss from crashes shown in **Table 36**. If the value for total economic loss from crashes of \$140,703,933 is divided by the number of crashes 1,107, then a cost per crash of \$127,103 is obtained. As shown in **Table 37**, a safety B/C Ratio of 1.9 was estimated for the Build Alternative. A B/C Ratio greater than 1.0 indicates that that implementing the Build Alternative is economically justifiable from a highway safety perspective.