

## 6.4 Safety Analysis

A brief safety analysis was conducted comparing the No-Action alternative and the recommended Build alternative. The analysis was qualitative and identified crash modification factors (CMFs) or crash reduction factors (CRFs) for the planned improvements, where applicable. The analysis considered the planned improvements as independent sites and an overall safety assessment considering the system as a whole was not performed. Further, the safety analysis does not consider the impacts of changes in traffic volume between the No-Action and Build alternatives. The resources used for this analysis included the following:

- FHWA CMF Clearinghouse
- AASHTO Highway Safety Manual, 2010
- NCHRP Report 500: Guidance for Implementation of the AASHTO Strategic Highway Safety Plan, 2003-2010
- NCHRP Report 687: Guidelines for Ramp and Interchange Spacing, 2013
- Signalized Intersections Informational Guide, FHWA 2013

When compared to the No-Action alternative, several improvements in the recommended Build alternative may reduce crash frequency and severity:

- CD Road system and eliminating an on-ramp to southbound I-95,
- Bike lanes on Cypress Creek Road and Commercial Boulevard,
- Reconstructed I-95 northbound to westbound Cypress Creek Road off-ramp, and
- Intersection improvements at N. Andrews Avenue/Commercial Boulevard – Including bridge over N. Andrews Avenue.

The safety analysis determined that there are no CMFs or CRFs that apply to the proposed improvements other than for the bike lanes on Cypress Creek Road and Commercial Boulevard. The assessment of the proposed improvements is summarized in **Table 6.1** below.

The HSM includes a CMF for prohibiting RTOR that applies to many different single vehicle and multiple vehicle crash types. The CMF does not apply to pedestrian or bicycle crashes. The equation for this CMF is  $0.98^{n_{\text{prohibit}}}$ , which shows that there could be a 2 percent reduction in single vehicle or multiple vehicle crashes at each approach with prohibited RTOR. The CMF Clearinghouse also has a number of three star or better CMFs which show that permitting a right turn on red will increase the number of pedestrian and bicycle crashes at a signalized intersection. Thus, prohibiting right turns on red could reduce the potential for these crashes from occurring.

**Table 6.1. Recommended Build Alternative Safety Analysis**

Improvement	Evaluation	Source
I-95 CD Road System	<p>When there are two consecutive entrance ramps, the expected number of crashes increases as the distance between the two entrance ramps decreases. Extending the distance between two entrance ramps decreases a contributing factor to crashes in this segment.</p> <p>Benefits of separating the consecutive entrance ramps should be considered on balance with higher traffic volumes entering at this location.</p> <p>Qualitative Assessment – May have lower crash frequency or severity in this segment due to fewer geometric contributing factors to crashes in this segment.</p>	<p>NCHRP 687: Guidelines for Ramp and Interchange Spacing, 2011, Page 60</p> <p>No Clearinghouse CMF regarding CD Road system</p>
Reconstructed/Proposed Two-lane Southbound Off-Ramp to Commercial Boulevard with Dual Right Turn Lanes	Qualitative Assessment – Limited negative safety impacts of signalized dual right turn lane as compared to No-Action.	<p>Signalized Intersections, Informational Guide, July 2013; Page 11-29</p> <p>No Clearinghouse CMF regarding dual right turn lanes</p>
Reconstructed/Proposed Two-Lane Southbound On-Ramp from N. Andrews Avenue (Tie into CD Road System)	Qualitative Assessment – No Impacts	No Clearinghouse CMF regarding two lane on-ramp
N. Andrews Avenue/Cypress Creek Road – Proposed Additional Right Turn Lane	Qualitative Assessment – Limited negative safety impacts of dual right turn lane as compared to No-Action.	<p>Signalized Intersections, Informational Guide, July 2013; Page 11-29</p> <p>No Clearinghouse CMF regarding dual right turn lanes</p>
Bike Lanes on Cypress Creek Road	<p>Reduction in bicycle/vehicle crashes on Cypress Creek Road (CMF = approximately 0.40)</p> <p>Qualitative Assessment – Anticipate fewer crashes as compared to No-Action.</p>	<p>FHWA CMF Clearinghouse Install Bike Lanes CMF - ID 7840 CMF = 0.42 vehicle/bicycle crashes, and ID 7841 Install Bike Lanes – 0.40</p>
Reconstructed I-95 Northbound to Westbound Off-Ramp	<p>Converting from free-flow merge to signalized intersection will separate vehicles in time and will eliminate weaving maneuver on Cypress Creek Road.</p> <p>Qualitative Assessment – Anticipate fewer crashes as compared to No-Action.</p>	No Clearinghouse CMF specific to this condition

Improvement	Evaluation	Source
Commercial Boulevard/Powerline Road Intersection Improvements – Including Additional Southbound Left Turn Lane, Additional Westbound Through Lane	<p>Crashes are not expected to significantly increase compared to No-Action with the additional left turn lane on the southbound approach; distribution of crash type may increase with more sideswipe crashes on this approach.</p> <p>There may be fewer sideswipe crashes on westbound approach to the intersection due to removing one left turn lane.</p> <p>Qualitative Assessment – Limited change from No-Action.</p>	<p>Signalized Intersections, Informational Guide, July 2013; Page 11-16</p> <p>No Clearinghouse CMF regarding triple left turn lanes</p>
Reconstruct a Portion of the Existing I-95 Westbound to Southbound Flyover (Transition Two Lanes to One Lane)	Qualitative Assessment – With appropriate design and roadside features limited changes compared to No-Action.	No Clearinghouse CMF specific to this condition
Proposed Triple Right Turn Lanes from NB I-95 to Eastbound Commercial Boulevard	<p>Signalized intersection guide documents that double right turn lanes may operate similarly to single right turn lanes. No research found regarding triple right turn lanes.</p> <p>Qualitative Assessment – Limited change from No-Action.</p>	<p>Signalized Intersections, Informational Guide, July 2013; Page 11-16</p> <p>No Clearinghouse CMF regarding triple right turn lanes</p>
Commercial Boulevard/N. Andrews Avenue Intersection Improvements – Including Bridge Over N. Andrews Avenue, Additional Southbound Left Turn Lane, Additional Eastbound Through Lane	<p>Bridge over N. Andrews Avenue will reduce traffic volume at the intersection, decreasing major variable influencing crash frequency.</p> <p>With appropriate design of receiving lane and signal phasing, dual left turn lanes show no substantive change from single left turns.</p> <p>Qualitative Assessment – Potential decrease in crash frequency due to reduced volume traveling through the intersection at-grade.</p>	<p>Signalized Intersections, Informational Guide, July 2013; Page 11-16</p> <p>No Clearinghouse CMF regarding dual left turn lanes</p> <p>No Clearinghouse CMF regarding grade separation</p>
Bike Lanes on Commercial Boulevard	<p>Reduction in bicycle/vehicle crashes on Commercial Boulevard (CMF = approximately 0.40)</p> <p>Qualitative Assessment – Anticipate fewer crashes as compared to No-Action.</p>	<p>FHWA CMF Clearinghouse Install Bike Lanes CMF - ID 7840 CMF = 0.42 vehicle/bicycle crashes, and ID 7841 Install Bike Lanes – 0.40</p>