SR 9/I-95 at Central Boulevard/PGA Boulevard

FDOT FM No.: 413265-1-32-01

Interchange Justification Report (IJR) Re-Evaluation (Ramp A)

Project Study Limits:
from the Military Trail (SR 809) partial interchange to the existing Donald Ross Road interchange
Palm Beach County, Florida

Prepared for:

FDOT District Four
3400 West Commercial Boulevard
Fort Lauderdale, FL 33309

January 2021

Interchange Justification Report (IJR)

I-95 at Central Boulevard/PGA BOULEVARD

INTERCHANGE JUSTIFICATION REPORT (IJR) RE-EVALUATION

FM No.: 413265-1-22-01

Florida Department of Transportation

Determination of Safety, Operational and Engineering Acceptability

Acceptance of this document indicates successful completion of the review and determination of safety, operational and engineering acceptability of the Interchange Access Request. Approval of the access request is contingent upon compliance with applicable Federal requirements, specifically the National Environmental Policy Act (NEPA) or Department's Project Development and Environment (PD&E) Procedures. Completion of the NEPA/PD&E process is considered approval of the project location design concept described in the environmental document.

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SYSTEMS IMPLEMENTATION OFFICE

QUALITY CONTROL CERTIFICATION FOR INTERCHANGE ACCESS REQUEST SUBMITTAL

Submittal Date: 11/11/2020

FM Number: 413265-1-22-01

Project Title: I-95 at Central Boulevard/PGA Boulevard Interchange Justification Report (IJR) Re-Evaluation

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Document Type: ☐ MLOU ☒ IJR ☐ IMR ☐ IOAR ☐ OTHER IJR Re-Evaluation

Status of Document (Only complete documents will be submitted for review; however, depending on the complexity of the project, interim reviews may be submitted as agreed upon in the MLOU)

The I-95 at Central Boulevard/PGA Boulevard IJR Re-Evaluation document is complete.

Quality Control (QC) Statement

This document has been prepared following FDOT Procedure Topic No. 525-030-160 (New or Modified Interchanges) and complies with the FHWA two policy requirements. Appropriate District level quality control reviews have been conducted and all comments and issues have been resolved to their satisfaction. A record of all comments and responses provided during QC review is available in the project file or Electronic Review Comments (ERC) system.

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1. INTRODUCTION

In 2015, the Florida Department of Transportation evaluated a new interchange access connection to I-95 at Central Boulevard in Palm Beach County, Florida. Currently, Central Boulevard crosses over, but does not provide access to, I-95. The proposed interchange project will improve regional mobility in northern Palm Beach County and provide congestion relief to adjacent interchanges. At the time of the original interchange justification report (IJR), an interchange at this location was in the 2035 LRTP Needs Plan, as well as the 2040 LRTP Cost Feasible Plan. Ultimately, the I-95 at Central Boulevard IJR was approved by Federal Highway Administration (FHWA) in November 2015.

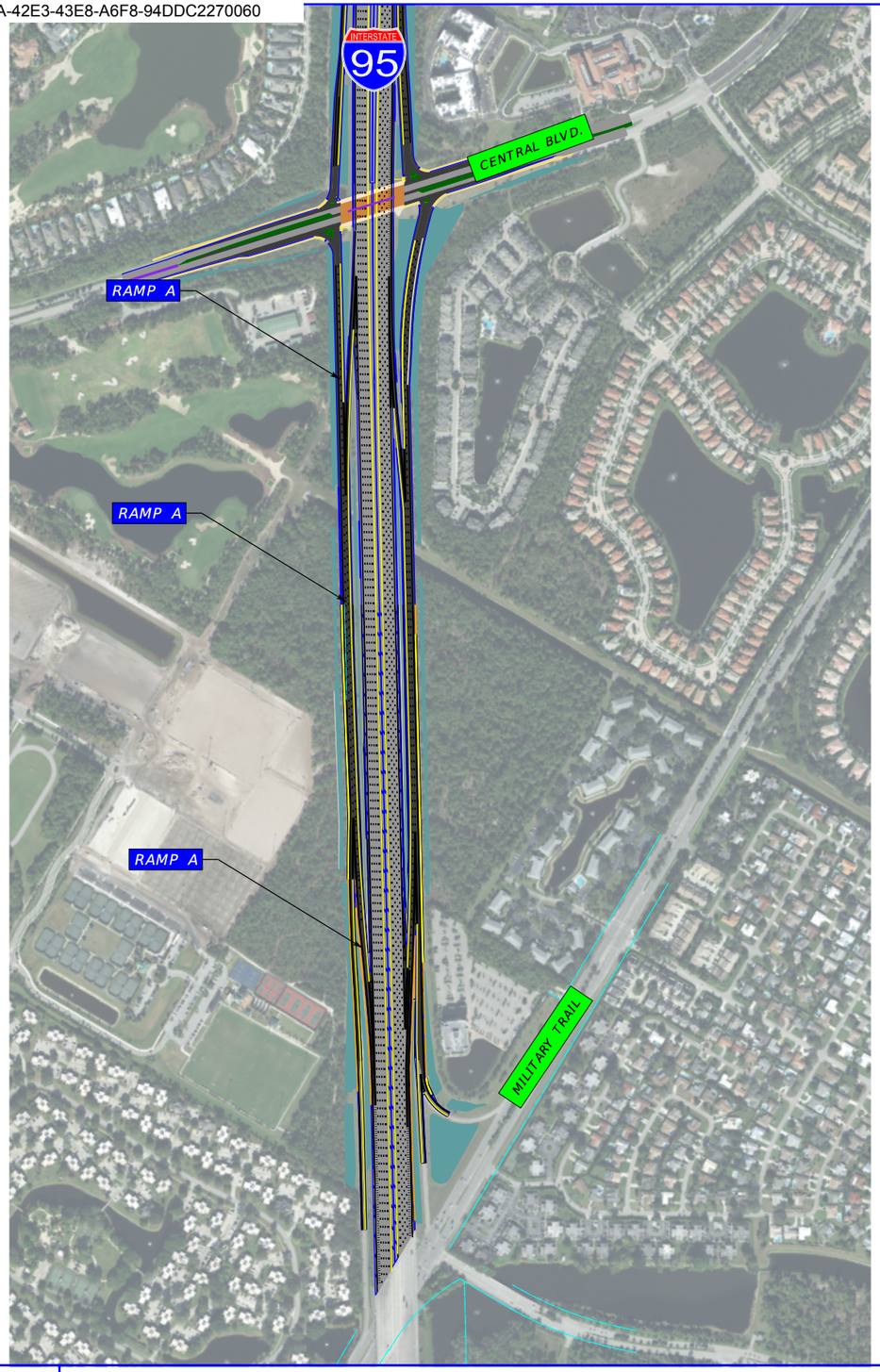
The proposed Central Boulevard interchange is approximately one mile north of the existing SR 809/Military Trail partial interchange, and two miles south of the existing Donald Ross Road interchange. The project location is depicted in **Figure 1**.

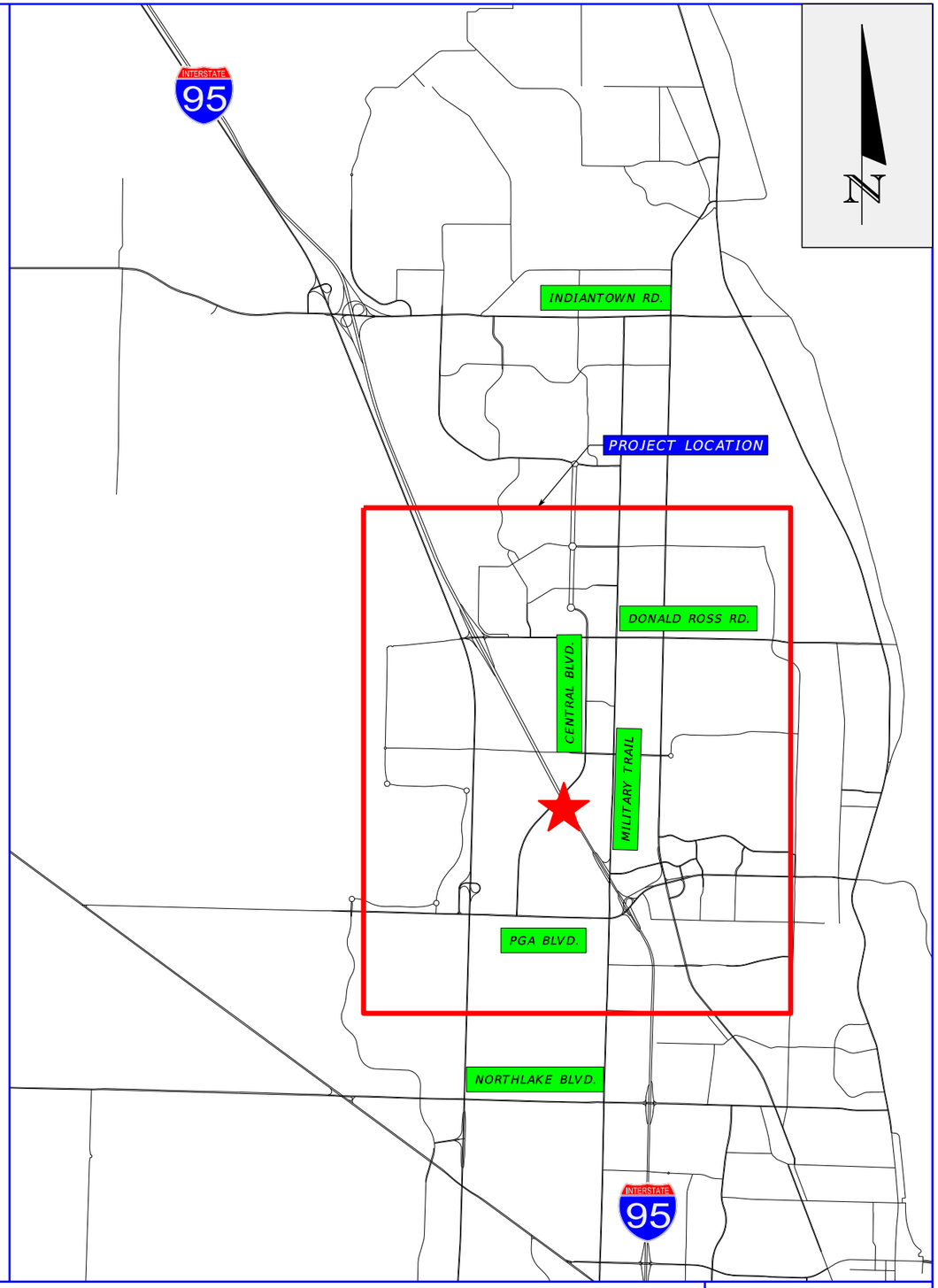
As the interchange proceeded into the design phase, a design modification to the I-95 southbound on-ramp from the proposed new interchange (identified as Ramp A) was recommended primarily to address safety concerns. The approved 2015 design concept includes a tapered merge lane along I-95 that may not be desirable from a safety perspective. In the proposed redesign of Ramp A, this tapered merge lane is eliminated providing a safer merge condition. As a result, a re-evaluation of the IJR was needed.

This proposed design modification involves merging the two lanes on Ramp A to a single lane prior to drivers entering the weaving section on southbound I-95 between Central Boulevard and PGA Boulevard. It is intended to provide a safer merge and weaving condition for drivers attempting to enter the I-95 southbound traffic flow from Ramp A. No other geometric modifications are proposed to the interchange design or arterial network.

The analysis will focus on the two-lane portion of Ramp A south of where Ramp A1 diverges, including the section of Ramp A that reduces to a single lane and where Ramp A joins with southbound I-95 to form a weaving section between Central Boulevard and PGA Boulevard. A schematic of the original design for Ramp A, known herein as the No Build condition, is included in Appendix A.

All work for the redesign of the ramp is contained within the current interchange footprint. Therefore, there will be no additional environmental impacts resulting from the proposed design modifications. This report provides a traffic operations and safety analysis of the proposed modified design concept of Ramp A.





FDOT

SR 9/I-95 at PGA Boulevard/Central Boulevard Interchange Justification Report

Project Location Map

FIGURE 1

2. DESIGN ALTERNATIVE

This document is intended to present the geometric design concepts under consideration for the proposed redesign of Ramp A along with the associated operational and safety analyses. The proposed Build alternative is analyzed in the IJR Re-Evaluation, where the approved 2015 IJR design concept will serve as the No Build condition for comparison purposes. The proposed design change will be evaluated to determine if it meets the purpose and need of the project and performs equal to or better than the approved 2015 IJR design concept.

2.1 Approved 2015 Design Plan (No Build Condition)

The 2015 IJR design for Ramp A is illustrated in Appendix A. Noted in this document as the No Build condition, Ramp A consists of three lanes and functions as a collector-distributor facility upstream of Ramp A1 (which leads to PGA Boulevard). Ramp A then diverges towards southbound I-95 as a two-lane ramp for its entire length. At the gore of the ramp, the inside lane of Ramp A terminates, while the outside lane joins I-95 as an added auxiliary lane, creating a 6-lane typical section downstream of the merge point. This creates a weaving section on southbound I-95 between PGA Boulevard and Central Boulevard.

2.2 Proposed Redesign Plan for Ramp A

Ramp A Lane Reduction - The proposed modification to Ramp A involves narrowing the southbound on-ramp from 2 lanes to 1 lane before Ramp A enters into the weaving section on I-95 southbound between PGA Boulevard and Central Boulevard. The proposed laneage of Ramp A is illustrated in Appendix B. This design change is expected to improve safety and traffic operations within I-95 southbound mainline; the weaving section; and on Ramp A.

Under the proposed design change, Ramp A remains as a three-lane collector-distributor (C-D) facility prior to the diverge to Ramp A1 (which leads to PGA Boulevard). Ramp A then continues towards southbound I-95 as a two-lane ramp for approximately 535 feet. At this location, Ramp A tapers to a single lane for approximately 600 feet where it joins southbound I-95 as an auxiliary lane creating a six-lane typical section downstream of the merge point. At this location, a weave section exists along southbound I-95.

3. TRAVEL DEMAND FORECAST – RAMP A

Per FDOT's Interchange Access Request (IAR) User's Guide dated September 2020, the validity of traffic volumes must be confirmed when performing a re-evaluation to determine if a significant change in traffic conditions is anticipated. Therefore, the validity of the traffic forecast from the 2015 IJR was reviewed by comparing the 2020 AM and PM peak hour forecasts for southbound I-95 between PGA Boulevard and Donald Ross Road (which represents the area that includes Ramp A) against the most recent historical traffic counts from 2015 through 2019. The comparison is summarized in **Table 1**.

Existing year 2020 counts were unavailable for southbound I-95 between PGA Boulevard and Donald Ross Road (FDOT Station 93-2214) due to the temporary suspension of data collection during the COVID-19 pandemic, as approved in the Methodology Letter of Understanding (MLOU). As a result, 2020 volumes were estimated based on a conservative historical growth rate of 1.0%. This growth rate was applied to the largest valid peak hour volume counted during the past five years to estimate 2020 peak hour, peak direction volumes. These estimated peak hour directional volumes were then compared against the approved IJR forecast of 2020 conditions on southbound I-95.

The approved 2015 IJR forecast of southbound I-95 between PGA Boulevard and Donald Ross Road for 2020 was determined to be considerably less than 2019 peak hour counts and estimated 2020 peak hour volumes. The originally approved forecasted volume for southbound I-95 was 5,530 vehicles per hour (vph) during the AM peak and 3,899 vph during the PM peak. However, the estimated 2020 peak hour directional volume on southbound I-95 is 7,251 vph in the morning and 4,733 vph during the afternoon. Because of the discrepancy between the approved forecast and the traffic volume counts, a volume adjustment factor is necessary to operationally analyze the design modifications to Ramp A.

Since forecasts for the future AM peak hour and PM peak hour were developed separately as part of the approved 2015 IJR, a separate volume adjustment factor was prepared for each peak period. A review of the forecast discrepancies summarized in **Table 1** indicate that the current volume on southbound I-95 during the AM peak hour is 31% greater than the original forecast. Similarly, the current volume on southbound I-95 during the PM peak hour is 21% greater than the original forecast. Therefore, the AM and PM peak hour volumes will be adjusted by 1.31 and 1.21, respectively.

For purpose of evaluating the design modification to Ramp A, these factors were only applied to the 2040 AM and PM peak hour projections of southbound I-95 between PGA Boulevard and

Central Boulevard from the approved 2015 IJR. Arterial roadway and intersection turning movement projections from the approved 2015 IJR outside of the I-95 study segment were not subject to a volume adjustment factor because they were not analyzed. A graphical depiction of the 2040 AM and PM peak hour traffic projections used for this IJR Re-Evaluation is provided on **Figure 2**.

TABLE 1

SOUTHBOUND I-95 & RAMP 'A' TRAFFIC VOLUME ADJUSTMENT FACTOR ANALYSIS

I-95 AT CENTRAL BLVD IJR RE-EVALUATION

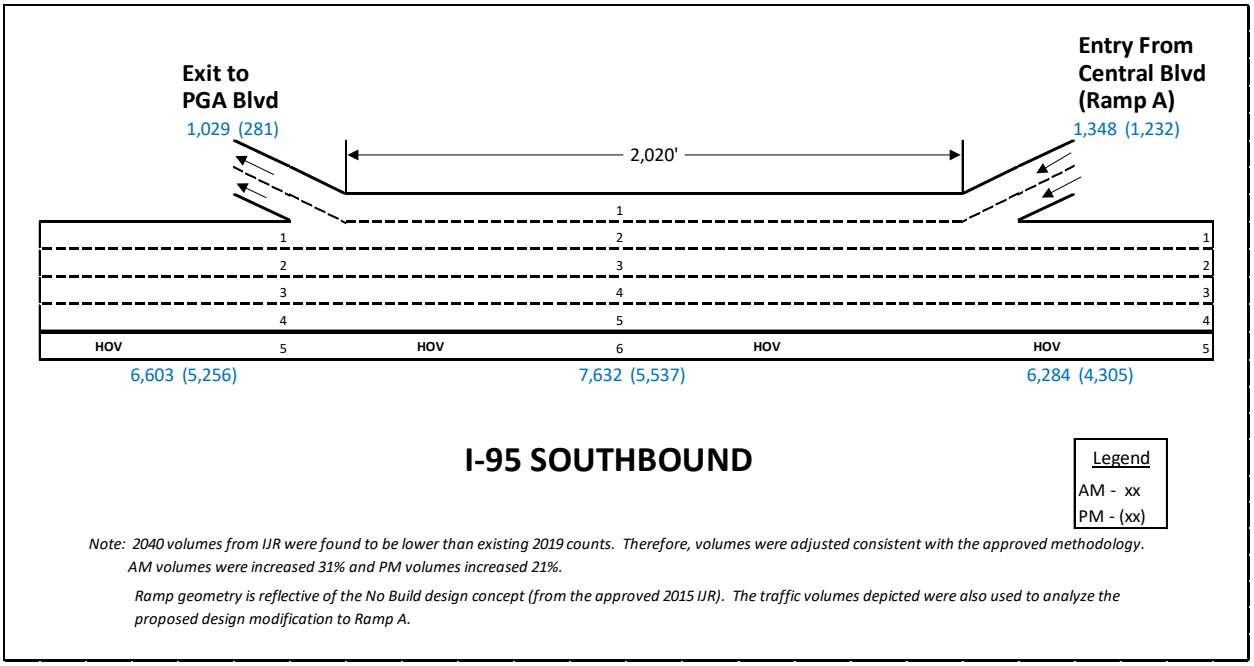
		SB I-95	SB I-95	SB I-95
I-95 between PGA Blvd and Donald Ross Rd	Year	AADT	AM Peak	PM Peak
	2015	63,405	7,112	3,982
	2016	72,751	8,495	4,585
	2017	70,113	7,026	4,686
	2018*	71,200	2,561	6,080
	2019	66,100	7,179	4,222
	2020**		7,251	4,733
2020 (volume projection from approved 2015 IJR - No Build)		n/a	5,530	3,899
Volume Adjustment Factor			*1.31*	*1.21*

Source: FDOT Count Site #93-2214

** 2018 peak hour traffic count is anomalous and inconsistent with historical travel patterns. As a result, it was discounted in developing a volume adjustment factor.*

*** Estimated 2020 volumes based on a conservative historical growth rate of 1.0% of SB I-95 during the AM peak hour from 2015 to 2019. This growth rate was applied to the largest valid peak hour volume counted during the past five years. to estimate 2020 peak hour, peak direction volumes to compare against the approved IJR forecast for 2020.*

Figure 2
Adjusted 2040 Traffic Volume Forecast – Ramp A Weaving Section



Note: 2040 volumes from IJR were found to be lower than existing 2019 counts. Therefore, volumes were adjusted consistent with the approved methodology. AM volumes were increased 31% and PM volumes increased 21%.

Ramp geometry is reflective of the No Build design concept (from the approved 2015 IJR). The traffic volumes depicted were also used to analyze the proposed design modification to Ramp A.

4. TRAFFIC OPERATONS ANALYSIS

Operations analyses for Ramp A were conducted based on procedures described in the Highway Capacity Manual, 6th Edition. They are consistent with the approach summarized in the MLOU, which was approved on July 10, 2020. The analyses are based on the lane configurations for Ramp A as depicted in **Appendices A and B**, and traffic volumes used for the analysis are consistent with **Figure 2**. In addition, the operations analysis utilized the following approved factors, which are consistent with those used in the 2015 IJR:

- Peak Hour factor = 0.95 for all time periods
- % Trucks in peak period = 3.7%
- One-lane ramp capacity = 2,100 pc/h (per HCM 6th Edition for ramp speed 40 – 50 mph)
- Two-lane ramp capacity = 4,200 pc/h (per HCM 6th Edition for ramp speed 40 – 50 mph)

For the No Build condition and the proposed geometric changes to Ramp A, ramp roadway and weaving analyses were conducted in accordance with HCM 6th Edition. Detailed results from the HCS analyses are presented in **Appendix C**, while the results are summarized in **Table 2**.

4.1 Level of Service Targets

FDOT Policy Topic No. 000-525-006c provides Level of Service (LOS) targets for the State Highway System based on the area type. The policy states:

> "*It is the Department's intent to plan, design and operate the State Highway System at an acceptable level of service for the traveling public. The automobile mode level of service targets for the State Highway System during peak travel hours are "D" in urbanized areas and "C" outside urbanized areas. The Department shall work with local governments to establish appropriate level of service targets for multimodal mobility and system design. The targets shall be responsive to all users, for context, roadway function, network design, and user safety."*

The I-95 corridor is part of the National and State Highway System and is located within an area that is considered urbanized. LOS D is the target to attain for the operational analyses of roadways within urbanized areas.

4.2 Operations Analysis for Approved 2015 Design Plan (No Build Condition)

The results from the operational weaving analysis show that the approved 2015 design configuration for Ramp A will operate at an acceptable level of service through 2040. The

southbound I-95 weaving section between Central Boulevard and PGA Boulevard is projected to operate at Level of Service (LOS) C during the 2040 AM peak hour and LOS B during the 2040 PM peak hour.

Future adjusted 2040 peak hour volumes indicate that the capacity for a two-lane ramp (4,200 passenger cars per hour) is adequate to accommodate the forecasts traffic volumes. As a result, Ramp A configured as a two-lane ramp under this No Build condition will operate acceptably through 2040. These findings are consistent with the approved 2015 IJR.

4.3 Operations Analysis for Proposed Redesign Plan for Ramp A

The operational weaving analysis of southbound I-95 between Central Boulevard and PGA Boulevard assuming the proposed lane reduction on Ramp A to a single lane was performed. Results indicate that weaving segment with the proposed design change to Ramp A will operate at an acceptable level of service through 2040, as summarized in **Table 2**.

Operational analyses reveal the weaving section will function at LOS C during the 2040 AM peak hour and LOS B during the 2040 PM peak hour. Vehicular densities within the weaving section are slightly greater given the proposed design modification as compared to the No Build condition. Also, estimated travel speeds in the weaving section will be modestly reduced as compared to the No Build configuration. However, speeds will continue to meet level of service targets through 2040. Volume-to-capacity ratios are projected to be below 1.0 for both the 2040 AM and PM peak hours, although this weaving section will be approaching its capacity threshold (particularly during the 2040 AM peak period).

The future adjusted 2040 peak hour volumes, given Ramp A tapers to a single lane prior to the gore area, were compared against the capacity for a single-lane ramp (2,100 passenger cars per hour). Results indicate that the traffic volume projections on Ramp A will not exceed the capacity of a single-lane ramp. Therefore, Ramp A will operate acceptably through 2040 if configured as a single lane.

Table 2
Weaving Analysis Summary (2040 Conditions)

Scenarios	Period	Density (pc/mi/ln)	Level of Service (LOS)	Speed (mi/h)	Volume-to-Capacity Ratio
No-Build	**AM**	22.3	C	62.2	0.68
	PM	15.8	B	63.9	0.45
Build	**AM**	25.8	C	53.9	0.99
	PM	18.1	B	55.8	0.66

Note: No Build condition represents the approved 2015 IJR design for Ramp A, which is for a 2-lane typical section. Build scenario is the proposed design modification to narrow Ramp A to 1 lane prior to the gore area.

5. SAFETY ANALYSIS

Although the new interchange on I-95 at Central Boulevard is not constructed at this time, a historical crash analysis was conducted to determine the types of crashes that occurred along the subject section of I-95. The last five years of available crash data (2013 through 2017) were obtained from the FDOT Crash Analysis Reporting System (CARS) on I-95 from south of PGA Boulevard to north of Central Boulevard. This includes the portion of interstate where Ramp A is proposed to be built. **Table 3** summarizes the observed crashes along these limits of I-95.

The number of crashes, crash types, severity, lighting conditions, surface conditions, when the crashes occurred, contributing causes, and weather conditions were all summarized in crash summary tables. The safety analyses is included in **Appendix D**.

A total of 78 crashes were reported within the study area during the five-year period. There were 21 crashes reported in 2013, 16 crashes in 2014, 9 crashes in 2015, 20 crashes in 2016, and 12 crashes in 2017. There were 31 crashes (or 40%) that involved injuries and no fatal crashes reported.

There were 48 (or 61%) reported crashes that occurred during daylight conditions and 41 (or 52%) reported crashes that occurred under dry surface conditions.

Overall, the leading crash type was Fixed Object, with 37 (or 47%) crashes reported for the five-year period. There were 11 Sideswipe crashes and 11 Sideswipe crashes reported during the 5-year period.

Table 3
Crash Summary of I-95 from South of PGA Boulevard to North of Central Boulevard

I-95		Number of Crashes Year					5 Year Total Crashes	Mean Crashes Per Year	%
		2013	2014	2015	2016	2017			
CRASH TYPE	Rear End	2	3	2	1	3	11	2	14.1%
	Head On	0	0	0	0	0	0	0	0.0%
	Angle	2	1	1	2	0	6	1	7.7%
	Left Turn	0	0	0	0	0	0	0	0.0%
	Right Turn	0	0	0	0	0	0	0	0.0%
	Sideswipe	4	2	1	3	1	11	2	14.1%
	Backed Into	0	0	0	0	0	0	0	0.0%
	Pedestrian	1	0	0	0	0	1	0	1.3%
	Bicycle	0	0	0	0	0	0	0	0.0%
	Fixed Object	*10*	*10*	*1*	*11*	*5*	*37*	*7*	*47.4%*
	Concrete Traffic Barrier	9	8	1	8	4	30	6	38.5%
	Tree (Standing)	0	1	0	2	0	3	1	3.8%
	Traffic Sign Support	0	0	0	1	0	1	0	1.3%
	Other Non Fixed Object Collisions	*1*	*0*	*1*	*2*	*1*	*5*	*1*	*6.4%*
	Parked Motor Vehicle	0	0	0	0	1	1	0	1.3%
	Struck by Falling/Shifting Cargo	1	0	0	0	0	1	0	1.3%
	Other Non-Fixed Object	0	0	1	2	0	3	1	3.8%
	Non-Collisions	*1*	*0*	*1*	*0*	*2*	*4*	*1*	*5.1%*
	Overturn/Rollover	0	0	1	0	1	2	0	2.6%
	Cargo/Equipment Loss or Shift	1	0	0	0	1	2	0	2.6%
	Others	0	0	2	1	0	3	1	3.8%
	Total Crashes	**21**	**16**	**9**	**20**	**12**	**78**	**16**	**100.0%**
SEVERITY	PDO Crashes	11	12	5	12	7	47	9	60.3%
	Fatal Crashes	0	0	0	0	0	0	0	0.0%
	Injury Crashes	10	4	4	8	5	31	6	39.7%
LIGHTING CONDITIONS	Daylight	16	9	5	12	6	48	10	61.5%
	Dusk	0	1	0	0	1	2	0	2.6%
	Dawn	0	0	1	0	0	1	0	1.3%
	Dark	5	6	3	8	5	27	5	34.6%
	Unknown	0	0	0	0	0	0	0	0.0%
SURFACE CONDITIONS	Dry	11	6	4	13	7	41	8	52.6%
	Wet	10	10	5	7	5	37	7	47.4%
	Others	0	0	0	0	0	0	0	0.0%

The study section of I-95 where Ramp A is proposed was evaluated using the Interactive Highway Safety Design Model (IHSDM). The IHSDM 2019 Release, 15.0.0 implements the Predictive Method of the Highway Safety Manual (HSM). The IHSDM Crash Prediction Module (CPM) estimates the frequency of crashes expected on a roadway when considering its geometric design and traffic characteristics.

The HSM Predictive Method utilizes Safety Performance Functions (SPFs) to estimate the predicted number of crashes for a facility given its roadway characteristics and traffic volume. The I-95 facility was modeled for a length of approximately 3,800 feet (0.72 mi). The analysis limits are 500 feet south of the PGA Boulevard interchange and extend 3,300 feet north of the proposed Central Boulevard interchange. This area includes Ramp A under both the No Build condition and the proposed redesign.

The predictive safety analysis was conducted based on the characteristics of the I-95 study segment and Ramp A, which represent inputs for the analysis. The area is urban, and I-95 is a divided multi-lane freeway with a non-traversable median. For the purposes of this safety analysis, the travel speed on I-95 is presumed to be consistent with a limited access facility. Further, the HSM methodology does not include high occupancy vehicle (HOV) lane in its procedures. Therefore, the I-95 segment was modeled as a four-lane section in each direction and based on the projected 2040 traffic volume projections included in this report.

An estimate of the predicted number of crashes to occur between 2020 and 2040 was prepared for both the No Build condition and the proposed redesign (Build scenario) of Ramp A. **Table 4** summarizes the predicted crash results per the HSM Predictive Method. Findings indicate that if no design changes are made to Ramp A, there will be a cumulative total of 649.52 predicted crashes for the 20-year period. Of this total, 197.11 crashes will be injury and fatal crashes and 452.42 will be property damage only crashes.

If the improvements to Ramp A are implemented as described herein, the safety analysis predicts that a slight decrease will occur in the number of crashes reported. Results indicate that the Build scenario will generate a cumulative total of 593.57 crashes between 2020 and 2040, 183.95 fatal and injury crashes, and 409.62 property damage only crashes. Overall, the Build improvements will result in 55.95 fewer total crashes within the 20-year analysis period, while fatal and injury crashes will be reduced by 13.16 crashes during the same timeframe. The predictive safety analysis worksheets are included in **Appendix D**.

Table 4
Predictive Crash Analysis Comparison between 2020 and 2040

	2020 - 2040		
	Total Expected Crashes	**Fatal and Injury Crashes**	**Property Damage Only Crashes**
No Build Scenario	649.52	197.11	452.42
Build Scenario	593.57	183.95	409.62
Net Difference	*-55.95*	*-13.16*	*-42.80*

Note: Based on Interactive Highway Safety Design Model (IHSDM) Crash Prediction Method, per Highway Safety Manual

Overall, the approved 2015 design concept includes a sudden tapered merge condition on the inside of southbound I-95 that is not desirable from a safety perspective. It creates a high risk for collisions involving traffic merging onto I-95. Drivers occupying the inside lane of the two-lane ramp would be unexpectedly confronted with a sudden lane drop as they are accelerating along the ramp. Potential conflicts would exist on both sides of the vehicle, requiring the driver to immediately merge with traffic from either the I-95 mainline or the second lane of Ramp A. No recovery area for drivers occupying the inside lane of Ramp A is provided under the approved 2015 design concept.

In the proposed redesign of Ramp A, this tapered merge lane that creates an unexpected maneuver is eliminated thereby providing a safer merge condition. Drivers in the outside lane of Ramp A merge to a single lane in advance of the gore area, rather than encounter a sudden lane drop on the inside of Ramp A at the gore. In a challenging driving environment, the proposed design modification to Ramp A represents a safer condition as the driver has the entire weaving section to find an accommodating gap along southbound I-95; only faces conflicting vehicles on one side; and enjoys a recovery area.

6. ENVIRONMENTAL CONSIDERATIONS

All construction for the redesign of Ramp A is to the inside of the ramp. Although there would be no additional environmental impacts resulting from the proposed design modifications, the proposed design modification will be processed as part of the design re-evaluation process.

7. RELATED PLANS AND PROJECTS

Metropolitan Planning Organization Plans

The Palm Beach Transportation Planning Agency (TPA) has identified in its 2045 Long Range Transportation Plan (LRTP) the construction of a new interchange at I-95 and Central Boulevard. Engineering and right-of-way phases are funded in the first five years of the plan (2020 through 2024), while construction may occur in the second five-year planning horizon (2025 through 2030).

County and Local Agency Plans and Projects

There are no identified local roadway improvements in the current Capital Improvement Program (CIP) related to Ramp A within the study area.

Department Plans and Projects

The current FDOT 5-Year Work Program includes the new interchange at I-95 and Central Boulevard (Financial Project ID: 413265-1). This project has funding programmed for design and right-of-way activities beginning in fiscal year 2021.

8. PROJECT SCHEDULE AND FUNDING

The proposed interchange improvements, identified as FDOT Project No. 413265-1, are included in the Departments' 5-Year Work Program. Design and right-of-way acquisition are currently programmed and funded by FDOT. Construction of the new interchange is currently unfunded but is a candidate project for 2029.

9. ASSESSMENT OF FHWA's POLICY ON ACCESS TO INTERSTATE SYSTEM

The FHWA's Policy on Access to the Interstate System provides considerations and requirements that must be met in order for proposed changes in access to the Interstate System to be approved. The current policy went into effect on May 22, 2017. The responses provided herein for both of the policy points demonstrate compliance with these requirements and justification for the proposed design modifications to Ramp A at I-95 and Central Boulevard in Palm Beach County, Florida.

Policy

It is in the national interest to preserve and enhance the Interstate System to meet the needs of the 21st Century by assuring that it provides the highest level of service in terms of safety and mobility. Full control of access along the Interstate mainline and ramps, along with control of access on the crossroad at interchanges, is critical to providing such service. Therefore, the Federal Highway Administration's (FHWA) decision to approve new or revised access points to the Interstate System under Title 23, United States Code (U.S.C.), Section 111, must be supported by substantiated information justifying and documenting that decision. The FHWA's decision to approve a request is dependent on the proposal satisfying and documenting the following requirements.

Considerations and Requirements

1. *An operational and safety analysis has concluded that the proposed change in access does not have a significant adverse impact on the safety and operation of the Interstate facility (which includes mainline lanes, existing, new, or modified ramps, and ramp intersections with crossroad) or on the local street network based on both the current and the planned future traffic projections. The analysis should, particularly in urbanized areas, include at least the first adjacent existing or proposed interchange on either side of the proposed change in access (Title 23, Code of Federal Regulations (CFR), paragraphs 625.2(a), 655.603(d) and 771.111(f)). The crossroads and the local street network, to at least the first major intersection on either side of the proposed change in access, should be included in this analysis to the extent necessary to fully evaluate the safety and operational impacts that the proposed change in access and other transportation improvements may have on the local street network (23 CFR 625.2(a) and 655.603(d)). Requests for a proposed change in access should include a description and assessment of the impacts and ability of the proposed changes to safely and efficiently collect, distribute, and accommodate traffic on the Interstate facility, ramps, intersection of ramps with crossroad, and local street network (23 CFR 625.2(a) and 655.603(d)). Each request should also include a conceptual plan of the type and location of the signs proposed to support each design alternative (23 U.S.C. 109(d) and 23 CFR 655.603(d)).*

The operational and safety analysis documented within this IJR re-evaluation demonstrates that the proposed design modification does not have an adverse impact on the safety and operation of the Interstate facility through the design year (2040). No geometric changes are proposed to the I-95 mainline as part of this project. The design modification involves the I-95 southbound on-ramp from the proposed new interchange (identified as Ramp A). It will merge the two lanes on Ramp A to a single lane prior to drivers entering the weaving section on southbound I-95 between Central Boulevard and PGA Boulevard.

The HCM analyses indicate that the design modifications to Ramp A will still permit the weaving section on southbound I-95 to operate at acceptable levels of service during the 2040 AM and PM peak hours. The weaving section will function at LOS C during the 2040 AM peak hour and LOS B during the 2040 PM peak hour. Vehicular densities within the weaving section are slightly greater given the proposed design modification as compared to the 2015 IJR design of Ramp A (otherwise known as the No Build condition). Also, estimated travel speeds in the weaving section will be modestly reduced as compared to the No Build configuration. Volume-to-capacity ratios are projected to be below 1.0 for both the 2040 AM and PM peak hours.

The future adjusted 2040 peak hour volumes, given Ramp A tapers to a single lane prior to the gore area, were compared against the capacity for a single-lane ramp (2,100 passenger cars per hour). Results indicate that the traffic volume projections on Ramp A will not exceed the capacity of a single-lane ramp. Therefore, Ramp A will operate acceptably through 2040 if configured as a single lane.

From a safety perspective, the approved 2015 design concept includes a sudden tapered merge condition on the inside of southbound I-95 that is not desirable from a safety perspective. It creates a high risk for collisions involving traffic merging onto I-95. In the proposed redesign of Ramp A, this tapered merge lane is eliminated providing a safer merge condition. Drivers in the outside lane of Ramp A merge to a single lane in advance of the gore area, rather than encounter a sudden lane drop on the side of Ramp A at the gore. In a challenging environment, the proposed design modification to Ramp A represents a safer condition.

To quantify the safety impact associated with the proposed design change, the HSM Predictive Method was utilized to conduct a comparative assessment of the proposed design modification to Ramp A with the No Build condition. The I-95 facility was modeled for a length of approximately 3,800 feet (0.72 mi), from 500 feet south of the PGA Boulevard interchange to 3,300 feet north of the proposed Central Boulevard interchange.

An estimate of the predicted number of crashes to occur between 2020 and 2040 was prepared for both the No Build condition and the proposed redesign (Build scenario) of Ramp A. Findings indicate that if no design changes are made to Ramp A, there will be a cumulative total of approximately 649 predicted crashes for the 20-year period. Of this total, about 197 crashes will be injury and fatal crashes and 452 will be property damage only crashes.

If the improvements to Ramp A are implemented as described herein, the safety analysis predicts that a slight decrease will occur in the number of crashes reported. Results indicate the proposed design modification to Ramp A will result in approximately 55 fewer total crashes within the 20-

year analysis period, while fatal and injury crashes will be reduced by about 13 crashes during the same timeframe. These quantitative results indicate that the proposed design change will improve safety within the transportation network.

The conceptual design change to Ramp A and the corresponding signing and marking plan is included in **Appendix B** of this IJR Re-Evaluation. The signing and marking plans incorporate all required new and modified signs identifying the access to the Interstate for drivers.

2. *The proposed access connects to a public road only and will provide for all traffic movements. Less than "full interchanges" may be considered on a case-by-case basis for applications requiring special access, such as managed lanes (e.g., transit or high occupancy vehicle and high occupancy toll lanes) or park and ride lots. The proposed access will be designed to meet or exceed current standards (23 CFR 625.2(a), 625.4(a)(2), and 655.603(d)). In rare instances where all basic movements are not provided by the proposed design, the report should include a full-interchange option with a comparison of the operational and safety analyses to the partial-interchange option. The report should also include the mitigation proposed to compensate for the missing movements, including wayfinding signage, impacts on local intersections, mitigation of driver expectation leading to wrong-way movements on ramps, etc. The report should describe whether future provision of a full interchange is precluded by the proposed design.*

The proposed design change to Ramp A at the I-95 and Central Boulevard interchange will preserve all access connection between public roads, as well as all the existing traffic movements, per the previously approved 2015 design for Ramp A (i.e. No Build concept). This improvement will be designed using the latest design and safety criteria which will meet or exceed the current FDOT and FHWA Design Standards for the Interstate system.

10. CONCLUSIONS AND RECOMMENDATIONS

The analysis performed herein demonstrates that the proposed redesign of Ramp A is expected to maintain acceptable traffic operations compared to the current approved design, while enhancing safety. The proposed redesign of Ramp A is expected to provide adequate capacity through 2040. Furthermore, the proposed redesign is expected to provide adequate capacity for the weaving section of southbound I-95 between Central Boulevard and PGA Boulevard through 2040. Predictive safety analysis indicates that the proposed redesign of Ramp A will result in fewer total crashes and fewer injury and fatal crashes as compared to the current design. **Based on these findings it is recommend that the Department move forward with the implementation of the proposed redesign of Ramp A.**

APPENDICES:

Appendix A: Schematic of Ramp A – No Build

Appendix B: Schematic of Ramp A – Proposed Design Change and Signing & Marking Concept

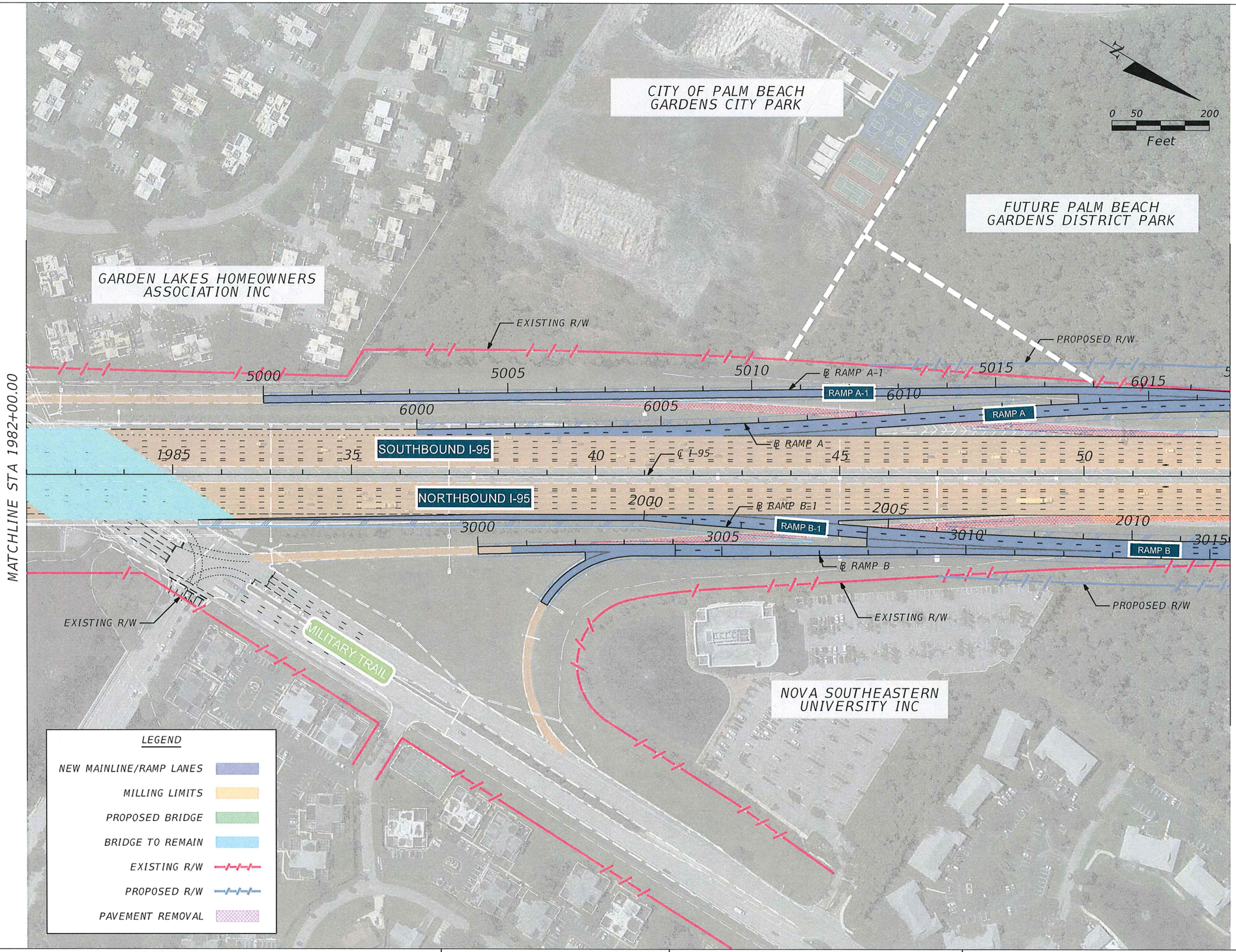
Appendix C: Traffic Operations Analysis

Appendix D: Safety Analysis

Appendix E: Methodology Letter of Understanding

Appendix A

Schematic of Ramp A - No Build



REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

SR 9/I-95 AT CENTRAL BLVD. INTERCHANGE PD&E STUDY

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 9	PALM BEACH	413265-1-22-01

I-95 FROM PGA BLVD. TO DONALD ROSS RD. (ALT 2)

SHEET NO. 2

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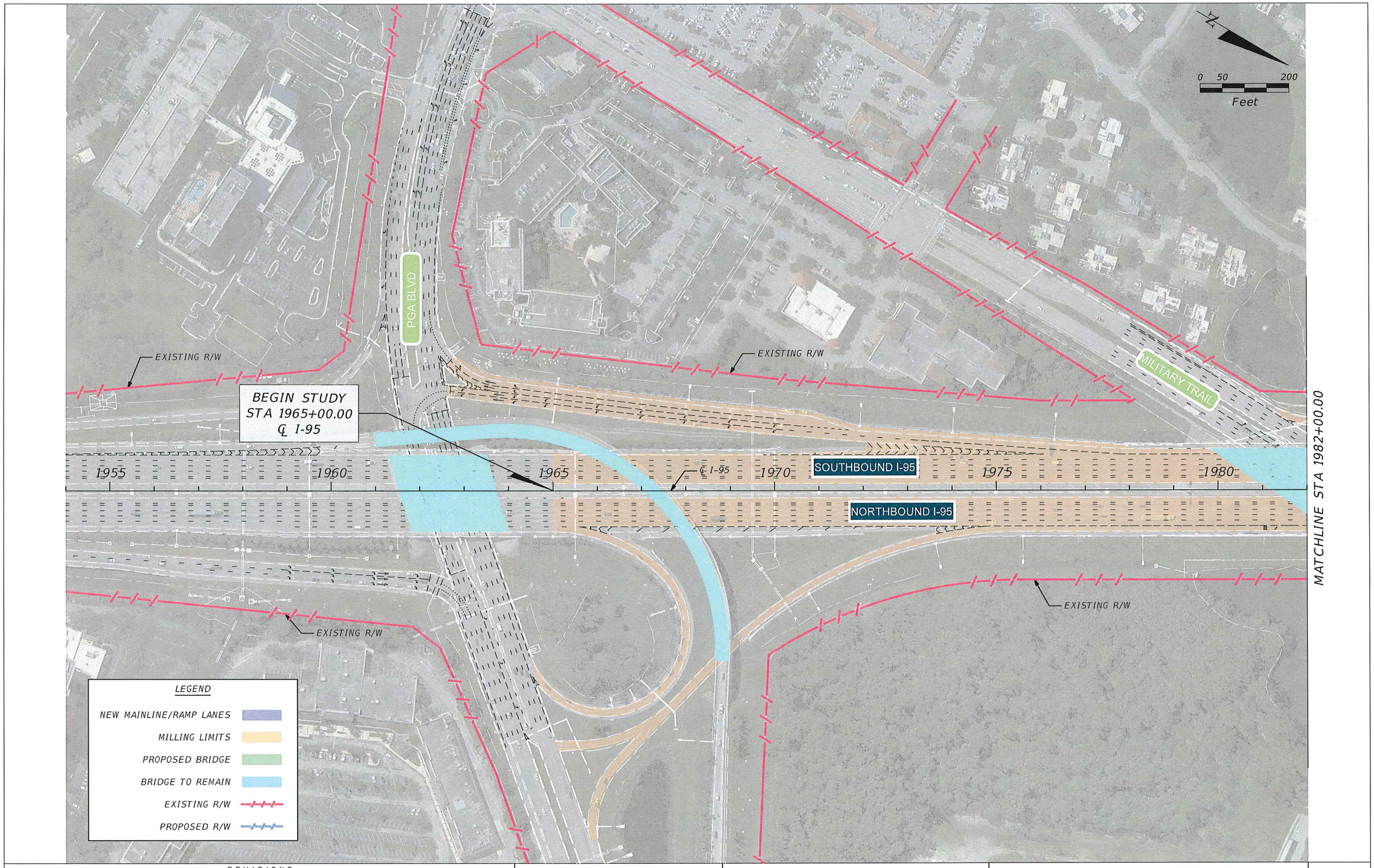


REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

SR 9/I-95 AT CENTRAL BLVD. INTERCHANGE PD&E STUDY

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 9	PALM BEACH	413265-1-22-01

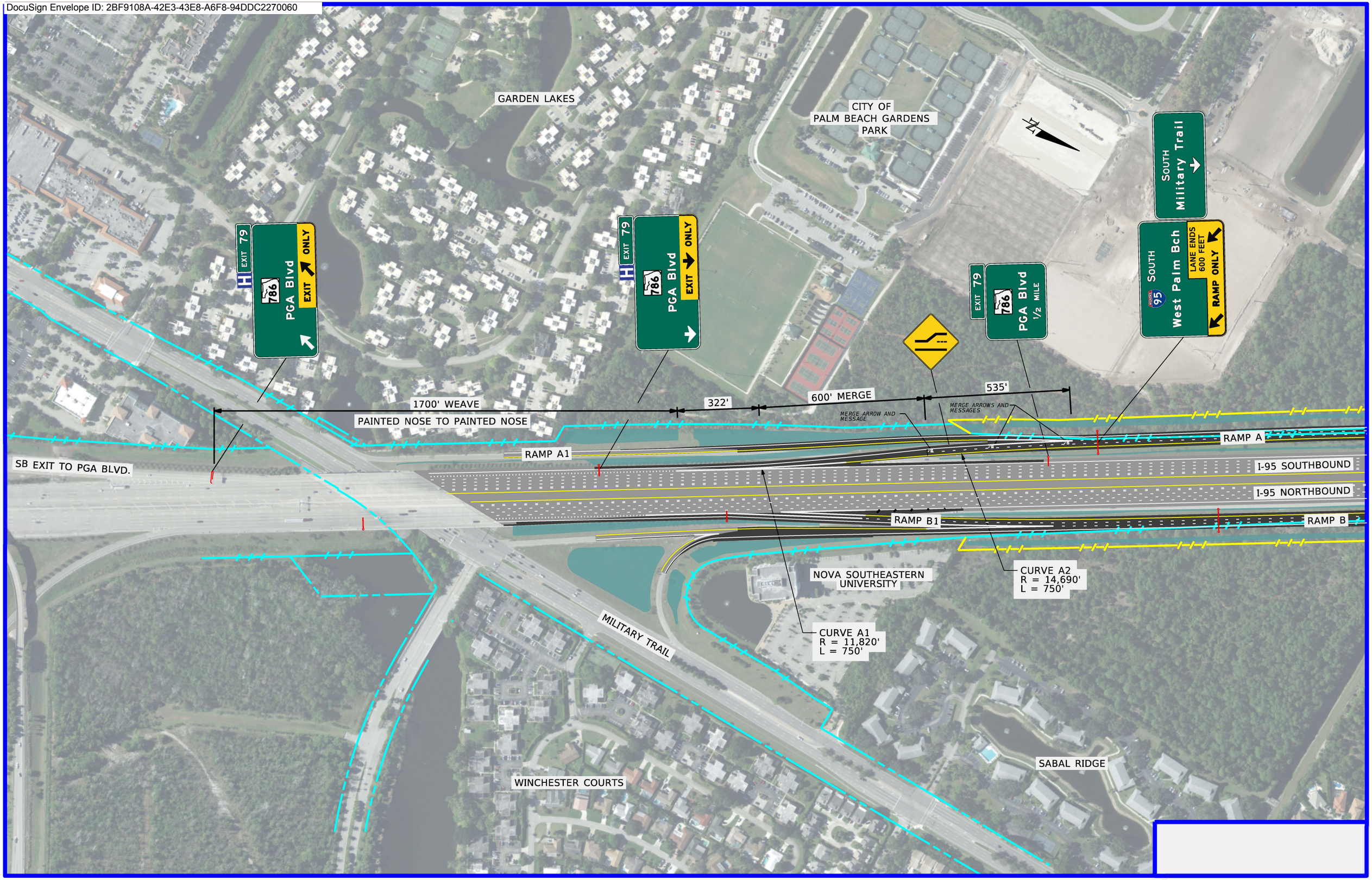
I-95 FROM PGA BLVD. TO DONALD ROSS RD. (ALT 2)

SHEET NO. 1

mbrloso 6/15/2016 8:58:42 AM H:\CADD\413265122O1\roadway\planrd05-bcc-ALT2.dgn

Appendix B

Schematic of Ramp A - Proposed Design Change and Signing & Marking Concept



Appendix C

Traffic Operations Analysis

No Build Scenario

HCS7 Freeway Weaving Report

Project Information

Analyst	RS&H	Date	10/12/2018
Agency	RS&H	Analysis Year	2040
Jurisdiction	RS&H	Time Period Analyzed	AM Peak
Project Description	I-95 Southbound (Central Boulevard to PGA Boulevard)		

Geometric Data

Number of Lanes (N), ln	6	Segment Type	Freeway
Short Length (L_S), ft	2000	Number of Maneuver Lanes (N_{WL}), ln	3
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	0
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	0
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	0.80	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	5358	1245	103	926
Peak Hour Factor (PHF)	0.95	0.95	0.95	0.95
Total Trucks, %	3.70	3.70	3.70	3.70
Heavy Vehicle Adjustment Factor (f_{HV})	0.964	0.964	0.964	0.964
Flow Rate (v_i), pc/h	5851	1359	112	1011

Weaving Flow Rate (v_w), pc/h	2370	Freeway Max Capacity (c_{IFL}), pc/h/ln	2400
Non-Weaving Flow Rate (v_{NW}), pc/h	5963	Density-Based Capacity (c_{IWL}), pc/h/ln	2259
Total Flow Rate (v), pc/h	8333	Demand Flow-Based Capacity (c_{IW}), pc/h	12324
Volume Ratio (VR)	0.284	Weaving Segment Capacity (c_W), veh/h	11880
Minimum Lane Change Rate (LC_{MIN}), lc/h	0	Adjusted Weaving Area Capacity, pc/h	12323
Maximum Weaving Length (L_{MAX}), ft	3847	Volume-to-Capacity Ratio (v/c)	0.68

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	954	Average Weaving Speed (S_W), mi/h	59.6
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1157	Average Non-Weaving Speed (S_{NW}), mi/h	63.3
Weaving Lane Change Rate (LC_W), lc/h	926	Average Speed (S), mi/h	62.2
Total Lane Change Rate (LC_{All}), lc/h	2083	Density (D), pc/mi/ln	22.3
Weaving Intensity Factor (W)	0.233	Level of Service (LOS)	C

HCS7 Freeway Weaving Report

Project Information

Analyst	RS&H	Date	10/12/2018
Agency	RS&H	Analysis Year	2040
Jurisdiction	RS&H	Time Period Analyzed	PM Peak
Project Description	I-95 Southbound (Central Boulevard to PGA Boulevard)		

Geometric Data

Number of Lanes (N), ln	6	Segment Type	Freeway
Short Length (L_S), ft	2000	Number of Maneuver Lanes (N_{WL}), ln	3
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	0
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	0
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	0.80	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	4052	1204	28	253
Peak Hour Factor (PHF)	0.95	0.95	0.95	0.95
Total Trucks, %	3.70	3.70	3.70	3.70
Heavy Vehicle Adjustment Factor (f_{HV})	0.964	0.964	0.964	0.964
Flow Rate (v_i), pc/h	4425	1315	31	276

Weaving Flow Rate (v_w), pc/h	1591	Freeway Max Capacity (c_{IFL}), pc/h/ln	2400
Non-Weaving Flow Rate (v_{NW}), pc/h	4456	Density-Based Capacity (c_{IWL}), pc/h/ln	2276
Total Flow Rate (v), pc/h	6047	Demand Flow-Based Capacity (c_{IW}), pc/h	13308
Volume Ratio (VR)	0.263	Weaving Segment Capacity (c_W), veh/h	12829
Minimum Lane Change Rate (LC_{MIN}), lc/h	0	Adjusted Weaving Area Capacity, pc/h	13310
Maximum Weaving Length (L_{MAX}), ft	3624	Volume-to-Capacity Ratio (v/c)	0.45

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	713	Average Weaving Speed (S_W), mi/h	60.6
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	846	Average Non-Weaving Speed (S_{NW}), mi/h	65.2
Weaving Lane Change Rate (LC_W), lc/h	926	Average Speed (S), mi/h	63.9
Total Lane Change Rate (LC_{All}), lc/h	1772	Density (D), pc/mi/ln	15.8
Weaving Intensity Factor (W)	0.205	Level of Service (LOS)	B

Build Scenario

HCS7 Freeway Weaving Report

Project Information

Analyst	RS&H	Date	08/01/2020
Agency	RS&H	Analysis Year	2040
Jurisdiction	RS&H	Time Period Analyzed	AM Peak
Project Description	I-95 Southbound Between Ramp A (Central Blvd) On Ramp and PGA Blvd Off Ramp		

Geometric Data

Number of Lanes (N), ln	6	Segment Type	Freeway
Short Length (L_S), ft	1700	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	0
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	0.80	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	5358	1245	103	926
Peak Hour Factor (PHF)	0.95	0.95	0.95	0.95
Total Trucks, %	3.70	3.70	3.70	3.70
Heavy Vehicle Adjustment Factor (f_{HV})	0.964	0.964	0.964	0.964
Flow Rate (v_i), pc/h	5851	1359	112	1011

Weaving Flow Rate (v_w), pc/h	2370	Freeway Max Capacity (c_{IFL}), pc/h/ln	2400
Non-Weaving Flow Rate (v_{NW}), pc/h	5963	Density-Based Capacity (c_{IWL}), pc/h/ln	2116
Total Flow Rate (v), pc/h	8333	Demand Flow-Based Capacity (c_{IW}), pc/h	8451
Volume Ratio (VR)	0.284	Weaving Segment Capacity (c_W), veh/h	8146
Minimum Lane Change Rate (LC_{MIN}), lc/h	1359	Adjusted Weaving Area Capacity, pc/h	8450
Maximum Weaving Length (L_{MAX}), ft	5413	Volume-to-Capacity Ratio (v/c)	0.99

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	811	Average Weaving Speed (S_W), mi/h	55.1
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	994	Average Non-Weaving Speed (S_{NW}), mi/h	53.5
Weaving Lane Change Rate (LC_W), lc/h	2200	Average Speed (S), mi/h	53.9
Total Lane Change Rate (LC_{All}), lc/h	3194	Density (D), pc/mi/ln	25.8
Weaving Intensity Factor (W)	0.372	Level of Service (LOS)	C

HCS7 Freeway Weaving Report

Project Information

Analyst	RS&H	Date	08/01/2020
Agency	RS&H	Analysis Year	2040
Jurisdiction	RS&H	Time Period Analyzed	PM Peak
Project Description	I-95 Southbound Between Ramp A (Central Blvd) On Ramp and PGA Blvd Off Ramp		

Geometric Data

Number of Lanes (N), ln	6	Segment Type	Freeway
Short Length (L_S), ft	1700	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	0
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	0.80	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	4052	1204	28	253
Peak Hour Factor (PHF)	0.95	0.95	0.95	0.95
Total Trucks, %	3.70	3.70	3.70	3.70
Heavy Vehicle Adjustment Factor (f_{HV})	0.964	0.964	0.964	0.964
Flow Rate (v_i), pc/h	4425	1315	31	276

Weaving Flow Rate (v_w), pc/h	1591	Freeway Max Capacity (c_{IFL}), pc/h/ln	2400
Non-Weaving Flow Rate (v_{NW}), pc/h	4456	Density-Based Capacity (c_{IWL}), pc/h/ln	2133
Total Flow Rate (v), pc/h	6047	Demand Flow-Based Capacity (c_{IW}), pc/h	9125
Volume Ratio (VR)	0.263	Weaving Segment Capacity (c_W), veh/h	8797
Minimum Lane Change Rate (LC_{MIN}), lc/h	1315	Adjusted Weaving Area Capacity, pc/h	9127
Maximum Weaving Length (L_{MAX}), ft	5190	Volume-to-Capacity Ratio (v/c)	0.66

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	606	Average Weaving Speed (S_W), mi/h	56.1
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	684	Average Non-Weaving Speed (S_{NW}), mi/h	55.7
Weaving Lane Change Rate (LC_W), lc/h	2156	Average Speed (S), mi/h	55.8
Total Lane Change Rate (LC_{All}), lc/h	2840	Density (D), pc/mi/ln	18.1
Weaving Intensity Factor (W)	0.339	Level of Service (LOS)	B

Appendix D

Safety Analysis

State of Florida Department of Transportation
CRASH SUMMARY

SECTION: **93220000** STATE ROUTE: **9**

ROADWAY LIMITS: **I-95 from MP 37.086 to MP 37.67** M.P. **36.850** TO **37.717** ENGINEER: **FDOT D6**

STUDY PERIOD: FROM **1/ 2013** TO **12/ 2013** COUNTY: **Palm Beach**

No.	MILE POST	DATE	DAY	TIME	CRASH TYPE	FATAL	INJURIES	PROP DAM	DAY / NIGHT	WET / DRY	CONTRIBUTING CAUSE (VEHICLE ONLY)
1	37.103	06/08/13	Sat	1035	Angle	0	0	1	Day	Wet	No Contributing Action
2	37.113	05/29/13	Wed	0723	Angle	0	0	1	Day	Wet	No Contributing Action
3	37.113	06/03/13	Mon	0342	Sideswipe	0	0	1	Night	Wet	#N/A
4	37.113	10/06/13	Sun	1230	Concrete Traffic Barrier	0	2	0	Day	Wet	Drove too Fast for Conditions
5	37.132	07/02/13	Tue	1528	Concrete Traffic Barrier	0	0	1	Day	Wet	Other Contributing Action
6	37.165	02/13/13	Wed	1648	Concrete Traffic Barrier	0	1	0	Day	Dry	Ran Off Roadway
7	37.189	09/02/13	Mon	1600	Concrete Traffic Barrier	0	1	0	Day	Wet	No Contributing Action
8	37.194	08/12/13	Mon	1111	Sideswipe	0	0	1	Day	Dry	Careless or Negligent Manner
9	37.194	09/10/13	Tue	1147	Concrete Traffic Barrier	0	0	1	Day	Wet	Careless or Negligent Manner
10	37.194	09/10/13	Tue	1148	Concrete Traffic Barrier	0	1	0	Day	Wet	Careless or Negligent Manner
11	37.226	10/11/13	Fri	1532	Pedestrian	0	5	0	Day	Dry	Swerved Or Avoided
12	37.226	12/09/13	Mon	0340	Rear-End	0	0	1	Night	Dry	Careless or Negligent Manner
13	37.260	01/08/13	Tue	2100	Sideswipe	0	0	1	Night	Dry	No Contributing Action
14	37.283	06/11/13	Tue	1649	Rear-End	0	3	0	Day	Dry	Other Contributing Action
15	37.283	09/25/13	Wed	1552	Cargo/Equipment Loss or Shift	0	0	1	Day	Dry	Other Contributing Action
16	37.283	08/23/13	Fri	0800	Concrete Traffic Barrier	0	2	0	Day	Dry	No Contributing Action
17	37.476	05/31/13	Fri	1520	Struck by Falling/Shifting Cargo	0	0	1	Day	Wet	No Contributing Action
18	37.476	05/21/13	Tue	2331	Concrete Traffic Barrier	0	1	0	Night	Dry	Careless or Negligent Manner
19	37.499	07/11/13	Thu	1554	Concrete Traffic Barrier	0	1	0	Day	Dry	Over-Correcting/Over-Steering
20	37.532	06/07/13	Fri	0409	Guardrail End	0	3	0	Night	Wet	Careless or Negligent Manner
21	37.649	08/19/13	Mon	0845	Sideswipe	0	0	1	Day	Dry	Failed To Keep In Proper Lane

Total No.	Fatal	Injury	PDO	Rear-End	Head-On	Angle	Left-Turn	Right-Turn	Sideswipe	Backed Into	Ped/Bike	Parked Car	Fixed Object	Ran into Water	Other
21	**0**	**10**	**11**	**2**	**0**	**2**	**0**	**0**	**4**	**0**	**1**	**0**	**10**	**0**	**0**
Percent	*0.00%*	*47.62%*	*52.38%*	*9.52%*	*0.00%*	*9.52%*	*0.00%*	*0.00%*	*19.05%*	*0.00%*	*4.76%*	*0.00%*	*47.62%*	*0.00%*	*0.00%*

Contrib. Cause	Day	Night	Wet	Dry	Careless Driving	FTYRW	Improper Turn	Ran Red Light	Exceeded Speed	Improper Passing	Disreg Cntl Dev	Erratic/ Aggress	Ran off Road	DUI	Wrong Way
Total	**16**	**5**	**10**	**11**	**6**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**2**	**0**
Percent	*76.19%*	*23.81%*	*47.62%*	*52.38%*	*28.57%*	*0.00%*	*0.00%*	*0.00%*	*4.76%*	*0.00%*	*0.00%*	*0.00%*	*4.76%*	*9.52%*	*0.00%*

TOTAL ENTERING VEHICLES/ADT: **96,714**

SEGMENT CRASH RATE: **0.686** CRASHES PER MILLION VEHICLE MILES

State of Florida Department of Transportation
CRASH SUMMARY

SECTION: **93220000** STATE ROUTE: **9**

ROADWAY LIMITS: **I-95 from MP 37.086 to MP 37.67** M.P. **36.850** TO **37.717** ENGINEER: **FDOT D6**

STUDY PERIOD: FROM **1/ 2014** TO **12/ 2014** COUNTY: **Palm Beach**

No.	MILE POST	DATE	DAY	TIME	CRASH TYPE	FATAL	INJURIES	PROP DAM	DAY / NIGHT	WET / DRY	CONTRIBUTING CAUSE (VEHICLE ONLY)
1	37.105	07/04/14	Fri	1641	Concrete Traffic Barrier	0	0	1	Day	Wet	Swerved Or Avoided
2	37.113	07/15/14	Tue	1240	Concrete Traffic Barrier	0	2	0	Day	Wet	Drove too Fast for Conditions
3	37.122	02/11/14	Tue	1445	Concrete Traffic Barrier	0	0	1	Day	Dry	Careless or Negligent Manner
4	37.151	07/29/14	Tue	1540	Concrete Traffic Barrier	0	0	1	Day	Wet	Ran Off Roadway
5	37.151	07/29/14	Tue	1630	Angle	0	1	0	Day	Wet	Careless or Negligent Manner
6	37.165	10/08/14	Wed	2120	Sideswipe	0	0	1	Night	Dry	Careless or Negligent Manner
7	37.189	05/15/14	Thu	1938	Guardrail Face	0	0	1	Night	Wet	Drove too Fast for Conditions
8	37.226	10/01/14	Wed	2030	Concrete Traffic Barrier	0	1	0	Night	Wet	Careless or Negligent Manner
9	37.283	07/14/14	Mon	0420	Rear-End	0	0	1	Night	Dry	Other Contributing Action
10	37.355	01/01/14	Wed	1800	Concrete Traffic Barrier	0	0	1	Night	Wet	Over-Correcting/Over-Steering
11	37.378	05/03/14	Sat	2335	Concrete Traffic Barrier	0	0	1	Night	Wet	Swerved Or Avoided
12	37.378	08/18/14	Mon	1600	Rear-End	0	0	1	Day	Dry	Careless or Negligent Manner
13	37.476	08/03/14	Sun	0630	Concrete Traffic Barrier	0	0	1	Day	Wet	Careless or Negligent Manner
14	37.476	09/03/14	Wed	2100	Tree (Standing)	0	0	1	Night	Wet	No Contributing Action
15	37.476	09/23/14	Tue	0805	Rear-End	0	0	1	Day	Dry	Failed to Yield Right-Of-Way
16	37.626	12/10/14	Wed	1336	Sideswipe	0	1	0	Day	Dry	Other Contributing Action

State of Florida Department of Transportation
CRASH SUMMARY

SECTION: **93220000** STATE ROUTE: **9**

ROADWAY LIMITS: **I-95 from MP 37.086 to MP 37.67** M.P. **36.850** TO **37.717** ENGINEER: **FDOT D6**

STUDY PERIOD: FROM **1/ 2014** TO **12/ 2014** COUNTY: **Palm Beach**

No.	MILE POST	DATE	DAY	TIME	CRASH TYPE			FATAL	INJURIES	PROP DAM	DAY / NIGHT	WET / DRY	CONTRIBUTING CAUSE (VEHICLE ONLY)		
Total No.	Fatal	Injury	PDO	Rear-End	Head-On	Angle	Left-Turn	Right-Turn	Sideswipe	Backed Into	Ped/Bike	Parked Car	Fixed Object	Ran into Water	Other
16	**0**	**4**	**12**	**3**	**0**	**1**	**0**	**0**	**2**	**0**	**0**	**0**	**10**	**0**	**0**
Percent	*0.00%*	*25.00%*	*75.00%*	*18.75%*	*0.00%*	*6.25%*	*0.00%*	*0.00%*	*12.50%*	*0.00%*	*0.00%*	*0.00%*	*62.50%*	*0.00%*	*0.00%*
Contrib. Cause	Day	Night	Wet	Dry	Careless Driving	FTYRW	Improper Turn	Ran Red Light	Exceeded Speed	Improper Passing	Disreg Cntl Dev	Erratic/ Aggress	Ran off Road	DUI	Wrong Way
Total	**9**	**7**	**10**	**6**	**6**	**1**	**0**	**0**	**2**	**0**	**0**	**0**	**1**	**0**	**0**
Percent	*56.25%*	*43.75%*	*62.50%*	*37.50%*	*37.50%*	*6.25%*	*0.00%*	*0.00%*	*12.50%*	*0.00%*	*0.00%*	*0.00%*	*6.25%*	*0.00%*	*0.00%*

TOTAL ENTERING VEHICLES/ADT: **164,500**

SEGMENT CRASH RATE: **0.307** CRASHES PER MILLION VEHICLE MILES

State of Florida Department of Transportation
CRASH SUMMARY

SECTION: **93220000** STATE ROUTE: **9**

ROADWAY LIMITS: **I-95 from MP 37.086 to MP 37.67** M.P. **36.850** TO **37.717** ENGINEER: **FDOT D6**

STUDY PERIOD: FROM **1/ 2015** TO **12/ 2015** COUNTY: **Palm Beach**

No.	MILE POST	DATE	DAY	TIME	CRASH TYPE	FATAL	INJURIES	PROP DAM	DAY / NIGHT	WET / DRY	CONTRIBUTING CAUSE (VEHICLE ONLY)
1	37.165	08/22/15	Sat	1840	Rear-End	0	0	1	Day	Dry	No Contributing Action
2	37.194	02/18/15	Wed	0813	Sideswipe	0	1	0	Day	Wet	#N/A
3	37.226	12/04/15	Fri	2129	Concrete Traffic Barrier	0	0	1	Night	Wet	Drove too Fast for Conditions
4	37.355	10/09/15	Fri	1455	Angle	0	0	1	Day	Wet	Careless or Negligent Manner
5	37.428	04/30/15	Thu	2205	Not Coded	0	1	0	Night	Dry	#N/A
6	37.476	07/01/15	Wed	2155	Rear-End	0	0	1	Night	Dry	#N/A
7	37.480	10/23/15	Fri	0632	Not Coded	0	2	0	Night	Wet	Careless or Negligent Manner
8	37.526	08/02/15	Sun	1235	Other Non-Fixed Object	0	0	1	Day	Dry	Careless or Negligent Manner
9	37.526	09/17/15	Thu	1800	Overturn/Rollover	0	1	0	Day	Wet	Swerved Or Avoided

Total No.	Fatal	Injury	PDO	Rear-End	Head-On	Angle	Left-Turn	Right-Turn	Sideswipe	Backed Into	Ped/Bike	Parked Car	Fixed Object	Ran into Water	Other
9	**0**	**4**	**5**	**2**	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**2**
Percent	*0.00%*	*44.44%*	*55.56%*	*22.22%*	*0.00%*	*11.11%*	*0.00%*	*0.00%*	*11.11%*	*0.00%*	*0.00%*	*0.00%*	*11.11%*	*0.00%*	*22.22%*

Contrib. Cause	Day	Night	Wet	Dry	Careless Driving	FTYRW	Improper Turn	Ran Red Light	Exceeded Speed	Improper Passing	Disreg Cntl Dev	Erratic/ Aggress	Ran off Road	DUI	Wrong Way
Total	**5**	**4**	**5**	**4**	**3**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**
Percent	*55.56%*	*44.44%*	*55.56%*	*44.44%*	*33.33%*	*0.00%*	*0.00%*	*0.00%*	*11.11%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*

TOTAL ENTERING VEHICLES/ADT: **160,500**

SEGMENT CRASH RATE: **0.177** CRASHES PER MILLION VEHICLE MILES

State of Florida Department of Transportation
CRASH SUMMARY

SECTION: **93220000** STATE ROUTE: **9**

ROADWAY LIMITS: **I-95 from MP 37.086 to MP 37.67** M.P. **36.850** TO **37.717** ENGINEER: **FDOT D6**

STUDY PERIOD: FROM **1/ 2016** TO **12/ 2016** COUNTY: **Palm Beach**

No.	MILE POST	DATE	DAY	TIME	CRASH TYPE	FATAL	INJURIES	PROP DAM	DAY / NIGHT	WET / DRY	CONTRIBUTING CAUSE (VEHICLE ONLY)
1	37.109	10/27/16	Thu	1220	Angle	0	1	0	Day	Dry	No Contributing Action
2	37.186	06/14/16	Tue	1950	Sideswipe	0	0	1	Day	Dry	Other Contributing Action
3	37.201	08/31/16	Wed	2309	Concrete Traffic Barrier	0	0	1	Night	Wet	No Contributing Action
4	37.226	08/16/16	Tue	1718	Not Coded	0	1	0	Day	Dry	Careless or Negligent Manner
5	37.226	08/24/16	Wed	2145	Concrete Traffic Barrier	0	0	1	Night	Wet	No Contributing Action
6	37.226	12/30/16	Fri	0130	Concrete Traffic Barrier	0	0	1	Night	Wet	Drove too Fast for Conditions
7	37.283	02/13/16	Sat	0056	Concrete Traffic Barrier	0	0	1	Night	Dry	Failed To Keep In Proper Lane
8	37.315	01/03/16	Sun	1920	Concrete Traffic Barrier	0	0	1	Night	Wet	No Contributing Action
9	37.436	02/13/16	Sat	2356	Other Non-Fixed Object	0	0	1	Night	Dry	No Contributing Action
10	37.436	05/16/16	Mon	0805	Concrete Traffic Barrier	0	1	0	Day	Dry	Over-Correcting/Over-Steering
11	37.436	05/22/16	Sun	1120	Tree (Standing)	0	0	1	Day	Dry	#N/A
12	37.476	08/20/16	Sat	2216	Sideswipe	0	2	0	Night	Dry	Failed To Keep In Proper Lane
13	37.476	09/13/16	Tue	1435	Other Non-Fixed Object	0	0	1	Day	Dry	No Contributing Action
14	37.476	11/05/16	Sat	2241	Sideswipe	0	1	0	Night	Dry	Other Contributing Action
15	37.494	01/27/16	Wed	1440	Angle	0	1	0	Day	Wet	No Contributing Action
16	37.494	05/10/16	Tue	1648	Concrete Traffic Barrier	0	1	0	Day	Dry	#N/A
17	37.513	02/15/16	Mon	1545	Traffic Sign Support	0	0	1	Day	Wet	No Contributing Action
18	37.526	01/06/16	Wed	1216	Concrete Traffic Barrier	0	1	0	Day	Wet	Careless or Negligent Manner
19	37.654	07/28/16	Thu	1100	Tree (Standing)	0	0	1	Day	Dry	No Contributing Action
20	0.185	07/01/16	Fri	1605	Rear-End	0	0	1	Day	Dry	Careless or Negligent Manner

Total No.	Fatal	Injury	PDO	Rear-End	Head-On	Angle	Left-Turn	Right-Turn	Sideswipe	Backed Into	Ped/Bike	Parked Car	Fixed Object	Ran into Water	Other
20	**0**	**8**	**12**	**1**	**0**	**2**	**0**	**0**	**3**	**0**	**0**	**0**	**1**	**0**	**2**
Percent	*0.00%*	*40.00%*	*60.00%*	*5.00%*	*0.00%*	*10.00%*	*0.00%*	*0.00%*	*15.00%*	*0.00%*	*0.00%*	*0.00%*	*5.00%*	*0.00%*	*10.00%*
Contrib. Cause	Day	Night	Wet	Dry	Careless Driving	FTYRW	Improper Turn	Ran Red Light	Exceeded Speed	Improper Passing	Disreg Cntl Dev	Erratic/ Aggress	Ran off Road	DUI	Wrong Way
Total	**12**	**8**	**7**	**13**	**3**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**2**	**0**
Percent	*60.00%*	*40.00%*	*35.00%*	*65.00%*	*15.00%*	*0.00%*	*0.00%*	*0.00%*	*5.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*10.00%*	*0.00%*

TOTAL ENTERING VEHICLES/ADT: **160,500**

SEGMENT CRASH RATE: **0.177** CRASHES PER MILLION VEHICLE MILES

State of Florida Department of Transportation
CRASH SUMMARY

SECTION: **93220000** STATE ROUTE: **9**

ROADWAY LIMITS: **I-95 from MP 37.086 to MP 37.67** M.P. **36.850** TO **37.717** ENGINEER: **FDOT D6**

STUDY PERIOD: FROM **1/ 2017** TO **12/ 2017** COUNTY: **Palm Beach**

No.	MILE POST	DATE	DAY	TIME	CRASH TYPE	FATAL	INJURIES	PROP DAM	DAY / NIGHT	WET / DRY	CONTRIBUTING CAUSE (VEHICLE ONLY)
1	37.098	06/16/17	Fri	2240	Concrete Traffic Barrier	0	0	1	Night	Wet	Swerved Or Avoided
2	37.125	01/07/17	Sat	1905	Sideswipe	0	0	1	Night	Wet	Failed To Keep In Proper Lane
3	37.125	07/24/17	Mon	0320	Concrete Traffic Barrier	0	1	0	Night	Dry	No Contributing Action
4	37.136	10/12/17	Thu	1228	Guardrail Face	0	0	1	Day	Wet	Drove too Fast for Conditions
5	37.186	03/09/17	Thu	0136	Cargo/Equipment Loss or Shift	0	0	1	Night	Dry	#N/A
6	37.226	02/12/17	Sun	1834	Parked Motor Vehicle	0	4	0	Night	Dry	Other Contributing Action
7	37.226	12/30/17	Sat	1707	Overturn/Rollover	0	3	0	Day	Dry	Other Contributing Action
8	37.236	01/23/17	Mon	0745	Rear-End	0	0	1	Day	Dry	Careless or Negligent Manner
9	37.315	03/12/17	Sun	1853	Concrete Traffic Barrier	0	0	1	Day	Wet	Drove too Fast for Conditions
10	37.476	12/21/17	Thu	1630	Rear-End	0	3	0	Day	Dry	Other Contributing Action
11	37.578	05/21/17	Sun	0240	Rear-End	0	0	1	Night	Dry	#N/A
12	37.588	10/19/17	Thu	0900	Concrete Traffic Barrier	0	1	0	Day	Wet	Careless or Negligent Manner

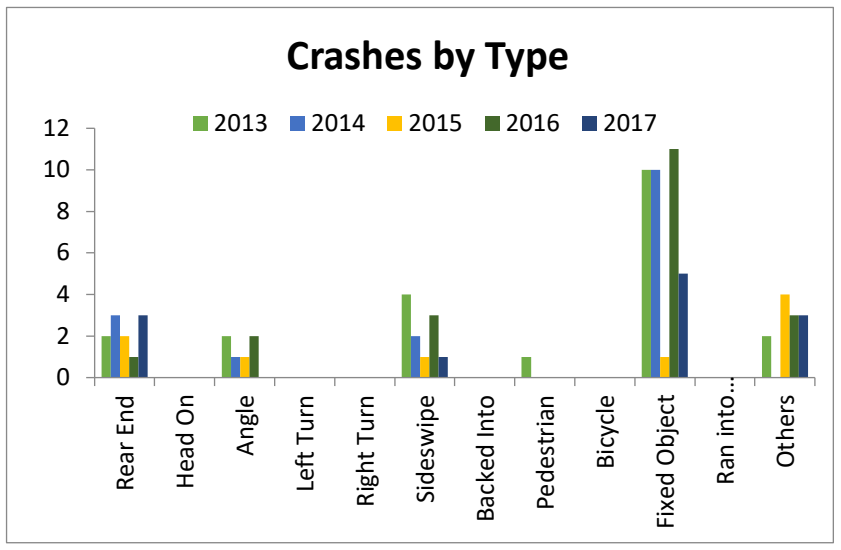
Total No.	Fatal	Injury	PDO	Rear-End	Head-On	Angle	Left-Turn	Right-Turn	Sideswipe	Backed Into	Ped/Bike	Parked Car	Fixed Object	Ran into Water	Other
12	**0**	**5**	**7**	**3**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**1**	**0**	**2**
Percent	*0.00%*	*41.67%*	*58.33%*	*25.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*8.33%*	*0.00%*	*0.00%*	*8.33%*	*8.33%*	*0.00%*	*16.67%*

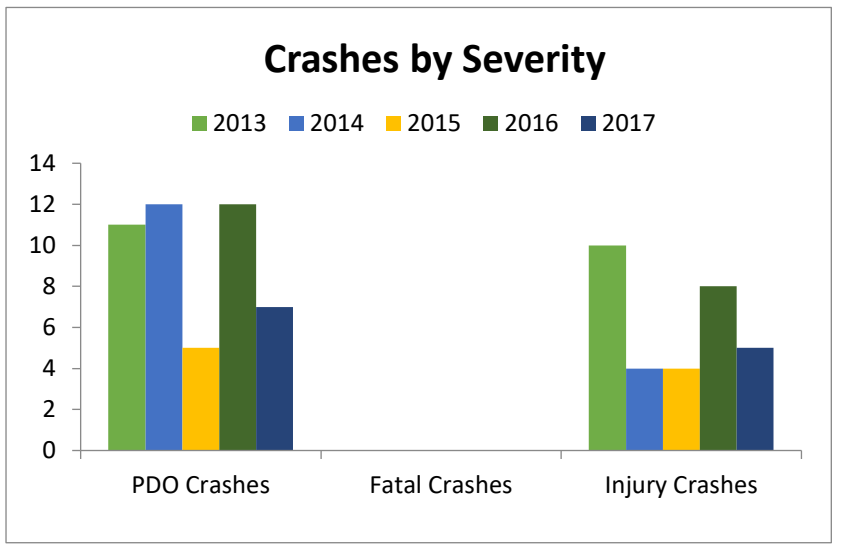
Contrib. Cause	Day	Night	Wet	Dry	Careless Driving	FTYRW	Improper Turn	Ran Red Light	Exceeded Speed	Improper Passing	Disreg Cntl Dev	Erratic/ Aggress	Ran off Road	DUI	Wrong Way
Total	**6**	**6**	**5**	**7**	**3**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**
Percent	*50.00%*	*50.00%*	*41.67%*	*58.33%*	*25.00%*	*0.00%*	*0.00%*	*0.00%*	*8.33%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*

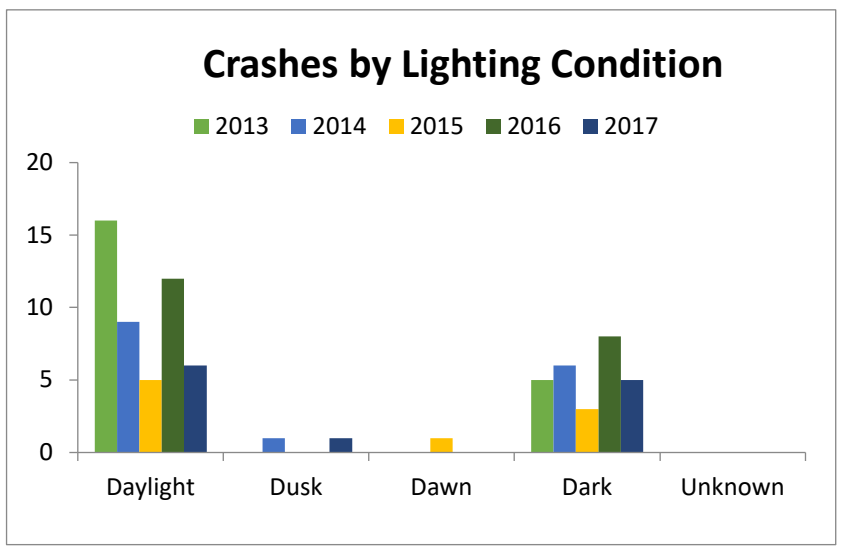
TOTAL ENTERING VEHICLES/ADT: **160,500** SEGMENT CRASH RATE: **0.177** CRASHES PER MILLION VEHICLE MILES

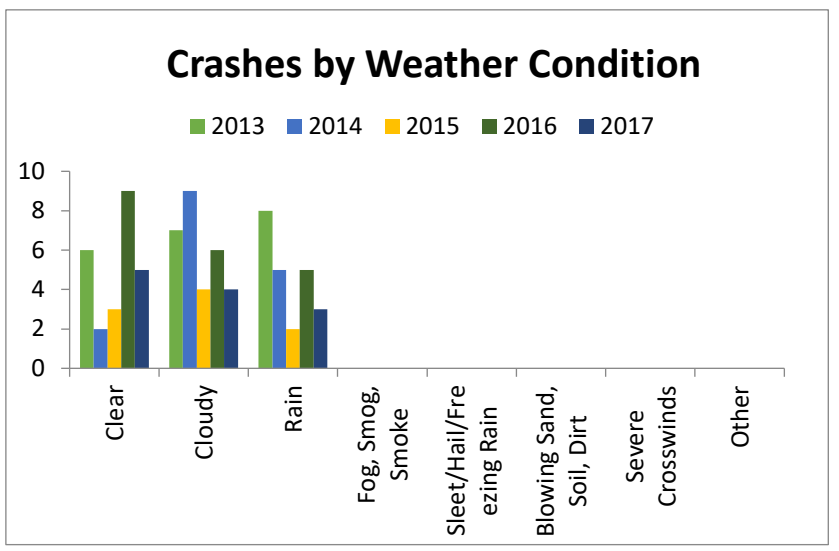
CRASH HISTOGRAMS

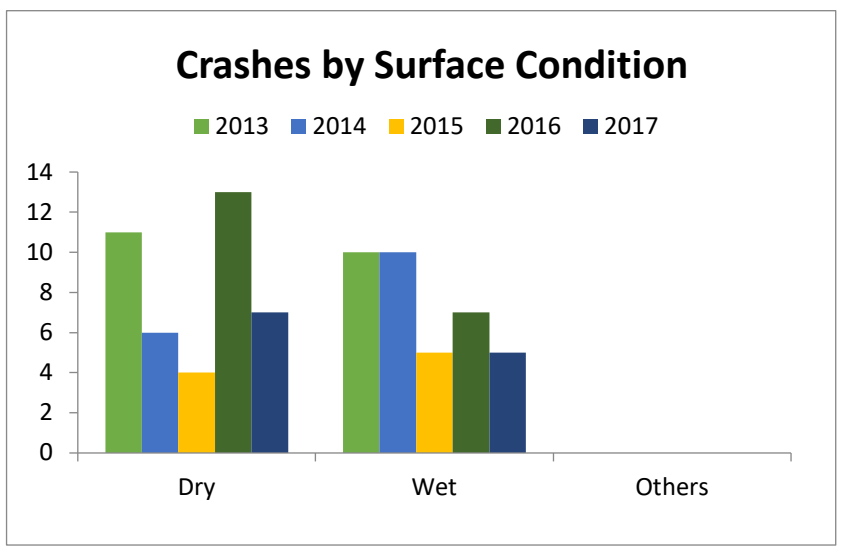
I-95

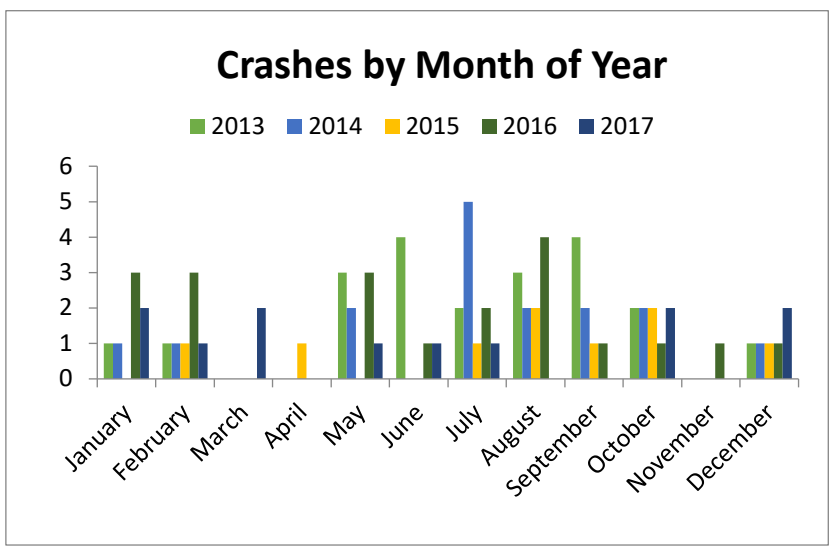


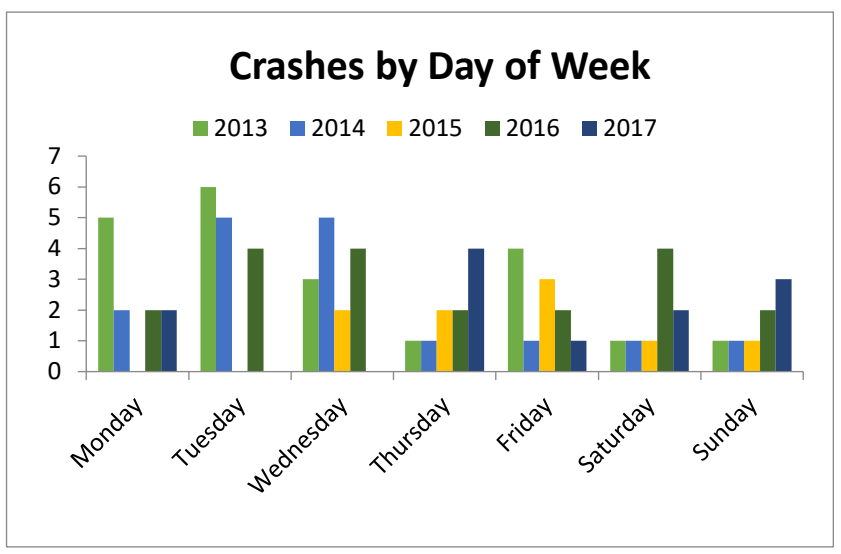


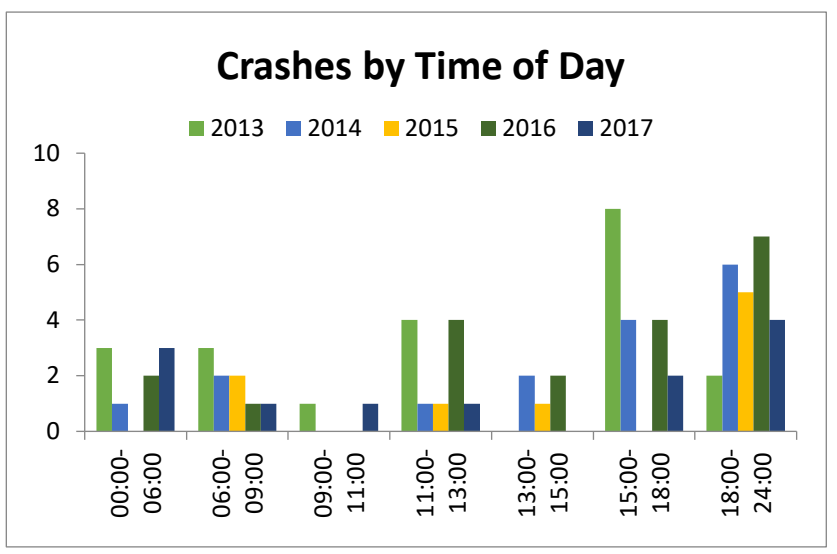












No Build Scenario

2020-2040 No Build Scenario
I-95 Freeway Segment

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

August 24, 2020

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2020-2040 No Build Scenario
I-95 Freeway Segment

Report Overview

Report Generated: Aug 24, 2020 2:38 PM
Report Template: System: Single Page, 508 Compliant [System] (mlcpm5, Nov 8, 2019 2:21 PM)

Evaluation Date: Thu Aug 13 10:48:28 EDT 2020
IHSDM Version: v15.0.0 (Oct 31, 2019)
Crash Prediction Module: v10.0.0 (Oct 31, 2019)

User Name: fuentesa
Organization Name: RS&H
Phone: 305-428-3213
E-Mail: antonio.fuentes@rsandh.com

Project Title: I-95 at Central Blvd - No Build v2
Project Comment: Created Wed Aug 12 20:17:36 EDT 2020
Project Unit System: U.S. Customary

Highway Title: I-95
Highway Comment: Created Wed Aug 12 20:18:34 EDT 2020
Highway Version: 1

Evaluation Title: 2020-2040
Evaluation Comment: Created Thu Aug 13 10:48:18 EDT 2020

Minimum Location: 15+00.000
Maximum Location: 53+00.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2020
Last Year of Analysis: 2040
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Section 1 Evaluation

Section: Section 1
Evaluation Start Location: 15+00.000
Evaluation End Location: 53+00.000
Functional Class: Freeway

2020-2040 No Build Scenario
I-95 Freeway Segment

Type of Alignment: Divided, Multilane
Model Category: Freeway Segment
Calibration Factor: FI_EN=1.0; FI_EX=1.0; FI_MV=1.0; FI_SV=1.0; PDO_EN=1.0; PDO_EX=1.0; PDO_MV=1.0; PDO_SV=1.0;

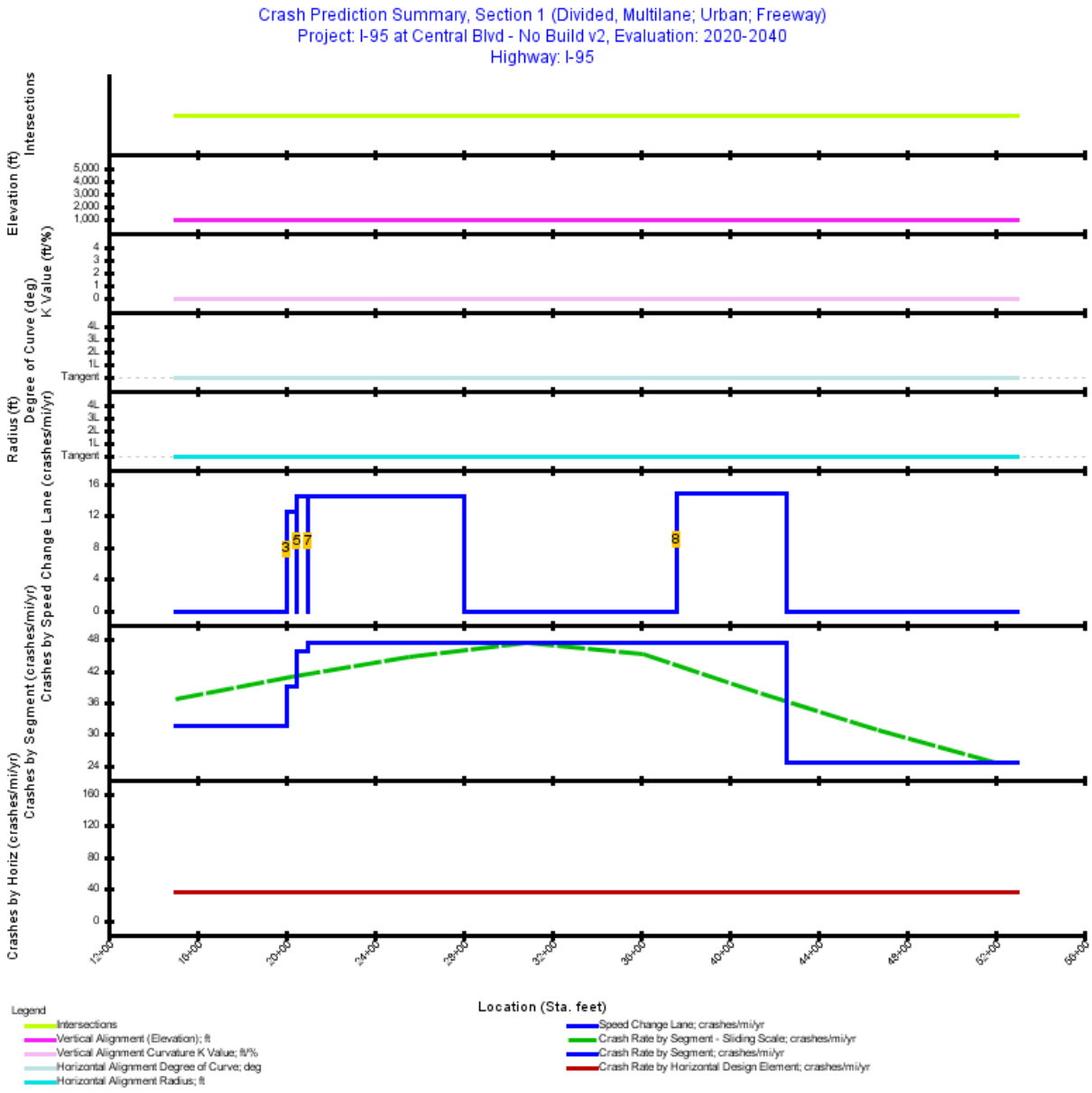

Figure 1. Crash Prediction Summary (Section 1)

2020-2040 No Build Scenario
I-95 Freeway Segment

Table 1. Evaluation Freeway - Homogeneous Segments (Section 1)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT	Median Width (ft)	Type	Effective Median Width (ft)
1	8F	Urban	15+00.000	20+00.000	500.00	0.0947	2020-2040: 140,400	30.00	Non-Traversable Median	54.00
2	8F	Urban	20+00.000	20+50.000	50.00	0.0095	2020-2040: 140,400	30.00	Non-Traversable Median	54.00
4	8F	Urban	20+50.000	21+00.000	50.00	0.0095	2020-2040: 158,000	30.00	Non-Traversable Median	54.00
6	8F	Urban	21+00.000	42+60.000	2,160.00	0.4091	2020-2040: 158,000	30.00	Non-Traversable Median	54.00
9	8F	Urban	42+60.000	53+00.000	1,040.00	0.1970	2020-2040: 120,500	30.00	Non-Traversable Median	54.00

Table 2. Evaluation Freeway - Speed Change Lanes (Speed Change)

Seg. No.	Type	Ramp Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT	Median Width (ft)	Type	Effective Median Width (ft)
3	8SC	Entrance	20+00.000	20+50.000	50.00	0.0095	2020-2040: 140,400	30.00	Non-Traversable Median	54.00
5	8SC	Entrance	20+50.000	21+00.000	50.00	0.0095	2020-2040: 158,000	30.00	Non-Traversable Median	54.00
7	8SC	Entrance	21+00.000	28+00.000	700.00	0.1326	2020-2040: 158,000	30.00	Non-Traversable Median	54.00
8	8SC	Exit	37+60.000	42+60.000	500.00	0.0947	2020-2040: 158,000	30.00	Non-Traversable Median	54.00

2020-2040 No Build Scenario
I-95 Freeway Segment

Table 3. Predicted Freeway Crash Rates and Frequencies Summary (Section 1)

First Year of Analysis	**2020**
Last Year of Analysis	**2040**
Effective Length (mi)	**0.5966**
Average Future Road AADT (vpd)	**142,686**
Predicted Crashes	
Total Crashes	**466.25**
Fatal and Injury Crashes	**130.24**
Property-Damage-Only Crashes	**336.02**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**28**
Percent Property-Damage-Only Crashes (%)	**72**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**37.2157**
FI Crash Rate (crashes/mi/yr)	**10.3952**
PDO Crash Rate (crashes/mi/yr)	**26.8206**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**652.48**
Travel Crash Rate (crashes/million veh-mi)	**0.71**
Travel FI Crash Rate (crashes/million veh-mi)	**0.20**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.52**

Note: *Effective Length* is the *segment length* minus the length of the *speed change lanes* if present.

2020-2040 No Build Scenario
I-95 Freeway Segment

Table 4. Predicted Freeway Speed Change Lane Crash Rates and Frequencies Summary (Speed Change)

First Year of Analysis	**2020**
Last Year of Analysis	**2040**
Evaluated Length (mi)	**0.2462**
Average Future Road AADT (vpd)	**78,662**
Predicted Crashes	
Total Crashes	**75.27**
Fatal and Injury Crashes	**20.71**
Property-Damage-Only Crashes	**54.57**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**28**
Percent Property-Damage-Only Crashes (%)	**72**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**14.5583**
FI Crash Rate (crashes/mi/yr)	**4.0048**
PDO Crash Rate (crashes/mi/yr)	**10.5535**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**148.45**
Travel Crash Rate (crashes/million veh-mi)	**0.51**
Travel FI Crash Rate (crashes/million veh-mi)	**0.14**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.37**

Note: *Total Travel and Crash Rates/Million Vehicle Miles* for *Speed Change Lanes* reflect AADTs that are **half of the Freeway Segment AADTs** based on the assumption of 50/50 directional distribution.

2020-2040 No Build Scenario
I-95 Freeway Segment

Table 5. Predicted Crash Frequencies and Rates by Freeway Segment/Intersection (Section 1)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Effective Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	15+00.000	20+00.000	0.0947	62.779	2.9895	0.8092	2.1803	31.5688	0.62
2	20+00.000	20+50.000	0.0047	3.881	0.1848	0.0511	0.1337	39.0264	0.76
4	20+50.000	21+00.000	0.0047	4.546	0.2165	0.0583	0.1582	45.7225	0.79
6	21+00.000	42+60.000	0.2955	292.940	13.9495	3.9362	10.0133	47.2138	0.82
9	42+60.000	53+00.000	0.1970	102.109	4.8623	1.3469	3.5154	24.6856	0.56
Total			0.5966	466.254	22.2026	6.2017	16.0009	37.2157	0.71

Note: *Effective Length* is the *segment length* minus the length of the *speed change lanes* if present. This may create Freeway segments with zero effective length and zero crashes.

Table 6. Predicted Crash Frequencies and Rates by Freeway Speed Change Lane (Speed Change)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
3	20+00.000	20+50.000	0.0095	2.496	0.1189	0.0318	0.0871	12.5515	0.49
5	20+50.000	21+00.000	0.0095	2.877	0.1370	0.0365	0.1005	14.4690	0.50
7	21+00.000	28+00.000	0.1326	40.283	1.9182	0.5114	1.4068	14.4690	0.50
8	37+60.000	42+60.000	0.0947	29.617	1.4103	0.4063	1.0040	14.8929	0.52
Total			0.2462	75.273	3.5844	0.9860	2.5984	14.5583	0.51

Note: *Travel Crash Rates/Million Vehicle Miles* for *Speed Change Lanes* reflect AADTs that are **half of the Freeway Segment AADTs** based on the assumption of 50/50 directional distribution.

2020-2040 No Build Scenario
I-95 Freeway Segment

Table 7. Predicted Crash Frequencies and Rates by Horizontal Design Element (Section 1)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	15+00.000	53+00.000	0.7197	541.527	25.7870	7.1877	18.5993	35.8304	0.89

Table 8. Predicted Crash Frequencies by Year (Section 1)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2020	25.79	7.19	27.873	18.60	72.127
2021	25.79	7.19	27.873	18.60	72.127
2022	25.79	7.19	27.873	18.60	72.127
2023	25.79	7.19	27.873	18.60	72.127
2024	25.79	7.19	27.873	18.60	72.127
2025	25.79	7.19	27.873	18.60	72.127
2026	25.79	7.19	27.873	18.60	72.127
2027	25.79	7.19	27.873	18.60	72.127
2028	25.79	7.19	27.873	18.60	72.127
2029	25.79	7.19	27.873	18.60	72.127
2030	25.79	7.19	27.873	18.60	72.127
2031	25.79	7.19	27.873	18.60	72.127
2032	25.79	7.19	27.873	18.60	72.127
2033	25.79	7.19	27.873	18.60	72.127
2034	25.79	7.19	27.873	18.60	72.127
2035	25.79	7.19	27.873	18.60	72.127
2036	25.79	7.19	27.873	18.60	72.127
2037	25.79	7.19	27.873	18.60	72.127
2038	25.79	7.19	27.873	18.60	72.127
2039	25.79	7.19	27.873	18.60	72.127
2040	25.79	7.19	27.873	18.60	72.127
Total	541.53	150.94	27.873	390.59	72.127
Average	25.79	7.19	27.873	18.60	72.127

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

2020-2040 No Build Scenario
I-95 Freeway Segment

Table 9. Predicted Crash Severity by Freeway Segment (Section 1)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.3707	0.9848	5.5458	10.0910	45.7865
2	0.0234	0.0622	0.3504	0.6376	2.8068
4	0.0267	0.0709	0.3993	0.7265	3.3228
6	2.0687	5.3250	28.8850	46.3825	210.2787
9	0.7079	1.8221	9.8837	15.8709	73.8241
Total	3.1974	8.2650	45.0642	73.7085	336.0190

Table 10. Predicted Crash Severity by Speed Change Lane (Speed Change)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
3	0.0167	0.0430	0.2334	0.3747	1.8282
5	0.0192	0.0494	0.2680	0.4304	2.1103
7	0.2688	0.6918	3.7527	6.0259	29.5438
8	0.2135	0.5497	2.9815	4.7876	21.0843
Total	0.5182	1.3339	7.2356	11.6187	54.5665

Table 11. Predicted Freeway Crash Type Distribution (Section 1)

Element Type	Crash Type	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)	Total Crashes	Percent Total (%)
Highway Segment	Collision with Animal	0.11	0.0	2.32	0.5	2.43	0.5
Highway Segment	Collision with Fixed Object	20.25	4.3	75.38	16.2	95.63	20.5
Highway Segment	Collision with Other Object	1.43	0.3	14.63	3.1	16.07	3.4
Highway Segment	Other Single-vehicle Collision	5.83	1.3	11.27	2.4	17.10	3.7
Highway Segment	Collision with Parked Vehicle	0.42	0.1	1.69	0.4	2.10	0.5
Highway Segment	Total Single Vehicle Crashes	28.05	6.0	105.28	22.6	133.33	28.6
Highway Segment	Right-Angle Collision	3.17	0.7	4.15	0.9	7.32	1.6
Highway Segment	Head-on Collision	0.82	0.2	0.46	0.1	1.28	0.3
Highway Segment	Other Multi-vehicle Collision	3.17	0.7	5.54	1.2	8.71	1.9
Highway Segment	Rear-end Collision	76.64	16.4	159.21	34.1	235.85	50.6
Highway Segment	Sideswipe, Same Direction Collision	18.39	3.9	61.38	13.2	79.77	17.1
Highway Segment	Total Multiple Vehicle Crashes	102.19	21.9	230.74	49.5	332.92	71.4
Highway Segment	Total Highway Segment Crashes	130.24	27.9	336.02	72.1	466.25	100.0
	Total Crashes	130.24	27.9	336.02	72.1	466.25	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 12. Predicted Exit Speed Change Lane Crash Type Distribution (Speed Change)

Element Type	Crash Type	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)	Total Crashes	Percent Total (%)
Highway Segment	Collision with Animal	0.00	0.0	0.15	0.5	0.15	0.5
Highway Segment	Collision with Fixed Object	1.67	5.6	4.36	14.7	6.04	20.4
Highway Segment	Collision with Other Object	0.14	0.5	0.63	2.1	0.77	2.6
Highway Segment	Other Single-vehicle Collision	0.42	1.4	0.48	1.6	0.90	3.0
Highway Segment	Collision with Parked Vehicle	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Total Single Vehicle Crashes	2.23	7.5	5.63	19.0	7.86	26.5
Highway Segment	Right-Angle Collision	0.09	0.3	0.25	0.9	0.35	1.2
Highway Segment	Head-on Collision	0.04	0.1	0.04	0.1	0.09	0.3
Highway Segment	Other Multi-vehicle Collision	0.14	0.5	0.34	1.1	0.47	1.6
Highway Segment	Rear-end Collision	4.68	15.8	11.91	40.2	16.60	56.0
Highway Segment	Sideswipe, Same Direction Collision	1.35	4.6	2.91	9.8	4.26	14.4
Highway Segment	Total Multiple Vehicle Crashes	6.30	21.3	15.46	52.2	21.76	73.5
Highway Segment	Total Highway Segment Crashes	8.53	28.8	21.08	71.2	29.62	100.0
	Total Crashes	8.53	28.8	21.08	71.2	29.62	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 13. Predicted Entrance Speed Change Lane Crash Type Distribution (Speed Change)

Element Type	Crash Type	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)	Total Crashes	Percent Total (%)
Highway Segment	Collision with Animal	0.00	0.0	0.07	0.1	0.07	0.1
Highway Segment	Collision with Fixed Object	2.36	5.2	4.32	9.5	6.68	14.6
Highway Segment	Collision with Other Object	0.23	0.5	1.21	2.6	1.44	3.1
Highway Segment	Other Single-vehicle Collision	0.82	1.8	0.54	1.2	1.35	3.0
Highway Segment	Collision with Parked Vehicle	0.05	0.1	0.10	0.2	0.15	0.3
Highway Segment	Total Single Vehicle Crashes	3.46	7.6	6.23	13.6	9.69	21.2
Highway Segment	Right-Angle Collision	0.23	0.5	0.54	1.2	0.77	1.7
Highway Segment	Head-on Collision	0.05	0.1	0.03	0.1	0.08	0.2
Highway Segment	Other Multi-vehicle Collision	0.21	0.5	0.50	1.1	0.71	1.6
Highway Segment	Rear-end Collision	6.61	14.5	17.75	38.9	24.36	53.3
Highway Segment	Sideswipe, Same Direction Collision	1.62	3.5	8.44	18.5	10.06	22.0
Highway Segment	Total Multiple Vehicle Crashes	8.72	19.1	27.25	59.7	35.97	78.8
Highway Segment	Total Highway Segment Crashes	12.17	26.7	33.48	73.3	45.66	100.0
	Total Crashes	12.17	26.7	33.48	73.3	45.66	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

2020-2040 No Build Scenario
PGA Blvd Off-Ramp

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

August 24, 2020

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Report Overview

Report Generated: Aug 24, 2020 2:41 PM
Report Template: System: Single Page, 508 Compliant [System] (mlcpm5, Nov 8, 2019 2:21 PM)

Evaluation Date: Thu Aug 13 10:44:48 EDT 2020
IHSDM Version: v15.0.0 (Oct 31, 2019)
Crash Prediction Module: v10.0.0 (Oct 31, 2019)

User Name: fuentesa
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Project Title: I-95 at Central Blvd - No Build v2
Project Comment: Created Wed Aug 12 20:17:36 EDT 2020
Project Unit System: U.S. Customary

Highway Title: PGA Off-Ramp
Highway Comment: Created Thu Aug 13 10:03:46 EDT 2020
Highway Version: 1

Evaluation Title: 2020-2040
Evaluation Comment: Created Thu Aug 13 10:44:38 EDT 2020

Minimum Location: 0.000
Maximum Location: 10+00.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2020
Last Year of Analysis: 2040
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 10+00.000
Functional Class: Freeway Service Ramp

2020-2040 No Build Scenario
PGA Blvd Off-Ramp

Type of Alignment: One Direction
Model Category: Freeway Service Ramp
Calibration Factor: EX_RAMP_MV_FI=1.0; EX_RAMP_MV_PDO=1.0; EX_RAMP_SV_FI=1.0; EX_RAMP_SV_PDO=1.0;

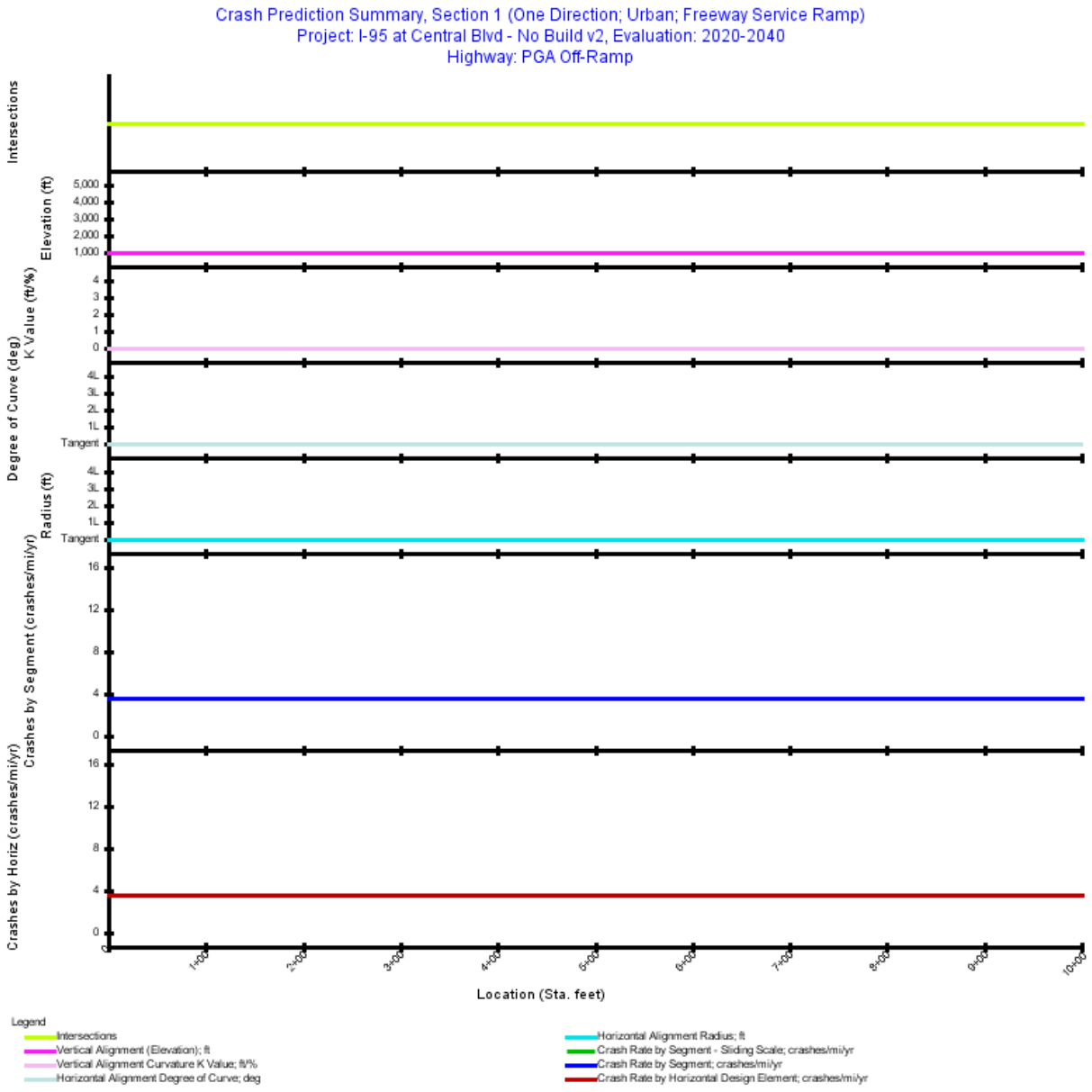

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

2020-2040 No Build Scenario
PGA Blvd Off-Ramp

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT
1	2EX	Urban	0.000	10+00.000	1,000.00	0.1894	2020-2040: 15,000

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2020**
Last Year of Analysis	**2040**
Evaluated Length (mi)	**0.1894**
Average Future Road AADT (vpd)	**15,000**
Predicted Crashes	
Total Crashes	**14.02**
Fatal and Injury Crashes	**5.05**
Property-Damage-Only Crashes	**8.97**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**36**
Percent Property-Damage-Only Crashes (%)	**64**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**3.5250**
FI Crash Rate (crashes/mi/yr)	**1.2700**
PDO Crash Rate (crashes/mi/yr)	**2.2550**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**21.78**
Travel Crash Rate (crashes/million veh-mi)	**0.64**
Travel FI Crash Rate (crashes/million veh-mi)	**0.23**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.41**

2020-2040 No Build Scenario
PGA Blvd Off-Ramp

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	10+00.000	0.1894	14.020	0.6676	0.2405	0.4271	3.5250	0.64
Total			0.1894	14.020	0.6676	0.2405	0.4271	3.5250	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	0.000	10+00.000	0.1894	14.020	0.6676	0.2405	0.4271	3.5250	0.64

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2020	0.67	0.24	36.029	0.43	63.971
2021	0.67	0.24	36.029	0.43	63.971
2022	0.67	0.24	36.029	0.43	63.971
2023	0.67	0.24	36.029	0.43	63.971
2024	0.67	0.24	36.029	0.43	63.971
2025	0.67	0.24	36.029	0.43	63.971
2026	0.67	0.24	36.029	0.43	63.971
2027	0.67	0.24	36.029	0.43	63.971
2028	0.67	0.24	36.029	0.43	63.971
2029	0.67	0.24	36.029	0.43	63.971
2030	0.67	0.24	36.029	0.43	63.971
2031	0.67	0.24	36.029	0.43	63.971
2032	0.67	0.24	36.029	0.43	63.971
2033	0.67	0.24	36.029	0.43	63.971
2034	0.67	0.24	36.029	0.43	63.971
2035	0.67	0.24	36.029	0.43	63.971
2036	0.67	0.24	36.029	0.43	63.971
2037	0.67	0.24	36.029	0.43	63.971
2038	0.67	0.24	36.029	0.43	63.971
2039	0.67	0.24	36.029	0.43	63.971
2040	0.67	0.24	36.029	0.43	63.971
Total	14.02	5.05	36.029	8.97	63.971
Average	0.67	0.24	36.029	0.43	63.971

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.1503	0.4558	1.5407	2.9045	8.9688

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)	Total Crashes	Percent Total (%)
Highway Segment	Collision with Animal	0.02	0.1	0.15	1.1	0.17	1.2
Highway Segment	Collision with Fixed Object	3.31	23.6	5.03	35.9	8.34	59.5
Highway Segment	Collision with Other Object	0.23	1.7	0.98	7.0	1.21	8.6
Highway Segment	Other Single-vehicle Collision	0.95	6.8	0.75	5.4	1.71	12.2
Highway Segment	Collision with Parked Vehicle	0.07	0.5	0.11	0.8	0.18	1.3
Highway Segment	Total Single Vehicle Crashes	4.59	32.7	7.03	50.1	11.61	82.8
Highway Segment	Right-Angle Collision	0.01	0.1	0.04	0.2	0.05	0.4
Highway Segment	Head-on Collision	0.00	0.0	0.00	0.0	0.01	0.1
Highway Segment	Other Multi-vehicle Collision	0.01	0.1	0.05	0.3	0.06	0.4
Highway Segment	Rear-end Collision	0.35	2.5	1.34	9.6	1.69	12.0
Highway Segment	Sideswipe, Same Direction Collision	0.08	0.6	0.52	3.7	0.60	4.3
Highway Segment	Total Multiple Vehicle Crashes	0.47	3.3	1.94	13.8	2.41	17.2
Highway Segment	Total Highway Segment Crashes	5.05	36.0	8.97	64.0	14.02	100.0
	Total Crashes	5.05	36.0	8.97	64.0	14.02	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
0.000	10+00.000	for segment #1 (0.000 to 10+00.000), The ramp type for Ramp PGA Off-Ramp is set at the Ramp Connection (Exit) and in the Ramp (Exit). The Ramp value takes precedence.

2020-2040 No Build Scenario
PGA Blvd On-Ramp

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

August 24, 2020

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Report Overview

Report Generated: Aug 24, 2020 2:40 PM
Report Template: System: Single Page, 508 Compliant [System] (mlcpm5, Nov 8, 2019 2:21 PM)

Evaluation Date: Thu Aug 13 10:41:37 EDT 2020
IHSDM Version: v15.0.0 (Oct 31, 2019)
Crash Prediction Module: v10.0.0 (Oct 31, 2019)

User Name: fuentesa
Organization Name: RS&H
Phone: 305-428-3213
E-Mail: antonio.fuentes@rsandh.com

Project Title: I-95 at Central Blvd - No Build v2
Project Comment: Created Wed Aug 12 20:17:36 EDT 2020
Project Unit System: U.S. Customary

Highway Title: PGA On-Ramp
Highway Comment: Created Wed Aug 12 20:53:56 EDT 2020
Highway Version: 1

Evaluation Title: 2020-2040
Evaluation Comment: Created Thu Aug 13 10:41:26 EDT 2020

Minimum Location: 0.000
Maximum Location: 10+00.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2020
Last Year of Analysis: 2040
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 10+00.000
Functional Class: Freeway Service Ramp

2020-2040 No Build Scenario
PGA Blvd On-Ramp

Type of Alignment: One Direction
Model Category: Freeway Service Ramp
Calibration Factor: ENT_RAMP_MV_FI=1.0; ENT_RAMP_MV_PDO=1.0; ENT_RAMP_SV_FI=1.0; ENT_RAMP_SV_PDO=1.0;

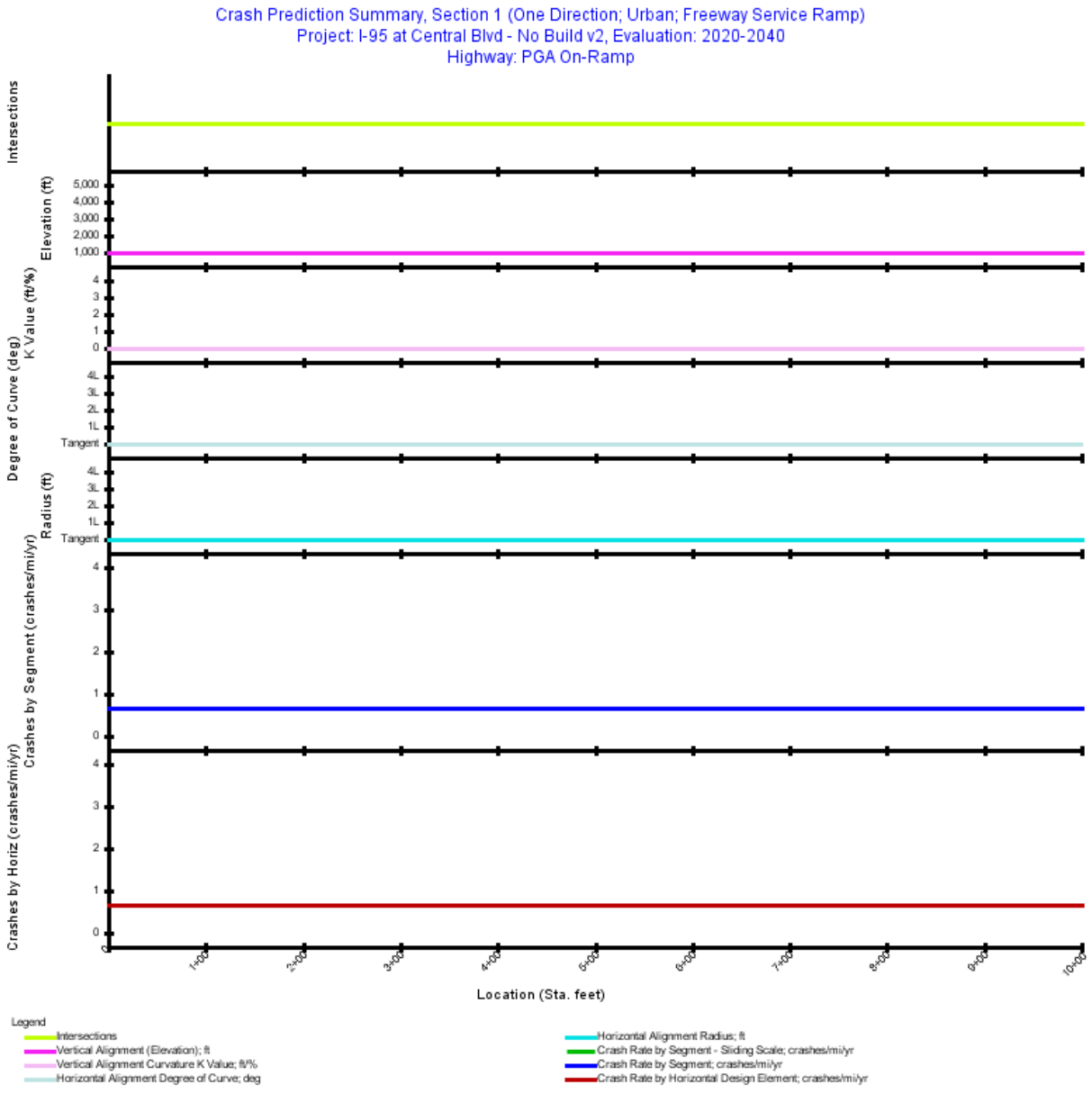

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

2020-2040 No Build Scenario
PGA Blvd On-Ramp

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT
1	1EN	Urban	0.000	10+00.000	1,000.00	0.1894	2020-2040: 2,500

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2020**
Last Year of Analysis	**2040**
Evaluated Length (mi)	**0.1894**
Average Future Road AADT (vpd)	**2,500**
Predicted Crashes	
Total Crashes	**2.62**
Fatal and Injury Crashes	**1.15**
Property-Damage-Only Crashes	**1.46**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**44**
Percent Property-Damage-Only Crashes (%)	**56**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**0.6575**
FI Crash Rate (crashes/mi/yr)	**0.2899**
PDO Crash Rate (crashes/mi/yr)	**0.3676**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**3.63**
Travel Crash Rate (crashes/million veh-mi)	**0.72**
Travel FI Crash Rate (crashes/million veh-mi)	**0.32**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.40**

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	10+00.000	0.1894	2.615	0.1245	0.0549	0.0696	0.6575	0.72
Total			0.1894	2.615	0.1245	0.0549	0.0696	0.6575	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	0.000	10+00.000	0.1894	2.615	0.1245	0.0549	0.0696	0.6575	0.72

2020-2040 No Build Scenario
PGA Blvd On-Ramp

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2020	0.12	0.06	44.091	0.07	55.909
2021	0.12	0.06	44.091	0.07	55.909
2022	0.12	0.06	44.091	0.07	55.909
2023	0.12	0.06	44.091	0.07	55.909
2024	0.12	0.06	44.091	0.07	55.909
2025	0.12	0.06	44.091	0.07	55.909
2026	0.12	0.06	44.091	0.07	55.909
2027	0.12	0.06	44.091	0.07	55.909
2028	0.12	0.06	44.091	0.07	55.909
2029	0.12	0.06	44.091	0.07	55.909
2030	0.12	0.06	44.091	0.07	55.909
2031	0.12	0.06	44.091	0.07	55.909
2032	0.12	0.06	44.091	0.07	55.909
2033	0.12	0.06	44.091	0.07	55.909
2034	0.12	0.06	44.091	0.07	55.909
2035	0.12	0.06	44.091	0.07	55.909
2036	0.12	0.06	44.091	0.07	55.909
2037	0.12	0.06	44.091	0.07	55.909
2038	0.12	0.06	44.091	0.07	55.909
2039	0.12	0.06	44.091	0.07	55.909
2040	0.12	0.06	44.091	0.07	55.909
Total	2.62	1.15	44.091	1.46	55.909
Average	0.12	0.06	44.091	0.07	55.909

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0246	0.0746	0.4747	0.5792	1.4621

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)	Total Crashes	Percent Total (%)
Highway Segment	Collision with Animal	0.00	0.1	0.03	1.0	0.03	1.2
Highway Segment	Collision with Fixed Object	0.69	26.2	0.87	33.2	1.55	59.4
Highway Segment	Collision with Other Object	0.05	1.9	0.17	6.4	0.22	8.3
Highway Segment	Other Single-vehicle Collision	0.20	7.6	0.13	5.0	0.33	12.5
Highway Segment	Collision with Parked Vehicle	0.01	0.5	0.02	0.7	0.03	1.3
Highway Segment	Total Single Vehicle Crashes	0.95	36.3	1.21	46.4	2.16	82.7
Highway Segment	Right-Angle Collision	0.01	0.2	0.00	0.2	0.01	0.4
Highway Segment	Head-on Collision	0.00	0.1	0.00	0.0	0.00	0.1
Highway Segment	Other Multi-vehicle Collision	0.01	0.2	0.01	0.2	0.01	0.5
Highway Segment	Rear-end Collision	0.15	5.8	0.17	6.6	0.32	12.4
Highway Segment	Sideswipe, Same Direction Collision	0.04	1.4	0.07	2.5	0.10	3.9
Highway Segment	Total Multiple Vehicle Crashes	0.20	7.8	0.25	9.5	0.45	17.3
Highway Segment	Total Highway Segment Crashes	1.15	44.1	1.46	55.9	2.62	100.0
	Total Crashes	1.15	44.1	1.46	55.9	2.62	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

2020-2040 No Build Scenario
PGA Blvd On-Ramp

Table 8. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
0.000	10+00.000	for segment #1 (0.000 to 10+00.000), The ramp type for Ramp PGA On-Ramp is set at the Ramp Connection (Entrance) and in the Ramp (Entrance). The Ramp value takes precedence.

2020-2040 No Build Scenario
Ramp A

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

August 24, 2020

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2020-2040 No Build Scenario
Ramp A

Report Overview

Report Generated: Aug 24, 2020 2:39 PM
Report Template: System: Single Page, 508 Compliant [System] (mlcpm5, Nov 8, 2019 2:21 PM)

Evaluation Date: Thu Aug 13 10:36:55 EDT 2020
IHSDM Version: v15.0.0 (Oct 31, 2019)
Crash Prediction Module: v10.0.0 (Oct 31, 2019)

User Name: fuentesa
Organization Name: RS&H
Phone: 305-428-3213
E-Mail: antonio.fuentes@rsandh.com

Project Title: I-95 at Central Blvd - No Build v2
Project Comment: Created Wed Aug 12 20:17:36 EDT 2020
Project Unit System: U.S. Customary

Highway Title: Ramp A
Highway Comment: Created Wed Aug 12 20:33:03 EDT 2020
Highway Version: 1

Evaluation Title: 2020-2040
Evaluation Comment: Created Thu Aug 13 10:36:46 EDT 2020

Minimum Location: 0.000
Maximum Location: 14+57.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2020
Last Year of Analysis: 2040
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

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Section Types

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 14+57.000
Functional Class: Freeway Service Ramp

2020-2040 No Build Scenario
Ramp A

Type of Alignment: One Direction
Model Category: Freeway Service Ramp
Calibration Factor: ENT_RAMP_MV_FI=1.0; ENT_RAMP_MV_PDO=1.0; ENT_RAMP_SV_FI=1.0; ENT_RAMP_SV_PDO=1.0;

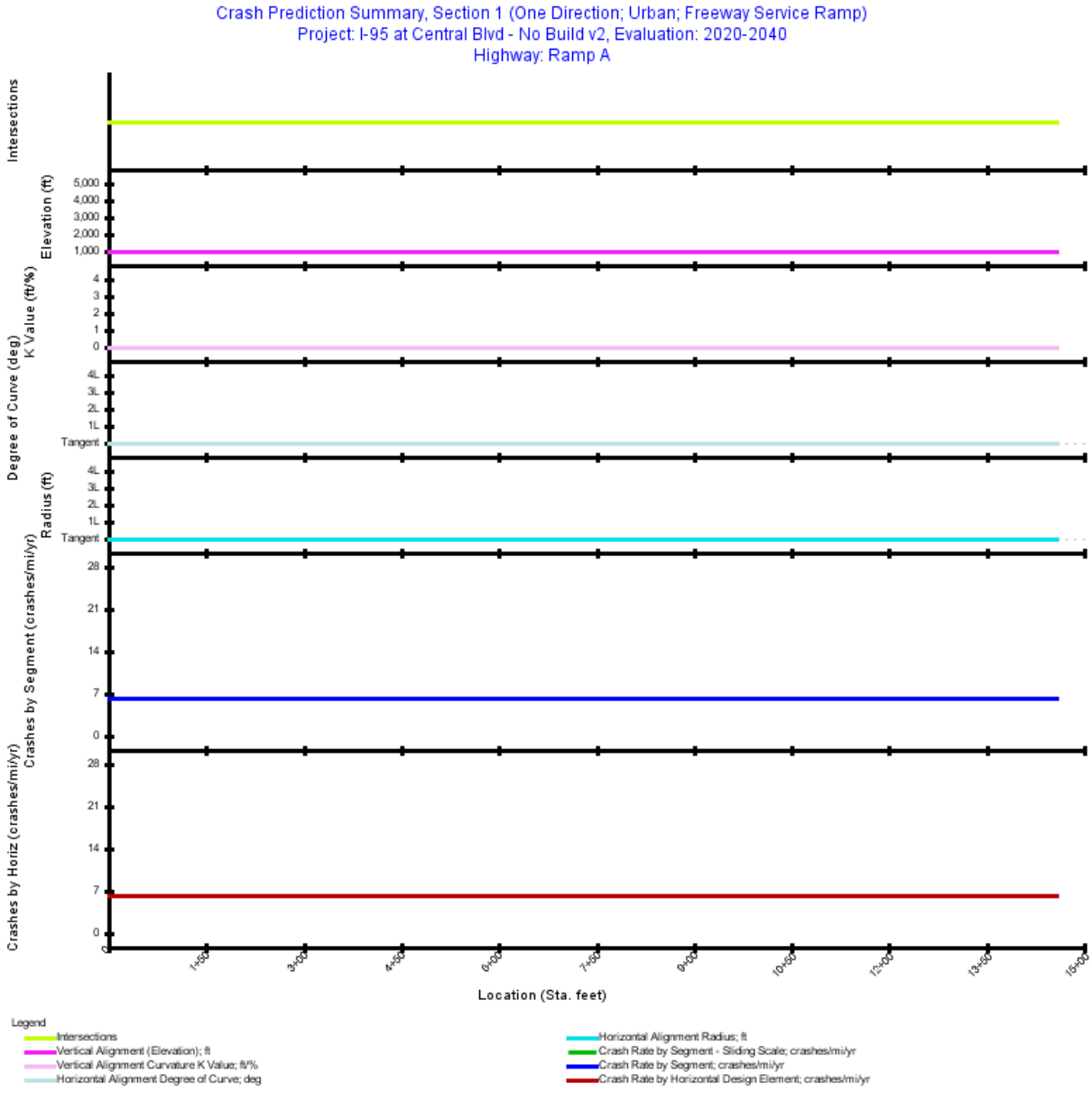

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

2020-2040 No Build Scenario
Ramp A

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT
1	2EN	Urban	0.000	14+57.000	1,457.00	0.2759	2020-2040: 19,600

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2020**
Last Year of Analysis	**2040**
Evaluated Length (mi)	**0.2759**
Average Future Road AADT (vpd)	**19,600**
Predicted Crashes	
Total Crashes	**36.49**
Fatal and Injury Crashes	**13.07**
Property-Damage-Only Crashes	**23.42**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**36**
Percent Property-Damage-Only Crashes (%)	**64**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**6.2971**
FI Crash Rate (crashes/mi/yr)	**2.2552**
PDO Crash Rate (crashes/mi/yr)	**4.0419**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**41.46**
Travel Crash Rate (crashes/million veh-mi)	**0.88**
Travel FI Crash Rate (crashes/million veh-mi)	**0.32**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.56**

2020-2040 No Build Scenario
Ramp A

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	14+57.000	0.2759	36.491	1.7377	0.6223	1.1153	6.2971	0.88
Total			0.2759	36.491	1.7377	0.6223	1.1153	6.2971	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	0.000	14+57.000	0.2759	36.491	1.7377	0.6223	1.1153	6.2971	0.88

2020-2040 No Build Scenario
Ramp A

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2020	1.74	0.62	35.814	1.11	64.186
2021	1.74	0.62	35.814	1.11	64.186
2022	1.74	0.62	35.814	1.11	64.186
2023	1.74	0.62	35.814	1.11	64.186
2024	1.74	0.62	35.814	1.11	64.186
2025	1.74	0.62	35.814	1.11	64.186
2026	1.74	0.62	35.814	1.11	64.186
2027	1.74	0.62	35.814	1.11	64.186
2028	1.74	0.62	35.814	1.11	64.186
2029	1.74	0.62	35.814	1.11	64.186
2030	1.74	0.62	35.814	1.11	64.186
2031	1.74	0.62	35.814	1.11	64.186
2032	1.74	0.62	35.814	1.11	64.186
2033	1.74	0.62	35.814	1.11	64.186
2034	1.74	0.62	35.814	1.11	64.186
2035	1.74	0.62	35.814	1.11	64.186
2036	1.74	0.62	35.814	1.11	64.186
2037	1.74	0.62	35.814	1.11	64.186
2038	1.74	0.62	35.814	1.11	64.186
2039	1.74	0.62	35.814	1.11	64.186
2040	1.74	0.62	35.814	1.11	64.186
Total	36.49	13.07	35.814	23.42	64.186
Average	1.74	0.62	35.814	1.11	64.186

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.2650	0.8036	4.1593	7.8408	23.4221

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)	Total Crashes	Percent Total (%)
Highway Segment	Collision with Animal	0.03	0.1	0.24	0.7	0.27	0.7
Highway Segment	Collision with Fixed Object	5.26	14.4	7.95	21.8	13.21	36.2
Highway Segment	Collision with Other Object	0.37	1.0	1.54	4.2	1.92	5.2
Highway Segment	Other Single-vehicle Collision	1.52	4.2	1.19	3.3	2.70	7.4
Highway Segment	Collision with Parked Vehicle	0.11	0.3	0.18	0.5	0.29	0.8
Highway Segment	Total Single Vehicle Crashes	7.29	20.0	11.10	30.4	18.39	50.4
Highway Segment	Right-Angle Collision	0.18	0.5	0.22	0.6	0.40	1.1
Highway Segment	Head-on Collision	0.05	0.1	0.03	0.1	0.07	0.2
Highway Segment	Other Multi-vehicle Collision	0.18	0.5	0.30	0.8	0.47	1.3
Highway Segment	Rear-end Collision	4.34	11.9	8.50	23.3	12.84	35.2
Highway Segment	Sideswipe, Same Direction Collision	1.04	2.9	3.28	9.0	4.32	11.8
Highway Segment	Total Multiple Vehicle Crashes	5.78	15.8	12.32	33.8	18.10	49.6
Highway Segment	Total Highway Segment Crashes	13.07	35.8	23.42	64.2	36.49	100.0
	Total Crashes	13.07	35.8	23.42	64.2	36.49	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

2020-2040 No Build Scenario
Ramp A

Table 8. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
0.000	14+57.000	for segment #1 (0.000 to 14+57.000), The ramp type for Ramp Ramp A is set at the Ramp Connection (Entrance) and in the Ramp (Entrance). The Ramp value takes precedence.

2020-2040 No Build Scenario
Ramp B1

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

August 24, 2020

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2020-2040 No Build Scenario
Ramp B1

Report Overview

Report Generated: Aug 24, 2020 2:39 PM
Report Template: System: Single Page, 508 Compliant [System] (mlcpm5, Nov 8, 2019 2:21 PM)

Evaluation Date: Thu Aug 13 10:37:55 EDT 2020
IHSDM Version: v15.0.0 (Oct 31, 2019)
Crash Prediction Module: v10.0.0 (Oct 31, 2019)

User Name: fuentesa
Organization Name: RS&H
Phone: 305-428-3213
E-Mail: antonio.fuentes@rsandh.com

Project Title: I-95 at Central Blvd - No Build v2
Project Comment: Created Wed Aug 12 20:17:36 EDT 2020
Project Unit System: U.S. Customary

Highway Title: Ramp B1
Highway Comment: Created Wed Aug 12 20:44:02 EDT 2020
Highway Version: 1

Evaluation Title: 2020-2040
Evaluation Comment: Created Thu Aug 13 10:37:38 EDT 2020

Minimum Location: 2000+00.000
Maximum Location: 2010+00.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2020
Last Year of Analysis: 2040
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

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The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 2000+00.000
Evaluation End Location: 2010+00.000
Functional Class: Freeway Service Ramp

2020-2040 No Build Scenario
Ramp B1

Type of Alignment: One Direction
Model Category: Freeway Service Ramp
Calibration Factor: EX_RAMP_MV_FI=1.0; EX_RAMP_MV_PDO=1.0; EX_RAMP_SV_FI=1.0; EX_RAMP_SV_PDO=1.0;

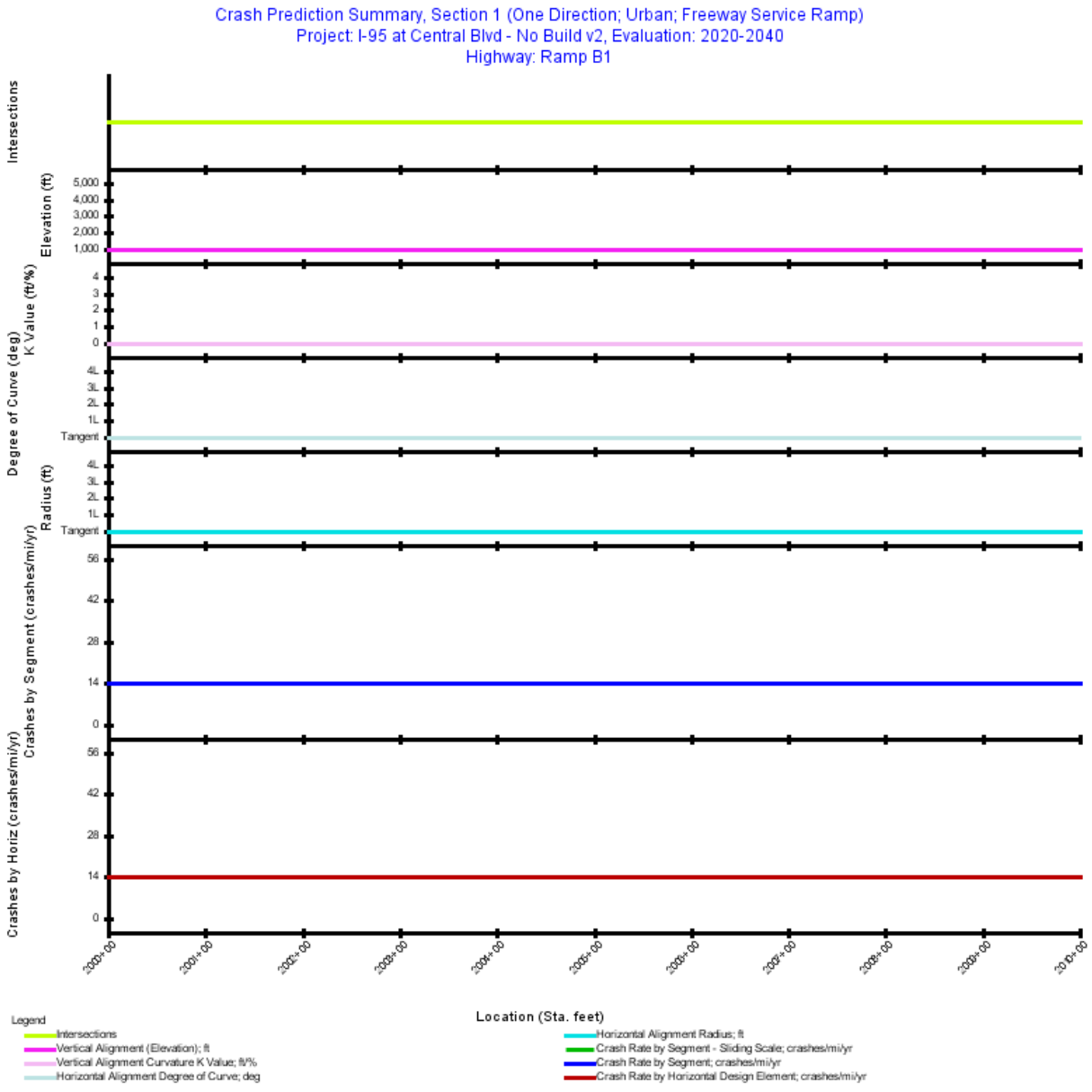

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

2020-2040 No Build Scenario
Ramp B1

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT
1	2EX	Urban	2000+00.000	2010+00.000	1,000.00	0.1894	2020-2040: 50,700

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2020**
Last Year of Analysis	**2040**
Evaluated Length (mi)	**0.1894**
Average Future Road AADT (vpd)	**50,700**
Predicted Crashes	
Total Crashes	**54.87**
Fatal and Injury Crashes	**26.89**
Property-Damage-Only Crashes	**27.98**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**49**
Percent Property-Damage-Only Crashes (%)	**51**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**13.7968**
FI Crash Rate (crashes/mi/yr)	**6.7620**
PDO Crash Rate (crashes/mi/yr)	**7.0348**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**73.60**
Travel Crash Rate (crashes/million veh-mi)	**0.75**
Travel FI Crash Rate (crashes/million veh-mi)	**0.36**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.38**

2020-2040 No Build Scenario
Ramp B1

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	2000+00.000	2010+00.000	0.1894	54.874	2.6130	1.2807	1.3323	13.7968	0.75
Total			0.1894	54.874	2.6130	1.2807	1.3323	13.7968	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	2000+00.000	2010+00.000	0.1894	54.874	2.6130	1.2807	1.3323	13.7968	0.75

2020-2040 No Build Scenario
Ramp B1

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2020	2.61	1.28	49.011	1.33	50.989
2021	2.61	1.28	49.011	1.33	50.989
2022	2.61	1.28	49.011	1.33	50.989
2023	2.61	1.28	49.011	1.33	50.989
2024	2.61	1.28	49.011	1.33	50.989
2025	2.61	1.28	49.011	1.33	50.989
2026	2.61	1.28	49.011	1.33	50.989
2027	2.61	1.28	49.011	1.33	50.989
2028	2.61	1.28	49.011	1.33	50.989
2029	2.61	1.28	49.011	1.33	50.989
2030	2.61	1.28	49.011	1.33	50.989
2031	2.61	1.28	49.011	1.33	50.989
2032	2.61	1.28	49.011	1.33	50.989
2033	2.61	1.28	49.011	1.33	50.989
2034	2.61	1.28	49.011	1.33	50.989
2035	2.61	1.28	49.011	1.33	50.989
2036	2.61	1.28	49.011	1.33	50.989
2037	2.61	1.28	49.011	1.33	50.989
2038	2.61	1.28	49.011	1.33	50.989
2039	2.61	1.28	49.011	1.33	50.989
2040	2.61	1.28	49.011	1.33	50.989
Total	54.87	26.89	49.011	27.98	50.989
Average	2.61	1.28	49.011	1.33	50.989

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.8003	2.4266	8.2032	15.4641	27.9793

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)	Total Crashes	Percent Total (%)
Highway Segment	Collision with Animal	0.06	0.1	0.40	0.7	0.45	0.8
Highway Segment	Collision with Fixed Object	9.85	17.9	12.92	23.5	22.76	41.5
Highway Segment	Collision with Other Object	0.70	1.3	2.51	4.6	3.20	5.8
Highway Segment	Other Single-vehicle Collision	2.84	5.2	1.93	3.5	4.77	8.7
Highway Segment	Collision with Parked Vehicle	0.20	0.4	0.29	0.5	0.49	0.9
Highway Segment	Total Single Vehicle Crashes	13.64	24.9	18.04	32.9	31.68	57.7
Highway Segment	Right-Angle Collision	0.41	0.7	0.18	0.3	0.59	1.1
Highway Segment	Head-on Collision	0.11	0.2	0.02	0.0	0.13	0.2
Highway Segment	Other Multi-vehicle Collision	0.41	0.7	0.24	0.4	0.65	1.2
Highway Segment	Rear-end Collision	9.94	18.1	6.86	12.5	16.80	30.6
Highway Segment	Sideswipe, Same Direction Collision	2.39	4.3	2.64	4.8	5.03	9.2
Highway Segment	Total Multiple Vehicle Crashes	13.25	24.2	9.94	18.1	23.19	42.3
Highway Segment	Total Highway Segment Crashes	26.89	49.0	27.98	51.0	54.87	100.0
	Total Crashes	26.89	49.0	27.98	51.0	54.87	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), The ramp type for Ramp Ramp B1 is set at the Ramp Connection (Exit) and in the Ramp (Exit). The Ramp value takes precedence.
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2020 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2021 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2022 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2023 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2024 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2025 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2026 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2027 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2028 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2029 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2030 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2031 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2032 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2033 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2034 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2035 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2036 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2037 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2038 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2039 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2040 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX

Build Scenario

2020-2040 Build Scenario
I-95 Freeway Segment

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

August 24, 2020

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2020-2040 Build Scenario
I-95 Freeway Segment

Report Overview

Report Generated: Aug 24, 2020 2:49 PM
Report Template: System: Single Page, 508 Compliant [System] (mlcpm5, Nov 8, 2019 2:21 PM)

Evaluation Date: Thu Aug 13 10:46:27 EDT 2020
IHSDM Version: v15.0.0 (Oct 31, 2019)
Crash Prediction Module: v10.0.0 (Oct 31, 2019)

User Name: fuentesa
Organization Name: RS&H
Phone: 305-428-3213
E-Mail: antonio.fuentes@rsandh.com

Project Title: I-95 at Central Blvd - Build v2
Project Comment: Created Wed Aug 12 20:17:36 EDT 2020
Project Unit System: U.S. Customary

Highway Title: I-95
Highway Comment: Created Wed Aug 12 20:18:34 EDT 2020
Highway Version: 1

Evaluation Title: 2020-2040
Evaluation Comment: Created Thu Aug 13 10:46:15 EDT 2020

Minimum Location: 15+00.000
Maximum Location: 53+00.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2020
Last Year of Analysis: 2040
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

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The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Section 1 Evaluation

Section: Section 1
Evaluation Start Location: 15+00.000
Evaluation End Location: 53+00.000
Functional Class: Freeway

Type of Alignment: Divided, Multilane
Model Category: Freeway Segment
Calibration Factor: FI_EN=1.0; FI_EX=1.0; FI_MV=1.0; FI_SV=1.0; PDO_EN=1.0; PDO_EX=1.0; PDO_MV=1.0; PDO_SV=1.0;

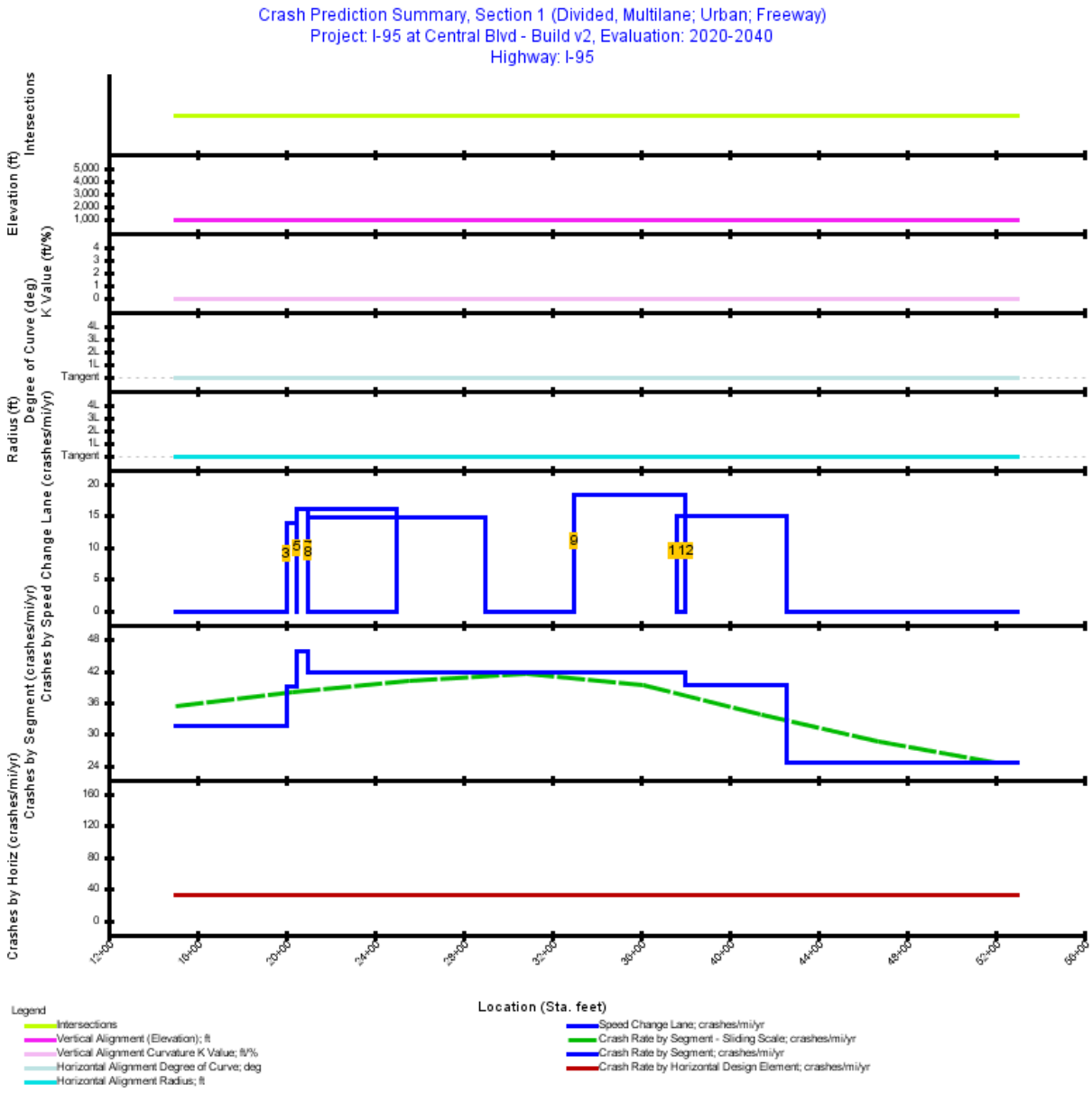

Figure 1. Crash Prediction Summary (Section 1)

2020-2040 Build Scenario
I-95 Freeway Segment

Table 1. Evaluation Freeway - Homogeneous Segments (Section 1)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT	Median Width (ft)	Type	Effective Median Width (ft)
1	8F	Urban	15+00.000	20+00.000	500.00	0.0947	2020-2040: 140,400	30.00	Non-Traversable Median	54.00
2	8F	Urban	20+00.000	20+50.000	50.00	0.0095	2020-2040: 140,400	30.00	Non-Traversable Median	54.00
4	8F	Urban	20+50.000	21+00.000	50.00	0.0095	2020-2040: 158,000	30.00	Non-Traversable Median	54.00
6	8F	Urban	21+00.000	38+00.000	1,700.00	0.3220	2020-2040: 158,000	30.00	Non-Traversable Median	54.00
11	8F	Urban	38+00.000	42+60.000	460.00	0.0871	2020-2040: 158,000	30.00	Non-Traversable Median	54.00
13	8F	Urban	42+60.000	53+00.000	1,040.00	0.1970	2020-2040: 120,500	30.00	Non-Traversable Median	54.00

Table 2. Evaluation Freeway - Speed Change Lanes (Speed Change)

Seg. No.	Type	Ramp Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT	Median Width (ft)	Type	Effective Median Width (ft)
3	8SC	Entrance	20+00.000	20+50.000	50.00	0.0095	2020-2040: 140,400	30.00	Non-Traversable Median	54.00
5	8SC	Entrance	20+50.000	21+00.000	50.00	0.0095	2020-2040: 158,000	30.00	Non-Traversable Median	54.00
7	8SC	Entrance	21+00.000	25+00.000	400.00	0.0758	2020-2040: 158,000	30.00	Non-Traversable Median	54.00
8	8SC	Exit	21+00.000	29+00.000	800.00	0.1515	2020-2040: 158,000	30.00	Non-Traversable Median	54.00
9	8SC	Entrance	33+00.000	38+00.000	500.00	0.0947	2020-2040: 158,000	30.00	Non-Traversable Median	54.00
10	8SC	Exit	37+60.000	38+00.000	40.00	0.0076	2020-2040: 158,000	30.00	Non-Traversable Median	54.00
12	8SC	Exit	38+00.000	42+60.000	460.00	0.0871	2020-2040: 158,000	30.00	Non-Traversable Median	54.00

2020-2040 Build Scenario
I-95 Freeway Segment

Table 3. Predicted Freeway Crash Rates and Frequencies Summary (Section 1)

First Year of Analysis	**2020**
Last Year of Analysis	**2040**
Effective Length (mi)	**0.5019**
Average Future Road AADT (vpd)	**139,796**
Predicted Crashes	
Total Crashes	**346.92**
Fatal and Injury Crashes	**93.97**
Property-Damage-Only Crashes	**252.96**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**27**
Percent Property-Damage-Only Crashes (%)	**73**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**32.9156**
FI Crash Rate (crashes/mi/yr)	**8.9154**
PDO Crash Rate (crashes/mi/yr)	**24.0002**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**537.80**
Travel Crash Rate (crashes/million veh-mi)	**0.65**
Travel FI Crash Rate (crashes/million veh-mi)	**0.17**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.47**

Note: *Effective Length* is the *segment length* minus the length of the *speed change lanes* if present.

2020-2040 Build Scenario
I-95 Freeway Segment

Table 4. Predicted Freeway Speed Change Lane Crash Rates and Frequencies Summary (Speed Change)

First Year of Analysis	**2020**
Last Year of Analysis	**2040**
Evaluated Length (mi)	**0.4356**
Average Future Road AADT (vpd)	**78,809**
Predicted Crashes	
Total Crashes	**144.38**
Fatal and Injury Crashes	**43.24**
Property-Damage-Only Crashes	**101.14**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**30**
Percent Property-Damage-Only Crashes (%)	**70**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**15.7832**
FI Crash Rate (crashes/mi/yr)	**4.7267**
PDO Crash Rate (crashes/mi/yr)	**11.0565**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**263.14**
Travel Crash Rate (crashes/million veh-mi)	**0.55**
Travel FI Crash Rate (crashes/million veh-mi)	**0.16**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.38**

Note: *Total Travel and Crash Rates/Million Vehicle Miles* for *Speed Change Lanes* reflect AADTs that are **half of the Freeway Segment AADTs** based on the assumption of 50/50 directional distribution.

2020-2040 Build Scenario
I-95 Freeway Segment

Table 5. Predicted Crash Frequencies and Rates by Freeway Segment/Intersection (Section 1)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Effective Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	15+00.000	20+00.000	0.0947	62.818	2.9913	0.8098	2.1815	31.5883	0.62
2	20+00.000	20+50.000	0.0047	3.884	0.1850	0.0512	0.1338	39.0628	0.76
4	20+50.000	21+00.000	0.0047	4.551	0.2167	0.0583	0.1584	45.7733	0.79
6	21+00.000	38+00.000	0.1572	137.536	6.5493	1.7536	4.7958	41.6632	0.72
11	38+00.000	42+60.000	0.0436	36.025	1.7155	0.4548	1.2607	39.3818	0.68
13	42+60.000	53+00.000	0.1970	102.109	4.8623	1.3469	3.5154	24.6856	0.56
Total			0.5019	346.923	16.5202	4.4746	12.0456	32.9156	0.65

Note: *Effective Length* is the *segment length* minus the length of the *speed change lanes* if present. This may create Freeway segments with zero effective length and zero crashes.

Table 6. Predicted Crash Frequencies and Rates by Freeway Speed Change Lane (Speed Change)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
3	20+00.000	20+50.000	0.0095	2.777	0.1323	0.0361	0.0962	13.9669	0.55
5	20+50.000	21+00.000	0.0095	3.202	0.1525	0.0414	0.1110	16.1002	0.56
7	21+00.000	25+00.000	0.0758	25.614	1.2197	0.3314	0.8883	16.1002	0.56
8	21+00.000	29+00.000	0.1515	46.774	2.2273	0.6209	1.6064	14.7003	0.51
9	33+00.000	38+00.000	0.0947	36.397	1.7332	0.6229	1.1103	18.3026	0.64
10	37+60.000	38+00.000	0.0076	2.369	0.1128	0.0325	0.0803	14.8929	0.52
12	38+00.000	42+60.000	0.0871	27.247	1.2975	0.3738	0.9237	14.8929	0.52
Total			0.4356	144.381	6.8753	2.0590	4.8163	15.7832	0.55

Note: *Travel Crash Rates/Million Vehicle Miles* for *Speed Change Lanes* reflect AADTs that are **half of the Freeway Segment AADTs** based on the assumption of 50/50 directional distribution.

2020-2040 Build Scenario
I-95 Freeway Segment

Table 7. Predicted Crash Frequencies and Rates by Horizontal Design Element (Section 1)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	15+00.000	53+00.000	0.7197	491.304	23.3954	6.5336	16.8618	32.5073	0.99

Table 8. Predicted Crash Frequencies by Year (Section 1)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2020	23.39	6.53	27.927	16.86	72.073
2021	23.39	6.53	27.927	16.86	72.073
2022	23.39	6.53	27.927	16.86	72.073
2023	23.39	6.53	27.927	16.86	72.073
2024	23.39	6.53	27.927	16.86	72.073
2025	23.39	6.53	27.927	16.86	72.073
2026	23.39	6.53	27.927	16.86	72.073
2027	23.39	6.53	27.927	16.86	72.073
2028	23.39	6.53	27.927	16.86	72.073
2029	23.39	6.53	27.927	16.86	72.073
2030	23.39	6.53	27.927	16.86	72.073
2031	23.39	6.53	27.927	16.86	72.073
2032	23.39	6.53	27.927	16.86	72.073
2033	23.39	6.53	27.927	16.86	72.073
2034	23.39	6.53	27.927	16.86	72.073
2035	23.39	6.53	27.927	16.86	72.073
2036	23.39	6.53	27.927	16.86	72.073
2037	23.39	6.53	27.927	16.86	72.073
2038	23.39	6.53	27.927	16.86	72.073
2039	23.39	6.53	27.927	16.86	72.073
2040	23.39	6.53	27.927	16.86	72.073
Total	491.30	137.21	27.927	354.10	72.073
Average	23.39	6.53	27.927	16.86	72.073

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 9. Predicted Crash Severity by Freeway Segment (Section 1)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.3710	0.9856	5.5505	10.0996	45.8109
2	0.0235	0.0623	0.3508	0.6384	2.8091
4	0.0267	0.0710	0.3999	0.7276	3.3261
6	0.9216	2.3723	12.8681	20.6631	100.7110
11	0.2390	0.6152	3.3371	5.3587	26.4754
13	0.7079	1.8221	9.8837	15.8709	73.8241
Total	2.2896	5.9285	32.3902	53.3582	252.9567

Table 10. Predicted Crash Severity by Speed Change Lane (Speed Change)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
3	0.0190	0.0488	0.2647	0.4250	2.0200
5	0.0218	0.0560	0.3040	0.4882	2.3317
7	0.1742	0.4484	2.4322	3.9055	18.6538
8	0.3263	0.8400	4.5563	7.3163	33.7349
9	0.3273	0.8426	4.5706	7.3394	23.3173
10	0.0171	0.0440	0.2385	0.3830	1.6867
12	0.1965	0.5057	2.7430	4.4046	19.3975
Total	1.0821	2.7855	15.1093	24.2620	101.1420

Table 11. Predicted Freeway Crash Type Distribution (Section 1)

Element Type	Crash Type	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)	Total Crashes	Percent Total (%)
Highway Segment	Collision with Animal	0.09	0.0	1.92	0.6	2.01	0.6
Highway Segment	Collision with Fixed Object	16.88	4.9	62.42	18.0	79.30	22.9
Highway Segment	Collision with Other Object	1.19	0.3	12.12	3.5	13.31	3.8
Highway Segment	Other Single-vehicle Collision	4.86	1.4	9.33	2.7	14.19	4.1
Highway Segment	Collision with Parked Vehicle	0.35	0.1	1.40	0.4	1.75	0.5
Highway Segment	Total Single Vehicle Crashes	23.38	6.7	87.18	25.1	110.56	31.9
Highway Segment	Right-Angle Collision	2.19	0.6	2.98	0.9	5.17	1.5
Highway Segment	Head-on Collision	0.56	0.2	0.33	0.1	0.90	0.3
Highway Segment	Other Multi-vehicle Collision	2.19	0.6	3.98	1.1	6.17	1.8
Highway Segment	Rear-end Collision	52.94	15.3	114.39	33.0	167.33	48.2
Highway Segment	Sideswipe, Same Direction Collision	12.71	3.7	44.10	12.7	56.80	16.4
Highway Segment	Total Multiple Vehicle Crashes	70.58	20.3	165.78	47.8	236.36	68.1
Highway Segment	Total Highway Segment Crashes	93.97	27.1	252.96	72.9	346.92	100.0
	Total Crashes	93.97	27.1	252.96	72.9	346.92	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 12. Predicted Exit Speed Change Lane Crash Type Distribution (Speed Change)

Element Type	Crash Type	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)	Total Crashes	Percent Total (%)
Highway Segment	Collision with Animal	0.00	0.0	0.38	0.5	0.38	0.5
Highway Segment	Collision with Fixed Object	4.23	5.5	11.35	14.9	15.58	20.4
Highway Segment	Collision with Other Object	0.34	0.5	1.65	2.2	1.99	2.6
Highway Segment	Other Single-vehicle Collision	1.06	1.4	1.26	1.7	2.32	3.0
Highway Segment	Collision with Parked Vehicle	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Total Single Vehicle Crashes	5.63	7.4	14.64	19.2	20.27	26.5
Highway Segment	Right-Angle Collision	0.24	0.3	0.66	0.9	0.90	1.2
Highway Segment	Head-on Collision	0.11	0.1	0.11	0.1	0.22	0.3
Highway Segment	Other Multi-vehicle Collision	0.34	0.5	0.88	1.1	1.22	1.6
Highway Segment	Rear-end Collision	11.84	15.5	30.97	40.5	42.81	56.0
Highway Segment	Sideswipe, Same Direction Collision	3.41	4.5	7.57	9.9	10.97	14.4
Highway Segment	Total Multiple Vehicle Crashes	15.94	20.9	40.18	52.6	56.12	73.5
Highway Segment	Total Highway Segment Crashes	21.57	28.2	54.82	71.8	76.39	100.0
	Total Crashes	21.57	28.2	54.82	71.8	76.39	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 13. Predicted Entrance Speed Change Lane Crash Type Distribution (Speed Change)

Element Type	Crash Type	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)	Total Crashes	Percent Total (%)
Highway Segment	Collision with Animal	0.00	0.0	0.09	0.1	0.09	0.1
Highway Segment	Collision with Fixed Object	4.20	6.2	5.98	8.8	10.18	15.0
Highway Segment	Collision with Other Object	0.41	0.6	1.67	2.5	2.08	3.1
Highway Segment	Other Single-vehicle Collision	1.45	2.1	0.74	1.1	2.19	3.2
Highway Segment	Collision with Parked Vehicle	0.09	0.1	0.14	0.2	0.23	0.3
Highway Segment	Total Single Vehicle Crashes	6.15	9.1	8.62	12.7	14.77	21.7
Highway Segment	Right-Angle Collision	0.41	0.6	0.74	1.1	1.15	1.7
Highway Segment	Head-on Collision	0.09	0.1	0.05	0.1	0.13	0.2
Highway Segment	Other Multi-vehicle Collision	0.37	0.5	0.69	1.0	1.06	1.6
Highway Segment	Rear-end Collision	11.77	17.3	24.55	36.1	36.32	53.4
Highway Segment	Sideswipe, Same Direction Collision	2.88	4.2	11.67	17.2	14.55	21.4
Highway Segment	Total Multiple Vehicle Crashes	15.51	22.8	37.71	55.5	53.22	78.3
Highway Segment	Total Highway Segment Crashes	21.67	31.9	46.32	68.1	67.99	100.0
	Total Crashes	21.67	31.9	46.32	68.1	67.99	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

2020-2040 Build Scenario
PGA Blvd Off-Ramp

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

August 24, 2020

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2020-2040 Build Scenario
PGA Blvd Off-Ramp

Report Overview

Report Generated: Aug 24, 2020 2:54 PM
Report Template: System: Single Page, 508 Compliant [System] (mlcpm5, Nov 8, 2019 2:21 PM)

Evaluation Date: Thu Aug 13 11:06:57 EDT 2020
IHSDM Version: v15.0.0 (Oct 31, 2019)
Crash Prediction Module: v10.0.0 (Oct 31, 2019)

User Name: fuentesa
Organization Name: RS&H
Phone: 305-428-3213
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Project Title: I-95 at Central Blvd - Build v2
Project Comment: Created Wed Aug 12 20:17:36 EDT 2020
Project Unit System: U.S. Customary

Highway Title: PGA Off-Ramp
Highway Comment: Created Wed Aug 12 20:49:40 EDT 2020
Highway Version: 1

Evaluation Title: 2020-2040
Evaluation Comment: Created Thu Aug 13 11:06:48 EDT 2020

Minimum Location: 0.000
Maximum Location: 10+00.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2020
Last Year of Analysis: 2040
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 10+00.000
Functional Class: Freeway Service Ramp

2020-2040 Build Scenario
PGA Blvd Off-Ramp

Type of Alignment: One Direction
Model Category: Freeway Service Ramp
Calibration Factor: EX_RAMP_MV_FI=1.0; EX_RAMP_MV_PDO=1.0; EX_RAMP_SV_FI=1.0; EX_RAMP_SV_PDO=1.0;

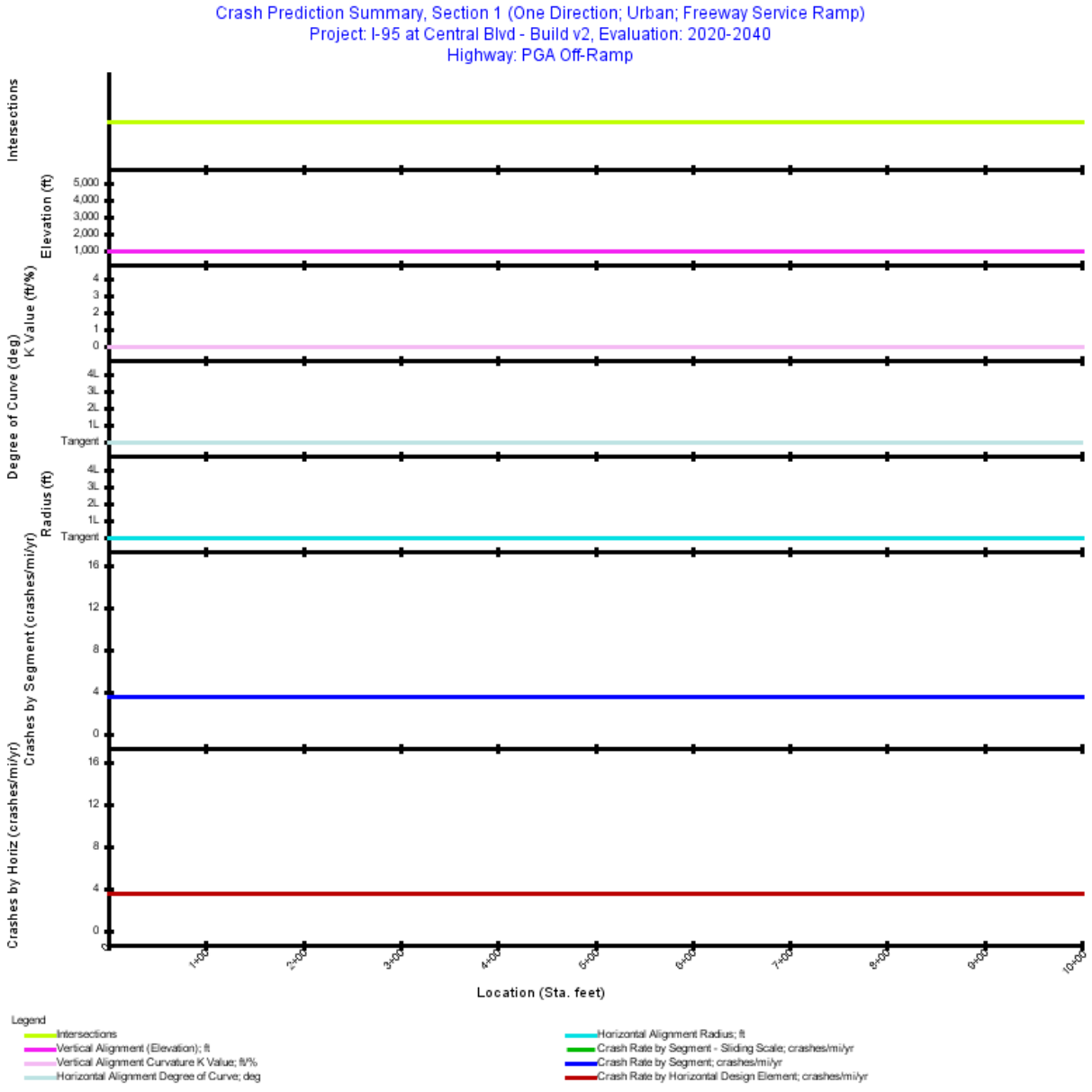

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

2020-2040 Build Scenario
PGA Blvd Off-Ramp

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT
1	2EX	Urban	0.000	10+00.000	1,000.00	0.1894	2020-2040: 15,000

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2020**
Last Year of Analysis	**2040**
Evaluated Length (mi)	**0.1894**
Average Future Road AADT (vpd)	**15,000**
Predicted Crashes	
Total Crashes	**14.02**
Fatal and Injury Crashes	**5.05**
Property-Damage-Only Crashes	**8.97**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**36**
Percent Property-Damage-Only Crashes (%)	**64**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**3.5250**
FI Crash Rate (crashes/mi/yr)	**1.2700**
PDO Crash Rate (crashes/mi/yr)	**2.2550**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**21.78**
Travel Crash Rate (crashes/million veh-mi)	**0.64**
Travel FI Crash Rate (crashes/million veh-mi)	**0.23**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.41**

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	10+00.000	0.1894	14.020	0.6676	0.2405	0.4271	3.5250	0.64
Total			0.1894	14.020	0.6676	0.2405	0.4271	3.5250	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	0.000	10+00.000	0.1894	14.020	0.6676	0.2405	0.4271	3.5250	0.64

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2020	0.67	0.24	36.029	0.43	63.971
2021	0.67	0.24	36.029	0.43	63.971
2022	0.67	0.24	36.029	0.43	63.971
2023	0.67	0.24	36.029	0.43	63.971
2024	0.67	0.24	36.029	0.43	63.971
2025	0.67	0.24	36.029	0.43	63.971
2026	0.67	0.24	36.029	0.43	63.971
2027	0.67	0.24	36.029	0.43	63.971
2028	0.67	0.24	36.029	0.43	63.971
2029	0.67	0.24	36.029	0.43	63.971
2030	0.67	0.24	36.029	0.43	63.971
2031	0.67	0.24	36.029	0.43	63.971
2032	0.67	0.24	36.029	0.43	63.971
2033	0.67	0.24	36.029	0.43	63.971
2034	0.67	0.24	36.029	0.43	63.971
2035	0.67	0.24	36.029	0.43	63.971
2036	0.67	0.24	36.029	0.43	63.971
2037	0.67	0.24	36.029	0.43	63.971
2038	0.67	0.24	36.029	0.43	63.971
2039	0.67	0.24	36.029	0.43	63.971
2040	0.67	0.24	36.029	0.43	63.971
Total	14.02	5.05	36.029	8.97	63.971
Average	0.67	0.24	36.029	0.43	63.971

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.1503	0.4558	1.5407	2.9045	8.9688

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)	Total Crashes	Percent Total (%)
Highway Segment	Collision with Animal	0.02	0.1	0.15	1.1	0.17	1.2
Highway Segment	Collision with Fixed Object	3.31	23.6	5.03	35.9	8.34	59.5
Highway Segment	Collision with Other Object	0.23	1.7	0.98	7.0	1.21	8.6
Highway Segment	Other Single-vehicle Collision	0.95	6.8	0.75	5.4	1.71	12.2
Highway Segment	Collision with Parked Vehicle	0.07	0.5	0.11	0.8	0.18	1.3
Highway Segment	Total Single Vehicle Crashes	4.59	32.7	7.03	50.1	11.61	82.8
Highway Segment	Right-Angle Collision	0.01	0.1	0.04	0.2	0.05	0.4
Highway Segment	Head-on Collision	0.00	0.0	0.00	0.0	0.01	0.1
Highway Segment	Other Multi-vehicle Collision	0.01	0.1	0.05	0.3	0.06	0.4
Highway Segment	Rear-end Collision	0.35	2.5	1.34	9.6	1.69	12.0
Highway Segment	Sideswipe, Same Direction Collision	0.08	0.6	0.52	3.7	0.60	4.3
Highway Segment	Total Multiple Vehicle Crashes	0.47	3.3	1.94	13.8	2.41	17.2
Highway Segment	Total Highway Segment Crashes	5.05	36.0	8.97	64.0	14.02	100.0
	Total Crashes	5.05	36.0	8.97	64.0	14.02	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
0.000	10+00.000	for segment #1 (0.000 to 10+00.000), The ramp type for Ramp PGA Off-Ramp is set at the Ramp Connection (Exit) and in the Ramp (Exit). The Ramp value takes precedence.

2020-2040 Build Scenario
PGA Blvd On-Ramp

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

August 24, 2020

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PGA Blvd On-Ramp

Report Overview

Report Generated: Aug 24, 2020 2:55 PM
Report Template: System: Single Page, 508 Compliant [System] (mlcpm5, Nov 8, 2019 2:21 PM)

Evaluation Date: Thu Aug 13 11:08:40 EDT 2020
IHSDM Version: v15.0.0 (Oct 31, 2019)
Crash Prediction Module: v10.0.0 (Oct 31, 2019)

User Name: fuentesa
Organization Name: RS&H
Phone: 305-428-3213
E-Mail: antonio.fuentes@rsandh.com

Project Title: I-95 at Central Blvd - Build v2
Project Comment: Created Wed Aug 12 20:17:36 EDT 2020
Project Unit System: U.S. Customary

Highway Title: PGA On-Ramp
Highway Comment: Created Wed Aug 12 20:53:56 EDT 2020
Highway Version: 1

Evaluation Title: 2020-2040
Evaluation Comment: Created Thu Aug 13 11:08:30 EDT 2020

Minimum Location: 0.000
Maximum Location: 10+00.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2020
Last Year of Analysis: 2040
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 10+00.000
Functional Class: Freeway Service Ramp

Type of Alignment: One Direction
Model Category: Freeway Service Ramp
Calibration Factor: ENT_RAMP_MV_FI=1.0; ENT_RAMP_MV_PDO=1.0; ENT_RAMP_SV_FI=1.0; ENT_RAMP_SV_PDO=1.0;

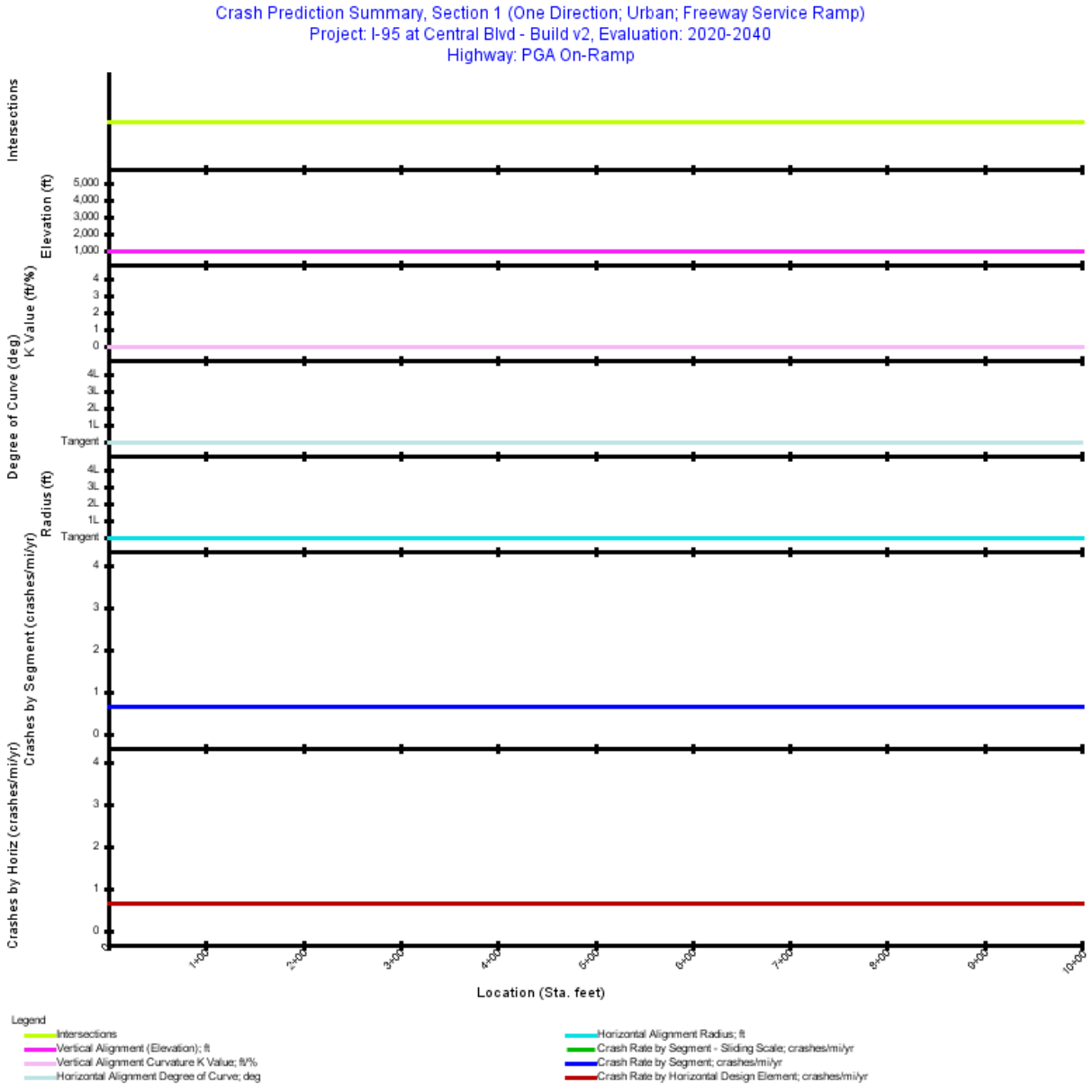

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

2020-2040 Build Scenario
PGA Blvd On-Ramp

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT
1	1EN	Urban	0.000	10+00.000	1,000.00	0.1894	2020-2040: 2,500

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2020**
Last Year of Analysis	**2040**
Evaluated Length (mi)	**0.1894**
Average Future Road AADT (vpd)	**2,500**
Predicted Crashes	
Total Crashes	**2.62**
Fatal and Injury Crashes	**1.15**
Property-Damage-Only Crashes	**1.46**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**44**
Percent Property-Damage-Only Crashes (%)	**56**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**0.6575**
FI Crash Rate (crashes/mi/yr)	**0.2899**
PDO Crash Rate (crashes/mi/yr)	**0.3676**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**3.63**
Travel Crash Rate (crashes/million veh-mi)	**0.72**
Travel FI Crash Rate (crashes/million veh-mi)	**0.32**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.40**

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	10+00.000	0.1894	2.615	0.1245	0.0549	0.0696	0.6575	0.72
Total			0.1894	2.615	0.1245	0.0549	0.0696	0.6575	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	0.000	10+00.000	0.1894	2.615	0.1245	0.0549	0.0696	0.6575	0.72

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2020	0.12	0.06	44.091	0.07	55.909
2021	0.12	0.06	44.091	0.07	55.909
2022	0.12	0.06	44.091	0.07	55.909
2023	0.12	0.06	44.091	0.07	55.909
2024	0.12	0.06	44.091	0.07	55.909
2025	0.12	0.06	44.091	0.07	55.909
2026	0.12	0.06	44.091	0.07	55.909
2027	0.12	0.06	44.091	0.07	55.909
2028	0.12	0.06	44.091	0.07	55.909
2029	0.12	0.06	44.091	0.07	55.909
2030	0.12	0.06	44.091	0.07	55.909
2031	0.12	0.06	44.091	0.07	55.909
2032	0.12	0.06	44.091	0.07	55.909
2033	0.12	0.06	44.091	0.07	55.909
2034	0.12	0.06	44.091	0.07	55.909
2035	0.12	0.06	44.091	0.07	55.909
2036	0.12	0.06	44.091	0.07	55.909
2037	0.12	0.06	44.091	0.07	55.909
2038	0.12	0.06	44.091	0.07	55.909
2039	0.12	0.06	44.091	0.07	55.909
2040	0.12	0.06	44.091	0.07	55.909
Total	2.62	1.15	44.091	1.46	55.909
Average	0.12	0.06	44.091	0.07	55.909

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0246	0.0746	0.4747	0.5792	1.4621

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)	Total Crashes	Percent Total (%)
Highway Segment	Collision with Animal	0.00	0.1	0.03	1.0	0.03	1.2
Highway Segment	Collision with Fixed Object	0.69	26.2	0.87	33.2	1.55	59.4
Highway Segment	Collision with Other Object	0.05	1.9	0.17	6.4	0.22	8.3
Highway Segment	Other Single-vehicle Collision	0.20	7.6	0.13	5.0	0.33	12.5
Highway Segment	Collision with Parked Vehicle	0.01	0.5	0.02	0.7	0.03	1.3
Highway Segment	Total Single Vehicle Crashes	0.95	36.3	1.21	46.4	2.16	82.7
Highway Segment	Right-Angle Collision	0.01	0.2	0.00	0.2	0.01	0.4
Highway Segment	Head-on Collision	0.00	0.1	0.00	0.0	0.00	0.1
Highway Segment	Other Multi-vehicle Collision	0.01	0.2	0.01	0.2	0.01	0.5
Highway Segment	Rear-end Collision	0.15	5.8	0.17	6.6	0.32	12.4
Highway Segment	Sideswipe, Same Direction Collision	0.04	1.4	0.07	2.5	0.10	3.9
Highway Segment	Total Multiple Vehicle Crashes	0.20	7.8	0.25	9.5	0.45	17.3
Highway Segment	Total Highway Segment Crashes	1.15	44.1	1.46	55.9	2.62	100.0
	Total Crashes	1.15	44.1	1.46	55.9	2.62	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
0.000	10+00.000	for segment #1 (0.000 to 10+00.000), The ramp type for Ramp PGA On-Ramp is set at the Ramp Connection (Entrance) and in the Ramp (Entrance). The Ramp value takes precedence.

2020-2040 Build Scenario
Ramp A

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

August 24, 2020

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2020-2040 Build Scenario
Ramp A

Report Overview

Report Generated: Aug 24, 2020 2:51 PM
Report Template: System: Single Page, 508 Compliant [System] (mlcpm5, Nov 8, 2019 2:21 PM)

Evaluation Date: Thu Aug 13 11:01:08 EDT 2020
IHSDM Version: v15.0.0 (Oct 31, 2019)
Crash Prediction Module: v10.0.0 (Oct 31, 2019)

User Name: fuentesa
Organization Name: RS&H
Phone: 305-428-3213
E-Mail: antonio.fuentes@rsandh.com

Project Title: I-95 at Central Blvd - Build v2
Project Comment: Created Wed Aug 12 20:17:36 EDT 2020
Project Unit System: U.S. Customary

Highway Title: Ramp A
Highway Comment: Created Wed Aug 12 20:33:03 EDT 2020
Highway Version: 1

Evaluation Title: 2020-2040
Evaluation Comment: Created Thu Aug 13 11:00:09 EDT 2020

Minimum Location: 0.000
Maximum Location: 14+57.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2020
Last Year of Analysis: 2040
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

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Section Types

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 14+57.000
Functional Class: Freeway Service Ramp

2020-2040 Build Scenario
Ramp A

Type of Alignment: One Direction
Model Category: Freeway Service Ramp
Calibration Factor: ENT_RAMP_MV_FI=1.0; ENT_RAMP_MV_PDO=1.0; ENT_RAMP_SV_FI=1.0; ENT_RAMP_SV_PDO=1.0;

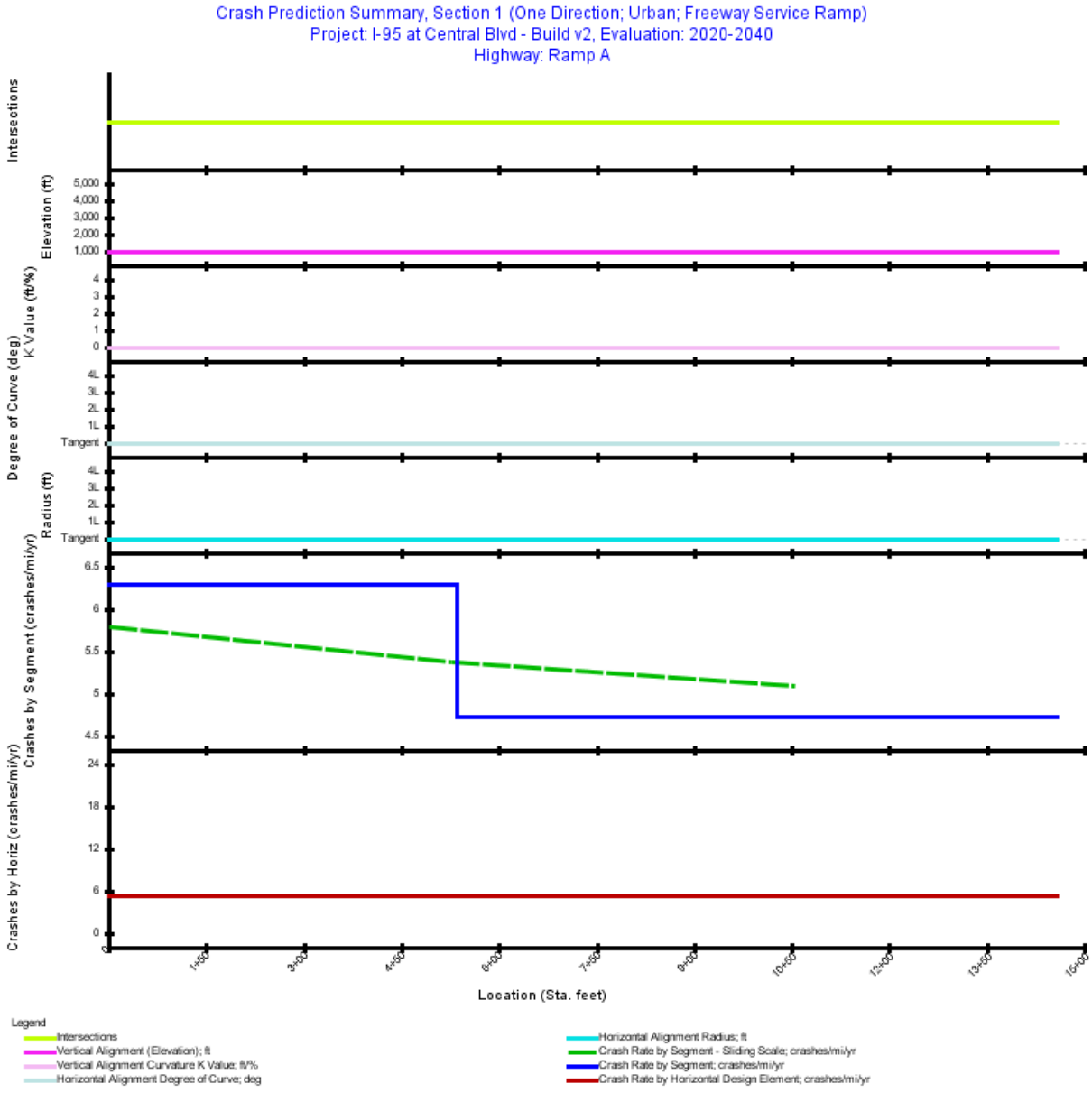

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

2020-2040 Build Scenario
Ramp A

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT
1	2EN	Urban	0.000	5+35.000	535.00	0.1013	2020-2040: 19,600
2	1EN	Urban	5+35.000	14+57.000	922.00	0.1746	2020-2040: 19,600

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2020**
Last Year of Analysis	**2040**
Evaluated Length (mi)	**0.2759**
Average Future Road AADT (vpd)	**19,600**
Predicted Crashes	
Total Crashes	**30.76**
Fatal and Injury Crashes	**13.65**
Property-Damage-Only Crashes	**17.11**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**44**
Percent Property-Damage-Only Crashes (%)	**56**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**5.3075**
FI Crash Rate (crashes/mi/yr)	**2.3554**
PDO Crash Rate (crashes/mi/yr)	**2.9520**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**41.46**
Travel Crash Rate (crashes/million veh-mi)	**0.74**
Travel FI Crash Rate (crashes/million veh-mi)	**0.33**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.41**

2020-2040 Build Scenario
Ramp A

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	5+35.000	0.1013	13.399	0.6381	0.2285	0.4095	6.2971	0.88
2	5+35.000	14+57.000	0.1746	17.357	0.8265	0.4215	0.4051	4.7332	0.66
Total			0.2759	30.756	1.4646	0.6500	0.8146	5.3075	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	0.000	14+57.000	0.2759	30.756	1.4646	0.6500	0.8146	5.3075	0.74

2020-2040 Build Scenario
Ramp A

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2020	1.47	0.65	44.380	0.81	55.620
2021	1.47	0.65	44.380	0.81	55.620
2022	1.47	0.65	44.380	0.81	55.620
2023	1.47	0.65	44.380	0.81	55.620
2024	1.47	0.65	44.380	0.81	55.620
2025	1.47	0.65	44.380	0.81	55.620
2026	1.47	0.65	44.380	0.81	55.620
2027	1.47	0.65	44.380	0.81	55.620
2028	1.47	0.65	44.380	0.81	55.620
2029	1.47	0.65	44.380	0.81	55.620
2030	1.47	0.65	44.380	0.81	55.620
2031	1.47	0.65	44.380	0.81	55.620
2032	1.47	0.65	44.380	0.81	55.620
2033	1.47	0.65	44.380	0.81	55.620
2034	1.47	0.65	44.380	0.81	55.620
2035	1.47	0.65	44.380	0.81	55.620
2036	1.47	0.65	44.380	0.81	55.620
2037	1.47	0.65	44.380	0.81	55.620
2038	1.47	0.65	44.380	0.81	55.620
2039	1.47	0.65	44.380	0.81	55.620
2040	1.47	0.65	44.380	0.81	55.620
Total	30.76	13.65	44.380	17.11	55.620
Average	1.47	0.65	44.380	0.81	55.620

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0973	0.2951	1.5273	2.8791	8.6004
2	0.1888	0.5723	3.6437	4.4460	8.5063
Total	0.2861	0.8674	5.1710	7.3251	17.1067

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)	Total Crashes	Percent Total (%)
Highway Segment	Collision with Animal	0.04	0.1	0.20	0.7	0.24	0.8
Highway Segment	Collision with Fixed Object	6.27	20.4	6.59	21.4	12.86	41.8
Highway Segment	Collision with Other Object	0.44	1.4	1.28	4.2	1.72	5.6
Highway Segment	Other Single-vehicle Collision	1.80	5.9	0.98	3.2	2.79	9.1
Highway Segment	Collision with Parked Vehicle	0.13	0.4	0.15	0.5	0.28	0.9
Highway Segment	Total Single Vehicle Crashes	8.68	28.2	9.20	29.9	17.88	58.1
Highway Segment	Right-Angle Collision	0.15	0.5	0.14	0.5	0.30	1.0
Highway Segment	Head-on Collision	0.04	0.1	0.02	0.1	0.06	0.2
Highway Segment	Other Multi-vehicle Collision	0.15	0.5	0.19	0.6	0.34	1.1
Highway Segment	Rear-end Collision	3.73	12.1	5.45	17.7	9.18	29.9
Highway Segment	Sideswipe, Same Direction Collision	0.90	2.9	2.10	6.8	3.00	9.7
Highway Segment	Total Multiple Vehicle Crashes	4.97	16.2	7.90	25.7	12.87	41.9
Highway Segment	Total Highway Segment Crashes	13.65	44.4	17.11	55.6	30.76	100.0
	Total Crashes	13.65	44.4	17.11	55.6	30.76	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
0.000	5+35.000	for segment #1 (0.000 to 5+35.000), The ramp type for Ramp Ramp A is set at the Ramp Connection (Entrance) and in the Ramp (Entrance). The Ramp value takes precedence.
5+35.000	14+57.000	for segment #2 (5+35.000 to 14+57.000), The ramp type for Ramp Ramp A is set at the Ramp Connection (Entrance) and in the Ramp (Entrance). The Ramp value takes precedence.
5+35.000	14+57.000	for segment #2 (5+35.000 to 14+57.000), traffic volume (19,600 vpd) for 2020 is not within the model limit (18,000 vpd) for reliable results for segment type 1EN
5+35.000	14+57.000	for segment #2 (5+35.000 to 14+57.000), traffic volume (19,600 vpd) for 2021 is not within the model limit (18,000 vpd) for reliable results for segment type 1EN
5+35.000	14+57.000	for segment #2 (5+35.000 to 14+57.000), traffic volume (19,600 vpd) for 2022 is not within the model limit (18,000 vpd) for reliable results for segment type 1EN
5+35.000	14+57.000	for segment #2 (5+35.000 to 14+57.000), traffic volume (19,600 vpd) for 2023 is not within the model limit (18,000 vpd) for reliable results for segment type 1EN
5+35.000	14+57.000	for segment #2 (5+35.000 to 14+57.000), traffic volume (19,600 vpd) for 2024 is not within the model limit (18,000 vpd) for reliable results for segment type 1EN
5+35.000	14+57.000	for segment #2 (5+35.000 to 14+57.000), traffic volume (19,600 vpd) for 2025 is not within the model limit (18,000 vpd) for reliable results for segment type 1EN
5+35.000	14+57.000	for segment #2 (5+35.000 to 14+57.000), traffic volume (19,600 vpd) for 2026 is not within the model limit (18,000 vpd) for reliable results for segment type 1EN
5+35.000	14+57.000	for segment #2 (5+35.000 to 14+57.000), traffic volume (19,600 vpd) for 2027 is not within the model limit (18,000 vpd) for reliable results for segment type 1EN
5+35.000	14+57.000	for segment #2 (5+35.000 to 14+57.000), traffic volume (19,600 vpd) for 2028 is not within the model limit (18,000 vpd) for reliable results for segment type 1EN
5+35.000	14+57.000	for segment #2 (5+35.000 to 14+57.000), traffic volume (19,600 vpd) for 2029 is not within the model limit (18,000 vpd) for reliable results for segment type 1EN
5+35.000	14+57.000	for segment #2 (5+35.000 to 14+57.000), traffic volume (19,600 vpd) for 2030 is not within the model limit (18,000 vpd) for reliable results for segment type 1EN
5+35.000	14+57.000	for segment #2 (5+35.000 to 14+57.000), traffic volume (19,600 vpd) for 2031 is not within the model limit (18,000 vpd) for reliable results for segment type 1EN
5+35.000	14+57.000	for segment #2 (5+35.000 to 14+57.000), traffic volume (19,600 vpd) for 2032 is not within the model limit (18,000 vpd) for reliable results for segment type 1EN
5+35.000	14+57.000	for segment #2 (5+35.000 to 14+57.000), traffic volume (19,600 vpd) for 2033 is not within the model limit (18,000 vpd) for reliable results for segment type 1EN
5+35.000	14+57.000	for segment #2 (5+35.000 to 14+57.000), traffic volume (19,600 vpd) for 2034 is not within the model limit (18,000 vpd) for reliable results for segment type 1EN
5+35.000	14+57.000	for segment #2 (5+35.000 to 14+57.000), traffic volume (19,600 vpd) for 2035 is not within the model limit (18,000 vpd) for reliable results for segment type 1EN

2020-2040 Build Scenario
Ramp A

Start Location (Sta. ft)	End Location (Sta. ft)	Message
5+35.000	14+57.000	for segment #2 (5+35.000 to 14+57.000), traffic volume (19,600 vpd) for 2036 is not within the model limit (18,000 vpd) for reliable results for segment type 1EN
5+35.000	14+57.000	for segment #2 (5+35.000 to 14+57.000), traffic volume (19,600 vpd) for 2037 is not within the model limit (18,000 vpd) for reliable results for segment type 1EN
5+35.000	14+57.000	for segment #2 (5+35.000 to 14+57.000), traffic volume (19,600 vpd) for 2038 is not within the model limit (18,000 vpd) for reliable results for segment type 1EN
5+35.000	14+57.000	for segment #2 (5+35.000 to 14+57.000), traffic volume (19,600 vpd) for 2039 is not within the model limit (18,000 vpd) for reliable results for segment type 1EN
5+35.000	14+57.000	for segment #2 (5+35.000 to 14+57.000), traffic volume (19,600 vpd) for 2040 is not within the model limit (18,000 vpd) for reliable results for segment type 1EN

2020-2040 Build Scenario
Ramp B1

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

August 24, 2020

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2020-2040 Build Scenario
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Report Overview

Report Generated: Aug 24, 2020 2:52 PM
Report Template: System: Single Page, 508 Compliant [System] (mlcpm5, Nov 8, 2019 2:21 PM)

Evaluation Date: Thu Aug 13 11:01:56 EDT 2020
IHSDM Version: v15.0.0 (Oct 31, 2019)
Crash Prediction Module: v10.0.0 (Oct 31, 2019)

User Name: fuentesa
Organization Name: RS&H
Phone: 305-428-3213
E-Mail: antonio.fuentes@rsandh.com

Project Title: I-95 at Central Blvd - Build v2
Project Comment: Created Wed Aug 12 20:17:36 EDT 2020
Project Unit System: U.S. Customary

Highway Title: Ramp B1
Highway Comment: Created Wed Aug 12 20:44:02 EDT 2020
Highway Version: 1

Evaluation Title: 2020-2040
Evaluation Comment: Created Thu Aug 13 11:01:39 EDT 2020

Minimum Location: 2000+00.000
Maximum Location: 2010+00.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2020
Last Year of Analysis: 2040
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 2000+00.000
Evaluation End Location: 2010+00.000
Functional Class: Freeway Service Ramp

Type of Alignment: One Direction
Model Category: Freeway Service Ramp
Calibration Factor: EX_RAMP_MV_FI=1.0; EX_RAMP_MV_PDO=1.0; EX_RAMP_SV_FI=1.0; EX_RAMP_SV_PDO=1.0;

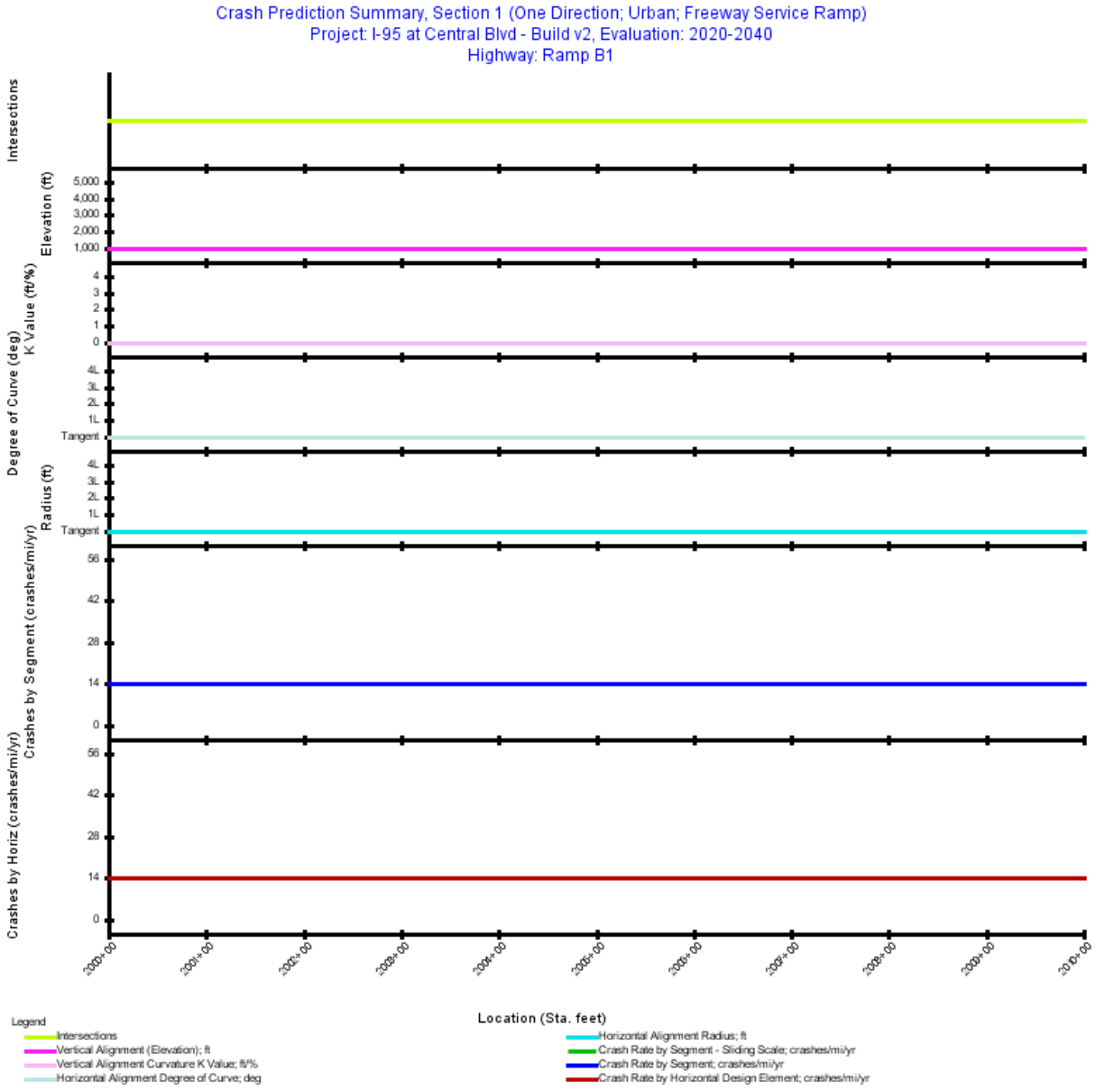


Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT
1	2EX	Urban	2000+00.000	2010+00.000	1,000.00	0.1894	2020-2040: 50,700

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2020**
Last Year of Analysis	**2040**
Evaluated Length (mi)	**0.1894**
Average Future Road AADT (vpd)	**50,700**
Predicted Crashes	
Total Crashes	**54.87**
Fatal and Injury Crashes	**26.89**
Property-Damage-Only Crashes	**27.98**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**49**
Percent Property-Damage-Only Crashes (%)	**51**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**13.7968**
FI Crash Rate (crashes/mi/yr)	**6.7620**
PDO Crash Rate (crashes/mi/yr)	**7.0348**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**73.60**
Travel Crash Rate (crashes/million veh-mi)	**0.75**
Travel FI Crash Rate (crashes/million veh-mi)	**0.36**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.38**

2020-2040 Build Scenario
Ramp B1

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	2000+00.000	2010+00.000	0.1894	54.874	2.6130	1.2807	1.3323	13.7968	0.75
Total			0.1894	54.874	2.6130	1.2807	1.3323	13.7968	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	2000+00.000	2010+00.000	0.1894	54.874	2.6130	1.2807	1.3323	13.7968	0.75

2020-2040 Build Scenario
Ramp B1

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2020	2.61	1.28	49.011	1.33	50.989
2021	2.61	1.28	49.011	1.33	50.989
2022	2.61	1.28	49.011	1.33	50.989
2023	2.61	1.28	49.011	1.33	50.989
2024	2.61	1.28	49.011	1.33	50.989
2025	2.61	1.28	49.011	1.33	50.989
2026	2.61	1.28	49.011	1.33	50.989
2027	2.61	1.28	49.011	1.33	50.989
2028	2.61	1.28	49.011	1.33	50.989
2029	2.61	1.28	49.011	1.33	50.989
2030	2.61	1.28	49.011	1.33	50.989
2031	2.61	1.28	49.011	1.33	50.989
2032	2.61	1.28	49.011	1.33	50.989
2033	2.61	1.28	49.011	1.33	50.989
2034	2.61	1.28	49.011	1.33	50.989
2035	2.61	1.28	49.011	1.33	50.989
2036	2.61	1.28	49.011	1.33	50.989
2037	2.61	1.28	49.011	1.33	50.989
2038	2.61	1.28	49.011	1.33	50.989
2039	2.61	1.28	49.011	1.33	50.989
2040	2.61	1.28	49.011	1.33	50.989
Total	54.87	26.89	49.011	27.98	50.989
Average	2.61	1.28	49.011	1.33	50.989

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.8003	2.4266	8.2032	15.4641	27.9793

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)	Total Crashes	Percent Total (%)
Highway Segment	Collision with Animal	0.06	0.1	0.40	0.7	0.45	0.8
Highway Segment	Collision with Fixed Object	9.85	17.9	12.92	23.5	22.76	41.5
Highway Segment	Collision with Other Object	0.70	1.3	2.51	4.6	3.20	5.8
Highway Segment	Other Single-vehicle Collision	2.84	5.2	1.93	3.5	4.77	8.7
Highway Segment	Collision with Parked Vehicle	0.20	0.4	0.29	0.5	0.49	0.9
Highway Segment	Total Single Vehicle Crashes	13.64	24.9	18.04	32.9	31.68	57.7
Highway Segment	Right-Angle Collision	0.41	0.7	0.18	0.3	0.59	1.1
Highway Segment	Head-on Collision	0.11	0.2	0.02	0.0	0.13	0.2
Highway Segment	Other Multi-vehicle Collision	0.41	0.7	0.24	0.4	0.65	1.2
Highway Segment	Rear-end Collision	9.94	18.1	6.86	12.5	16.80	30.6
Highway Segment	Sideswipe, Same Direction Collision	2.39	4.3	2.64	4.8	5.03	9.2
Highway Segment	Total Multiple Vehicle Crashes	13.25	24.2	9.94	18.1	23.19	42.3
Highway Segment	Total Highway Segment Crashes	26.89	49.0	27.98	51.0	54.87	100.0
	Total Crashes	26.89	49.0	27.98	51.0	54.87	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), The ramp type for Ramp Ramp B1 is set at the Ramp Connection (Exit) and in the Ramp (Exit). The Ramp value takes precedence.
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2020 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2021 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2022 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2023 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2024 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2025 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2026 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2027 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2028 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2029 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2030 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2031 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2032 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2033 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2034 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2035 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2036 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2037 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2038 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2039 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX
2000+00.000	2010+00.000	for segment #1 (2000+00.000 to 2010+00.000), traffic volume (50,700 vpd) for 2040 is not within the model limit (32,000 vpd) for reliable results for segment type 2EX

Appendix E

Methodology Letter of Understanding

Florida Department of Transportation Interchange Access Request

Methodology Letter of Understanding (MLOU)

Type of request ☒ IJR ☐ IMR ☐ IOAR

Type of Process ☐ Programmatic ☒ Non-Programmatic

SR 9/I-95 at Central Boulevard/PGA Boulevard

Interchange Justification Report (IJR) Re-Evaluation

FPID 413265-1-22-01

Coordination of assumptions, procedures, data, networks, and outputs for project traffic review during the access request process will be maintained throughout the evaluation process.

Full compliance with all MLOU requirements does not obligate the Acceptance Authorities to accept the IAR.

The Requestor shall inform the approval authorities of any changes to the approved methodology in the MLOU and an amendment shall be prepared if determined to be necessary.

Requestor	DocuSigned by: Bing Wang 9E1581AC2160401...	7/8/2020 | 9:43 AM EDT
	Bing Wang, PE *Project Manager*	*Date*
Interchange Review Coordinator	DocuSigned by: Cesar Martinez DC7B7B72D0BD4A2...	7/8/2020 | 9:58 AM EDT
	Cesar Martinez, PE FDOT District Four – Interchange Coordinator	*Date*
Systems Management Administrator (if applicable)	DocuSigned by: Chris Edmonston 7114473052D3466...	7/8/2020 | 10:33 AM EDT
	Chris Edmonston *Systems Management Administrator – Central Office*	*Date*
Federal Highway Administration	DocuSigned by: Mark Clasgens 2A09BD362AC94D3...	7/10/2020 | 2:11 PM EDT
	Mark Clasgens, PE *Program Operations Engineer*	*Date*

1.0 Project Description

Provide background or supporting information that explains the basis for the request.

In 2015, the Florida Department of Transportation evaluated a new interchange access connection to I-95 at Central Boulevard in Palm Beach County, Florida. The proposed project will improve regional mobility by constructing an interchange at I-95 and Central Boulevard in northern Palm Beach County. An interchange at this location was in the 2035 LRTP Needs Plan, and is shown in the 2040 LRTP Cost Feasible Plan. Central Boulevard currently crosses over, but does not provide access to, I-95 at this location. This IJR was approved by FHWA in November 2015.

Subsequently, a design modification to the I-95 southbound on-ramp from the proposed new interchange (identified as Ramp A) has necessitated a re-evaluation of the IJR. This design modification involves merging the two lanes on Ramp A to a single lane prior to drivers entering the weaving section on southbound I-95 between Central Boulevard and PGA Boulevard.

This document serves as the Methodology Letter of Understanding (MLOU) that outlines the criteria, assumptions, processes (analyses), and documentation requirements for the I-95 at Central Boulevard/PGA Boulevard IJR Re-Evaluation. The IJR Re-Evaluation will serve as a component of the design change Re-Evaluation for the same area. The design change is to improve safety and overall traffic operations for the southbound C-D system - Ramp A.

A. Purpose and Need Statement
Provide the Purpose, the Need, and the Goals and Objectives.

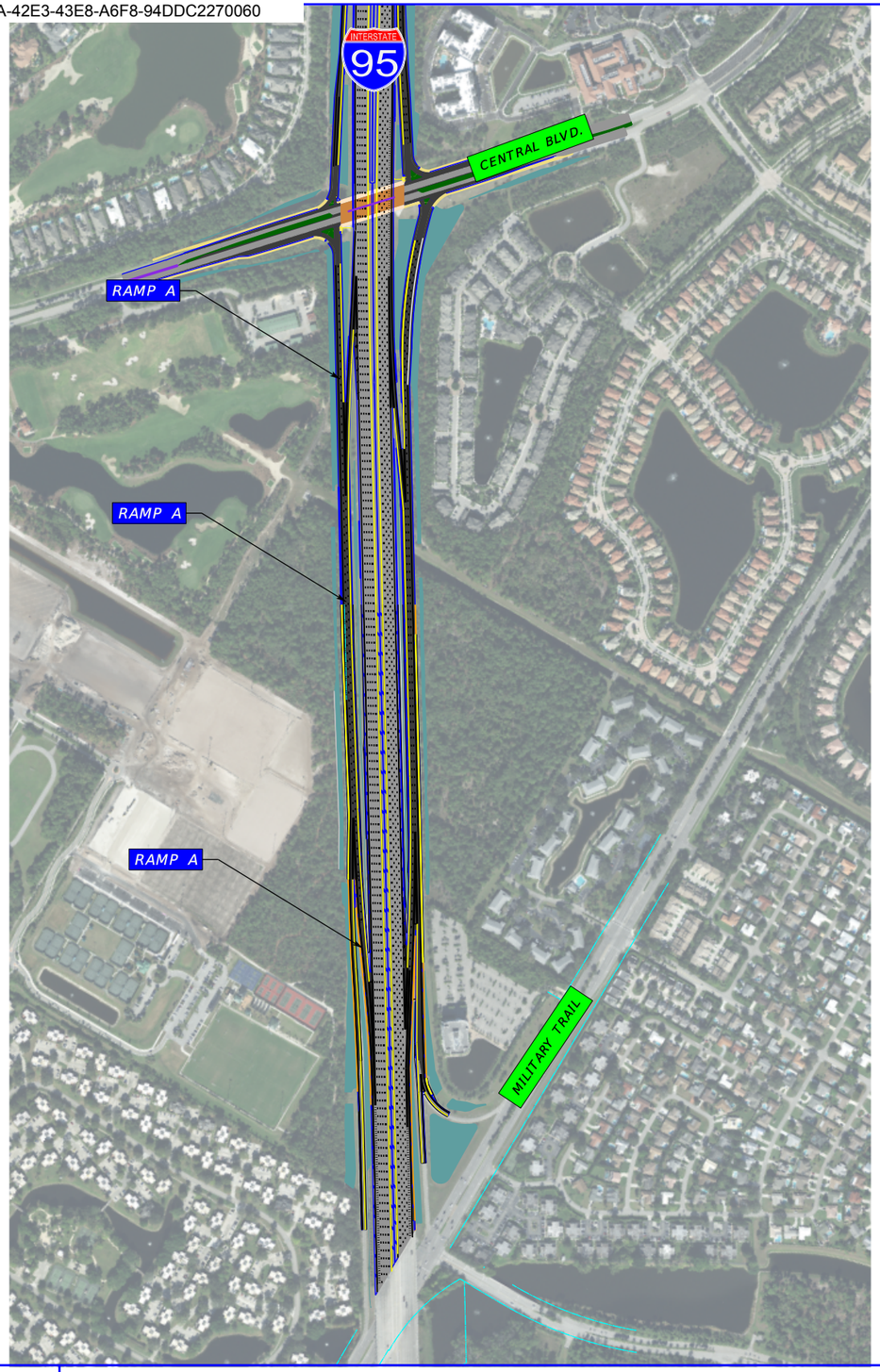
A design modification to the I-95 southbound on-ramp from the proposed new interchange (identified as Ramp A) has necessitated a re-evaluation of the IJR. This design modification involves merging the two lanes on Ramp A to a single lane prior to drivers entering the weaving section on southbound I-95 between Central Boulevard and PGA Boulevard. The design modification is intended to provide a safer merge and weaving condition for drivers attempting to enter the I-95 southbound traffic flow from Ramp A.

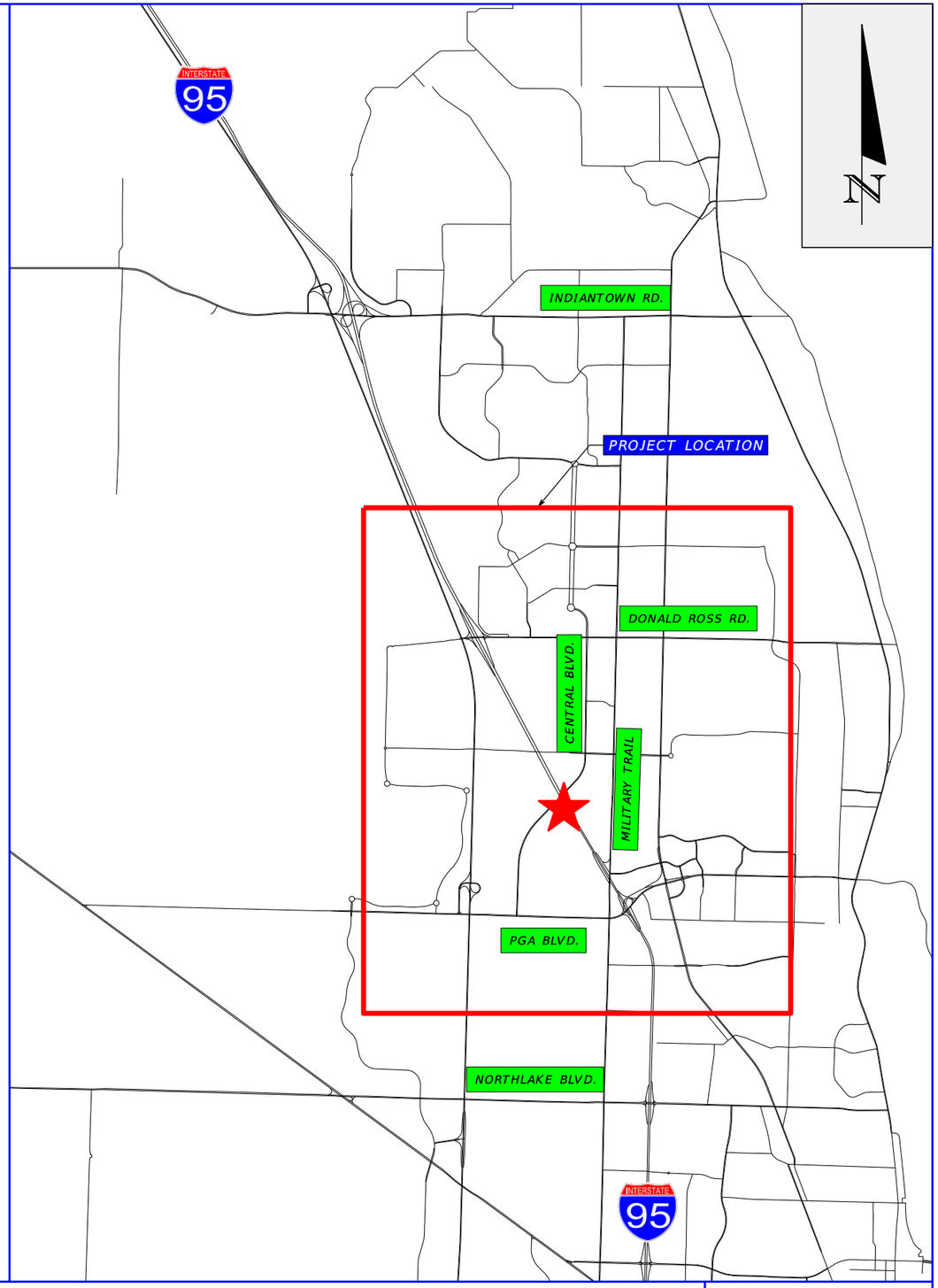
B. Project Location
Provide project description and a map of the IAR project location.

Located in Palm Beach County, Florida, the proposed Central Boulevard interchange is approximately one mile north of the existing Military Trail (SR 809) partial interchange, and two miles south of the existing Donald Ross Road interchange. The project location is depicted in Figure 1.

C. Area of Influence
Provide a description of the area of influence along the main line and cross street.

For this re-evaluation, the focus is on Ramp A which represents a southbound on-ramp between Central Boulevard and PGA Boulevard. The location of Ramp A and a schematic of the proposed lane reduction is included in Attachment A.





FDOT

SR 9/I-95 at PGA Boulevard/Central Boulevard Interchange Justification Report

Project Location Map

FIGURE 1

The analysis will focus on the two-lane portion of Ramp A south of where Ramp A1 diverges, including the section of Ramp A that reduces to a single lane and where Ramp A joins with southbound I-95 to form a weaving section between Central Boulevard and PGA Boulevard.

D. Project Schedule
Identify the schedule of production activities consistent with a proposed conceptual funding plan and opening year.

The proposed interchange improvements, identified as FDOT Project No. 413265-1-52-01, are included in the Departments' 5-Year Work Program. Design and right-of-way acquisition are currently programmed and funded by FDOT for 2020, with right-of-way acquisition also funded for 2021 and 2022. Construction of the new interchange is scheduled to begin in 2025 with its completion by 2028.

2.0 Analysis Years

A. Traffic Forecasting
- Base year = 2013
- Horizon year = 2040

B. Traffic Operational Analysis
- Existing year = 2013 (No analysis required for IJR Re-evaluation)
- Design year = 2040

Within the study area, a comparison of the 2013 AADTs used in the approved 2015 IJR was made against current 2018 AADTs. This comparison will assist in determining the validity of the base year.

The existing year (2013) and design year (2040) for the re-evaluation are all consistent with the previously approved 2015 IJR. Per current project schedule, the proposed interchange improvements are anticipated to open in 2028. The proposed southbound design change to Ramp A is expected to improve traffic operations and safety through design year 2040 when compared to the 2015 IJR Recommended Alternative.

A year of failure analysis shall be performed for Preferred Alternative, in case a failing LOS is obtained in Design Year.

3.0 Alternatives

The No-Build and Build alternatives shall be analyzed in the Interchange Access Request (IAR). The approved 2015 IJR design concept will serve as the No Build Alternative for comparison purposes. Details of all reasonable build alternatives considered, including those eliminated from further considerations, shall be documented. The documentation for the alternatives eliminated can be minimal like a summary of what was considered, reasons for elimination, etc. Build Alternatives meeting the purpose and need of the project shall have a more detailed description and evaluated in the IAR. The implementation of TSM&O alternative will be considered in the IAR.

The proposed design change concept and the approved 2015 IJR design concept will be analyzed in this IJR Re-Evaluation. The proposed design change will be evaluated to determine whether it meets the purpose and need of the project and performs equal or better than the approved 2015 IJR design

concept. The proposed design change consists of:

- **Ramp A Lane Reduction (see Attachment A):** This proposed modification to Ramp A involves narrowing this on-ramp from 2 lanes to 1 lane before Ramp A enters into the weaving section on I-95 southbound between PGA Boulevard and Central Boulevard. The laneage of the proposed Ramp A is illustrated in Attachment A. This design change is expected to improve safety and traffic operations within I-95 southbound mainline; the weaving section; and on Ramp A.

4.0 Data Collection

All data previously gathered and utilized in the approved IJR will be used for this re-evaluation.

The IJR Re-Evaluation will utilize data that was previously collected for the 2015 I-95 at PGA Boulevard/Central Boulevard IJR and the related I-95 at Central Boulevard PD&E Study. As such, no new data collection is anticipated for the IJR Re-Evaluation.

A. Transportation System Data

No new data collection is anticipated. The IJR Re-Evaluation will utilize data from prior studies.

B. Existing and Historical Traffic Data

No new data collection is anticipated. The IJR Re-Evaluation will utilize data from prior studies.

C. Land Use Data

No new data collection is anticipated. The IJR Re-Evaluation will utilize data from prior studies.

D. Environmental Data

No new data collection is anticipated. The IJR Re-Evaluation will utilize data from prior studies.

E. Planned and Programmed Projects

Information on planned and programmed projects will be gathered from FDOT and Palm Beach County. Most current available information will be incorporated in the analyses.

5.0 Travel Demand Forecasting

Per FDOT's Interchange Access Request (IAR) User's Guide, the validity of traffic volumes must be confirmed when performing a re-evaluation to determine if a significant change in traffic conditions is anticipated.

In keeping with the guidelines of the FDOT's IAR User's Guide, the validity of the traffic forecast from the 2015 IJR was checked by comparing the 2020 AM and PM peak hour forecasts for southbound I-95 between PGA Boulevard and Donald Ross Road (which represents the area that includes Ramp A) against the most recent three years of historical traffic counts. The comparison is summarized in Table 1.

TABLE 1

SOUTHBOUND I-95 & RAMP 'A' TRAFFIC VOLUME ADJUSTMENT FACTOR ANALYSIS

I-95 AT CENTRAL BLVD IJR RE-EVALUATION

		SB I-95	SB I-95	SB I-95
I-95 between PGA Blvd and Donald Ross Rd	Year	AADT	AM Peak	PM Peak
	2015	63,405	7,112	3,982
	2016	72,751	8,495	4,585
	2017	70,113	7,026	4,686
	2018*	71,200	2,561	6,080
	2019	66,100	7,179	4,222
	2020**		7,251	4,733
2020 (volume projection from approved 2015 IJR - No Build)		n/a	5,530	3,899
Volume Adjustment Factor			*1.31*	*1.21*

Source: FDOT Count Site #93-2214

** 2018 peak hour traffic count is anomalous and inconsistent with historical travel patterns. As a result, it was discounted in developing a volume adjustment factor.*

*** Estimated 2020 volumes based on a conservative historical growth rate of 1.0% of SB I-95 during the AM peak hour from 2015 to 2019. This growth rate was applied to the largest valid peak hour volume counted during the past five years. to estimate 2020 peak hour, peak direction volumes to compare against the approved IJR forecast for 2020.*

The approved 2015 IJR forecast of southbound I-95 between PGA Boulevard and Donald Ross Road for 2020 was determined to be considerably less than 2019 peak hour counts and estimated 2020 peak hour volumes. The originally approved forecasted volume for southbound I-95 was 5,530 vehicles per hour (vph) during the AM peak and 3,899 vph during the PM peak. However, the estimated 2020 peak hour directional volume on southbound I-95 is 7,251 vph in the morning and 4,733 vph during the afternoon. Because of the discrepancy between the approved forecast and the traffic volume counts, a volume adjustment factor is necessary to analyze Ramp A.

Since forecasts for the future AM peak hour and PM peak hour were developed separately as part of the approved 2015 IJR, a separate volume adjustment factor will be prepared for each peak period. A review of the forecast discrepancies summarized in Table 1 indicate that the current volume on southbound I-95 during the AM peak hour is 31% greater than the original forecast. Similarly, the current volume on southbound I-95 during the PM peak hour is 21% greater than the original forecast. For analysis purposes of Ramp A, these factors will be applied to the 2040 AM and PM peak hour projections of Ramp A and southbound I-95 from the approved 2015 IJR. (The volume adjustment factors will be applied to the movements that comprise the weaving section on I-95 southbound between PGA Boulevard and Central Boulevard.)

A. *Selected Travel Demand Model(s)*

Not applicable for this IJR Re-Evaluation. Travel demand forecasts from the 2015 IJR for Ramp A will be factored as described in Section 5.0.

B. Project Traffic Forecast Development Methodology

Describe the methodology and assumptions in developing the future year traffic volumes (AADT and DDHV)

Not applicable for this IJR Re-Evaluation. Travel demand forecasts from the 2015 IJR for Ramp A will be factored as described in Section 5.0.

C. Validation Methodology

Describe the validation methodology using current FDOT procedures and data collection procedure

Identify how modifications to the travel demand forecasting model will be made, including modifications to the facility type and area type for links, modifications to socio-economic data and all input and output modeling files for review.

Not applicable for this IJR Re-Evaluation. Travel demand forecasts from the 2015 IJR for Ramp A will be factored as described in Section 5.0.

D. Adjustment Procedures

Identify the process used to adjust modeled future year traffic to the defined analysis years. Discuss how trends/growth-rates will be factored into this, if applicable.

Travel demand forecasts from the 2015 IJR for Ramp A will be factored as described in Section 5.0. Since forecasts for the future AM peak hour and PM peak hour were developed separately as part of the approved 2015 IJR, a separate volume adjustment factor will be prepared for each peak period. A review of the forecast discrepancies summarized in Table 1 indicate that the current volume on southbound I-95 during the AM peak hour is 31% greater than the original forecast. Similarly, the current volume on southbound I-95 during the PM peak hour is 21% greater than the

original 2020 forecast. These factors will be applied to the 2040 AM and PM peak hour projections of Ramp A and southbound I-95 from the approved 2015 IJR to adjust them accounting for the current peak hour volume discrepancy. The volume adjustment factors will be applied to the movements that comprise the weaving section on I-95 southbound between PGA Boulevard and Central Boulevard.

Trends and growth rates are not applicable for this adjustment procedure as the approved growth projected for the Ramp A study area included in the 2015 IJR will not be affected.

E. Traffic Factors

- Utilizing recommended ranges identified in the Project Traffic Forecasting Handbook and Procedure (525-030-120).
- Utilizing other factors, identified below

Traffic factors from the 2015 IJR will be applied.

Roadway	K	D	T	T_f	PHF	MOCF	PHF
I-95	n/a	n/a	7.5	3.7	0.95	n/a	0.95
Ramp A	n/a	n/a	7.5	3.7	0.95	n/a	0.95

Source: Approved *Methodology Letter of Understanding* for SR-9/I-95 at PGA Boulevard/Central Boulevard Interchange Justification Report (IJR), March 2014.

6.0 Traffic Operational Analysis

The area type, traffic conditions, and analysis tools to be used are summarized in this section.

A. Existing Area Type/Traffic Conditions

Area Type	Conditions	
	Under Saturated	Saturated
Rural	☐	☐
Urban Area/Transitioning Area	☐	☒

B. Traffic Analysis Software Used

Software		System Component					
		Freeway				Crossroad	
Name	Version	Basic Segment	Weaving	Ramp Merge	Ramp Diverge	Arterials	Intersections
HCS 7 HCM	HCM 6th Edition	☒	☒	☒	☒	☐	☐
Synchro	☐	☐	☐	☐	☐	☐	☐
SimTraffic	☐	☐	☐	☐	☐	☐	☐
Corsim	☐	☐	☐	☐	☐	☐	☐
Vissim	☐	☐	☐	☐	☐	☐	☐
Other	☐	☐	☐	☐	☐	☐	☐

C. Calibration Methodology

- *Calibration methodology and parameters utilized will be documented.*
- *Calibration Measures of Effectiveness (MOEs) and calibration targets.*

Not applicable for this IJR Re-Evaluation, as no microscopic simulations tools will be used.

D. Selection of Measures of Effectiveness (MOE)

- *The Level of Service criteria for each roadway classification, including mainline, ramps, ramp terminal intersections and the crossroad beyond the interchange ramp terminal intersections are identified below.*
- *In addition to the Level of Service criteria, state other operational MOEs to be utilized for the evaluation of alternatives.*

MOEs gathered from HCS will include:

- Density
- Level of Service
- Speed
- Volume-to-capacity ratio (for ramp roadway analysis)

7.0 Safety Analysis

A. Detailed crash data within the study area will be analyzed and documented.

Years: Source:

Using data gathered between January 2012 to December 2016, a quantitative crash analysis will be conducted. This analysis will be prepared consistent with Highway Safety Manual (HSM) procedures. This analysis will document how the proposed change to Ramp A will affect safety in the study area via FHWA's Interactive Highway Safety Design Model (IHSDM) 2019 software, Release 15.0.

8.0 Consistency with Other Plans/Projects

A. The request will be reviewed for consistency with facility Master Plans, Actions Plans, SIS Plan, MPO Long Range Transportation Plans, Local Government Comprehensive Plans or development applications, etc.

B. Where the request is inconsistent with any plan, steps to bring the plan into consistency will be developed.

C. The operational relationship of this request to the other interchanges will be reviewed and documented. The following other IARs are located within the area of influence.

We are not aware of any other Interchange Access Requests currently under consideration within the area of influence.

9.0 Environmental Considerations

A. Status of Environmental Approval and permitting process.

B. Identify the environmental considerations that could influence the outcome of the alternative development and selection process.

All relevant environmental and NEPA considerations related to the Ramp "A" design change will be identified, assessed, and documented in the IJR Re-Evaluation.

10.0 Coordination

Yes	No/NA	
☒	☐	An appropriate effort of coordination will be made with appropriate proposed developments in the area.
☒	☐	Request will identify and include (if applicable) a commitment to complete the other non-interchange/non-intersection improvements that are necessary for the interchange/intersection to function as proposed.
☒	☐	Request will document whether the project requires financial or infrastructure commitments from other agencies, organizations, or private entities.
☒	☐	Request will document any pre-condition contingencies required in regards to the timing of other improvements and their inclusion in a TIP/STIP/LRTP prior to the Interstate access approval (final approval of NEPA document).
☒	☐	Request will document the funding and phasing.

**Explain if No or Not Applicable (N/A) is checked*:

11.0 Anticipated Design Exceptions and Variations

☒ *Design exceptions/variations are not anticipated, but if an exception/variation should arise it will be processed per FHWA and FDOT standards.*

☐ *The following exceptions/variations to FDOT, AASHTO or FHWA rules, policies, standards, criteria or procedures have been identified:*

12.0 Conceptual Signing Plan

A conceptual signing and marking plan shall be prepared and included in the access request.

A conceptual signing plan will be included in the IJR Re-Evaluation document.

13.0 Access Management Plan

☒ *Access management plan within the area of influence will not be changed by the proposed improvements to the interchange.*

☐ *The improvement will affect access management within the area of influence will be changed. An access management plan will be developed within the area of influence to complement the improvements to the interchange:*

14.0 FHWA Policy Points

The two FHWA policy points will be addressed within the access request.

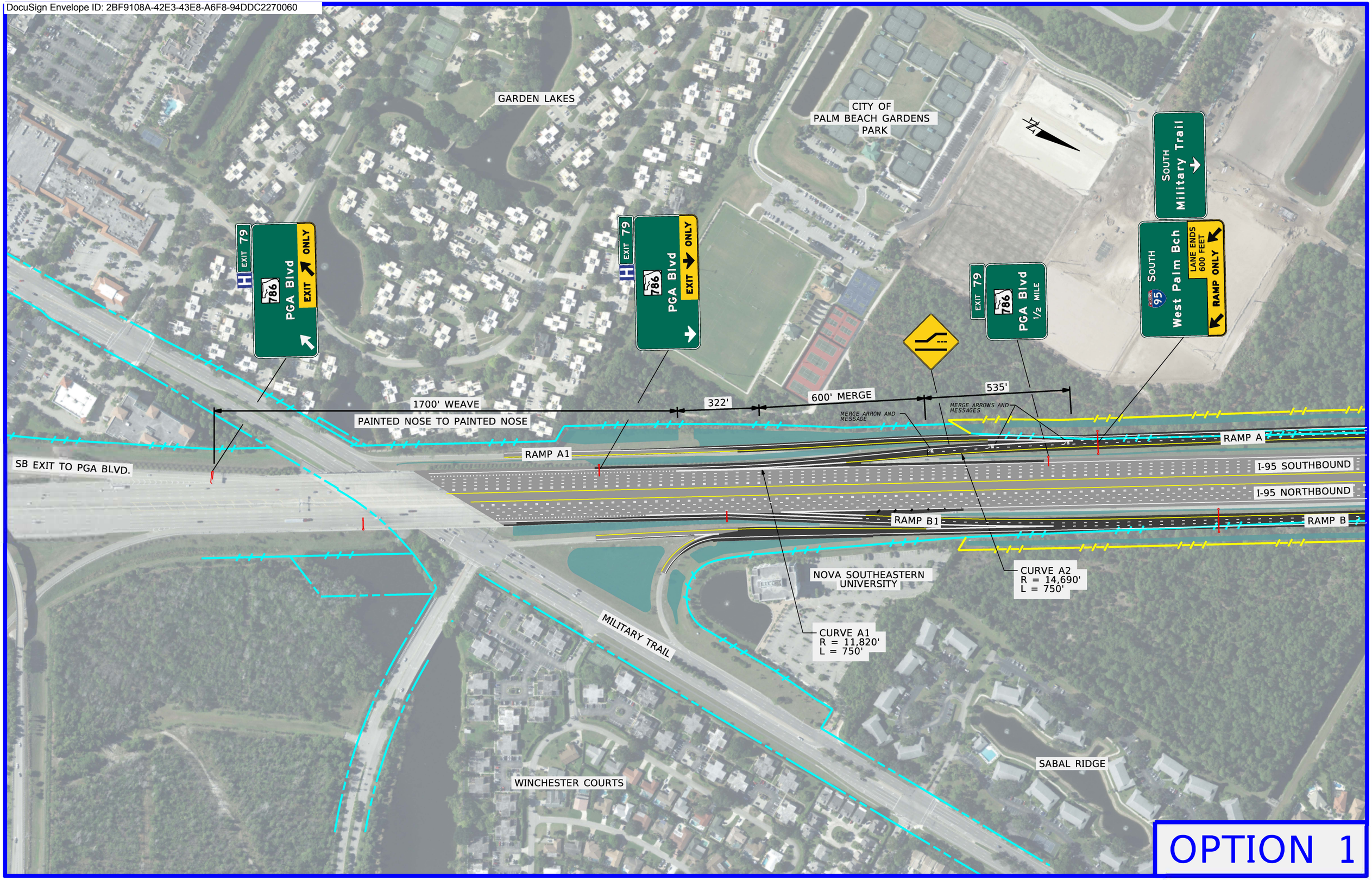
The two FHWA policy points (May 22, 2017) are listed, in part, below.

1. *An operational and safety analysis has concluded that the proposed change in access does not have a significant adverse impact on the safety and operation of the Interstate facility (which includes mainline lanes, existing, new, or modified ramps, and ramp intersections with crossroad) or on the local street network based on both the current and the planned future traffic projections.*

2. *The proposed access connects to a public road only and will provide for all traffic movements. Less than ``full interchanges'' may be considered on a case-by-case basis for applications requiring special access for managed lanes (e.g., transit, HOVs, HOT lanes) or park and ride lots. The proposed access will be designed to meet or exceed current standards (23 CFR 625.2(a), 625.4(a)(2), and 655.603(d)).*

ATTACHMENT A

Ramp “A” Lane Reduction Schematic



ATTACHMENT B

Approved Methodology Letter of Understanding

for

SR-9/I-95 at PGA Boulevard/Central Boulevard
Interchange Justification Report (IJR)
March 2014

SR-9/I-95 at PGA Boulevard/Central Boulevard PD&E Study

FM No. 413265 1 22 01

Methodology Letter of Understanding

March 31, 2014

Submitted to:
Florida Department of Transportation
District 4

INTERCHANGE JUSTIFICATION STUDY

Methodology Letter of Understanding (MLOU)

Type of request: ☒ IJR ☐ SIJR ☐ IMR ☐ SIMR ☐ IOAR ☐

SR-9/I-95 at Central Boulevard/PGA Boulevard

Interchange Justification/Project Development & Environmental Study

FPID: 413265 1 22 01

Determination of Engineering and Operational Acceptability

Signing this document does not constitute approval of the Interchange Access Request or commitment of funds. It is to be used as a guide and reference as the study progresses and is intended to establish initial expectations for the study. This document does not bind FDOT nor does it nullify the right to request changes to the study process, evaluation criteria or to request documentation above and beyond the items discussed in this document.

Requestor — Patrick R. Glass — 12/20/13

Patrick R. Glass, PE
Florida Department of Transportation, District 4

Date

N/A

☒ *Expressway Authority* — [Type Name Here] — *Date*

[Type Title Here]

Interchange Review Coordinator — 12/20/13

Gustavo Schmidt, PE
District 4 Planning and Environmental Engineer

Date

☐ *Other* — *Date*

[Type Title Here]

State Interchange Review Coordinator — 2/6/14

Martha Hodgson
Systems Planning Office – Central Office

Date

☐ *Federal Highway Administration* — for: 4/3/14

Chad Thompson, PE
Program Operations Engineer

Date

Type of request: ☒ **IJR** ☐ **SIJR** ☐ **IMR** ☐ **SIMR** ☐ **IOAR** ☐

- *Coordination of assumptions, procedures, data, networks, and outputs for project traffic review during the access request process will be maintained throughout the evaluation process.*
- *Full compliance with all MLOU requirements does not obligate the Acceptance Authorities to accept/approve the interchange access request.*

1.0 Introduction and Project Description

A. Provide background or supporting information that explains the basis for the request.

The Florida Department of Transportation (Requestor) is preparing an Interchange Justification Report (IJR) for the consideration of a proposed interchange with Interstate 95 (I-95) and Central Blvd. located in the City of Palm Beach Gardens, Palm Beach County, Florida. The purpose of this study is to establish the need and justification for the proposed interchange through the preparation of an IJR.

This document will serve as the Methodology Letter of Understanding (MLOU) between the Florida Department of Transportation (FDOT) District Four Interchange Review Committee (DIRC), and the Federal Highway Administration (FHWA). The MLOU has been developed in accordance with the FDOT Policy No. 000-525-015-g: Approval of New or Modified Access to Limited Access Facilities on the Strategic Intermodal System (SIS), FDOT Procedure No. 525-030-160-i: New or Modified Interchanges, and the FDOT Traffic Forecasting Handbook.

B. Purpose and Need Statement

Provide the Purpose, the Need, and the Goals and Objectives.

The purpose of the project is to improve regional mobility and overall traffic operations by examining improvements at the existing interchanges between Northlake Boulevard and Donald Ross Road along I-95, including at SR 786 (PGA Boulevard), as well as consideration of new interchange access within these limits, with focus on Central Boulevard and I-95, or Hood Road and I-95. The purpose is to achieve acceptable (LOS D) regional Levels of Service (LOS) in the future condition. The need for the project is based on the following primary and secondary criteria:

PRIMARY CRITERIA

CAPACITY/TRANSPORTATION DEMAND: Improve Operational Capacity and Overall Traffic Operations (Level of Service)

The project is anticipated to improve traffic operations at the PGA Boulevard interchange and study area roadways/intersections by implementing regional operational and capacity improvements to meet the future travel demand projected as a result of Palm Beach County population and employment growth. According to traffic data presented in the I-95 Area Wide Mobility Study, the northbound I-95 ramp terminal intersection at PGA Boulevard is currently operating at LOS E/F (AM/PM Peak Hours) and the intersection of PGA Boulevard at Military Trail is currently operating at LOS E (AM/PM Peak Hours). By year 2035, if no improvements occur, several additional locations are projected to deteriorate to unacceptable conditions, including the southbound I-95 ramp terminal intersection at PGA Boulevard to LOS F (PM Peak Hour), the intersection of PGA Boulevard and Central Boulevard to LOS F (AM/PM Peak Hours) and the intersection of PGA Boulevard at Florida's Turnpike to LOS F (AM/PM Peak Hours).

An Interchange Justification Report for a new interchange at Central Boulevard was completed in 2009 by Palm Beach County. It recommended the construction of a new

interchange along with the removal of the partial interchange ramps for I-95 at Military Trail to preserve interchange spacing requirements. At the two flanking interchanges (PGA Boulevard and Donald Ross Road), looking at intersection LOS at the two signalized ramp intersections (east side and west side), in two time periods (AM and PM) - a total of eight analyses, when comparing the No-Build and Build conditions in 2032, adding the new interchange at Central Boulevard improved the LOS by one letter grade in 3 instances, provided no change in 4, and degraded the LOS in one. The 2009 interchange proposal was not accepted by FDOT. In addition to revisiting the effect of a new interchange on existing interchange operations, this IJR will give additional attention to regional mobility issues

GROWTH MANAGEMENT: Accommodate Future Population and Employment Growth

The area surrounding the existing I-95 and PGA Boulevard interchange is urbanized containing a mixture of commercial, industrial, mixed-use and residential land uses with vacant land in the northeast quadrant. According to the City of Palm Beach Gardens Comprehensive Plan, future land use is to remain relatively unchanged, with the exception of the area east of the interchange which has been designated as part of the Bioscience Research Protection Overlay (BRPO). The BRPO was developed to protect portions of land for biotechnology/biosciences land uses and includes the Scripps Florida Phase II/Briger Tract DRI which consists of 82 acres located south of Donald Ross Road, north of Hood Road and east and west of I-95 (just north of the study area). The DRI includes 1,600,000 square feet of Biotech Research and Development, 2,400,000 square feet of biotechnological/ biomedical, pharmaceutical, and office space, 2,700 residential dwelling units, and 500,000 square feet of retail space. According to SERPM projections developed for Palm Beach County as part of the Palm Beach MPO 2035 LRTP development: - Population is projected to grow from 1,270,302 in 2005 to 1,677,170 in 2035 [32% increase]. - Employment is projected to grow from 544,496 in 2005 to 800,045 in 2035 [46.9% increase]. The improvements will be critical in supporting the growing bioscience industry and vision of the County, as well as the expanding residential, commercial and industrial uses in the vicinity of the interchange.

SECONDARY CRITERIA

MODAL INTERRELATIONSHIPS: Enhance Freight Mobility

I-95 is the primary interstate route along the east coast of the United States extending from Maine to Florida and serving some of the most populated urban areas in the country. In Florida, I-95 is a designated Strategic Intermodal System (SIS) highway. The SIS is a statewide network of highway, railway and waterway corridors as well as transportation hubs that handle the bulk of Florida's passenger and freight traffic. Highways that are designated as part of the SIS provide for movement of high volumes of goods and people at high speeds. Within southeast Florida, I-95 is a vital north-south transportation corridor providing important regional access to major east/west and north/south transportation corridors, as well as residential and employment activity centers and other regional destinations in the area. The proposed improvements at the I-95 and PGA Boulevard interchange and surrounding roadways/intersections are critical to enhance the mobility of goods by alleviating current and future congestion at the interchange and on the surrounding freight network. Reduced congestion will serve to maintain and improve viable access to the major transportation facilities and businesses of the area (including connectors to freight activity centers/local distribution facilities or between the regional freight corridors).

EMERGENCY EVACUATION: Enhance Emergency Evacuation and Response Times

I-95 and PGA Boulevard serve as part of the emergency evacuation route network designated by the Florida Division of Emergency Management. Also designated by Palm Beach County and the City of Palm Beach Gardens as evacuation facilities, I-95 and PGA Boulevard are critical in facilitating traffic during emergency evacuation periods as they connect other major arterials and highways of the state evacuation route network. The project is anticipated to:

- Improve emergency evacuation capabilities by enhancing connectivity and accessibility to I-95 and other major arterials designated on the state evacuation route network.
- Increase the operational capacity of traffic that can be evacuated during an emergency event.

C. Project Location

Provide a description of the interchange access request study area

Moving from south to north, the approximate milepost numbers along I-95 (Section 93220000) at the centerlines of the various cross roads (and the spacing between them in miles) are as follows:

Northlake Blvd. – 34.78
Spacing – 2.22
PGA Blvd. – 37.00
Spacing – 0.40
Military Trail – 37.40
Spacing – 1.02
Central Blvd. – 38.42
Spacing – 0.55
Hood Rd – 38.97
Spacing – 1.41
Donald Ross Rd. – 40.38

Exhibit /Figure #1 Project Location attached ☒

D. Area of Influence

Along mainline: Between Northlake Blvd. and Donald Ross Rd.

Along crossroads: The major intersections (minor ones such as Donald Ross Rd. at Heights Blvd., or PGA Blvd. at Shady Lakes Dr. were ignored) of:
Donald Ross Rd. between 64th Dr. N. and Military Trail;
Hood Rd. between Eastpointe Blvd. and Military Trail;
PGA Blvd. between the Turnpike and Lake Victoria Gardens;
Northlake Blvd. between Keating Dr. and Sandtree Ln; and
Central Blvd. between PGA Blvd. and Donald Ross Rd.

Exhibit/Figure #2 Area of Influence attached ☒

E. Project Schedule

Identify the schedule of production activities consistent with a proposed conceptual funding plan and opening year.

The anticipated schedule is aimed at submittal of the Final Interchange Proposal in early July, 2014, and completion of the Project Development and Environmental

(PD&E) report by June 1, 2015. The Final Interchange Proposal will be completed before the initiation of the PD&E Study, so that the scope of the PD&E can be established first. This is the reason for the separate completion dates of this phased improvement study.

2.0 Analysis Years

Traffic Operational Analysis will be conducted for the following years:

- Existing year **2013**
- Opening year 2020
- Interim year(s) 2030
- Design year 2040

Traffic Forecasting will be conducted on a 2040 model approved for use in the I-95 PD&E. Traffic will be Forecasted for the following years and then interpolated for the other traffic operational analysis years:

- Base year 2010
- Model Year 2040
- Horizon years 2040

3.0 Considered Alternatives

		Year of Analysis			
All Alternatives		*Existing*	*Opening*	*Interim*	*Design*
No Build		☒	☒	☒	☒
Build	**Preferred Alternative**	☐	☒	☒	☒
	Other Alternatives	☐	☒	☒	☒
TSM&O Alternative		☐	☒	☒	☒

☐ Requestor has developed specific alternative(s) at this point and the alternative(s) are described below.

Exhibit/Figure # attached ☐

☒ Build alternatives that were eliminated from consideration or evaluated within the PD&E process and discarded, will be documented as to why they were not carried forward.

4.0 Data Collection

The type of data that may be used should be identified.

A. Transportation System Data
Straight Line Diagrams, signal timing information, aerial photos, field inspection, Property Appraiser data, Comprehensive Plan Transportation Elements, Recently

adopted Functional Class determination have been assembled for use during this study.

B. Existing and Historical Traffic Data
Historical traffic data from FDOT and Palm Beach County. Existing traffic data (turning movement counts – some 8 hours on one day, some 24 hours over three days), 72 hour volume counts collected at selected arterial locations and some interchange ramps, and 72 hour classification counts collected at some interchange ramps. Counts were collected in April and May, 2013.

C. Land Use Data
Future Land Use Elements from the Palm Beach County and City of Palm Beach Gardens Comprehensive Plans. Model related socio-economic data forecasts agreed on by the MPO. Approved developments not reflected in any of the above.

D. Environmental Data
Environmental data contained in the Florida Natural Areas Inventory (FNAI), records documenting hazardous or contaminated properties from the Florida Department of Environmental Protection and Palm Beach County, and historical/cultural resource records of the State Historic Preservation Office, as well as the National Register of Historic Places will all be considered during this study.

E. Planned and Programmed Projects
Programmed Improvements: the MPO's current Transportation Improvement Program (TIP), and the Capital Improvement Elements from the Comprehensive Plans of Palm Beach County and the City of Palm Beach Gardens. Commitments from Development Agreements. Planned Improvements: the MPO's Long Range Transportation Plan (LRTP) and the SIS Cost Feasible Plan.

5.0 Travel Demand Forecasting

A. Selected Travel Demand Model(s)

The Southeast Regional Planning Model (SERPM) version 6.5 is the version that was used to update the three MPO LRTPs to 2035 conditions. It was validated to 2005 conditions. SERPM v6.5 was the basis for a subarea model used for the I-95 Corridor Planning Study (CPS), and that model bore the same name: I-95 CPS. For the I-95 PD&E effort, this sub-area model was further refined to a tight sub-area model. The I-95 PD&E tight sub-area model followed I-95 as far north as Linton Blvd., and included the first arterial intersections east and west of the ramp terminals at each interchange. The FDOT has extended the tight sub-area model northward to Indiantown Road for this IJR, and broadened it through the IJR study area to include *most* of the major intersections within it. This is a trip based model that contains no traffic analysis zones north of the Palm Beach County/Martin County border.

B. Project Traffic Forecast Development Methodology
Describe the methodology and assumptions in developing the future year alternative travel demand models and methodology and software to be applied to develop future year project traffic (AADTs and DDHVs).

This model produces three separate assignments: a three hour AM peak period, a three hour PM peak period, and a third assignment containing the sum of all the off-peak hours in the day. The directional balance in volumes typically observed in a daily model is absent here, and the directionality of traffic in the peak periods is evident in the assignment volumes.

C. Validation Methodology
☒ Utilizing current FDOT procedures in data collection.

Procedure: The validation work for the I-95 PD&E study was done on a 2010 network. The 2010 zonal contents used in this model were not Census based, but rather an interpolation between the 2005 zonal contents and 2035 zonal contents developed for SERPM 6.5 and approved by the respective MPOs as part of the last LRTP update process. 2010 Census based estimates at the TAZ level were not yet approved for use when this effort occurred. Similarly, the 2040 zonal contents used in the I-95 PD&E effort were not the same as the 2040 zonal contents being developed by the MPOs for the next update of their LRTPs; the work effort on the I-95 PD&E preceded the approval for use of the new 2040 data sets. Rather, the 2040 zonal data sets used in the I-95 PD&E work contain extrapolations beyond the approved 2035 zonal contents.
One of the refinements to this subarea model was the use of CUBE Analyst to make adjustments to the O-D table that is the output of the trip distribution step in ways that improved the agreement between the model assignment volumes in the validation year and traffic counts. Unlike historical models, for which validation was performed using daily traffic counts as the basis of comparison, the aforementioned adjustments to the O-D table were made seeking better agreement in peak period volumes (assignment versus counted). For this reason, peak period volumes are the most reliable output from this model.

- Identify how modifications to the travel demand forecasting model will be made, including modifications to the facility type and area type for links, modifications to socio-economic data and all input and output modeling files for review.

The FDOT has previously used this model for the I-95 PD&E (Stirling Rd. to Linton Blvd. – Corridor Design Traffic Report, November 2012), which was reviewed and accepted by the FHWA. Documentation of any modifications that were made to the model can be provided if needed under separate cover.

D. Adjustment Procedures
Identify the process used to adjust modeled future year traffic to the defined analysis years. Discuss how trends/growth-rates will be factored into this.

As mentioned above, because peak period volumes are the most reliable output of

the model, in the I-95 PD&E the traditional factoring of model daily volumes down to peak hour directional volumes through the use of K and D factors was not used. Peak period volumes were used directly, subject to reasonableness checks. This will also be the approach used in this IJR.

The model's peak period output does need to be converted to a peak hour volume. The developer of the tight sub-area model used the term "diurnal factor" to describe the peak hour's fraction of the three hour peak period. The developer noted sufficient spatial stability in this factor to use only one in all locations, with a separate factor for the AM and PM peak periods. This estimation work was done for mainline locations. Absent a suggestion from the model developer, the two diurnal factors for AM and PM from the PD&E work will be used for all peak period assignment volumes, mainline or arterial, in this IJR.

Opening (2020) and interim (2030) year peak hour volumes will be interpolations (assuming exponential growth) between 2013 existing condition peak hour volumes and 2040 horizon/design year peak hour volumes. The growth rate in traffic volumes necessary to reach 2040 model volumes will be compared with the growth rate in land use intensity implicit in a comparison of the 2010 and 2040 socio-economic data sets used in the base year and horizon year simulation models. The historic trend in traffic volume growth is not a reliable source for comparison here due to the influence of the recession and the impending limit on future development as the county approaches build out.

E. Traffic Factors

☒ Utilizing recommended ranges identified in the Project Traffic Forecasting Handbook and Procedure (525-030-120).

☒ Utilizing other factors, identified below

Roadway	K	D	T	T_f	PHF	MOCF
I-95	N/A	N/A	7.5	3.7	0.95	N/A
All Arterials	N/A	N/A	3.4	1.7	0.95	N/A

Source: I-95: FDOT Sta. 2187 (N of PGA Blvd), 2012. Arterials: FDOT Sta. 5300 (PGA Blvd. E. of I-95), 2012.

6.0 Traffic Operational Analysis

The area type, traffic conditions, and analysis tools to be used are summarized in this section.

A. Area Type/Traffic Conditions

Area Type	Conditions	
	Under-saturated	*Saturated*
Rural	☐	☐
Urban Areas/Transitioning Urbanized Areas	☐	☒
Urbanized Areas/Central Business District (CBD)	☐	☐

B. Traffic Analysis Software Used

Software		System Component					
		Freeways					
Name	*Version*	*Basic Segment*	*Weaving*	*Ramp Merge*	*Ramp Diverge*	*Arterials*	*Intersections*
LOSPLAN		☐	☐	☐	☐	☐	☐
HCS/HCM		☒	☒	☒	☒	☐	☐
Synchro		☐	☐	☐	☐	☒	☒
SimTraffic		☐	☐	☐	☐	☐	☐
Corsim		☐	☐	☐	☐	☐	☐
Vissim		☐	☐	☐	☐	☐	☐
		☐	☐	☐	☐	☐	☐

C. Calibration

☒ Calibration methodology and parameters utilized will be documented. Any deviations will be justified.

D. Selection of Measures of Effectiveness (MOE)

- *The Level of Service criteria for each roadway classification, including mainline, ramps, ramp terminal intersections and the cross road beyond the interchange ramp terminal intersections are identified below.*
  The LOS threshold will be consistent with FDOT procedures and be LOS "D" for all conditions. The methods used will be according to the 2010 Highway Capacity Manual.

- *In addition to the Level of Service criteria, state other operational criteria to be utilized for the evaluation of alternatives, including ramp queue lengths, arterial level of service, etc.*
  Average arterial speed, intersection delay, queue lengths.

7.0 Safety Analysis

☒ Detailed crash data within the study area will be analyzed and documented.
Years: 2006 - 2011
Source: FDOT Crash Analysis Report Database

8.0 Consistency with Other Plans/Projects

☒ The request will be reviewed for consistency with facility Master Plans, Actions Plans, SIS/ FIHS Plan, MPO Long Range Transportation Plans, Local Government Comprehensive Plans or development applications, etc.

☒ Where the request is inconsistent with any plan, steps to bring the plan into consistency will be developed.

☒ The operational relationship of this request to the other interchanges will be reviewed and documented. The following other Interchange Access Requests are located within the area of influence.

We are not aware of any other Interchange Access Requests currently under consideration within the area of influence.

9.0 Environmental Considerations

A. Status of Environmental Approval and permitting process

This interchange proposal is being conducted before initiating the NEPA process. Once the conclusions of this study are known, the NEPA study will commence, including determination of the class of action.

B. Identify the environmental considerations that could influence the outcome of the alternative development and selection process.

A cursory desktop review of the corridor conditions indicates low potential for environmental impact that cannot be minimized or effectively mitigated. Potential noise impacts have a moderate potential to require engagement during the NEPA phase for these improvements, but it is likely that mitigation of impacts will be possible.

10.0 Coordination

Yes	No	N/A	
☒	☐	☐	An appropriate effort of coordination will be made with appropriate proposed developments in the area.
☒	☐	☐	Request will identify and include (if applicable) a commitment to complete the other non-interchange/non-intersection improvements that are necessary for the interchange/intersection to function as proposed.
☒	☐	☐	Request will document whether the project requires financial or infrastructure commitments from other agencies, organizations, or private entities.
☒	☐	☐	Request will document any pre-condition contingencies required in regards to the timing of other improvements and their inclusion in a TIP/STIP/LRTP prior to the Interstate access acceptance (final approval of NEPA document).
☒	☐	☐	Request will document the funding and phasing.

11.0 Anticipated Design Exceptions and Variations

☒ Design exceptions are not anticipated, but as the PD&E phase of the project provides additional detail, any identified design exceptions will be noted.

☐ The following exceptions/variations to FDOT, AASHTO or FHWA rules, policies, standards, criteria or procedures have been identified:

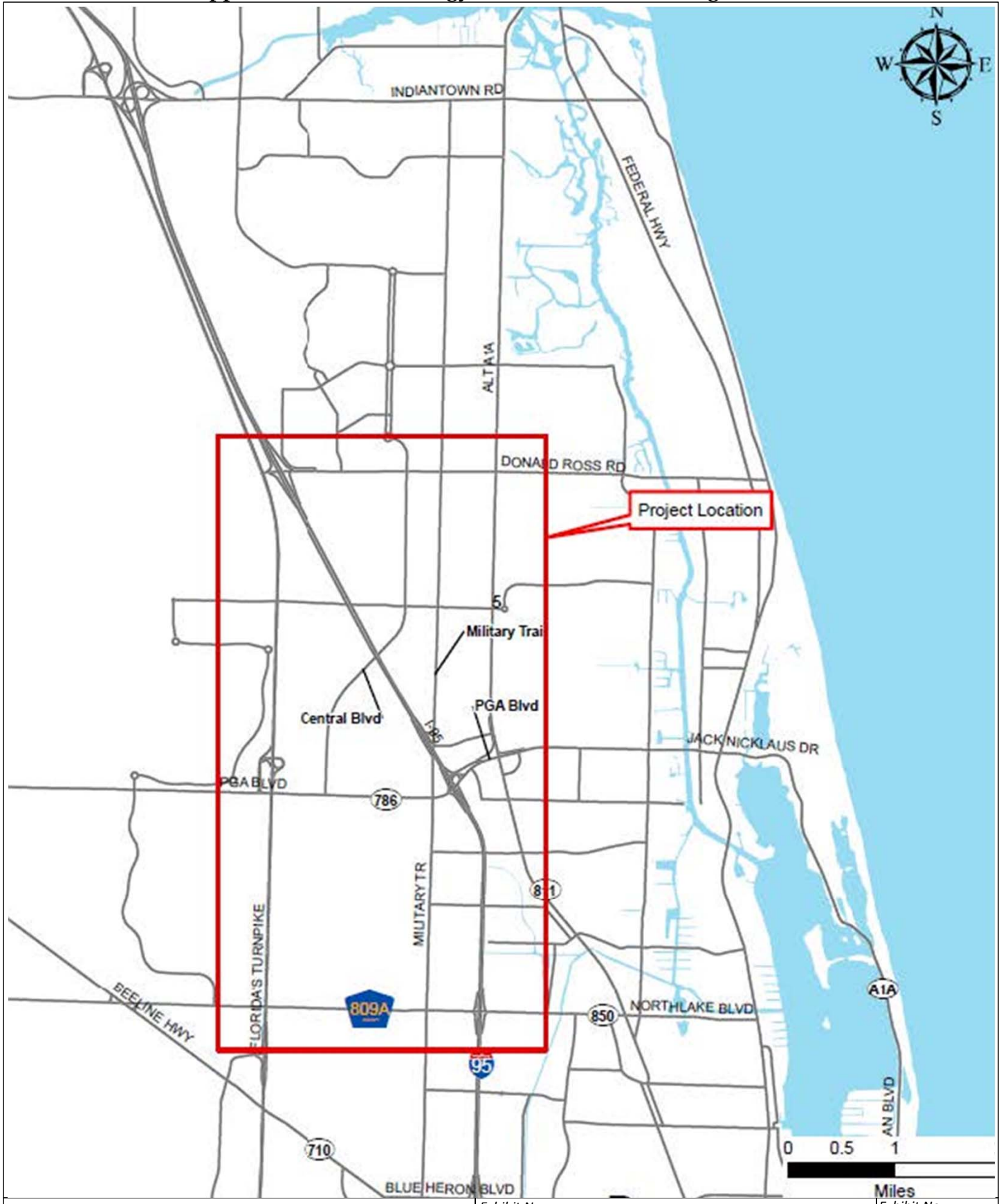
12.0 Conceptual Signing Plan

☒ A conceptual signing and marking plan shall be prepared and included.

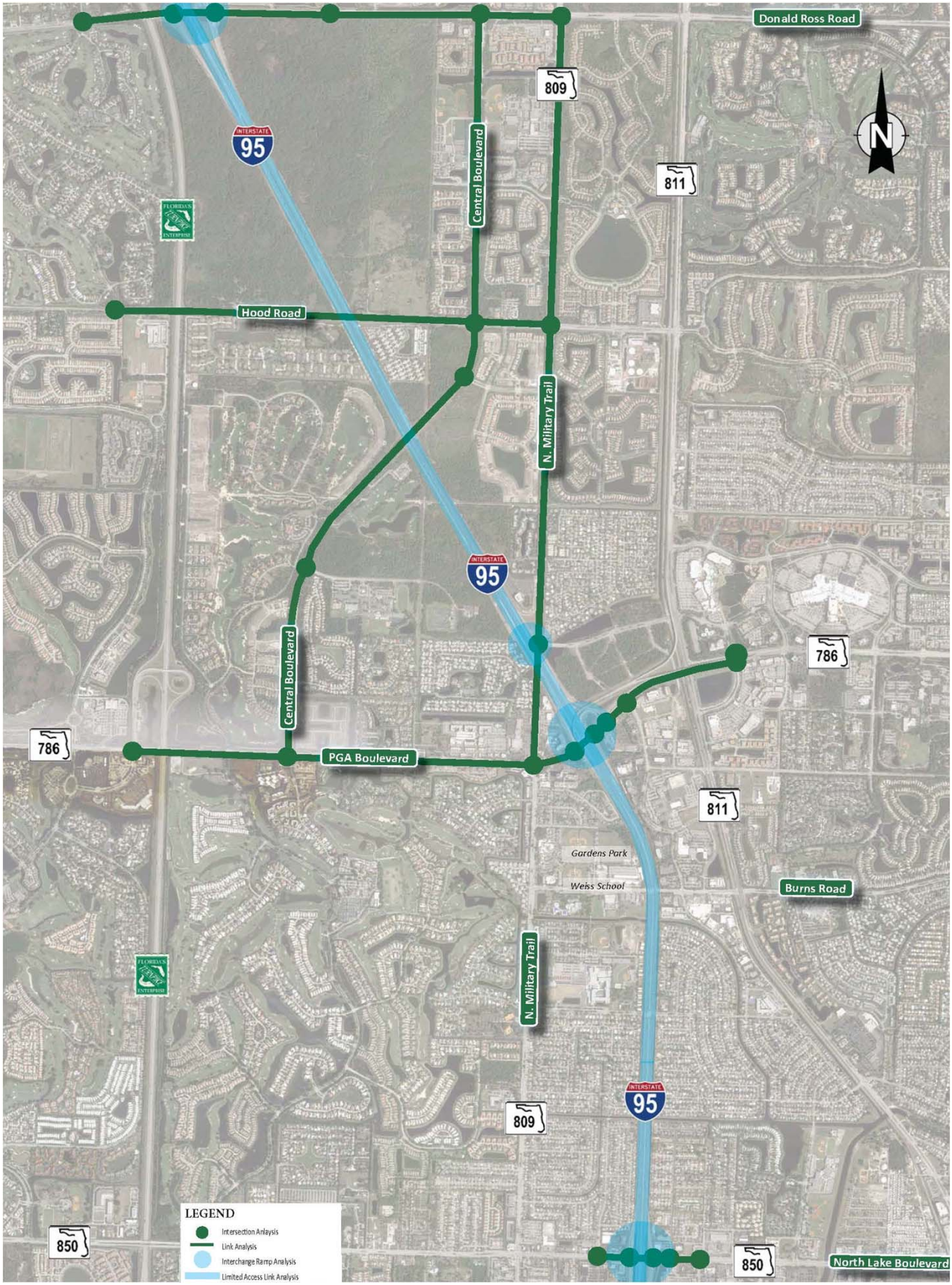
13.0 FHWA Policy Points

The following eight FHWA Policy Criteria (also known as 8 FHWA criteria, Doc E9-20679, dated August 22, 2009) will be specifically addressed within the requested unless identified as not applicable:

N/A	8 FHWA Criteria
☐	Policy Point 1: Need for the Access Point Revision
☐	Policy Point 2: Reasonable Alternatives
☐	Policy Point 3: Operational and Safety Analyses
☐	Policy Point 4: Access Connections and Design
☐	Policy Point 5: Land Use and Transportation Plans
☐	Policy Point 6: Future Interchanges
☐	Policy Point 7: Coordination
☐	Policy Point 8: Environmental Processes



Project Name: **SR 9 / I-95 at PGA Boulevard/ Central Boulevard** Project Development & Environmental Study FM No. 413265-1-22-01	*Exhibit Name:* **Project Location Map**	*Exhibit No.* 1
	Report Title: Methodology Letter of Understanding	*Page No.* Ex. 1
		Date: 7/21/13



Project Name: **SR 9 / I-95 at PGA Boulevard/ Central Boulevard** Project Development & Environmental Study FM No. 413265-1-22-01	*Exhibit Name:* **Project Area of Influence**	*Exhibit No.* 2
	Report Title: Methodology Letter of Understanding	*Page No.* Ex-2
		Date: 8/21/13