Table 4.3 – Opening Year 2025: Build Alternative Off-Ramp Signal Queuing Analysis Results

I-95/SR 9	Movement	Available Storage (ft)(1)	Queue (ft)(2)	
			AM	PM
Southbound Ramp Terminal	SB to WB (R)	1,640	357	423
	SB to EB (L)	1,640	208	213
Northbound Ramp Terminal	NB to EB (R)	1,330	202	261
	NB to WB (L)	1,330	140	252

(1) The available storage length was calculated accounting for changes in number of lanes.
(2) The queuing distance was obtained by the 95th percentile Synchro queue length analysis.

Table 4.4 – Design Year 2045: Build Alternative Off-Ramp Signal Queuing Analysis Results

I-95/SR 9	Movement	Available Storage (ft)(1)	Queue (ft)(2)	
			AM	PM
Southbound Ramp Terminal	SB to WB (R)	1,640	#625(3,4)	572
	SB to EB (L)	1,640	338	202
Northbound Ramp Terminal	NB to EB (R)	1,330	215	266
	NB to WB (L)	1,330	146	300

(1) The available storage length was calculated accounting for changes in number of lanes.
(2) The queuing distance was obtained by the 95th percentile Synchro queue length analysis.
(3) # indicates that volume exceeds capacity and queues may be longer than calculated based on two signal timing cycles
(4) #625' per lane. The Build Concept provides two (2) SBR (650' each). Further review using the SimTraffic microsimulation tool indicated that the SB right-turn movement queues will not be longer than calculated using the Synchro tool. Therefore, SBR queues are not expected to reach or impact I-95/SR 9 SB mainline through traffic.

4.4 Build Alternative – Safety Analysis

It should be noted that the *June 2021 I-95/SR 9 at Woolbright Road IMR* analysis showed improved traffic operations and safety within the project study area when compared to the No-Build Alternative due to reduction in congestion and improved geometric design of the Approved IAR Alternative to improve safety. Therefore, the following safety analysis is focused on a comparison between the Approved IAR Alternative, and the improvements implemented as part of the proposed Build Alternative in accordance with the purpose and need for this project. Documentation of the Build Alternative safety analysis and supporting documentation is provided in **Appendix F**.

The safety analysis was conducted to evaluate the Build Alternative (versus the Approved IAR Alternative) for Opening Year 2025 and Design Year 2045. The quantitative safety analysis was conducted utilizing Safety Performance Functions (SPF) based on the *Highway Safety Manual* (HSM) procedures and the *2022 FDOT IARUG Safety Analysis Guidance* for the following intersections:

1. Woolbright Road at SW 8th Street/Corporate Drive;
2. I-95/SR 9 SB Ramp Terminal at Woolbright Road; and
3. I-95/SR 9 NB Ramp Terminal at Woolbright Road.

The safety analysis was divided into: 1) Intersection analysis (SW 8th Street/Corporate Drive); and 2) Freeway Ramp Terminal (I-95/SR 9 ramp terminal intersections). The safety analysis was conducted using the FDOT Safety Performance for Intersection Control Evaluation (SPICE) Tool (most current version v4.0.0 10/13/2021). The SPICE tool calculates crash frequency and severity by utilizing HSM strategies to perform a comparative predictive safety analysis of different intersection control strategies. This tool was developed by FHWA (and modified by FDOT) to automate the predictive analysis of intersections. This tool allows conducting intersection control evaluations by developing the appropriate Safety Performance Functions (SPFs) based on the Empirical Bayes (EB) method and implementation of Crash Modification Factor (CMF) as applicable. **Table 4.5** summarizes the results of the safety analyses for Opening Year 2025 and Design Year 2045.

Table 4.5 – Build Alternative Safety Analysis Results

Control Strategy	Location	Crash Type	Opening Year 2025	Design Year 2045	Total Crashes Project	Rank(1)	Source of Prediction
Approved IAR Alternative	SW 8th St / Corporate Drive	Total	21.58	23.59	474.46	2	SPF w/EB
		Fatal/Injury	5.22	5.76	115.34		
	I-95/SR 9 Ramp Terminals	Total	42.19	48.08	946.49	2	SPF no/EB
		Fatal/Injury	20.08	23.06	452.54		
	Total	**Total**	**63.77**	**71.67**	**1,420.95**	**2**	**N/A**
		Fatal/Injury	**25.30**	**28.82**	**567.88**		
Build Alternative	SW 8th St / Corporate Drive	Total	18.69	20.43	410.96	1	SPF w/EB
		Fatal/Injury	4.52	5.00	99.98		
	I-95/SR 9 Ramp Terminals	Total	41.28	46.67	922.52	1	SPF no/EB
		Fatal/Injury	19.18	21.65	428.58		
	Total	**Total**	**59.97**	**67.10**	**1,333.48**	**1**	**N/A**
		Fatal/Injury	**23.70**	**26.65**	**528.56**		

(1) A Ranking of 1 is given to the safest alternative.

The Intersection analysis followed the procedures in Chapter 12 of the HSM. The Approved IAR Alternative was labeled Traffic Signal; and the Build Alternative was labeled Traffic Signal (Alt). The intersection analysis was conducted for the intersection of Woolbright Road and SW 8th Street/Corporate Drive. The EB method was applied. A review of the FDOT State Safety Office Geographic Information System (SSOGis) indicated that crash data for SW 8th Street and Corporate Drive was not complete; therefore, the crash data was obtained from Signal 4 Analytics for the most recent five-year period of 2017 to 2021 (instead of 2016 to 2020 as expected in the approved MLOU). The crash database summary table and SPICE worksheet are presented in Appendix F.

A review of the crash data within the functional area of the intersection indicates that the crash frequency has been very consistent with an annual average of 24.6 crashes per year. The database indicates that there was a total of 20 crashes in 2017, 25 crashes in 2018, 27 crashes in 2019, 22 crashes in 2020, and 29 crashes in 2021, respectively. Therefore, no significant deviations were observed due to COVID19 pandemic.

A calibration factor of 1.00 was used for both Alternatives. All the inputs utilized were consistent for both alternatives except as follows:

- Number of Major Street Through Lanes: Approved IAR Alternative = 7; Build Alternative = 6
- Max # of Lanes Crossed by Pedestrians: Approved IAR Alternative = 10; Build Alternative = 9

The value differences on the Number of Major Street Through Lanes and Max # of Lanes Crossed by Pedestrians reflect the additional WB auxiliary through lane under the Approved IAR Alternative. The SPF calculation does not include the number of turn lanes as a variable; therefore, the safety benefits from the additional SB left-turn lane implemented on the Build Alternative are not included. The safety analysis indicates that the Build Alternative will produce approximately 63.50 less crashes than the Approved IAR Alternative at the intersection of Woolbright Road and SW 8th Street/Corporate Drive between Opening Year 2025 and Design Year 2045.

The Ramp Terminal Intersections analysis followed the procedures in Chapter 19 of the HSM 2014 Supplement. The Approved IAR Alternative was labeled Signalized Diamond; and the Build Alternative was labeled Signalized Diamond (Alt). The Ramp Terminal Intersections analysis was conducted for the I-95/SR 9 at Woolbright Road Ramp Terminal Intersections. The EB method was not applied since this segment of Woolbright Road will be modified from 4-lanes to 6-lanes under both Alternatives. The SPICE worksheet is presented in Appendix F.

A calibration factor of 1.00 was used for both Alternatives. All the inputs utilized were consistent for both alternatives except as follows:

- Effective Number of Lanes Serving Exit Ramp: Approved IAR Alternative = 3; Build Alternative = 4. It should be noted that these values reflect a methodology limitation to a maximum of 4-lanes. The actual proposed configuration is: Approved IAR Alternative = 4; Build Alternative = 5. For purpose of this analysis, one lane was subtracted from each configuration to maintain the net difference between the two Alternatives.
- The analysis considers the SB Exit Ramp Right Turn Control as Signal/Stop/Yield controlled based on field observations and the presence of Pedestrian Crossing Signs (W11-2 and W16-7P); even though, the right-turn lane has its own receiving lane. It should be noted that a Yield Sign (R1-2) and Advance Yield Sign (W3-2) were previously provided for this movement until 2016. The NB Exit Ramp Right Turn has (Exiting Conditions) and will maintain (Approved IAR Alternative) Yield Sign control.

Due to methodology limitations, the SPF calculation does not include the total number of Lanes Serving Exit Ramps; therefore, the safety benefits from the additional SB and NB right-turn lanes implemented on the Build Alternative are not included. The safety analysis indicates that the Build Alternative will produce approximately 23.97 less crashes than the Approved IAR Alternative at the I-95/SR 9 at Woolbright Road Ramp Terminal Intersections between Opening Year 2025 and Design Year 2045.

The safety analysis indicates that the Build Alternative will improve safety conditions. Based on the results of the HSM analysis, the proposed condition would reduce the predicted total project life cycle crashes by a total of 87.47 crashes. Of those 87.47 crashes, 39.32 are predicted to be fatal/injury crashes.