Similarly, **Table 27** summarizes crashes per MEV for the intersections in the influence area. The ramp terminal intersections are currently experiencing similar crash rates, with the northbound ramp terminal experiencing 0.14 crashes per MEV and the southbound ramp terminal experiencing 0.23 crashes per MEV. FDOT does not report crash rates for ramp terminal intersections, and therefore a statewide comparison is unavailable. The bounding intersection to the south – US 41 and 73rd Street – experiences 0.14 crashes per MEV, a significantly lower rate than the FDOT statewide rate of 0.65 crashes per MEV.

Table 27: Calculation of crash rate for intersections and ramp terminals

Intersection or Ramp Terminal	Total Crashes	US-41 Entering AADT	Crossroad or Ramp Entering AADT	Crashes per Year	Total Crash Rate per MEV	FDOT Crash Rate
I-275 NB and US-41 Ramp Terminal	11	21,700	20,000	2.2	0.14	N/A
I-275 SB and US-41 Ramp Terminal	16	30,600	7,100	3.2	0.23	N/A
US-41 and 73rd Street/69th Street Intersection	10	28,100	10,400	2	0.14	0.65

8.2 Future Safety Analysis

The focus of the future safety analysis is to understand the impact of the traffic volume and other proposed changes in the future on the safety performance of the influence area. For most components of the influence area, the change is simply traffic volume growth. There are three (3) proposed changes for the study area – the conversion of the northbound ramp terminal signal from span wire mounted to mast arm mounted, the conversion from stop-control to signal-control at the southbound ramp terminal, and the installation of crosswalks and pedestrian features. The following sections describe the analysis performed to assess the impact of the proposed changes at the ramp terminals. The analyses focus on the opening year 2024 and the design year 2034.

8.2.1 I-275 Northbound Ramps and US 41 Ramp Terminal

The proposed change for the northbound ramp terminal is to change the current span wire-mounted traffic signal to a mast arm-mounted traffic signal. Per research available in the FHWA CMF Clearinghouse, this conversion is expected to result in a 3-percent reduction in all crashes (CMF ID 9404) at a signalized intersection and a 2-percent reduction in FI crashes (CMF ID 9405) at a signalized intersection. Both CMFs are rated three stars on the CMF Clearinghouse. Unfortunately, no similar research is available for ramp terminals. As such, it was assumed that this CMF can apply to the signalized northbound ramp terminal. Relevant CMF Clearinghouse output sheets can be found in **Appendix S**.

The northbound ramp terminal experienced 6.8 total crashes and 3.4 FI crashes during the study period. The CMF can be applied to the No Build crash frequency to determine the potential crash frequency of the Build condition.

Table 28 summarizes the results of this analysis. Converting from the span-wire mounted signal to a mast-arm mounted signal is expected to produce small annual reductions, roughly 1 FI crash and 1 PDO crash every ten years.

Table 28: Summary of CMF Analysis for Northbound Ramp Terminal

Crash Type	All	FI	PDO
Observed Crash Frequency, No Build	6.8	3.4	3.4
CMF	0.97	0.98	N/A
Observed Crash Frequency, Build	6.6	3.3	3.3
Expected Annual Crash Reduction	0.2	0.1	0.1

Based on the CMF, the proposed change is expected to provide a small safety improvement to the intersection by improving the visibility of the traffic signals.

8.2.2 I-275 Southbound Ramps and US 41 Ramp Terminal

The proposed treatment for the I-275 southbound ramp terminal with US 41 is a conversion from minor stop-control to signalization. Unfortunately, there is no CMF in the Clearinghouse for conversion of stop-control to signal for a ramp terminal. In addition, this ramp terminal could not be accurately modeled using the HSM Part C Predictive Method in ISATe. First, the HSM model for stop-control ramp terminals only accounts for crossroads with a maximum of four (4) lanes, whereas this site has six (6) lanes. Additionally, the AADT range for the crossroad and ramps for this terminal are significantly outside of the applicable AADT range for the HSM ramp terminal crash prediction models. The maximum applicable crossroad AADT for a stop-control diamond ramp terminal is 18,000 vehicles per day, whereas the crossroad AADT for this terminal are 25,600 vehicles per day for the inside leg and 32,500 vehicles per day for the outside leg. Similarly, the maximum applicable total ramp volume for a stop-control diamond ramp terminal is 10,000 vehicles per day compared to the 13,600 vehicles per day at this ramp terminal. This indicates the model would extrapolate for the No Build condition, which would be an unreliable prediction. The project team performed a prediction knowing the results were extrapolated but found unrealistic results (e.g., the signalized intersection produced an FI crash frequency prediction three-times higher than the unsignalized ramp terminal).

Without a CMF for converting a ramp terminal from stop-control to signal-control and a reliable method to predict crashes at the terminal under the No Build and Build condition, a qualitative discussion of the benefits is warranted. Various resources show that signalizing an intersection is expected to provide safety benefits, particularly for injury crashes. National research found benefits for signalizing an intersection. McGee et al. documented numerous CMFs for signalizing urban intersections in NCHRP Report 491: Crash Experience Warrant for Traffic Signals. **Table 29** summarizes those CMFs. Note the significant reduction expected for all crashes as well as angle crashes, which offset the expected increase in rear end crashes.

Table 29: Summary of Signalization CMFs from NCHRP Report 491

CMF Clearinghouse ID	CMF	Intersection Type	Crash Type	Crash Severity	CMF Clearinghouse Rating
316	0.86	3-Leg	All	FI	4 Stars
317	0.66	3-Leg	Angle	FI	3 Stars
318	1.5	3-Leg	Rear End	FI	3 Stars
319	0.77	4-Leg	All	FI	4 Stars
320	0.33	4-Leg	Angle	FI	5 Stars
321	1.38	4-Leg	Rear End	FI	4 Stars

Based on research summarizing the safety effects of converting stop-control intersections to signalized intersections, it is safe to assume similar effects would be realized when signalizing the I-275 southbound and US 41 ramp terminal. Providing the signal will control movements through the intersection and reduce the potential angle and left-turn conflicts which occur at higher frequencies at stop-control intersections. Table 30 summarizes the potential crash reduction using the 4-leg intersection CMFs (a 4- and 5-stars rating) from **Table 29**. Assuming signalization of the ramp terminal produces a similar safety effect as intersections, FI crashes are expected to be reduced by 0.6 crashes per year, FI angle crashes by 1.2 per year, and FI rear end crashes to increase by 0.2 per year. The small increase in rear end crashes is acceptable given the significant decrease in angle crashes, given the kinetic energy involved in angle crashes is typically much higher than rear end crashes.

Table 30: Summary of CMF Analysis for SB Ramp Terminal Intersection

FI Crash Type	FI, All	FI, Angle	FI, Rear End
Observed FI Crash Frequency, No Build	2.6	1.8	0.6
CMF, FI Crashes	0.77	0.33	1.38
Observed FI Crash Frequency, Build	2.0	0.6	0.8
Expected Annual FI Crash Reduction	0.6	1.2	-0.2

8.2.3 Pedestrian Improvements

The proposed alternative includes the installation of crosswalks and pedestrian features at both ramp termini intersections. Currently, there are no crosswalks, warning signage, or pavement markings identifying pedestrian crossings on US 41 and the interchange ramps. The proposed crosswalks and signage will help address these needs. Additionally, pedestrian crossings of US 41 and the interchange ramps will be accounted for in the signal phasing at both ramp terminals. Finally, all crossings will include ADA-compliant hardware. These improvements will increase pedestrian mobility and safety in the interchange area.