## 7.2 Future Safety Analysis

Based on the project future safety analysis needs, a combination of HSM Part C methodologies and countermeasure CMF was used to account for the potential safety benefits. As the first step, a predictive method was used for the following facilities within the study's AOI based on the noted geometric differences between No-Build and Build conditions.

- Freeway ramp segments (NB on/off ramps and SB on/off ramps)
- Ramp terminals (I-95 at SR 524 NB and I-95 at SR 524 SB ramp terminals)
- Arterial intersections (SR 524 at S. Friday Road and SR 524 at N. Friday Road)

Since the Build conditions do not involve changes (from the No-Build) to the freeway mainline or the gore areas, only the freeway ramps and ramp terminals were evaluated. For the arterial (SR 524), intersections are evaluated because of the four-lane widening and other improvements. It should be noted that since the combined area of influence approximately covers the SR 524 segments between S. Friday Road and I-95, and I-95 and N. Friday Road, only the study intersections were evaluated. For the predictive method, the Enhanced Interchange Safety Analysis Tool (ISATe) Build 06.10 – Modified was used for the freeway components, whereas HSM Spreadsheets were used for the study intersections.

For this study, the Build alternative includes converting the existing diamond interchange to a DDI along with the widening of SR 524 corridor from two lanes to four lanes. As part of the second step, since the predictive method does not account for the conversion of a diamond interchange to a DDI, a CMF was used to determine the reduction in crashes between a diamond interchange (with four-lane arterial) and a DDI (with a four-lane arterial). ISATe was initially used to evaluate the study ramp terminals with a two-lane SR 524 and a four-lane SR 524.

### *7.2.1 Ramp Segments and Ramp Terminal Results*

**Table 26** summarizes the expected crashes for the No-Build and Build alternatives based on ISATe analysis for 20 years (2025-2045). As mentioned in the previous section, the Build improvements include widening of SR 524 to four lanes, addition of turn lanes at the ramp terminals, and

converting the existing diamond interchange to a DDI. This table also shows the expected crash reduction based on the CMF for a diamond interchange to a DDI conversion. Please note that since SR 524 will be widened to a four-lane roadway under the Build alternative, calculating the expected crash frequency by the Empirical Bayes Method is not applicable.

**Table 26: No-Build vs Build Expected Crash Summary (2025-2045) for the Freeway Components**

| Alternative & Facility Type | Total Predicted Crashes | K | A | B | C | O |
|---|---|---|---|---|---|---|
| (1A) No-Build (Ramp Segments) | 47.4 | 0.2 | 1.5 | 5.1 | 10.0 | 30.7 |
| (2A) No-Build (Ramp Terminals) | 209.8 | 1.9 | 10.5 | 31.5 | 47.0 | 119.0 |
| **(3A: 1A+2A) No-Build (Totals)** | **257.2** | **2.1** | **12.0** | **36.5** | **56.9** | **149.6** |
| (1B) Build (Ramp Segments) | 36.9 | 0.1 | 1.2 | 3.9 | 7.7 | 23.9 |
| (2B) Build (Ramp Terminals)# | 189.2 | 1.5 | 8.7 | 26.9 | 44.3 | 108.0 |
| (3B = 2B*0.858) Build (Diamond Interchange to DDI-Ramp Terminals)* | 162.3 | 1.3 | 7.5 | 23.1 | 38.0 | 92.7 |
| **(4B: 1B+3B) Build (Totals)** | **199.2** | **1.4** | **8.6** | **27.0** | **45.7** | **116.6** |
| **(3A-4B) Crash Reduction** | **58.0** | **0.6** | **3.4** | **9.5** | **11.2** | **33.1** |

*Notes:*
*1. K – Fatality; A - Incapacitating Injury; B – Non-incapacitating Injury; C – Possible Injury; O – Property Damage Only (PDO). Definitions based on FDOT Manual*
*2. ISATe analysis provides the sum of crashes for the specified time period*
*2. # - ISATe analysis for a diamond interchange with four-lane SR 524*
*3. *CMF is 0.858 for ID 10761 - convert diamond interchange to a DDI, AbdelRahman et al., 2021, cmfclearinghouse.org*
*4. KABCO crash distribution is from the latest 2022 FDOT Design Manual, Table 122.6.4; No-Build Ramp Terminals: KABCO distribution for 2-lane undivided arterials/intersections; No-Build/Build Ramp Segments: KABCO distribution for freeway ramps; Build Ramp Terminals: KABCO distribution for 4-lane divided arterials/intersections*
*5. Totals may not exactly match with the sum because of rounding*

### *7.2.2 Study Intersection Results*

**Table 27** summarizes the expected crashes for the No-Build and Build alternatives based on HSM Spreadsheets for an urban intersection for 20 years (2025-2045). As mentioned in the previous section, the study intersections of SR 524 at S. Friday Road and SR 524 at N. Friday Road include widening of SR 524 to four lanes and turn lane improvements. It is to be noted that since the HSM Spreadsheets allow safety analysis for one year at a time, the analysis was conducted for the years

2025 and 2045. A separate analysis was conducted for the year 2035 and it was found that the expected number of crashes for the interim years (other than 2025 and 2045) closely follow a linear trend. As such, the expected crashes for the interim were interpolated using the calculated expected annual crash data for the years 2025 and 2045.

**Table 27: No-Build vs Build Expected Crash Summary (2025-2045) for the Study Intersections**

| Alternative & Facility Type | Total Predicted Crashes | K | A | B | C | O |
|---|---|---|---|---|---|---|
| (1A) No-Build (Study Intersections) | 99.3 | 0.9 | 5.0 | 14.9 | 22.2 | 56.3 |
| (1B) Build (Study Intersections) | 100.1 | 0.8 | 4.6 | 14.2 | 23.4 | 57.2 |
| **(1A-1B) Crash Reduction** | **-0.8** | **0.1** | **0.4** | **0.7** | **-1.2** | **-0.9** |

*Notes:*
*1. K – Fatality; A - Incapacitating Injury; B – Non-incapacitating Injury; C – Possible Injury; O – Property Damage Only (PDO). Definitions based on FDOT Manual*
*2. HSM Spreadsheets were used for this analysis*
*3. KABCO crash distribution is from the latest 2022 FDOT Design Manual, Table 122.6.4. No-Build: KABCO distribution for 2-lane undivided arterials/intersections; Build: KABCO distribution for 4-lane divided arterials/intersections*
*4. Totals may not exactly match with the sum because of rounding*

It is to be noted that there is slight increase in the expected number of crashes for the Build alternative compared to the No-Build alternative over a 20-year period, most likely because of the four-lane widening and corresponding increase in traffic. However, this increase is observed for the possible injury and PDO crashes and not for the fatal and injury crashes.

### *7.2.3 Crash Reduction Benefit for the Entire Facility*

One of the last steps in evaluating whether the improvements provide a safety benefit is developing the crash reduction estimates based on the proposed study area improvements. **Table 28** illustrates the crash reduction estimates for the Build alternative over the No-Build alternative. As noted in **Table 28**, the safety analysis results indicate that the proposed improvements within the AOI are expected to have approximately **57 less crashes and $14.3 million** in crash cost savings compared to the No-Build alternative over a 20-year period. The crash reduction benefit of the proposed improvements is experienced over all crash severity types including fatal, injury,

and PDO crashes. **Appendix N** contains the crash data utilized and safety analysis conducted for this study.

**Table 28: Crash Reduction Benefit for the Entire Facility (2025-2045)**

| Alternative | Total Facility Predicted Crashes | Total Crash Cost Savings | K | A | B | C | O |
|---|---|---|---|---|---|---|---|
| No-Build *(3A from Table 25 plus 1A from Table 26)* | 356.5 | | 3.0 | 17.0 | 51.4 | 79.2 | 205.9 |
| Build (*(4B from Table 25 plus 1B from Table 26)* | 299.3 | | 2.2 | 13.3 | 41.2 | 69.2 | 173.7 |
| **(1C) Crash Reduction** | **57.2** | | **0.7** | **3.7** | **10.2** | **10.0** | **32.2** |
| (2C) Crash Cost* | - | | $10,890,000 | $888,030 | $180,180 | $103,950 | $7,700 |
| **(1C*2C) Crash Cost Savings** | **-** | **$14,324,651** | **$7,889,056** | **$3,302,632** | **$1,841,967** | **$1,043,028** | **$247,968** |

*Notes:*
*1. K – Fatality; A - Incapacitating Injury; B – Non-incapacitating Injury; C – Possible Injury; O – Property Damage Only (PDO). Definitions based on FDOT Manual*
*2. *KABCO crash costs are from the latest 2022 FDOT Design Manual, Table 122.6.2*
*3. Totals may not exactly match with the sum because of rounding*