

10. COMPARATIVE SAFETY ANALYSIS

The purpose of the comparative safety analysis was to determine the safety impacts of reconfiguring the I-4 westbound to SR 528 eastbound interchange ramp from one lane (No-Build) to two lanes (Build). To determine these impacts, a predicted crash frequency analysis was performed utilizing the Enhanced Interchange Safety Analysis Tool (ISATe) Build 06.10 – Modified to Include Present Worth Analysis. A qualitative analysis was also performed for the proposed improvements.

10.1. Quantitative Ramp Analysis

Table 35 provides the results of the ISATe analysis for the I-4 westbound to SR 528 eastbound interchange ramp.

Table 35: No-Build vs Build ISATe Predicted Crash Frequency Results

Scenario/ Feature	Predicted Fatal Crashes	Predicted Injury Crashes	Predicted Property Damage Only Crashes	Total Predicted Crashes	Total Present Value
No-Build – Ramp	0.6	31.9	34.5	67.0	\$7,790,000
Build – Ramp	0.8	42.0	56.9	99.7	\$10,550,000
<i>Difference – Build minus No-Build</i>	<i>0.2</i>	<i>10.1</i>	<i>22.4</i>	<i>32.7</i>	<i>\$2,760,000</i>

Note: Some values in **Table 35** will not sum due to rounding from the ISATe output spreadsheets.

The results of the analysis show the Build configuration is predicted to experience more injury and property damage only (PDO) crashes over the 10-year life cycle of the project. The Build configuration is showing a \$2,760,000 increase in total present value over the No-Build, primarily due to the predicted increase in injury and PDO crashes. The total present value was calculated for each alternative by applying the KABCO comprehensive crash costs from FDM Table 122.6.2 to the predicted crash severity distributions. This calculation is performed in ISATe.

A contributing factor to the predicted crash increase for the Build condition is the overall ramp length increase. The Build condition 2-lane ramp is approximately 600' longer than the No-Build ramp, which directly contributes to approximately 11 more total predicted crashes over the 10-year life cycle (approximately 33% of the total predicted crash increase).

While the Build configuration is showing an increase in crashes, it is common to see 2-lane ramps with a higher crash frequency than a single lane ramp. A 2-lane ramp will introduce lane change crashes which are not present for single lane ramps. The Final Report for NCHRP 17-45 Safety Prediction Methodology and Analysis Tool for Freeways and Interchanges found that on average, 2-lane ramps will experience a higher crash frequency than single lane ramps. From page 233 of the Final Report: "The trend lines...also indicate that crash frequency is lower on urban ramps and C-D roads with one lane, relative to those with

two lanes...They also indicate that a single-lane urban C-D road segment has about 50 percent fewer crashes than a two-lane urban C-D road segment. ...this trend is due to a significant increase in multiple-vehicle crashes on two-lane entrance ramps and C-D roads, relative to those on single-lane ramps and C-D roads.”

Limitations exist with the current Highway Safety Manual (HSM) methodologies and tools when it comes to quantitatively analyzing the proposed improvements evaluated in this study. For example, the analysis does not quantify the negative safety impact and expected increase in crashes that occur due to spillback from the single lane ramp onto the mainline. It is known through observation that having slow moving or stopped vehicles on the mainline creates significant speed differentials and increases the occurrence of crashes. **Appendix K** provides the inputs and outputs of the qualitative safety analysis.

10.2. Qualitative Safety Analysis

Limitations exist with the current Highway Safety Manual (HSM) methodologies and Enhanced Interchange Safety Analysis Tool (ISATe) when it comes to quantitatively analyzing the proposed improvements evaluated in this study. The Crash Modification Factor (CMF) Clearinghouse was also reviewed but no potentially applicable CMFs were found for the specific improvements proposed. A qualitative safety analysis was conducted to highlight the safety benefits that can be expected with the proposed improvements and provide a full picture of safety impacts proposed as part of this project.

The projected traffic volume along the I-4 westbound off-ramp to eastbound SR 528 is expected to exceed the capacity of a single lane ramp. In an unconstrained network, it would be expected that there would be queue spillback onto the I-4 westbound mainline lanes due to this ramp capacity issue. It is known through observation that having slow moving or stopped vehicles on the mainline creates significant speed differentials and increases the occurrence of crashes. This was found to be true in the I-4 westbound crash data east of the SR 528 off-ramp, where 375 of the 406 crashes were either rear-end, sideswipe, or run off the road related (92 percent).

The widening of the I-4 westbound off-ramp to eastbound SR 528 will provide adequate capacity to accommodate the project traffic demand along the ramp which would mitigate the potential for queue spillback onto the I-4 mainlines and minimize the high-speed differential crash potential along I-4 westbound. The proposed ramp widening would mitigate the potential for high-speed differential rear end, sideswipe, and run off the road crashes due to eliminated spillback onto the I-4 westbound mainline lanes.

With the new two-lane off-ramp to SR 528, vehicles in the far left lane will have to weave across two lanes to access the International Drive exit ramp. The current HSM methodologies cannot analyze this type of weaving configuration, but the microsimulation analysis of the Build scenario shows that the eastbound segment of SR 528 between I-4 and International Drive is not expected to be congested based on the speed and density results in the future year peak hours. Therefore, safety is not anticipated to be negatively impacted along this segment of SR 528 due to the weaving maneuver.

10.3. Comparative Safety Analysis Summary

The following bullets summarize the comparative safety analysis of the Build improvements for the I-4 westbound to SR 528 eastbound ramp:

- **Quantitative Safety Summary –**
 - The Build configuration is predicted to experience more injury and property damage only (PDO) crashes over the 10-year life cycle of the project.
 - The Build condition 2-lane ramp is approximately 600' longer than the No-Build ramp, which directly contributes to approximately 11 more total predicted crashes over the 10-year life cycle (approximately 33% of the total predicted crash increase).
 - It is also common to see 2-lane ramps with a higher crash frequency than a single lane ramp based on research presented in NCHRP 17-45 Safety Prediction Methodology and Analysis Tool for Freeways and Interchanges. It is expected that the quantitative tools available for use would also show an increase in crashes for a two-lane ramp versus a single lane ramp based on the current safety methodologies.
- **Qualitative Safety Summary –** Limitations exist with the current HSM methodologies and ISATe in regard to the following issues:
 - It is known through observation that having slow moving or stopped vehicles on the mainline creates significant speed differentials and increases the occurrence of crashes. This was found to be true in the I-4 westbound crash data east of the SR 528 off-ramp, where 375 of the 406 crashes were either rear-end, sideswipe, or run off the road related (92 percent). The proposed ramp widening would mitigate the potential for high-speed differential rear end, sideswipe, and run off the road crashes due to eliminated spillback onto the I-4 westbound mainline lanes.
 - With the new two lane ramp to SR 528, vehicles in the far left lane will have to weave across two lanes to access the International Drive exit ramp. Current HSM methodologies cannot analyze this type of weaving configuration but the microsimulation analysis of the Build scenario shows that the eastbound segment of SR 528 between I-4 and International Drive is not expected to be congested based on the speed and density results in the future year peak hours. Therefore, safety is not anticipated to be negatively impacted along this segment of SR 528 due to the weaving maneuver.